

Reciprocating Screw Extrusion Blow Molding

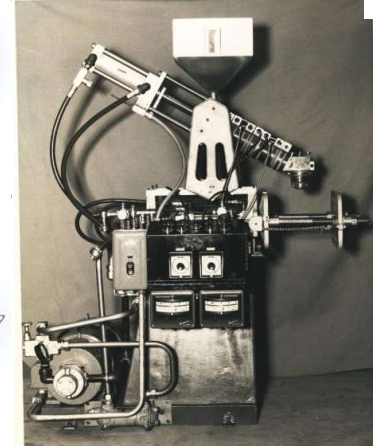
Rocheleau Blow Molding Systems

-Nick Rocheleau



History

- Established in 1938, by L.A. Rocheleau, as tool & die shop in Fitchburg, Massachusetts
- Built first blow molding machine in 1960s
- Offer wide variety of extrusion blow molding machines and trimming systems ranging from 1" to 90mm extruders
- Service customers in 40+ countries
- Family owned and operated, spanning 4 generations



ROSADE Blow Molder, 1964



RS-90 Blow Molder, 2018



RS Series



RS-90

- 340 kg (750 lbs) HDPE/hour.
- 90mm (3.54") extruder
- 48" maximum platen width
- other options available



RS-80

- 204 kg (450 lbs) HDPE/hour
- 80mm (3.150") extruder
- 48" maximum platen width
- other options available



RS-70

- 159 kg (350 lbs) HDPE/hour
- 70mm (2.75") extruder
- 40" maximum platen width
- other options available

RS-25

- 125 kg (275 lbs) HDPE/hour
- 63.5mm (2.50") extruder
- 32" maximum platen width
- other options available



Smaller Options



SPB-3

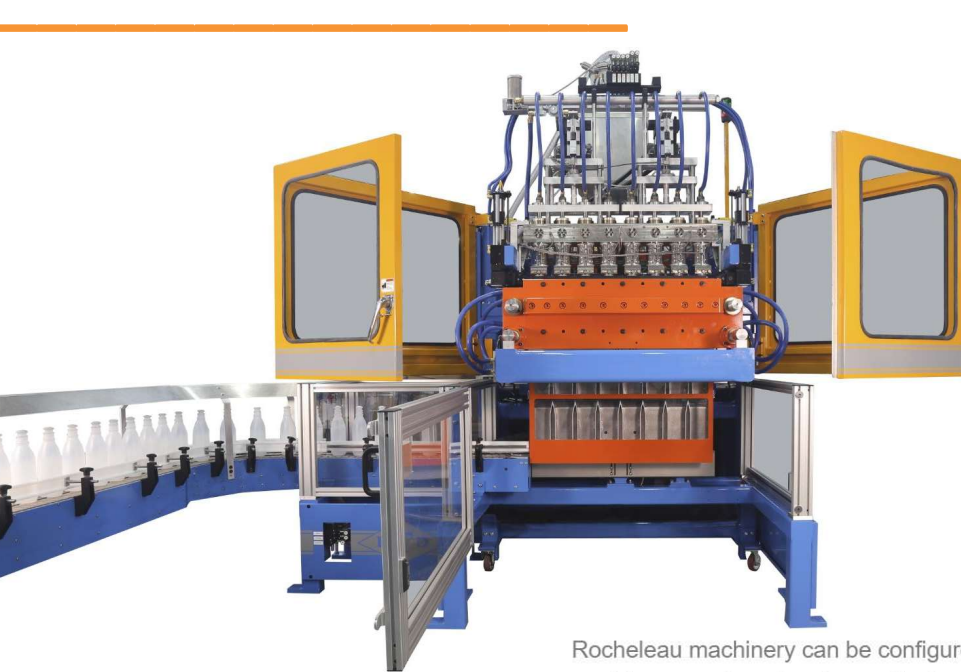
- 64 kg (140 pounds) HDPE/hour
- Modular design with 18" clamp
- 57 mm diameter (2.25") reciprocating screw extruder
- Die heads from single to 5-parison configuration

R-4

- 38mm diameter (1.5") reciprocating screw extruder
- Single to 3-parison die head configurations
- 32 kg (70 lbs)/hr maximum output
- Additional applications for schools, laboratories, and R&D development
- Trimming and other options available



Automation



Rocheleau machinery can be configured in a modular fashion, offering flexible solutions for evolving manufacturing demands. Automation and other options are available. Individual components can be incorporated into Rocheleau systems or other adaptable machine lines.

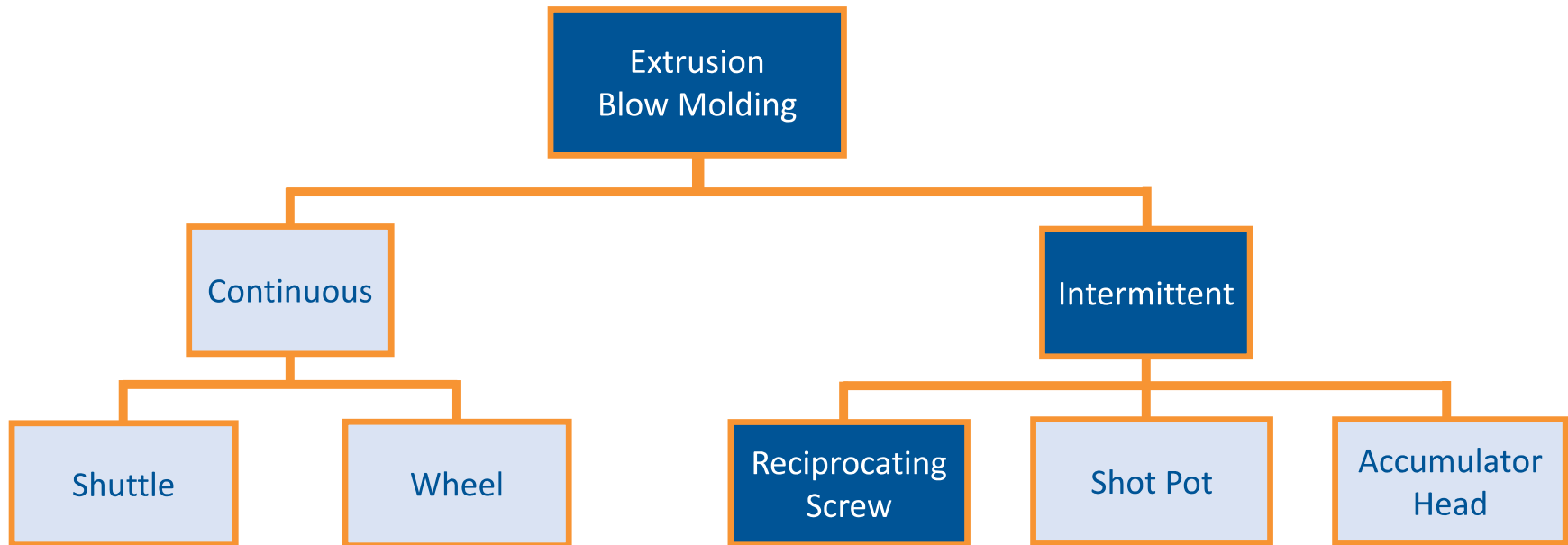
Spin Trim: Fully automated spin trimming for dome scrap removal

Detabber: Tail puller consistently provides precise, efficient tail scrap removal

Impact Deflash: Vertical trimmer allows bottles to remain standing in upright position for easier transition to down-line processes



Why Recip?



Materials

- High Density Polyethylene (HDPE)
- Low Density Polyethylene (LDPE)
- Polypropylene (PP)
- Others



Markets

- Dairy
- Food & Beverage
- Industrial
- Automotive



Advantages

- Simple Machine Motions
 - Screw Turn, Clamp Open/ Close, Inject
- Relative Low Cost per Cavity

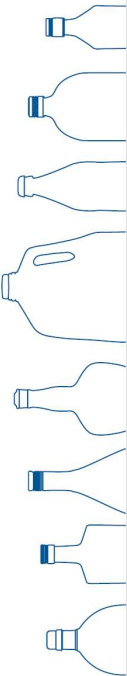
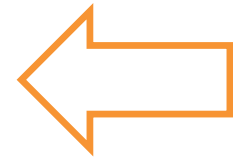
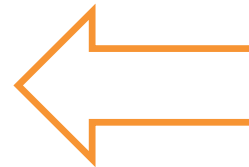
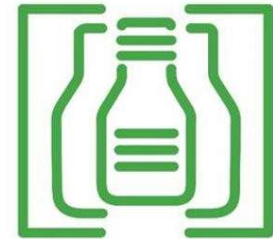
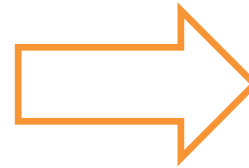
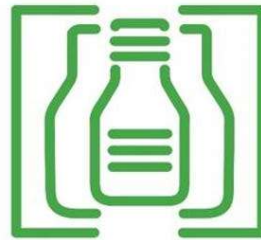
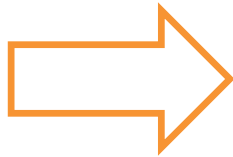
■ Fast Cycle Times

Container	Gram Weight	Estimated Cycle Time (Seconds)	Cavitation	Bottles per Hour	Bottles per 6,000 Hour Year (At 100% Efficiency)
Lightweight					
Dairy Gallon	62	6.5-7.5	6	3,085	18,510,000+
1/2 Gallon	42	6.5-7.5	8	4,114	24,684,000+
Wide Mouth Gallon	90-110	10.5-11.5	6	1,964	11,784,000+
10 Quart (Water)	165	14.5-15.5	3	720	4,320,000+
Industrial					
Gallon	95-110	11.5-12.5	6	1,800	10,800,000+
	140	15-17	6	1,350	8,100,000+

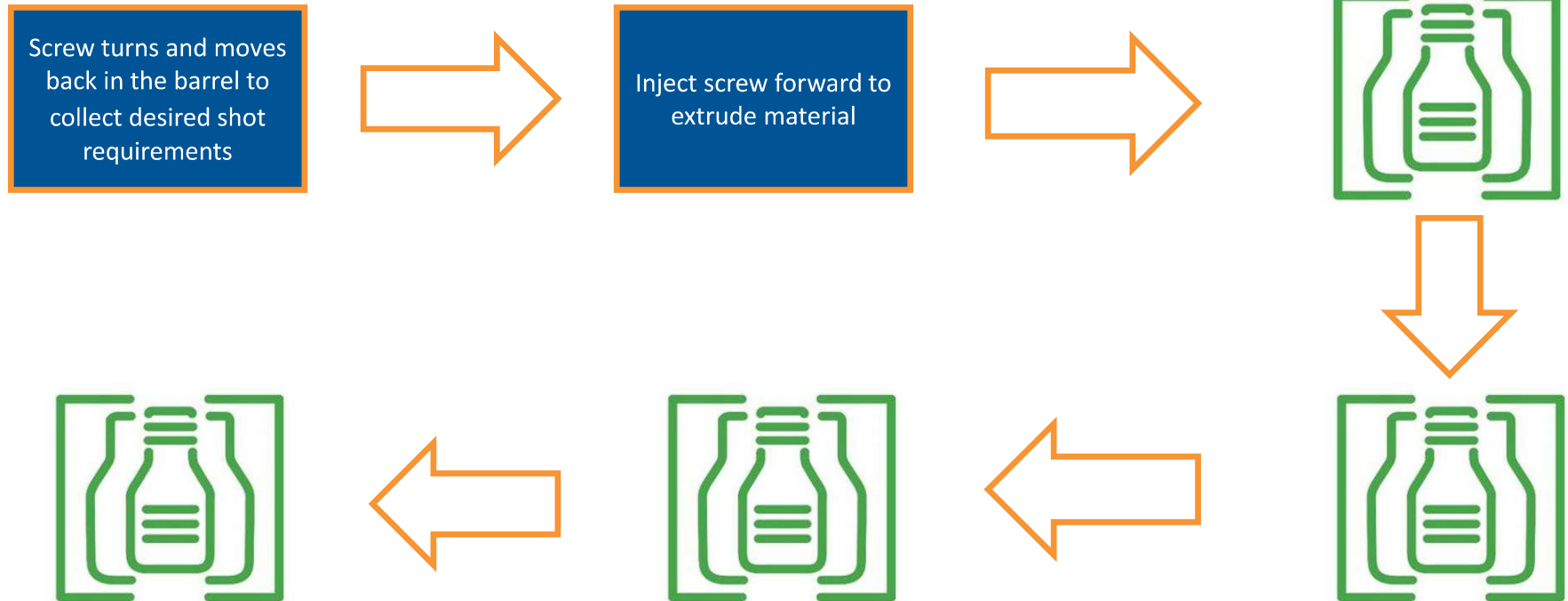


Cycle Process

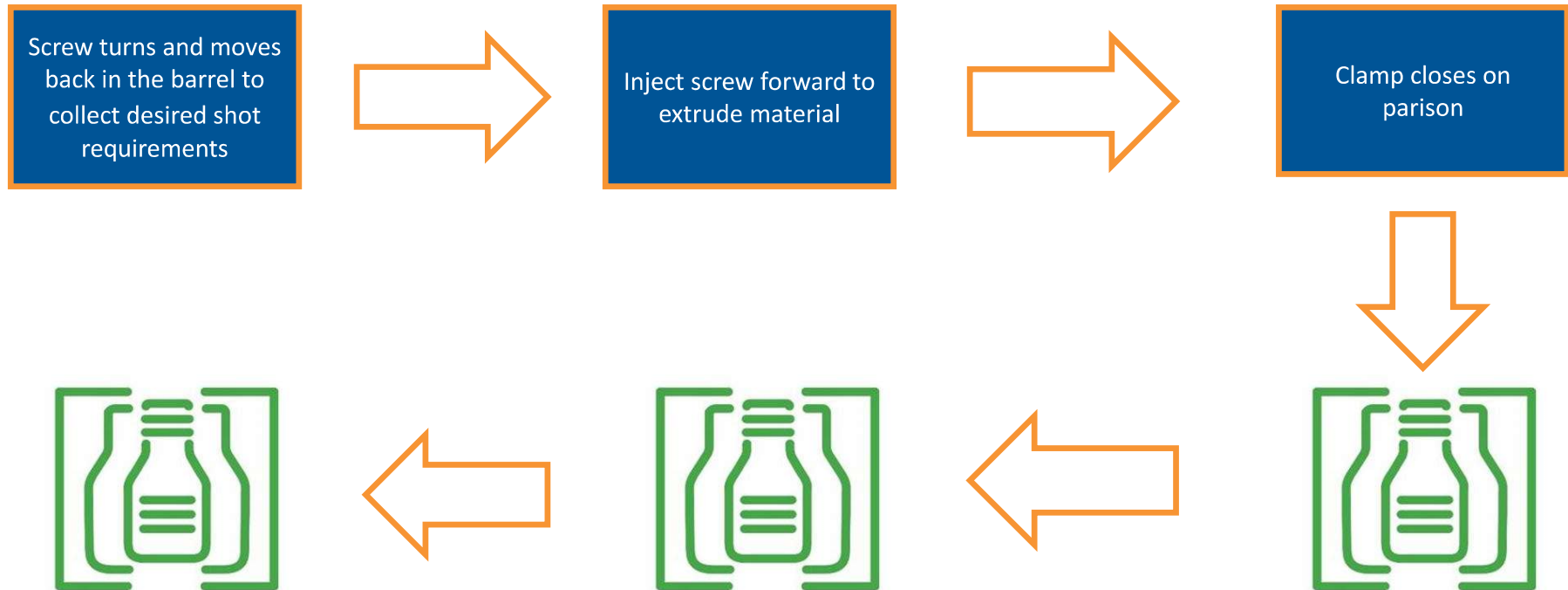
Screw turns and moves
back in the barrel to
collect desired shot
requirements



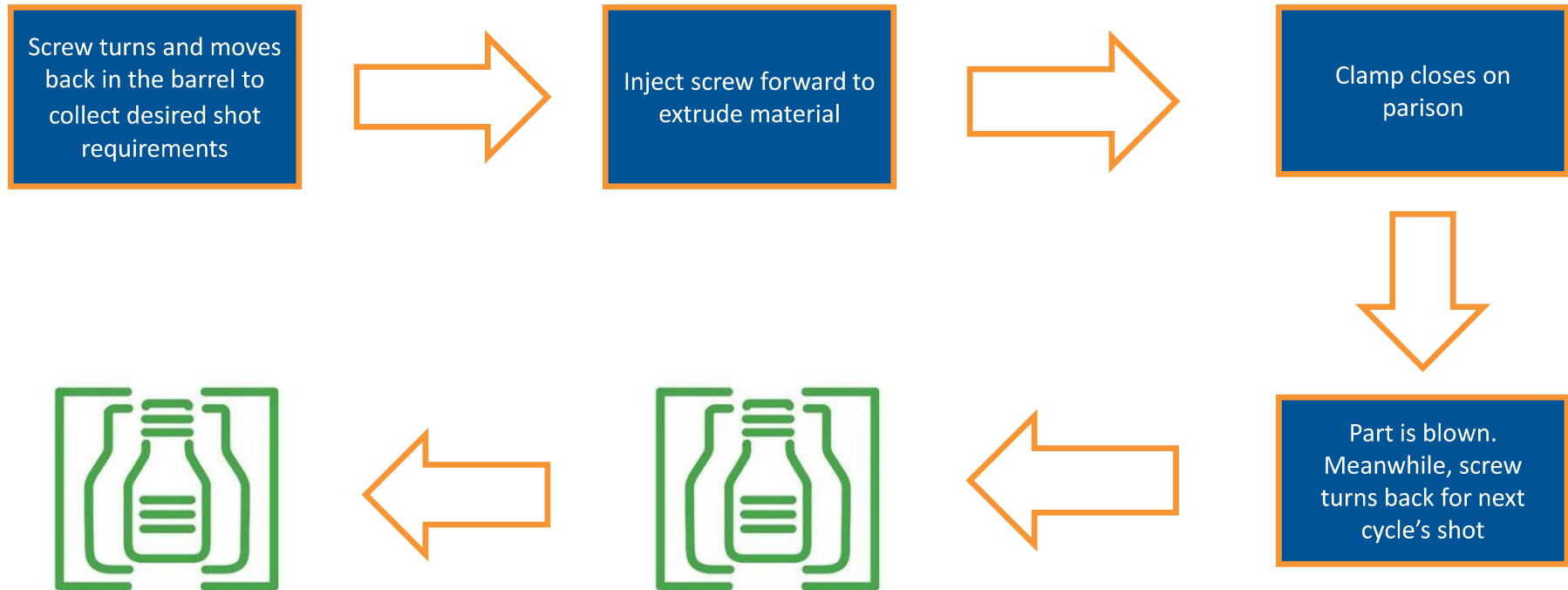
Cycle Process



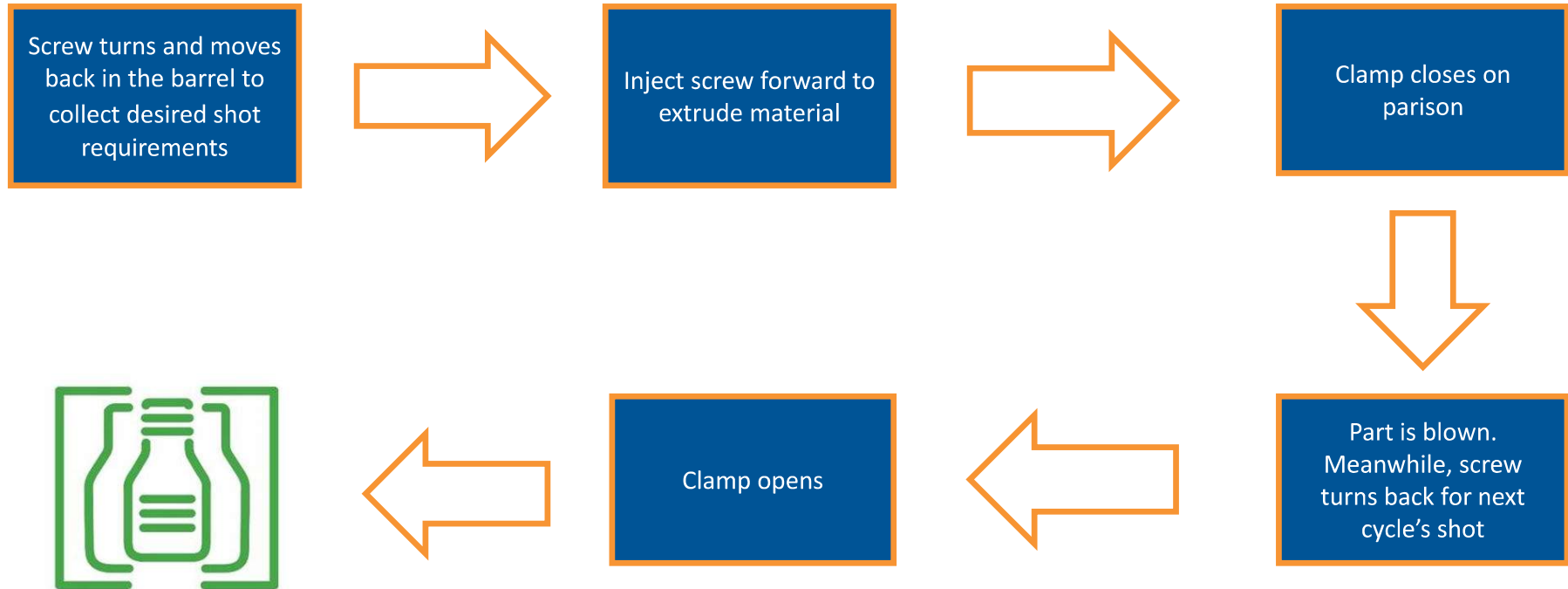
Cycle Process



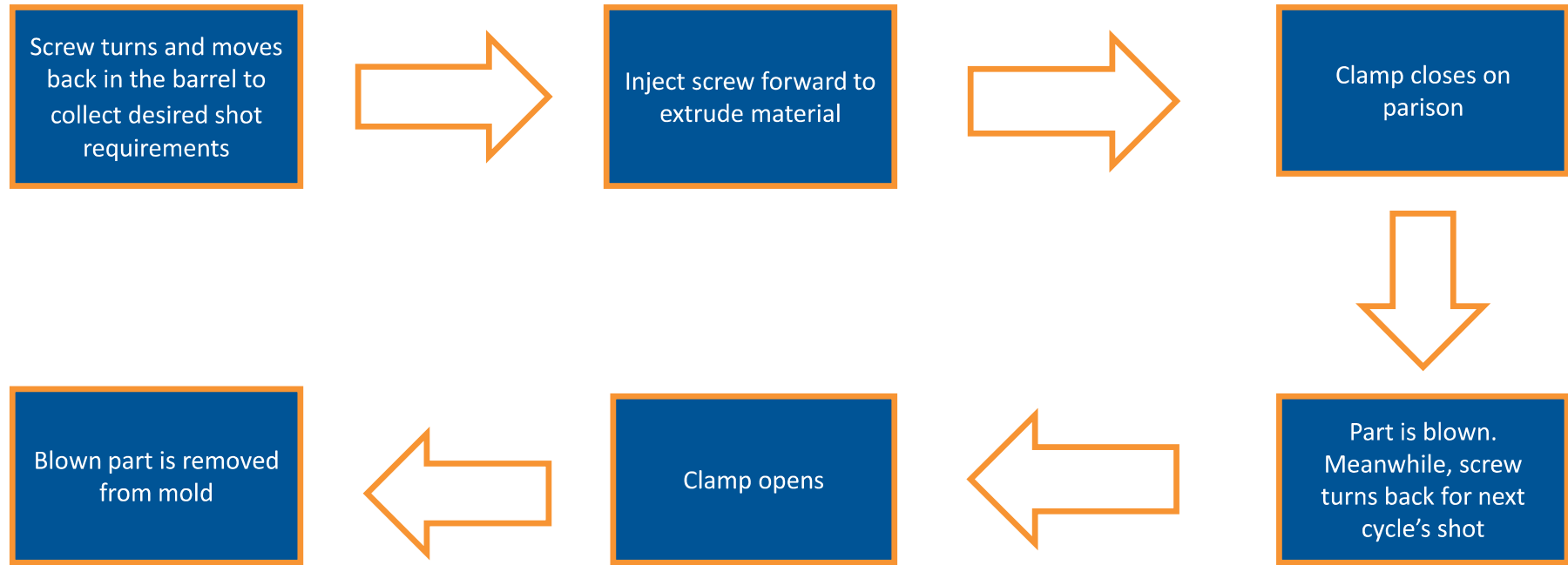
Cycle Process



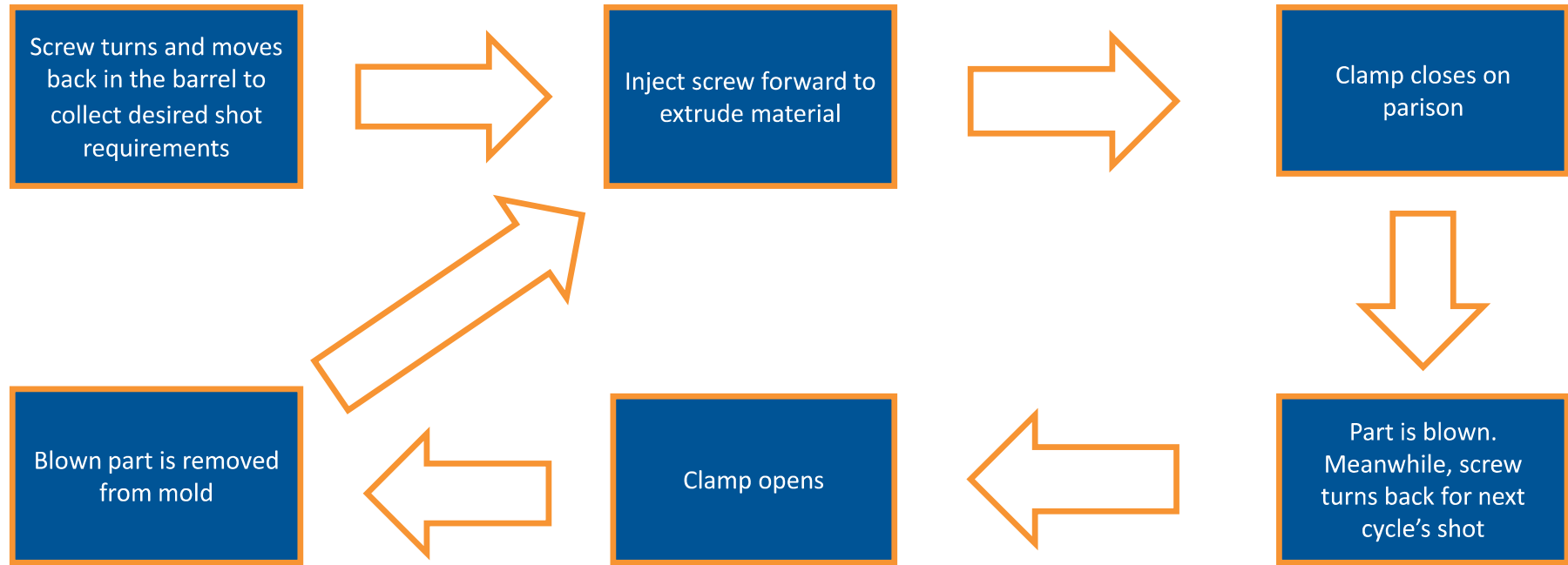
Cycle Process



Cycle Process



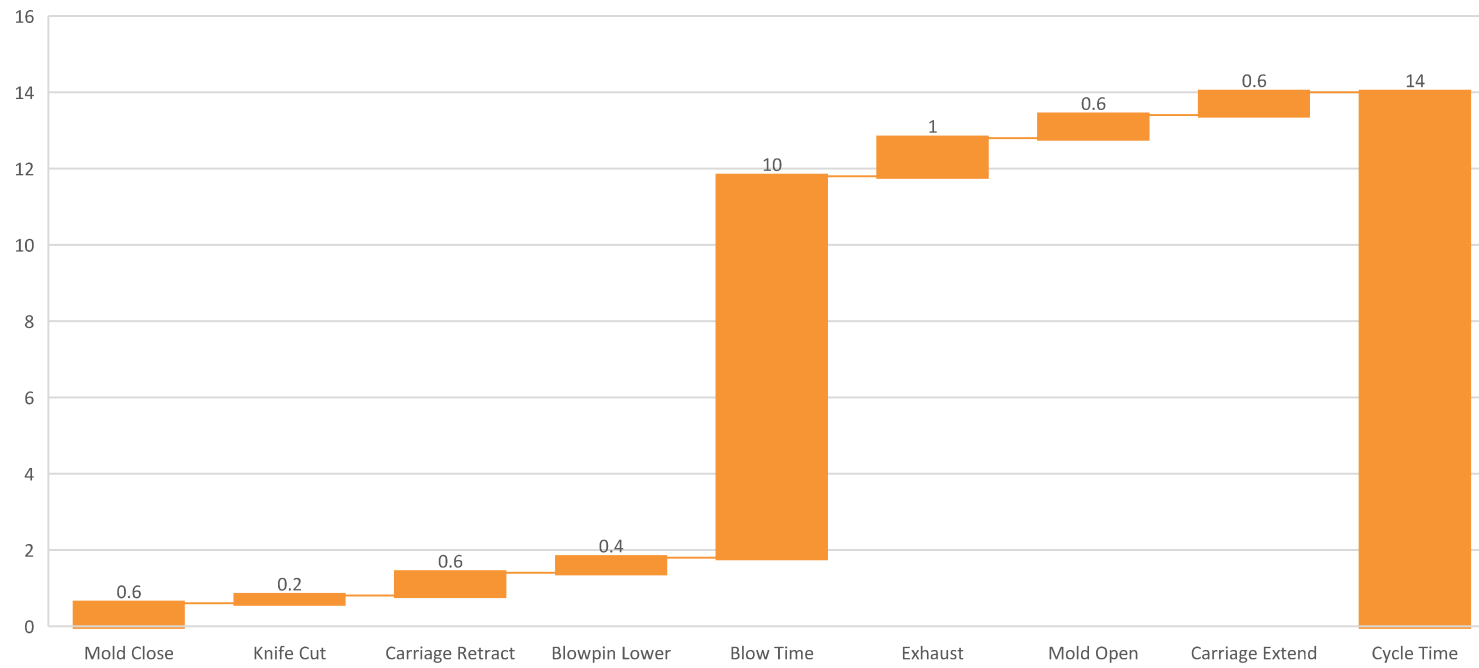
Cycle Process



Cycle Process

Shuttle Sequence

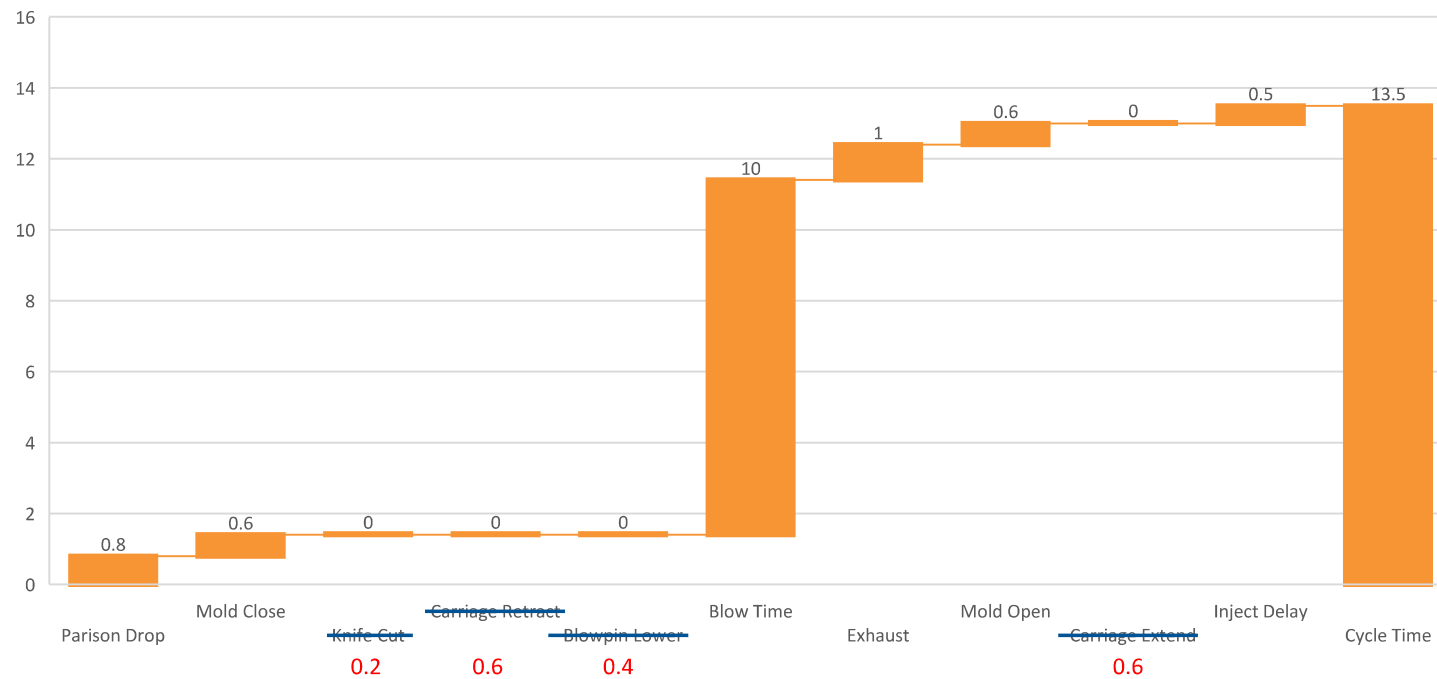
Machine Functions



Cycle Process

Recip Sequence

Machine Functions



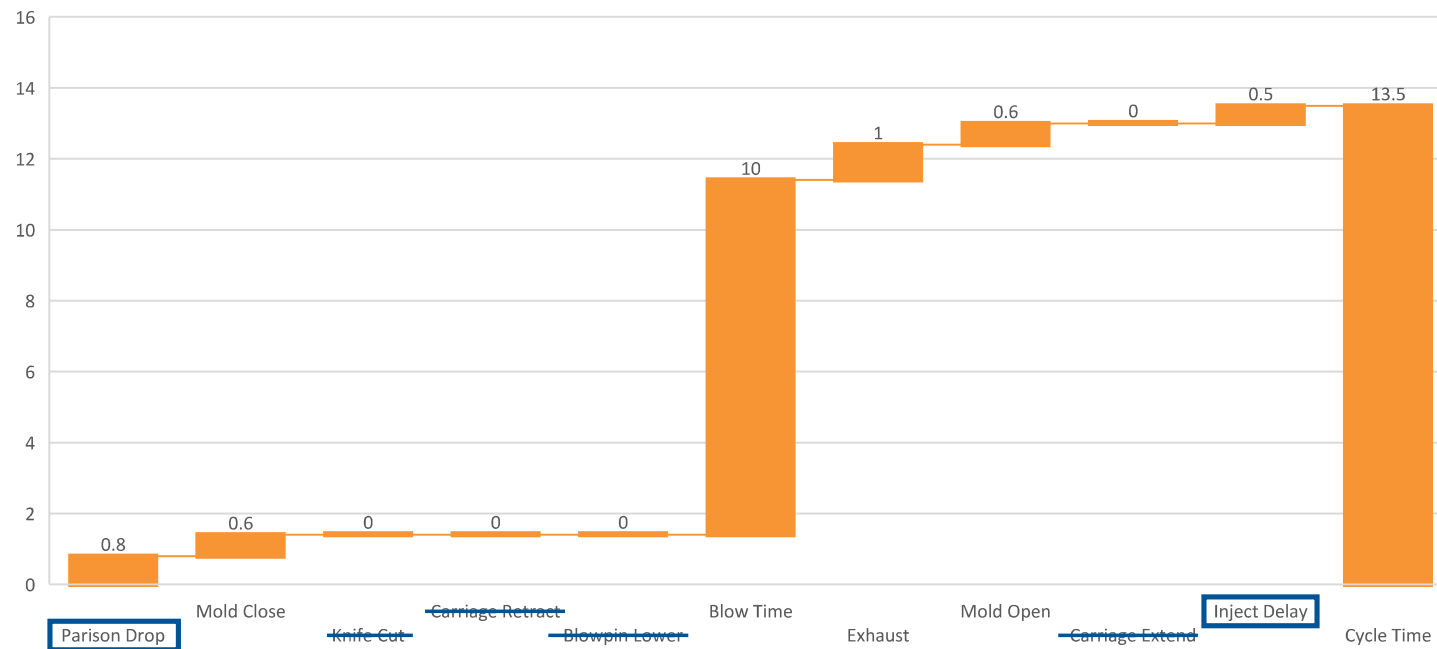
1.8 seconds



Cycle Process

Recip Sequence

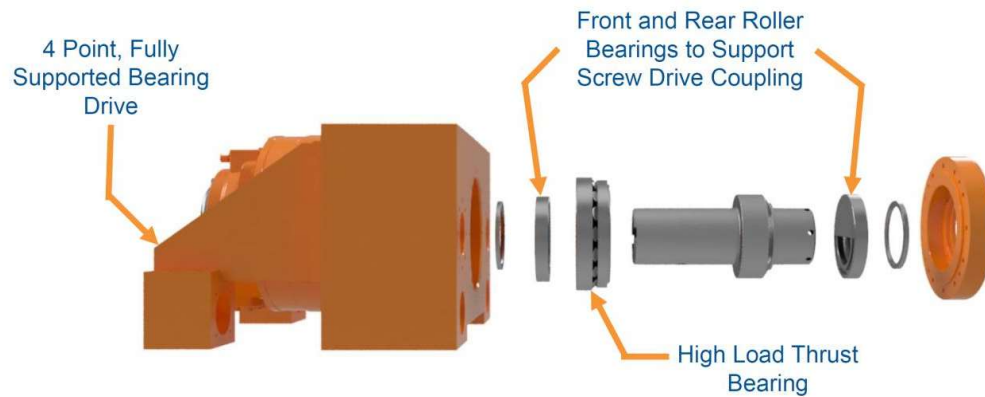
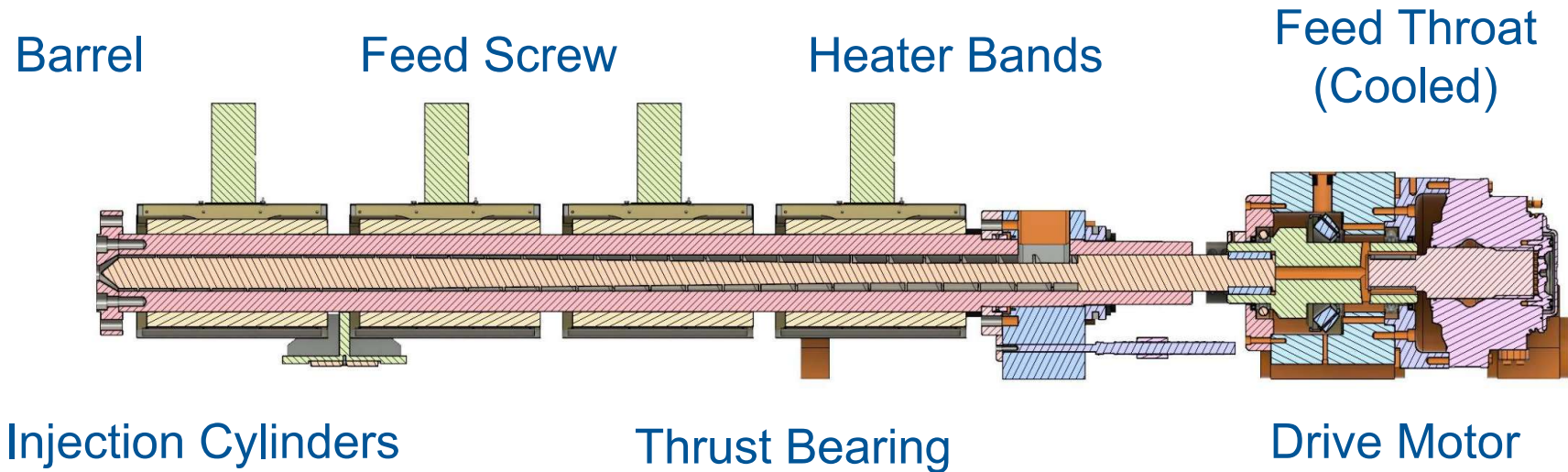
Machine Functions



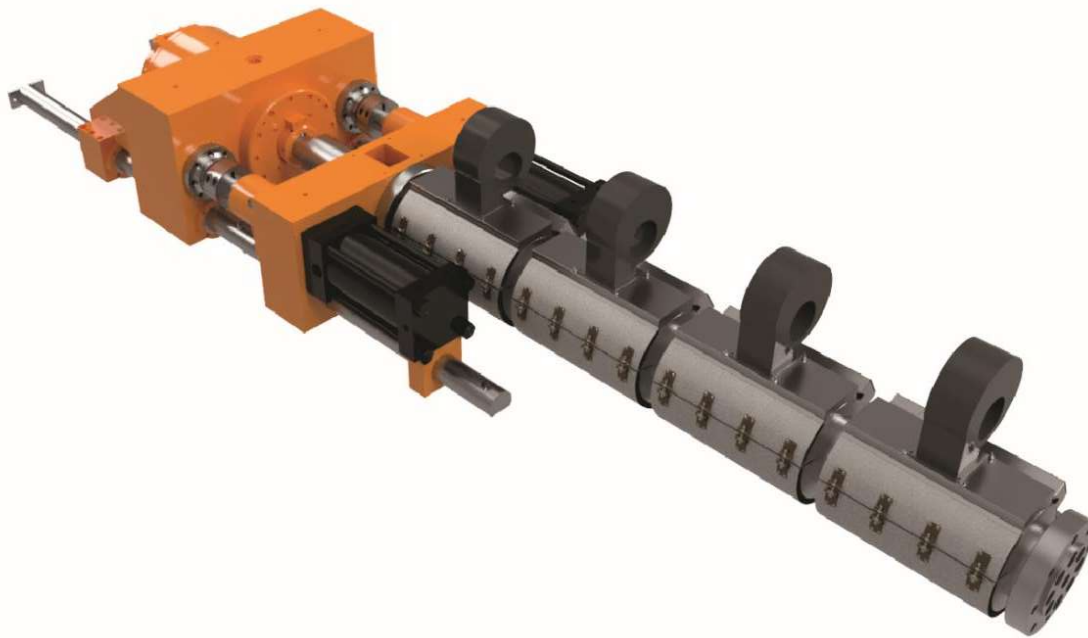
1.3
seconds



Extruder Overview



Extruder Overview

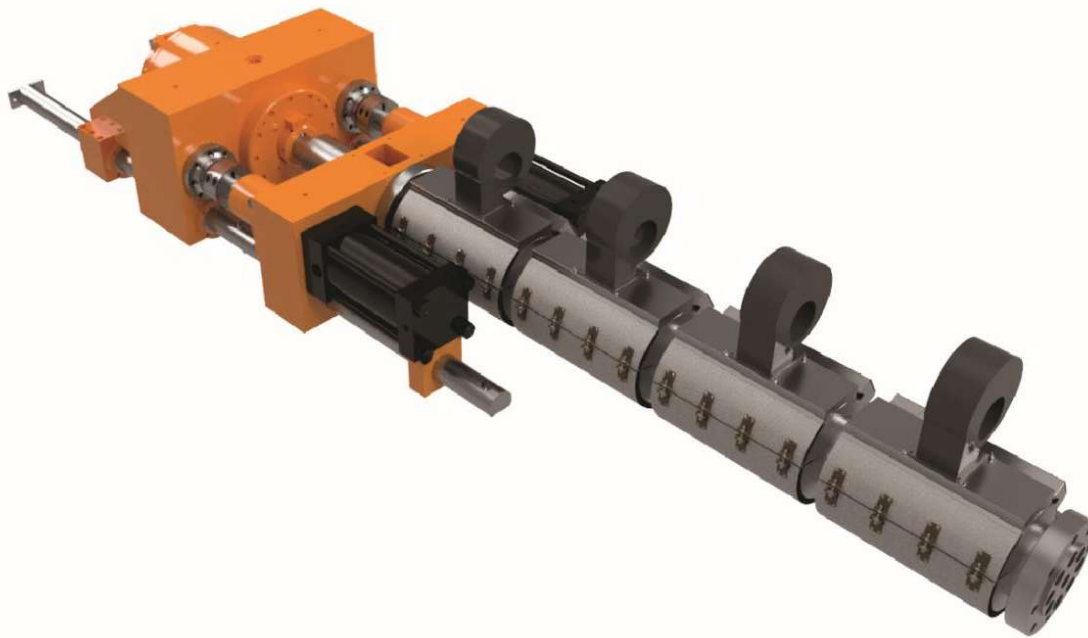


■ Major Functions:

- Shot Size – Barrel is used as material reservoir to accumulate desired shot length
- Screw Speed – Speed determined by cycles time and shot length
- Back Pressure – Pressure built by restricting the oil flow from injection cylinders to tank. Too much back pressure can result in unwanted material drooling from head. Not enough can result in poor melt quality or air bubbles.
- Injection Speed / Drop Time – Speed which the parison is extruded



Extruder Overview

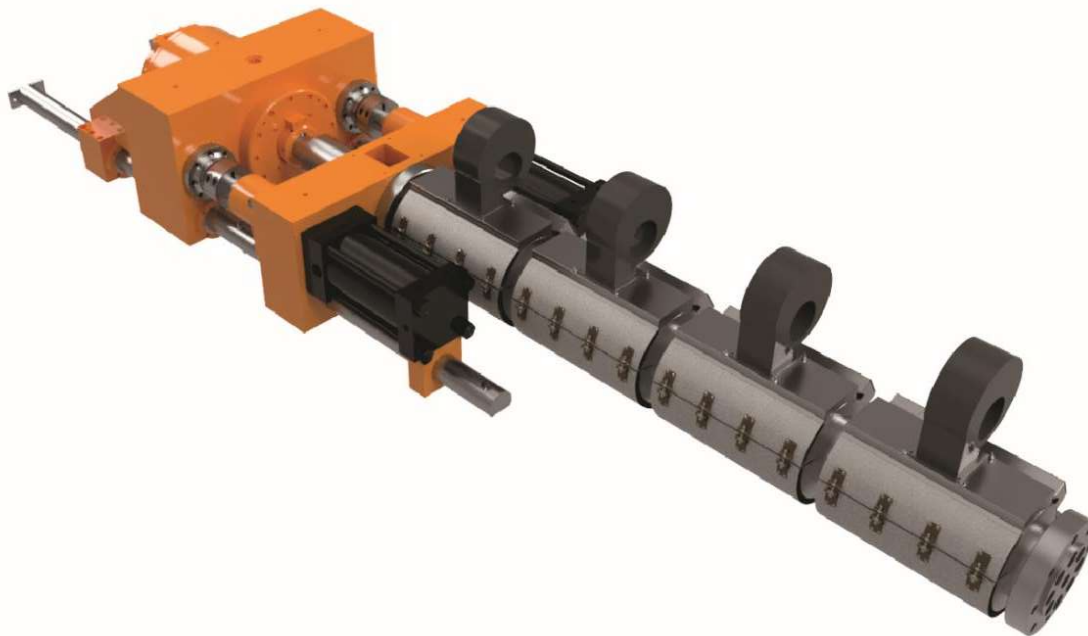


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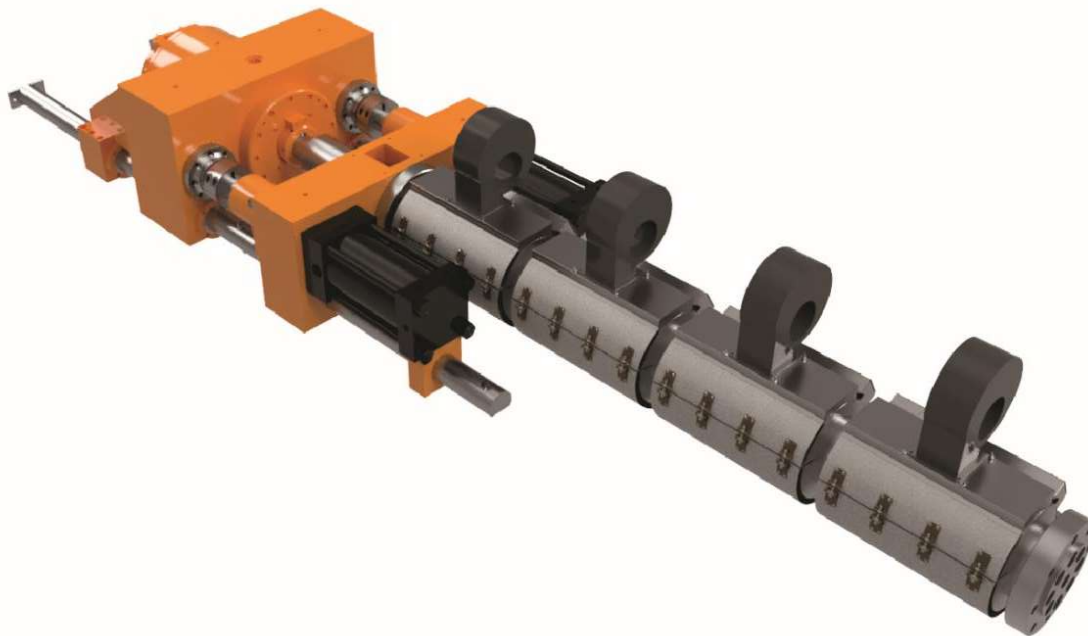


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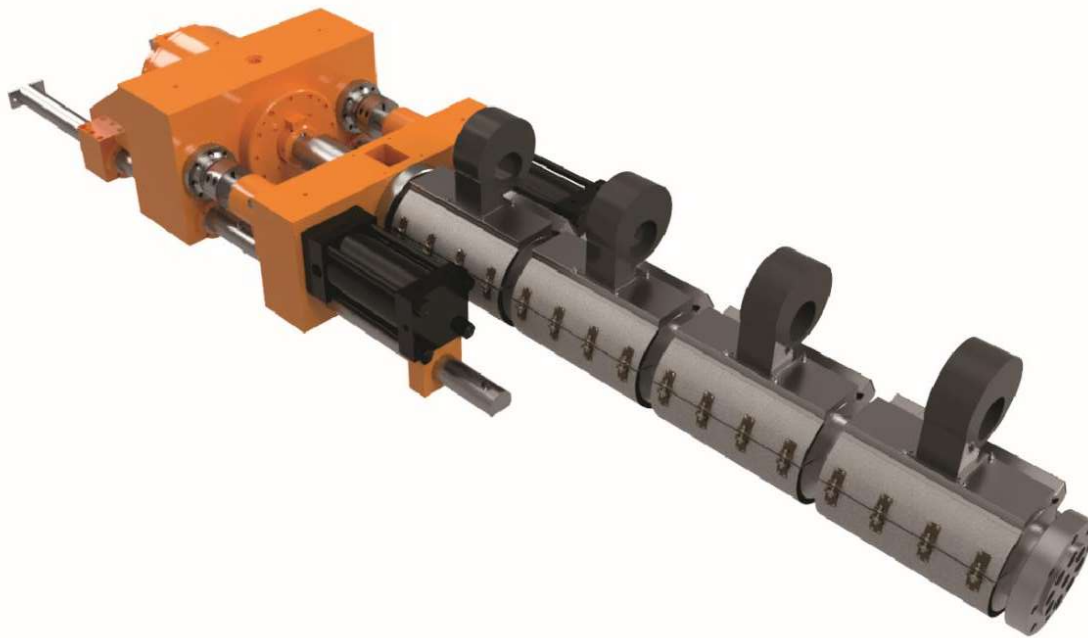


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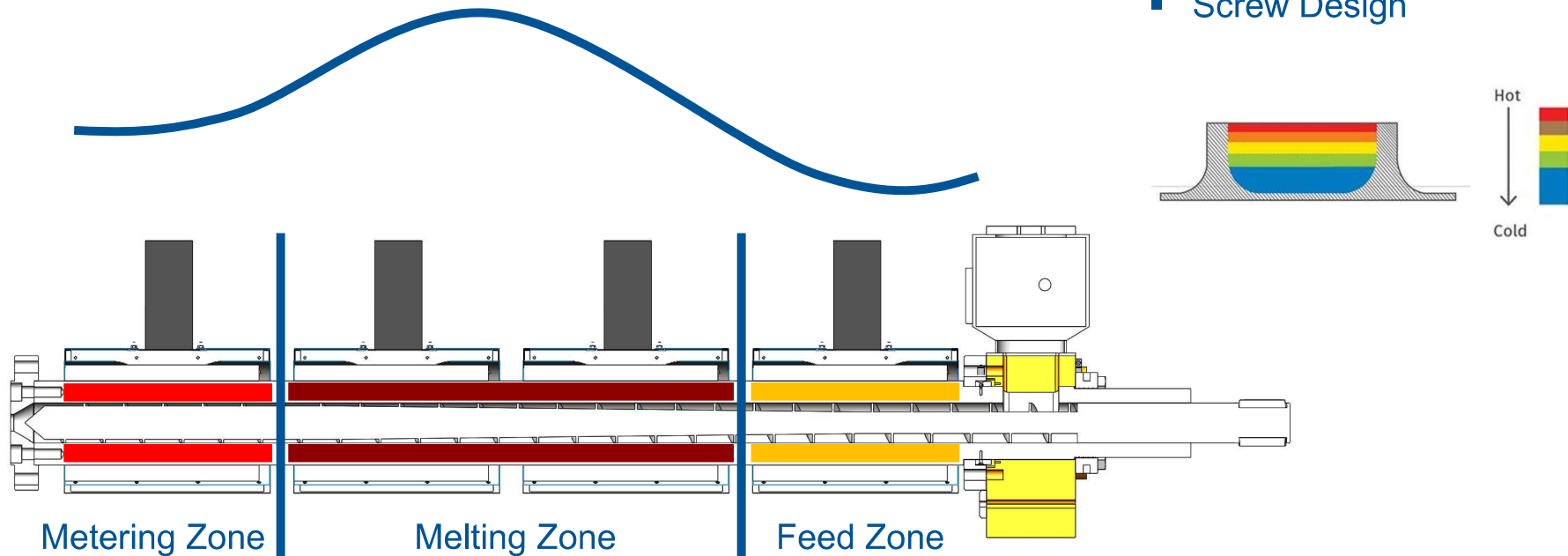
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- Injection Speed / Drop Time – Speed which the parison is extruded



Heat Profile

Factors for Melt Quality

- Screw Speed
- Back Pressure
- Temp. Profile
- Screw Design



Start Up & Shut Down

Shut Down

- Stop production of machine
- Manually purge extruder with hand functions
 - 10 Shots Typical
- Lower screw speed and injection rate to 25% of machine capacity
- Continue to manually purge extruder with hand functions at these slower settings
 - 20 Shots Typical
- Ensure that screw is in the full forward position before turning off the heats

▪ Main Goal

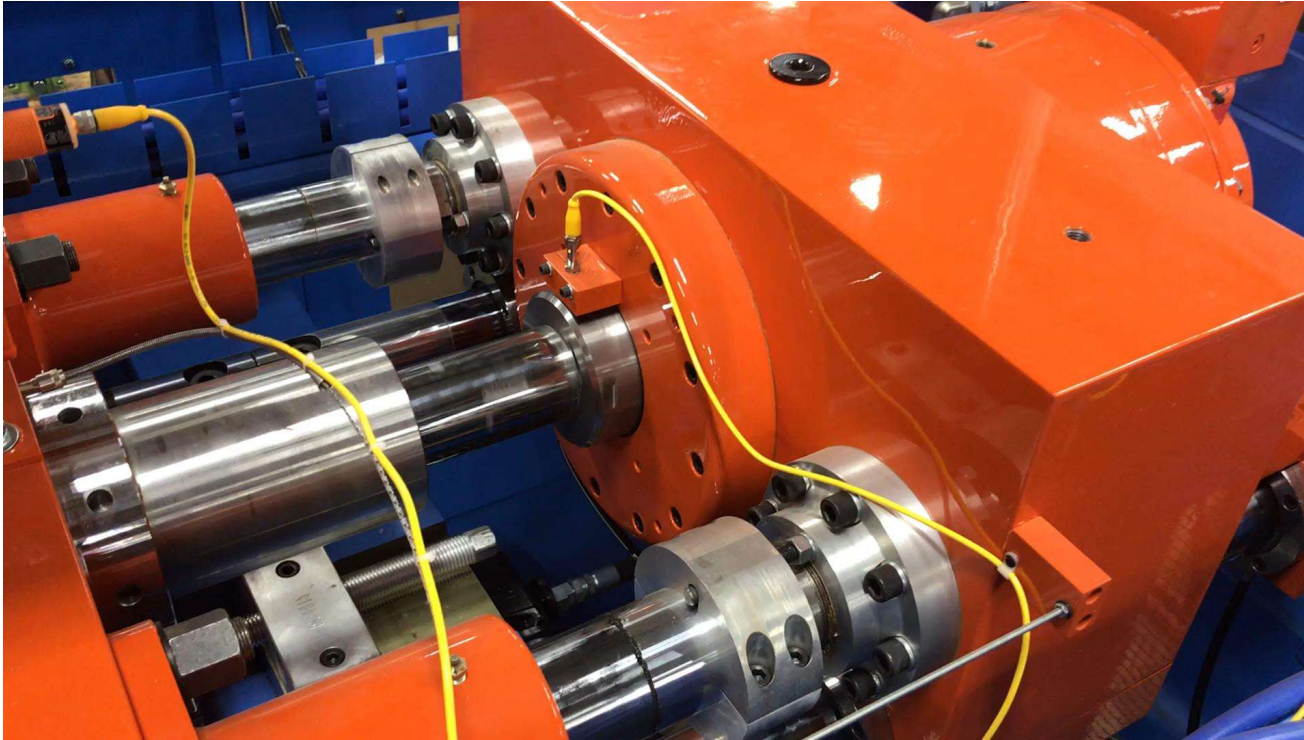
- Reduce burning caused by shear heat
- Reduce stress on screw & motor
- Less waste

Start Up

- Allow machine heats to be on for MINIMUM of 2 hours
- Manually purge extruder with hand functions at 25% of machine capacity
 - 20 Shots Typical
- Increase screw speed and injection rate to typical cycle speeds
- Continue manual purge
 - 10 Shots Typical



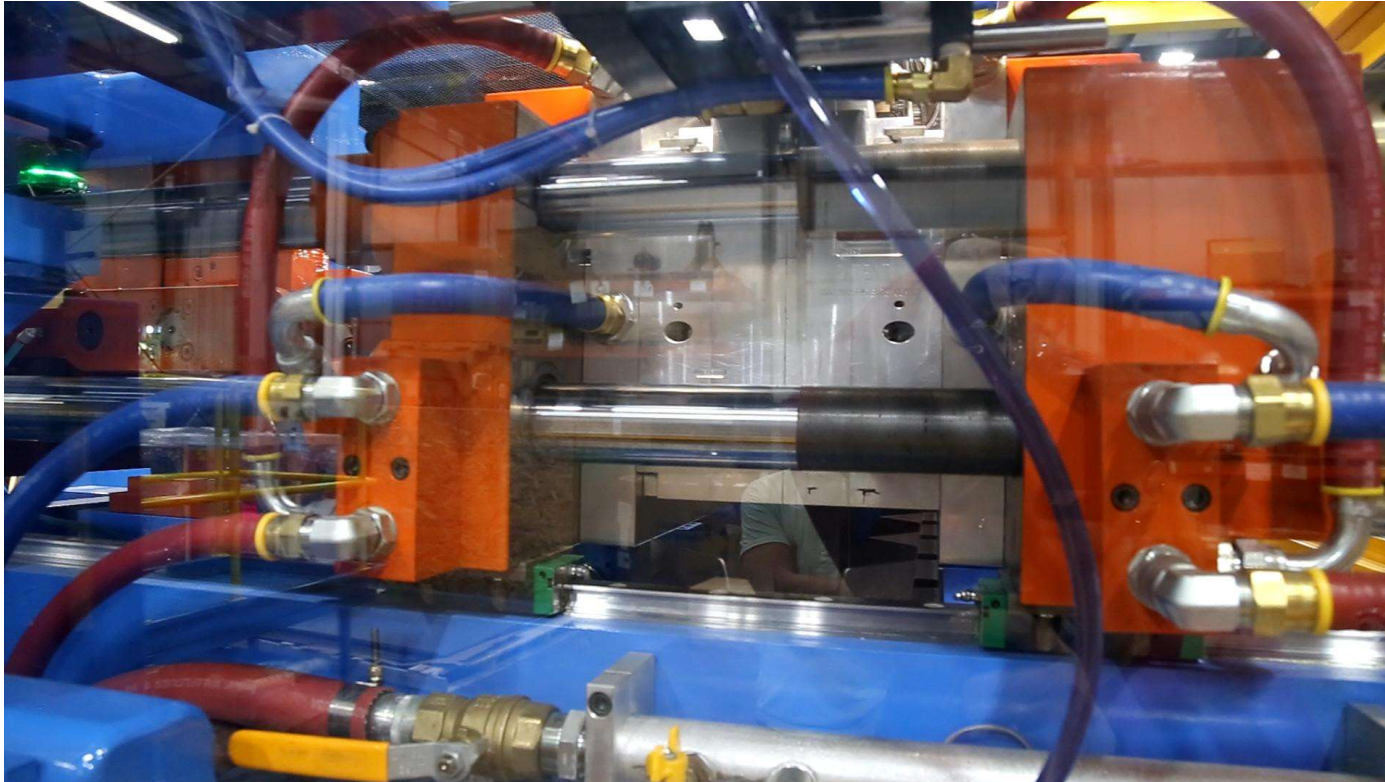
Extruder Overview



Video Showing
Feed Screw
Retract and Plunge



Extruder Overview

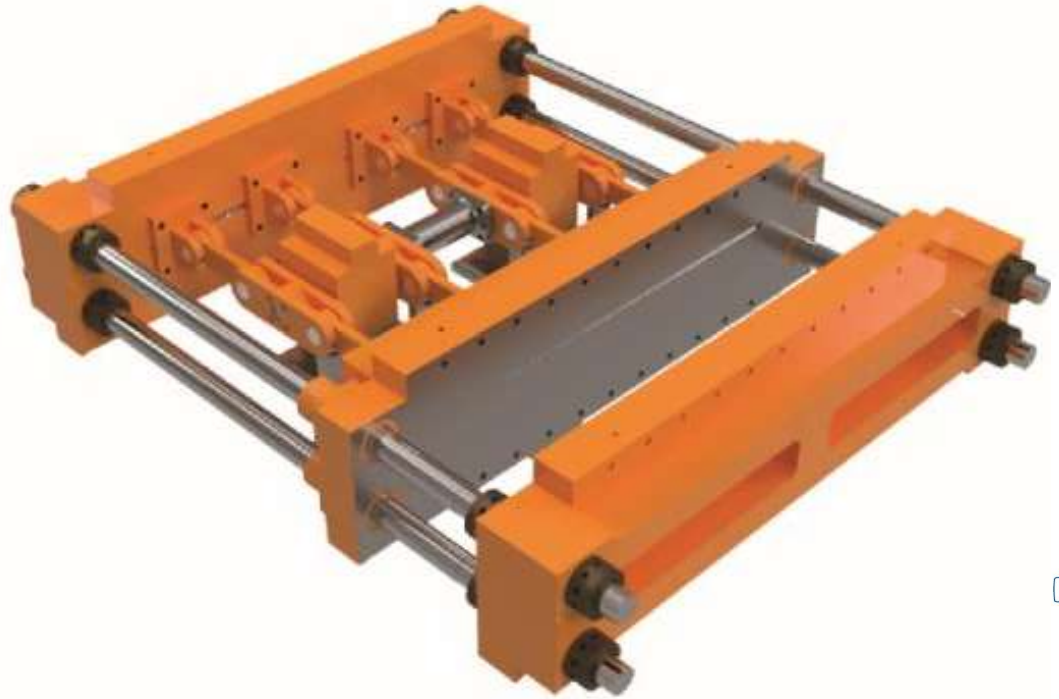


Video
Showing
Parison
Drop Speed



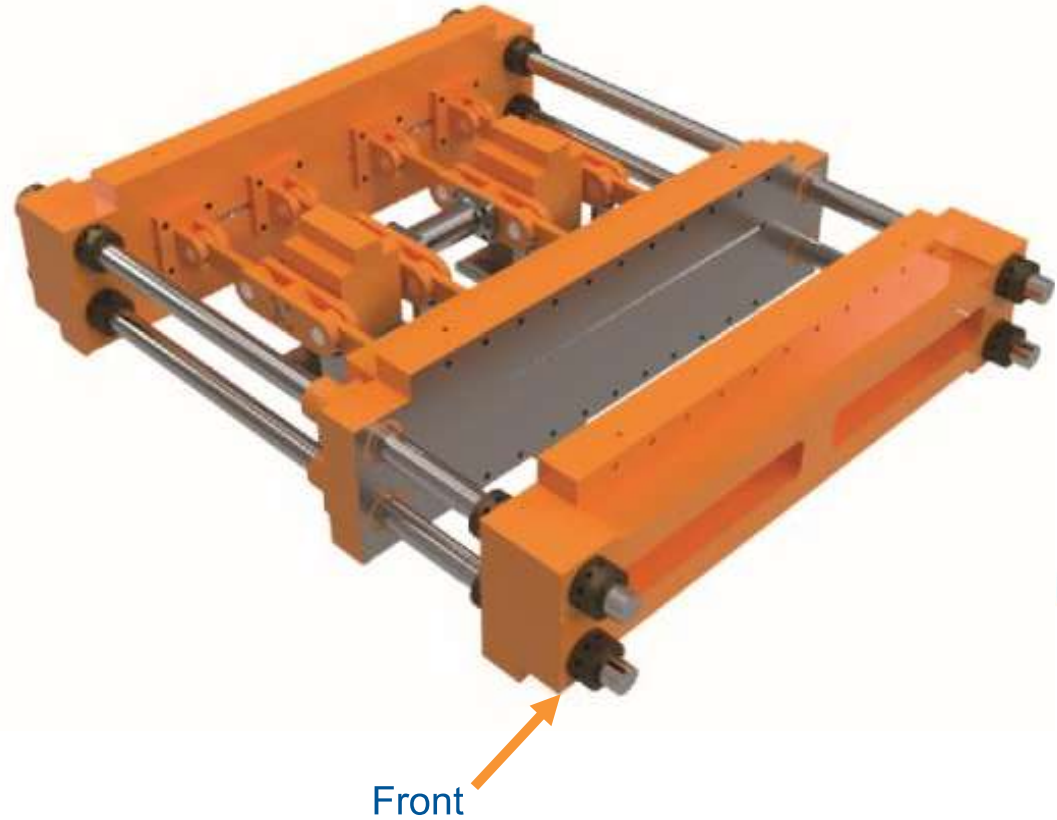
Clamp Overview

- Consists of 3 platens: Front, Rear, & Push
- Tie bars connect front and push platens
- Force created by “Rotac”
- Toggle arms used for equal and opposite movement between rear and push platen
- Adjustment on tie bars tonnage
- Typical clamp pressure = 1,000-1,200 PSI
- Tonnage set to .020 / .025 for typical light weight HDPE applications
- Clamp Daylight



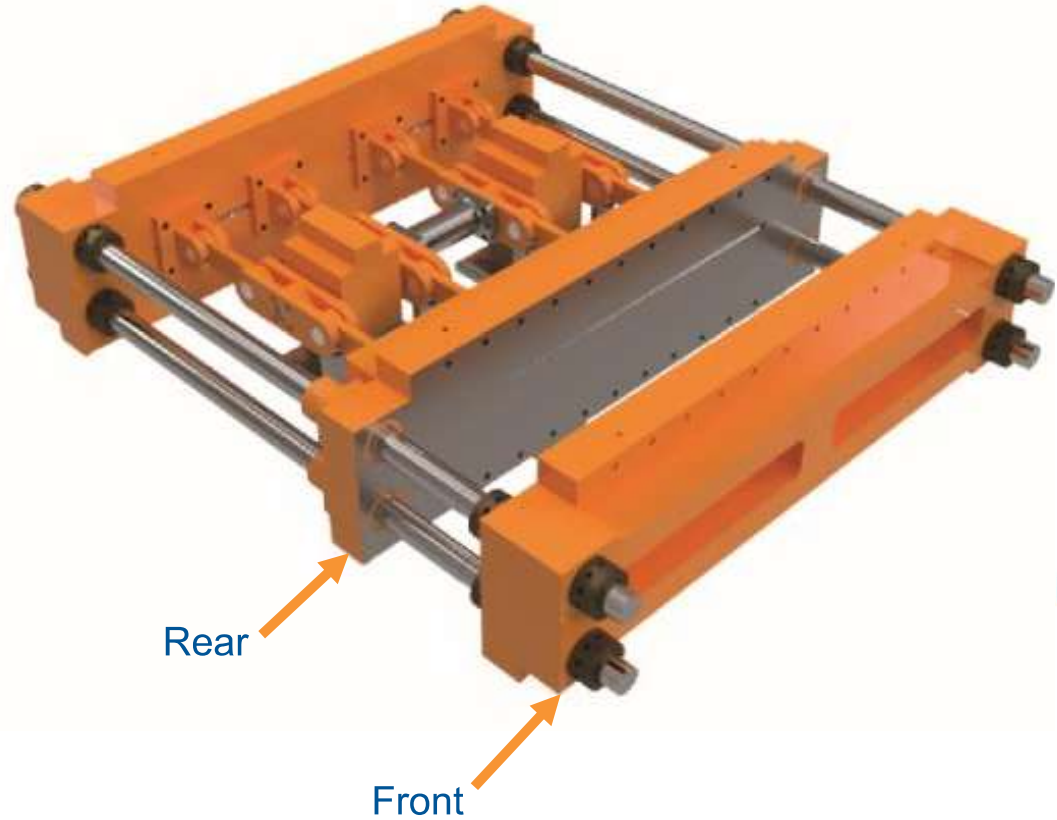
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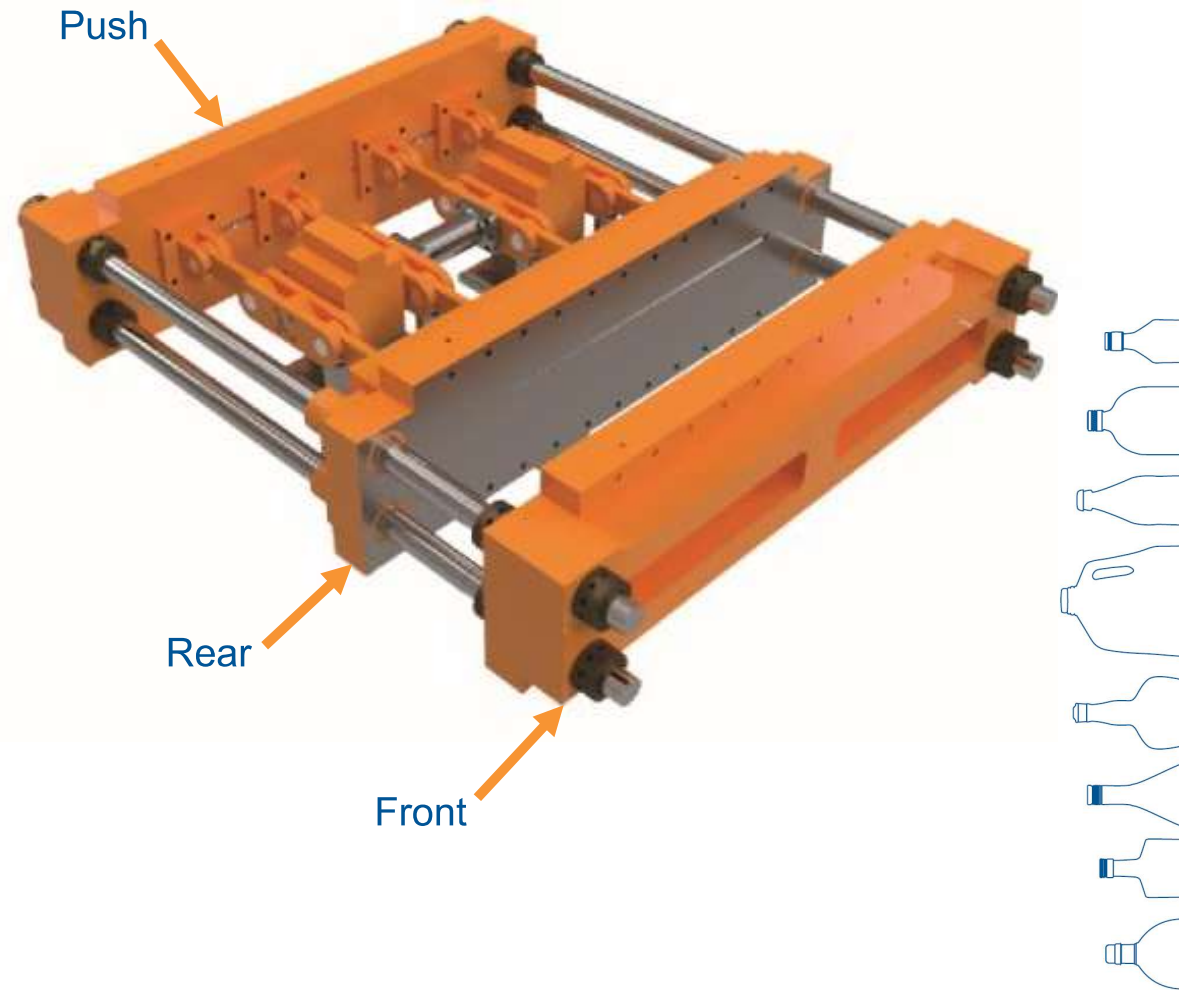
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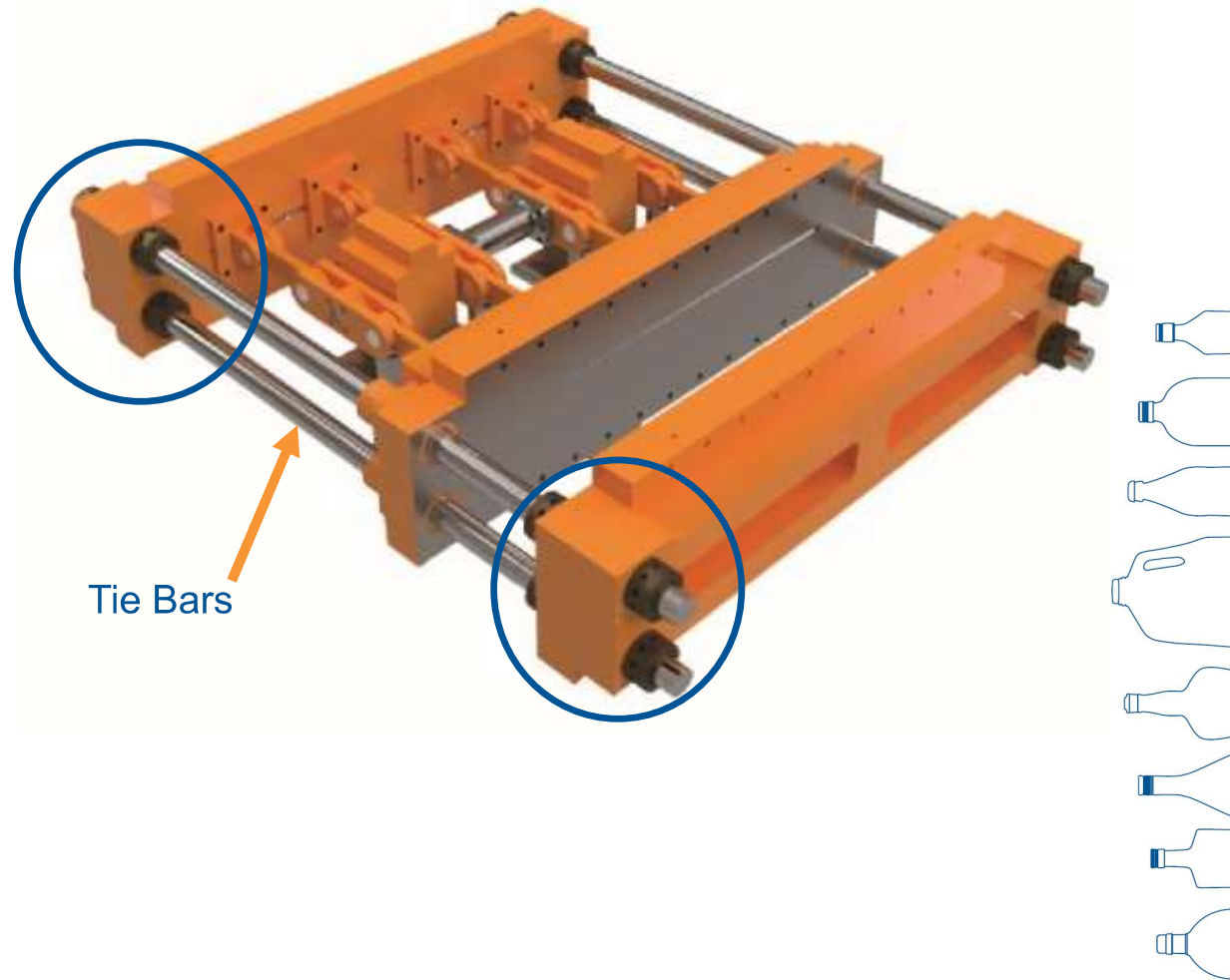
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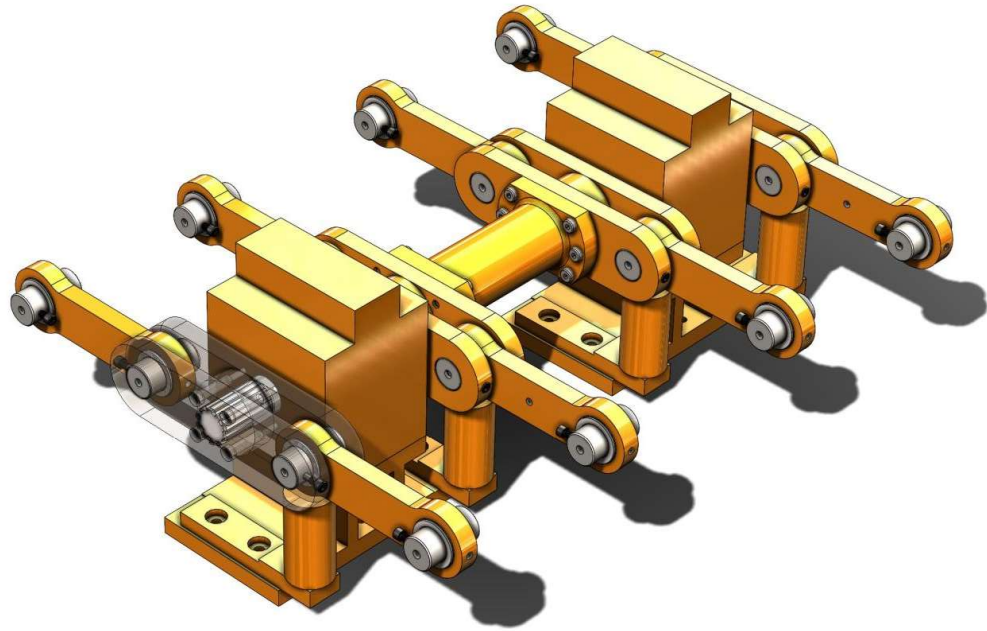
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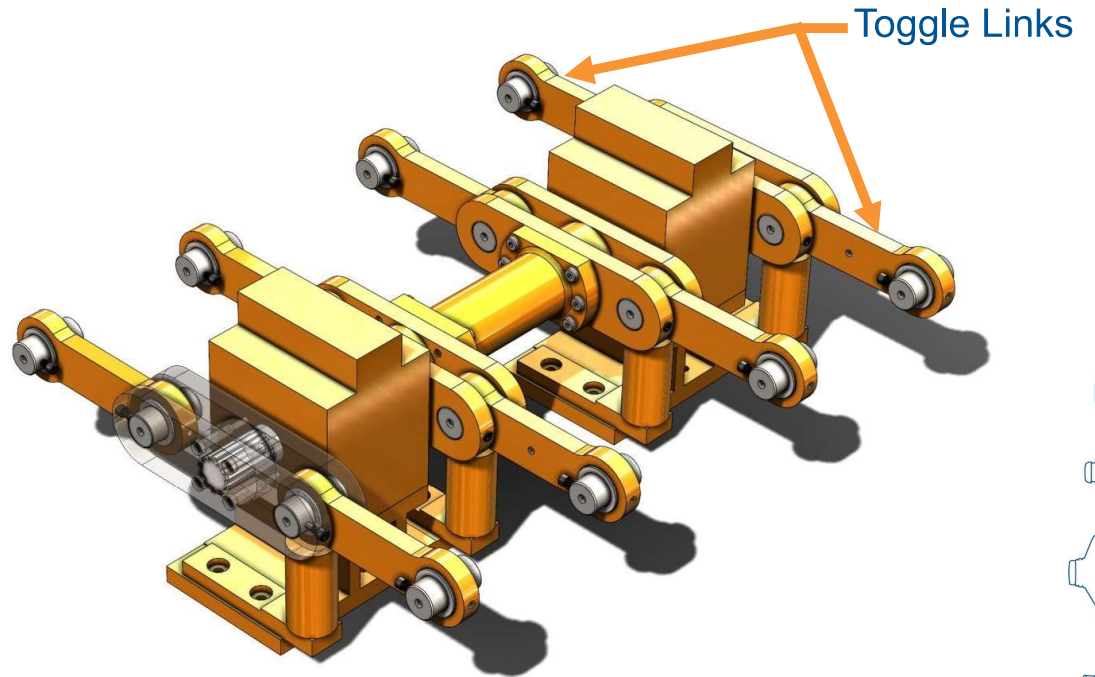
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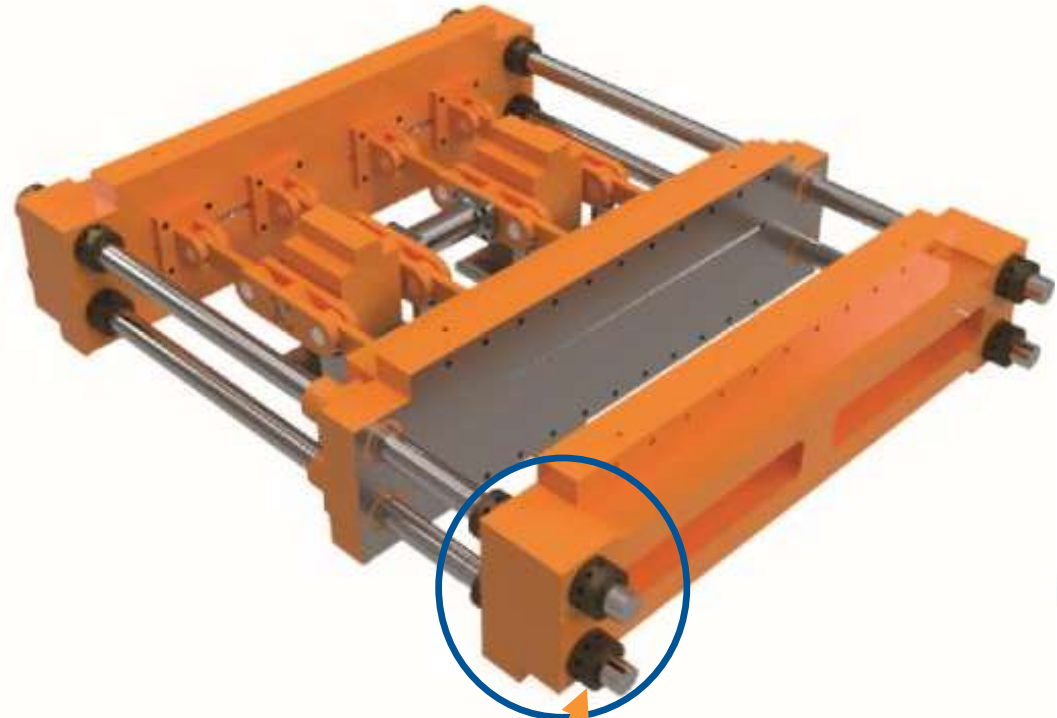
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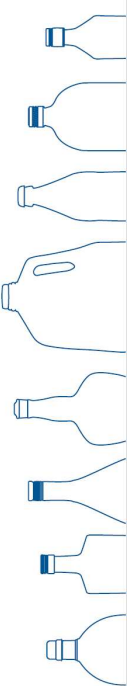


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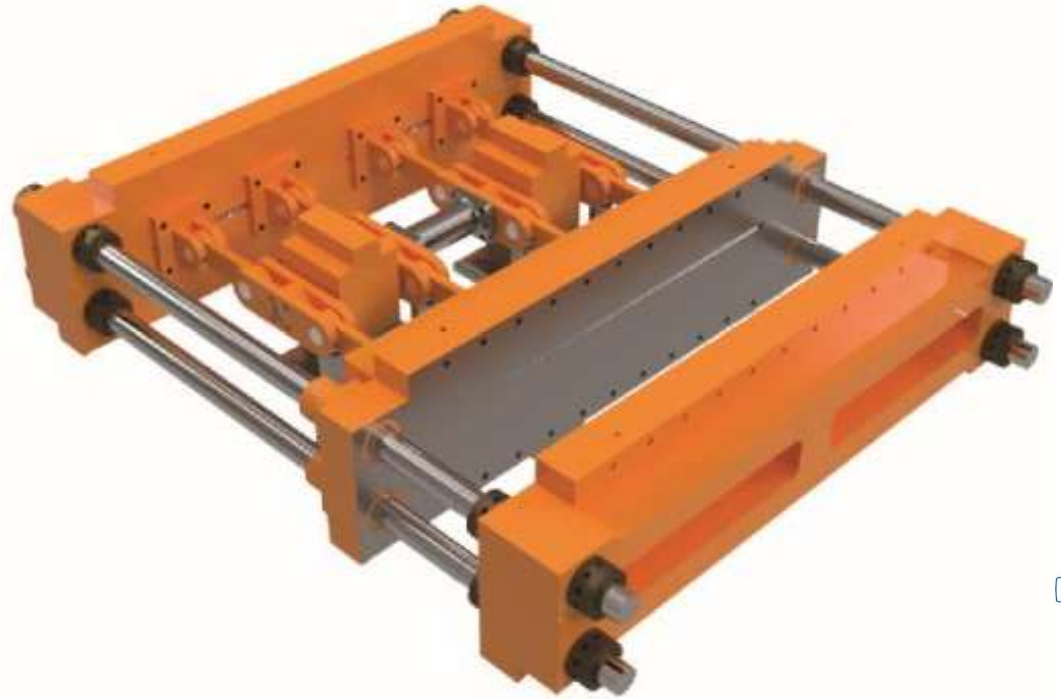


Tie Bar
Adjusting Nuts



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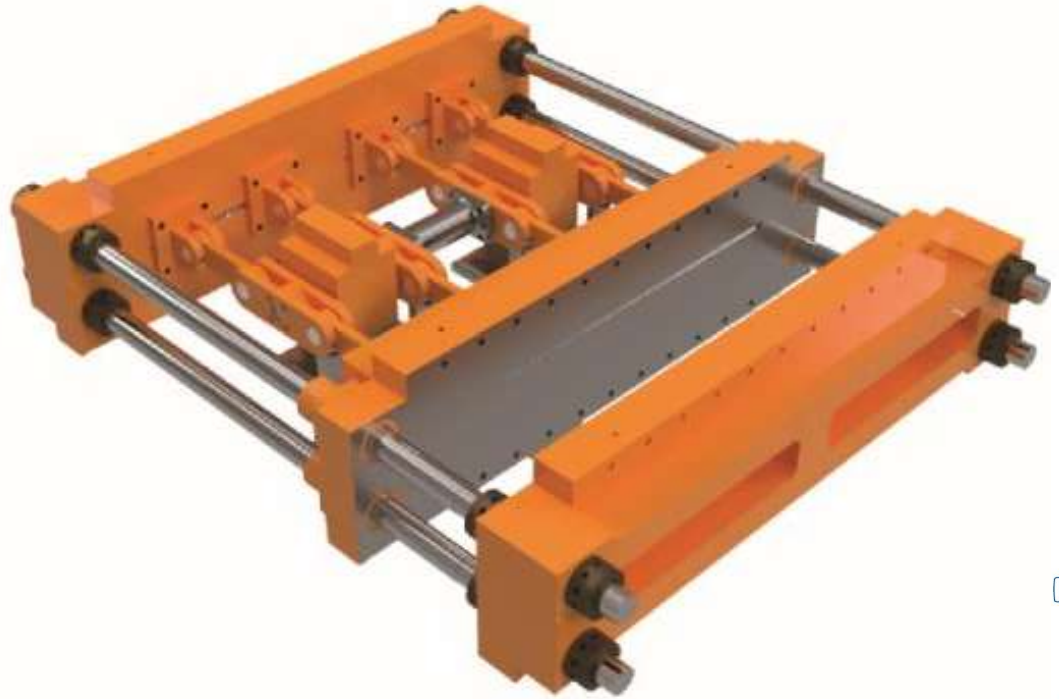


*Tonnage is amount of compression between mold halves to cut through layer of plastic during cycle.

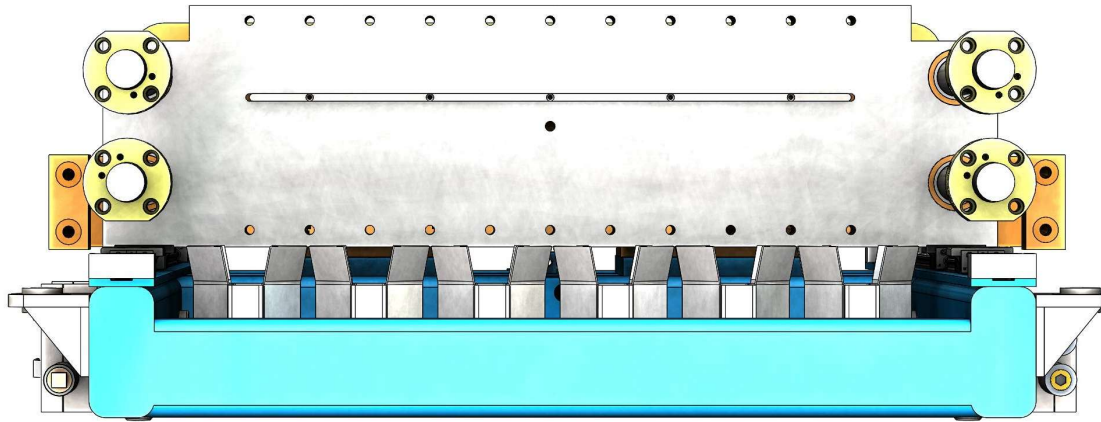
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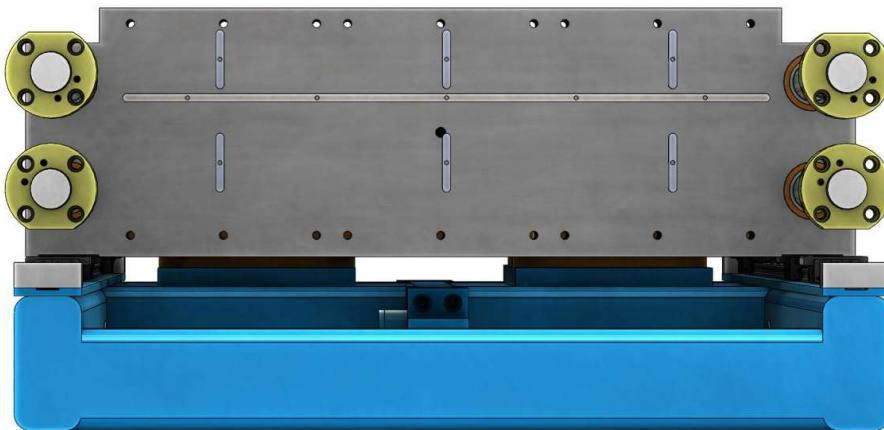
*Amount the mold opens to allow removal of the blown part



Clamp Overview



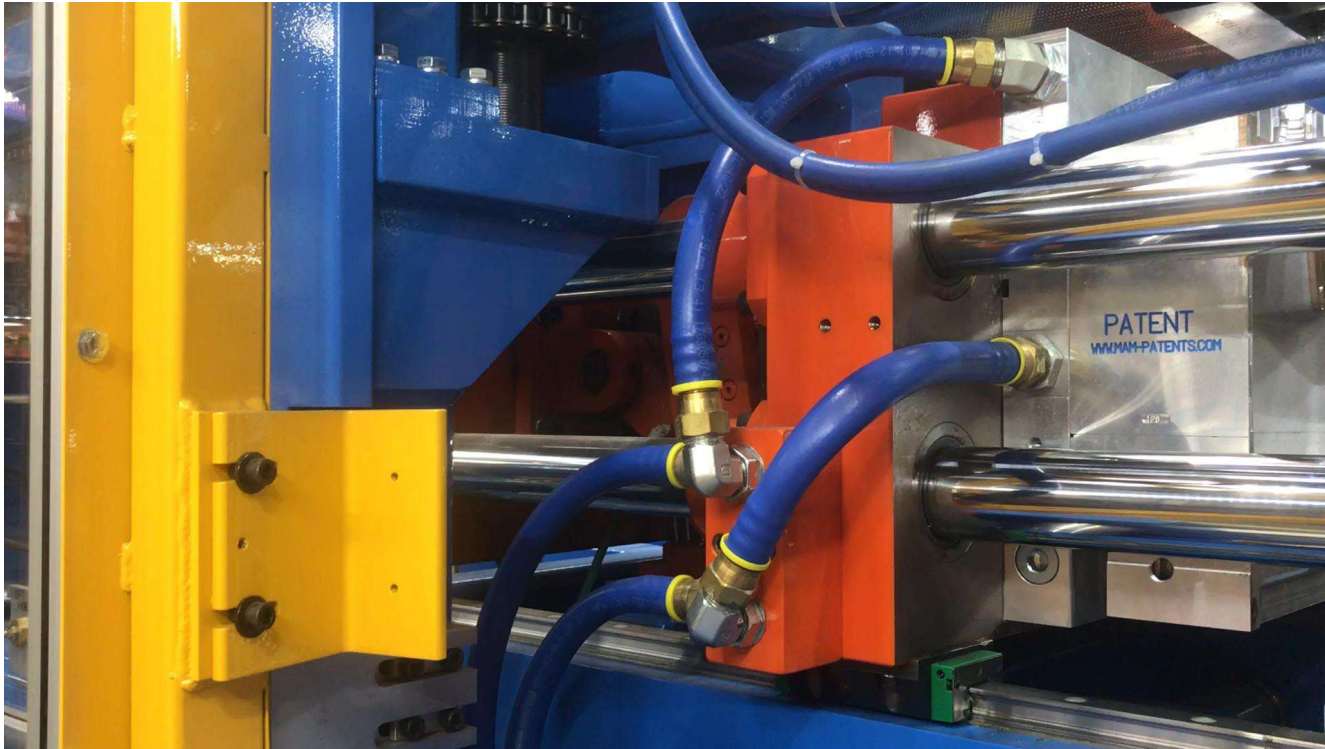
**16" Tall x 48" Wide
Molding Envelope**



**16" Tall x 42" Wide
Molding Envelope**
*Available with
Clamp Side-Shift*



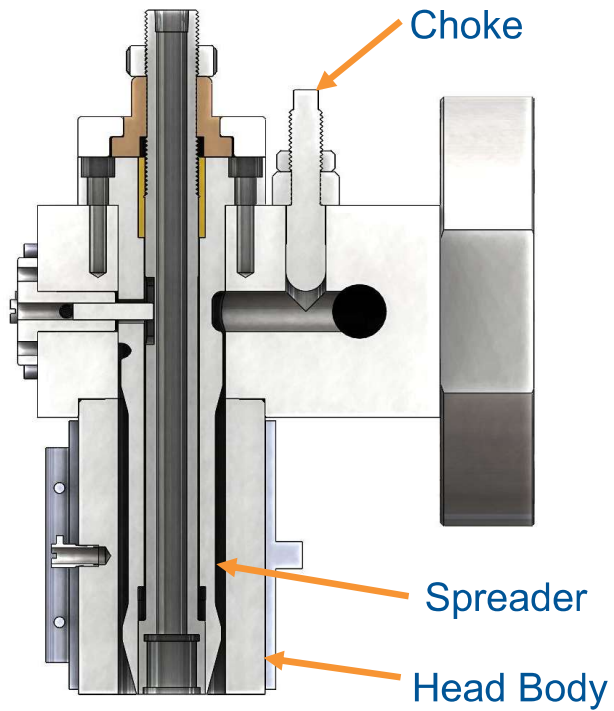
Clamp Overview



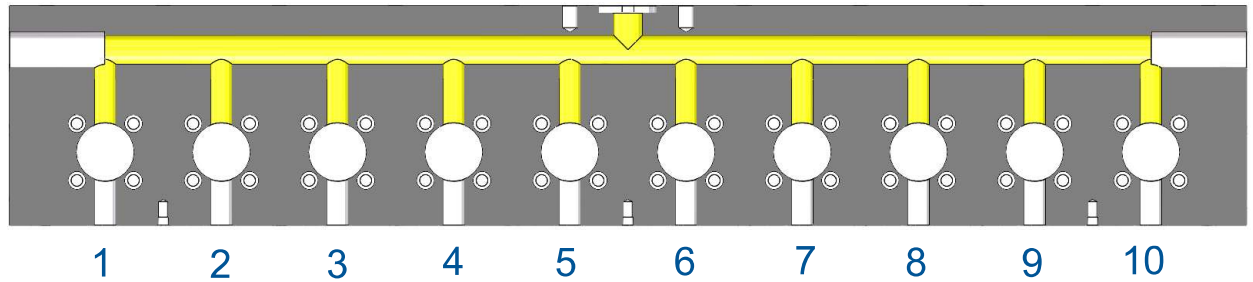
Video
Showing
Clamp
Functions



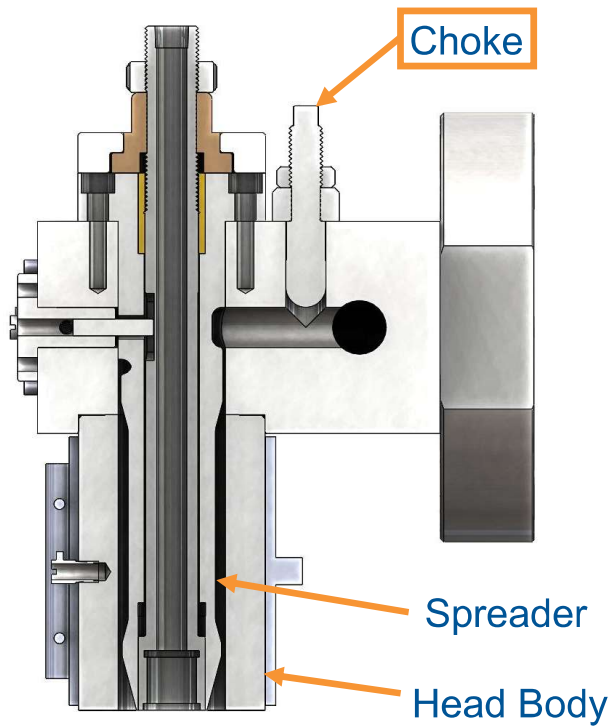
Head Design



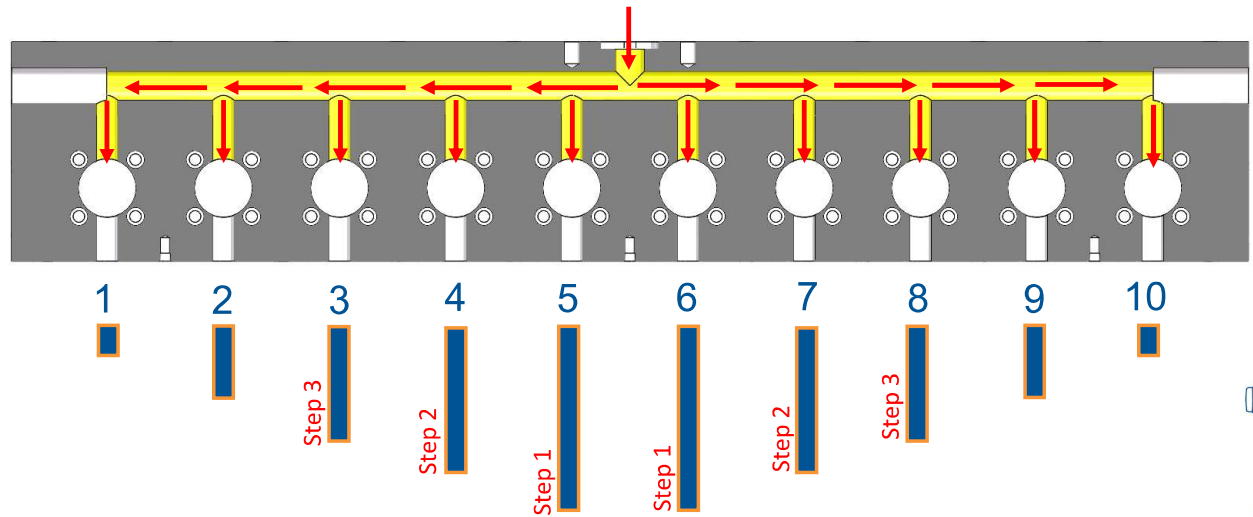
Head Manifold: 10 Parison x 4" Centerline



Head Design



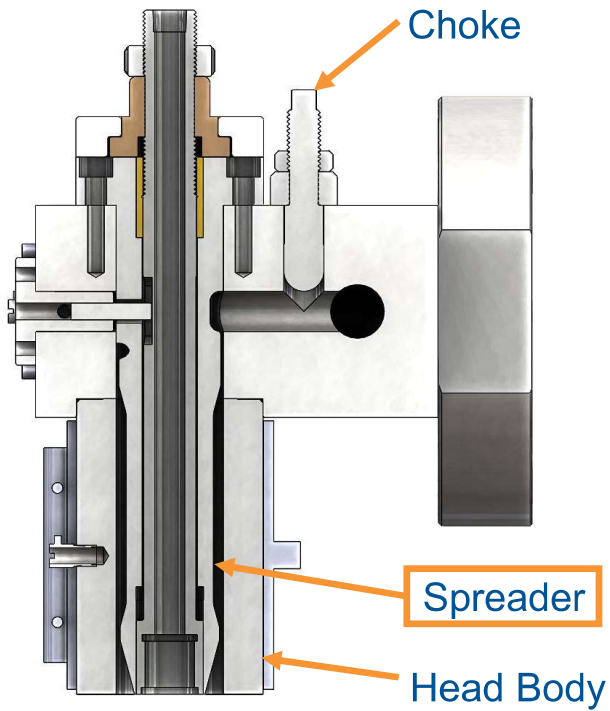
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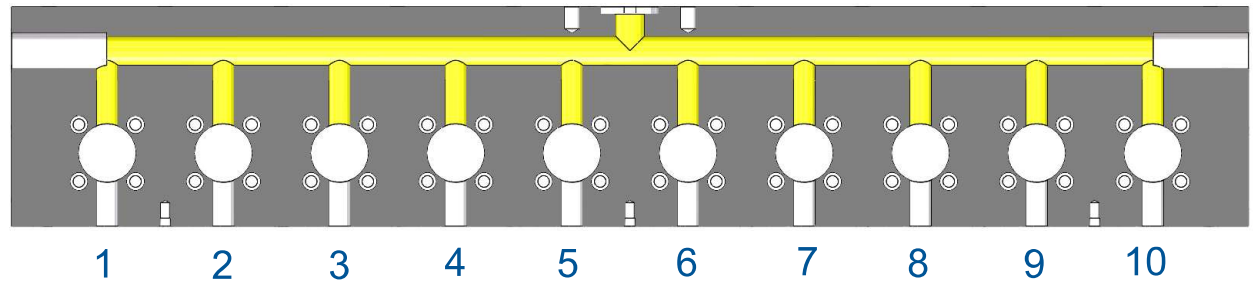
Choke – Allows us to restrict flow to each head individually to balance parison lengths



Head Design



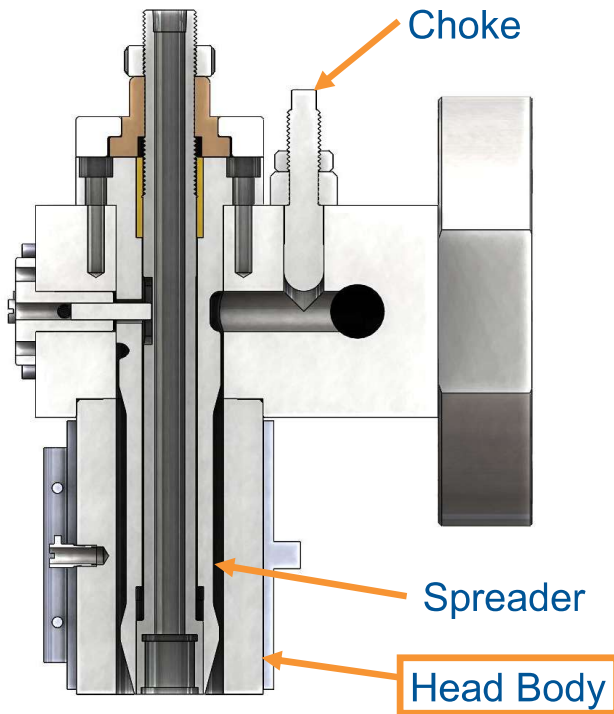
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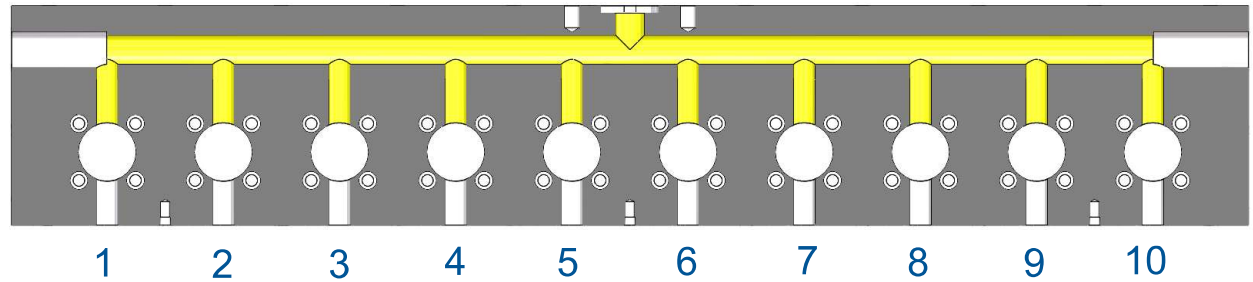
Spreader – Or forming pin, used to weld and shape parison into cylindrical shape. Upper or lower chokes used to generate additional head pressure.



Head Design



Head Manifold: 10 Parison x 4" Centerline

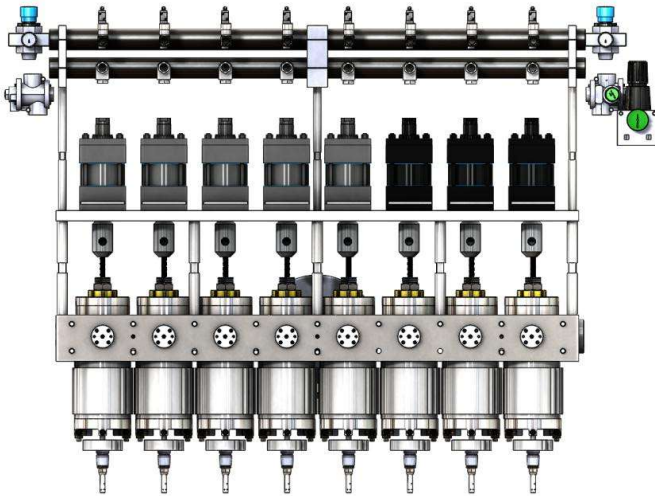


Head Body – Final reservoir before material is extruded. Size of part being molded/ parison size can alter size of head.



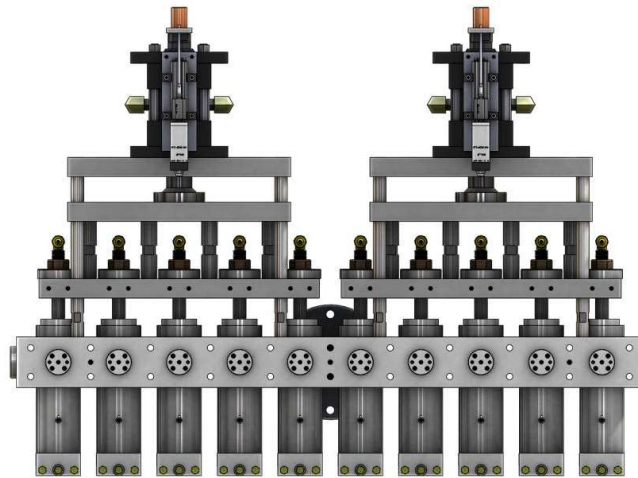
Head Design Options

Top Finish / Calibrated
Neck Finish



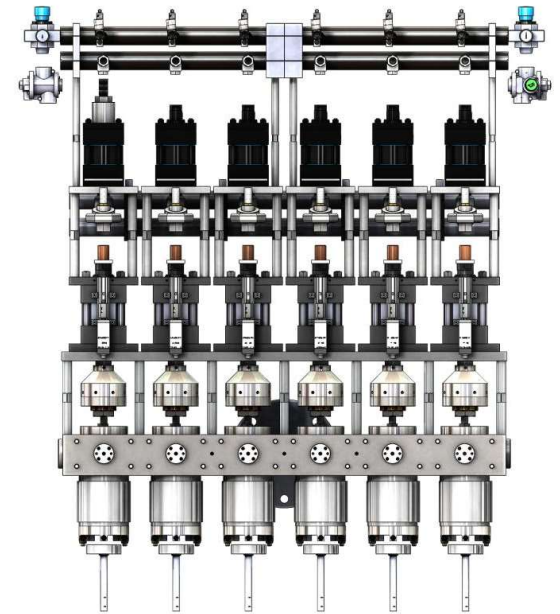
Shown: 8-Head x 6" c.c.

Parison Programming



Shown: 10-Head x 4.75" c.c.

Top Finish
With
Parison Programming



Shown: 6-Head x 8" c.c.

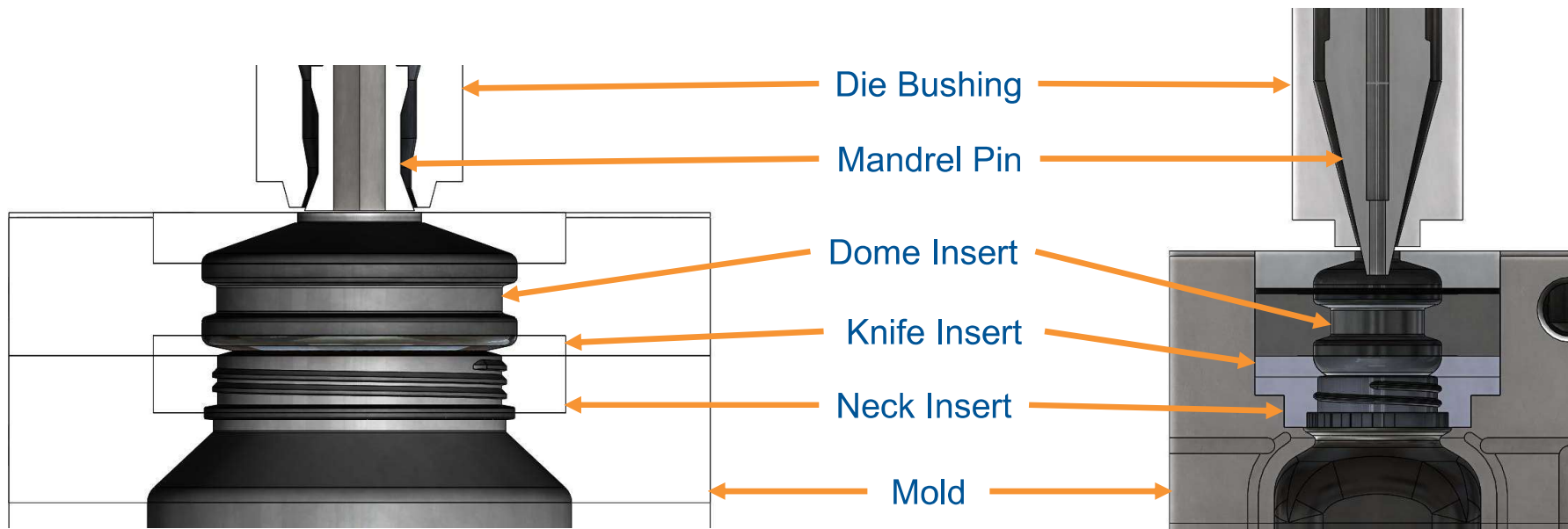


Dome Seal

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert

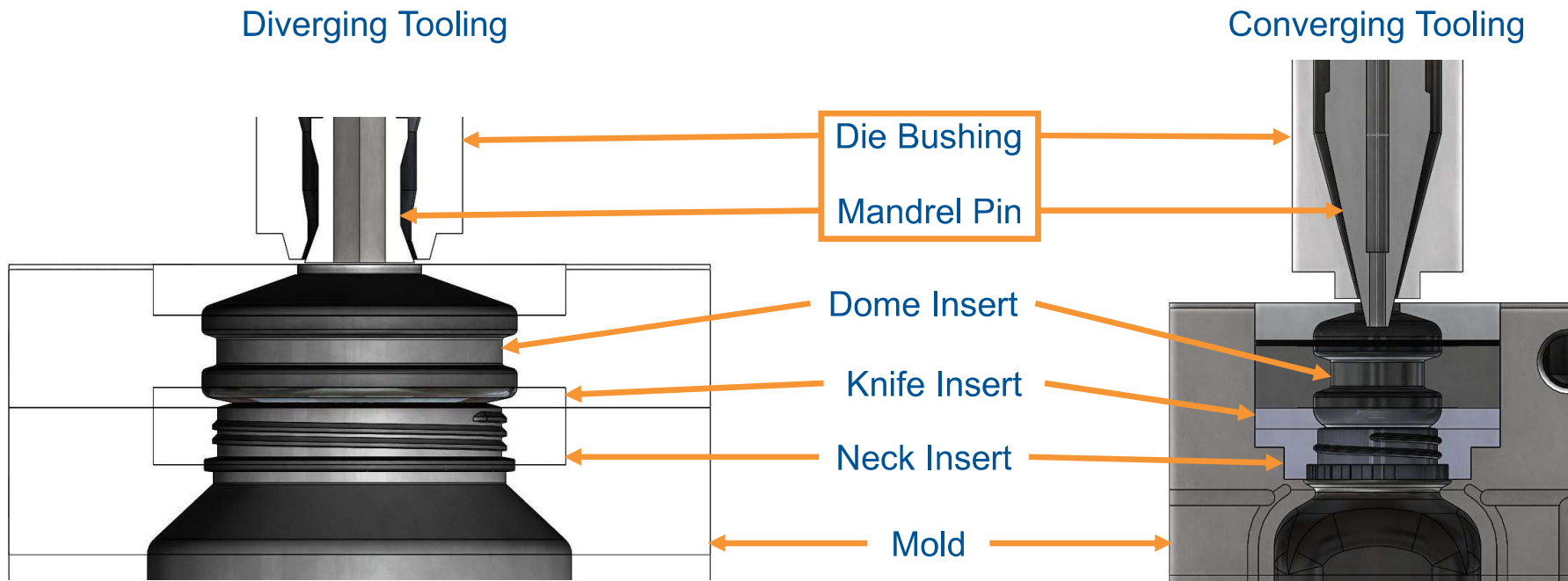
Diverging Tooling

Converging Tooling



Dome Seal

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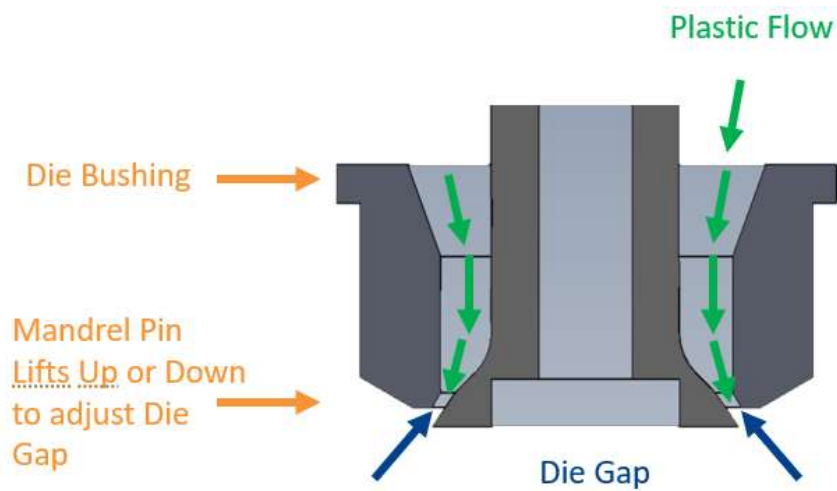


Die Tooling – Used to create die gap, gap between pin and bushing to allow plastic to flow. This determines parison thickness

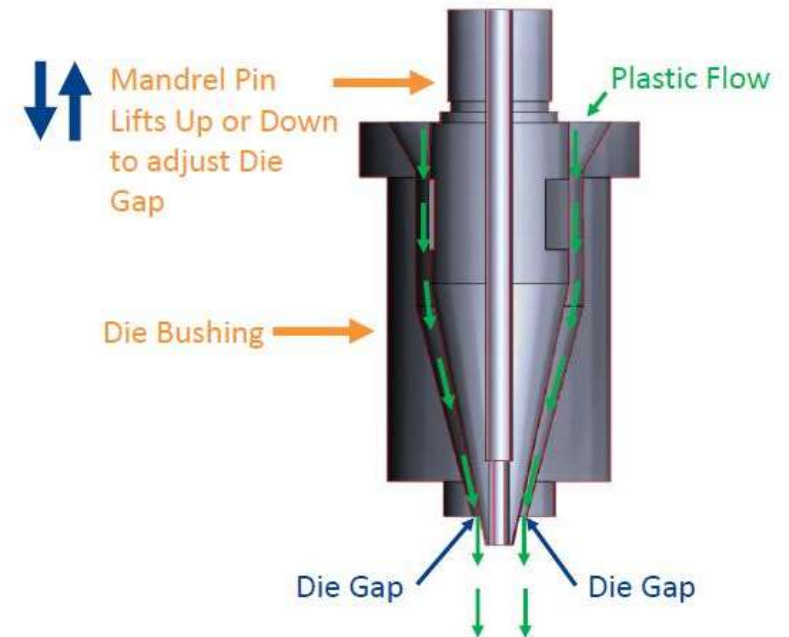
Tooling

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert

Diverging Tooling

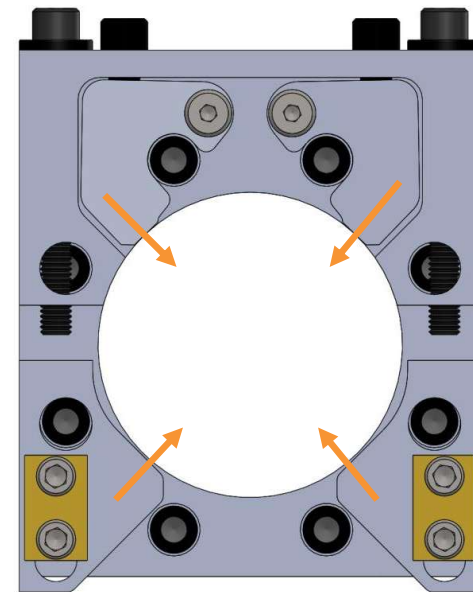
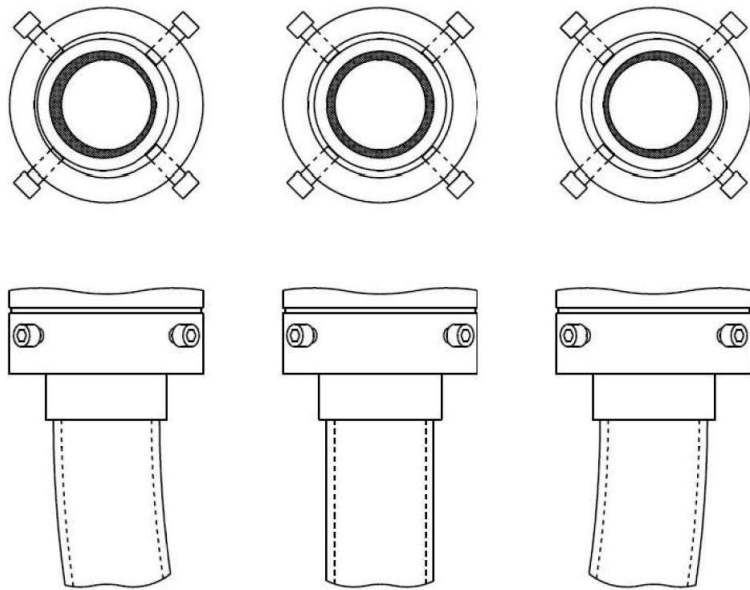


Converging Tooling

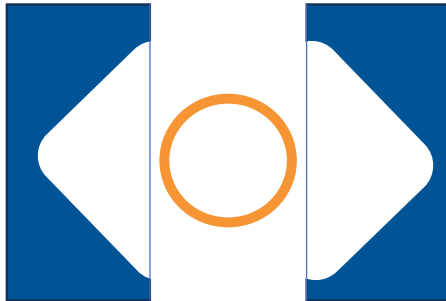


Tooling

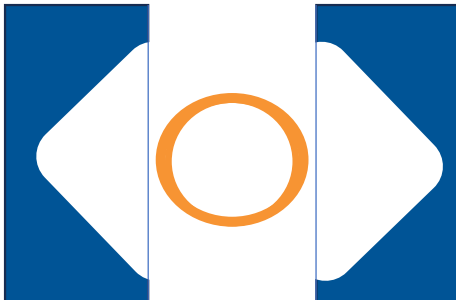
Parison Alignment



Tooling

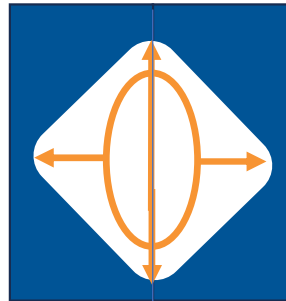


Round parison with uniform wall thickness

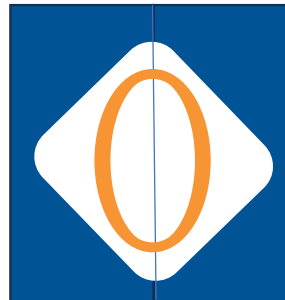


Ovalized tooling to give more material opposite of parting line

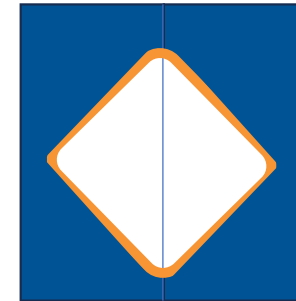
Ovalized Tooling



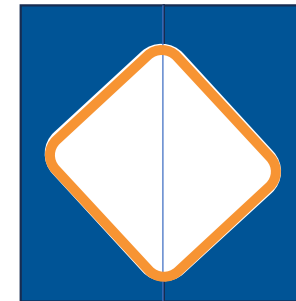
As mold closes, it compresses the parison



Added material opposite of parting line compensates for compression



Uneven wall distribution. Thin areas from variable stretch

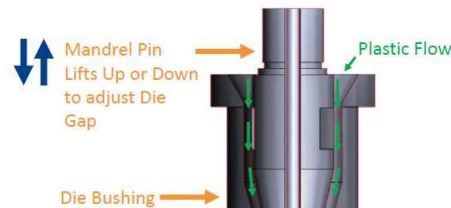


More uniform wall distribution

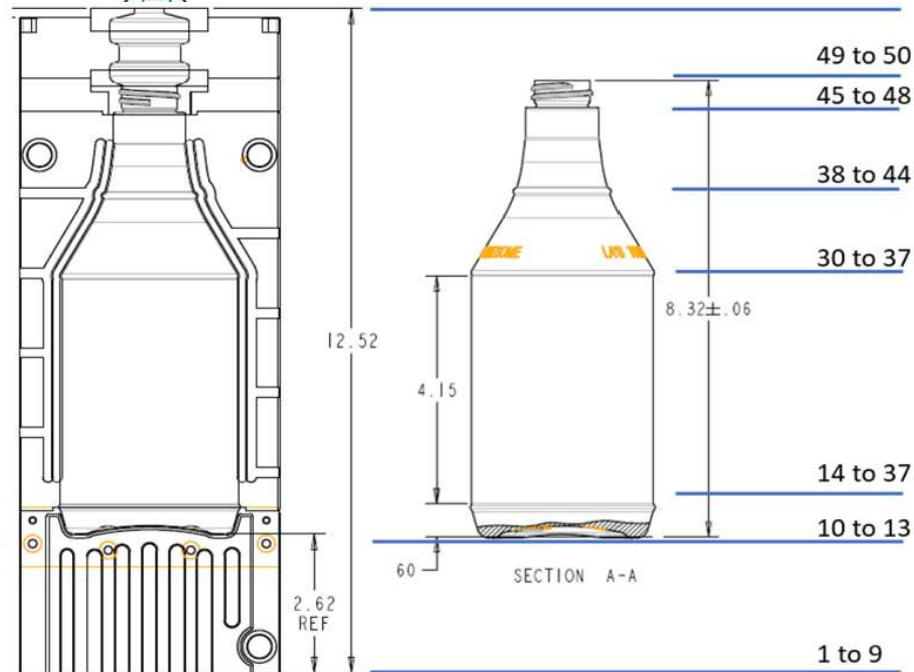


Tooling

- Manipulate die gap during extrusion process
- Add and/or remove thickness to specific areas of the bottle without altering overall part weight
- Each set point is scaled by length of parison

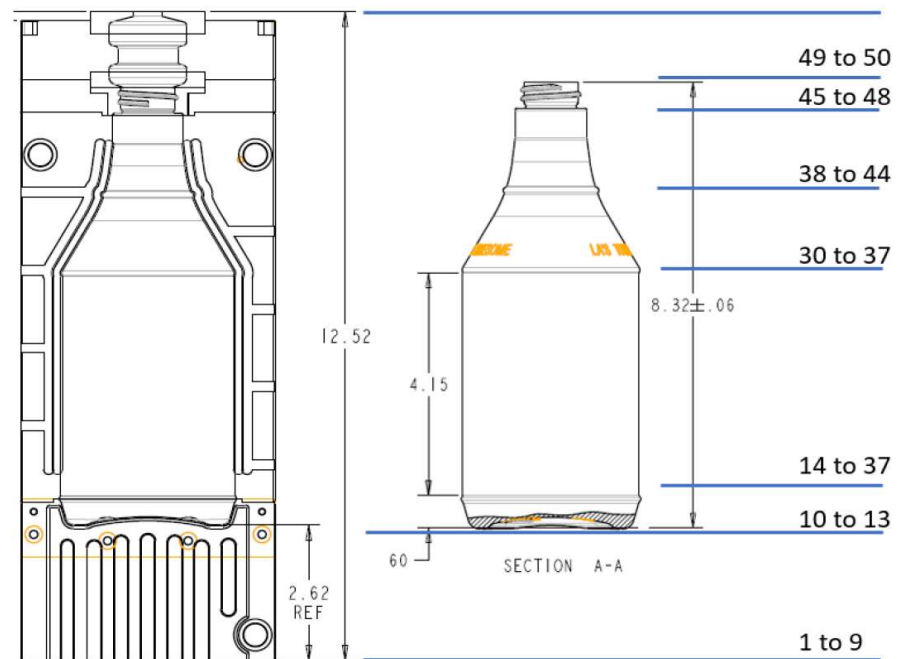


Parison Programming



Tooling

Parison Programming



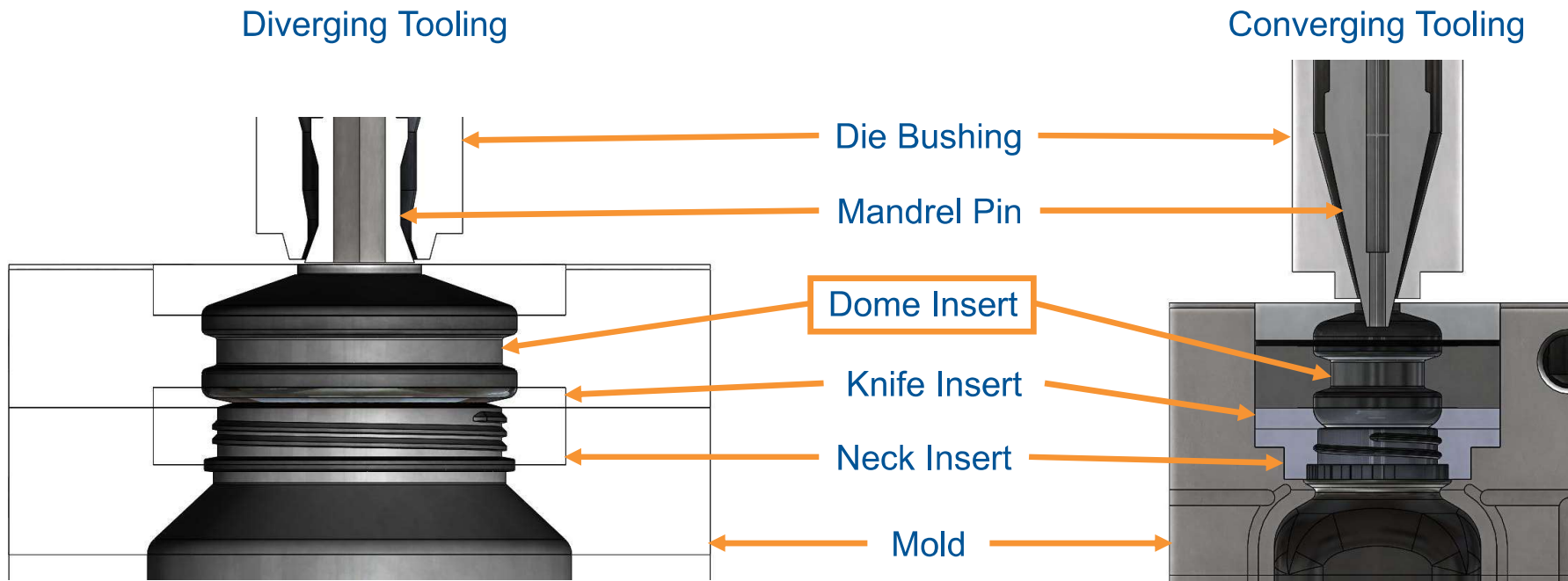
Tooling

Parison Programming



Dome Seal

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert

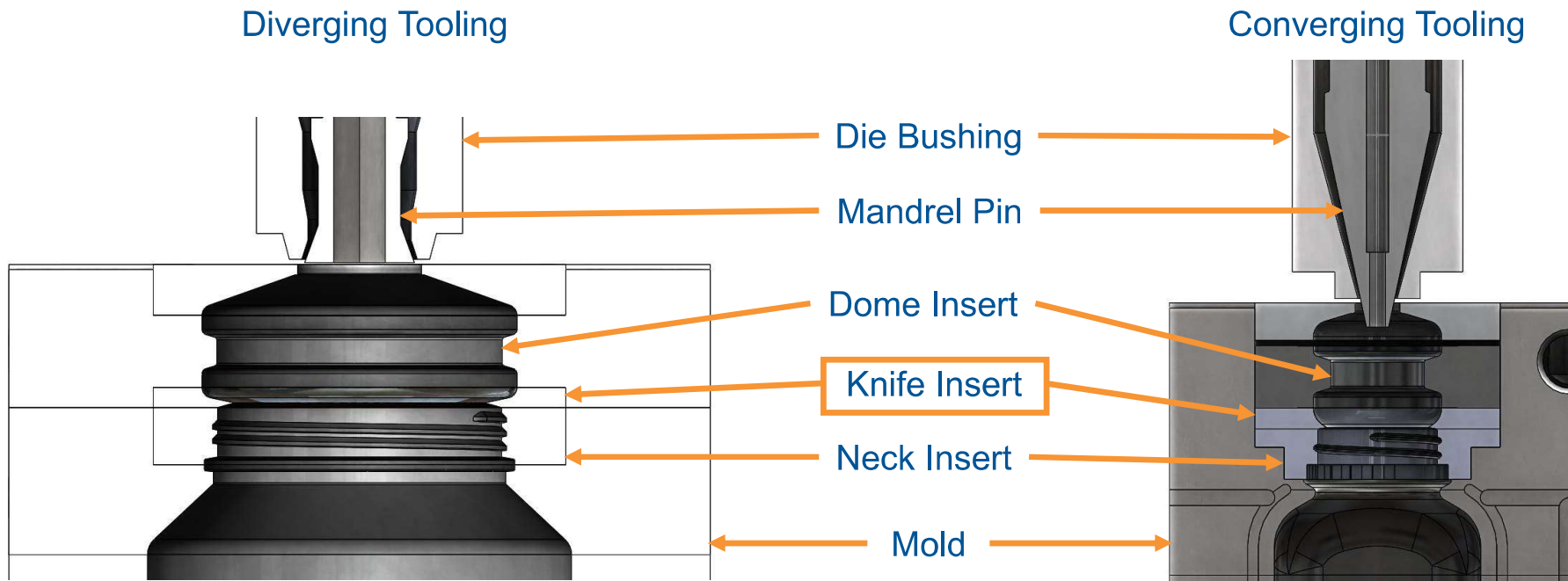


Dome Insert– Size of spin dome for spin trimmer. Dome size is typically determined by neck size of bottle.



Dome Seal

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert

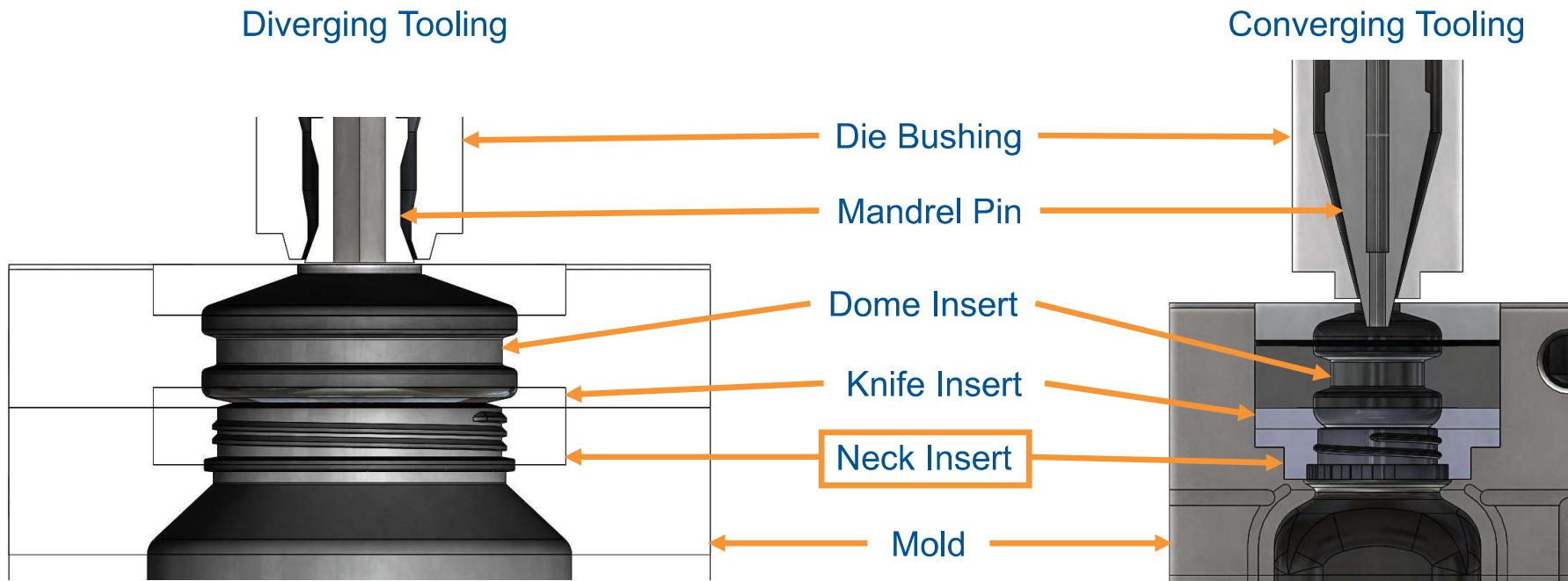


Knife Insert– Knife sets the size of the interior lip of the neck. This is the sealing surface for caps. Sizes can vary based on cooling/ cycle time



Dome Seal

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert

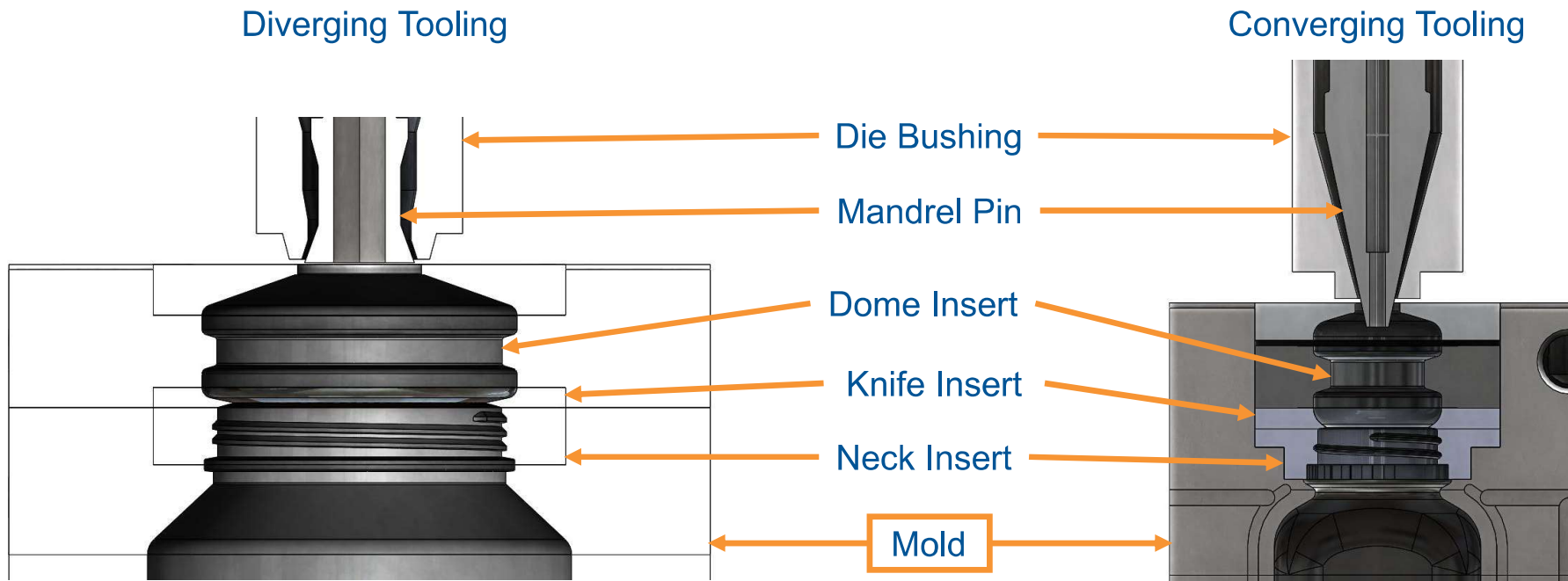


Neck Insert– Neck is specific to the style cap that will be used.



Dome Seal

- Parison Captive Inside Neck
- Neck I.D. Formed By Knife Insert



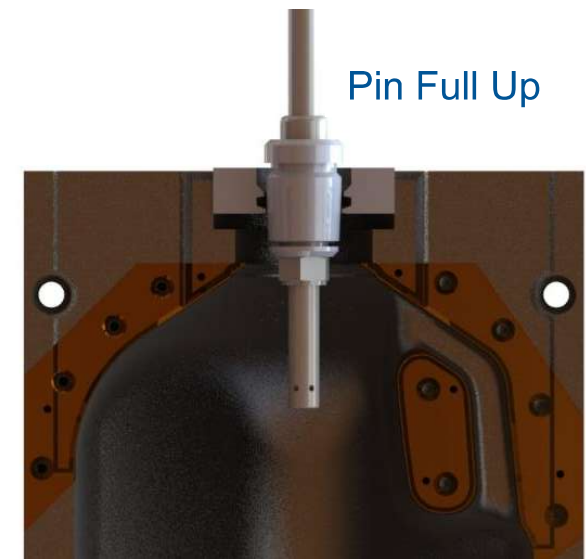
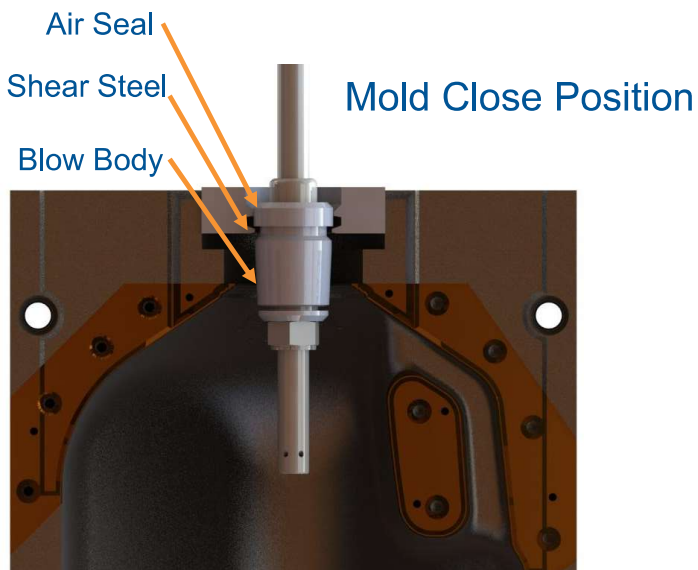
Mold– Shape of the container.



Pull-Up Neck Finish

Note: Flash depths can be critical

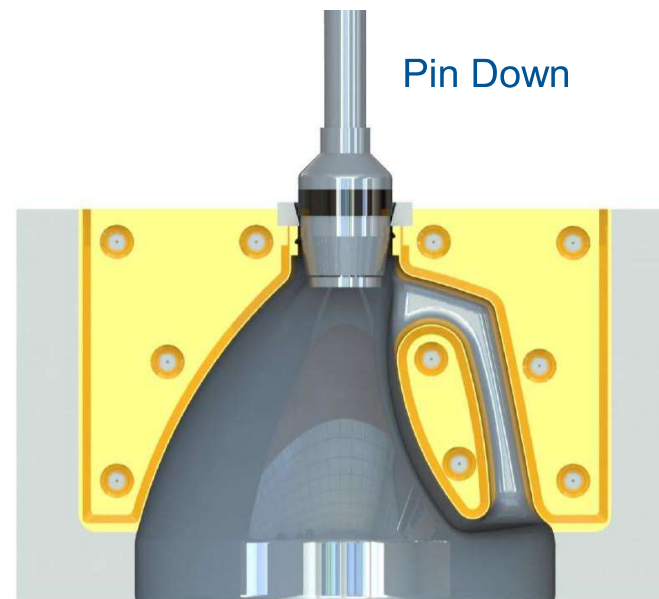
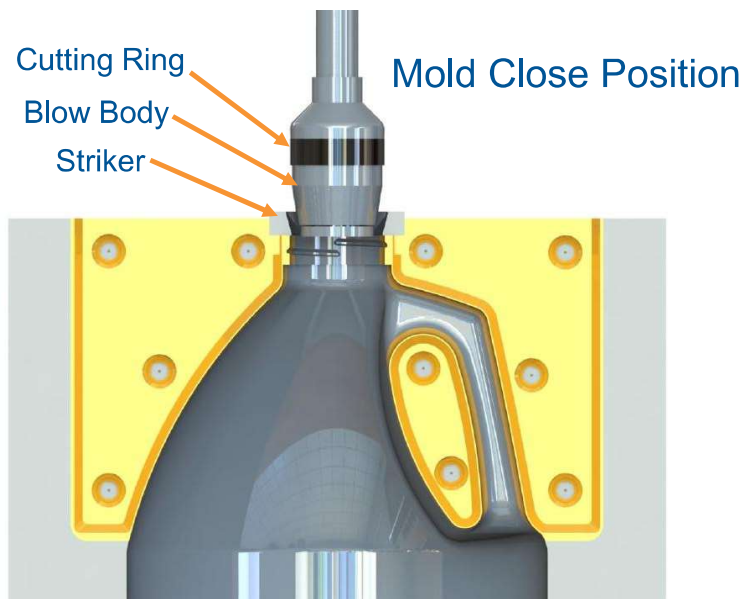
- Parison Wider Than Neck
- Light Weight Neck
- Calibrated I.D. Based On Blow Body/ Knife Size
- Caps Seal On Inside Of Neck



Ram Down Neck Finish

Note: Flash depths can be critical

- Parison Wider Than Neck
- Rigid Neck
- Flat, Smooth Top Surface
- I.D. & Neck Thickness Determined By Angle and Size Of Striker, Cutting Rings, and Blow Body

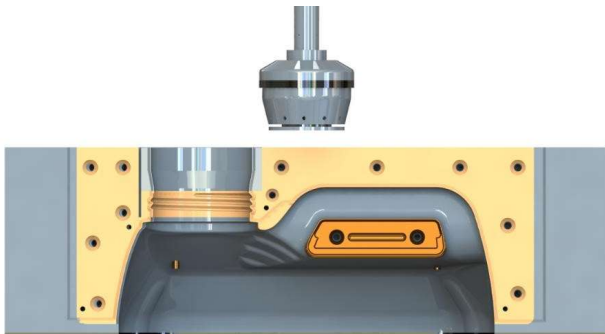


Ram Down Neck Finish

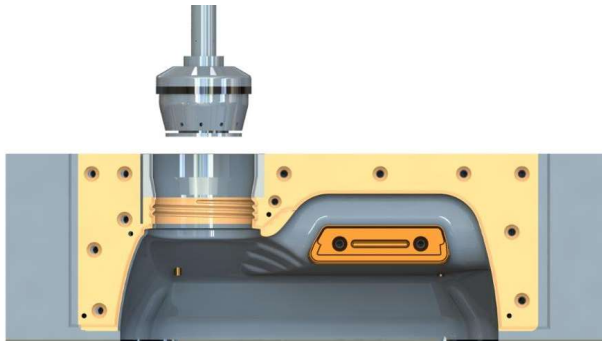
- Off Centered Neck

Note: Flash depths can be critical

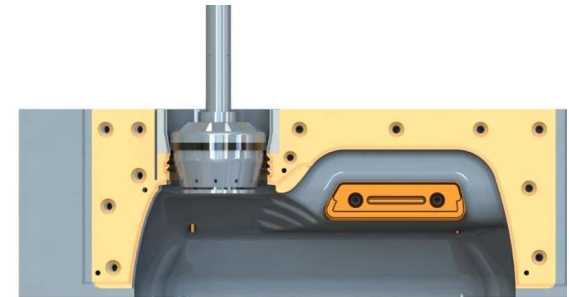
Mold Close Position



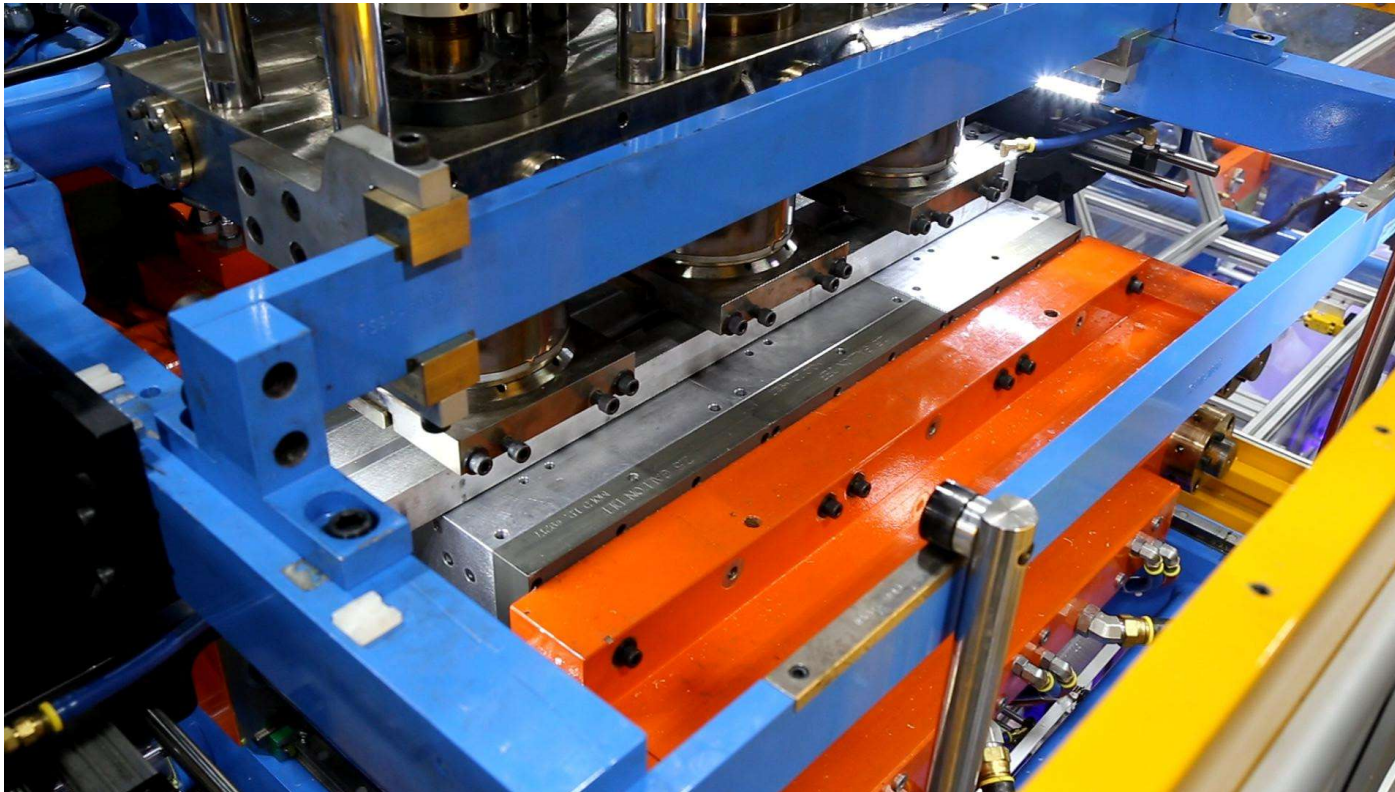
Side Shift / Center Blow Pin



Pin Down



Clamp Overview



Video
Showing
Clamp Side
Shift
Functions

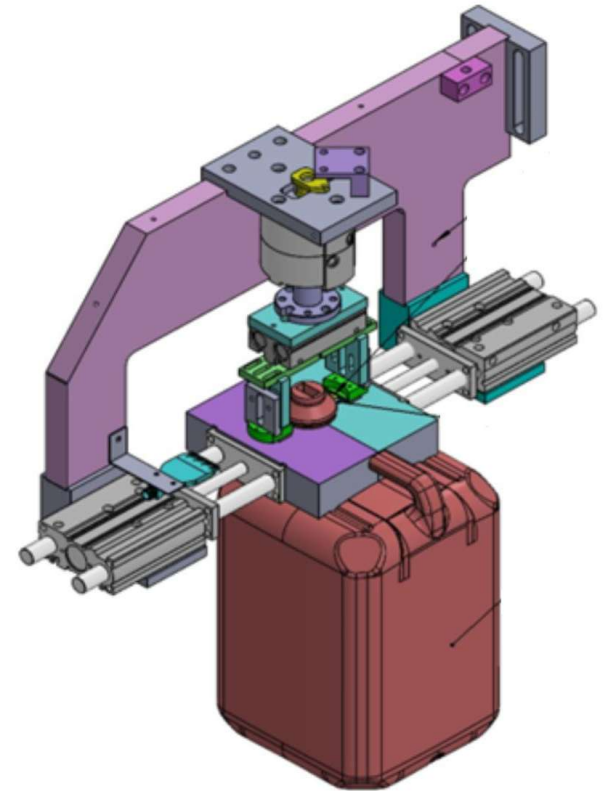


Clamp Side Shift Neck Finish

- Off Centered Neck

Note: Flash depths can be critical

- Impact Cut False Dome
- Impact Trim Top Flash & Handle
- Rotary Cropping Head To Cut Dome



Clamp Side Shift Neck Finish

Video
Showing
Clamp Side
Shift
Functions



MODEL RS-80
2-Head with VT-2 &
Rotary Cropping Head



Bottle Trimming

Spin Dome



Impact Deflash

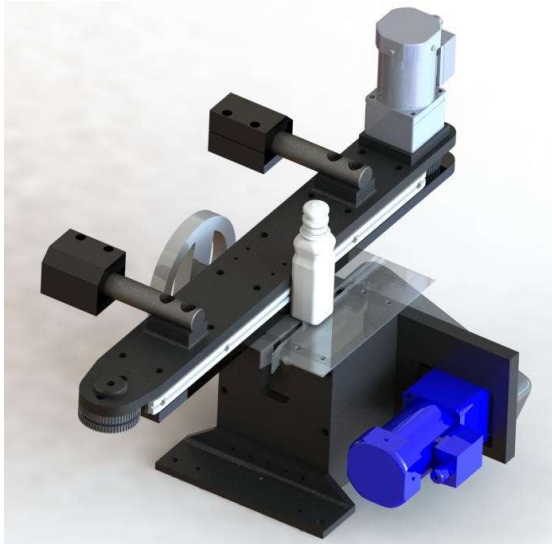


Bottle Trimming

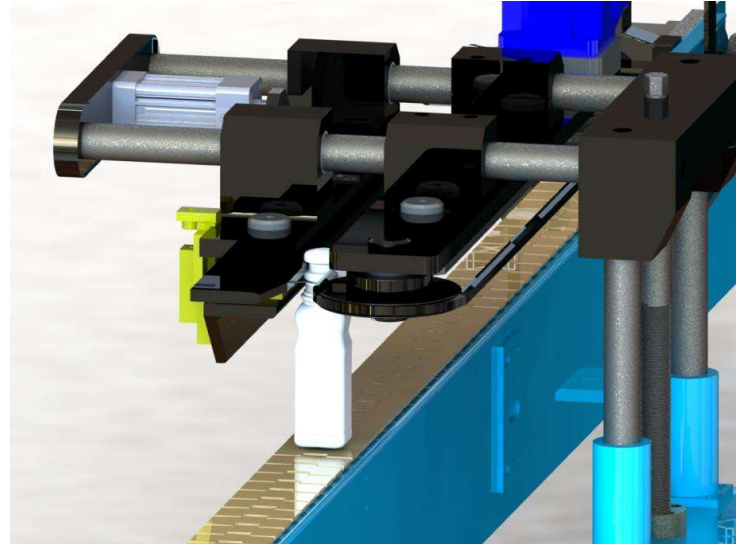
Bottle From
Mold



Tail Puller



Spin Trimmer

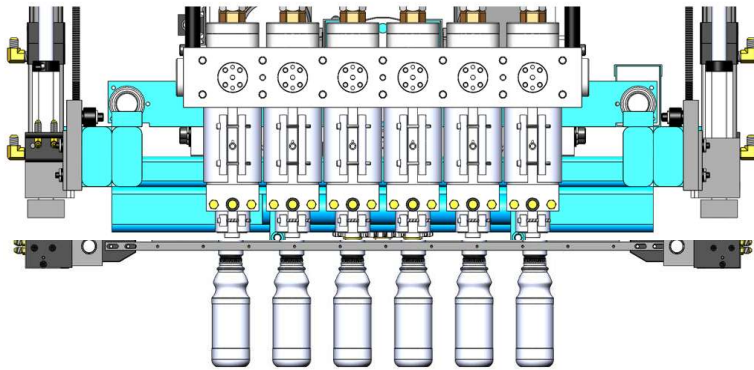


Finished
Bottle

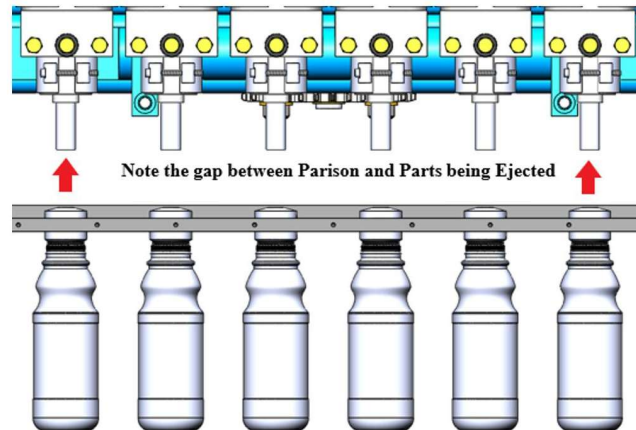
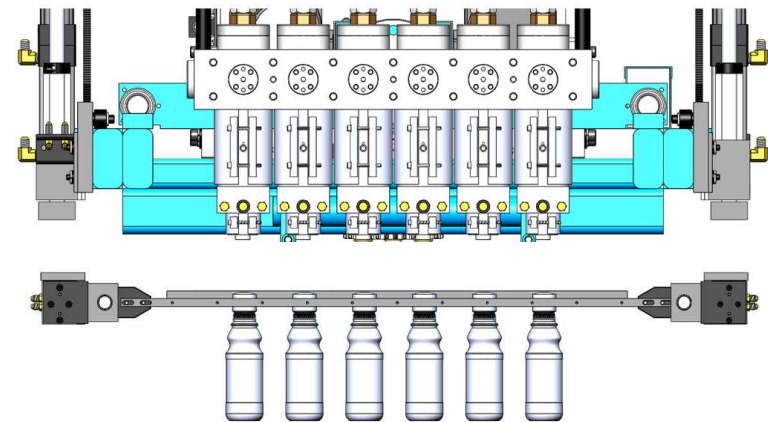


Bottle Trimming

Stage 1



Stage 2



Bottle Trimming



Video
Showing
Spin Dome
Take Away
Automation

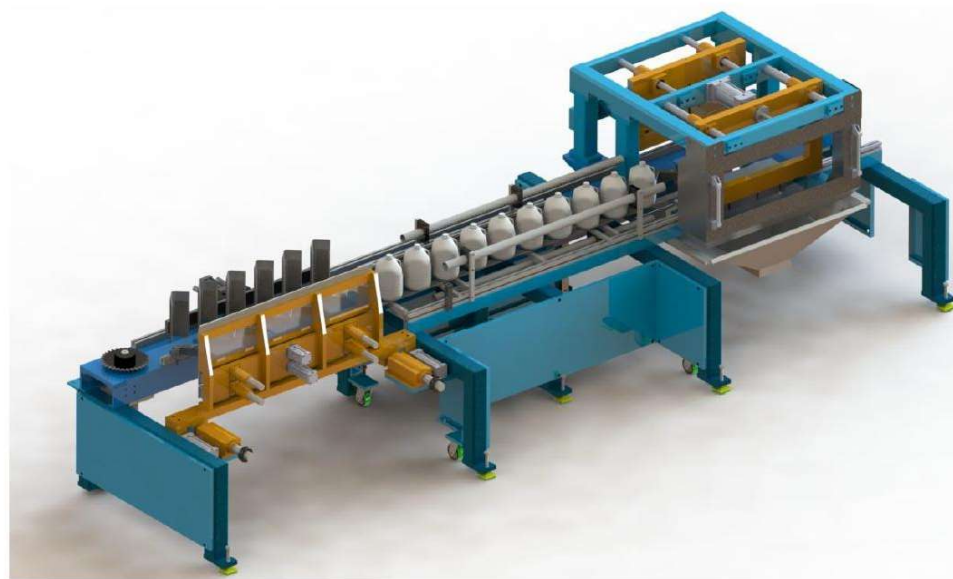


Bottle Trimming

Bottle From
Mold



Vertical Impact
Trimmer



Finished
Bottle

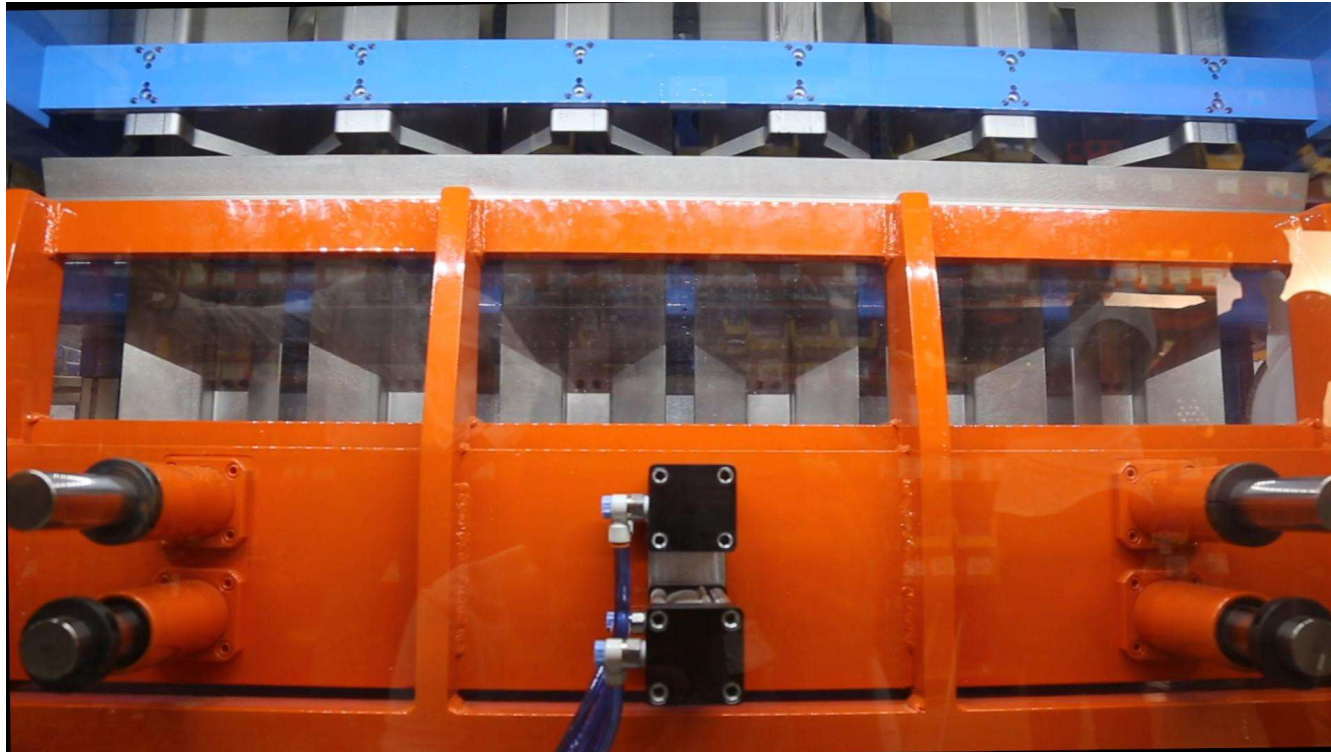


Bottle Trimming

- Robust Single Stage Gripper Eject System Effectively Transfers Parts to Take Away Automation
- Water Cooled Gripper Bars



Bottle Trimming



Video
Showing
Vertical
Deflash
Automation



Wrap Up

- Dairy, Industrial & Consumer Packaging
- HDPE, LDPE, PP most commonly used materials
- Material for shot is accumulated in the front of the barrel
- Screw retracts, then plunges forward
- Dome Seal, Pull-Up, Ram Down neck finishes
- Multiple trimming methods depending on bottle design



THANK YOU

