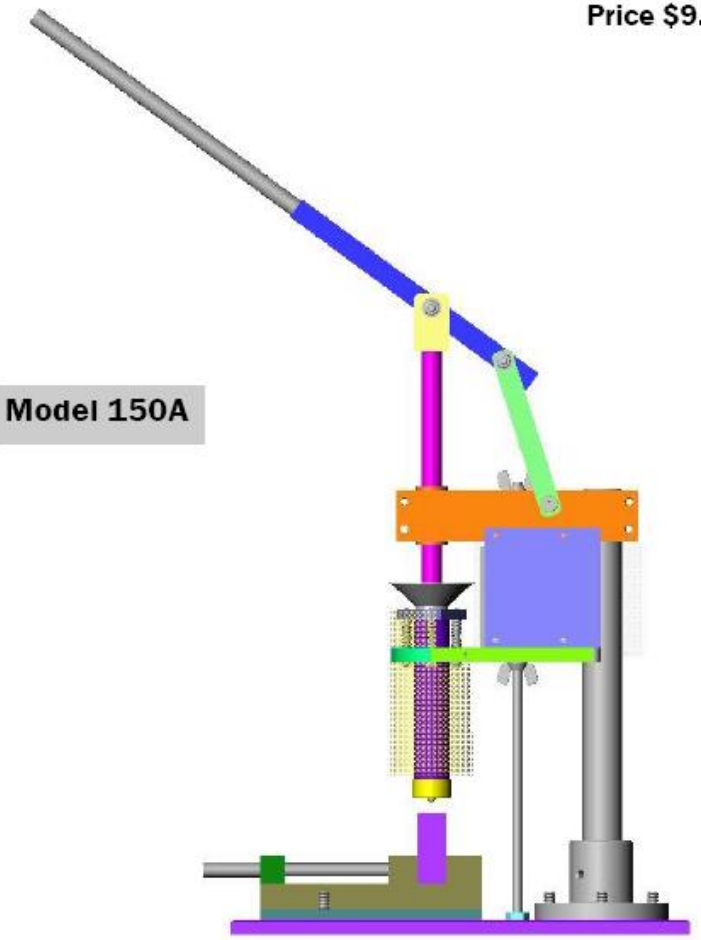
PIM-SHOOTER™
BENCH PLASTIC INJECTOR
Operating and Safety Manual

Price $9.00



Model 150A

LNS TECHNOLOGIES

PO Box 66301
Scotts Valley, CA 95067
www.easyplasticmolding.com

90 DAY LIMITED WARRANTY

This LNS Technologies product is guaranteed to be free from defects in workmanship and materials for 90 days from the purchase date.

Within 90 days of purchase, the product (along with proof of purchase date) may be returned to LNS Technologies, PO Box 66301, Scotts Valley, CA 95067, freight prepaid and we will repair it or replace it (at our option) for no additional charge.

Limitations of this warranty include: implied warranties, payment for loss of time, inconvenience, loss of use of your product or property damage caused by your product or its failure to work, or any other incidental or consequential damages including personal injury. This warranty does not include defects resulting from accidents, damage while in transit to our location, unauthorized repairs, misuse, fire, flood, or acts of God. When returning products, please carefully pack and send along with your name, address, phone number, proof of purchase date (payment receipt) and a description of the operating problem.

PIM150-MAN-0514

Printed in the USA.

TABLE OF CONTENTS

PROPOSITION 65 WARNING: This product contains chemicals, including lead, known to the State of California to cause cancer and birth defects or other reproductive harm.

Wash hands after handling.

PREFACE

Thank you for choosing the Model PIM-SHOOTER™ injection molding machine. This machine represents several years of engineering, development and testing.

It is very important to **READ AND UNDERSTAND THIS INSTRUCTION MANUAL THOROUGHLY BEFORE OPERATING THE MACHINE.** It is also important that all personnel operating this machine should read these instructions and cautions. Additional manuals are available for purchase on our website: (www.techkits.com/bim)

This user's guide should be saved for future reference and passed on to any subsequent owner. It covers both the safety information and operating instructions of the Model 150A PIM-SHOOTER™. This machine has been designed for hobby and classroom use and has certain limitations on its operation. Read this manual carefully so that you clearly understand the limitations.

INTRODUCTION

The Model 150A PIM-SHOOTER™ is an bench model injection molder designed for production of thermoplastic parts in quantities required for making prototypes and low-volume production. It is perfect for hobbyists, small businesses and has many applications in the classroom.

The PIM-SHOOTER™ has a steel ram plunger that operates inside of a heated barrel. The temperature of the barrel is accurately controlled by a digital temperature controller and thermocouple.

The Model 150A is easy and simple to operate. It uses inexpensive aluminum tooling. Operating costs and maintenance are low. The machine has been engineered to be robust and reliable, but it is important to read and understand all of the operating and safety information before operating the machine.

Insulating gloves and safety glasses are included with each Model 150A machine. It is important to read the safety information and ALWAYS use the gloves and eye protection when operating this machine.

IMPORTANT SAFETY INFORMATION

Even though the PIM-SHOOTER™ is a simple machine, it is NOT A TOY. Safe and proper operating procedures must always be followed. As with all machinery, there are certain hazards involved with the operation of the product. Using the machine with respect and caution will considerably lessen the possibility of personal injury. Always use common sense and exercise caution in the workshop.

REMEMBER: Your personal safety is your responsibility. Read and understand all the following safety information before you operate the machine:

- **ALWAYS wear ANSI approved safety glasses when running this equipment.**
- **WARNING—The machine is EXTREMELY HOT while in operation. Due to high surface temperatures, keep clothing and other combustible objects at least 36" away from the unit.**
- **CAUTION—To reduce the risk of burns, fire, electrical shock or injury to persons: Do not allow children or untrained persons near the unit.**
- **ALWAYS wear heat insulating gloves when operating this machine and when handling molds Never touch ANY of the metal parts during operation, including metal parts that are not behind the heat shield. Only touch the foam covered handle when positioning the machine.**
- **WARNING—Do not use flammable liquids or operate the machine near flammable liquids, vapors or other combustible materials.**
- **CAUTION—Make sure the machine is secured to the bench before operating the machine. The machine must be clamped to the bench or secured by screws using the holes provided in the base plate.**

- **CAUTION—During operation, the force required on the feed lever of the machine can be enough to cause the machine to tip over. For this reason, the base plate must be securely anchored to prevent it from tipping over (see page 5).**
- **WARNING—During operation, melted plastic may drip from the nozzle tip of the injector. NEVER touch molten plastic! Hot plastic is dangerous & causes burns.**
- **NEVER leave the heater on when the machine is unattended or not being operated. Some plastic material can degrade and emit harmful gases.**
- **ALWAYS unplug AC power from the machine when not in use or when performing maintenance.**
- **Allow the unit to cool before storing it.**
- **NEVER operate the machine at temperatures above 490 degrees F. There are parts on this machine that can be damaged by temperatures higher than 490 degrees F.**
- **NEVER purge the machine without supporting the nozzle as shown on page 20.**
- **ALWAYS insure that plastic pellet materials are dry and free of excess moisture.**
- **ONLY operate the machine in a well ventilated area. Certain molten plastics can release harmful fumes during the melting process.**
- **CAUTION—Do not operate the unit with a damaged power cord. Do not modify the power plug. If the power cord is damaged or broken, it must be replaced by the manufacturer.**
- **IMPORTANT—The machine must be grounded. Grounding provides a path of least resistance for electrical current to reduce the risk of electrical shock. This machine is equipped with a cord having an equipment-grounding conductor and grounding plug. The plug must be used only in a grounded outlet that is properly installed in accordance with all local codes and ordinances. Do not remove the grounding pin.**
- **DO NOT use this unit in damp or wet locations. Do not expose to rain.**
- **DO NOT open or attempt to alter any part of this unit. There are no user serviceable parts in this unit other than what is described in this owner's manual.**
- **DO NOT replace the fuse with a higher amperage rating.**
- **DO NOT attempt to use this machine with materials or temperature setpoints other than those listed in Table 2 on page 9.**
- **DO NOT disassemble or modify any parts of this machine.**

INSTALLATION

After unpacking your machine, refer to Figure 4 on page 10 and locate the round handle extension. Screw it firmly into the square main handle.

Before operating the machine, it must be securely mounted to your workbench or to a tabletop. During injection, very large forces are exerted on the handle and the machine will tip forward if not secured. If you are mounting it to a table, make sure the table is of a sturdy construction as the Model 150A weighs around 50 lbs or more.

The base plate of the machine has 4 mounting holes located near the corners of the plate. Use 4 carriage bolts or lag screws to secure the base to the bench or table.

When you mount the machine to a bench, leave at least 6" of space on both sides of the machine to allow an area to disassemble the mold and an area to keep plastic pellets for refilling the machine.

DO NOT OPERATE THE MACHINE UNTIL IT IS SECURELY FASTENED TO THE WORK BENCH OR TO THE TABLETOP!

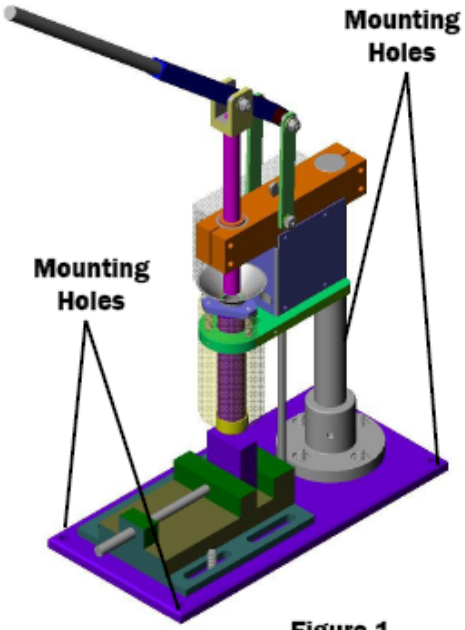


Figure 1

ELECTRICAL

The incoming power for the machine requires up to 3 Amps of service. Voltage requirements of the machine vary based on the model option selected. Refer to the label on the control box for voltage requirements. The machine is equipped with a cord having an equipment-grounding conductor and grounding plug. The plug must be used only in a grounded outlet that is properly installed in accordance with all local codes and ordinances. Do not remove the grounding pin.

- **EQUIPMENT OVERVIEW**

GENERAL SPECIFICATIONS

The Model BIM-SHOOTER™ is a hand operated injection molding machine. It requires secure mounting on a bench top and electrical power to operate. The machine will inject up to 0.9 oz (general purpose ABS) of plastic per cycle, will operate at material temperatures up to 490° F, and can mold a piece with a projected area of up to 12 sq. inches. Temperature of the material is controlled by a digital heat controller and monitored with a K-type thermocouple.

Table 1

MODEL 150A	SPECIFICATIONS
ELECTRICAL	120VAC, 400W 50/60Hz
TEMPERATURE RANGE	Room Temp -> 490 deg, F
MAXIMUM SHOT CAPACITY	1.25 Cubic Inches 0.75 ounces (PS) 21 gm (PS)
MAXIMUM MOLD DIMENSIONS	8.0" W x 5.0" H x 5.0" D
MINIMUM MOLD SPRUE OPENING	0.25" diameter mold sprue opening.

COMPONENT IDENTIFICATION

Before using the machine, it is important that you become familiar with all the components and their nomenclature.

TEMPERATURE CONTROL BOX

ON/OFF SWITCH: This is used to switch power on to the machine. The switch will illuminate to indicate that the power is on.

TEMPERATURE CONTROLLER: This is used to control the barrel temperature of the machine. The barrel temperature will vary according to the thermoplastic material that is being injected. Refer to page 8 for details of operating the temperature controller. The temperature controller's display will be off when the machine power is off.

AC CORD AND PLUG: On models designed to run on 110-120VAC, a 6' long power cord is provided so the machine can be plugged into a standard grounded wall-outlet. The plug must be plugged into an appropriate AC outlet that is properly installed in accordance with all local codes and ordinances. Do not remove the ground pin.

FUSE HOLDER: The incoming power for the machine requires a 4 Amp fuse. If the fuse ever needs replacement, make sure the AC cord is unplugged.

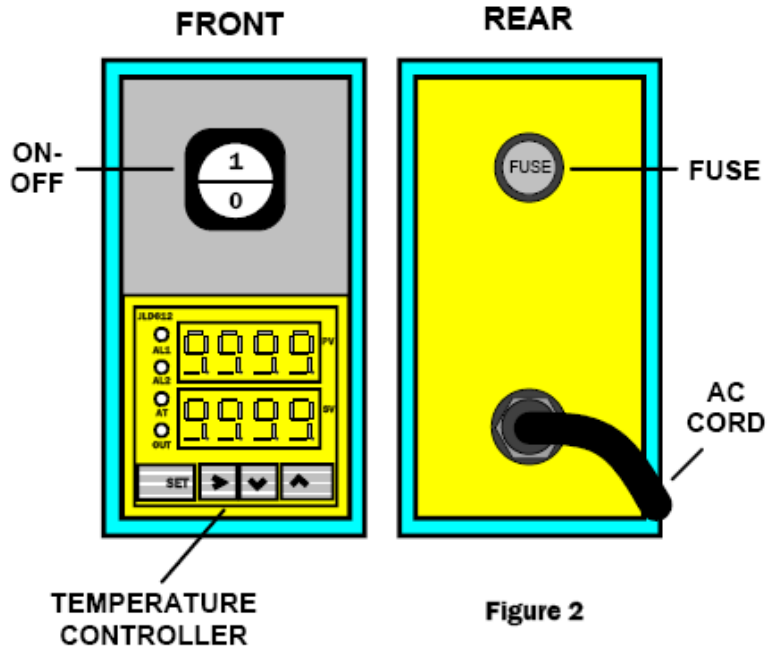


Figure 2

TEMPERATURE CONTROL

The temperature controller monitors the barrel temperature and controls the barrel heater in order to maintain a selected temperature. The upper display (PV) indicates the actual measured temperature of the barrel. The lower display (SV) shows the set-point value, which is set by the user. The setpoint value (SV) is determined by the plastic material that is being injected. Table 1 shows the setpoint temperature for each of the plastic materials that can be used with this machine.

FOR SAFETY, ENTERING A SETPOINT VALUE (SV) GREATER THAN 0490 (490°F) WILL DISABLE THE HEATER! ONLY USE MATERIALS AND SETPOINTS SHOWN IN TABLE 1.

Figure 10 below identifies the functions and displays of the temperature controller.

Figure 3
Temperature Controller

1 -- AL1, relay J1 indicator (Overtemp).
2 -- AL2, relay J2 indicator (Heater ON).
3 -- AT, blanking during auto tuning process.
4 -- Out, output indicator.
5 -- (SET) Setting / Confirm.
6 -- (NEXT) Digit select.
7 -- (DOWN) Select next parameter / value decrement.
8 -- (UP) Selection previous parameter / value increment.
9 -- (SV) Target temperature value (Setpoint).
10 -- (PV) Current temperature value.

Table 2
Molding Temperature Guidelines

Thermoplastic Material	Barrel Temperature (°F)	Mold Temperature (°F)
ABS	385-420	80-140
Acetal (Delrin)	405-420	175-220
Polpropylene	375-425	60-120
TPE	320-340	50-80
LDPE (polyethylene)	350-410	80-110
EVA	275-350	Not required

These temperatures are guidelines only. You may need to adjust the temperature set-points to get satisfactory results. Start with the lowest temperature listed and slowly increase it only if you are not getting material to successfully flow into the mold.

All of the internal parameters of the temperature controller have been pre-configured at the factory. The only parameter that needs to be set by the user is the Barrel Temperature setpoint matching the material being injected.

To change the Barrel Temperature setpoint:

On the temperature controller press the (SET) button.
The display shows: PASS/0000

Press (NEXT) button 3 times, then press the (UP) button.
The display shows: PASS/0001

Press the (SET) button.
The display shows: Su/AH1

Press the (SET) button again.
The display shows: Su/0XXX (where 0XXX is the last temperature setpoint).

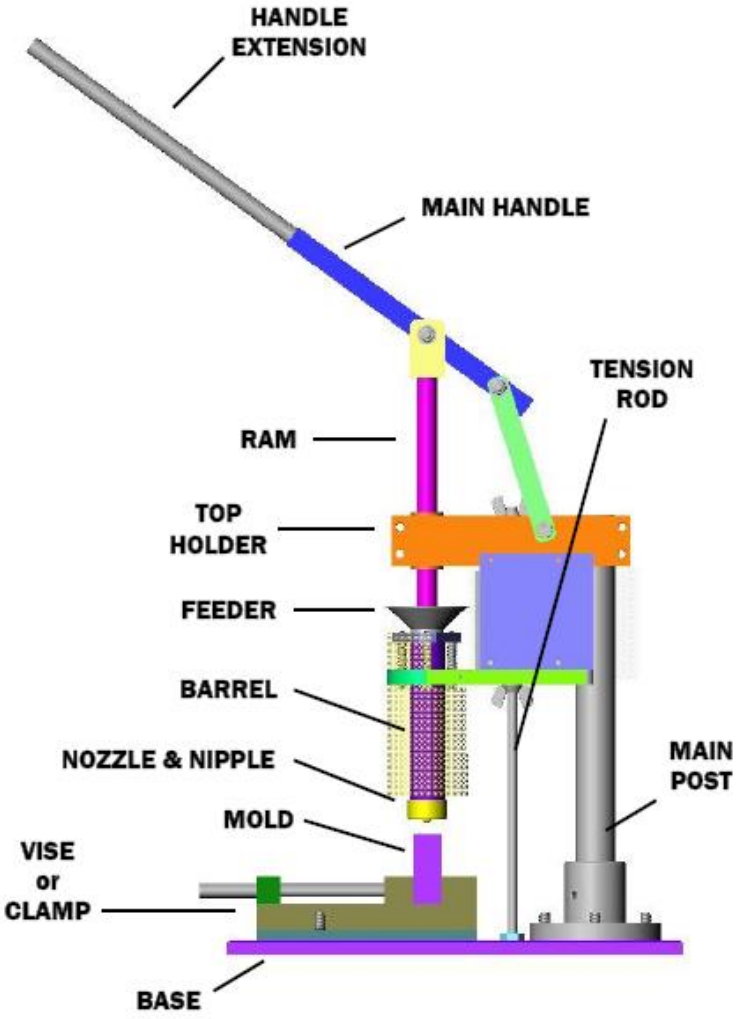
Use the (NEXT) along with the (UP) and (DOWN) buttons to enter the new temperature.
The display shows: Su/0XXX (where 0XXX is the new temperature value).

When new temperature is displayed, press the (SET) button to enter it.
The display show: Su/AH1

Press the (DOWN) button.
The display shows: End/Su

Press (SET) button to finish the temperature setting operation.

Figure 4
Injector Components



INJECTOR COMPONENTS

HANDLE: The handle is used provide the ram motion and pressure during injection. It is designed to deliver a multiplied injection force to the ram.

EXTENSION: The extension attaches to the main handle to give added leverage. NOTE: the added leverage provided by the extension will cause the machine to tip forward if the base is not securely mounted.

RAM: During injection, as the handle is moved downward, the ram travels into the barrel to force molten thermoplastic material into the mold. After each injection cycle, the handle must be used to raise the ram so that more pellets can be added to the feeder.

TOP HOLDER: The top holder is attached to the main post and guides the ram into the barrel during the injection cycle. The top holder can be adjusted up or down on the post to accommodate various mold sizes.

TENSION ROD: The tension rod functions to counteract the large ram forces encountered during the injection cycle. Details on adjusting the top holder and tension rod are on page 17.

FEEDER: The feeder is used to add un-melted pellets to the injector. It has a funnel shape to direct the pellets into the barrel. WARNING – The feeder can become hot while operating the machine. Do not touch the feeder when the heater has been on. Use a scoop or dispensing container to add pellets to the feeder.

BARREL & HEATER: The barrel is where the thermoplastic pellets get melted so the molten plastic can be injected into the mold. The barrel has a heater and thermocouple which allows the temperature controller to maintain the barrel temperature setpoint.

GUARD: WARNING – The barrel gets extremely hot and can cause severe burns if touched. The guard is provided to prevent direct contact with the barrel & heater. Never remove the guard from the injector and always wear protective gloves during operation.

NOZZLE: The nozzle has been designed to deliver molten plastic to the mold and to prevent un-melted pellets from entering the mold. Do not modify the nozzle or the opening in the nozzle. The nozzle has a small protruding nipple that is designed to enter the sprue hole of the mold and help direct the flow of the molten plastic into the mold. WARNING – Hot plastic is very dangerous, it is fluid as well as hot and shows no visible signs that it could burn you. It can drip like molasses from the nozzle and should be treated very cautiously.

MOLD: Molds must be supplied by the user or sample molds can be purchased at www.techkits.com/pim (see Appendix C for ordering supplies). The mold consists of two halves that need to be securely clamped together using either a vise or with clamps supplied by the user (see page 13).

MOLD INFORMATION

Perhaps the most important piece involved in the injection molding process is the mold. However, the Model 150A injection machine does NOT include a mold, obviously because the plastic item that you wish to produce will require a unique mold that has been designed for your particular item.

NOTE: LNS Technologies does not offer a service to create your custom mold! We are also not a volume supplier of plastic pellets!

We specialize only in the design and manufacture of low-cost, quality molding machines. You will need to contact a mold designer or machine shop to get a mold made to your exact specifications. Or if you have CNC or EDM equipment available, you may be able to manufacture your own mold. Also, once you determine the plastic material that is appropriate for your item, you will need to find a volume plastic pellet supplier.

Since the Model 150A injection machine is designed for prototype production or limited volume production, it is possible to use low-cost aluminum molds with this equipment. Some of our customers have also successfully used epoxy or silicon molds with properly designed support frames.

We at LNS Technologies had a outside company design and manufacture sample aluminum molds for us. These sample molds plus small quantities of plastic pellet materials are available for purchase on our website: www.techkits.com/bim. You may want to purchase one of our sample molds to allow you to practice with the Model 150A machine before you obtain your own custom mold. Also, you may want to purchase small quantities of various plastic pellets from us in order to determine the material that is most suitable for your molded item.

MOLD DIMENSIONS

Molds are usually designed as two halves so that the molded part can be removed after injection. When the mold is closed, the space between the two halves forms the mold cavity, that will be filled with molten plastic to create the desired part. Multiple-cavity molds are sometimes used, in which the two mold halves form several identical part cavities. As shown in Table 1, the volume of the mold cavity cannot exceed 1.25 cubic inches when used with the Model 150A injector.

A mold sprue opening is required to allow the molten plastic to flow from the nozzle into the mold cavity. As shown in Table 1, the minimum mold sprue opening diameter is 0.25" in order to work properly with the Model 150A nozzle.

The diagram on the right gives some general suggestions on mold construction. The maximum outside mold dimensions for use with this machine are 7" wide x 5" thick x 5" tall.

Figure 5

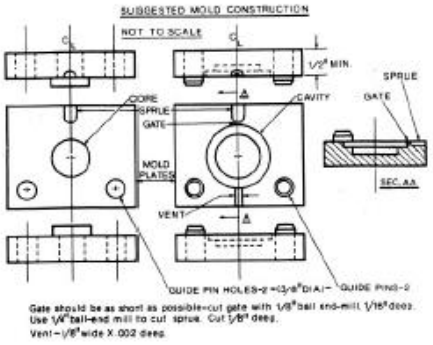


Figure 7 on the following page shows a 7" wide x 4" tall mold being used in the Model 150A.

MOLD CLAMPING

Extreme pressures can be developed when injecting molten plastic into molds. It is possible for the pressures inside the mold to exceed 1,000 pounds per sq. inch! This means the halves of the mold must be clamped together tightly during injection. The total clamp force needed is determined by the projected area of the part being molded. The required force can also be determined by the material used and the size of the part.

In order to keep the cost of the Model 150A affordable, a basic clamping vise (shown on the right) is included with the machine. Depending upon your particular mold design you may need to provide a stronger clamping mechanism for your mold.

Figure 6
Basic Clamping Vise

In some circumstance, alternate methods can be used to hold the mold closed other than the basic clamping vise. Often when injecting into large molds, two "C-clamps" can be used to hold the mold closed.

As seen in Figure 7, the basic clamping vise can be removed and the mold can simply rest on the base plate below the nozzle.

Also, some molds can be designed such that the two halves are bolted together and no clamping would be required.

Figure 7
Clamps without Vise

QUICK RELEASE CLAMP

We also offer as an accessory, a quick-release clamping fixture.

This handy toggle clamping fixture allows faster cycling that can increase the number of parts produced per hour.

(See ordering supplies on Page 24)

Figure 8
Optional Toggle Vise

MOLD HEATING

Mold Pre-heater—As explained in the overview, the mold will usually need to be pre-heated before injection to prevent the molten plastic from cooling too quickly. This is especially true when you first begin molding parts and the aluminum mold is at room temperature. Often, after molding several parts, the mold retains the heat from the molten plastic and the mold pre-heating can be lessened or skipped.

WARNING: A pre-heated or injected mold can be hot enough to cause severe burns! Always use protective gloves when handling the molds both before and after injecting.

A simple, economical & repeatable way to pre-heat the mold is to use a hot plate with adjustable temperature settings (see Figure 9). Using protective gloves, place the mold flat on the hot plate for a fixed time or use a thermometer to determine a more precise pre-heat temperature.

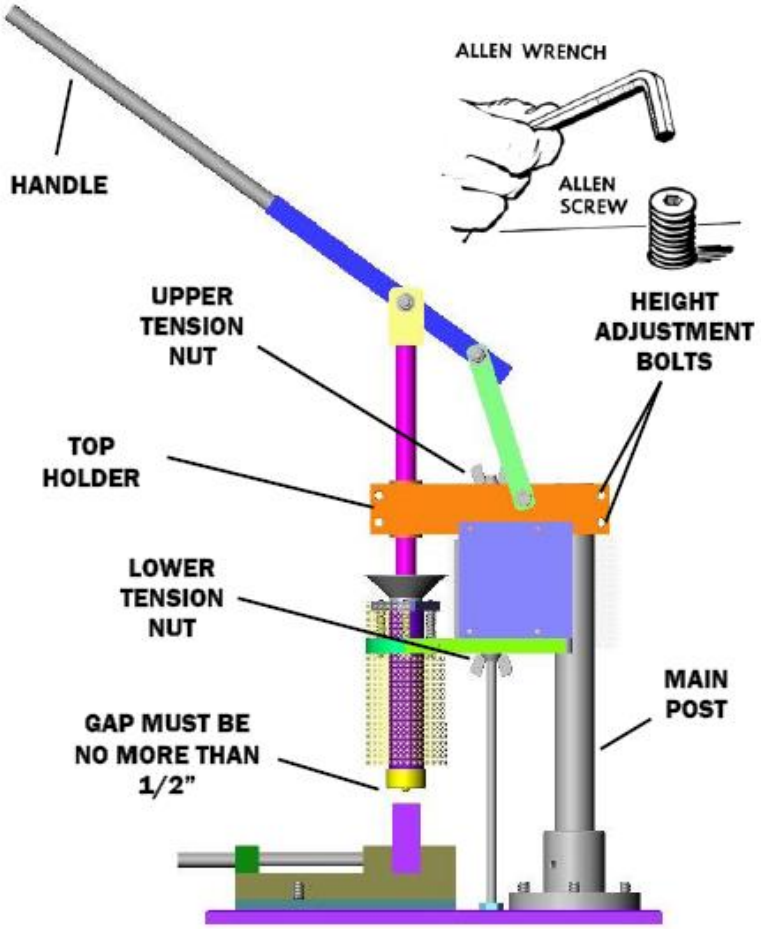
Table 2 (see page 9) shows recommended mold pre-heat temperatures for various thermoplastic materials. These temperatures are simply guidelines. You will need to experiment to find the best pre-heat temperature that will keep the molten plastic from cooling too quickly during the injection cycle. See Appendix B for more information on problems encountered during molding.

Figure 9
Mold Pre-heating

EQUIPMENT OPERATION

1. Before starting to inject with your Model 150A, it is important to adjust the height of the machine to work properly with the size of your mold. A 6mm Allen wrench is included to loosen and tighten the HEIGHT ADJUSTMENT BOLTS.

Figure 10
Height Adjustment



The height of the machine is changed by moving the TOP HOLDER higher or lower on the MAIN POST. The TOP HOLDER is clamped to the MAIN POST by the two HEIGHT ADJUSTMENT BOLTS. The goal of the machine height adjustment is to make sure that the gap between the nozzle and the top of your mold is less than 1/2 inch. This gap allows clearance to insert and remove the mold during each injection cycle. If this gap is too small the mold cannot be inserted below the nozzle. And if the gap is too big, the nozzle will not be able to make good contact with the mold during the injection stroke.

Step 1—Loosen the two HEIGHT ADJUSTMENT BOLTS using the 6mm Allen wrench. The TOP HOLDER position will now be determined by the UPPER & LOWER TENSION NUTS. By loosening both TENSION NUTS and then turning the LOWER TENSION NUT, the TOP HOLDER can be raised or lowered.

Step 2—If necessary, raise the TOP HOLDER far enough to insert and clamp your mold into the vise. Then raise or lower the TOP HOLDER so that the gap between the nozzle and the top of the mold is less than 1/2 inch. You may need to adjust the position of your vise so that the small nipple on the nozzle enters the sprue hole on the mold when the HANDLE is lowered.

Once you have the gap set, tighten the vise into position and then tighten the HEIGHT ADJUSTMENT BOLTS. Verify that the mold can be removed & inserted into the vise when the HANDLE is up. Then verify that the nozzle nipple repeatedly & smoothly enters the sprue hole on the mold when the HANDLE is lowered.

Step 3—Now tighten the UPPER and LOWER TENSION NUTS and the height adjustment is completed.

2. Plug the control box cord into an AC outlet. Turn power on to the barrel heater by turning on the On/Off switch on the control box. Once the AC power is on, the switch will be lit and the machine's temperature controller will become active.

3. Set the desired temperature on the temperature controller. Refer to Table 2 on page 9 for recommended temperature settings for the material being used. These temperatures are simply starting point guidelines. Refer to information given by the material's manufacturer before processing any thermoplastic.

4. On the temperature controller, when the PV display value reaches the SV display value, the machine has come up to its proper molding temperature. At this point, the temperature controller will automatically switch the barrel heater on and off to maintain the SV temperature value.

5. Use a scoop or dispenser to put the plastic pellets to be molded into the feeder until they reach the top of the barrel.

WARNING—Never touch the metal funnel shaped feeder with bare hands or fingers. It can be hot and can cause burns! Wear protective gloves and safety glasses at all times when using this machine.

6. Wait a few minutes after adding the pellets to allow time for the plastic pellets in the barrel to melt completely. If you are pre-heating the mold, this is a good time to start the mold pre-heat. When you see some molten plastic drooling from the nozzle, that is a good indication that the machine is ready to begin molding parts.

7. ALWAYS USE PROTECTIVE GLOVES WHEN HANDLING THE MOLD. Clamp the two halves of the mold firmly together using either a vise or "C-clamps. Make sure to position the mold directly below the nozzle so that the nozzle nipple will enter the mold's sprue hole when the barrel lowers during the injection operation.

8. **With a screwdriver or similar tool, scrape any molten plastic that may be drooling from the nozzle. Then pull down on the handle until the nozzle nipple seats into the mold sprue hole. Now exert a firm and uninterrupted pull on the handle to force the molten plastic into the mold cavity. If the injection stroke is not continuous, the plastic will start to solidify before the cavity is completely filled. Note: depending upon the mold design and the plastic material's properties, it can require a surprisingly large force to completely fill the mold cavity.**

9. **When the mold cavity is full, hold pressure on the handle for an extra few seconds. This gives the plastic a chance to cool a bit under pressure to avoid shrinkage of the plastic part. After the holding time, lift the handle to its fully up position so that more pellets can be added for the next cycle. As the handle is lifted, the barrel will rise and the mold can be removed and opened almost immediately.**

NOTE: Not every molded part will be perfect, especially in the beginning. The mold may overfill and cause flashing around the edges of the part. Or more commonly, the mold cavity may fail to fill completely. It may take some time and practice to get the feel for how much pressure and stroke are required for a particular mold or material. Barrel temperature settings and mold pre-heat temperatures can sometimes require experimentation.

Don't be frustrated if you can't produce perfect parts right away. Our suggestion is to start with high melt flow materials like our polypropylene before attempting more difficult materials like ABS. Also experiment with different temperatures for both the mold and for the barrel. Start with recommended temperatures and raise the temperatures in 10 deg increments to see if you get better results. If the parts start flashing or getting voids on the surface, then the temperatures have gone too high.

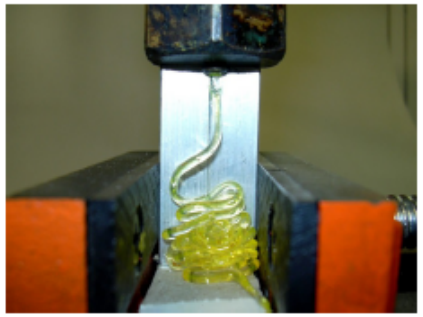
But the good news is that there is no wasted material. Sprues, flashing and rejected parts may be reused and molded again by cutting up the plastic into small pieces.

Consult Appendix B, the trouble-shooting section of this manual if you have difficulty making satisfactory parts. However, once you get the settings and the techniques working, you will then be able to consistently produce good parts. Often at a rate of one every few minutes.

EQUIPMENT PURGING

Purging is the process of cleaning the previous material from the machine. Note: purging of this machine is not required. The machine can be turned off with plastic material still in the barrel. The plastic material in the barrel will re-melt when the machine is turned back on. However, purging can be helpful when switching to materials of different colors. Purging with a natural color material will allow you to see when the previous material has been completely purged from the barrel.

Usually, an inert thermoplastic is used for purging, such as natural grade low-density polyethylene (LDPE). When LDPE is used, purging is complete when the polymer exiting the nozzle is completely clean (clear while hot). When you are planning to run both light and dark colored materials , it is a good idea to use the lighter color first, as darker colors are more difficult to purge completely. **NEVER combine acetal and PVC in the barrel for any reason!**



WARNING—Always use safety glasses and protective gloves when performing a purging operation. Hot plastics, especially when they contain excess moisture, may burst from the nozzle with an explosive force when injecting or extruding into the air. NEVER combine acetal and PVC in the barrel for any reason!

Note: the nozzle must be pressed against a surface such as a mold during purging. If you attempt to inject or extrude with the nozzle in the open air, the machine can be damaged.

Here are the steps for purging the **PIM-SHOOTER™:**

1. Put on protective gloves and safety glasses, then position a mold so the nozzle rests against the top edge of the mold when the handle is pulled down. (See photo above).

2. Turn the control box power on and enter the proper temperature setpoint in the temperature controller (see page 8).

3. Add the LDPE material to the feeder until the barrel is full and wait until the barrel reaches the temperature setpoint.

4. Now steadily pull the handle on the drill press to force the molten plastic out of the machine. WARNING—Do not touch the molten plastic. It is hot and can cause burns.

5. Repeat steps 5 and 6 until the plastic leaving the nozzle is clean and clear.

EQUIPMENT MAINTENANCE

The **PIM-SHOOTER™** is a simple machine and has been designed to require very little regular maintenance. Here are recommendations:

- Keep the work area neat and clean.
- Keep dirt or foreign material away from the feeder and from entering the barrel.
- All bare steel parts like the ram shaft, handle and main post should be wiped clean and lightly oiled regularly to avoid rust.

REPAIRS

The **PIM-SHOOTER™** has no user serviceable parts. If your machine needs repair contact us and we will help with your service needs.

LNS
TECHNOLOGIES
PO Box 66301
Scotts Valley, CA 95067
www.techkits.com

We will provide you with an estimate of the repairs costs if the unit is past the 90-day warranty period.

FOR SAFETY AND TO PREVENT VOIDING THE WARRANTY:

- Do not disassemble the nozzle or barrel for any reason. Use the purging operation to remove unwanted plastic material.
- Do not modify any part of this machine or enlarge the nozzle opening.
- Do not attempt to open the control box. There are no user serviceable parts inside.
- Do not remove the guard.
- Do not modify any parameters in the temperature controller except the setpoint (SV).

Appendix A — Thermoplastics Properties

The materials listed below have been tested to work with this machine. Do not attempt to use materials that require barrel temperatures above 490°F (like nylon). Do not use PVC in this machine. PVC can release toxic fumes and can be very corrosive.

The information contained below has been accrued through our experience with the thermoplastic materials listed. It is intended as a rough guide and is not a comprehensive listing of all materials on the market. Note that within each type of thermoplastics there are many grades with varying properties. But this should provide a general introduction to the materials that we have obtained & tested.

Acetal (Delrin, Etc.)
Acetal plastic produces formaldehyde gas when overheated which can be noxious, so follow the temperature setting recommendations. Always purge the material when you suspect overheating. Be careful when purging, because gases formed may force material back through the feeder. Maintain temperatures below 420°F to avoid overheating and use adequate ventilation when molding acetal.

Rapid filling of the mold and mold pre-heating helps produce best molding results.

Thermoplastic Elastomer (TPE)
TPE's show advantages of both rubbery materials and plastic materials. Molded parts are flexible and have a soft rubbery feel. This material is very easy to inject and the mold requires little or no pre-heating. TPE parts are easy to remove from the mold.

TPE materials come in many blends with varying flexibility properties. Each specific blend will have different molding temperatures.

Acrylonitrile Butadiene Styrene (ABS)
ABS can be a challenging material to inject. ABS plastic must be stored in a sealed container in dry conditions to prevent it from absorbing moisture. ABS will tend to shrink after it is in the mold cavity, so holding pressure for several seconds after injection and mold pre-heating will produce best molding results.

Polypropylene (PP)
Polypropylene is extremely chemical resistant and almost completely impervious to water. It is widely used for chemical containers and industrial applications. Typical polypropylene items include toys, battery boxes, patio furniture & dishwasher safe food containers.

Polypropylene does not absorb moisture like ABS, so no pre-drying of the pellets is required. It is fairly easy to inject, but the mold will need pre-heating for best results. PP will tend to drool from the nozzle. Injection temperatures can range from 380°F to 425°F.

Polypropylene will tend to shrink after it is in the mold cavity, so hold pressure for several seconds after injection.

Polyethylene (PE)
Polyethylene is likely the most common thermoplastic in everyday use. Low density polyethylene (LDPE) is the cheapest type and is commonly used to make shrink wrap packaging. High density polyethylene (HDPE) is more expensive and comes in multiple densities. Polyethylene is often used for household bottles, packaging films, pallets, milk crates and toys.

Low Density Polyethylene (LDPE)
LDPE is often used to purge other materials from the machine (see page 20), but can also be used to mold finished parts. LDPE does not flow readily, so you may not see any drooling from the nozzle. Also the pressure needed to inject LDPE into the mold cavity is higher than the other materials listed.

LDPE does not absorb moisture, so no pre-drying of the pellets is required. The mold will need pre-heating for best results. Injection temperatures can range from 350°F to 410°F.

LDPE will tend to shrink after it is in the mold cavity, so holding pressure for several seconds after injection and mold pre-heating will produce best molding results.

High Density Polyethylene (HDPE)
Since HDPE is denser than LDPE it requires higher heat for injecting. Injection temperatures can range from 410°F to 440°F.

Ethylene-Vinyl Acetate (EVA)
EVA material for injection molding is soft and flexible. It is easy to inject and the mold does not usually require any pre-heating. EVA has very little shrinkage & releases from the mold easily. Do not hold pressure after the cavity has filled. At temperatures above 420°F EVA can emit fumes which must be avoided.

Polystyrene (PS)
Polystyrene is likely the second most common thermoplastic in everyday use. It is used to make toys, appliance housings, pushbuttons and knobs plus CD and DVD cases.

No pre-drying of Polystyrene pellets is required. The mold will need pre-heating for best results. Injection temperatures can range from 350°F to 410°F.

Melt Flow Index

The melt flow index (MFI), also known as the melt flow rate (MFR), determines the melt flow properties (measured in g/10 min) of a material at a specific load and temperature. In general, thermoplastic materials with a high melt flow index (15-35) will flow easier into the mold than a material with a low melt flow index (1-9). Whenever possible, try to use plastics that have a high MFI in order to get best results with this equipment.

Appendix B — Molding Problems

Problem	Possible Causes	Corrective Action
Short Shot (mold not full)	1. Mold too cold 2. Plastic is too cold 3. Injection pressure low	1. Increase mold pre-heat 2. Increase controller setpoint 3. Increase injection pressure
Flashing on molded part	1. Injection pressure too high 2. Clamp force too low 3. Foreign matter on surfaces	1. Reduce injection pressure 2. Increase mold clamp force 3. Clean mold surfaces
Part has bubbles or is blistered or streaked	1. High moisture in pellets 2. Plastic temperature too high	1. Use only dry material 2. Reduce controller setpoint
Part is burned or discolored	1. Plastic temperature too high 2. Previous material residue	1. Reduce controller setpoint 2. Purge previous material
Sink marks in molded part	1. Mold too hot 2. Injection pressure too low 3. Plastic temperature too high 4. Pressure hold time too short	1. Reduce mold pre-heat 2. Increase injection pressure 3. Reduce controller setpoint 4. Increase pressure hold time.

SHORT SHOT

FLASHING & SINK MARKS

Appendix C — Ordering Supplies

Additional pellets, molds and other supplies & accessories can be ordered from the **PIM-SHOOTER™** website: www.easyplasticmolding.com

LNS Technologies
PO Box 66301
Scotts Valley CA 95067
(707) 328-6244

Appendix D — FAQ (Frequently Asked Questions)

- **Do I have to purge the machine before turning it off?**

No, purging is not required. The machine can be turned off with plastic material still in the barrel. The plastic material in the barrel will re-melt when the machine is turned back on. Purging can be helpful when switching to materials of different colors. Purging with a natural color material will allow you to see when the previous material has been completely purged from the barrel, but is not required.

- **Can Polystyrene be injected with the machine?**

Polystyrene has been tested and it can be successfully injected with this machine. However, polystyrene parts will be VERY difficult to remove from the mold. Since all of our molds are aluminum, the mold could be damaged when trying to remove polystyrene parts. If you use polystyrene with aluminum molds, a mold release is recommended.

- **Why are Nylon and PVC materials unsuitable?**

The maximum temperature that this machine can operate at is 490 deg F. Nylon typically requires higher temperatures than 490 deg F. for injection. Any thermoplastic materials that require injection temperatures above 490 deg F. will not work with this machine.

PVC plastic can emit toxic vapors when heated and PVC can corrode the metal parts of the machine. Never use PVC plastic with this machine!

- **Can recycled plastics be used in this machine?**

Yes! Rejected parts can be cut into small pieces and placed back into the barrel. Also, clean recycled LDPE or HDPE bottles can be cut into small strips and used in this machine.

- **I set the recommended temperature, but the material is difficult to inject.**

Each type of material has many property variations. The recommended temperatures should be used as a starting point. If the material does not melt and flow, then gradually increase the temperature setting in 10 degree increments until you get satisfactory results. But never attempt to set temperatures above 490 deg. F. on this machine. Note: the temperature is set too high if the material from the nozzle is discolored, makes a popping noise, emits fumes or contains gas bubbles.