Seed Tube

Molder: Steinwall, Inc.

Moldmaker: Contour Mold

Material Supplier: Omni Plastics

Designer: John Deere

OEM: John Deere

Product Description

This one-piece injection molded agricultural tube dispenses seeds in the ground. The prior tube design (clam-shell parting lines) caused the seeds to bounce resulting in variability in ground placement. A one-piece design eliminated this variability for farmers allowing for optimum soil and moisture utilization per plant.

This simple-looking part was anything but simple. The design was limited by existing geometry (machinery) constants; the molded tube needed to be both straight and curved.

Critical elements: A double-acting slide was necessary to allow the straight portion of the core to eject first and then a swing arm was required to allow the core to clear the cavity steel when ejecting. In addition, cooling the moving curved-core was challenging; the challenge was machining ¼ inch water lines into an 18 inch curved core while maintaining steel strength. Finally, the press and tool required an elaborate 10 proximity switch procedure to properly sequence while molding.

Why is the product innovative?

The part looks surprisingly simple; yet a simple part design sometimes involves creativity and a complex mold design. The project objective was to design a one-piece molded tube given existing exterior part geometry; the current design was a clam-shell tube. The tube is used for dispensing seed into the ground, and the clam-shell parting lines caused seeds to bounce resulting in variability in ground placement.

The design was achieved in three steps; first, design the curved core, then design the cooling, and finally determine the sequencing of the mold. This design needed to accommodate high annual volumes, requiring the process to be extremely robust and repeatable.

Step One: The core required a straight section followed by a curved contour; therefore, a double-acting slide was necessary to allow for the straight portion of the core to eject first, and then a swing arm was required to allow the core to clear the cavity steel when ejecting.

Shutting off the swing-arm core also presented unique design challenges. Since the core moves on an arc, the shut off point involved dynamic analysis to guarantee proper alignment. Without proper alignment, core damage could result increasing flash at the end of the tube. This flash was undesirable as it would also cause the seed to bounce.

Step Two: Cooling the curved-core that was moving on a double-acting hydraulic slide with a swing-arm was extremely challenging! The challenge was machining ¼ inch water lines into an 18 inch curved core while maintaining steel strength. After several false attempts, the solution was to machine the water lines first in flat stock and then machine the steel into a curved shape.

Step Three: Final sequencing of the tool operation is very involved and took this form:

Mold Open

1. Lock Pin open
2. Hydraulic slide out
3. Hydraulic swing-arm open
4. Mold open
5. Ejection Forward

Mold Close

1. Ejection retract
2. Mold close
3. Hydraulic swing-arm close
4. Hydraulic slide in
5. Lock Pin closed

The timing of the sequencing above is crucial to producing acceptable parts. Several proximity switches were installed to increase the robustness of the operation.