MACHINING

Level - III

Learning Guide 11

Unit of Competence: Test and Dry-Run Tool and Die Components

Module Title: Testing and Dry-Running Tool and Die Components

LG Code: <u>IND MAC3 11 0217</u>

Instruction Sheet	Learning Guide #1

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Set up press and die
- Setup mould and moulding machines
- Operate mould and press machines
- Check conformance of product

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Plastic and rubber raw materials are checked, as required
- Fixed side of mould is clamped to fixed side of machine checking alignment based on machine operations
- Operate Moulding machine
- press tripped for sample product according to machine operations

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 60.
3. Read the information written in the information "Sheet
4. Accomplish the "Self-check test.
5. Do the "LAP test".

Introduction

A die is a specialized tool used in manufacturing industries to cut or shape material mostly using a press. Like molds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology.

A tool is an object used to extend the ability of an individual to modify features of the surrounding environment. Although many animals use simple tools, only human beings, whose use of stone tools dates back hundreds of millennia, have been observed using tools to make other tools. The set of tools required to perform different tasks that are part of the same activity is called gear or equipment.

Manufacturing is the production of products for use or sale, using labor and machines, tools, and chemical or biological processing or formulation. It is the essence of secondary industry. The term may refer to a range of human activity, from handicraft to high-tech, but is most commonly applied to industrial design, in which raw materials from primary industry are transformed into finished goods on a large scale. Such goods may be sold to other manufacturers for the production of other more complex products (such as aircraft, household appliances, furniture, sports equipment or automobiles), or distributed via the tertiary industry to end users and consumers (usually through wholesalers, who in turn sell to retailers, who then sell them to individual customers).

A forming press, commonly shortened to press, is a machine tool that changes the shape of a workpiece by the application of pressure. The operator of a forming press is known as a press-tool setter, often shortened to tool setter.

Molding or moulding (see spelling differences) is the process of manufacturing by shaping liquid or pliable raw material using a rigid frame called a mold or matrix. This itself may have been made using a pattern or model of the final object.

A mold or mould is a hollowed-out block that is filled with a liquid or pliable material such as plastic, glass, metal, or ceramic raw material. The liquid hardens or sets inside the mold, adopting its shape. A mold is the counterpart to a cast. The very common bi-valve molding process uses two molds, one for each half of the object. Articulated molds have multiple pieces that come together to form the complete mold, and then disassemble to release the finished casting; they are expensive, but necessary when the casting shape has complex overhangs. better source needed] Piece-molding uses a number of different molds, each creating a section of a complicated object.

What Is Die Setting?

The stamping press uses a die assembly, or die, to form or shape metal. The die, shown in Figure 1, is a production tool used to create workpieces consistently within required specifications. For each new workpiece, a new die must be installed on the press. Successful press operation depends on whether or not the die has been installed properly. Proper die installation is crucial to keep the press operator and die setter safe as well as prevent damage to the stamping press.

Figure 1. The die shapes and forms metal.

As the new die is being installed, the die setter or press operator must remember that productivity is at a standstill during this time. As a result, the phrase "last good part to first good part" should be your top priority. In other words, after the last good part is produced with the previous die assembly, the first good part with the new die can begin only after properly installing the new die. Figure 2 shows a part from the previous die and a part from the new die. Die setting must be efficient and precise. In this class, you will learn how to remove the previous die and install a new die properly to keep production moving at an acceptable pace.

Figure 2. The die setter must remember the phrase "last good part to first good part."

Understanding Press Specifications

Before you begin die setup, you must understand the basic controls and specifications of the press, as well as observe all lockout procedures. If your press is under lockout, do not operate it, and contact your supervisor. Locate the press specification plate attached to the side of your press, as shown in Figure 1. The press specification plate serves as a guide during the die installation process. The specification plate tells you the following:

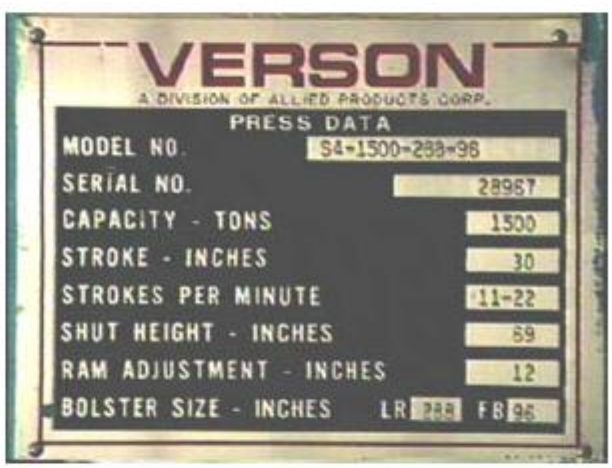


Figure 1. The press specification plate identifies important information for die changing.

- ✓ Model number identifies the type or style of press you are using.
- ✓ Serial number identifies the specific press you are using.
- ✓ Capacity in tons is the maximum force that the press should apply.
- ✓ Strokes per minute is the amount of times the press strokes down to create a workpiece.
- ✓ Shut height (Figure 2) is the distance, in inches, from the slide face to the bolster, with the slide at bottom dead center (BDC).
- ✓ Ram adjustment displays the number of inches the ram can be adjusted. This value is relevant to the height of the die. The die setter adjusts the ram with the pitman

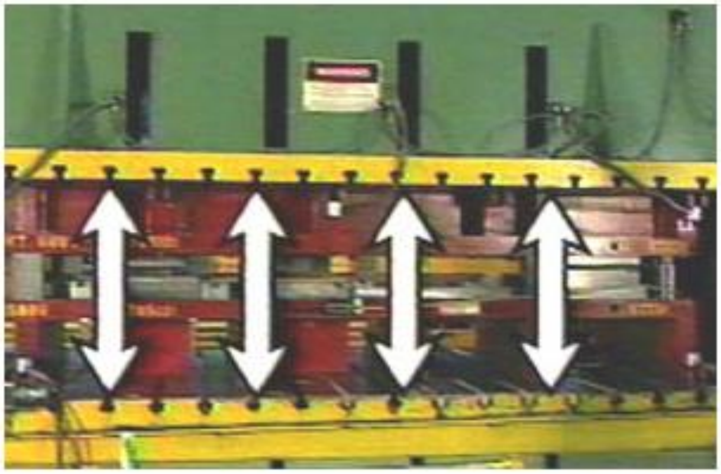


Figure 2. Shut height is the distance from the slide face to the bolster with the slide at BDC.

Preparing to Remove the Die Assembly

Before you remove the current die assembly, you must prepare yourself and your work area. Follow these steps to remove the previous die assembly:

- ✓ Locate the die setup instructions, The setup instructions contain all of the information that you need to ensure that the die is ready for setup.
- ✓ Check that all necessary equipment is properly positioned and readily available. Some shops have a cart, like the one which conveniently holds all of the necessary equipment.
- ✓ Remove or disconnect any previous tooling, coil stock, gauges, samples, and any other materials from the previous setup that are not needed for the next setup.

- ✓ Remove auxiliary equipment, such as the part or scrap conveyor bins. Also, remove or disconnect air or automatic lubrication lines.
- ✓ Remove and properly store the safety block, which is in place beneath the slide. Be sure to replace the safety block in its holder. Reconnect the safety plug, if there is one.
- ✓ Remember to save a sample of the strip along with samples of the parts from the previous press operation. These samples remain with the die in the tool room.

Loosening the Die Assembly

To loosen the die assembly, the slide must be at BDC. Once the slide is at BDC, turn the main motor off, and wait for the flywheel to stop rotating. Next, move the adjustment rod, located above the ram, to the top of its range. Then, loosen the adjustment rod lock bolt, and move the adjustment rod all the way up, and tighten the lock bolt.

If your press has a striker mechanism, like the one in Figure 1, move the arm up and out of the way. To do this, loosen the locknut on the bracket, as you can see in Figure 2. This holds the striker rod or arm. Move the rod or arm all the way up in the bracket. Then, tighten the locking mechanism. Next, you must find the air line valve for the air cushion if the press has one. Release the pressure by moving the valve to "off." Also, be sure to release the air from the auxiliary air tank.

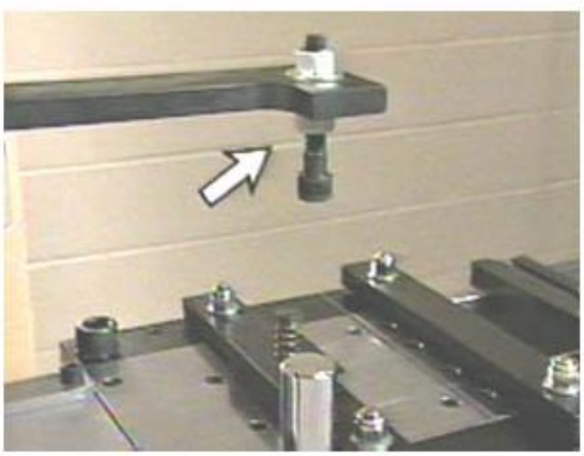


Figure 1. A striker mechanism.

Figure 2. To move the arm of the striker out of the way, loosen the locknuts.

Next, loosen the clamps located around the upper and lower die shoes to detach the die assembly. Some clamp components include t-bolts, fulcrums, and bridges. T-bolts and hold-down bolts are used to hold down the punch shoe. Die clamps and t-bolts are held in t-slots in the ram face. Hold-down bolts are screwed directly into the die and through the ram face.

Next, loosen the punch shoe by inching it no higher than the guide pins, and keep your hands clear. This is necessary because you cannot remove die clamps from the bottom half of the die until the punch shoe is loose. If the press has a shank, you must loosen the shank locknuts with a long wrench or extension. These tighten the clamp that holds the shank up against the press. Then, lift out air cushion pressure pins, clean them off, and re-insert them. Finally, after all unclamping, follow shop procedures to have the die removed from the bolster.

Preparing for a New Die Installation

Before you can begin your next die installation, you must prepare the work area and the press. First, ensure that the last die setup was removed. As always, obtain the setup instructions for the next die installation. Make sure that the necessary equipment, die, and material to be run is ready, and ensure that there is clear access to the die area, as Figure 1 shows. The safety block should be installed, but it must not impede the installation of the die assembly you are about to set up. Check to see that the motor is off and the flywheel has stopped.

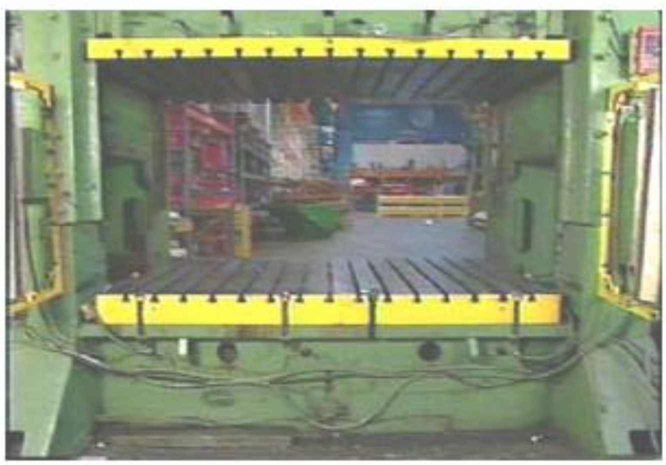


Figure 1. Clear access into the die area is important for installing the new die.

Next, make sure that the bolster is wiped down with a clean shop rag. This is to ensure that no burrs are present on the bolster. Burrs under the die shoe can tilt the shoe and cause the punch to hit unevenly. You can check to ensure that burrs are not on the bolster by gently rubbing your hand over the clean surface on the bolster plate and slide. However, you must be very careful if you rub your bare hand on the bolster. If burrs are present, they can cut your hand.

Figure 2. Wiping down the bolster prevents burrs from interfering with the die setup.

Installing Pressure Pins

The use of an air cushion allows the press to exert even more force on the part. If your die installation requires the use of an air cushion, you must properly install pressure pins according to the specifications given. As Figure 1 shows, the setup instructions identify the number and size of pressure pins, as well as where the pressure pins are to be located for a specific operation. This information may also be present on the die shoe. Occasionally, the location for pressure pins is identified by paint marks.

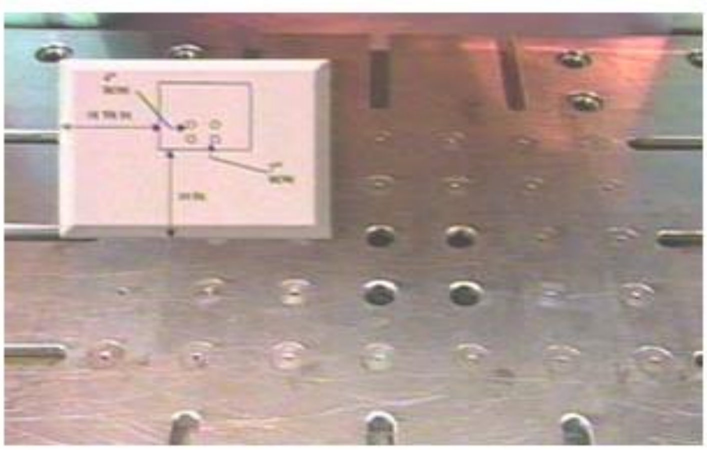


Figure 1. The setup instructions specify the location of pressure pins.

Once you obtain the correctly sized pressure pins, make sure that all of the pressure pin holes are free of slugs or scraps. If the air cushion was not used for the previous setup, there will be plugs in the bolster. You can remove these plugs by using a small magnet, as shown in Figure 2. Once the pressure pin holes have been cleared out, slip the pressure pins into the pressure pin holes. Always be sure that the pressure pins are installed in a symmetrical, balanced pattern. Whether the press operation requires an air cushion or not, all unused pressure pin holes must be plugged to prevent entry of scrap or slugs. To ensure that

the die shoe does not detach, seat the plugs flush with the bolster, as shown in Figure 3. Lastly, before you continue with die setup, be sure that the air pressure from the air cushion has been released.

Figure 2. A small magnet easily clears out the pressure pin holes.

Figure 3. Seating the pressure pins flush with the bolster ensures that the die shoe does not detach.

Selecting Die Installation Bolts

The die must be bolted down for proper installation. A set of hold-down bolts or t-bolts and clamps must be used to hold down the punch shoe to the ram. This must be done whether the punch shoe has a shank or not. Some die shoes can be bolted directly to the bolster plate through the bolt notches on the shoe. However, most dies require bolts. As a result, you must choose

the proper t-bolts and hold-down bolts. Remember, never use a machine bolt in a t-slot. Always use a full-sized nut with t-bolts, as shown in Figure 1. When selecting a bolt, keep in mind that a bolt that is too short will pull loose and strip out the threads. The bolt must enter the hole or nut with a distance equal to 1½ times the bolt diameter. Hold-down bolts that are too long will bottom out in the tapped hole. Bolts that are too long will also require an excessive number of washers. If your hold-down bolt requires more than two washers, select a shorter bolt. Figure 2 shows an example of a properly sized bolt that only requires one washer.

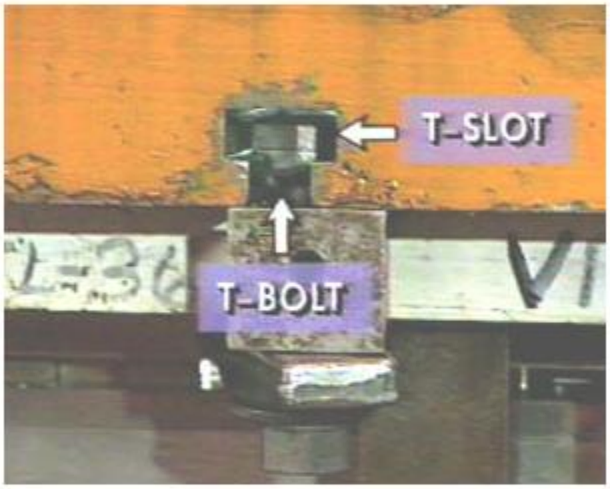


Figure 1. Only t-bolts should enter into t-slots.

Figure 2. Use a bolt that does not require more than two washers.

Also, make sure that the washers under the bolt head or nut are not bent or damaged. These components must have the correct inner diameter (ID), outer diameter (OD), and thickness, as Figure 3 illustrates. The washer ID should have very little clearance when fitted over the bolt, while the washer OD should properly support the nut. The washer must also be thick enough so that it can support the nut and does not bend when it is tightened.

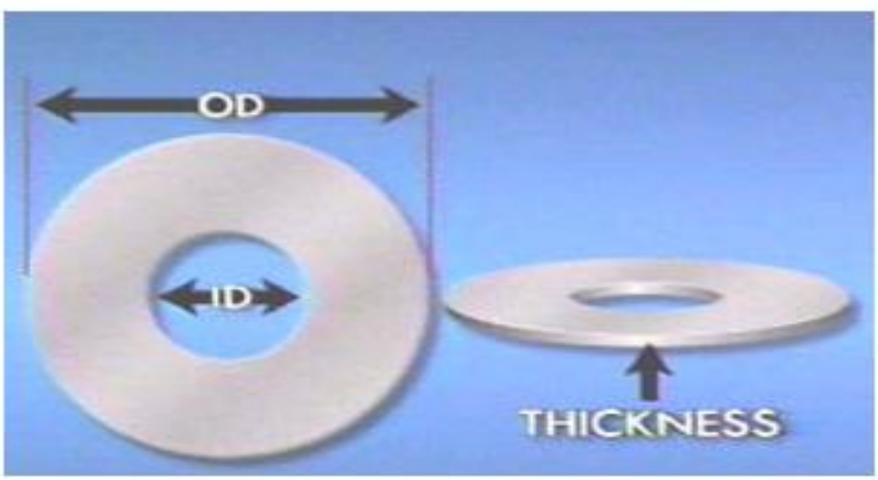


Figure 3. Washers, nuts, and bolts must all have corresponding dimensions.

Selecting the Proper Clamps

Die shoes may require two, four, or even more clamps. You will also need a nut and some washers. A clamp consists of a t-bolt, bridge, and fulcrum block, as shown in Figure 1. The bridge rests one of its sides on the die shoe. The other side of the bridge rests on a fulcrum block. The bridge must be precisely aligned with the slot in the bolster. The bridge that you select must be strong enough to support clamping pressure. Bridges that are too long or too thin will bend. Figure 2 shows a die setter selecting a bridge.

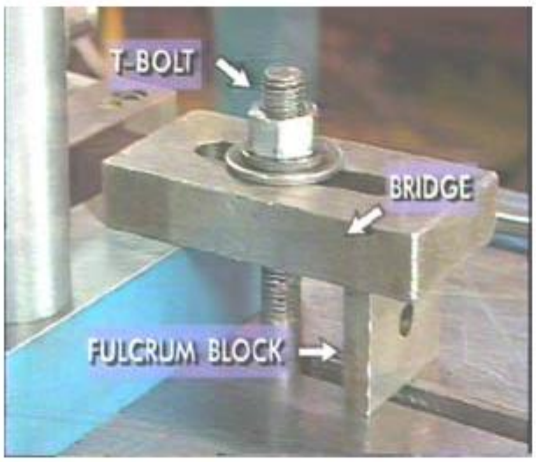


Figure 1. A complete clamp.

Figure 2. The right bridge supports clamping pressure.

The fulcrum block usually consists of two or more interlocking triangles, but some fulcrum blocks are one piece. Fulcrum blocks are specially machined to be square and have two parallel sides. Never select odd scraps of metal to substitute for the fulcrum block. Use a fulcrum block equal to the die height, as shown in Figure 3. Place the fulcrum block next to the die shoe, and adjust the height accordingly. Installing the wrong block height will tilt the bridge and cause the shoe to slip. Be sure to clamp the fulcrum block over the die shoe. The bridge must extend well over the die shoe and fulcrum block, as shown in Figure 3. Clamping on the edge of the shoe and fulcrum block causes the clamp to slip eventually. Position the t-bolt closer to the shoe than to the fulcrum block. Remember, you are clamping down on the shoe, not the fulcrum block.

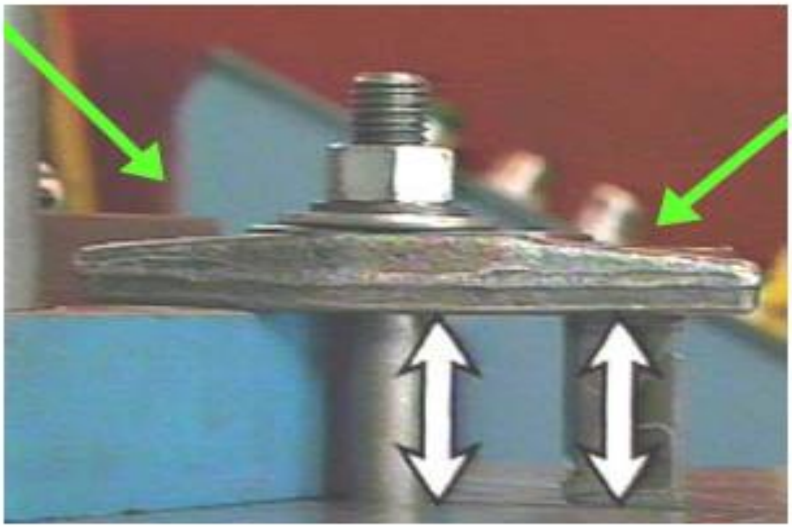


Figure 3. The fulcrum block must be the same size as the die shoe. The bridge must also extend well over the die shoe and the fulcrum block.

Installing the New Die

Installing a new die involves a few quick steps. First, the new die must be delivered to the press area using a fork truck or die cart, depending on your shop procedure. Figure 1 shows a new die delivery using a cart. Before installation, clean off the top of the punch shoe or parallels using the appropriate tool. As you do this, be very careful and stand clear of the press. Next, slide the die from the fork truck or die cart to the approximate center of the bolster plate. Usually, the die assembly is installed with the guide pins to the back side of the press. If your facility uses a die change system using die lifters, be sure the die lifters are all the way up, as shown in Figure 2, before the die is slid into place. If quick die change positioning locators are used, simply slide the die into position. Check with your supervisor for your company's policy.

Figure 1. Some shops use carts to deliver the new die.

Figure 2. Die lifters should be all the way up so that the new die fits easily into place.

If the punch shoe has a shank, use a ruler to measure the diameter of the slide hole and punch shank. If the shank is smaller than the slide hole, select a collar from the tool cart. The OD of the collar must fit the slide hole, and the ID must fit the shank. As shown in Figure 3, measure to be sure that the collar OD and ID are appropriate. The collar also has a slot, which must be parallel to the front of the die assembly. You may need to tap the collar onto the shank slot opening while facing the side of the press. This will help the collar to properly compress and firmly grip the shank.

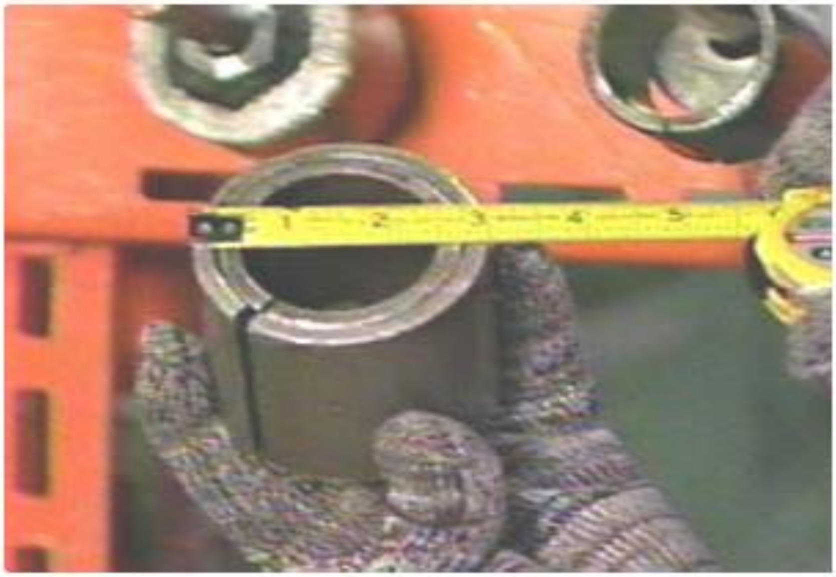


Figure 3. Measure the collar to be sure that the OD and ID are appropriate.

Centering the New Die

The new die that you install must be centered, especially for coil-fed and automatic feeding operations. If the die assembly is not centered either from front-to-back or left-to-right, the slide will push down with uneven pressure. This can cause a serious accident and damage the press.

The pressure pins and a shank, if present, may help to position the die shoe in the center of the bolster. The holes in the die shoe must be located over the pressure pins. If your setup does not call for pressure pins or does not have a shank, slide the die assembly to the approximate center of the bolster.

Use your ruler to decide if the die assembly is properly located on the bolster. Take the measurement from each side of the die shoe to the respective edge of the bolster, as shown in Figure 1. Both of these measurements must be the same. If necessary, reposition the die assembly until the measurements are the same. Perform this same measurement from the front and the back, as shown in Figure 2. Once the die is in its proper position, the die lifter is lowered. Keep in mind that shop procedures vary for centering the die, so check with your supervisor.

Figure 1. Measure the die from the side of the die shoe to the edge of the bolster.

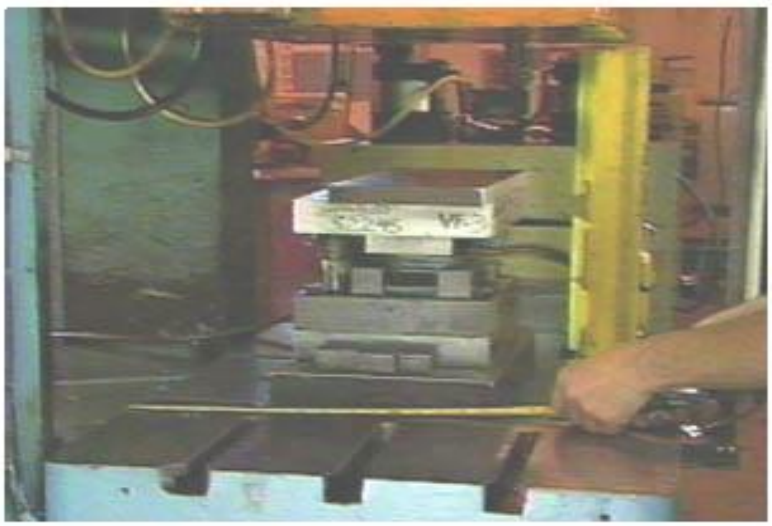


Figure 2. Take a measurement from the front to the back of the bolster.

Shut Height Adjustment

Now that the die is centered, you must rough adjust the shut height of the press to the height of the die assembly. Your facility may use standardized tooling so that the shut height of the die does not vary greatly. However, the press shut height must always be adjusted to some degree, because it must be higher than the height of any die installed in the press.

Before rough adjusting the shut height, you must be familiar with the way your press adjusts shut height. The press may use an electric slide adjust button, or you may need to manually adjust shut height on the pitman, or your machine might have a gear-driven slide adjuster. If your press uses an electric slide adjust button like the control shown in Figure 1, you simply need to unlock the button by turning the key to "on." Then, press the up or down buttons as needed to change shut height.

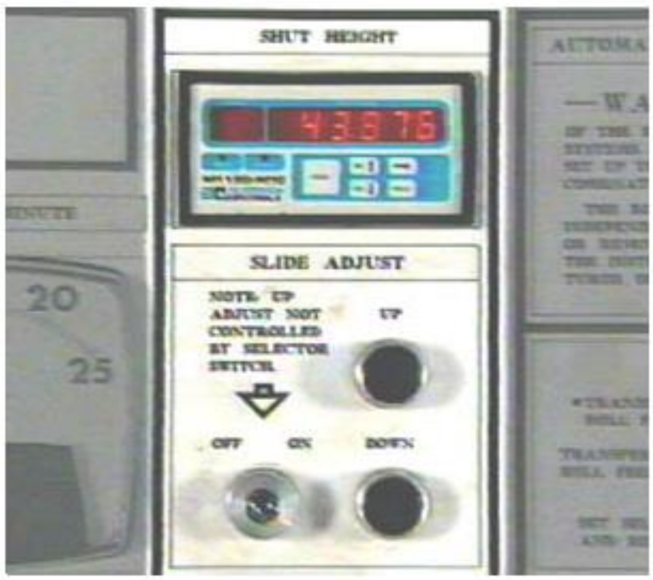


Figure 1. Press the slide adjust buttons to electrically adjust shut height.

To adjust shut height manually, loosen the slide locknuts, and use the slide adjusting screw, shown in Figure 2, to adjust the shut height. To adjust shut height with a gear-driven slide adjuster, turn the adjusting screw clockwise to lower the shut height and counterclockwise to raise it, as Figure 3 shows. Also, your machine may have a shut height adjustment readout, shown in Figure 4, which expresses how much shut height was adjusted during setup in inches or millimeters. Keep in mind that you should only use this readout as a reference because it may be inaccurate.

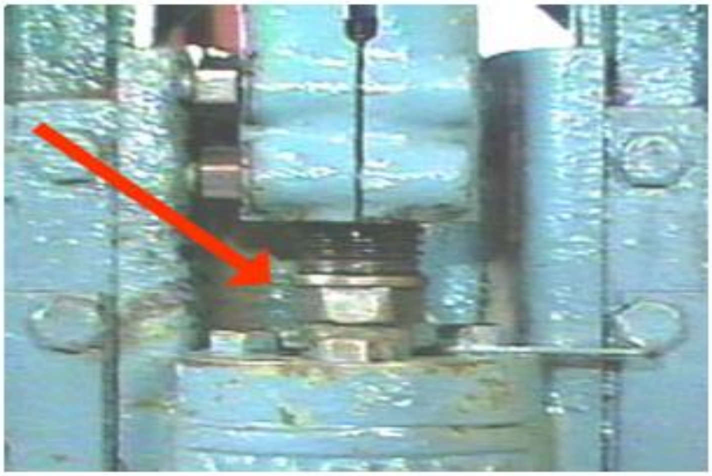


Figure 2. Turn the slide adjusting screw to manually adjust shut height.

Figure 3. Turn the adjusting screw either clockwise or counterclockwise when using a gear-driven slide adjuster.

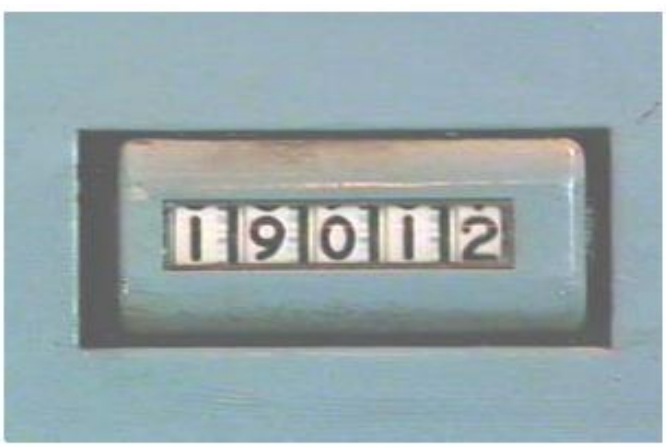


Figure 4. A shut height adjustment readout indicates how much the shut height has been adjusted.

Adjusting Shut Height Without a Shank

To begin rough adjusting shut height, you must always begin at TDC. This may require you to remove the safety block and place it back into its socket. You want to rough adjust the shut height of the press so that the distance between the bottom face of the slide and the top of the punch shoe is at least the stroke length plus 1/4 inch. Determine press stroke length by checking the press specification plate, as shown in Figure 1. You can see an example of shut height that is properly adjusted in Figure 2. This additional clearance prevents the press from bottoming out. To rough adjust the shut height on the press, find the stroke length of the press from the specification plate on your machine. Next, with the slide at TDC, use a ruler to measure the distance between the face of the slide and the top of the punch shoe. Compare this value with the stroke of the press and at least 1/4 inch. For example, if the stroke length is 30 in., and the desired clearance is 1/4 in., then the shut height must be 30 1/4 inch.

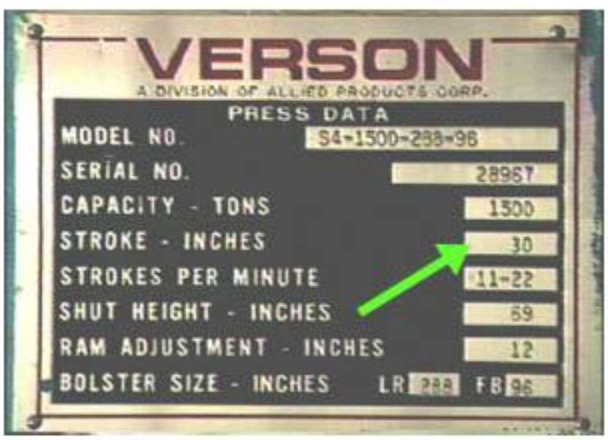


Figure 1. You can determine press stroke length by checking the press specification plate.

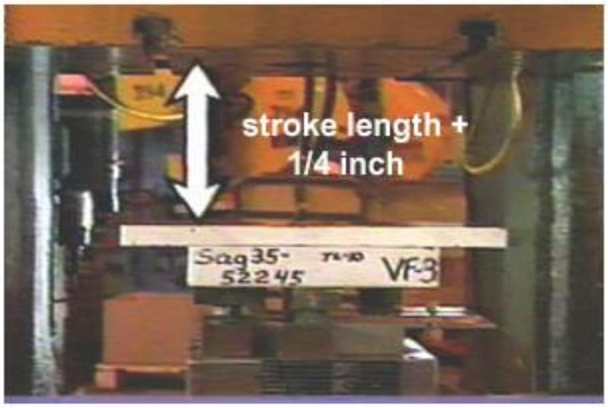


Figure 2. Proper shut height should be at least the stroke length plus 1/4 inch.

Based on the desired shut height, you must determine whether the current shut height must be raised or lowered. If you adjust the shut height with an electronic height adjuster, turn the key to "off" after adjusting. If you manually adjusted the shut height, lightly tighten the slide locknuts after adjusting. At this time, you can put the t-bolts for the punch in place if the punch shoe has holes for hold-down bolts rather than slots. This is because at this time, there is a small gap between the ram and the upper die shoe, so it is easier to line up the t-nut that is in the t-slot in the face of the ram and the bolt. If you are working on a press with a part-revolution clutch, turn on the main motor and inch down to BDC. If you are using a full-revolution clutch, lower or bar the press down to BDC according to shop procedures.

Rough Adjusting Shut Height With a Shank

If you need to rough adjust a press that has a shank, lower the slide to BDC and watch the shank and die face to be sure that the shank is aligned with a hole in the face of the slide. If you had to position the t-bolts and the slide earlier due to the configuration of your punch shoe, be sure that they are aligned with the holes in the punch shoe as you lower the slide. Once the slide is at BDC, press the main motor stop button and dissipate hazardous energy that could cause the press to cycle accidentally. Turn on the air pressure if you are using pressure pins. The pressure pins will push up into the die assembly, as shown in Figure 1. This assures that the die assembly is correctly located over the pressure pins.

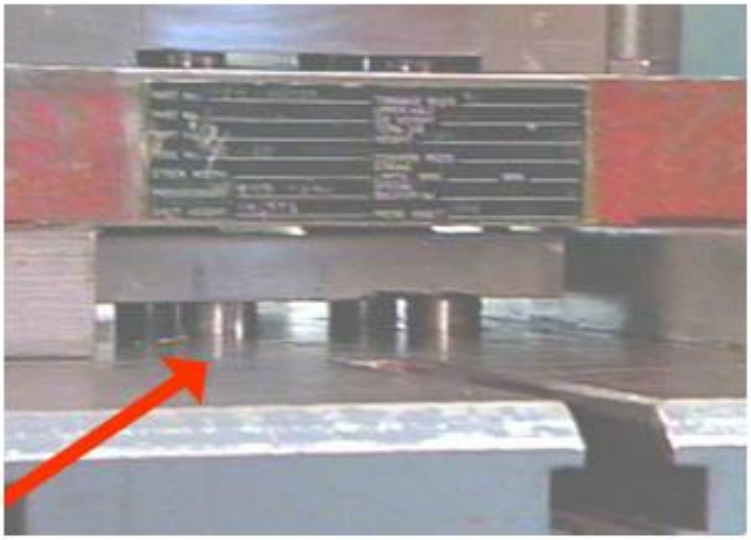


Figure 1. Pressure pins push up on the die assembly.

Now, the face of the slide should be about 1/4 in. from the punch shoe. Adjust the shut height down until the face of the slide just touches the top of the punch shoe. Check to be sure that the slide face contacts the punch shoe on all four sides. Lock in the slide height that you have set depending on the type of shut height adjustment on the press. Tighten the shank locknuts, which are shown in Figure 2. If you are working with a coil-fed press, re-check the position of the die to be sure that it is properly aligned with the coil feeding line.

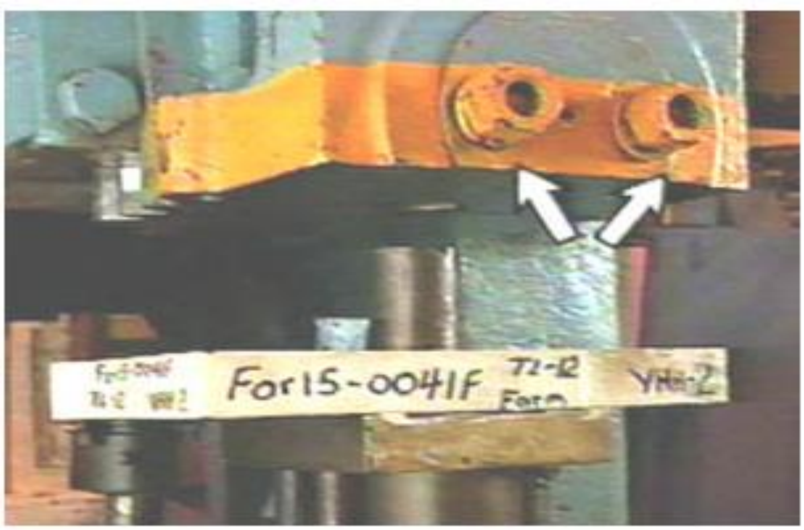


Figure 2. Tighten the shank locknuts to lock in the slide height.

Installing the Clamping Devices for the Die Assembly

When installing the upper clamps, clamp the upper half of the die assembly, or the punch shoe, to the face of the slide, as Figure 1 shows. Remember to select just enough washers to bring the end of each nut even with the end of the bolt. Use no more than two washers. The clamps should be positioned to hold all four sides of the die securely. Install the washers and nuts with the t-bolts or hold-down bolts and nuts and finger tighten the nuts. When all the nuts and washers are in place, use a wrench to gradually tighten the nuts, as Figure 2 shows. Alternate tightening between nuts at opposite corners. Continue to tighten until the punch shoe is drawn tight to the face of the slide.

Figure 1. First, clamp the upper clamps to the face of the slide.

Figure 2. Alternate between tightening nuts on either side of the slide face.

Next, bolt or clamp the lower die securely to the bolster. Install fulcrums, t-bolts, and bridges to the die shoe and use a wrench to tighten them. Alternate between nuts and opposite corners of the die shoe. Tighten the nuts firmly.

Completing Clamping Device Installation

Now that you have tightened all of the components for the die assembly, you can remove all die setup accessories from the die area, such as unused nuts, bolts, clamps, blocks, and tools. You must be sure that there is clearance between the punch and die components when the slide is at BDC. As shown in Figure 1, place a wire or a feeler gauge between the punch and die components to be sure that the clearance is sufficient.

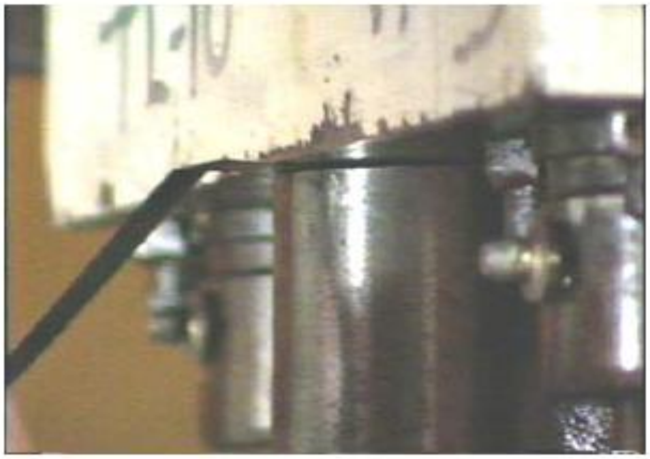


Figure 1. A feeler gauge determines if there is enough clearance between punch and die components.

If it is necessary, readjust the shut height until the gap between the stop block and punch shoe is sufficient. Check to see that the slide locknuts are tightened. Be sure that the slide adjust button is turned to "off" and the key has been removed. Inch the press to TDC, and finally, as shown in Figure 2, lubricate the guide pins according to your shop practices before you operate the press.

Figure 2. Before operating the press, you must lubricate the guide pins.

The Knockout Bar

Some presses use a knockout bar, like the one in Figure 1. The knockout bar is used on the press to cause spring-loaded pins or the shedder plates in the punch shoe to operate at the correct time in the stroke. The spring-loaded pins or shedder plates will also remove any workpiece that sticks to the punch. As you removed the previous die assembly, you were required to adjust the knockout bar to the upper limit of its adjustment. After installing the new die assembly, it must be readjusted.

Figure 1. After installing a new die, you must readjust the knockout bar.

To readjust the knockout bar, raise the slide to TDC, and loosen the lock bolts, as shown in Figure 2. Push the adjustment rod down until the knockout bar is pushed partway down in the slot. Spring-loaded pins or shedder plates in the punch shoe should protrude slightly out of the punch assembly (1/16 in.–1/4 in.), as long as they do not damage the position of the adjustment rod. Lastly, tighten the adjustment rod lock bolt.

Figure 2. Loosen the lock bolts to readjust the knockout bar.

Setting the Counterbalance Air Pressure

Counterbalance air pressure is used to offset the weight of the slide and upper die assembly. It prevents excess bearing wear and aids the motor in bringing the slide back to the top of its stroke after stamping a part. On part-revolution clutch presses, correct counterbalance air pressure adjustment may also help the press to stop faster.

If your press is equipped with counterbalance air pressure, you must adjust it before running your first workpiece. The counterbalance air pressure must be adjusted to be slightly greater than the combined weight of the top half of the die assembly, slide, and pitman. Consequently, you must first determine the upper die weight. You should find this information marked or stamped on either the upper die shoe or lower die shoe. The press should have a weight-to-air

pressure plate, like the one in Figure 1, riveted to the side or back of the press. This plate lists the air pressure required to balance the press by matching air pressure to the weight of the top half of the die assembly. This provides air pressure settings for various upper die weights. Once you find this information, to set the counterbalance air pressure:

- Match the weight of the upper die with the weights listed on the counterbalance chart to determine the proper air pressure setting.
- Locate the air regulator for controlling counterbalancing air pressure.
- Adjust the regulator valve, as Figure 2Figure shows, so the gauge matches the recommended pressure for the weight of the upper die being used.
- Lock the valve, or tighten the locknut.

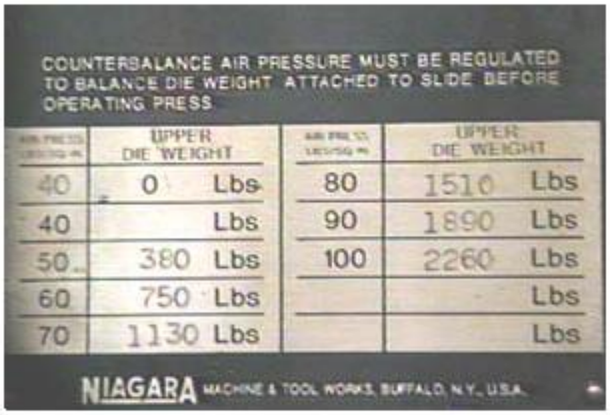


Figure 1. The weight-to-air pressure plate provides necessary information for setting the counterbalance air pressure.

Figure 2. Adjust the regulator valve to the appropriate pressure.

Keep in mind that, while you are setting the counterbalance air pressure, the safety devices have not yet been activated. Always stay clear of the point of operation.

Testing the New Die

After setting the counterbalance air pressure, you must inch, bar, or jog the press through a stroke with nothing in the dies, as Figure 1 shows. As you lower the slide, watch closely as you approach BDC. Check for the correct shut height, and look for loose bolts and clearance as the punch nears stroke-down position. Also, watch and listen for any signs of looseness or slippage in the die shoe and punch shoe. Do not assume that shut height is properly adjusted because tightening the clamps may have changed the clearance. If necessary, make any shut height adjustments.

Figure 1. Inch the press through a stroke with nothing in the dies.

Check the job ticket for the new die to find its required speed. Adjust the speed for the press. Using the inch controls, cycle the press a few times to ensure correct operation. If your press has a part-revolution clutch, check the clutch or brake psi settings and regulator gauge settings, which are shown in Figure 2, against the requirements outlined in your die setup instructions.

Figure 2. Be sure that the clutch or brake psi settings are correct.

Finally, you are ready to begin producing parts with the new die. Completing a die change is quite an accomplishment. Die setting is a challenging task that requires skilled personnel.

Die components

The main components for die In a hole toolsets are:

- Die block – This is the main part that all the other parts are attached to.
- Punch plate – This part holds and supports the different punches in place.
- Blank punch – This part along with the blank die produces the blanked part.
- Pierce punch – This part along with the pierce die removes parts from the blanked finished part.
- Stripper plate – This is used to hold the material down on the blank/pierce die and strip the material off the punches.
- Pilot – This will help to place the sheet accurately for the next stage of operation.
- Guide, back gauge, or finger stop – These parts are all used to make sure that the material being worked on always goes in the same position, within the die, as the last one.
- Setting (stop) block – This part is used to control the depth that the punch goes into the die.
- Blanking dies in a hole – See blanking punch
- Pierce die in a hole– See pierce punch.
- Shank – used to hold in the presses. it should be aligned and situated at the center of gravity of the plate.

Die Setups for Bending

Up to this point, the components you have studied most closely resemble a die for punching and blanking operations. Punch and die setups for the following bending operations will differ in appearance:

- Air bending dies do not use the bottom of the die to shape the sheet metal. As shown in Figure 1, the depth of the punch travel determines the angle in the bend. These simple dies are very common for low-production operations.

- V-bending dies contain a matching V-shaped punch and die, as shown in Figure 2. Both components shape the metal. These dies are most often used for low-production operations on the press brake.
- Edge bending dies use a punch to bend the sheet over a wiping die, as shown in Figure 3. A pressure pad also holds down the sheet during operation. These dies are more expensive and are best suited for high-production operations.

No shearing happens during bending operations. Even though the setup differs from punching and blanking dies, the punch and die still work together to shape and form the sheet metal.

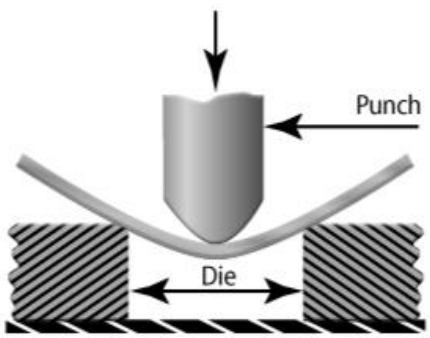


Figure 1. Air bending does not rely on the die bottom.

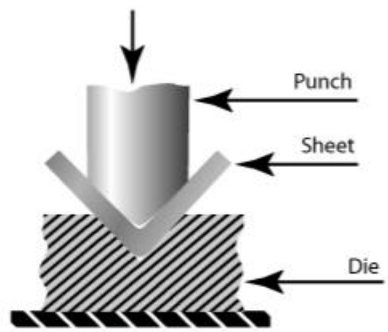


Figure 2. V-bending requires a matching punch and die.

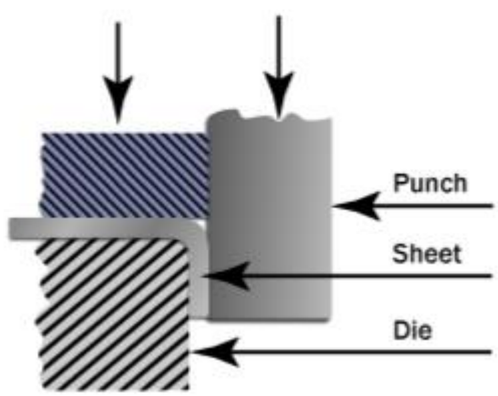


Figure 3. Edge bending uses a punch to bend the sheet over a die.

Die Setups for Drawing

Die setups for drawing operations also have their own particular arrangement of the components. At first glance, a drawing die may closely resemble a die for punching. However, drawing operations require sufficient space between the punch and the die opening to allow for the movement of the sheet metal.

As you can see in Figure 1, the punch gradually forces the metal into the die cavity. The metal bends over the die opening and flows into the die. During operation, a blank holder holds down the metal around the edge as it is drawn into the die cavity.

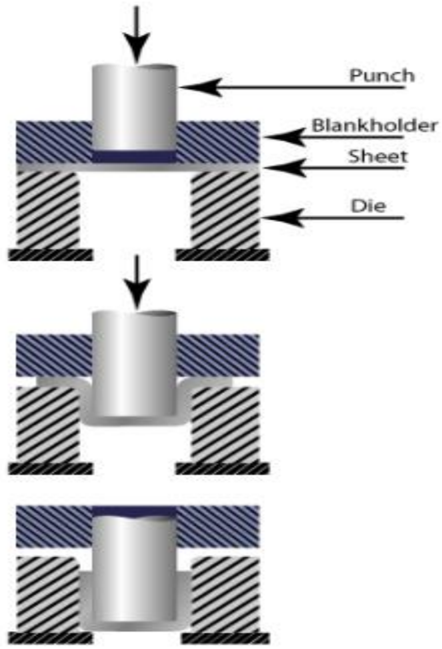


Figure 1. Drawing requires a gradually descending punch and a blankholder.

Drawing operations generate a substantial amount of friction. The amount of force exerted by the blank holder must be carefully determined. If the blank holder supplies too little holding force, the outer edge will wrinkle. If too much force is applied, the metal will stretch irregularly and possibly tear.

Molding processes

Molding is a manufacturing process that involves shaping a liquid or malleable raw material by using a fixed frame; known as either a mold or a matrix. The mold is generally a hollow cavity receptacle, commonly made of metal, where liquid plastic, metal, ceramic, or glass material is poured. In most cases, the mold is derived from the initial pattern or template of the final object; its main objective is to reproduce multiple uniform copies of the final product. As the liquid cools and hardens inside the mold, the final configuration is achieved. Its removal is facilitated by the use of a release agent or ejection pins.

We are surrounded by both ordinary and complex objects that were manufactured as a result of the molding manufacturing process. Molding has occurred throughout the millennia. Evidence of its usage has been discovered dating as far back as the Bronze Age, where stones were used as molds to produce spear tips.

Modern molding processes include plastic injection molding, Liquid Silicone Rubber (LSR) molding, over molding, and insert molding. Customized prototypes and end-use parts are produced with the plastic injection molding process. The standard process eliminates the use of embedded heating or cooling lines within the molds so that molders, also known as molding technicians, can carefully monitor fill pressure, aesthetics, and overall part quality.

Liquid Silicone Rubber (LSR) molding is a highly flexible material that is considered a thermosetting polymer, meaning its molded state is permanent and it can’t be remelted like a thermoplastic could. A specific LSR molding tool is designed with CNC machining, thus providing different surface finish options for the end-use LSR part.

Over molding allows a single part to contain multiple materials. Once a substrate part’s total run is molded, over mold tooling is setup on the press. It is then hand-placed into the mold and over molded with either a thermoplastic or liquid silicone rubber material. Insert molding is similar to over molding, but most commonly uses a preformed metal substrate part that over molds it with plastic to create the final part.

Injection molding

As its name implies, injection molding is the manufacturing process of injecting material into a mold to produce a part. While the most common materials used for injection molding are metals, thermoplastic polymers and thermosetting polymers, other possible materials include glass, elastomers, and confections. Die-casting specifically refers to the injection molding of metals.

The first injection molding machine was patented in 1872 by the American inventor brothers John Wesley and Isaiah Hyatt, who eventually used it to produce collar stays, buttons, and hair combs. A German inventor patented the injection molding of plasticized cellulose acetate, a much less flammable material than cellulose nitrate, in 1939. World War II was responsible for the industry's rapid expansion as demand exploded for affordable, mass-produced products. The industry went on to witness the invention of the first screw injection machine in 1946, which, today, accounts for the vast majority of all machines.

Later in the 1970's, the first gas-assisted injection molding process was developed, making it possible to produce complex, hollow objects that cooled quickly. This greatly improved design flexibility as well as the strength and finish of manufactured parts. It also reduced production time, cost, weight, and waste. Today, the plastic injection molding industry produces a broad range of products across numerous sectors, which include the aerospace, automotive, construction, consumer goods, packaging, plumbing, and toy industries.

Although injection molding is a versatile process, it is critical that careful attention is given to a mold's design and material, the material used, the part's desired shape and features, and the specifications of the molding machine. Molds are generally made from steel or aluminum and are precision-machined to form their specific features. A liquid material is fed into a heated barrel, mixed, and fed into the mold's cavity, eventually cooling and hardening to the mold's configuration.

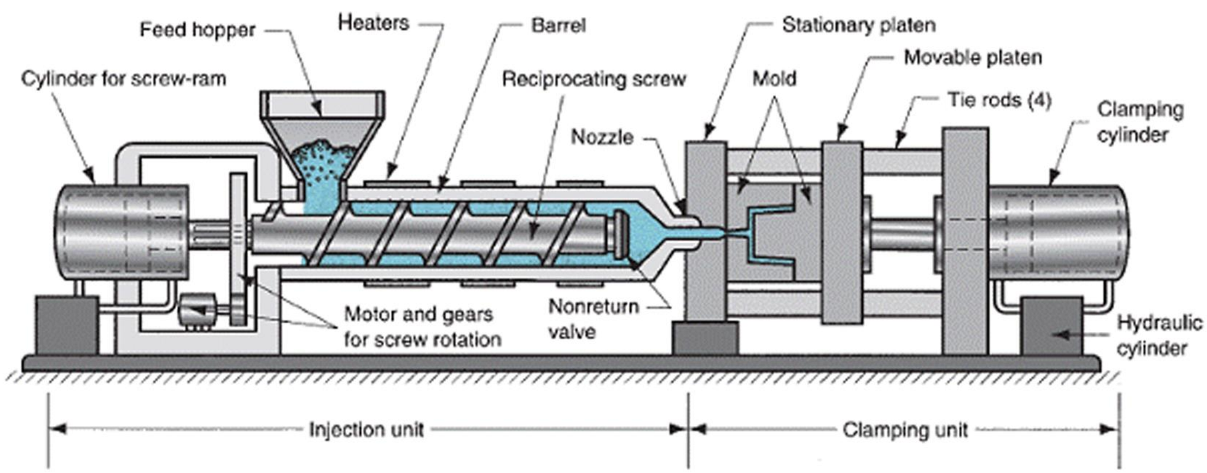
Optimal for high-volume production, a diverse variety of parts from small components like bottle caps, packaging, musical instruments to toy cars, all the way up to entire body panels of cars, mechanical parts and gears, and most plastic parts on the shelves today, are produced thanks to injection molding.

Thanks to advances in 3D printing technology, photopolymers can be used for manufacturing some simple injection molds considering that they don't melt during the injection molding of low-temperature thermoplastics.

The equipment used in injection molding includes injection molding machines, molds or dies, and injection and ejector molds. Due to their high cost, custom molds are handled and stored very carefully with special attention being given to environmental temperature and humidity levels in an effort to prevent warping.

The two main methods for constructing molds are: standard machining (CNC) and Electrical Discharge Machining (EDM). Standard machining has historically been the more conventional method and developments in CNC (Computer Numerical Control) have allowed the fabrication of more complex molds with greater speed. EDM, also known as spark erosion, has also been widely adopted in mold making. Tool steel is the most common material used in mold making. Well-designed molds built of modern hard aluminum (7075 and 2024 alloys) are easily capable of

100,000, or greater, part life with proper mold maintenance. Mild steel, aluminum, nickel or epoxy are only suitable for prototype or very short production runs.



Roto molding

Roto molding, also called rotational molding, entails filling a charge, or shot weight, of material into a heated hollow mold, which is followed by slowly rotating the mold, causing the softened material to disperse and adhere to the mold's walls. The mold continues to rotate at all times during the heating phase to achieve and maintain an even thickness throughout the part. This rotation also prevents sagging, or deformation, during the cooling phase.

The distinct advantage of roto molding is that it is an easier process than any other when it comes to producing large, hollow parts, such as oil tanks or chairs. In addition, the molds used in roto molding are significantly less expensive than other types of molds. Very little material is wasted with roto molding; excess material can often be reused, making it both economic and ecological.

Another advantage lies in the molds themselves; they necessitate less tooling, which means they can be manufactured and put into production much faster than other molding processes. This is especially valuable for complex parts. Rotational molding is also the process of choice for short runs and rush deliveries. The molds can be exchanged quickly, or different colors can be used without purging the mold. With other processes, purging may be required to exchange colors.

The main drawbacks are the hard-to-reach areas in the mold and a long cooling duration that leads to significant mold downtime.

The first application of bi-axial rotation and heat was documented in 1855, mainly to produce metal artillery shells and other hollow vessels. The initial objective of using rotation was to create consistency in wall thickness and density. Eventually, rotational molding was used for hollowing wax objects; shortly thereafter roto molding was used to fabricate chocolate eggs. It was subsequently applied with the use of plaster-of-Paris in the 1920's. In the 1950's, it was originally applied to plastics and was slow to receive industry adoption because of its sluggish productivity rate and the limitation caused by a small number of suitable plastics. The first rotomolded products were doll heads, which led to the creation of other plastic toys, eventually creating road cones, marine buoys, and car armrests. The resulting popularity accelerated the development of larger machinery and eventually led to the creation of a worldwide trade association called The Association of Rotational Molders (ARM).

New plastics like polycarbonate, polyester, and nylon, were introduced to rotational molding in the 1980's, leading to new applications for the process, such as fuel tanks and industrial moldings. Most recently, the development of plastic powders and process control improvements has led to a considerable increase in its application.

A broad spectrum of equipment sizes can be found among the various rotational molding machines. Generally, a rotational molding machine is comprised of molds, an oven, a cooling chamber, and mold spindles. Uniform coating of the plastic inside each mold is achieved with the spindles being mounted on a rotating axis. The quality of the molds, usually aluminum-based, is directly linked to the quality and finish of the final product.

The different roto molding machines are as follows:

- Rock and roll machine
- Clamshell machine
- Vertical or up-and-over rotational machine
- Material jetting
- Vertical or up-and-over rotational machine
- Shuttle machine
- Swing-arm machine
- Carousel machine

The rock-and-roll machine is specialized to mainly produce long narrow parts. The clamshell machine is a single-arm rotational molding machine that heats and cools in the same chambers and takes up less space than the shuttle and swing arm machines. Vertical rotational machines are considered small-to-medium in size (in comparison with other roto molding machines), and are energy-efficient thanks to their compact heating and cooling chambers.

Although a single-arm shuttle machine exists, most shuttle machines have two arms that alternate the molds between the heating chamber and cooling station. The arms are independent of each other and they turn the molds bi-axially. The swing-arm machine is beneficial for companies with prolonged cooling cycles or lengthy demolding time. It can have up to four arms with a bi-axial movement. Each arm is independent of the other since it’s not necessary to operate all the arms simultaneously. The carousel machine is one of the most common bi-axial machines in the industry. It can have up to four arms and six stations, and is available in a wide range of sizes.

Blow molding

The original principle of blow molding is derived from glassblowing. Essentially, blow molding is a manufacturing process that forms hollow plastic parts.

Blow molding is first launched by melting down plastic and forming it into a parison, which is a tube-like segment of plastic with a hole in one end that allows compressed air to pass. A “preform,” rather than a parison, is used with injection and injection stretch blow molding (ISB). The parison is then clamped into a mold and air is blown into it, causing the pressure to push the plastic outwards to match the mold. Upon the plastic’s cooling and hardening, the part is ejected.

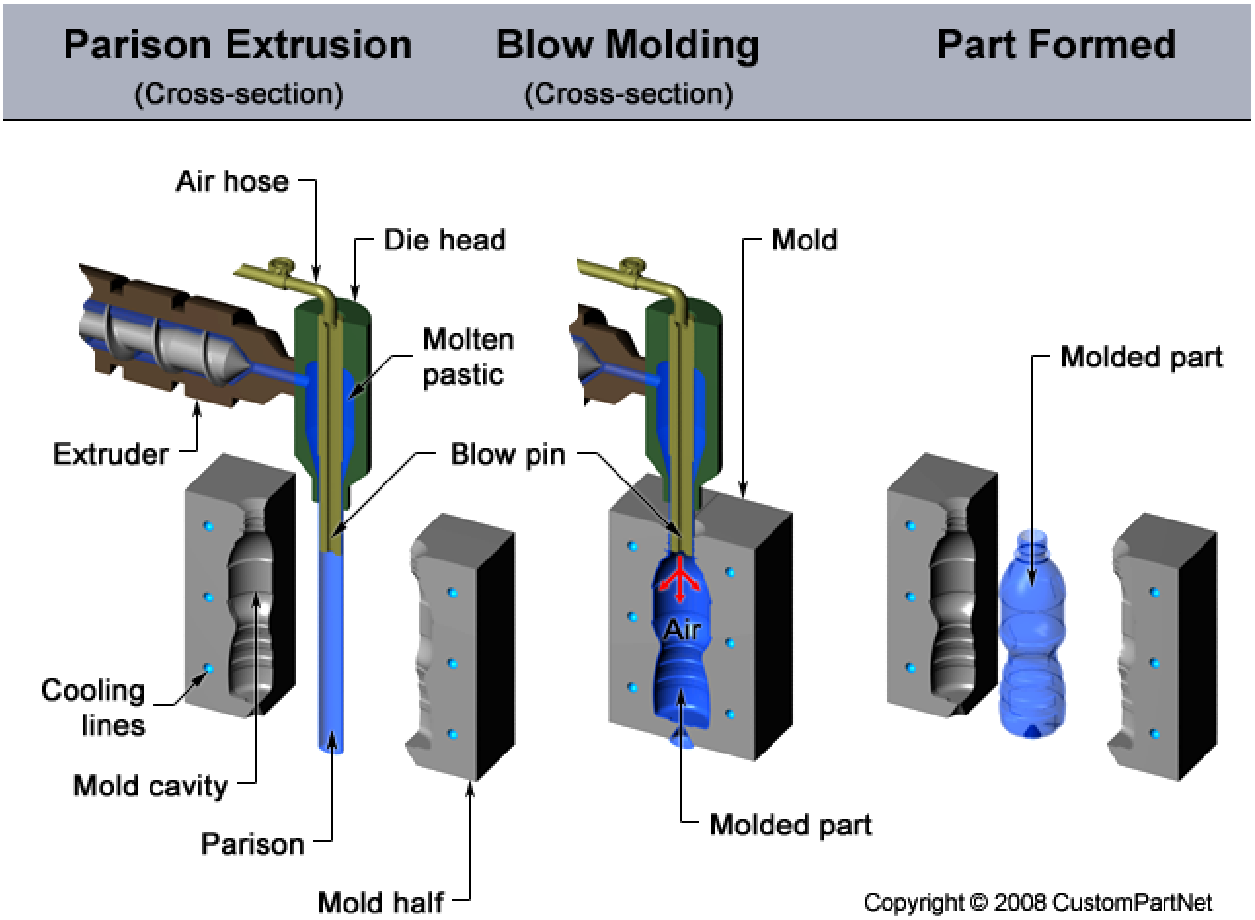
Three main types of blow molding exist:

Extrusion Blow Molding (EBM) first occurs by taking melted plastic and extruding it through a parison with compressed air and into the mold. It features two variations: continuous and intermittent.

Injection Blow Molding (IBM) is generally used for small medical and single-serve bottles. It is used to produce large quantities of hollow glass and plastic objects by injection molding a polymer onto a core pin which is rotated to a blow molding station to be inflated and cooled. IBM imposes restrictions on bottle design, only allowing a champagne base to be made for carbonated bottles.

Injection stretch molding is suitable for cylindrical, rectangular, or oval bottles and has two main different methods, notably the single-stage and two-stage processes. With the single-stage method, the same machine is used to both preform manufacture and bottle blow the object. This method is highly suitable for low volumes and short runs. In the case of the two-stage process, the plastic is first molded into a “preform” using the injection molding process. The “preforms” are then packaged and fed after cooling into a reheat stretch blow molding machine. While there is a high capital cost and a large floor footprint is required, injection stretch molding can produce very high volumes and feature minimal restriction on bottle design. The bottles can also be sold as a completed item for a third-party to blow.

Spin trimming is an operation closely related to blow molding. It occurs when a knife spins, or revolves, around a container that has an excess of material due to the molding process. The knife cuts the excess material away and allows it to be recycled to create new moldings.



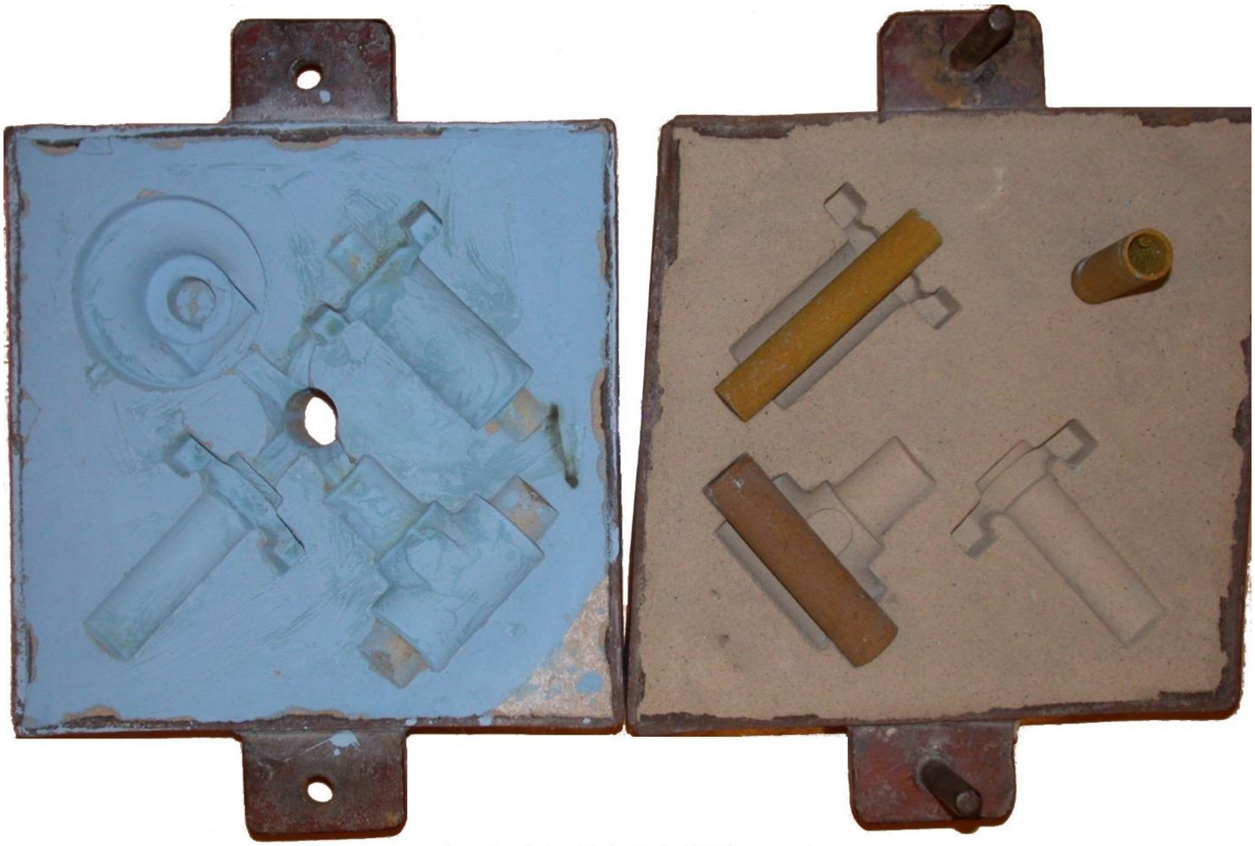
Casting

Casting is a 6,000-year-old molding process that involves filling a liquid material into a mold of a desired shape. The liquid goes on to gradually cool and solidify. The solidified part is called a casting. It is either ejected or broken out of the mold to finalize the process. Typically, metals or cold setting materials such as epoxy, concrete, plaster, or clay are used in casting. Casting is the preferred process for producing complex shapes that would otherwise be too difficult or costly to make through other methods. A copper casted frog is the oldest living proof that intricate casting patterns were used as early as 3200 BC.

The two main types of casting are metal and non-metal (such as plaster, concrete, or resin). Metal casting involves the heating of a metal into its liquid state and sequentially pouring the liquid into a mold. The mold and metal are allowed to cool until the liquid metal solidifies, at which point the casting is recovered from the mold. Plaster, concrete, or resin casting typically make use of single-use disposable molds or multi-use molds made of small, rigid pieces such as latex rubber. Topical treatments can be applied to the surface of plaster or concrete when the surface is flat or lacks transparency. They can also be used to give the appearance of metal or stone. Resin is particularly well adopted in the construction of sinks, countertops, and shower stalls. Adding powdered stone and different colors can provide a near-realistic imitation of natural marble or travertine.

Fettling is the process of cutting, grinding, shaving, or sanding away unwanted irregularities caused by seams and imperfections in the molds. Today, the integration of robotics has been adopted to perform some fettling. However, “fettlers” have historically carried out this grueling work manually, often with risks for repercussions to their health.

One way to save costs throughout the entire casting manufacturing phase is to apply casting process simulation software such as AutoCAST and MAGMa; this simulation uses numerical methods to calculate quality, solidification, and cooling, and provides a measurable prediction of the mechanical properties, thermal stresses, and distortion. It is considered the most valuable innovation in casting technology in 50 years.

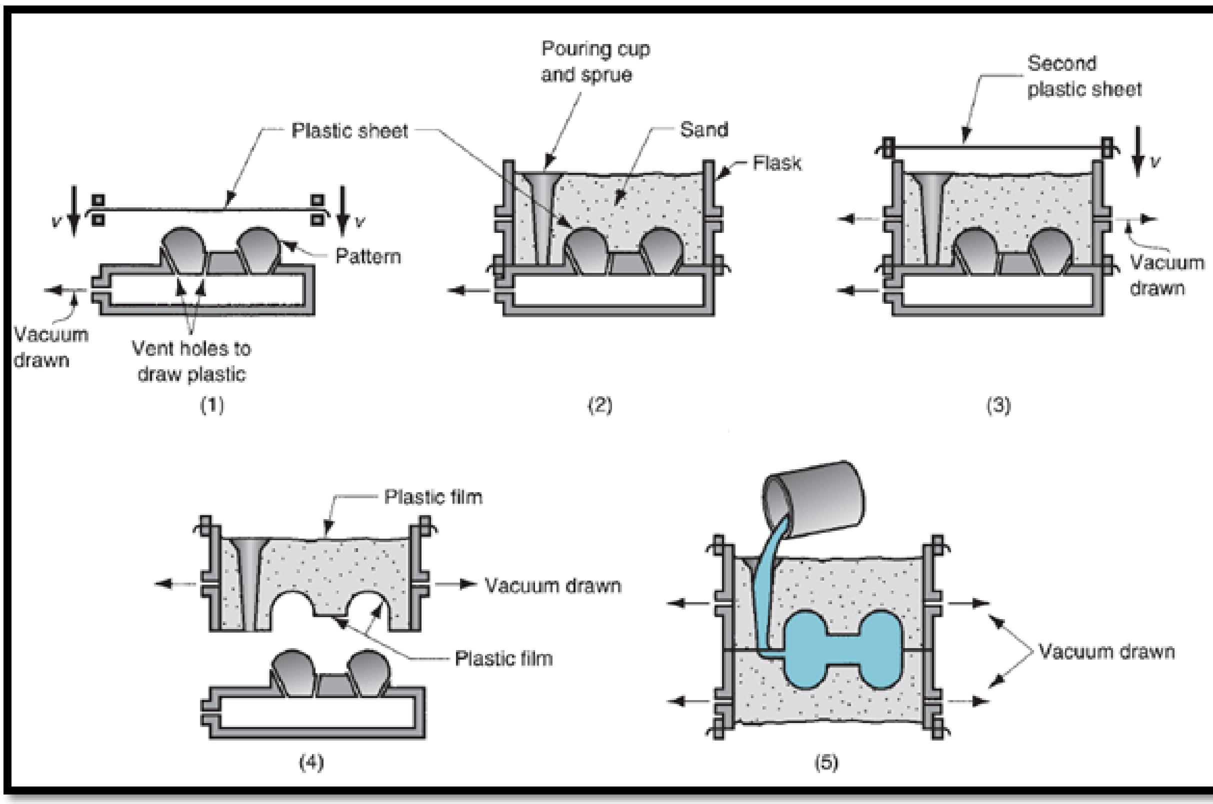


Vacuum molding

Vacuum molding, sometimes referred to as vacuum forming, is a straightforward molding process that uses vacuum pressure to force a sheet of heated and stretched plastic onto a single-surface mold. The plastic is heated to a forming temperature and the suction holds the plastic sheet against the mold until the desired shape is achieved. Vacuum molded components are preferential to complex fabricated sheet metal, fiberglass, or plastic injection molding for applications such as kiosks, automated teller machines, medical imaging equipment, engine covers, or for interior trim and seat components of train wagons.

There is a broad range of possible patterns in vacuum molding. Wood is the most common mold for vacuum molding, mainly because of its affordability and its freedom to perform design changes. Recycled objects can also be used as molds for their sustainability. Despite being costly, aluminum molds can accelerate the fabrication process because of their effectiveness with shallow draw parts. Composite molds are more affordable than cast or machined aluminum molds and offer reliable durability while producing high-quality parts. The most suitable materials for vacuum molding are thermoplastics while the most common and adaptable is High Impact Polystyrene Sheeting (HIPS). Acrylic is a suitable material for vacuum molding, used for its transparency, in applications such as aerospace, for example, with cockpit window canopies.

Finishing operations are necessary to transform the product into a suitable state. Common finishing methods include: guillotining, drilling, roller cutting, press cutting, and CNC (Computer Numerical Control) machine cutting.



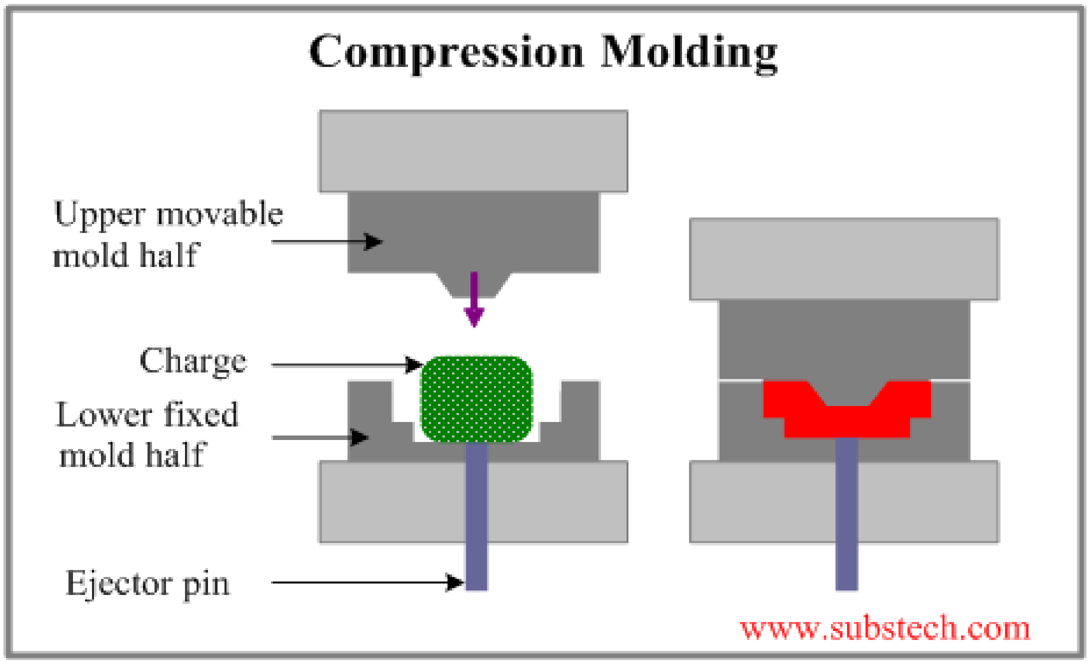
Compression molding

Compression molding is a forming process that heats and softens a plastic material in order to achieve a desired shape. It entails placing the plastic material, either in the form of pellets or sheet, into an open, heated metal mold. The mold then softens the material, forcing it to conform to the mold's shape as pressure is applied while it closes allowing the curing phase to take place. Once completed, excess materials protruding from the mold, called “flashes,” need to be removed to achieve a good finish.

First developed to manufacture composite parts for metal replacement applications, compression molding is typically used to make larger flat or moderately curved parts for the automotive industry including Long Fiber Reinforced Thermoplastics (LFT) and Glass Fiber Mat Reinforced Thermoplastics (GMT). Some of these parts include: hoods, fenders, scoops, spoilers, as well as smaller, more intricate parts.

One main advantage of compression molding is its capacity to mold large, relatively intricate parts as well as to produce ultra-large basic shapes that would otherwise be impossible with extrusion techniques. It is also one of the lowest-cost methods when compared with transfer or injection molding. Plus, waste reduction is maximized, which is particularly beneficial when working with expensive compounds. The drawbacks of compression molding include poor product consistency, difficulty in controlling flashing, and its lack of suitability for certain types of parts.

Compression molding can manufacture based on numerous materials such as Polyester fiberglass resin systems (like Bulk Molding Compound (BMC) or Sheet Molding Compound (SMC), polyamides-imides (like Torlon), polyimides (like Vespel), PolyPhenylene Sulfide (PPS), PolyEther Ether Ketone (PEEK), phenolics, thermoset polyester vinyl ester, epoxy, Diallyl Phthalate (DAP) and silicones.

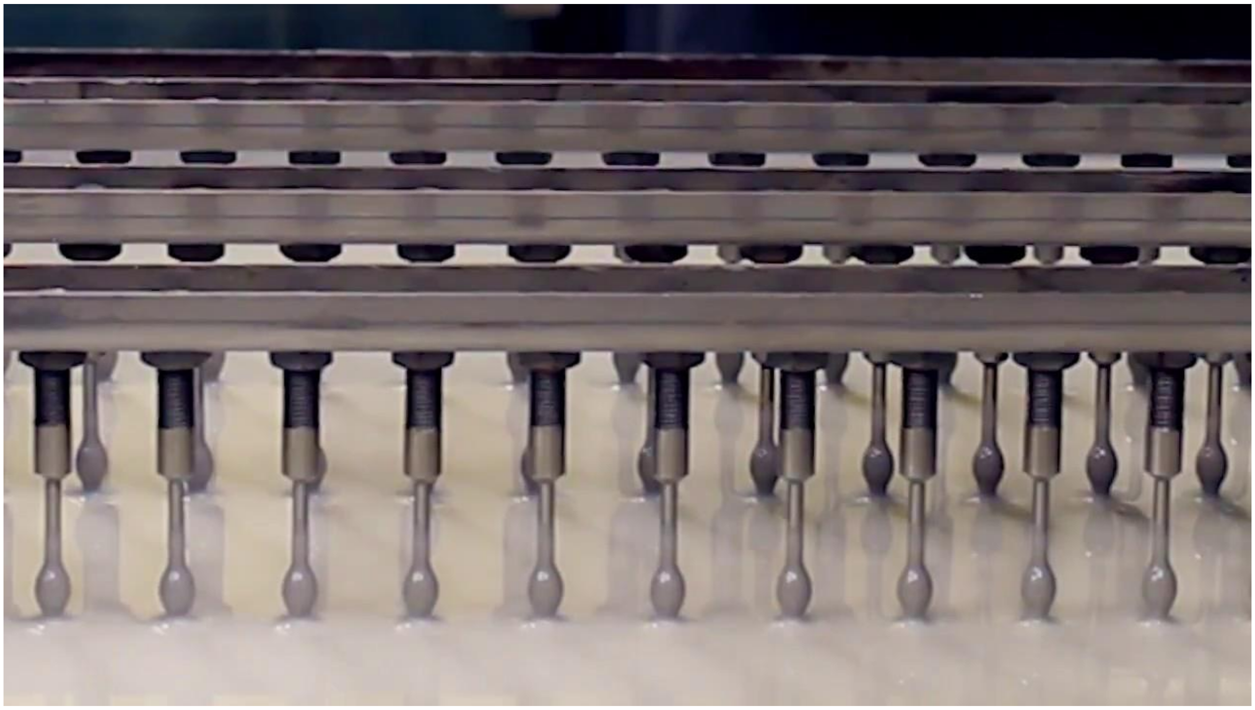


Dip molding

As its name implies, dip molding is a plastic manufacturing process that takes heated metal molds and dips them into a PVC liquid called plastisol to form a plastic part. The liquid can either be heated or at room temperature. The part is then cooled, drained, hardened, and stripped from its mold to produce the finished product. The molds can be submerged multiple times to achieve the desired thickness. For certain materials, a curing process may be required.

Dip molding can produce parts at a fraction of the cost of injection molding and at an accelerated pace. It is suitable for short runs of prototypes as well as for high-production orders. Plastisol is an affordable material and is available in a broad range of custom and standard colors. It is also flame retardant, UV and mildew resistant and relatively resistant to scratching and abrasion. In addition to plastisol, dip molding materials include latex, ieneoprene, polyurethanes, silicones, and epoxy. The main drawbacks include the time required to produce a part and the difficulty of controlling the thickness.

The range of possibilities with dip molding is vast, however, some common applications for dip molding include caps and plugs, gasoline nozzle covers, gloves, protective ax covers, socket holders, and many more.



Basic Press Controls

Before you begin press operation, you must be familiar with the basic press controls.

- The red stop button, or E-stop, shown in Figure 1, stops the press stroke, and it may turn off the main motor. The E-stop button is most often used in emergency situations when the press must stop immediately.
- The yellow stop button, or top stop button, also shown in Figure 1, stops the press stroke in the stroke-up position. This button does not shut off the main motor.
- The main motor start/stop button turns the press motor on and off. This button is often located on the main control panel or on a separate enclosure. Some presses have just one main motor start/stop button, and some have two separate start and stop buttons, like those shown in Figure 2.
- The mode selector is a switch that indicates the different modes of operation on the press. This switch is your supervisor or die setter.

- The operator controls consist of hand and foot controls that allow the press operator to cycle the press. Dual palm buttons, shown in Figure 3, are the most common type of operator controls.

Figure 1. The E-stop button stops the press stroke immediately, and the yellow stop stops the press in the stroke-up position.

Figure 2. The main motor start and stop buttons turn the press motor on and off.

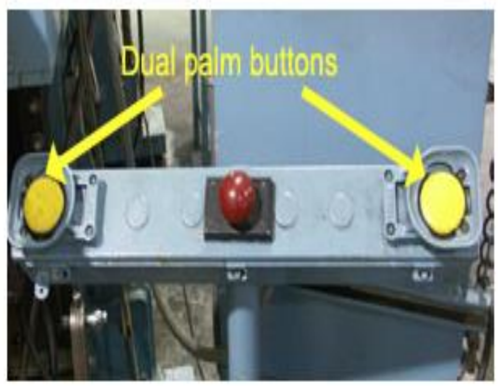


Figure 3. The dual palm buttons are the most common type of operator controls.

The E-Stop

Depending on the type of press, the E-stop may serve different functions. Put simply, the E-stop button stops the press. However, depending on the type of press you have, the E-stop button, shown in Figure 1, may stop the press during different points in the stroke.

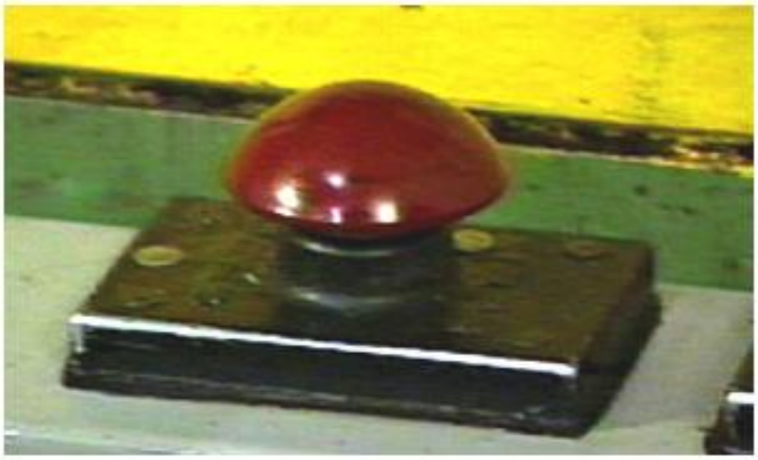


Figure 1. On part-revolution clutch presses, the E-stop button stops the press in mid-stroke.

On part-revolution clutch presses, the E-stop disengages the clutch and applies the crankshaft brake to stop the ram even if the press is in mid-stroke. However, the flywheel may rotate for a number of minutes. On the other hand, most full-revolution clutch presses do not have an E-stop button. If a full-revolution clutch press does have an E-stop, like the press in Figure 2, it will stop the main motor, but the ram does not stop immediately until it returns to the stroke-up position, or top dead center (TDC). Some presses use the E-stop button as the main motor stop, as Figure 3 shows.

Figure 2. On full-revolution clutch presses, the E-stop button stops the main motor, but the ram does not stop until it returns to stroke-up position.

Figure 3. Some presses use the E-stop button as the main motor stop.

Modes of Operation

The typical press consists of four common modes of operation. Figure 1 shows a mode selector on a press:

- Inch mode is generally used during die setup. However, the press operator may use the inch mode when loading a new coil of material. During inch mode, the ram can be moved a little at a time to different points in the stroke. This mode is used for part-revolution clutch presses only. For full-revolution clutch presses, the ram is lowered by a special rod or by jogging. The inch mode should never be used to make parts during regular production.
- Single stroke mode is most often used for manually fed operations. During single stroke mode, the press completes one entire stroke at a time at full operating speed. The ram stops at its highest position ready for its next stroke.
- Automatic single stroke mode is used when an auxiliary sensor or feeding mechanism completes the signal for the press to begin a single stroke. The press will continue making one stroke at a time automatically as long as it is not overridden by another sensor.
- Continuous mode is also known as production mode. Continuous mode is used once the coil-fed job is set up and ready to run. The press will continue stroking automatically until the yellow or red stop button is pressed. Other devices, such as a malfunction detector or tonnage monitor may also send a stop signal to the press.

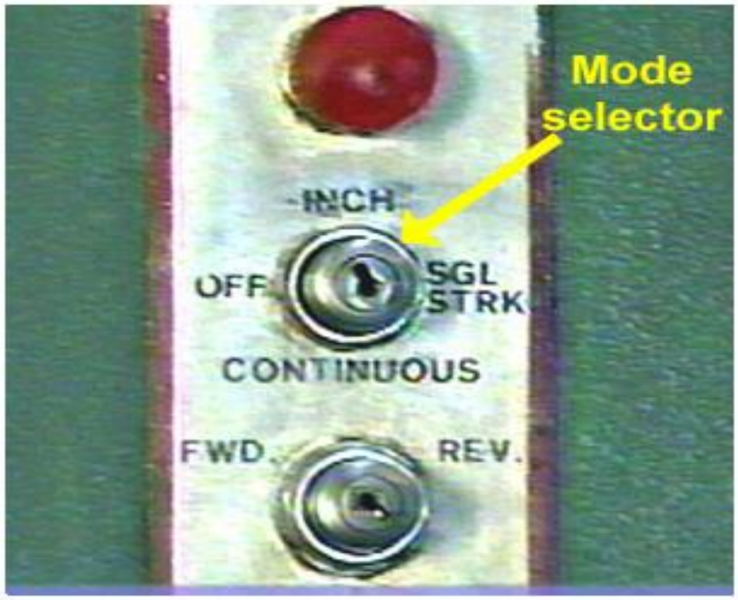


Figure 1. A mode selector on the press.

Operator Controls

Before operating the press, you must locate the operator controls. These controls consist of dual palm buttons or a foot switch. The dual palm buttons initiate the motion of the ram. The press operator must use both hands to push the dual palm buttons at the same time, as Figure 1 shows. This causes the clutch to engage with the flywheel, which turns the crankshaft. This moves the ram up and down. As the press returns to the top of its stroke, the clutch disengages, and the brake is applied to stop the crankshaft. The type of ram motion depends on the mode of operation selected.

Figure 1. The press operator uses both hands to push the dual palm buttons at the same time.

The press operator may also use a foot switch to initiate motion of the ram. Often, foot switches are covered with a guard. You must insert your foot into the guard, and depress the foot switch, as Figure 2 shows. This causes the ram to move. Releasing your foot off the foot switch will stop the ram.

Figure 2. The press operator also uses a foot switch to initiate ram motion.

Along with basic press controls and operator controls, you must locate the on and off buttons for any scrap conveyors or ejection chutes, which are shown in Figure 3.

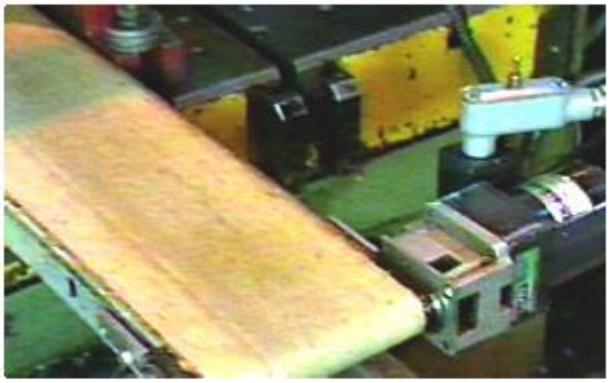


Figure 3. The press operator must locate the on and off controls for scrap conveyors or ejection chutes.

Preparation for Press Operation

Before you operate the press, you must prepare the area for press operation. First, make sure that the press is not under lockout. If the press is locked out, like the one in Figure 1, do not attempt to use it, and notify your supervisor. If the press is not under lockout, check the selector switch to make sure that the press is in the proper mode of operation.

Figure 1. If the press is under lockout, do not use it.

Eliminate any safety hazards from the work area. Remove any brooms, scrap, or trash, and put away any tools that may be lying around. Also, you must keep the work area dry and free of oil. Next, organize your work area, and make sure to properly position part bins or scrap bins. Figure 2 shows a clean, organized work area.

Figure 2. The press area must be clean and organized.

Inspect controls and wiring for damage. Control or wiring damage may cause a device to short out, preventing it from working properly. Next, inspect the die area, and make sure it is free of scraps and jams. Also, inspect the feed chutes and ejection chutes for jams. Finally, inspect the safeguarding devices for damage. If any of these components are damaged, notify your supervisor before operating the press.

Lastly, turn on any parts conveyors needed for the operation. Also, turn on all other necessary components, such as the uncoiler, straightener, and feed mechanism.

Operating the Press in Inch Mode

The inch mode is used in die setup operations or when loading new material. In most cases, the press operator will only use inch mode to load new material. Also, keep in mind that only part-revolution clutch presses can use inch mode.

Before operating the press in inch mode, press the main motor start button. Next, turn the mode selector to "inch," as the selector in Figure 1 shows. In inch mode, the dual palm buttons are used as the inch buttons, or dual inch buttons. There are usually two separate dual inch buttons, but some presses have just one inch button.

Keep in mind that while operating the press in inch mode, safeguarding devices may not function. Consequently, it is important to observe all safety precautions when operating the press.

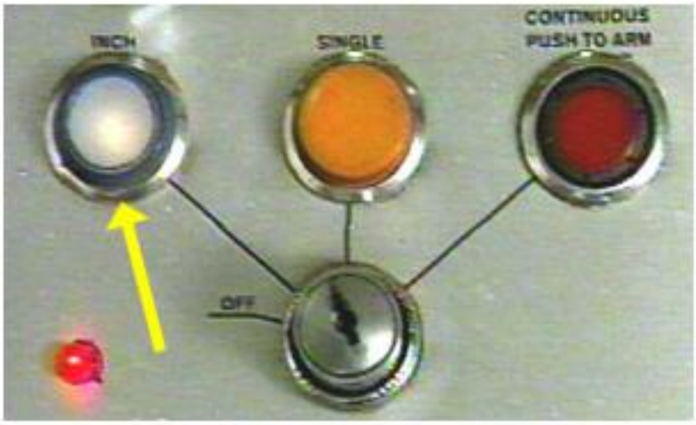


Figure 1. Inch mode is used in die setup or when loading new material.

To inch the press, push and release the dual inch buttons in short taps. The press ram moves a short distance for each tap. Now, hold down the dual inch buttons. The press continues to cycle as long as these buttons are held down. Inch the press until the ram is at its lowest position, or bottom dead center (BDC), shown in Figure 2. This allows you to make sure that the ram is properly aligned with the die assembly. When the press is set up with a die, be careful not to stick the ram in the BDC position. Always stop before or inch past the BDC position and release on the up stroke. Then, inch the press until it is at its highest position, or top dead center (TDC).

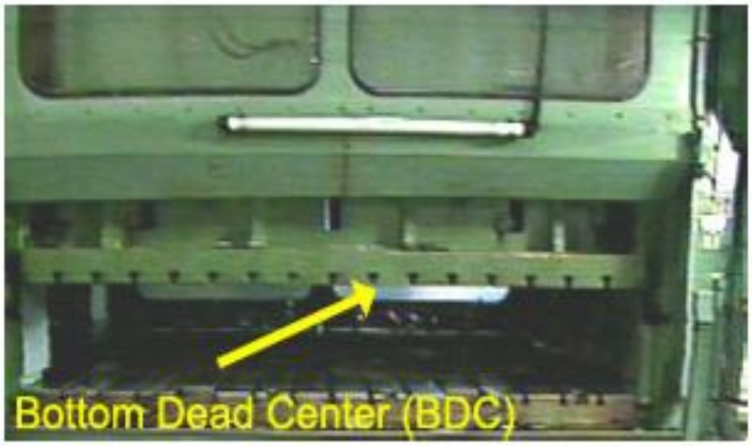


Figure 2. When you inch the press to BDC, you can check that the ram is properly aligned with the die.

Operating the Press in Single Stroke Mode

The single stroke mode is mainly used for manually fed press operations, which stamps one part at a time. Single stroke mode can also be used during setup. Select single stroke on the mode selector, as you can see in Figure 1. To operate the press in single stroke mode, press the dual palm buttons, and hold them down until the ram has gone beyond the stroke-down position, then release them. The ram will return to stroke-up position and stop. However, releasing the buttons too soon may cause the press to stick at BDC. Press the dual palm buttons again, and hold them down all the way through a press cycle. The ram should automatically stop in the stroke-up position, shown in Figure 2.

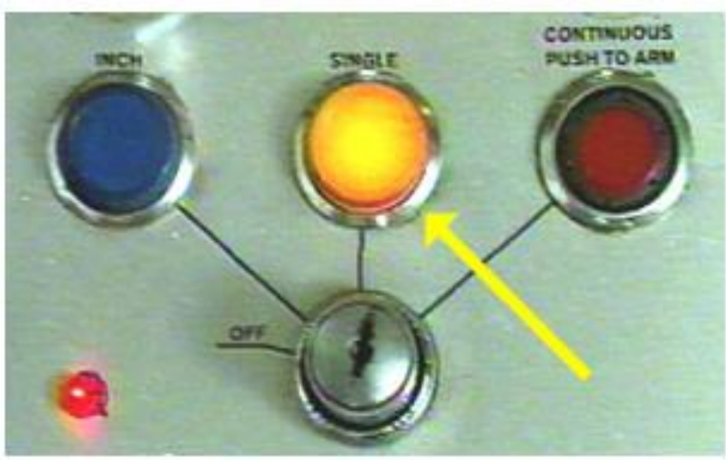


Figure 1. Single stroke mode is mainly used to stamp one part at a time.

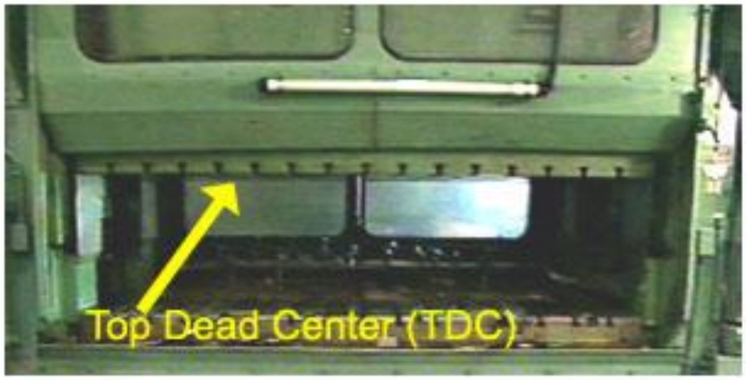


Figure 2. In single stroke mode, the ram strokes down and returns to stroke-up position, or TDC.

Presses with single stroke mode must be equipped with a feature that signals the press to stop even though you continue to hold down the buttons. While holding down the dual palm buttons, if the press strokes a second time, notify your supervisor.

Part-revolution clutch presses used in single stroke mode have a safety requirement. To make sure that this feature works, press the dual palm buttons, and after the ram begins to move, release them immediately. The ram should stop part way through the stroke. Then, return the press to inch mode, and inch the ram to the stroke-up position.

Operating the Press in Continuous Mode

Continuous mode is also known as production mode. This is the most important mode of operation on the press, because it can quickly produce a large number of parts. The press operator must make sure that the press is operating properly in this mode, or damage to the press, die assembly, or finished parts may result. While the press is in continuous mode, the press operator must make sure that parts are progressing along the die and that they are ejected correctly. Press operators must also monitor the tonnage of the press and make sure that scrap is not piling up.

To initiate continuous mode, turn the mode selector to continuous, as Figure 1 shows. Next, you must arm the control. Press the button labeled "arming," "preset," or "arm and ready," like the control in Figure 2. These buttons prevent inadvertent startup of the press in continuous mode. Depending on the type of press, the arm control may be any one of these buttons. Next, press the dual palm buttons. The press ram will cycle continuously until it receives a stop signal.

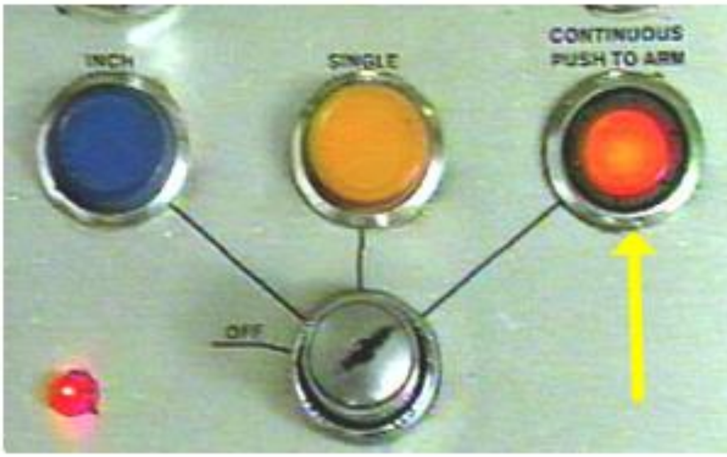


Figure 1. Continuous mode is also known as production mode.

Figure 2. The arm control button prevents inadvertent startup of the press in continuous mode.

Stopping the Press

When the press is in continuous mode, the ram will cycle continuously until a stop sensor signals the press to come to a stop, or the press operator initiates a stop. This sensor may be any one of the following types:

- The yellow "top stop" button stops the press in the stroke-up position, as Figure 1 shows. The press operator uses this button to stop the ram motion when there is no need to stop the ram during its current stroke.
- The E-stop button stops the press quickly. On part-revolution clutch presses, the ram motion will stop as soon as the brake can stop the ram regardless of position. For full-revolution clutch presses, the ram will not stop until it completes the stroke and returns to top dead center. After an E-stop, you may need to restart the main motor.
- Sensing devices in the die area may signal the press to stop. Tonnage monitors or malfunction sensors detect problems in the die area. Safety sensors include photoelectric sensors, proximity sensors, and fiber optic sensors. These sensors often monitor material position and part ejection.
- Safety devices, such as light curtains or interlocked barrier guards, like the one in Figure 2, may signal the press to stop. If one of these devices detects motion, it will signal the press to stop.

Figure 1. The yellow "top stop" button stops the press in the stroke-up position.

Figure 2. A barrier guard may signal the press to stop.

Press Sensing Devices

The press contains a variety of sensing devices that detect problems in the press or in the die area. Should there be an error during press operation, these devices activate stop signals.

A common sensing device in the die area is a tonnage monitor, shown in Figure 1. A tonnage monitor checks the amount of pressure being exerted on the die. If there is too much pressure on the die, the tonnage monitor signals the press to stop.

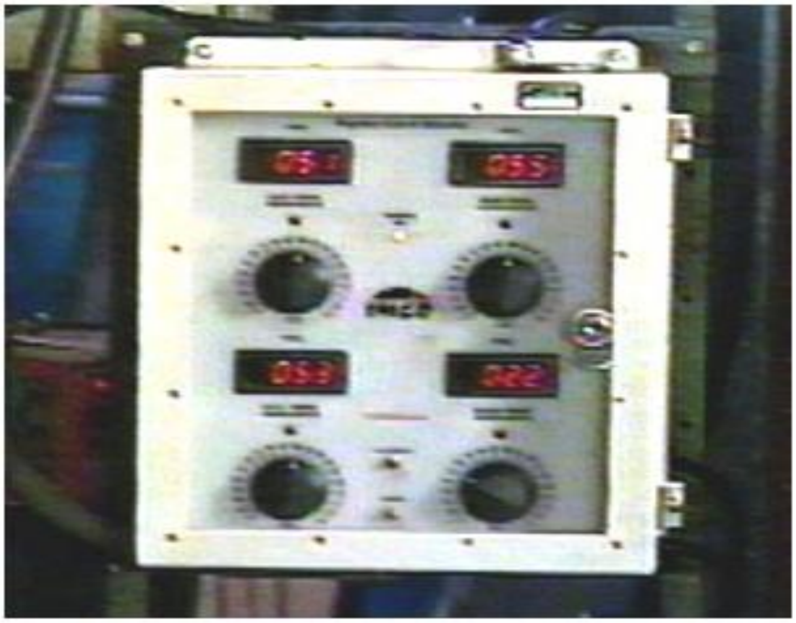


Figure 1. A tonnage monitor checks the amount of pressure exerted on the die.

The press also has safety sensors, such as photoelectric sensors and proximity sensors, which monitor material position control and part ejection control. Each type of sensor uses two sensors, which are networked to each other. One verifies that the material is in position, while the other verifies that the part has been ejected. If these sensors do not detect the material or part, they will signal the press to stop.