FUNDAMENTAL MANUFACTURING PROCESSES

PLASTIC BLOW MOLDING

SCENE 1.
CG: EXTRUSION BLOW MOLDING
white text centered on black

SCENE 2.
tape 401, 07:25:29-07:25:41
zoom in, extrusion process
tape 401, 07:08:50-07:09:06
parison extruded

NARRATION (VO):

THE PROCESS OF EXTRUSION BLOW MOLDING INVOLVES APPLYING HEAT AND PRESSURE TO THERMOPLASTIC RESIN TO PRODUCE WHAT IS CALLED THE MELT. THIS MELT IS THEN FORCED THROUGH A DIE TO PRODUCE A PARISON WHICH IS THEN DROPPED, TRAPPED OR CONVEYED TO AN OPEN BLOW MOLD FOR SUBSEQUENT BLOW MOLDING.

SCENE 3.
tape 403, 01:22:44-01:22:49
extrusion blow molding
tape 399, 04:00:50-04:01:40
blue background
CG: INTERMITTENT
CONTINUOUS

NARRATION (VO):

EXTRUSION BLOW MOLDING USES EITHER AN INTERMITTENT, OR CONTINUOUS METHOD FOR THE FORMATION OF THE MOLTEN PARISON.

SCENE 4.
tape 408, 10:10:53-10:11:05
intermittent extrusion blow molding
CG, SUPER: INTERMITTENT EXTRUSION

NARRATION (VO):

INTERMITTENT EXTRUSION PRODUCES A PARISON ONLY WHEN THE BLOW MOLD IS READY.

SCENE 5.
tape 403, 01:19:09-01:19:15
reciprocating screw style blow molding machine
tape 401, 07:12:36-07:12:44
accumulator and ram style blow molding machine

NARRATION (VO):

THESE PARISONS ARE PRODUCED BY USING EITHER A RECIPROCATING SCREW, OR AN ACCUMULATOR AND RAM STYLE MACHINE.

SCENE 6.
tape 409, 01:00:40-01:00:50
GRAPHIC: wide, reciprocal screw

NARRATION (VO):

extrusion blow molding machine
CG, SUPER: HOPPER
tape 409, 01:01:10-01:01:20
GRAPHIC: same graphic, hopper highlighted
CG, SUPER: FEED BARREL
tape 409, 01:01:40-01:01:50
GRAPHIC: same graphic, externally heated feed barrel highlighted
CG, SUPER: RECIPROCAL SCREW
tape 409, 01:02:10-01:02:20
GRAPHIC: same graphic, reciprocal screw highlighted
CG, SUPER: FEED ZONE
tape 409, 01:02:40-01:02:50
GRAPHIC: same graphic, reciprocal screw's feed zone highlighted
CG, SUPER: COMPRESSION ZONE
tape 409, 01:03:10-01:03:20
GRAPHIC: same graphic, reciprocal screw's compression zone highlighted
CG, SUPER: METERING ZONE
tape 409, 01:03:40-01:03:50
GRAPHIC: same graphic, reciprocal screw's metering zone highlighted
CG, SUPER: HEAD AND DIE ASSEMBLY
tape 409, 01:04:10-01:04:20
GRAPHIC: same graphic, head and die assembly highlighted

THE MAIN SECTIONS OF A RECIPROCAL SCREW EXTRUSION BLOW MOLDING MACHINE ARE THE HOPPER...,

AN EXTERNALLY HEATED FEED BARREL...,

A RECIPROCAL SCREW WHICH HAS A FEED ZONE...,

COMPRESSION ZONE...,

AND METERING ZONE...,

AND THE HEAD AND DIE ASSEMBLY.

SCENE 7.
tape 408, 10:01:27-10:01:38
zoom out, hopper being vacuum fed automatically
tape 408, 10:03:26-10:03:33
zoom out, plastic being vacuum fed automatically

NARRATION (VO):

RESIN, USUALLY IN THE FORM OF PLASTIC PELLETS, IS FED TO THE FEED BARREL FROM THE HOPPER. THIS HOPPER MAY BE FILLED MANUALLY, OR VACUUM FED AUTOMATICALLY.

SCENE 8.
tape 414, 00:00:56-00:01:30
ANI: cutaway, resin entering feed barrel, driven forward by rotating screw

NARRATION (VO):

AS THE RESIN ENTERS THE FEED BARREL IT IS DRIVEN FORWARD BY THE ROTATION OF THE SCREW.

SCENE 9.
continue animation, resin driven forward, melting due to external heat on the feed barrel and the frictional shearing forces

NARRATION (VO):

THE RESIN BEGINS TO MELT AS IT IS MOVED FORWARD

generated by the rotation of the screw

DUE TO BOTH THE FRICTIONAL SHEARING FORCES GENERATED BY THE ROTATION OF THE SCREW, AND THE HEAT FROM EXTERNAL HEATING BANDS ATTACHED TO THE FEED BARREL.

SCENE 10.
continue animation, melted resin reaching end of feed barrel, screw retracting as resin fills chamber

NARRATION (VO):

THE MELTED RESIN BUILDS UP IN PRESSURE AS IT IS COMPRESSED AND CONFINED AT THE END OF THE FEED BARREL. TO CONTROL THIS PRESSURE BUILD-UP, THE ROTATING SCREW IS RETRACTED.

SCENE 11.
continue animation
tape 401, 07:28:53-07:29:04
fully charged chamber, screw forced forward
tape 401, 07:22:00-07:22:12
melt pushing through the extruder's head and die assembly, forming parison

NARRATION (VO):

ONCE THE PROPER AMOUNT OF MELTED RESIN IS AVAILABLE, THE SCREW IS HYDRAULICALLY FORCED FORWARD. THIS RAPIDLY FORCES THE HOMOGENEOUS MELT THROUGH THE EXTRUDER'S HEAD AND DIE ASSEMBLY TO FORM A PARISON.

SCENE 12.
tape 408, 10:07:08-10:07:14
accumulator and ram style blow molding machine
tape 401, 07:14:12-07:14:40
accumulator type reciprocal machine with reciprocal screw holding the melt, forcing melt through head and die assembly

NARRATION (VO):

IN THE ACCUMULATOR TYPE OF RECIPROCAL MACHINE, A RECIPROCAL SCREW FORCES MELTED RESIN INTO AN ACCUMULATOR. THE ACCUMULATOR IS A RESERVOIR THAT HOLDS THE MELT UNDER PRESSURE AND TEMPERATURE, WHILE MAINTAINING THE SPECIFIED AMOUNT OF HOMOGENOUS MELTED RESIN REQUIRED TO PRODUCE THE PARISON. ONCE THE ACCUMULATOR IS FILLED TO ITS DESIRED POSITION, A HYDRAULICALLY OPERATED RAM FORCES THE HOMOGENOUS MELT THROUGH THE HEAD AND DIE TO FORM A PARISON.

SCENE 13.
tape 408, 10:17:06-10:17:23

NARRATION (VO):

parison extruded from accumulator and ram style blow molding machine

USING AN ACCUMULATOR MAKES THE DELIVERY RATE OF THE MELT THAT FORMS THE PARISON INDEPENDENT OF THE DELIVERY RATE OF THE EXTRUDER, AND PROVIDES FOR THE FORMATION OF LARGE PARISONS AT A VERY FAST RATE SO PARISON SAG DOESN'T BECOME A PROBLEM.

SCENE 14.
tape 408, 10:12:15-10:12:35
zoom out, accumulator and ram style blow molding machine producing large part

NARRATION (VO):

AN ACCUMULATOR IS TYPICALLY USED TO MANUFACTURE HIGH PRODUCTION, LARGE INDUSTRIAL PARTS, AND MAY HOLD UP TO 54 KILOGRAMS OF RESIN TO PRODUCE THE PARISON FOR A SINGLE PART.

--- FADE TO BLACK ---

SCENE 15.
tape 412, 10:08:31-10:09:01
continuous extrusion blow molding
CG, SUPER: CONTINUOUS EXTRUSION

NARRATION (VO):

CONTINUOUS EXTRUSION PRODUCES AN ENDLESS PARISON WHICH IS CONSTANTLY POSITIONED IN BLOW MOLDS FOR PROCESSING.

SCENE 16.
continue previous shot
tape 403, 01:17:22-01:17:29
continuous extrusion blow molding
tape 412, 01:04:41-01:04:51
continuous extrusion blow molding

NARRATION (VO):

THE MAIN SECTIONS OF A CONTINUOUS BLOW MOLDING EXTRUSION MACHINE ARE VERY MUCH LIKE THE RECIPROCAL SCREW MACHINE EXCEPT THAT THE SCREW CONTINUALLY ROTATES, BUT DOES NOT RECIPROCATE. THIS CONSTANTLY FORCES MELTED RESIN FROM THE FRONT OF THE SCREW THROUGH THE HEAD AND DIE TO FORM A CONTINUOUS FLOWING PARISON.

SCENE 17.
tape 402, 08:12:42-08:12:47
intermittent head and die assembly
tape 403, 01:28:54-01:29:00
continuous head and die assembly
tape 412, 10:05:38-10:05:46
continuous head and die assembly

NARRATION (VO):

BOTH INTERMITTENT,
AND CONTINUOUS EXTRUSION HAVE HEAD AND DIE ASSEMBLIES WHOSE FUNCTIONS ARE TO FORM THE MELTED

tape 410, 00:18:10-00:18:23
intermittent head and die assembly

RESIN INTO A UNIFORM PARISON, AND TO MAINTAIN A CONSTANT TEMPERATURE AND PRESSURE ON THE MELT WHILE PROVIDING THE DESIRED WALL THICKNESS AS THE MELT EXITS THE DIE AS A PARISON.

SCENE 18.
tape 402, 08:06:46-08:07:03
med, pan to intermittent head and die assembly, tilt to parison

NARRATION (VO):

MOST EXTRUDER HEAD AND DIE ASSEMBLIES ARE CLASSIFIED AS THE CROSSHEAD TYPE, WHICH DIVERTS THE MELT FLOW 90 DEGREES FROM A HORIZONTAL TO A VERTICAL ORIENTATION.

SCENE 19.
tape 408, 10:11:29-10:11:43
c.u. crosshead die assembly
CG, SUPER: CENTER-FEED ASSEMBLY
SIDE-FEED ASSEMBLY

NARRATION (VO):

TWO KINDS OF CROSSHEAD DIE ASSEMBLIES ARE MOST COMMONLY USED IN EXTRUSION BLOW MOLDING:
THE CENTER-FEED,
AND THE SIDE-FEED ASSEMBLY.

SCENE 20.
CG, SUPER: CENTER-FEED ASSEMBLY
tape 399, 04:03:40-04:03:50
GRAPHIC: cut away of center-feed assembly
tape 399, 04:04:40-04:04:50
GRAPHIC: cut away of center-feed assembly, parison produced

NARRATION (VO):

THE CENTER-FEED ASSEMBLY PRODUCES A FAIRLY UNIFORM MELT BY FORCING IT TO FLOW VERTICALLY DOWNWARD AROUND THE TIP OF A CONICAL, TORPEDO-SHAPED CORE CALLED A MANDREL OR PIN. THIS RESULTS IN STRAIGHT FLOW ALL AROUND THE MANDREL.

SCENE 21.
CG, SUPER: SIDE-FEED ASSEMBLY
tape 399, 04:02:10-04:02:20
GRAPHIC: cut away of side-feed assembly
tape 399, 04:02:40-04:02:50
GRAPHIC: cut away of side-feed assembly, parison starting
tape 399, 04:03:10-04:03:20
GRAPHIC: cut away of side-feed assembly, parison produced

NARRATION (VO):

IN THE SIDE-FEED ASSEMBLY, THE MELTED RESIN IS FORCED AROUND THE PERIMETER OF THE MANDREL, ALLOWING THE MELT TO FLOW UNIFORMLY DOWN AROUND THE MANDREL AND THEN EXTRUDED THROUGH THE DIE AS A PARISON.

SCENE 22.
tape 399, 04:05:10-04:05:20

NARRATION (VO):

GRAPHIC: cut away die producing parison
tape 399, 04:05:40-04:05:50
GRAPHIC: cut away die producing parison, mandrel highlighted
tape 399, 04:06:10-04:06:20
GRAPHIC: cut away die producing parison, bushing highlighted
extrusion of parison

THE DIE CONSISTS OF A MANDREL AND A BUSHING WHICH ARE DESIGNED TO PRODUCE A PARISON OF THE DESIRED WALL THICKNESS.

SCENE 23.
tape 403, 01:35:32-01:35:36
parison being produced
tape 399, 04:06:40-04:06:50
GRAPHIC: converging die tooling
tape 399, 04:07:10-04:07:20
GRAPHIC: diverging die tooling

NARRATION (VO):

THERE ARE TWO PRIMARY TYPES OF DIE TOOLING: CONVERGING, WHICH FLARES INWARD, AND DIVERGING, WHICH FLARES OUTWARD.

SCENE 24.
tape 401, 07:26:17-07:26:28
zoom out, extrusion process
tape 408, 10:20:05-10:20:23
parison being produced from die assembly

NARRATION (VO):

AS THE HOT PARISON IS EXTRUDED TO ITS DESIRED LENGTH, IT IS SUBJECT TO SAGGING WHICH CAUSES THINNING AT THE TOP OF THE PARISON. TO OVERCOME THIS PROBLEM, IT'S BEST TO EXTRUDE THE PARISON AS FAST AS POSSIBLE, AT THE CORRECT TEMPERATURE, WHILE USING A PARISON PROGRAMMER.

SCENE 25.
continue previous shot
tape 413, 00:01:28-00:01:38
ANI: parison programmer moving the mandrel, increasing and decreasing the parison's wall thickness as it is formed
tape 401, 07:15:30-07:15:46
parison being formed

NARRATION (VO):

THE PARISON PROGRAMMERS' FUNCTION IS TO MOVE THE MANDREL, INCREASING OR DECREASING THE GAP BETWEEN IT AND THE BUSHING. THIS VARIES THE PARISON'S WALL THICKNESS AS IT IS BEING FORMED. MOST INTERMITTENT AND CONTINUOUS EXTRUSION MACHINES UTILIZE SOME TYPE OF PARISON PROGRAMMER.

SCENE 26.
tape 403, 01:19:10-01:19:15
wide, zoom out intermittent extrusion blow molding system
tape 403, 01:02:19-01:02:22
intermittent extrusion blow molding system

NARRATION (VO):

INTERMITTENT EXTRUSION IS USED ON A VARIETY OF BLOW MOLDING MACHINES TO PRODUCE A WIDE RANGE OF

tape 402, 08:12:37-08:12:40
product produced through intermittent extrusion
tape 403, 01:21:40-01:21:43
bottles produced on intermittent extrusion molding system

PRODUCTS.

SCENE 27.
tape 403, 01:25:11-01:25:16
continuous extrusion blow molding system
tape 403, 01:48:15-01:48:22
continuous parison extruding
tape 412, 01:04:34-01:04:39
shuttle/reciprocating blow molding system
tape 403, 01:46:21-01:46:25
rotary wheel blow molding system

NARRATION (VO):

CONTINUOUS EXTRUSION UTILIZES SEVERAL PROCESSING TECHNIQUES ON MANY DIFFERENT BLOW MOLDING SYSTEMS. THESE INCLUDE:

SHUTTLE OR RECIPROCATING BLOW MOLDING SYSTEMS, AND ROTARY WHEEL BLOW MOLDING SYSTEMS.

SCENE 28.
tape 412, 01:02:53-01:03:10
shuttle/reciprocating blow molding system

NARRATION (VO):

SHUTTLE OR RECIPROCATING BLOW MOLDING FREQUENTLY USES MULTIPLE MOLDS, THUS REQUIRING MULTIPLE PARISONS. THIS IS ACHIEVED BY USE OF A MANIFOLD WHICH DISTRIBUTES THE MELTED RESIN TO SEVERAL DIES FOR FORMATION OF THE PARISONS.

SCENE 29.
tape 412, 01:03:25-01:03:33
c.u. shuttle/reciprocating blow molding parison cut
tape 403, 01:26:55-01:27:07
shuttle/reciprocating blow mold arriving at blowing station, parison blown

NARRATION (VO):

USUALLY A CUTTING DEVICE IS MOUNTED BELOW THE DIE HEAD OR DIE HEADS TO CUT THE PARISON OR PARISONS. ONCE THE MOLDS ARRIVE AT THE BLOW POSITION, A BLOW PIN INSERTED INTO THE MOLD, OR A NEEDLE INTEGRAL WITH THE MOLD ENTERS THE PARISON AND BLOWS THE PRODUCT INTO SHAPE.

SCENE 30.
tape 403, 01:46:16-01:46:25
2 shots, zoom in to vertical wheel system, dissolve to wide of rotary wheel system
tape 403, 01:48:09-01:48:13
vertical rotary wheel for continuous blow molding system

NARRATION (VO):

FOR LARGER, LONG RUN HIGH PRODUCTION PARTS, UP TO 20 OR MORE SPLIT MOLDS CAN BE MOUNTED ON EITHER A HORIZONTAL TURNTABLE OR VERTICAL ROTARY WHEEL FOR

CONTINUOUS BLOW MOLDING OPERATION.

SCENE 31.
continue previous shot
tape 403, 01:47:38-01:47:44
med, follow mold under extrusion die receiving parison
tape 403, 01:47:30-01:47:37
mold under extrusion die receiving parison

NARRATION (VO):

AS THE ROTARY WHEEL TURNS, MOLDS PASS UNDER THE EXTRUSION DIE TO RECEIVE AND CLOSE AROUND THE PARISON. BLOWING AIR IS INTRODUCED THROUGH A BLOWING PIN WHICH PENETRATES THE PARISON AS THE MOLD CLOSES.

SCENE 32.
tape 403, 01:46:31-01:46:35
molds unclamping, opening using cams
tape 403, 01:47:45-01:47:48
c.u. molds closing and clamping using cams
tape 403, 01:48:33-01:48:41
parison extruding

NARRATION (VO):

AS THE WHEEL ROTATES, THE MOLDS CAN BE EITHER OPENED OR CLOSED VIA CAMS OR CYLINDERS. THE SPEED OR REVOLUTION OF THE WHEEL DETERMINES BLOW TIME, COOLING TIME, EXHAUST TIME AND EJECT TIME.

SCENE 33.
tape 403, 01:47:22-01:47:28
parts ejected from rotary wheel system, trimmed
tape 403, 01:50:25-01:50:31
c.u. parts ejected from rotary wheel system, trimmed

NARRATION (VO):

ONCE THE WHEEL ROTATES TO A SPECIFIC POSITION, THE BLOW MOLD OPENS AND THE PRODUCT IS EJECTED AND TRIMMED.

--- FADE TO BLACK ---