tooling

Maintain tablet quality by inspecting these critical points

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Inspecting tooling and tablet press components for wear and defects can help you understand and resolve problems with tablet quality. This article focuses on inspection points that are easy to overlook but can cause significant tablet quality issues and limit tooling service life.

Operators have always needed to inspect the tablet press and compression tooling to ensure tablets met specifications. But it became especially important in the 1950s, and it had nothing to do with poor-quality or non-conforming tablets. Rather, it stemmed from the arrival of a tablet press—Manesty's Drycota—that was rejecting non-conforming tools.

The Drycota was a rare machine then and it still is. It has a side-by-side design and uses a single drive shaft to both compress and dry-coat tablets. When it was introduced into the USA from England, the press came with cam tracks that conformed to the Manesty standard. Many American operators were unaware of that and continued using standard TSM punches, which often caused the press to seize and crash because the TSM punch heads were larger than what the Drycota required.

Back then—with lead times for tooling orders averaging somewhere between 4 and 6 months—many tablet manufacturers hired local machine shops to reverse-engineer the tooling. They weren't always successful, and ultimately operators turned to a punch-head "go/no-go"

gauge, which was kept at the machine's side so operators could quickly determine whether they had the right punch head and profile.

The moral of the story: Understand the importance of configuring the tablet press correctly and use the right tools to verify your setup.

What to check

Today, we can do better than a go/no-go gauge. But first, everyone working on a press should know the critical dimensions of a tablet compression tool—be it a punch or die—and understand how they can affect tablet quality.

On a rotary tablet press, the "working length" of the punch is the most critical dimension. It is defined as the distance from the head flat to the lowest measureable area of the punch cup (Figure 1). The right length helps ensure consistent tablet hardness, weight, and thickness, which are the fundamental physical attributes we track to ensure tablet quality. Naturally, that means establishing procedures to inspect in-process tooling. It's also important to inspect new tools, typically by spot-checking them against the matching report that should accompany every tooling shipment. Make sure that each punch is within the allowable tolerance: 0.002 inch across a set of upper or lower tools and no more than a 15 percent variation in the cup depth.

When inspecting in-process tools, check for die-bore wear. If the bore is too worn, it can lead to excessive tablet flashing, capping, and laminating. If you didn't know about checking the die bore for wear, you're not alone. Until recently, it was difficult if not impossible to inspect this area because the tools for doing so were either ineffective or unaffordable to many people. Traditionally, an optical comparator was the tool of choice for conducting quick and simple checks for punch-tip wear, head profiles, surface details of tips, etc. But a comparator only shows a silhouette of the die bore and does not measure wear.

Another traditional tool is the micrometer, but it doesn't allow you to check tip wear properly because it only measures the largest area of the punch tip. A micrometer can also measure the tip diameter of new tooling, but it should not be used on in-process tooling because it doesn't effectively measure small variations in diameter caused by wear.

A better option is to use an instrument dedicated to the task, such as a tooling condition monitor [1]. In addition to determining the extent of die-bore wear, the instrument can measure the clearance between the punch tip and bore, which corresponds to die-bore wear. Excessive clearance between the punch tip and the die bore typically leads to tablet flashing. You should also examine the punch tips themselves for wear. Is the punch cup in good condition? Look closely for evidence of a j-hook, which can cause picking (Figure 2).

Other critical dimensions that affect tablet quality are found on the tablet press itself. The pressure rollers, ejection cams, fill cam, and punch retainers all play an integral role in ensuring tablet quality. Furthermore, these are all wear parts, and you and your co-workers should understand that their service life depends on how you run your press and what you run on it. The more you run the press and the more aggressive the products, the more frequently you must inspect.

Some of these components require removal from the press for inspection, but with others you can check for signs of wear or damage while they are on the machine. A pressure roll, for example, can be inspected for run-out using a dial indicator fixed to a magnetic base. Run-out refers to the degree of inconsistency on the surface as a part rotates and it can be checked by applying the indicator to the roller's face and spinning it by hand, as illustrated in the photos (next page). When run-out exceeds the specified tolerance, the likelihood of premature tooling wear grows, and that leads to inconsistent tablet quality, typically in thickness and hardness.

FIGURE 1

Working length is the most critical dimension.

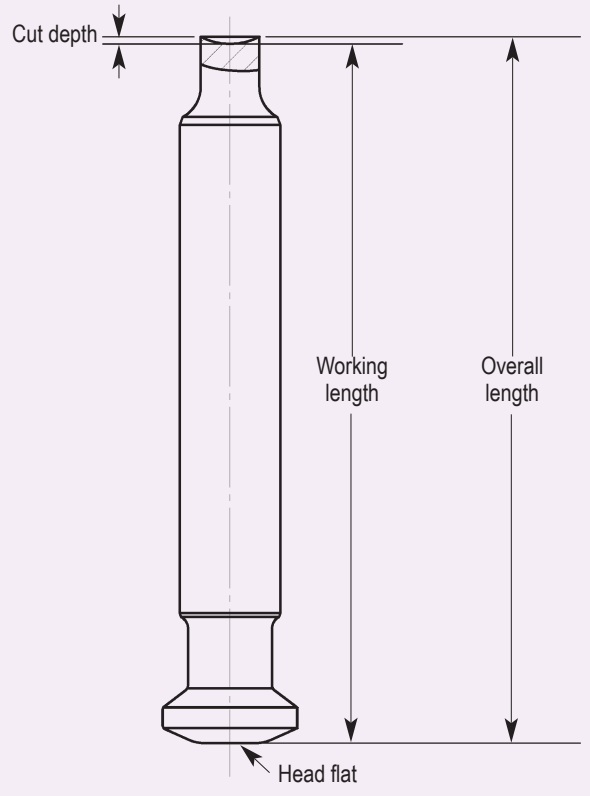
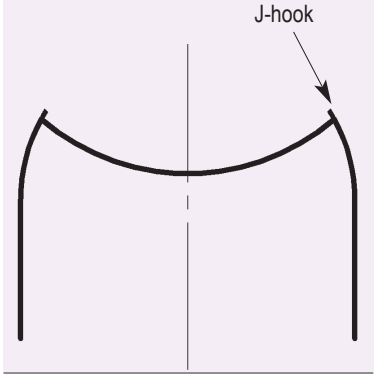


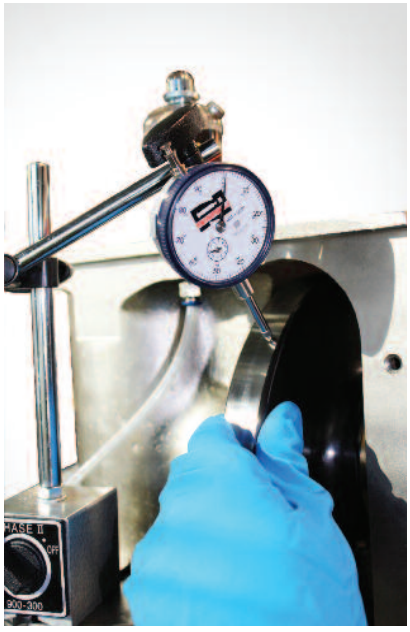
FIGURE 2

A j-hook can cause picking.

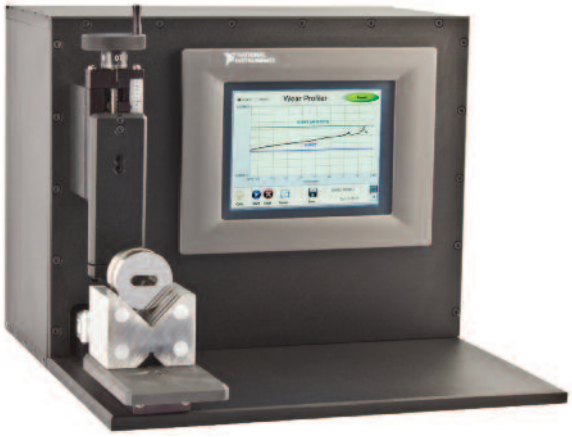


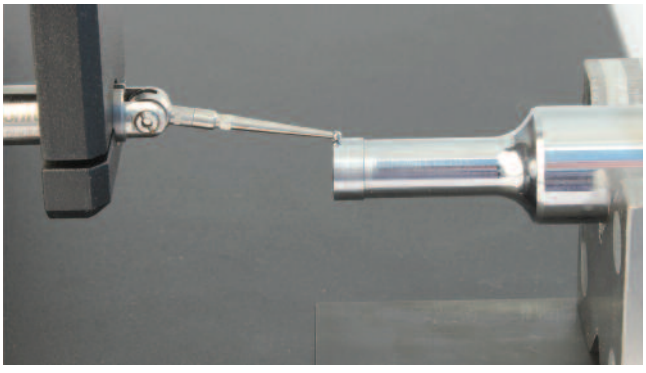
Attach the magnetic base securely to a stable surface.


Adjust the dial or digital indicator until it makes uniform contact with the pressure roll and lock it in place by tightening the clamp.


Turn the pressure roll slowly by hand to determine the run-out value.

You can inspect other parts, such as fill cams, visually for wear while they are on the machine, and a metal mirror on a telescoping handle is useful for that. But removing them will let you make a more thorough examination.




A tooling condition monitor [1] measures wear rings on the inside of a die, detects punch-tip wear, and predicts clearance issues by compiling micro-measurements and analyzing the data. The data enable you to forecast tool life by tracking wear between tools. The monitor is one of the few devices that measures die-bore wear and detects wear rings.

While you're at it, verify the size of the fill cam. It should provide a depth of fill that is appropriate to the size of the tablet you're making. The wrong size fill cam can lead to excessive product loss and tablet weight variations.

When inspecting ejection cams, check the height using a straight edge. The punch tips should just touch it, indicating that there is enough clearance for tablets to be taken off the die table without chipping them.

Make it routine

To make your company's tabletting operations as reliable and surprise-free as possible, write everything down. Every operator, supervisor, and manager should follow these standard operating procedures exactly to ensure everyone inspects all components the same way. Next, make sure everyone on staff is actually following the inspection schedule. And then verify that. No one should assume that the press parts and tooling are within their tolerances and in good condition.

Too often, people say they don't have time to conduct these checks as frequently as recommended, but doing so really is a good investment. Compare the time you spend on prevention to what you'd spend—in both time and money—on broken tools or defective tablets. Make these checks a habit and you'll extend tooling and press service life and produce high-quality tablets consistently. *T&C*

Reference

1. Available from Natoli Engineering, St. Charles, MO.

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