Value Engineering and Cost Performance Modeling Reduce Cost of Ownership

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Whether manufacturer, bottler, or consumer, everyone benefits from higher quality at the lowest achievable cost.

However, lowest achievable cost seldom equates with the lowest price: less costly consumables are rarely the key to lowering overall manufacturing costs. Rather, better quality materials and improved technology pave the way to repeatedly larger cost savings. High production rates demand consistent performance and a high level of precision in critical stages of manufacturing. In glass container manufacturing, one critical point occurs when the bottle is removed from the mold. By using long-lasting, precision-machined take-out holders and inserts, manufacturers actually save money in the long run. This can be demonstrated with cost performance modeling that compares how various materials perform in terms of bottle quality and machine uptime. But the benefits of high performance materials will not be realized unless they are used properly. When using high-performance materials, manufacturers should obtain value engineering support from the supplier. Value engineering support ensures that the design and function of the manufacturing setup meet the requirements to reduce costs and increase production. Such design, however, is not obvious and often is counterintuitive. For example, one might assume that tighter tolerances will result in better performance, but that is not always the case. In the manufacture of glass containers with threaded finishes, standard guidelines in the design of insert prints help ensure better results. By following these guidelines when preparing insert prints, designers can improve insert performance and reduce insert costs. Two key factors affect the performance of glass containers with threaded finishes. First, the neck ring must be designed with tight tolerances and precision machining so that the bottle finish threads are formed correctly. Second, the take-out insert must be accurately aligned when the bottle is transferred out of the mold. Working with the take-out holder or tongs, the take-out insert must close around the threaded neck and lift the bottle out of the mold without damaging the bottle threads or neck. With high-speed equipment for increased production, alignment of the holder and the insert are just as critical as the design and precision machining of the insert. Small alignment variations can result in deformed finish, excessive wear and tear on the insert, or breakage that leads to reduced pack rates, machine downtime, and increased production costs.

Insert with optimal design will encapsulate thread without contact. Support is provided under thread during bottle removal.

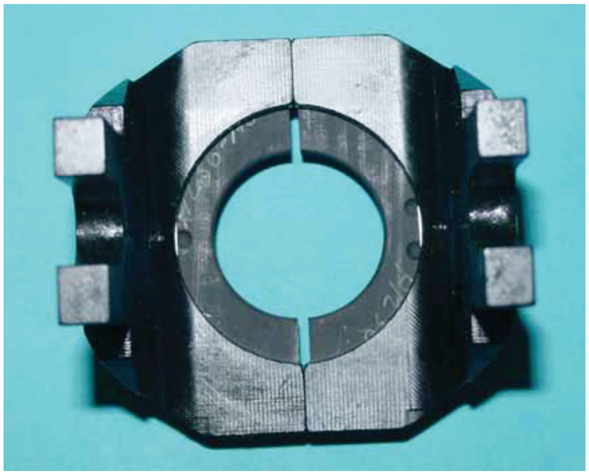
DESIGN AND DESIRED FINISH

The neck ring design and the desired bottle finish dictate the precision insert design. However, there are some important differences as the two have different functions. The insert must work correctly with the take-out holder before it can work correctly with the bottle. Precision machining, alignment pins, and shoulder stops are all important in the correct setup of the holders. Similar features are required for the insert to fit snugly into the holder so that it is in the correct position. Generally, the tolerances needed on the insert are not as exacting as the tolerances required to form the threads. The insert lifts the bottle by picking it up under the thread. Therefore, the thread detail in the insert is slightly larger than the threads on the bottle. Since the profile is machined into a blank insert that is then cut into halves, the design must allow for a saw kerf. Clearance between the finish and the insert to prevent pinching is also required and allows for more relaxed tolerances. Unless the designer clearly understands how graphite inserts are machined and the allowances required for the inserts to work properly, the print may be produced with unnecessary tolerances, with parting lines that are called out without kerf allowances, or with important dimensions omitted, inhibiting proper inspection. Prints that do not meet all the requirements for proper machining lead to increased machining costs, delayed deliveries, and inserts that do not fit properly into the holder or pick up the bottle correctly.

VARIATIONS ON THE STANDARD

Although there are industry standard profiles, designers often opt for variations on the standard in an effort to create inserts that will perform more precisely on the equipment in their manufacturing facilities. Many variations are due to changes in the finish design required by the bottling plant to eliminate leaking or broken finishes during the capping operation. However, these variations may be unnecessary if the insert works correctly with the holder and with the finish formed by the neck ring. In this situation, the take out holder and insert must be precision machined. Following standard guidelines in the design of insert prints will ensure that the end product is correct, eliminating extra costs, special costs, and the need for hand sanding when the finish is pinched. The most important requirement is that all the necessary information for manufacturing is on the print and the finished articles can be verified back to that print. Many manufacturing companies produce insert prints from the neck ring or the bottle drawing. Insert manufacturers have standardized their production techniques with production tooling to ensure repeatability and consistency of these parts.

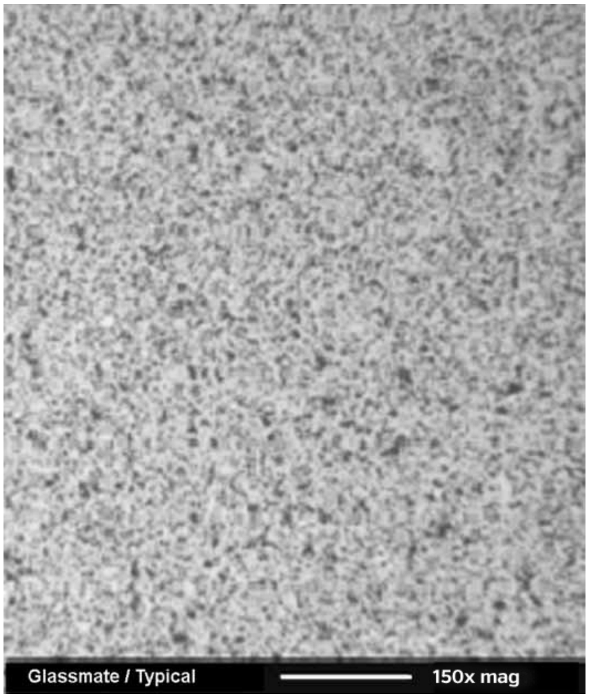
Generally graphite inserts are machined as blanks and the profile is machined prior to splitting the insert. The splitting process results in a kerf; the size of this kerf must be incorporated into the drawing, because that measurement is critical to ensure that the two halves fit together with the proper diameter. In some cases the take out holder is engineered so that the split halves will fit together to form a perfect circle. Thus, it is crucial to know how the holders work with the inserts to achieve optimum results. The finish is machined to a size larger than ware or neck ring dimensions to account for clearance of bottle finish. If the insert has the same dimensions as the neck ring it will deform the bottle finish. The locations of functional features for the holder are called out and used to verify other dimensions. Other functional tolerances are ± 0.005 in or ± 0.127 mm for outside dimension, locating tabs, and holder interfaces.



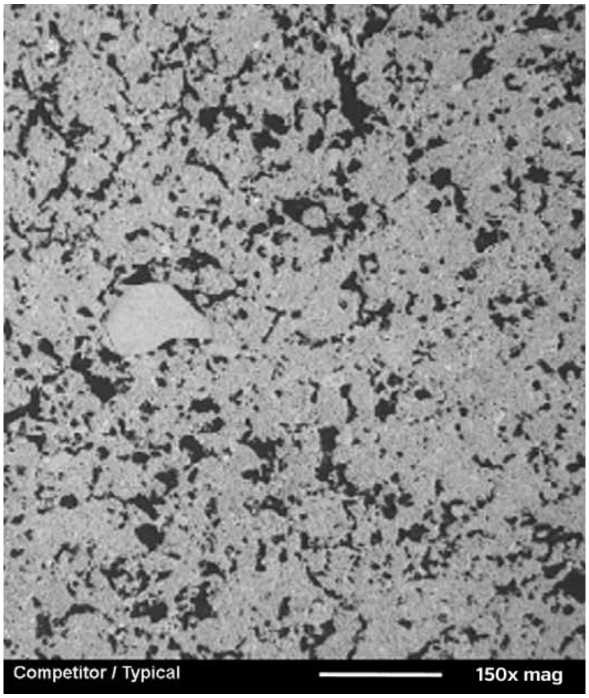
Holder with insert designed to allow kerf. When installed in a holder from Entegris, true diameters are achieved.

Insert manufacturers have standardized their production techniques with production tooling to ensure part repeatability and consistency.

Following these insert design guidelines is just the first step in achieving good performance and reducing cost. Next, designers must select the best graphite grade for the application. Selecting the right grade of graphite can extend the expected life of the insert under specific conditions. Conditions to consider include: the type and weight of ware, type of pickup, speed of machine, and the number of bottles to be produced. These variables influence insert lifetime. Selection of the best graphite grade for the job will reduce machine downtime, which ultimately increases the profitability of the line. Applications that require high-performance graphite inserts are thread transfer inserts and crown transfer inserts. High performance, 5-micron grain size graphite will have the uniform microstructure and high strength necessary to resist wear created by repeated contact with container threads and the weight of the bottle. In a typical crown transfer production line, inserts made from high-performance graphite will last twice as long as a 10-micron grain size graphite. In a typical thread transfer production line, inserts from high-performance graphite can last up to three times as long as other graphite inserts. Increased insert lifetime means less machine downtime to change inserts, which makes the job more profitable. Precision inserts should be used with precision holders to achieve optimal cost reductions. Easy-to-setup holders ensure that both halves are square and of equal height for correct machine setup. This is important at the start of production and can reduce the need for adjustments with the weight of bottles after the machine is warmed up. Once the holders are set, holders that provide for quick insert change reduce machine downtime. Depending on the style of holder used, changeout times can run from five to 15 minutes. All these factors must be considered at the outset to maximize savings. Modeling software allows the manager to compare the costs of two different products with their associated benefits. The model projects increased or decreased costs due to machine downtime for changing inserts, based on wear factors of specific materials. The cost of ownership model can predict potential savings created by reduced downtime due to longer insert lifetime from the quality of the graphite and from using quick-change holders. The bottom line is that precision parts made from high quality materials may cost more than alternatives, but in the long run they solve problems and save both time and money.



5 micron GLASSMATE® material



Competitor's 5 micron material

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