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Choosing the Appropriate Capping Technology for Your Application

Capping machine design, when regarding the basic technology employed for cap application, can be broken into two general categories of machines. The first technology is In-Line Cappers and the second is Rotary Chuck-Style Cappers. These machines differ dramatically in both their core design as well as in their techniques for applying closures.

There is one similar attribute of design that does exist between the two technologies. That is the arrangement of a cap sorter mounted overhead which discharges oriented caps into a gravity fed chute down to a dispenser located at the chute's end. The differences become great regarding the manner in which both the closure and container are handled from this point forward in the process of cap application.

With In-line Cappers, bottles traveling on the infeed conveyor of the machine are gripped on their outer edges by side gripping belts that are speed matched to the conveyor. The neck of the gripped bottle will pass under the cap dispenser and a cap will be stripped-out directly by the finish of the neck. The closure resting on the finish will pass through a series of cap tightening wheels which spin the cap onto the threaded neck finish. The last pair of wheels are equipped with friction clutches to deliver the desired torque to the capped container. The capped bottle will be released from the griping belts at the discharge of the capper.

With Chuck-Style cappers, the oriented closure at the end of the cap chute is not picked-up by the bottle. It is instead picked out of the chute by a cap transfer device, which then places it into the gripping chuck of a capping head. This pick-and-place mechanism can be either a rotary starwheel with pockets or pegs or can be individual pegs associated with each capping head station. Bottles on the infeed conveyor of the machine enter an infeed timing screw which separates them to match the specific pitch of the capping heads. Bottles are transferred to an infeed starwheel, which then delivers them to the turret starwheel where they are placed and centered directly underneath the capping heads. The rotating capping head that has a cap held in its gripping chuck, will then descend onto the bottle and apply the cap to the desired torque. Application torque is controlled by a clutch mechanism within each capping head. Once the cap is applied, the jaws of the chuck will open and the head will rise off of the capped bottle. Bottles are restrained from rotating while the cap is applied by a gripping system while the bottle is in the turret starwheel. Capped bottles are then placed onto the exit conveyor by a discharge starwheel.

The following are a comparison of the attributes of each technology for a variety of categories including financial considerations, operating features and performance characteristics:

Initial Investment: An In-Line capper requires a much lower initial investment in comparison to a rotary Chuck-Style capper. A Chuck capper can be 4 to 10 times the cost of an in-line for the purchase of the base machine.

Cost of Change parts: In-Line cappers have a lower cost for the additional change parts required to run differing sizes of containers and closures. The cap handling equipment is limited to the sorter, chute and dispenser. There is no cap transfer mechanism or individual chucks as there is with a rotary machine. Changes in cap diameters on In-line machines are accommodated by adjusting the spacing of the tightening wheels. The cost for bottle handling change parts are also avoided with In-line cappers as their side gripping belts adjust to accommodate differing size containers.

Footprint: An In-Line capper will typically have a smaller footprint than a rotary machine. In many cases, an In-line machine can be mounted over an existing section of bottle conveyor.

Operating Speeds: Rotary Chuck-Style cappers have much higher speed capabilities than In-Line machines. Chuck cappers can be supplied with as few as 1 head to as many as 40 heads to operate at production speeds from as low as 10 BPM to speeds as high as 1200 BPM. In-Line cappers are typically speed limited to a maximum of 200 BPM.

Cap Size Considerations: In-Line cappers are limited in the diameter of cap that can be dependably applied. The greater the diameter of a closure, the greater the application torque required to apply it. The cap tightening wheels of In-Line machines contact only a small area on each side of the cap and cannot generate the sufficient torque required to apply these large caps. In addition, containers that have large diameter neck finishes are readily ovalized by the side gripping belts used to prevent rotation. Ovalization of the neck finish will result in misapplied and cocked caps. For these reasons, In-Line machines perform best with closures smaller than 53mm in diameter. Conversely, since the gripping chucks of a rotary capper provide 360 degrees of contact with the sidewalls of the cap, there is positive gripping for the application of torque regardless of the size of the closure. In addition, bottles are supported by the machined pockets of the starwheel to help maintain the round shape of the neck finish during the cap application.

Cap Shape Considerations: An In-Line capper will be generally limited to applying closures that are round in shape. Chuck style cappers can apply round, rectangular, square, oval, tapered and reverse tapered caps.

Caps with Tamper Evident Bands: Chuck-Style cappers have a tremendous advantage over In-Line machines when applying closures with tamper evident bands. The TE band typically has an interference fit with the threads on the neck finish of the bottle. Direct pick-off of these caps by the bottle results in the caps sitting crooked on the bottle finish and generates a high number cocked caps with In-line machines. A Chuck-Style capper will have a TE cap positively held by the jaws of the chuck and it will be brought down squarely onto the bottle finish and held squarely during its entire application which avoids the incidence of cocked caps. In addition, the capping head on a Chuck-Style machine can deliver a downward force (Top Load) onto the closure as it is being applied. This top load helps force the TE band over the thread finish of the bottle neck to properly engage the threads of the cap with the threads of the neck finish.

Torque Accuracy Considerations: For closures that require a narrow range of application torque to ensure their proper performance, a Chuck-Style capper will deliver more accurate control of the torque being applied to the closure. The positive gripping chuck and clutch within each capping head combine to deliver more accurate performance over In-Line machines.

Closure Style Capabilities: Because an In-Line capper relies on the neck finish of the bottle itself to pick- off the cap from the cap dispenser, these machines are limited to running closures that lend themselves to being easily picked-off. This is suitable for non TE banded screw-on caps. A Chuck-Style capper has the flexibility to run both TE banded and n on TE banded closures as well as closures that are applied with a push-down motion, non-round closures that are first oriented and then pushed down, plug-style closures that are pressed into a bottle, and fitments that are pressed over a bottle finish.

Container Style Capabilities: As In-Line cappers must rely upon their side gripping belts to restrain the container from rotating during cap application, they are limited, when running round containers, to those that have sufficient rigidity to withstand the forces applied by these belts. The contoured pockets of the bottle handling equipment of a rotary capper, allow containers to be gripped without deforming their shapes. In addition, lightweight PET containers such as those used for water, juice and soft drink packages can be handled by their neck support ring that is an integrally molded part of the bottle finish. The sidewalls of these bottles are so weak, they cannot be run using an In-line machine.

In closing, the decision of which capper category is appropriate for a particular project should include an evaluation of the attributes of the current packages to be run, attributes of the future packages that might be run, capabilities of the machine technology being considered, matched up against the performance expectations for the packaging line and the capital available for the investment in the machine.

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