

Third-Motion Servo Plug Assist

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The form press on most thermoforming machines features upper and lower moving platens. In addition, many machines now feature a third motion – a plug-assist drive. Initially, plug-assist tooling was always mounted in a fixed position on the platen opposite the mold. However, there are significant advantages to mounting plug assists independent of the other two platens. Machine builders call this third-motion servo plug assist, servo-driven plug assist, servo plug drive or independent servo plug assist.

Regardless of the name, all suppliers of large-platen thermoforming equipment in North America now offer independent, third-motion, servo-driven plug assists for processing deep-draw products.

North American large bed thermoformers normally have a mold with female inserts mounted on the top platen with the plug assist on the lower platen. With the advent of servo-operated platens, equipment suppliers are more easily able to incorporate a third motion to achieve independent plug action.

Generally speaking, European equipment has always had an independent plug assist. Even in trim-in-mold machines where one platen is fixed and the opposite moves, you are likely to find a plug assist. The plug assists in older equipment were driven via pneumatic or hydraulic cylinders. In this type of press, the plug assist was attached to rods that passed through the fixed tool half and connected to a spider plate. The drive mechanism was attached to the spider plate. Today both form/trim/stack and trim-in-mold machines incorporate servomotors for the platen and plug movements.

Processors of deep-drawn containers need to incorporate

independent third motion plug assist on any new equipment purchases to remain competitive in the cost-driven world markets of today. What does independent third motion plug assist do for the processors?

BENEFITS

- A) Third-motion allows tooling to be designed to eliminate flexing. Elimination of flexing allows tooling to clamp tighter and prevent any slipping of material through the clamp rings. Material slippage can be more pronounced in large platen formers due to larger, heavier tools.
- B) Third motion allows for faster cycling because plug assists can be moved back to a home position before the tools are opened, decreasing time required for platen travel.
- C) It is easier to down-gauge sheet thickness requirements producing product with more uniform material distribution resulting in less weight with comparable strength.
- D) Third-motion tooling allows different forming techniques. 1) The forming air pressure can be started before the plug assists is fully extended. 2) A vacuum pulse (Brown Machine - Patent Pending) can be applied on the plug side to keep material away from the mold cavity lip during plus assisting. 3) It is very easy to incorporate coining in the lip area on the mold inserts. This gives uniform consistent return lips on the finished products. This is of particular importance for those products that require lip rolling.

MACHINE DESIGN

Today there are two basic third-motion designs used in large platen thermoforming machines for the North American market:

- A) The pressure box is designed as a rectangular box. The plug assists

mount to a plate inside the box. To get strength in the clamp plate, posts are mounted in the areas between plug assists. Four to six rods are mounted on the back side of the plug plate and extend through the base of the pressure box for connection to the third-motion plug drive.

- B) The pressure box is designed as a solid box with bored holes for the plug assists. The plug assists are each mounted to a rod that extends through the base of the pressure box. All plug rods connect to a spider plate. The third-motion drive connects to the spider plate.



Fig. 1. Bottom platen with plug assist servo motor in the foreground.

Method A does not have as much strength as method B. In addition, the compressed air consumption used in method A is considerably greater than that used in method B. Processors should also look at the method of attaching the third-motion drive. To mount the pressure box easily in the thermoformer, both the pressure box and plug drive should have automatic connection to the platens.

Processors should review the method of attaching the plug assist. The difference in changing out plug assists in a large, multi-cavity tool can vary significantly depending on the method used when changing plug assist.

Equipment suppliers each have their own design for third-motion axes. Processors should evaluate the actuation method, guidance and stabilization, duty factors and maintenance accessibility to minimize downtime and reduce operating costs. |