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The Manifold and Head Assembly

Continuing our review of all elements of the blow molding process, this report focuses on the forming of the parison, which determines the weight of the containers, wall distribution and appearance.

Function of the Manifold
Plastic flowing from the extruder must be channeled to one or more heads to form a tube (parison) for blow molding a container. The extrusion manifold, which functions much like the manifold of an automatic gear shift car that channels a gas/air mixture to each cylinder, does this channeling.

The blow molding manifold may split the flow of polyethylene into several paths directed to each head. These flow paths have either changing diameters (larger as you move away from the main feed) or the same diameters with choke screws incorporated. In either case, the paths ensure that each head receives identical amounts of polymer.

The choke screws (Figure 1) generally are adjusted to open up more of the flow channel as you move away from the main feed. This adjustment is necessary to maintain uniform parison lengths. Uneven parison lengths can cause unloading or trimming problems because of uneven tails on the final bottles.

Die Head
As the molten polyethylene leaves the manifold, it enters the die head. Figure 1 details just one of the many head designs used today. This assembly forces the melt to split into two streams around a mandrel sleeve or flow divider and meet on the opposite side where the melt welds together again. This split is the first step in forming a hollow tube or parison.

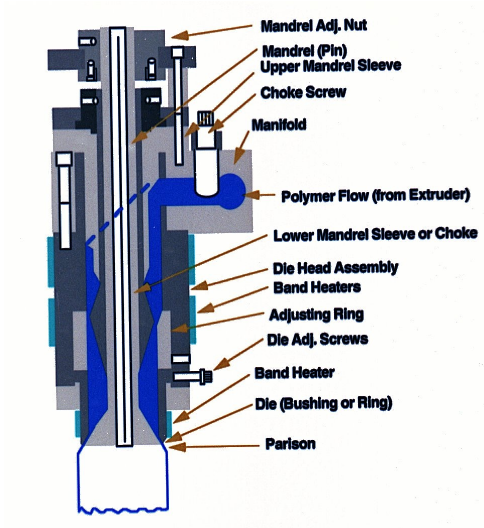

Figure 1

As the polymer moves down the head assembly, it meets the lower mandrel sleeve, sometimes referred to as a choke. This assembly restricts the flow of material or produces back pressure, which ensures a good weld. The lower mandrel sleeve is adjusted vertically to control the amount of back pressure, but is generally left in the full-up position.

In some cases, an adjusting ring is incorporated in the die head to control the differences in polymer velocities. Polymer tends to flow faster down the weld line side of the head, causing curling of the parison upon its exit. This ring can be adjusted eccentrically to restrict the flow on this side, thus resulting in a parison that drops straight. In most cases, the ring is centered on the mandrel sleeve or choke.

(Continued on Page 2)

LyondellBasell Technical Tip

tech.topic

The Manifold and Head Assembly *(continued)*

DIE AND MANDREL

As the polymer leaves the lower mandrel sleeve (choke), it enters the die and mandrel, sometimes referred to as the bushing or ring and pin (Figure 1). This is the final shaping orifice.

The die and mandrel design is determined by many factors, such as container size and shape, container weight, neck finish, resin type, etc. There are two types of mandrels used in the industry today – converging and diverging (Figure 2). The diverging type is generally used for large containers, while the converging type is normally used for smaller containers where the parison can be encapsulated by the neck, thus eliminating any neck flash.

The ever-increasing trend toward light weighting containers, such as the milk bottle, has spurred the need for shaped or ovalized dies. These dies produce a superior container with an even wall distribution around its circumference.

The die and mandrel are precision tools and should be cared for as such. Any nicks and dings in them end up as flaws in the finished container. Care must be taken to avoid dropping them or cleaning them with abrasive tools. A copper scraper or wire brush suffices for cleaning.

In the die and mandrel, the die bolts and mandrel placement can be adjusted to obtain the proper parison. The die bolts (Figure 3) can be moved to change the die's position around the mandrel. This adjustment produces a uniform wall around the parison, which should also result in a parison that drops straight.

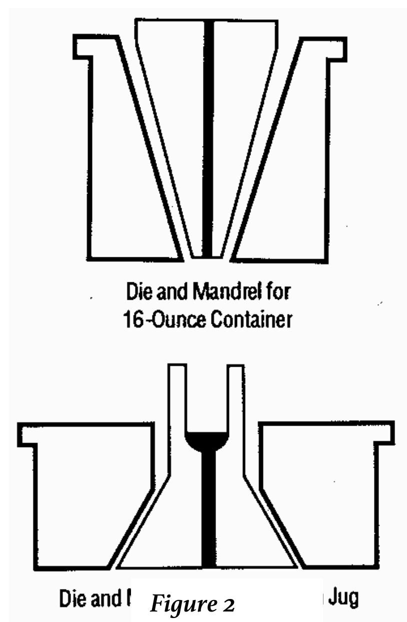

Figure 2

(Continued on Page 3)

LyondellBasell Technical Tip

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The Manifold and Head Assembly *(continued)*

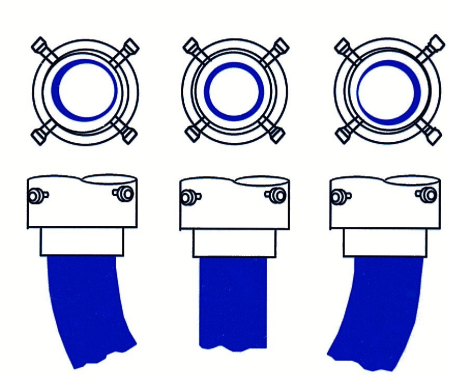

Figure 3

The mandrel can be moved vertically to vary the parison wall thickness and therefore, the container weight. Adjustment can be done by turning a mandrel-adjusting nut (Figure 1) or by means of a hydraulic cylinder controlled by a parison programmer.

Parison programming is a means to produce a container with an even wall distribution vertically. This program moves the mandrel up and down during the extrusion of the parison. This movement produces a parison with walls of varying thickness vertically in areas needed for the shape of the container. The programmer can be adjusted to change the average wall thickness or weight of the container without changing the parison profile.

For more information about blow molding, contact your LyondellBasell sales or technical service representative.

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