

Plastic Bottle Manufacturing Process

How are plastic bottles made? Bottles are usually formed through blow molding, although there are several techniques, including reheat and blow molding, extrusion blow molding, and reciprocating blow molding.

Reheat and Blow Molding Bottles

The first stage of a typical 2-step Reheat and Blow Machine (RBM) bottle manufacturing process is injection molding. Plastic pellets are plasticized in the barrel of an injection molding machine where the plastic is melted by heat and the shearing action of a feed screw. The plastic is then injected into multiple-cavity molds where it assumes the shape of long, thin tubes. These tubes, called parisons, usually include the formed necks and threads that will be used to cap the bottles that are yet to come. PET parisons, or pre-forms, are easily shipped to bottling facilities as they are much more compact than fully formed bottles.

During the re-heat process, the parisons are loaded into a feeder and run through an unscrambler, which orients the parisons for feeding into the blow molding machine. The parisons are heated by passing by quartz heaters and then enter the mold. Here, a thin steel rod, called a mandrel, slides into the neck of the parison where it fills the parison with highly pressurized air, and stretch blow molding begins: as a result of the pressurized air, heat, and pressure, the parison is blown and stretched into the mold axially and radially, where it assumes a bottle shape. This process produces what is called a bi-axially oriented bottle which provides a CO₂ barrier ideal for containing carbonated beverages.

The mold must be cooled relatively quickly, so that that the newly formed component is set properly. There are several cooling methods, both direct and indirect, that can effectively cool the mold and the plastic. Water can be coursed through pipes surrounding the mold, which indirectly cools the mold and plastic. Direct methods include using pressurized air or carbon dioxide directly on the mold and plastic.

Once the bottle (or, in continuous manufacturing, bottles) has cooled and set, it is ready to be removed from the mold. If a continuous molding process has been used, the bottles will need to be separated by trimming the plastic in between them. If a non-continuous process has been used, sometimes excess plastic can seep through the mold during manufacturing and will require trimming. After removing the bottle from the mold and removing excess plastic, the plastic bottles are ready for transportation or filling.

Extrusion Blow Molding Bottles

Other bottle manufacturing processes combine the formation of the parisons and the blow molding in a single continuous process. One such machine is a continuous extrusion machine wherein an extruder is continuously producing a parison. In the extrusion blow molding process, the parison forms vertically and its wall thickness is varied by changing the size of the orifice through which the parison extrudes. Mold halves close over the suspended parison and transfer it to the blow molding station where the bottle is formed as in the second step of the RBM process described above. Varying the wall thickness solves the problem of non-uniformity of the hanging parison as the weight of the formed portion would otherwise stretch the hot and still-forming section above it. Wall thickness is thus increased as the parison forms to create a uniform thickness throughout the formation.

Reciprocating Blow Molding Bottles

Another manufacturing process is the reciprocating blow molding machine. These machines move the screw linearly within the injector barrel to accumulate a shot. Then the screw pushes the shot over the mandrel to create the parison after which it is formed in the usual manner. Such machines are commonly used to create the ubiquitous HDPE handled milk jug, originally produced by Uniloy Corp. in the 1960s.

How are Water Bottles Made?

Water bottle manufacturing depends on the material used to make the bottle, as these bottles are often made of plastic, metal, or other materials. But what are plastic water bottles made of? The disposable types are made of PET, while reusable water bottles can be made from PET, PP, or PVC (polyvinyl chloride).

For disposable water bottles, sometimes recycled PET is mixed in with new PET before the material is melted at 500 degrees F (260 C). From there the plastic goes through the RBM process outlined above. Reusable water bottles need their plastic melted at 150-350 degrees F (66-177 C) before they are extrusion blow molded. From there they can be reheated a second time to shape them further, and then they are cooled. For more information, you can also check out our article on the top water bottle manufacturers.