Increasing tabletting efficiency and/or improving quality usually requires incorporating new technology into your manufacturing process, and it’s no different with tablet tooling. This article discusses the benefits of multi-tip tooling and the production factors you should assess before switching.

As the name suggests, multi-tip tooling multiplies the number of tips per punch, and significantly increases the number of tablets produced with each rotation of the turret. That, in turn, enables you to run fewer presses and thus use floor space more efficiently and reduce overall operating costs.

There are four main types of multi-tip punches: internal cap fixing, external cap fixing, pin fixing, and monoblock. Each type has its own benefits and drawbacks.
With internal cap fixing, punch tips are inserted into the cap, which is then secured to the punch body with self-locking screws. Residue will naturally stick to the exposed composite parts but can be easily cleaned off. To manage contamination risks, simply strip the tool and clean each component part.

External cap fixing resembles internal cap fixing, but because fixing pins secure the cap by traversing the punch and cap, it can accommodate more tips per punch. As with internal cap fixing, strip and clean the components if contamination is a concern. To ensure the punch guides and seals won’t be compromised and the fixing hole won’t interfere, consult a tooling designer.

The pin fixing configuration does not have a cap. Instead, individual tips are inserted into the punch body and secured with fixing pins. This assembly reduces the risk of contamination and requires fewer components than the internal cap and external cap assemblies, which simplifies punch tip replacement. Component cleaning is the same as mentioned above. A sealant can be applied to the pin holes if required.

Monoblock multi-tip punches are ideal when using a press equipped with a wash-in-place system. Unlike the other three configurations, a monoblock punch doesn’t require disassembly because it is machined from a single piece of steel. The absence of joints also minimizes the potential for contamination and eliminates the risk of damage to punch guides or seals. If the tip of a monoblock is damaged, however, the whole punch must be replaced.

As with standard punches—and the other multi-tip punches—monoblocks can include seal grooves that accept drip cups, which protect tablets from machine lubricants and other contaminants during compression. However, this reduces the number of tips per punch compared to the other multi-tip punch configurations.

To demonstrate how a multi-tip monoblock can improve production rates and increase output, we compared the performance of single-tip to two-tip monoblock tooling on a Fette tablet press equipped with a segmented die table. With the single-tip tooling, the press ran at 900 rpm and produced 900,000 tablets per hour. But the customer required more output, so we installed the two-tip monoblock tooling and ran the machine at 1,200 rpm, which increased the output to 2.4 million tablets per hour.

**EDM versus milling**

There are two methods to create monoblocks: Electro-discharge machining (EDM) and milling. EDM is a manufacturing process that uses electrical discharges to remove material and shape the punch. Milling uses rotary cutters and computer numerical control machines to remove material.

A 2002 study compared how EDM and milling affected the fatigue life of tool steel [1]. Researchers used various tests to characterize the tool steel’s surface roughness,
Is your operation ready for multi-tip tooling?

Almost all presses can accommodate multi-tip tooling, but several aspects must be considered before investing to ensure production runs smoothly.

The press must be in good working order, with no significant wear in the turret area, including punch guides, keyways, and die pockets. Replace the cams if they show excessive wear or degradation to prevent damage to the punch heads.

The upper turret must have a keyway in the guide to ensure the punch tips align with the dies. The lower turret doesn’t require a keyway because the punch tips remain in the dies. Nonetheless, keyways are beneficial there because they speed setup and reduce the likelihood of damage to the lower punch tips.

The feeder paddles may need modification to ensure they deliver enough formulation to the dies. This could be as simple as lowering the paddle assembly closer to the die table or it may require using a paddle feeder with angled blades.

Not all press instrumentation and monitoring systems can accommodate multi-tip tooling. Assess the system before installing multi-tip tooling to ensure it can provide accurate production information. The tablet ejection system must be able to handle larger production volumes to avoid blockage in the discharge chute. Adjusting the take-off angle may be necessary so that individual tablets don’t interfere with each other during ejection.

Test the flowability of the formulation. Multi-tip tableting may require the dies to fill faster, which requires good flow of the granulation. If the granulation doesn’t flow fast enough, problems can occur, including material bridging, feeder overfill, and tablet weight variation. You may need to modify the feeder mechanism to allow the press to maintain its turret speed. This may include modifying the feeder paddles, as mentioned above, and/or the feed frame so it can accommodate a larger hopper.

Particle size distribution is another important factor. If the formulation has a high percentage of fines, particles may be more likely to enter the clearance between the tip and die wall, build up, and cause tightness and friction in the lower punches, leading to premature head wear and damaged cam tracks. If it's not possible to modify the particle size distribution, consider changing the tablet design and/or the working tolerance between the tip and die wall as a work-around.

You should also assess the design of the tablet. Naturally, tablet size is the primary factor that determines how many tips a punch can accommodate, but shape matters, too. Ovals can be challenging to arrange while maintaining a robust punch, optimizing die filling, and improving tablet take-off.

If your press includes a wash-in-place system or if contamination and space constraints are major concerns, monoblock tooling is likely the best option. Whatever you decide, assess the quality of the tooling and the process used to make them to determine whether they will enable the tooling to withstand the rigors of production and allow the press to work at the compression rates and speed your operation requires. — S.O.

Reference


Steve Osborn is a design and multi-tip tooling expert at I Holland, Nottingham, UK. Its products are distributed in the USA, Canada, and Puerto Rico by IPR, 1241 Hardt Circle, Bartlett, IL 60103. Tel. 630 823 4700. Website: www.iprinc.net.