Morgan-Press Injection Molder

Standard Operating Procedure
Morgan Industries, Inc.
Model G-100T

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Introduction

The Morgan-Press, Model G-100T, is an injection molder designed for practical and economical manufacturing of thermoplastic parts in quantities required for prototyping and low-volume production. It is primarily used for encapsulation, engineering prototypes, medical/dental devices, and marketing samples. The Morgan-Press is an ideal molder because it is easy to change molds and materials to make different parts. It is also capable of processing a full range of thermoplastic materials.

The Model G-100T Morgan-Press Injection Molder has the following specifications:

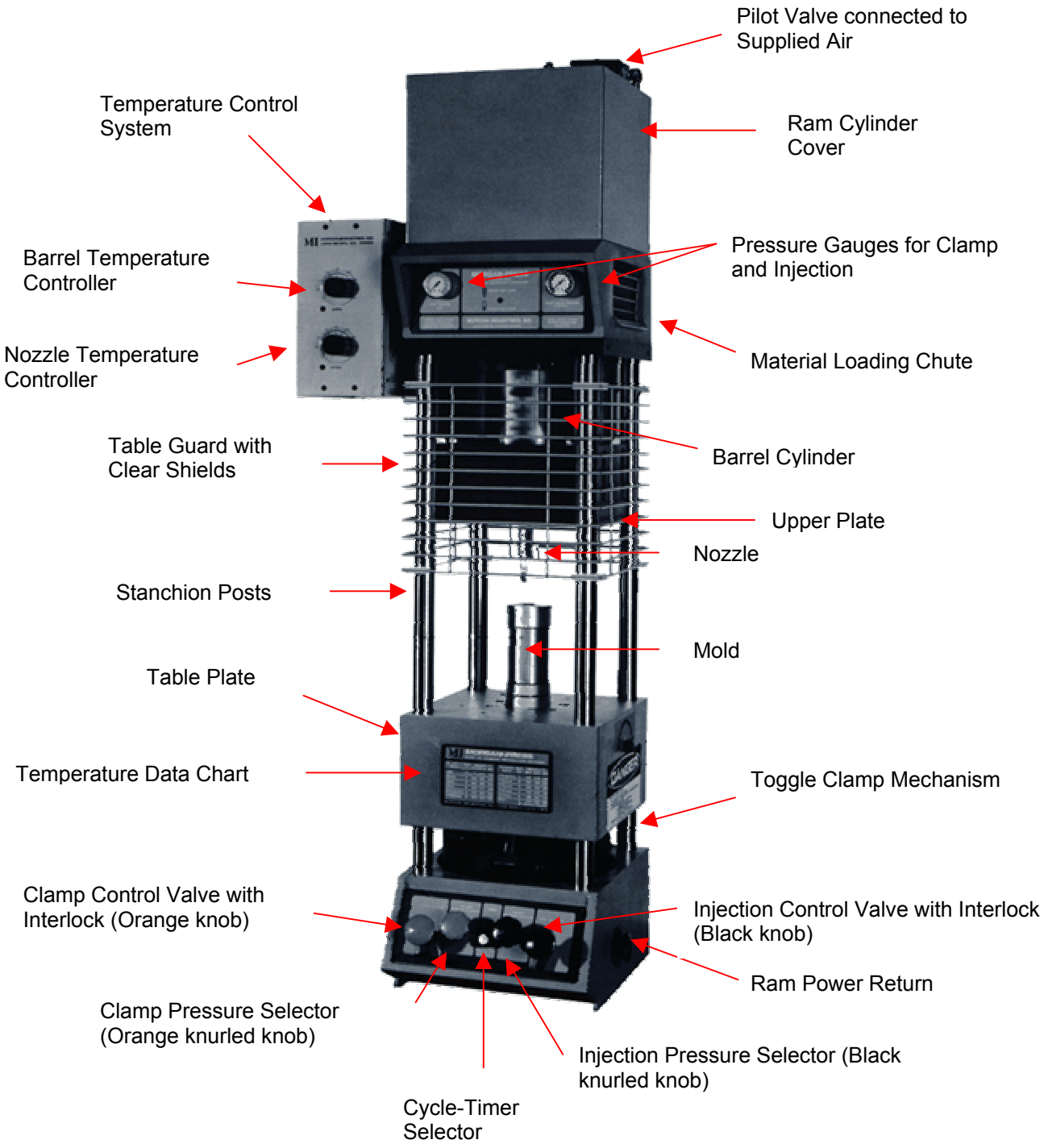
- 0 – 800 °F (0 – 430 °C) temperature control range
- 6 cu. in. (4 oz.) maximum single shot
- 20 ton maximum clamping force (toggle)
- 12,000 psi maximum injection pressure
- Utilities required:
  - Electrical: 120 volts AC
  - Compressed air: 200 psi (max.)

The operating instructions and instructional video should be carefully reviewed prior to operating the Morgan-Press. Included in the manual are the equipment setup, pneumatics of the mold injector, manual operating instructions, shutdown, and maintenance.

Caution: Always exercise caution and use proper protective equipment when operating the Morgan-Press.

1 Equipment Setup

Below is a diagram of the equipment set up for the Morgan-Press Model G-100T.



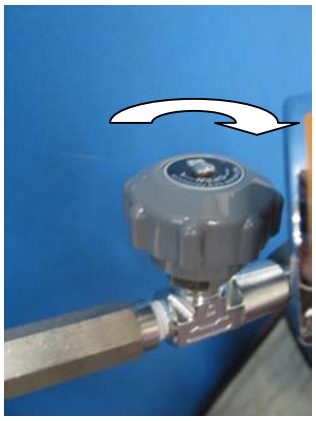
2 Pneumatics

2.1 Introduction

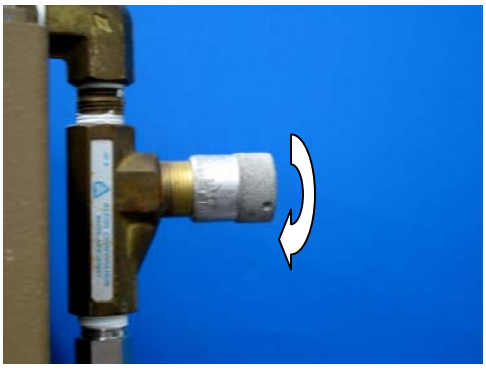
The pneumatic system is used to operate the clamp system and the injection system. The air supply for the pneumatic system should be from a compressed air source. Line pressures up to 200 psi can be used safely. The minimum supplied air pressure for proper operation is 100 psi. At low pressures the machine will still function, however, the maximum clamp force and maximum injection pressures will be lower accordingly. When operating at higher temperatures and with more viscous materials, higher air pressure should be used.

The minimum air flow for proper operation is 1 cubic feet per minute (cfm). Inadequate air flow will result in reduced injection speed and pressure recovery time. If short shots or poorly filled parts are observed, the air flow is too low.

2.2 Pneumatic Hookup

Make sure the safety valve on the air supply is turned to the closed position	
Open the compressed air valve slightly	

Pneumatic Hookup (cont'd)

Adjust valve so that the pressure is about 200 psi	
Open the safety valve to allow the air to flow through the molder	
Adjust the middle gauge valve (not pictured) to ensure a pressure of about 200 psi is flowing through the system.	
Completely open the flow control valve to maximum flow.	

2.3 Pneumatic Controls

The pneumatic controls are located at the base of the machine. The two orange knobs control the clamp system; the two black knobs and the silver knob control the injection system.

The Clamp Pressure Gauge and Injection Pressure Gauge are located at the top panel of the molder.

Clamp Pressure Gauge

Injection Pressure Gauge

The Ram Return Valve is located on the right side of molder base.

2.3.1 Clamp System

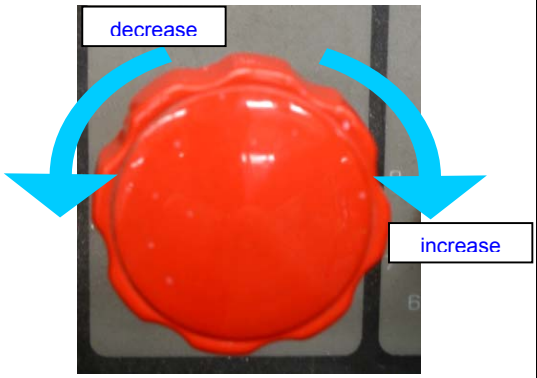
Below are the two knobs that control the Clamp System. The Clamp Control Valve controls the raising and lowering of the Table Plate. The Clamp Pressure Selector Valve regulates the air pressure to the Clamp Control Valve. A maximum of 20 tons of clamp force is exerted at 200 psi air pressure.

Clamp Control Valve

Clamp Pressure Selector

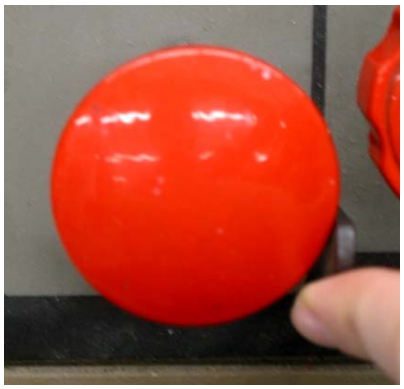
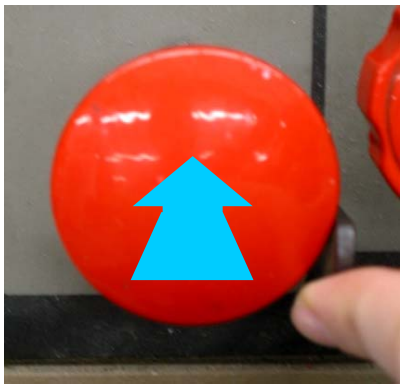
☞ When clamping at 10 tons or greater, the Upper Plate assembly must be used. Excessive clamp force against the nozzle will cause damage to top casting.

Step 1: Set the Clamp Pressure

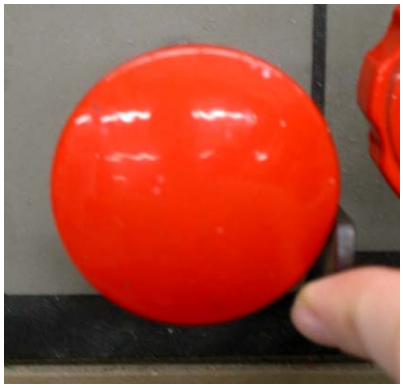
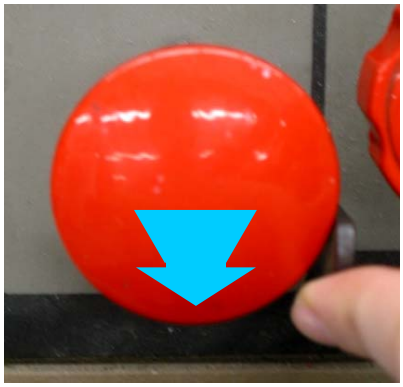
Rotate the Clamp Pressure Selector - clockwise: increase - counterclockwise: decrease	
Check that the clamp pressure is set to the desired pressure on the Clamp Pressure Gauge	

☞ The Table Guard must be locked down before the Table Plate can be moved.

Step 2: Raise the Table Plate

On the Clamp Control Valve, move the interlock upward	
While holding the interlock up, push the orange knob in until the table plate is at the desired height	
Release the interlock to maintain the table plate at the desired height	

Step 3: Lower the Table Plate

On the Clamp Control Valve, move the interlock upward	
While holding the interlock up, pull the orange knob in until the table plate is lowered to the desired height	
Release the interlock to maintain the table plate at the desired height	

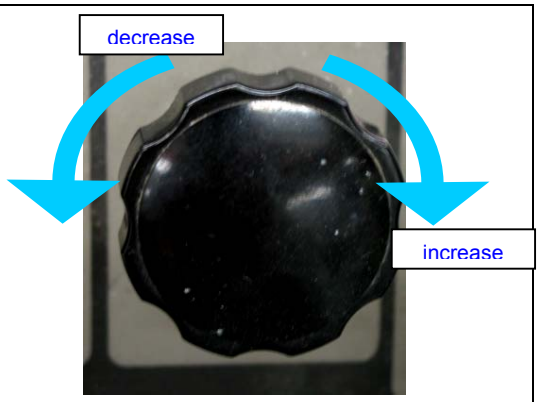
2.3.2 Injection System

Below are the two knobs that control the Injection System. The Injection Control Valve controls the raising and lowering of piston. The Injection Pressure Selector Valve regulates the air pressure to the Injection Control Valve. The operating range for the injection pressure is from 6-8 x 10 psi.

Injection Control Valve

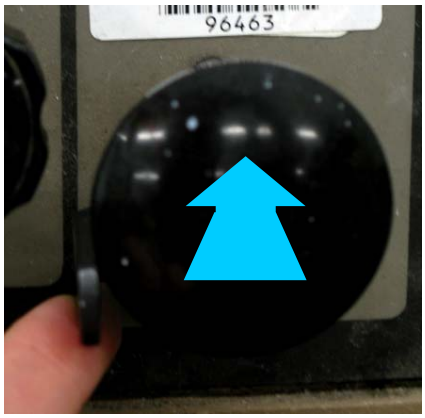
Injection Pressure Selector

Step 1: Set the Injection Pressure

Rotate the Injection Pressure Selector - clockwise: increase - counterclockwise: decrease	
Check that the injection pressure is set to the desired pressure on the Injection Pressure Gauge	

☞ The Table Guard must be locked down before the material can be injected.

Step 2: Inject Polymer

On the Injection Control Valve, move the interlock upward	
While holding the interlock up, push the black knob in In the Material Loading Chute, watch as the Ram Rod pushes the plastic down through the barrel Release the black knob when the Ram Rod is completely depressed	
Release the interlock	

Step 3: Return the Ram Rod

Push the Ram Return Valve intermittently until the end of the Ram Rod is visible in the Material Loading Chute	

3 Temperature Control

3.1 Introduction

Temperature can be controlled with three heaters at 3 different locations on the Morgan Press:

Barrel Temperature Controller

Nozzle Temperature Controller

Hot Plate Temperature Controller

The Barrel heater initially melts the plastic, while the nozzle and Hot Plate control polymer temperature during the molding process. The Barrel and Nozzle Temperature Controllers, with ranges between 0 to 800˚F, are located on a separate electrical cabinet on the left side of the Morgan Press. A set point temperature may be set by depressing the controller knobs and adjusting the temperature value. A signal light near the control knobs periodically turn on when electrical current is running through the system to raise the temperature. When the light is off, the set point has been reached.

The hot plate temperature, which controls the temperature of the mold, has its own setting located on the front of the plate. A signal light on the hot plate will turn on when it is in use.

A guideline of appropriate temperatures for different materials can be seen on the chart placed on the bottom front of the Morgan Press. As a rule of thumb, use the minimum temperature at which the material will flow successfully into the mold. The barrel temperature setting will usually be 20 to 50˚F below the nozzle setting.

☞ These temperatures are simply guidelines. Refer to information given by the material's manufacturer before processing any thermoplastic.

☞ The temperature is probably too high if material drooling from the nozzle appears discolored, contains gas air bubbles, or emits fumes.

☞ The material is probably too low if it does not drool from the nozzle or does not appear to be in a fluid state during extrusion.

Caution: PROLONGED HEATING MAY CAUSE ADVERSE PHYSICAL EFFECTS FOR DIFFERENT MATERIALS. MAINTAIN A CONSISTENT MOLDING CYCLE.

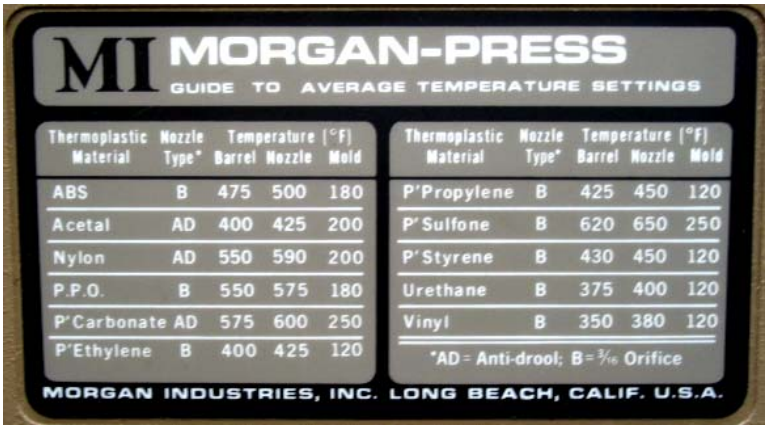
AVOID BODILY CONTACT WITH MOLTEN MATERIAL AND HEATED SURFACES.

3.2 Operational Procedures

Before You Begin

Once Morgan Press is plugged in and turned on, the temperature controls for the barrel and nozzle, located on the electrical cabinet, automatically turn on.

Determine the proper temperatures needed for your material. Use the temperature chart or manufacturer information. Tests may also be performed to determine optimum temperatures to properly melt the material.



MI MORGAN-PRESS

GUIDE TO AVERAGE TEMPERATURE SETTINGS

Thermoplastic Material	Nozzle Type*	Temperature (°F) Barrel	Nozzle	Mold
ABS	B	475	500	180
Acetal	AD	400	425	200
Nylon	AD	550	590	200
P.P.O.	B	550	575	180
P'Carbonate	AD	575	600	250
P'Ethylene	B	400	425	120
P'Propylene	B	425	450	120
P'Sulfone	B	620	650	250
P'Styrene	B	430	450	120
Urethane	B	375	400	120
Vinyl	B	350	380	120

*AD = Anti-drool; B = 3/16 Orifice

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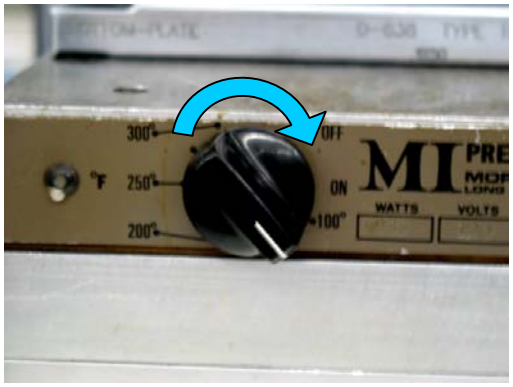
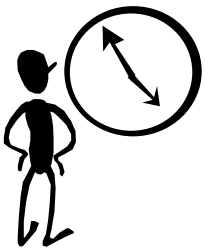
Step 1: Setting the Barrel and Nozzle Temperatures

Depress and turn the temperature control knobs for the barrel and nozzle until desired temperature set points are reached	

Step 2: Setting the Hot Plate Temperature

Situate mold (and spool, if necessary) appropriately on top of the hot plate.	
Plug in Hot Plate, and set temperature to desired set point	

Wait until the hot plate is given enough time to reach the desired temperature and the set points are reached on the barrel and nozzle temperature controllers (signal light off).



4 Manual Operation

4.1 Purging the Morgan-Press

The Morgan-Press should be purged of residual polymer prior to use which will:

1. Cleanse the barrel of polymer with contaminants, impurities, or degradation
2. Remove corrosive or abrasive materials which may attack the steel if left in the barrel cylinder for extended periods
3. Facilitate changing/cleaning of the nozzle

4.1.1 Purging Materials

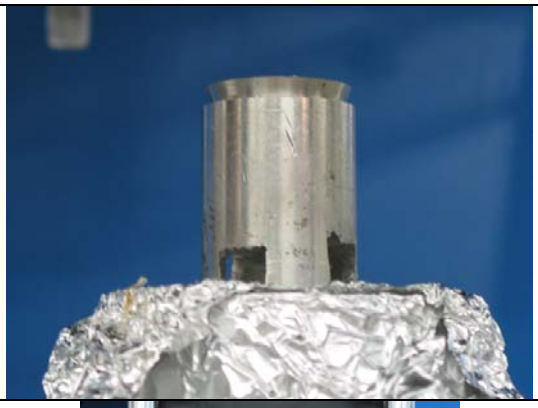
Usually, an inert thermoplastic is used for purging, such as natural grade polyethylene or polypropylene. Since it is readily available, low-density polyethylene (LDPE) should be used.

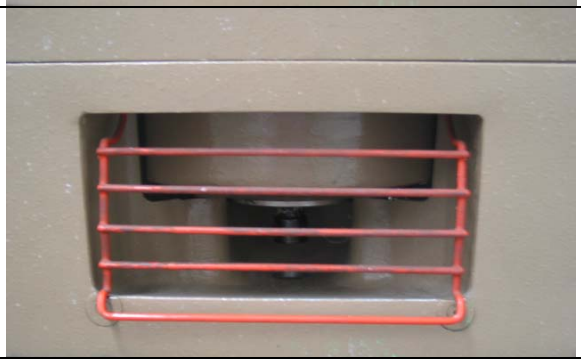
4.1.2 How to Purge

The most common way of purging the Morgan-Press is to freely extrude the residual polymer out of the Barrel. The Barrel is loaded with the desired purging material and repeatedly purged until the extrusion is satisfactory. Since LDPE is recommended for use in purging the barrel, purging is complete when the polymer exiting the nozzle is completely clean (clear while hot).

A purging mold, created by Matt Cline, is used for purging. This ensures that the nozzle safety interlock is satisfied.

The following steps explain how to purge the Morgan-Press:
(*see instructional video for further explanation*)

1. Place the purging mold on the Table Plate and make sure that it is properly centered	
2. Close the Table Guard	

3. Adjust the height of the Table Plate until the purging mold is flush with the nozzle	
4. Adjust the temperature for the Barrel and the nozzle to the proper molding temperatures	
5. Add the polyethylene to the Material Loading Chute and fill the barrel until it is full	
6. Remove excess polyethylene and close the Gate	
7. Adjust the injection pressure to 7 x 10 psi using the Injection Pressure Selector	
8. Inject the polyethylene through the purging mold until no more polymer comes out (*see Section 2.3.2*)	
9. To return the Ram Rod, press the Ram Return Valve on the side of the molder intermittently until the end of the Ram Rod is visible in the Material Loading Chute	
10. Repeat until the polymer leaving the nozzle is clean	

☞ Place aluminum foil wrapped cylinders under the purging mold for easy clean-up.

☞ Injection will not be possible until the Chute Gate is securely closed to satisfy safety interlock.

5 Shutdown

When the machine is no longer in use, follow the appropriate shutdown procedures below:

5.1 Shutdown without Purge

1. Switch off Temperature Controls and disconnect the electrical power cord
2. Check that the Ram Piston is above the Barrel
3. Turn the Clamp, Ram, and Injection Speed Control regulators off (check that pressure gauges read zero pressure)
4. Disconnect the air line or turn off the regulator that is supplying the unit

5.2 Shutdown with Purge

1. Turn the temperature controllers off or to the proper settings for the material that is used for purging
2. Remove mold from the machine (Follow instructions for purging located in section 3.1)
3. When purging is complete, perform steps 1 through 4 in section 4.1

☞ Not all applications require purging during the shutdown procedure.

☞ Polycarbonate and ABS should be purged because they will leave a brown film on the barrel wall.

☞ Vinyl polymers and copolymers (PVC) should always be purged because they are very corrosive.

☞ Thermoplastic left in a barrel during shutdown and re-plasticized will degrade to some extent.

6 Maintenance

The Morgan Press requires very little regular maintenance. However, it is recommended that the following procedures be adopted in maintaining the machine:

1. Stanchion posts should be wiped clean and lightly oiled regularly.
2. Put oil in the holes provided on the thrust and pivot arms of toggle mechanism under the table on weekly basis or when dry.
3. Keep dirt, granules, and chips out of the toggle area and off the table platen.
4. Grease the table gears every six months.
5. Keep the Ram Shaft clean of excess material constantly.
6. Keep work are neat and clean.
7. Inspect moveable parts for signs of wear.

6.1 Parts Listing

In the event of a malfunctioning part, locate the part from the list below to find the manufacturer so a replacement can be ordered.

PART NAME	**MANUFACTURER**
BASE CASTING ASSEMBLY	
Toggle Base Casting	Morgan
Lower Panel	Morgan
Control Valve Drop Bar (2)	Morgan
Clamp Air Regulator	Watts #R-113-02-DP
Ram Air Regulator	Watts #R-113-02-DP
Clamp Control Valve	Lexair #M384-0602
Ram Control Valve	Lexair #M382-1306
Timer Valve	Watson #180-N-PM
Ram Return Valve	Lexair #M382-0601
Clam Control Valve Muffler (2)	Allied Witan #C28
Injection Control Valve Muffler	Allied Witan #CP28
Reservoir Cover	Morgan
Reservoir Gasket	Morgan
TABLE ASSEMBLY	
Table Platen	Morgan
Table Guard	Morgan
Lexan Shield (4)	Morgan
Post Slider, Table Guard (8)	Morgan
Actuator Pin	Morgan
Table Actuator, Interlock Valve	Air & Hydraulics #321004
Elevating Shaft	Morgan
Elevating Gear	Boston Gear #L-152-BY-P
Temperature Data Label	Morgan
Up/Down Label	Morgan
3/8" Allen Key with molded handle	Morgan

MOUNT PLATE ASSEMBLY

Mount Plate	Morgan
Shroud	Morgan
Upper Panel	Morgan
Clamp Pressure Gauge	U.S. Gauge #102030
Ram Pressure Gage	U.S. Gauge #102030
Ram Actuator Interlock Valve	Air & Hydraulics #321204
Chute Cover	Morgan
Chute Guard	Morgan
Spring Clip, Table Guard	Seastrom #4521-16-50-2C

TEMPERATURE CONTROLLER CABINET

Cabinet Housing	Morgan
Cabinet Door	Morgan
Mounting Bracket	Morgan
Nozzle Temperature Control	Watlow Series 100 standard or
Barrel Temperature Control	Watlow Series 808 optional
Electric Cord	Morgan
Strain Relief	L-51 Electroline
Terminal Strip	Kulka #600-10
Rocker Switch	Carlingswitch #LTILA54-6S-WH-RC-NBL

TOGGLE CLAMP MECHANISM

Base Plate Assembly (All welded)

Base Plate	Morgan
Side Plate (2)	Morgan
Angle Bracket (2)	Morgan
Side Pivot Lug (2)	Morgan
Center Pivot Lug	Morgan

Cylinder Assembly

Cylinder	Morgan
Cylinder Back Cover	Morgan
Cylinder Over Retainer Bracket	Morgan
Cylinder Piston	Morgan
Cylinder Drive Shaft	Morgan
Cylinder Piston O-Ring	Parco #568-429 Buna-N
Back Cover O-Ring Seal	Parco #568-162 Buna-N
Back Shaft O-Ring (2)	Parco #568-214 Buna-N
Cylinder Pivot Dowel Pin (2)	SPS Unbrako 5/8" x 1 3/4"

Thrust Shaft Assembly

Threaded Shaft	Morgan
Shaft Sleeve (Welded) with:	Morgan
Steel Ball	1 1/2" Steel Ball
Ball Retainer	Morgan
Bevel Gear	Boston Gear #L-152-BY-G
Ball Socket	Morgan
Retainer Nut	Morgan (1 1/4" - 12 nut)

Connecting System

Connecting Arm (2)	Morgan
Connecting Arm Dowel Pin (2)	SPS Unbrako 5/8" x 4"
Shock Absorber Pad (2)	Morgan
Pivot Shaft	Morgan

TIE BAR ASSEMBLY

Stanchion Post (4)	Morgan
Stanchion Nut (8)	Morgan
Stanchion Washer (8)	Morgan

UPPER PLATEN ASSEMBLY

Top Plate	Morgan
Side Legs (2)	Morgan
Side, Lower box (2)	Morgan
Front/Back, Lower Box	Morgan
Bottom Plate	Morgan

BARREL ASSEMBLY

Barrel Assembly	Morgan
Flange	Morgan
Flange Spacer (3)	Morgan
Barrel Insulation Collar	Morgan
Barrel Heater Band	Glenn #3066 S1Y-36"
Nozzle Heater Band	Glenn #2424 S1Y-36"
Thermocouple Bayonet Adapter (2)	Gordon #TH298-1
Thermocouple (2)	Gordon #1598-42-4
Barrel Heat Guard/Insulation	Morgan
Silicon Bolt Spacer (3)	Morgan
Metal Bolt Spacer (3)	Morgan
Barrel Bolt (3)	3/8-16 x 5" Soc Hd Cap Screw
Nozzle	Morgan

TABLE ASSEMBLY

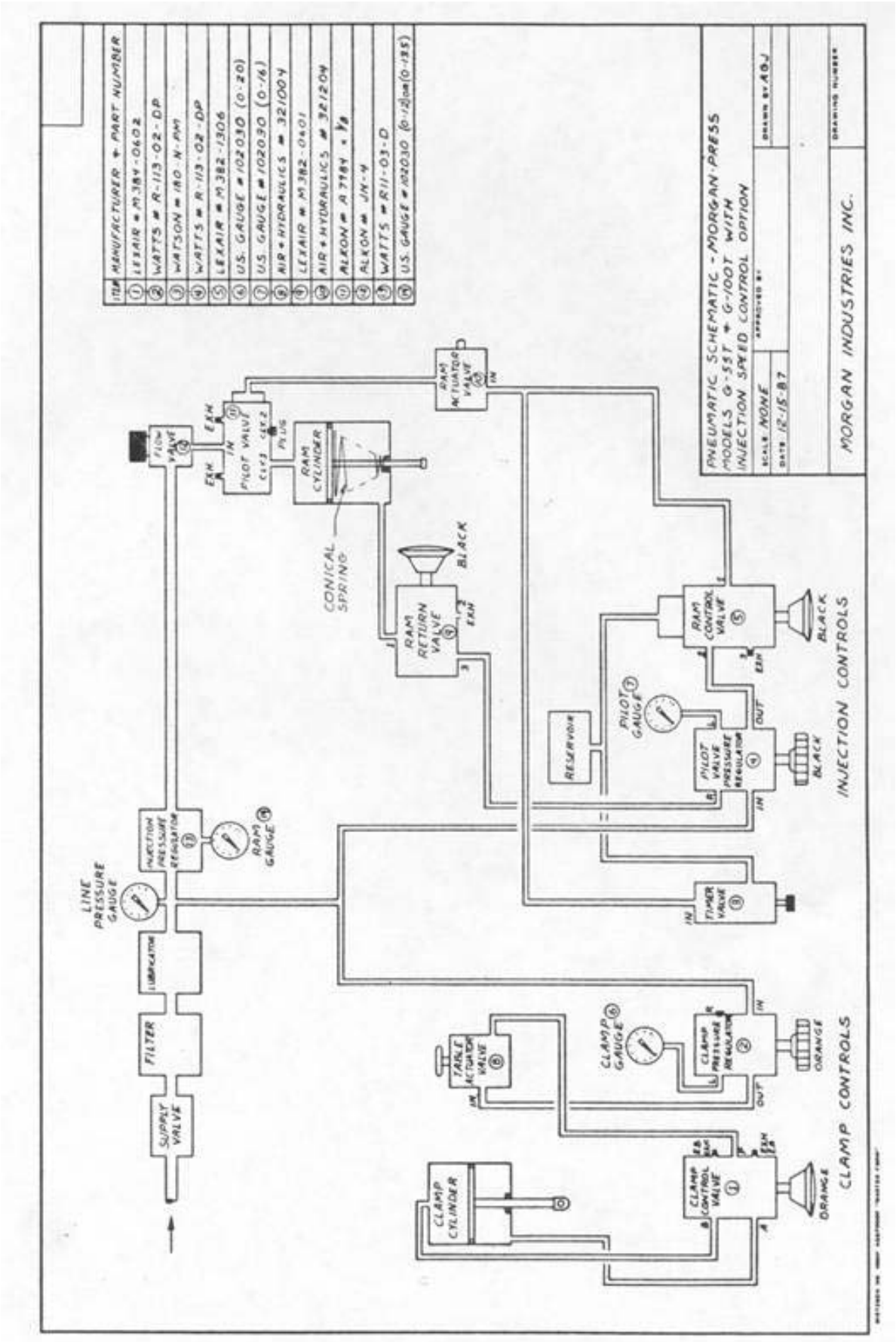
Ram Cylinder	Morgan
Ram Cylinder Cover	Morgan
Ram Cylinder Piston	Morgan
Ram Shaft	Morgan
Barrel Piston	Morgan
Ram Cylinder Piston O-Ring	Parco #568-443 Buna N
Ram Shaft O-Ring (2)	Parco #568-117 (Viton)
Ram Return Spring	Morgan
Ram Cylinder Gasket	Morgan
Quick Exhaust Valve	Hannifin #OR-25
Quick Exhaust Valve Muffler	Allied Witan #M02

7 Troubleshooting

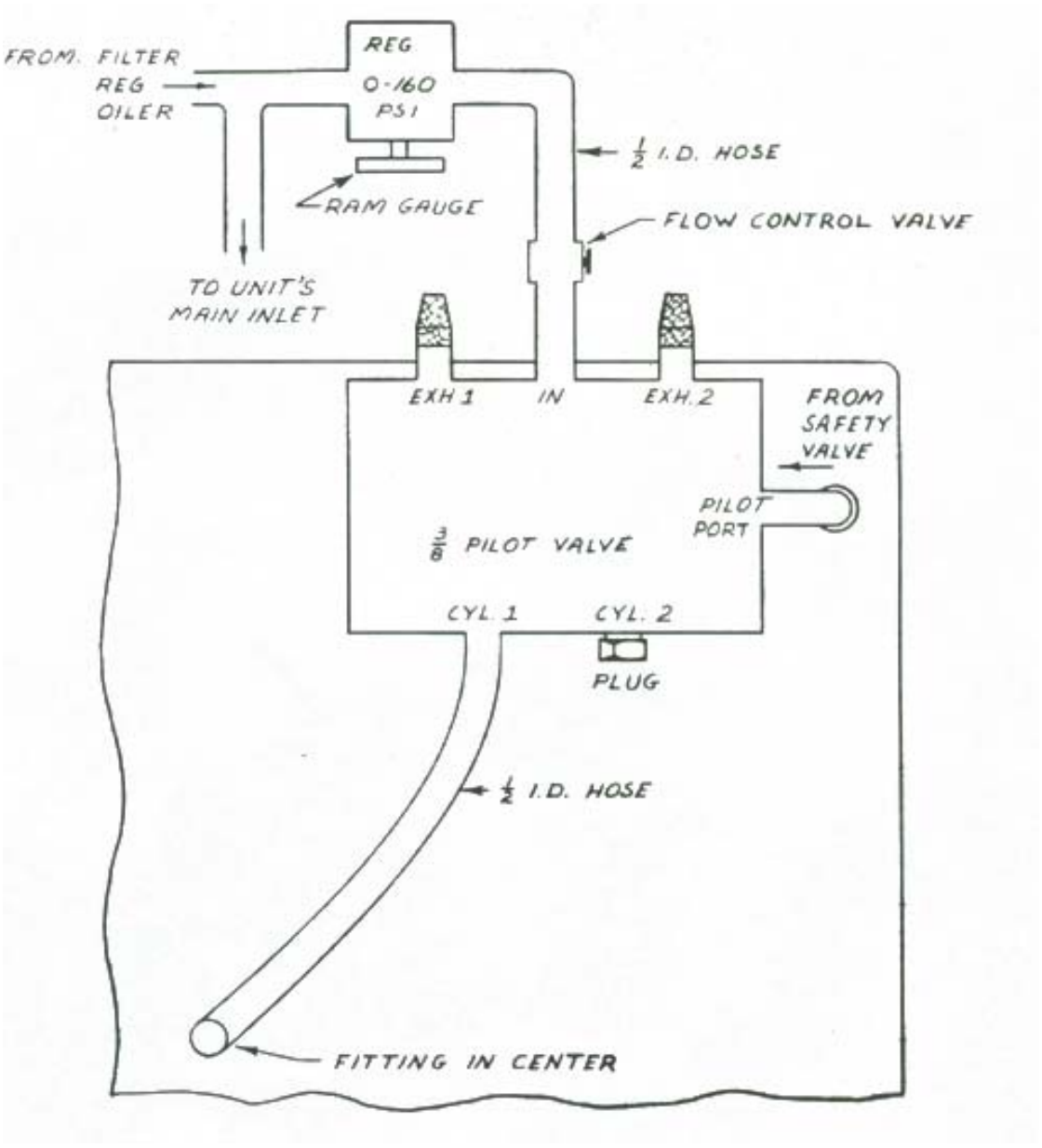
Defect	Possible Causes	Corrective Action
Mold not full (short shot)	1. Material too cold 2. Mold too cold 3. Insufficient cavity venting of mold 4. Injection pressure too low 5. Time cycle too short 6. Gates and/or runners too small	1. Raise barrel and nozzle zone temperatures 2. Apply heat to mold 3. Rework mold to allow more venting 4. Raise injection pressure 5. Increase injection cycle time 6. Increase the size of runners and gates
Mold halves separate (part flashed at parting line)	1. Injection pressure too high for clamp force selected	1. Lower injection pressure, pr raise clam force, or both
Part discolored	1. Heat too high 2. Cycle time too long	1. Lower selected temperatures 2. Shorten cycle time
Excessive “sink” in part	1. Part design 2. Injection pressure too low 3. Gate too small 4. Cycle time too short 5. Material too hot 6. Mold too hot	1. Avoid thick sections 2. Raise injection pressure 3. Adjust mold to allow more gating 4. Increase injection cycle time 5. Lower nozzle and barrel temperatures 6. Cool mold
Surface of part streaked, blistered, and/or bubbles in part	1. Moisture in material granules 2. Material temperature too high	1. Dry material thoroughly before molding 2. Lower nozzle and barrel temperatures

Appendix

Pneumatic System



Pilot Valve


FROM. FILTER
REG
OILER
REG
0-160
PSI
1/2 I.D. HOSE
RAM GAUGE
FLOW CONTROL VALVE
TO UNIT'S
MAIN INLET
EXH 1
IN
EXH. 2
FROM
SAFETY
VALVE
PILOT
PORT
3/8 PILOT VALVE
CYL. 1
CYL. 2
PLUG
1/2 I.D. HOSE
FITTING IN CENTER

Flow Control Valve