

FUNDAMENTAL MANUFACTURING PROCESSES

Die Casting

SCENE 1.

CG: Die Casting Machines  
white text centered on black

SCENE 2.

**tape 445, 12:06:10-12:06:19**  
zoom out, horizontal die casting  
machines  
**tape 443, 09:11:47-09:11:55**  
pan, horizontal die casting  
machine  
**tape 465, 01:20:57-01:20:20**  
vertical die casting machine

NARRATION (VO) :

THERE ARE SEVERAL TYPES OF DIE CASTING MACHINES IN  
USE TODAY. MOST OF THESE MACHINES ARE  
HYDRAULICALLY ACTUATED AND OPERATE HORIZONTALLY,  
BUT VERTICALLY OPERATING MACHINES ARE ALSO  
UTILIZED.

SCENE 3.

continue previous shot  
**tape 445, 12:03:35-12:03:44**  
horizontal machine injecting  
metal

NARRATION (VO) :

THE PRINCIPAL DIFFERENCE BETWEEN VERTICAL...,  
AND HORIZONTAL DIE-CASTING MACHINES IS, AS THE  
TERMS IMPLY, THE DIRECTION OF METAL INJECTION INTO  
THE DIE.

SCENE 4.

**tape 464, 09:13:55-09:14:02**  
c.u. injection system  
CG, SUPER: Injection System  
**tape 445, 12:16:40-12:16:50**  
pan, clamping system  
CG, SUPER: Clamping System

NARRATION (VO) :

ALL DIE CASTING MACHINES INCLUDE A METAL-INJECTION  
SYSTEM TO GET THE METAL IN THE DIE,  
AND A CLAMPING SYSTEM TO KEEP THE DIE HALVES  
CLOSED DURING INJECTION.

SCENE 5.

**tape 442, 08:05:09-08:05:16**  
hot-chamber die casting machine  
**tape 468, 00:09:00-00:10:00**  
blue background  
CG: Hot-Chamber Machine  
Cold-Chamber Machine

NARRATION (VO) :

THE TWO PRINCIPAL TYPES OF DIE CASTING MACHINES  
ARE:  
THE HOT-CHAMBER...,  
AND COLD-CHAMBER TYPE.

SCENE 6.

CG, SUPER: Hot-Chamber Machine  
**tape 445, 12:04:22-12:04:36**  
hot-chamber die casting machine

**NARRATION (VO) :**

THE HOT-CHAMBER MACHINE IS USED MAINLY FOR DIE-CASTING ZINC AND OTHER METALS OF LOW MELTING TEMPERATURE. HOWEVER, IT IS ALSO USED TO DIE-CAST MAGNESIUM.

SCENE 7.

**tape 462, 06:06:31-06:06:42**  
pan of holding pot  
**tape 442, 08:07:37-08:07:48**  
c.u. plunger  
**tape 473, 00:01:18-00:01:28**  
GRAPHIC: cutaway of hot-chamber machine, injection system highlighted

**NARRATION (VO) :**

THE MACHINE'S SHOT OR CHARGE END HAS A HOLDING POT, WHICH IS A RESERVOIR FOR THE MOLTEN METAL SEATED IN A FURNACE, AND AN INJECTION SYSTEM FOR TRANSFERRING THE METAL THROUGH A GOOSENECK-SHAPED PIPE TO THE DIE.

SCENE 8.

**tape 462, 06:05:57-06:06:14**  
pull back from plunger,  
injection system submerged in  
holding pot

**NARRATION (VO) :**

THE PLUNGER END OF THE INJECTION SYSTEM AND THE LOWER PORTION OF THE TRANSFER PIPE ARE SUBMERGED IN THE MOLTEN METAL. FOR THIS REASON, ALUMINUM AND COPPER ALLOYS ARE UNSUITABLE FOR USE, SINCE THEY CHEMICALLY ATTACK OR ERODE THE SUBMERGED INJECTION SYSTEM.

SCENE 9.

**tape 473, 00:02:16-00:02:23**  
ANI: cutaway of hot-chamber machine showing the injection system, plunger rising, charge of metal entering the pipe through a port, plunger stopping, add white burst  
**tape 473, 00:02:26-00:02:40**  
ANI: plunger then descending, closing the port and driving the charge through a nozzle at the end of the pipe and into the die

**NARRATION (VO) :**

WHEN THE PLUNGER RISES, A CHARGE OF METAL ENTERS THE PIPE THROUGH A PORT. WHEN THE PLUNGER DESCENDS, IT CLOSES THE PORT AND DRIVES THE CHARGE THROUGH A NOZZLE AT THE END OF THE PIPE AND INTO THE DIE.

SCENE 10.

**tape 442, 08:08:00-08:08:09**  
c.u. plunger descending, then rising

**NARRATION (VO) :**

INJECTION PRESSURES MAY RANGE FROM 1,500 TO MORE

THAN 4,500 POUNDS PER SQUARE INCH OR 10 TO 31 MEGA PASCALS.

--- TOUCH BLACK ---

SCENE 11.

CG, SUPER: Cold-Chamber Machine  
**tape 450, 17:02:12-17:02:22**  
cold-chamber die casting machine

**NARRATION (VO) :**

THE COLD-CHAMBER MACHINE IS USED PRIMARILY TO DIE-CAST THE ALUMINUM, MAGNESIUM, AND COPPER ALLOYS.

SCENE 12.

**tape 444, 11:14:35-11:15:08**  
zoom in from ladle system to  
pouring of shot

**NARRATION (VO) :**

IN THE COLD-CHAMBER MACHINE, THE CHARGE IS SUPPLIED BY LADLE OR FEED SYSTEM FROM AN EXTERNAL FURNACE SOURCE TO A HOLDING POT AT THE SHOT END OF THE MACHINE. THE FEED SYSTEM COMPONENTS ARE NOT SUBMERGED IN THE MOLTEN METAL.

SCENE 13.

continue previous shot

**NARRATION (VO) :**

THE CHARGE IS Poured AHEAD OF THE PLUNGER TIP THROUGH A POUR HOLE IN THE SHOT SLEEVE. AS THE PLUNGER ADVANCES, IT CLOSES THE POUR HOLE AND DRIVES THE MOLTEN METAL INTO THE DIE.

SCENE 14.

**tape 464, 09:15:00-09:15:18**  
c.u. cold-chamber plunger  
injecting metal

**NARRATION (VO) :**

INJECTION PRESSURES MAY RANGE TO 10,000 POUNDS PER SQUARE INCH OR 69 MEGA PASCALS FOR ALUMINUM AND MAGNESIUM, ALTHOUGH SOME MACHINES CAN PROVIDE STILL GREATER PRESSURES.

SCENE 15.

**tape 468, 00:07:45-00:08:09**  
ANI: plunger thrusting forward  
to release casting

**NARRATION (VO) :**

AFTER THE METAL IN THE DIE SOLIDIFIES AND THE DIE HALVES ARE SEPARATING, THE PLUNGER THRUSTS FORWARD, EXTENDING THE PLUNGER TIP PAST THE COVER

DIE. THIS PUSHES THE BISCUIT THAT SOLIDIFIES AT THE END OF THE SHOT SLEEVE, ASSISTING CASTING RELEASE.

--- TOUCH BLACK ---

SCENE 16.

**tape 464, 09:01:20-09:01:26**  
static, accumulator, highlight accumulator  
**tape 441, 07:06:20-07:06:32**  
zoom in, plunger descending on hot chamber system

**NARRATION (VO) :**

BOTH HOT-CHAMBER AND COLD-CHAMBER MACHINES OFTEN UTILIZE ONE OR MORE ACCUMULATORS TO BOOST INJECTION PRESSURE FOR DIE CASTING.

SCENE 17.

**tape 464, 09:03:53-09:04:11**  
zoom in, pressure gauge on accumulator

**NARRATION (VO) :**

AN ACCUMULATOR IS A CYLINDRICAL PRESSURE VESSEL CHARGED WITH INERT GAS, USUALLY NITROGEN, WHICH STORES HYDRAULIC FLUID AT A PRESSURE REQUIRED FOR RAPID, HIGH-PRESSURE INJECTION.

SCENE 18.

**tape 450, 17:15:08-17:15:18**  
pan from intensifiers to machine plunger being driven forward  
**tape 450, 17:15:31-17:15:44**  
zoom in, digital pressure readout increasing  
**tape 450, 17:07:17-17:07:25**  
wide, cold chamber plunger driven forward

**NARRATION (VO) :**

PRESSURE INTENSIFIERS ALSO CAN BE USED TO INCREASE INJECTION PRESSURE. THESE GROUPS OF HYDRAULIC CYLINDERS CAN DOUBLE, EVEN QUADRUPLE, PRESSURE BY APPLYING HIGH FORCE THROUGH A SHORT DISTANCE AT THE END OF THE PLUNGER STROKE. THIS PACKS THE MOLTEN METAL MORE TIGHTLY INTO DIE-CAVITY DETAILS.

--- TOUCH BLACK ---

SCENE 19.

**tape 464, 09:17:00-09:17:12**  
wide, clamping system releasing pressure, dies separating

**NARRATION (VO) :**

THE CLAMPING SYSTEM OF THE DIE CASTING MACHINE CAN BE FULLY HYDRAULIC, MECHANICAL, PNEUMATIC OR A COMBINATION OF THESE SYSTEMS.

SCENE 20.

**tape 445, 12:17:08-12:17:20**

**NARRATION (VO) :**

toggle system on die cast machine

THE MOST COMMON CLAMPING METHOD USES COMPOUND TOGGLES WITH A HYDRAULIC CYLINDER TO PROVIDE THE FULL CLAMPING FORCE.

SCENE 21.

CG, SUPER: Clamping-Force Capacity

**tape 442, 08:23:41-08:23:55**

casting removed, dies clamped shut

CG, SUPER: Shot-Weight Capacity

**tape 464, 09:13:11-09:13:19**

shot being poured into cold chamber system

**NARRATION (VO) :**

DIE CASTING MACHINES ARE TYPICALLY RATED BY CLAMPING-FORCE CAPACITY. THIS IS THE AMOUNT OF FORCE THE MACHINE CAN PROVIDE TO RESIST THE PRESSURE GENERATED DURING METAL INJECTION. MACHINES ALSO MAY BE RATED BY THE SHOT-WEIGHT CAPACITY OF THE INJECTION SYSTEM.

SCENE 22.

**tape 463, 07:10:37-07:10:54**

static of dies on platens, highlight platens

**NARRATION (VO) :**

THE DIE HALVES ARE ATTACHED TO PLATENS ON THE DIE CASTING MACHINE.

SCENE 23.

**tape 442, 08:23:01-08:23:10**

dies closing for injection of part

**tape 468, 00:09:00-00:10:00**

blue background

CG: Stationary Platen  
Movable Platen

**NARRATION (VO) :**

THESE PLATENS ARE LARGE THICK BLOCKS OF STEEL WHICH WILL NOT DEFLECT DURING INJECTION. THEY INCLUDE THE STATIONARY PLATEN, AND THE MOVABLE PLATEN.

SCENE 24.

**tape 463, 07:09:11-07:09:22**

zoom in, stationary platen holding the cover die half

**tape 445, 12:09:00-12:09:12**

zoom out, hole in stationary plate

**NARRATION (VO) :**

THE STATIONARY PLATEN HOLDS THE DIE HALF THAT IS CALLED THE COVER HALF. THIS PLATEN HAS A HOLE DIRECTLY IN LINE WITH THE METAL INJECTION CYLINDER.

SCENE 25.

**tape 463, 07:11:59-07:12:07**

zoom in, movable platen holding the ejector die half

**tape 463, 07:14:52-07:14:58**

movable platen sliding closed on ways

**NARRATION (VO) :**

THE MOVABLE PLATEN HOLDS THE OTHER DIE HALF, CALLED THE EJECTOR HALF. THIS MOVABLE PLATEN SLIDES BACK AND FORTH ON WAYS.

SCENE 26.

**tape 442, 08:22:32-08:22:46**  
die halves separating, ejector  
pins releasing casting

**NARRATION (VO) :**

WHEN THE METAL HAS SOLIDIFIED AND THE DIE HALVES  
SEPARATE, MECHANICALLY OR HYDRAULICALLY ACTUATED  
EJECTOR PINS RELEASE THE CASTING FROM THE EJECTOR  
HALF OF THE DIE.

SCENE 27.

**tape 462, 06:02:20-06:02:30**  
die halves being lubricated  
before closing

**NARRATION (VO) :**

BEFORE CLOSING, THE DIE HALVES ARE LUBRICATED BY  
EXTERNAL SPRAYS TO ASSIST IN COOLING, CASTING  
RELEASE AND TO MINIMIZE DIE WEAR.

SCENE 28.

**tape 464, 09:08:47-09:08:55**  
zoom in, lubricant applied  
manually  
**tape 462, 06:04:45-06:04:53**  
lubricant applied automatically

**NARRATION (VO) :**

LUBRICANTS, USUALLY WATER-SOLUBLE, CAN BE MANUALLY  
APPLIED...,  
BUT ARE OFTEN SPRAYED AUTOMATICALLY USING CENTRAL  
DIE SPRAY SYSTEMS.

SCENE 29.

**tape 450, 17:10:01-17:10:12**  
lubricant applied automatically,  
blast of air applied afterwards

**NARRATION (VO) :**

THE APPLICATION OF DIE SPRAY IS USUALLY FOLLOWED  
BY AN AIR BLAST TO BLOW OFF RESIDUAL WATER, AND TO  
REMOVE ANY LOOSE METAL LEFT FROM THE PREVIOUS  
SHOT.

--- TOUCH BLACK ---

SCENE 30.

**tape 464, 09:09:45-09:09:51**  
casting removed with tongs  
**tape 445, 12:15:27-12:15:37**  
casting dropped onto a conveyor  
**tape 440, 06:01:43-06:01:54**  
casting removed using automatic  
extractors, then spraying die

**NARRATION (VO) :**

AFTER RELEASE FROM THE DIE, THE CASTING CAN BE  
REMOVED MANUALLY WITH TONGS...,  
OR DROPPED ONTO A CONVEYOR OR DOWN A CHUTE FOR  
TRANSFER FROM THE MACHINE...,  
OR REMOVED USING AUTOMATIC EXTRACTORS. THESE

EXTRACTORS ARE COMMONLY USED AND OFTEN PROVIDE  
AUTOMATIC DIE SPRAY LUBRICATION.

SCENE 31.

**tape 440, 06:08:48-06:09:12**  
robotic arm removing casting,  
spraying die, arm rotating,  
dropping casting into quenching  
tank, arm returning to its  
former position

**NARRATION (VO) :**

IN ONE AUTOMATIC EXTRACTION SYSTEM, A ROBOTIC ARM  
REMOVES A CASTING, AND SPRAYS THE DIE HALVES...,  
THE ARM THEN ROTATES, PRESENTS THE CASTING TO A  
CONVEYOR SYSTEM RUNNING THROUGH A QUENCHING TANK,  
AND RETURNS TO ITS FORMER POSITION FOR THE NEXT  
CASTING.

SCENE 32.

**tape 440, 06:10:51-06:11:06**  
casting conveyed to trimming  
press

**NARRATION (VO) :**

THE CASTING PASSES THROUGH THE QUENCHING TANK AND  
IS CONVEYED TO A TRIMMING PRESS WHERE AN OPERATOR  
TRIMS THE CASTING OF EXCESS METAL.

SCENE 33.

**tape 462, 06:21:02-06:21:09**  
trimmings conveyed to furnace  
**tape 462, 06:21:30-06:21:36**  
trimming falling into furnace

**NARRATION (VO) :**

THESE TRIMMINGS FALL ONTO A CONVEYOR THAT RETURNS  
THEM TO THE MELT FURNACE FOR REMELTING.

--- TOUCH BLACK ---

SCENE 34.

**tape 445, 12:21:02-12:21:32**  
worker at computer screen

**NARRATION (VO) :**

BOTH HOT- AND COLD-CHAMBER DIE CASTING SYSTEMS CAN  
BE FULLY AUTOMATED TO EXECUTE OPERATIONS BY  
PROGRAMMED COMMANDS, WHICH CAN BE STORED IN THE  
SYSTEM COMPUTER AND RECALLED AT ANY TIME.

SCENE 35.

continue previous shot  
**tape 444, 11:19:35-11:19:45**  
computer screen reading out  
material

**NARRATION (VO) :**

MANY PROCESS PARAMETERS, SUCH AS INJECTION SPEED,  
DIE TEMPERATURE AND CLAMPING FORCE, CAN BE  
CONTINUALLY MONITORED DURING THE CASTING CYCLE TO

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ENSURE QUALITY DIE CASTINGS. PROCESS PARAMETERS  
CAN ALSO BE RECORDED FOR QUALITY ASSURANCE, AND  
USED FOR STATISTICAL PROCESS CONTROL.

--- FADE TO BLACK ---