BLOW MOLDING PROCESS COMPARISON

BY: Jeff Newman
VP Sales & Marketing

If you are new to blow molding or if you have been in the industry for 30 years, it can still be confusing as to what type of machinery or process is best for you next application. I have been fortunate in my career to design and build machinery for every type of blow molding process. For you information I consider there to be 6 primary machinery processes for packaging applications.

- Shuttles (Continuous extrusion)
- Wheels (Continuous extrusion)
- Injection Blow
- Injection Stretch Blow (1 Step)
- Reheat Stretch Blow (2 Step)
- Reciprocating screw (Intermittent extrusion)

Some people may refer to them differently and some may argue several of these should be grouped together, but for sake of discussion, we will use this grouping. Before we compare, let's take a moment to define the technologies.

Shuttle Machinery

This is the most popular type of machinery for blow molding HDPE and PP containers around the world. Literarily, thousands are sold every year. A shuttle machine consists of either single or dual clamps that shuttle (or slide) from under the die head to a blow pin assembly for blowing. The machines come in all sizes and configurations from single cavity to as many as 20-30 and bottle sizes from a few ounces up to a 10 litre jerry can. Included in the shuttle group is the long stroke type machine. Popular manufacturers include Bekum, SIG, Automa and Magic to name only a few of hundreds.

PROS:

- Relatively inexpensive for small to medium volume production requirements
- Deliveries container with calibrated neck
- Typically trims container prior to exiting machine
- Most flexible in container size and number of cavities
- Can handle coextrusion
- Can handle all type of container shapes including handleware

CONS:

- Can not process PET material
- Hydraulics and controls can be complex
- Requires multiple machines for very high production volumes unless
- Multiple parisons can be difficult to process consistently

Wheel (Rotary) Machinery

The rotary blow molders are the machine of choice for very high volumes of containers for markets such a liquid detergent and juice in North America markets. Wheels are typically chosen over shuttles because of processing ease (and cost) due to single parison technology and lower cost per container for high volume applications. This is especially true for coextrusion and multilayer applications. Machine can be designed to handle a wide range of container sizes, but are typically committed to a narrow range of container variation after built. Because the containers are blow with a needle (instead of blow pin), it is not unusually to blow container in a neck to neck configuration to increase the production output. Wheels come in various configurations including indexing, continuous motion, vertical (like ferris wheel) and horizontal (like merry go round). Some even now have the capability to produce calibrated neck containers. Most, however rely on downstream trimming equipment to trim and finish the container. Major manufacturers include Wilmington Machinery and Graham.

PROS:

- Lowest cost method for high volume production requirements
- Simple design and controls for maintenance
- Single parison well suited for multilayer application for repeatability and cost
- Easy to utilize IML
- Can achieve very high production volume from a single machine.

CONS:

- Typically can not be converted to different number of cavities after being built.
- High investment requires commitment to high volume production situations.
- Requires secondary trimming and finishing equipment.

Injection Blow Machinery

These machines inject mold a preform onto core rods and then index the core rods to a blow station to blow the container. Machines are typically 3-4 stations allow for condition and part removal. They are utilized extensively for very small containers such as pharmaceutical and hotel shampoo type containers. Major manufacturers are Jomar, Procrea and Milacron.

PROS:

- Scrap less process meaning no flash to trim and no regrind

- Typically suited for container .5 litre and smaller
- Capable of running a wide range of materials
- High quality injection molded neck finish

CONS:

- Very high tooling cost per container typically cost 40-50% of the machine cost.
- Difficult to run coinjection or multilayer
- Minimum cycle time typically 15 seconds
- Can not do handleware

Injection Stretch Blow (1-Step)

This process is almost entirely dedicated to PET and more recently, PP applications. The process is very similar to Injection Blow described above except for two areas: 1) the preforms are not transported on core rods but instead held by the neck finish and 2) during the blowing process, rods stretch the preform prior to blowing to orient the material. For materials such as Pet this biaxial orientation substantially increases the physical properties to weight ratios. Major manufacturers include Aoki and Nissei.

PROS:

- Scrap less process meaning no flash to trim and no regrind
- Allows for biaxial orientation for strength and clarity
- High quality injection molded neck finish
- Typically suited for .5 litre up to 20 litre
- Capable of PET none carbonated beverage of containers
- Capable of lower volume production applications
- Does not require separate preform mold and machine

CONS:

- High tooling cost
- Minimum cycle typically 18-20 seconds
- Can not produced carbonated beverage container (Not enough biaxial orientation due to high preform temperature at blowing
- Not suited for polyolefins.
- Can not blow handleware
- Difficult to run coinjection or multilayer

Reheat Stretch Blow (2-Step)

This process is also almost 100% for PET applications. The processes utilizes preforms made on a standalone injection molding machine, stored and then reheated and stretch blow similar to the 1-step process above. Here however, the preforms are blown at a lower temperature allowing the maximum amount of biaxial orientation and therefore the maximum strength to weight ratios. The reheat process can be for ultra high output type applications such a carbonated soda bottles while other machines can be smaller for medium to high production requirements. Major machinery manufactures include Sidel and Krupps.

PROS:

- Can be very high speed production (40,000 container / hour)
- Produces a very high strength to weight ratio container
- Can purchase or make preforms
- Primarily PET material
- Machines for low and medium volume application are becoming available

CONS:

- Can not mold handleware
- Not capable of polyolefins
- Large Have to have a separate preform mold and injection molding machine or purchase preforms
- For low volume production, if special design preform is required, cost can be expensive

Reciprocating screw (Intermittent extrusion)

This is the most popular and cost effective method to produce light weight dairy, juice and water container. In this process the extruder feed screw reciprocates similar to an injection molding machine. The molds are stationary under the die head and simple open and close but do not shuttle. As the screw moves forward, the parison is push out into the molds for blowing. For light weight container, cycle times can be very fast with some under 5 seconds. Major machinery manufactures include Rocheleau and Uniloy.

PROS:

- Very fast cycle time capabilities
- Simple machine motions since clamps do not move
- Capable of 16 cavities small bottles or 8 gallons. Smaller models available
- Relative low cost per cavity
- Can easily run homo polymers and very low melt temperatures

CONS:

- Limited to monolayer applications
- Primary materials are HDPE and limited amount of PP.
- Difficult to parison program

For more information about Blow Molding or Wilmington Machinery contact: Jeff Newman, PO Box 7308, Wilmington, NC 28406. Phone 910-452-5090.
jnewman@wilmingtonmachinery.com
www.wilmingtonmachinery.com