Key considerations for incorporating a stack mold centering device

In the search for greater productivity, molders continue to innovate improved ways of part production. Multi-parting line systems, for example, can produce shorter lead times, lean operation and lower-cost parts. In these configurations, two single-face molds are integrated into one system.

Stack molds are one type of multi-parting line solution, producing twice the effective output of a single-face mold. However, they also require more design, manufacturing and maintenance time. One design consideration that makes stack molds especially complex is ensuring that the two parting lines open simultaneously and equally every time. Helical gear stack mold centering devices accomplish just that. These devices save molders time and money in production due to their interchangeable components and assemblies that simplify the design, installation, adjustment and maintenance of stack molds.

This paper will explore the challenges and best solutions for integrating a centering device into your mold.
Basics of multi-parting line molds
Multi-parting line systems are used instead of single-face molds to increase productivity without increasing floor space, to mold high-quality components if the part size is too large for a family mold arrangement and also to facilitate absolute color match. Multi-parting line molds are classified, among other things, based on their parting line arrangements:

- **Series configuration:** The parting lines are located one after the other from the locating ring toward the moving platen. Plastic is injected into cavities from the center portion requiring only one barrel; however, a series configuration can be used with a multi-barrel press if desired. This configuration also allows the plastic to be injected into the mold halves clamped directly to the platens. The center of the mold forms the core and moves the parts from one side to the other.

- **Parallel configuration:** The parting lines are next to each other if looking from the locating ring to the moving platen. There are always two barrels with this arrangement, either parallel or perpendicular to each other. If perpendicular, it can be an independent, bolt-on unit. For reference, see Figures 1, 2 and 3 showing different parallel configurations below. The first shot is often a substrate (strong material like nylon) and second shot is a seal over the first material, giving the part its outer appearance. The part is moved from the first shot by robot or by rotating core side to the second shot.

Stack molds
Stack molds are the most popular type of multi-parting line systems. These molds are essentially two, single-face molds back-to-back, fused together by the common manifold. The two parting lines are in series configuration. The largest advantage a molder can achieve with a stack mold is that output can be doubled within the same tie bar distance as a single-face mold. This requires larger shut height per machine, while still maintaining productivity. A molder can often also use about the same machine tonnage as with a corresponding single-face mold.

There are some considerations, however, when using stack molds. Parts must be relatively shallow so the shut height of the stack mold will not become too large. The initial cost may appear higher, but, in fact, it is lower than the alternative use of two single-face molds. Cycle times increase slightly compared to using a same-footprint, single-face mold. The best applications are high-volume items such as lids, containers or bowls. Stack molds have three parts: a stationary side clamped to the stationary platen, a moving side clamped to
the moving platen and a center portion. When the moving platen pulls the moving side, it moves away from the center portion. Without centering devices, the parting line openings are random. If the platen moves 20 inches, it is possible that one plate opens 2 inches and the other 18 inches without centering devices. Because the center portion is not physically attached to the stationary and moving sides, centering devices make sure that if the platen is open 20 inches, then each of the other sides both open 10 inches each.

The drawings below represent the three major stack mold types. Figure 4 shows a stack mold in which parts are molded so that the parting line on the stationary side is free. The configuration involves multiple cavitation and a long sprue bar in the middle. In Figure 5, there is a shorter sprue bar that ends at the parting line. The configuration in Figure 6, used for grill-type parts, has no shutoff or opening in middle of the part, so the sprue bar needs to be offset.

A newer type of stack configuration, which features a center platen that rotates on a vertical axis, is increasingly in demand for a variety of soft-touch applications. Figures 7 and 8 show setups that are a hybrid of stack mold and parallel configuration, with two barrels (two different materials) coming into the mold.

Figure 7 shows the second barrel oriented vertically to the opening of the moving platen (perpendicular to main barrel). In Figure 8, the two barrels are parallel. When the tool opens, the core portion moves. The movement transfers the core with the part from the stationary side to the moving side, so that after the mold is closed, the second shot is molding over the first shot.

There are several other types of multi-parting line configurations, including dual mold carrier, typically involving two single-face molds; tandem molds, in which the parting lines are sequential; vertical slide, where the platen moves vertically; and co-injection, which uses two different barrels and materials. These other types do not require mold centering, so the helical gear does not apply in these cases.
Helical gear centering devices
As the mold continuously opens and closes, helical gear centering devices ensure that the two parting lines open simultaneously and equally every time. These devices provide equal and synchronized parting line openings for two- or four-level stack molds. The devices work on standard, spin-stack and other types of stack molds.

The centering devices contain a double-helical gear shaft with a left-hand thread on one end, a right-hand thread on the other and two mating nuts that fit on the corresponding threads. The nuts can be made of nylon that is molded into aluminum sleeves, or brass. The gear shaft is retained by a pair of tapered roller bearings contained in bearing housings, while the nuts that mate with the helical gear are self-adjusting and held by the nut housing only with friction. If a molder should need to adjust the mold thickness and loosen the nut housing, these components are self-aligning – three screws compress at the side of the nut housing. The nut can then be locked in that orientation, and the tool will move perfectly.

Since a stack mold usually needs two or four assemblies to operate, the devices are adjustable to compensate for differences between the moving and stationary side stack heights. The gear produces a small footprint, which is ideal if a stack mold or spin-stack has cooling lines and multiple cooling circuits or side entry robots are needed. The gear also can be placed in any corner of the mold, leaving the top, sides and bottom open for auxiliary equipment.

Four sizes are common for the part:
- one 28mm gear, a series of two, 38mm gears and one 48mm size when looking at the nominal outside diameter of the gear.
- The devices are easily installed by alignment rods, and can be adjusted to accommodate asymmetric arrangements. They are made from lightweight, aircraft-grade aluminum housings.
Design considerations

There are three points the designer needs to consider when designing a stack mold:

1. Leader Pin Engagement: The leader pins at the top need to stay engaged when the tool is totally opened to give stability to the center portion, and maintain its alignment with the other two portions of the stack mold.

2. Center Support: The center portion usually contains the mold cavities and hot runner. The center portion needs to ride on center supports. These supports transfer its weight to the tie bars or machine ways. The center supports should be adjustable.

3. Centering Device: Centering devices must be included to ensure that the parting lines open consistently, equally and in sync. The centering devices are not designed to align the three portions of a stack mold; this is the function of the leader pins. The centering devices cannot carry the weight of the center portion, either; this is the function of the center support. The function of the centering device is only to control and synchronize the parting line openings.

These design guidelines are important to remember. Leader pins and centering devices can disengage if the machine opens more than the designed stroke. To prevent this problem, it’s critical to share the design data with the mold maker and molder such as the leader pin arrangements, center support and weight transfer beforehand.

Conclusion

As molders continue to innovate and make improvements in part production, productivity will always be front and center in their considerations. Multi-parting line systems such as stack molds produce shorter lead times, but there are requirements when using such a system – namely the use of centering devices. Helical gear stack mold centering devices remedy this issue. The centering device system makes molders more efficient due to reduced costs and time spent in production. These devices are helping simplify the design, installation, adjustment and maintenance of stack molds. When choosing your next stack mold configuration, consider incorporating helical gear centering devices.