MOLDMAN SYSTEMS
LOW-PRESSURE MOLDING

MOLDMAN™ 1050

Operations Manual

1.0 Introduction

1.1 Introduction

Moldman Systems would like to thank you for purchasing a Mold-man™ 1050 low-pressure molding machine. The Mold-man™ 1050 machine is designed specifically for low-pressure molding with low viscosity long-life thermoplastic materials.

The Mold-man™ 1050 machine is designed for safe and simple operation. Password protected set-up screens allow the user to input the injection, temperature and mold-set settings relevant to the molding application. Normal machine operation can only be performed when the machine is in production mode.

The raw materials are melted to liquid state prior to injecting into the mold-set. It is critical that operators and maintenance personnel become familiar with the relevant sections of this manual. Please pay special attention to the maintenance and cleaning guidelines for the equipment. Successful, long-term operation of both the machine and the over-molding of components depend on proper preventative maintenance.

Moldman Systems will support you by technical support. Please contact us when we can be of service. Congratulations with your purchase of a Mold-man™ 1050 and good luck with your low-pressure molding applications!

Moldman Systems LLC

NOTE!
All personnel involved in set-up, operation and maintenance of this machine must familiarize themselves with the guidelines in this manual. Read and follow the safety guidelines herein and in manuals for integrated equipment such as the melt unit.

NOTE!
Keep this manual near the machine and available to anyone involved in the installation, set-up, operation or maintenance of the equipment. The guidelines in this manual must be followed to ensure safe working conditions. Injury or death could result from not following the guidelines herein.

1.2 Type and Origin

Machine model:	Mold-man™ 1050
Type:	Low-pressure injection molding machine
Weight:	375 lbs [170 kg].
Overall dimensions:	24” W x 36” D x 33” H [457 x 914 x 838 mm]
Manufacturer:	Moldman Systems 4649 Air Center Circle, Suite 101 Reno, Nevada 89502 Phone: (775) 332-1600 www.moldmanmachines.com

1.3 Intended Use

The Mold-man™ 1050 machine is designed for encapsulation of various electronic components, molding of wiring harness components, grommets, connectors and plugs utilizing low-pressure molding.

WARNING!

The machine should only be used with thermoplastic polyamide hot melt resins such as Technomelt material.

WARNING!

The unit is designed for and only intended for use as described within this manual. Using the machine for any other applications or in a manner not consistent with this manual will void the warranty of the machine and could lead to injury or death.

Moldman Systems cannot be liable for any incident resulting from unintended use. Please contact Moldman Systems if you have any questions. Phone #: (775) 332-1600.

1.4 Setup and Space Requirements

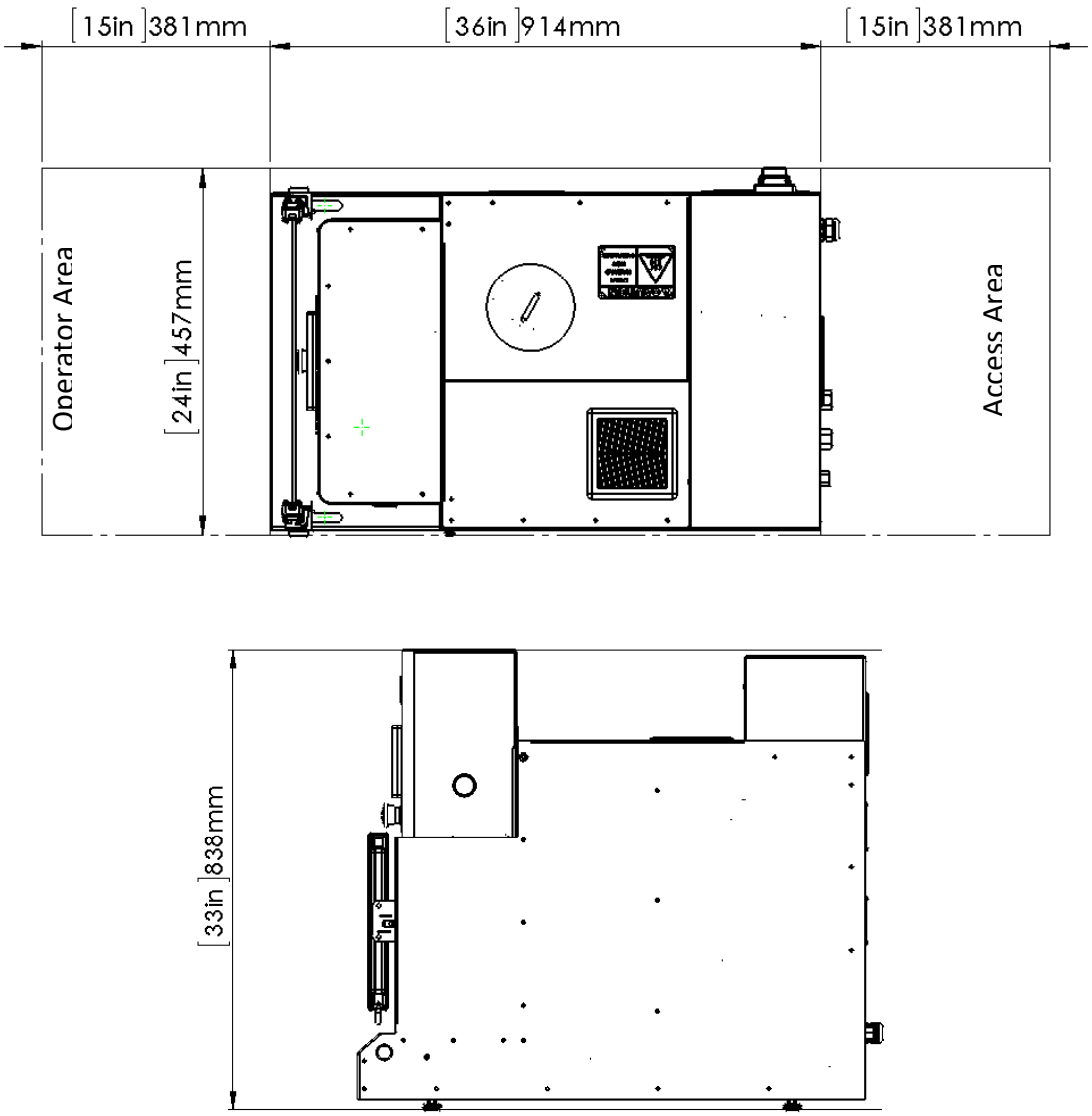


Figure 1: Equipment set-up

The equipment is ready to be installed and setup as an integrated system once it is unpacked. The total footprint of the machine, as well as the space required for operation and maintenance is outlined in Figure 1.

WARNING!

If two or more Mold-man machines are set-up next to each other, there is a potential for interference from the safety light curtain of the neighboring machines. This could create a potentially hazardous situation, please contact Moldman Systems for assistance!

1.5 Mold-man™ 1050 overview

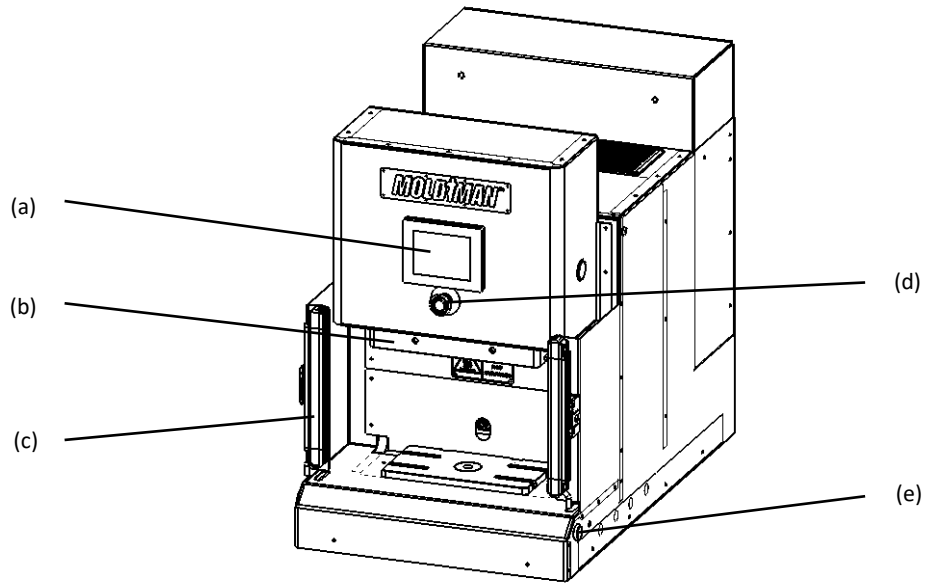


Figure 2: Machine front

(a) Touch Screen
(b) Clamp
(c) Light Curtains
(d) E-Stop
(e) Actuation Buttons

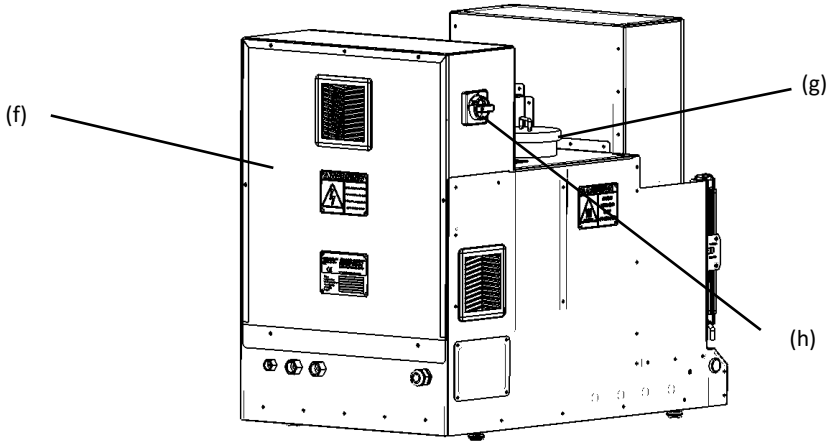


Figure 3: Machine back

(f) Electrical Enclosure
(g) Melt Reservoir
(h) Power Switch

The Mold-man™ 1050 low pressure molding machine is safe and easy to operate. When the machine has reached set-point temperature, operation simply consists of inserting components and activating the actuation buttons (e).

A pneumatic system controls the clamp, as well as all secondary motions e.g. ejectors, nozzle valves, etc. The electrical enclosure on the back of the machine contains the electric components. The touch screen (a) allows the user to input machine parameters and displays machine status and information. A PLC controls and monitors the molding sequence as well as all motion and user inputs. Low viscosity long-life thermoplastic materials are poured into the melt reservoir (g) to be melted to liquid state.

Mold-man™ 1050 machine is designed with operator safety in mind. The clamp motion is safe guarded by the safety light curtain (c). “Breaking” the safety light curtain will prevent clamp (b) motion or stop motion immediately if in a motion sequence. Pressing the emergency stop button (d) will have the same effect on clamp motion as “breaking” the safety light curtain. In addition, the power to all heaters will be removed and air pressure will be vented from part of pneumatic system.

WARNING!

Parts of the pneumatic system of the will remain under pressure, even if the machine is turned off and/or disconnected from the air supply!

WARNING!

The machine is equipped with safety shields and safety interlocking devices. Do not remove these or in any other way modify the machine from the original design.

2.0 Safety

Operation of the Mold-man™ 1050 machine is simple. However, safety must be a prime concern. Strictly follow the Warning messages and Notes contained in this manual.

WARNING!

The equipment processes materials at temperatures up to 500°F. The melt reservoir and nozzle are HOT! The hot molten material can cause severe burns! Always wear protective, heat resistant gloves and protective clothing! Always use safety glasses! Do not touch molten material! Even hardened material can still be very hot! Parts of the machine can remain hot for up to 8 hours after the machine is turned off.

NOTE!

In the event of burns, the exposed body parts must be cooled with water immediately. Hold the burned area under cold, running water for at least 30 minutes. Seek medical attention.

WARNING!

The machine is equipped with safety shields and safety interlocking devices. Do not remove these or in any other way modify the machine from the original design.

WARNING!

Prior to performing any maintenance on the machine, all utilities must be turned off and disconnected. This includes electrical power, air and water supply. Parts of the machine are pneumatically operated and contain fluid under pressures even after the machine has been disconnected from all utilities. Fluid pressure must be safely bled off prior to any maintenance or injury could occur.

WARNING!

Turn off the machine main power supply immediately in case of malfunction – the main power switch is located on the right side of the machine.

WARNING!

Only qualified personnel should perform maintenance and repairs on machine.

3.0 Installation

WARNING!

Transportation, lifting and installation of the equipment may only be performed by qualified and authorized personnel.

3.1 Mold-man™ 1050 overview

The Mold-man™ 1050 machine may only be lifted by utilizing a forklift of sufficient capacity. The weight of the machine is 375 lbs. [170 kg]. Engage the forklift forks beneath the lower frame as shown in Figure 4. Ensure that the forks support the entire length of the machine.

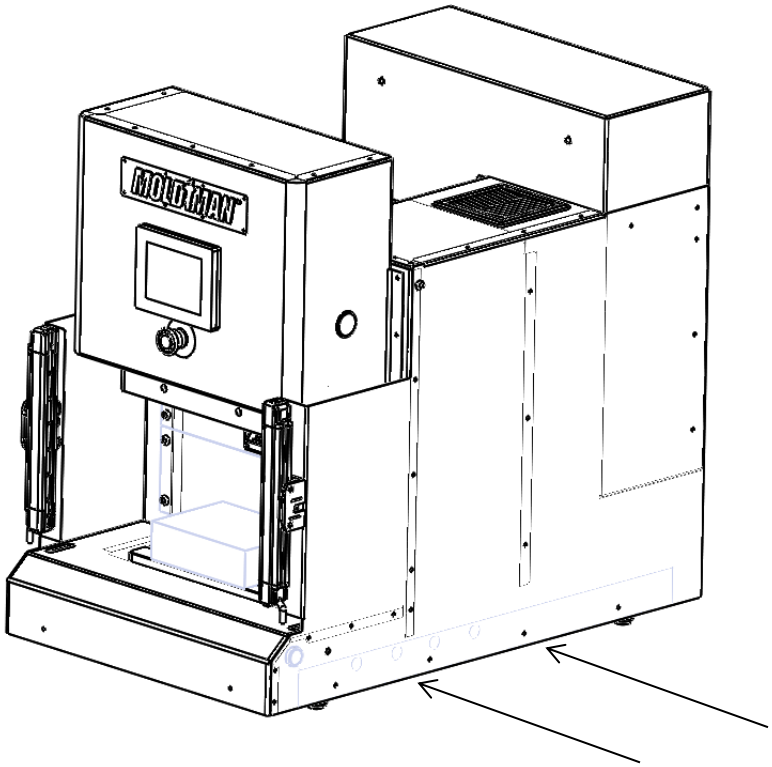


Figure 4: Forklift forks need to be facing the direction of the arrows

3.2 Utility Connections

WARNING!

To minimize the risk of potential safety problems, please follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and may change with time. Please determine which codes should be followed, and verify that the equipment, installation, and operation is in compliance with the latest revision of these codes.

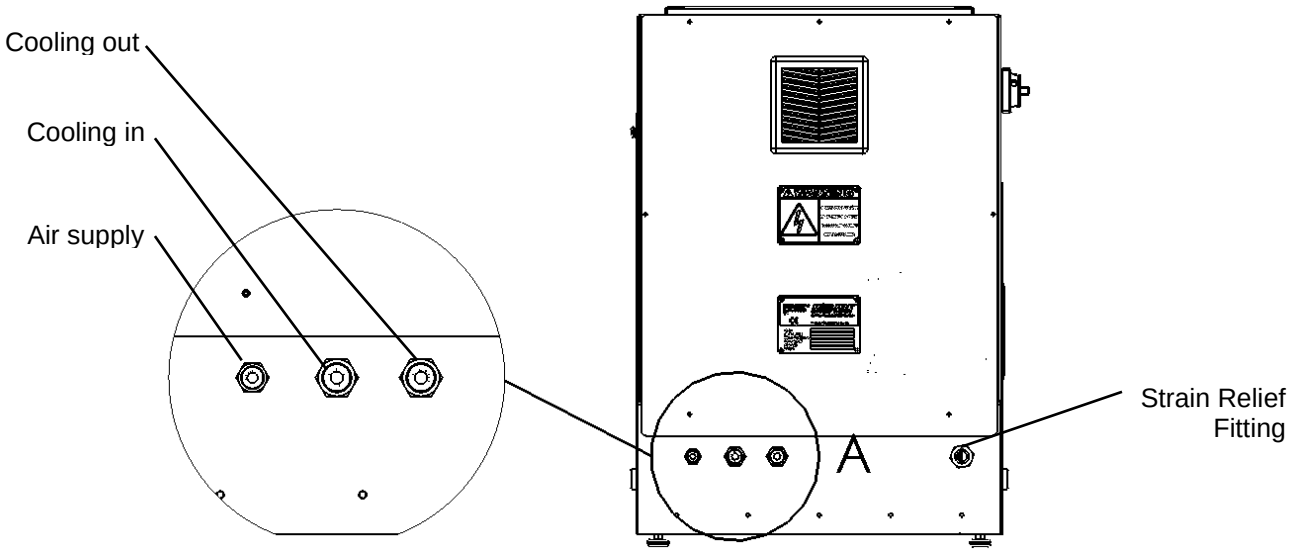


Figure 5: Mold-man 1050 utility connection points

3.2.1 Electrical connection

The bottom panel of the machine electrical enclosure is equipped with a strain relief fitting [Fig. 5] to feed the main power cable into the electrical enclosure. The machine requires a power supply of the following capacity: 200-240 VAC, single phase, 50/60 Hz, 30 Ampere.
Ground is connected to terminal marked with grounding symbol and 200-240VAC is connected to terminals “L1” and “N/L2”. In electrical systems with a neutral conductor, the neutral is connected to terminal “N/L2”.

3.2.2 Air Supply

Dry, filtered air at minimum 115 PSI [0.8 Mpa] and 4.0 SCFM [120 lpm] is connected to the 3/8” FNPT connection labeled “Air “.

3.2.3 Cooling Supply

Consistent chilled water or a water/glycol mixture supply is required for the operation of the chiller. A re-circulating water chiller with temperature variation of no more than 2ºF is recommended. The chiller is connected to the two 1/2” FNPT connections, located on the back. The chiller outlet port is connected to the “Cooling In” fitting, the chiller inlet port is connected to the “Cooling Out” fitting.
Inlet pressure should be at least 7 PSI [0.05 Mpa] and not exceed 60 PSI [0.4 Mpa].

4.0 Operation

4.1 Introduction

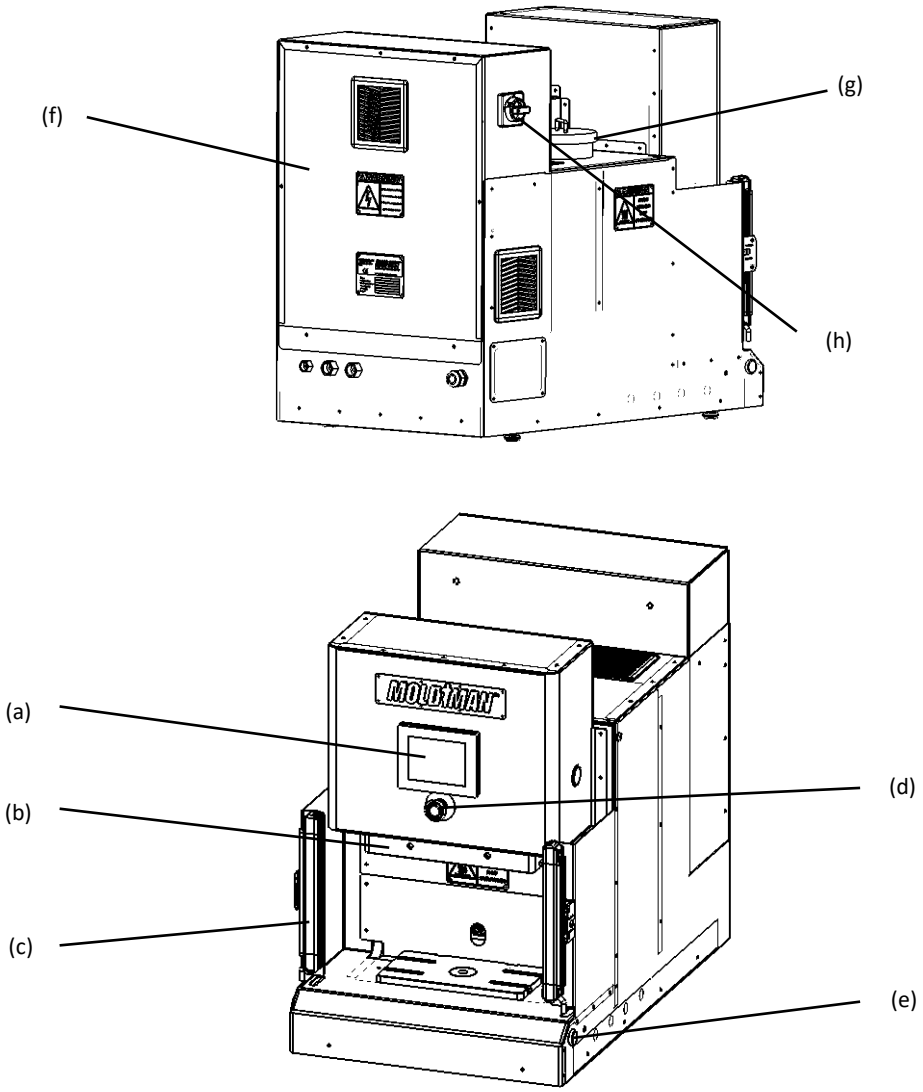


Figure 6: Operating features

WARNING!

The Mold-man 1050 is designed for single person operation only. Ensure that the equipment is only operated by one operator and no other persons are in the close proximity during operations.

The Mold-man 1050 operator station is designed for easy setup of your molding operations. The machine consists of the two actuation buttons (e) and the emergency stop button at the front of the machine (d), a touch-screen for parameter entry and machine status information (a), and the clamp (b). Turn the power switch to “ON” position to turn on the machine. Ensure that the melt reservoir (g) contains a sufficient amount of molding material for molding operation.

Once the machine is setup and ready, operation simply consists of inserting components and activating one of the actuation buttons.

4.2 Machine Start-Up and Touch Screen Navigation

When the machine is powered up, the touchscreen first displays a screen as shown in Fig. 7 with the message “Please wait for system to boot” on the bottom of the screen, and the “Mold-man 6200” logo displayed on the top. Once the boot up process is complete, The “Mold-man 1050” logo will be displayed, and “Machine OK” will be displayed as shown in Fig. 8 if no other alarms are present.

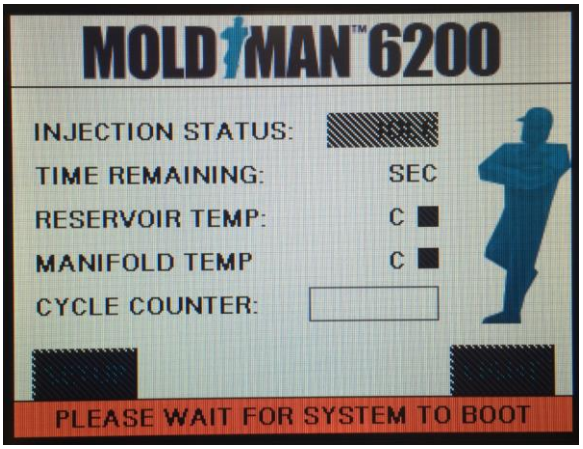


Figure 7: Boot up screen

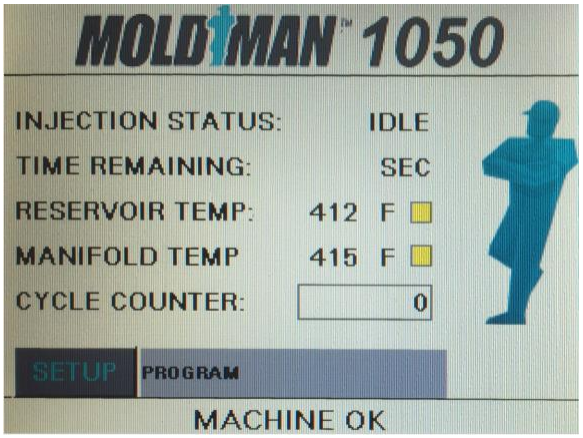


Figure 8: Production mode screen

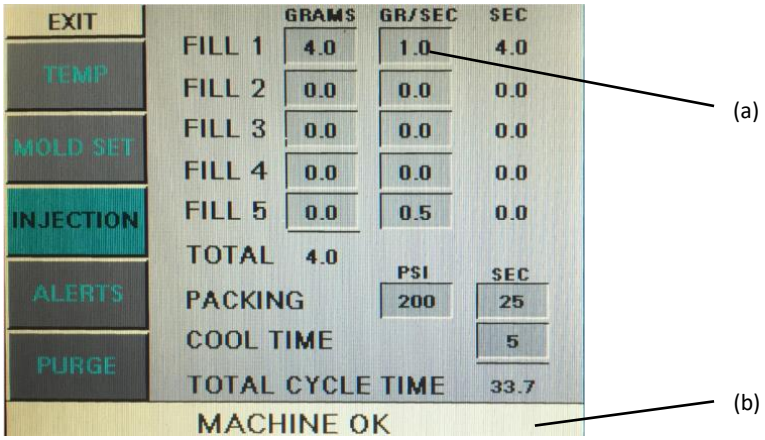


Figure 9: Sample screen

All screens that accept a user input have outline boxes (a) for the values that can be changed. Touching the value in the outline box brings up a pop up screen where a new value can be entered. In addition, all screens have a common status bar at the bottom (b), which can display the following messages:

MACHINE OK	No alarms are present and machine can be operated.
LIGHT CURTAIN ACTIVATED	The safety light curtain is interrupted, preventing clamp or shuttle table motion from occurring.
PLEASE WAIT FOR THE SYSTEM TO BOOT	Software is loading
TEMPERATURE LOW	This message is displayed when the actual temperature zones are in between 360F and set point minus 10F.
TEMPERATURE FAULT	A component in the temperature control loop is not working properly.
PUMP ERROR	A fault in the pump servo drive has occurred.
CLAMP OBSTRUCTED	The clamp is unable to reach the bottom position.
CLAMP NOT AT TOP	The clamp is unable to reach the top position.
E-STOP ACTIVATED	The emergency stop button has been pressed. All machine operation is aborted. To resume, pull the e-stop and press one of the two actuation buttons to reset the e-stop.
RELAY FAULT – MUST CYCLE POWER	A fault in the relay system has occurred. Cycle power to the machine to reset the system.
OVER PRESSURE	The pressure in the injection system has exceeded the maximum. This error will appear when attempting to inject material while the injection flow path is blocked, or when the cavity is over-filled during the fill step of the injection cycle.

4.2.1 Production mode

The production mode screen is the first screen that is displayed after the machine is turned on and the software is loaded.

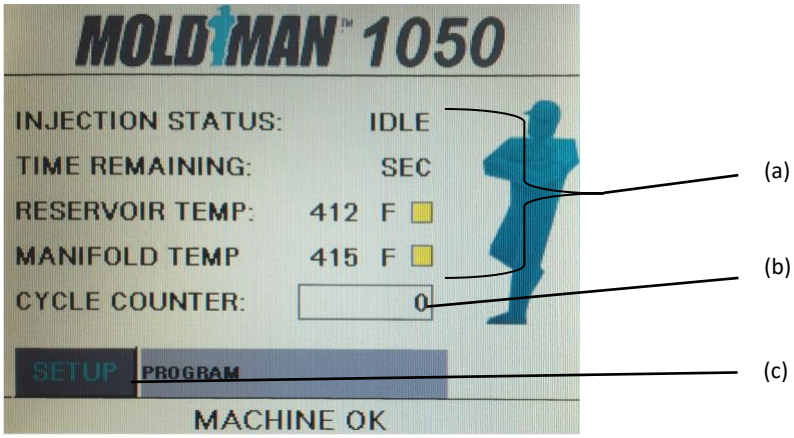


Figure 10: Production Mode Screen

Injection molding can only be performed in production mode. This screen provides injection and temperature information (a). In addition, the screen has a cycle counter which can be re-set to any number by pressing the box (b). The “SETUP” button brings the user to the setup screen (c).

4.2.2 Setup mode navigation

4.2.3 Setup screen

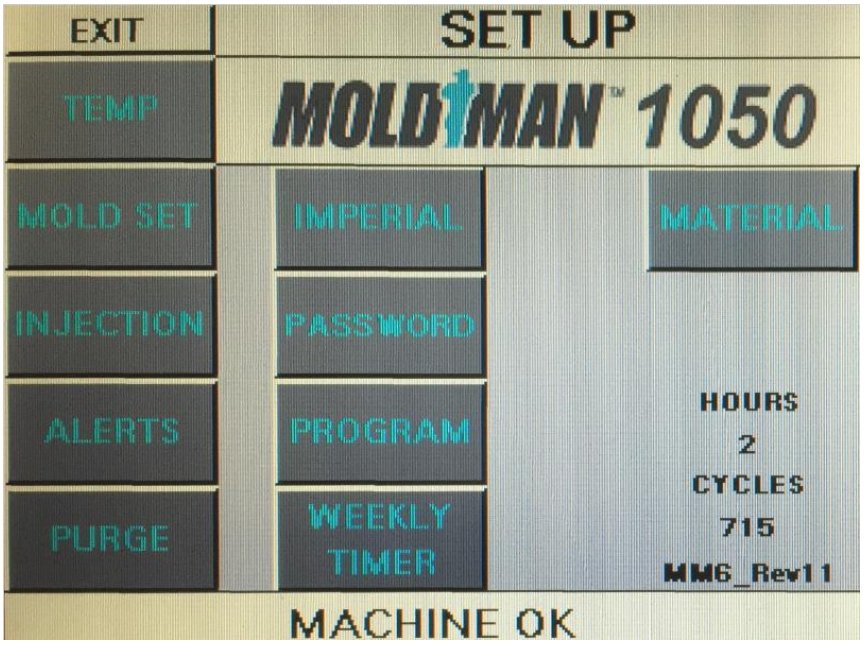


Figure 11: Set up screen

This set-up screen allows the user to enter various parameters associated with the molding application, such as temperature and injection settings. The Menu bar on the left including the “exit” button on the top left corner is displayed on all the setup screens. Pushing the “exit” button will return the user to the production mode screen. The individual buttons on the left side are as follows:

TEMP	Advances to Temperature screen
MOLD-SET	Advances to the Mold-set setup screen
INJECTION	Advances to the Injection setup screen
ALERTS	Advances to the Alert setup screen
PURGE	Advances to the Purge setup screen
IMPERIAL/METRIC	Switches between Imperial and Metric units
PASSWORD	Advances to the Password setup screen
PROGRAM	Advances to the injection parameter program setup screen.
WEEKLY TIMER	Advances to the Weekly Timer setup screen
MATERIAL	Advances to the Material setup screen

In addition, the Setup Screen displays a Total Hour and Total Cycle counter in the lower right hand corner. The individual setup screens are explained in greater detail on the following pages.

4.2.4 Temperature setup screen

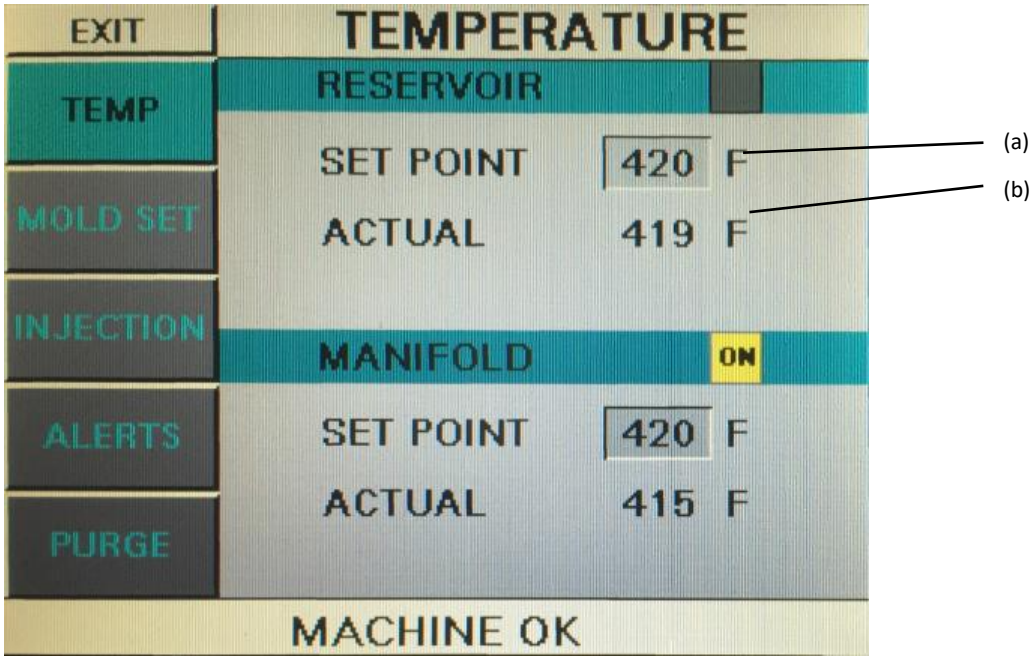


Figure 12: Temperature set up screen

This screen is used to set the temperatures for the two different temperature zones: Reservoir and Manifold.
Each zone has two temperature displays, the set point temperature (a) and the actual temperature (b). Pushing the outline box around the set point (a) lets you adjust the set point temperature in a separate pop up screen.

NOTE!

The minimum temperature for the machine to operate is 360F. Maximum set point temperature is 475F.

The machine is equipped with an automatic temperature turn-off feature. If the machine has not been operated for 2 hours, all heating elements in the machine will turn off. The machine resets to the original set-point temperatures when the actuation buttons, the E-stop button or the touchscreen is actuated.

IMPORTANT!

Please observe and follow manufactures recommendations for setting correct temperatures to process molding materials.

4.2.5 Mold-set set up screen

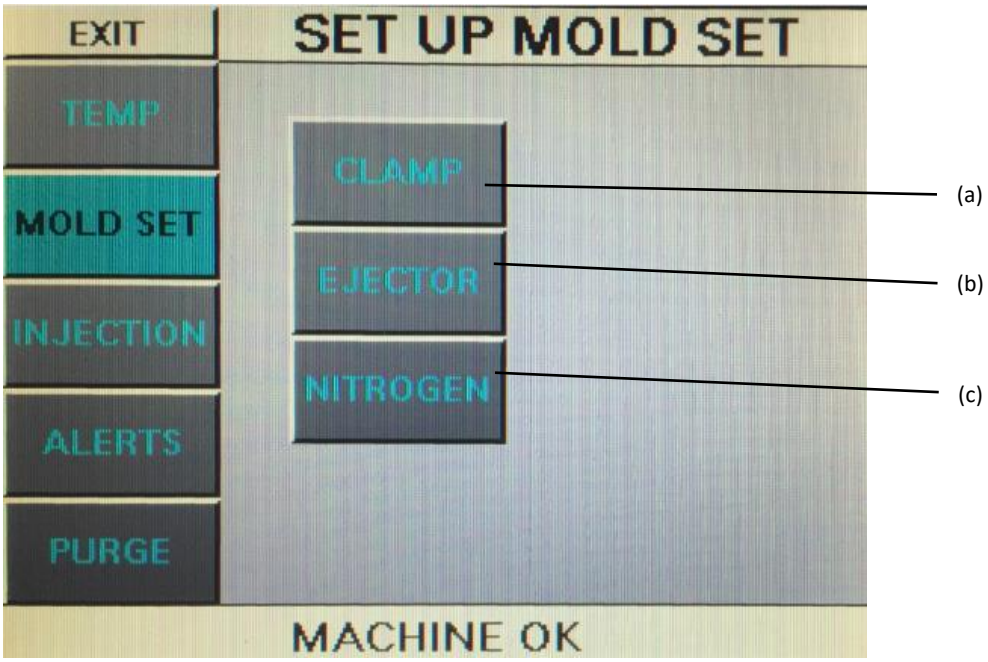


Figure 13: Mold-set set up screen

The Mold-set setup screen is used to install a mold-set. The mold-set installation procedure is outlined in section 4.3.

The “Clamp” button (a) will advance the user to the clamp setup screen. The “Ejector” button (b) will allow the user to set up the ejector system parameters. The “Nitrogen” (c) button advances the user to the nitrogen kit setup screen. These functions are explained in more detail in the following sections.

NOTE: The NITROGEN function will only be enabled on machines equipped with a nitrogen kit.

4.2.6 Clamp set up screen

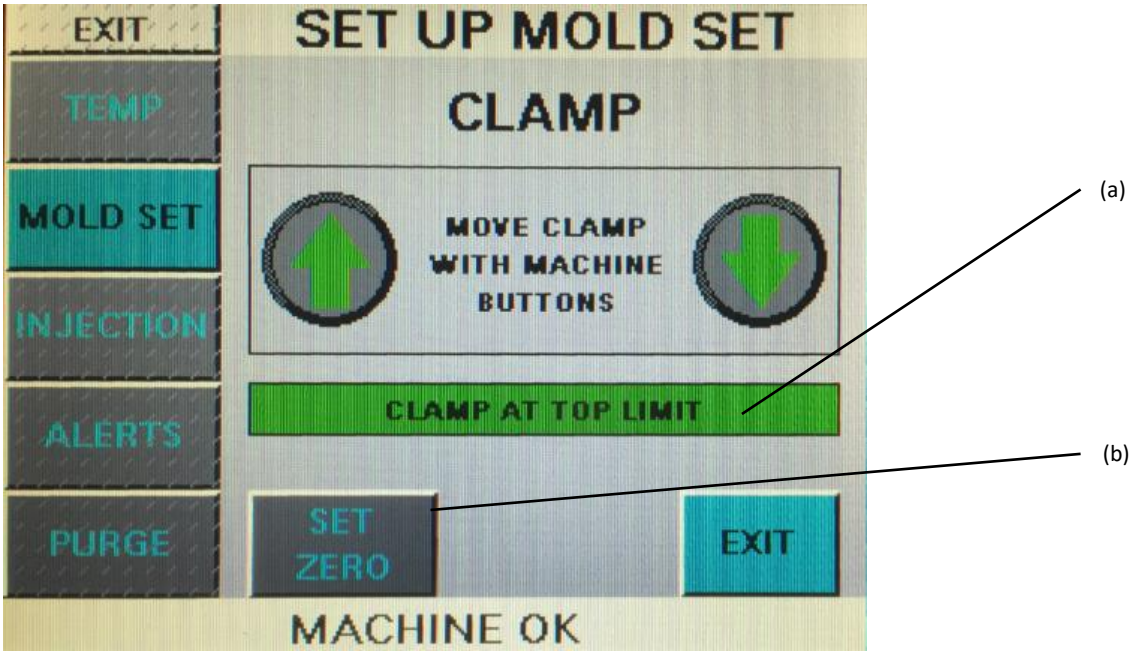


Figure 14: Clamp set up screen

The clamp screen is used to set the zero position of the clamp when installing a mold-set. The zero position is the position of the clamp when the two mold halves meet. This position needs to be set every time a different mold-set is installed on the machine.

To set the zero position, first install the mold-set as outlined in Section 4.3. Use the machine buttons located on the sides of the machine to move the clamp downward until the two mold-halves meet. The left button moves the clamp upward and the right button moves the clamp downward. Press the “Set Zero” button (b) to set the zero position. The banner (a) displays “CLAMP AT TOP LIMIT” when the clamp is in the top position and “CLAMP AT BOTTOM LIMIT” when the clamp is in the zero position.

4.2.7 Set ejector screen

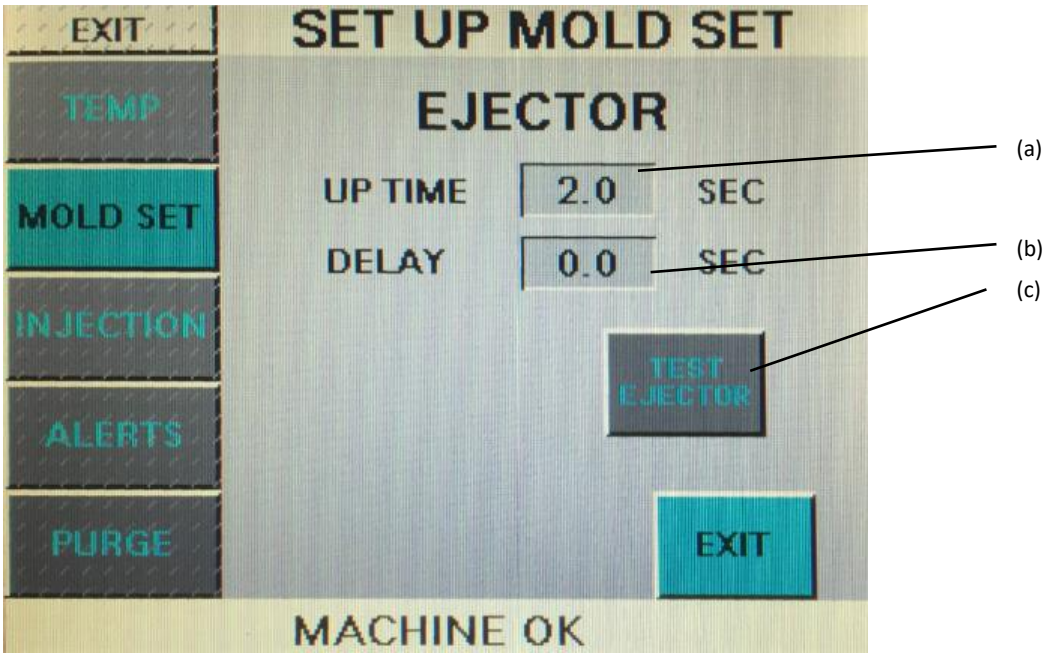


Figure 15: Ejector Set up Screen

The ejectors are activated in production mode after the injection cycle is completed and the clamp reaches its top position. The ejector “Up Time” is the amount of time that the ejector stays in the upper position after the clamp has reached its top position or if set, after the “Ejector Delay” time has elapsed. Use outline box (a) to adjust the ejector “Up Time.” The “Ejector Delay” will delay the activation of the ejector after the clamp has reached its top position by the time entered in outline box (b). Use the “Test Ejector” (c) button to test the current settings. Setting both timers to zero will deactivate the ejector motion. Maximum timer value is 9.9 seconds.

4.2.8 Nitrogen set up screen

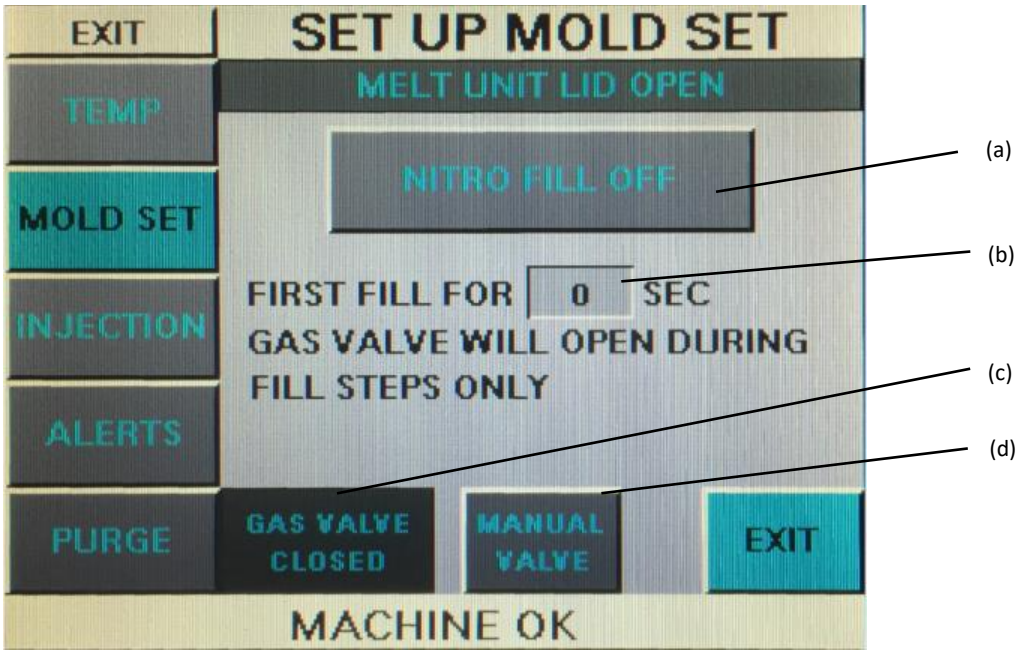
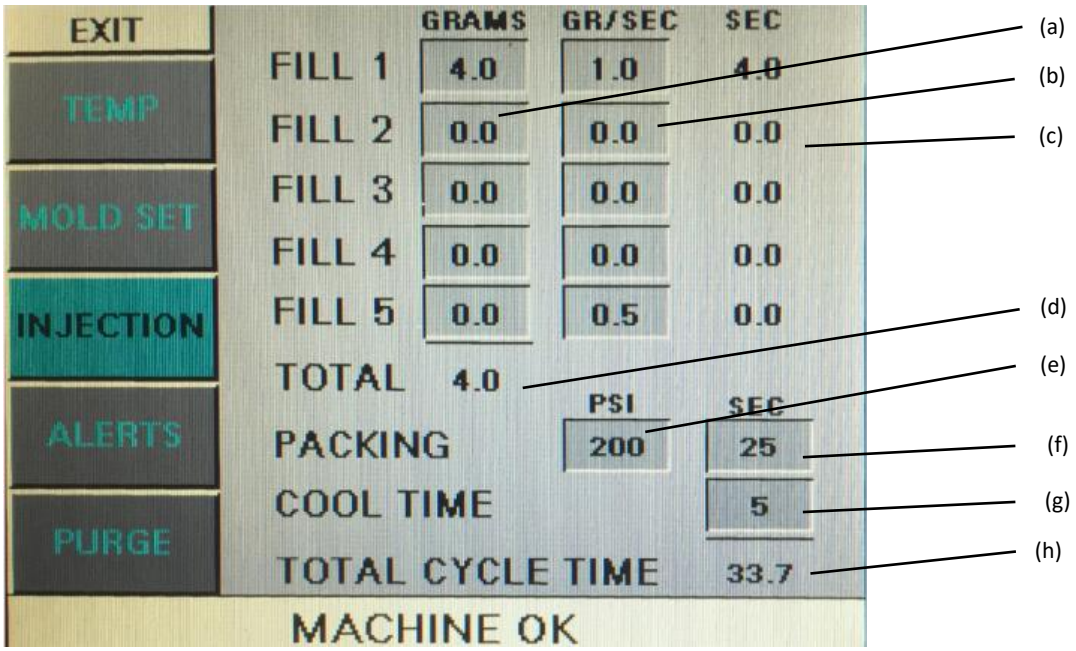


Figure 16: Nitrogen set up screen

NOTE: The NITROGEN function will only be enabled on machines equipped with a nitrogen kit.

Pressing “Nitrogen” allows the user to change the settings for the nitrogen injection function. This function allows Nitrogen to be injected into the tank during the fill step of the injection cycle. Pressing “Nitro Fill Off” (a) will switch between enabling and disabling the function. The amount of time to fill the tank can be changed by pressing the field (b) and entering the desired time in seconds. The first fill occurs every time the lid is closed. The indicator (c) displays whether or not the gas valve is opened. Nitrogen can be manually injected into the tank by pressing “Manual Valve” (d). Press the button again to close the valve and stop nitrogen injection.

4.2.9 Injection set up screen



The injection screen allows the user to setup and adjust the injection cycle. Up to five fill steps allow for a specified amount of material to be injected with a specified fill rate for each of the steps. The fill steps are used to fill the cavity, and most applications only require the use of one fill step. The mass to be injected for each step can be adjusted by pushing outline box (a). It can be adjusted in 0.1 gram increments and the maximum weight that can be specified is 999.9 grams. The fill rate represents the speed with which the material is injected during the fill step, it is adjustable in 0.1 gr/sec increments and the maximum fill rate is 25.0 gr/sec. Adjust the fill rate by pushing on outline box (b). The Duration of each fill step is automatically calculated and displayed in the "Sec" column (c). The total mass of all five fill steps is automatically calculated and displayed (d).
If the injection setup is correct, packing pressure is the pressure exerted on cavity after the cavity has been filled by the fill steps. Maximum pressure is 500 PSI [35 bar]. Adjust the injection pressure by pushing the outline box (e). The timer (f) adjusts the duration that the machine will pressurize [pack] the mold-set cavity. Cool time (g) completes the cycle and is the time that the machine will keep the mold-set closed without further pressurizing [packing] the cavity.
The machine automatically calculates the total injection cycle time and displays it in the lower right hand corner (h).
Instructions on how to optimize injection parameters are found in Section 5.0.

NOTE!

Most applications will only require the use of FILL 1. The molding cycle will automatically skip FILL 2 through FILL 5 and go directly to PACKING.

NOTE!

If the viscosity of the material is too high, i.e. due to a low temperature, it might not be possible to achieve the maximum fill rate.

4.2.10 Alert set up screen

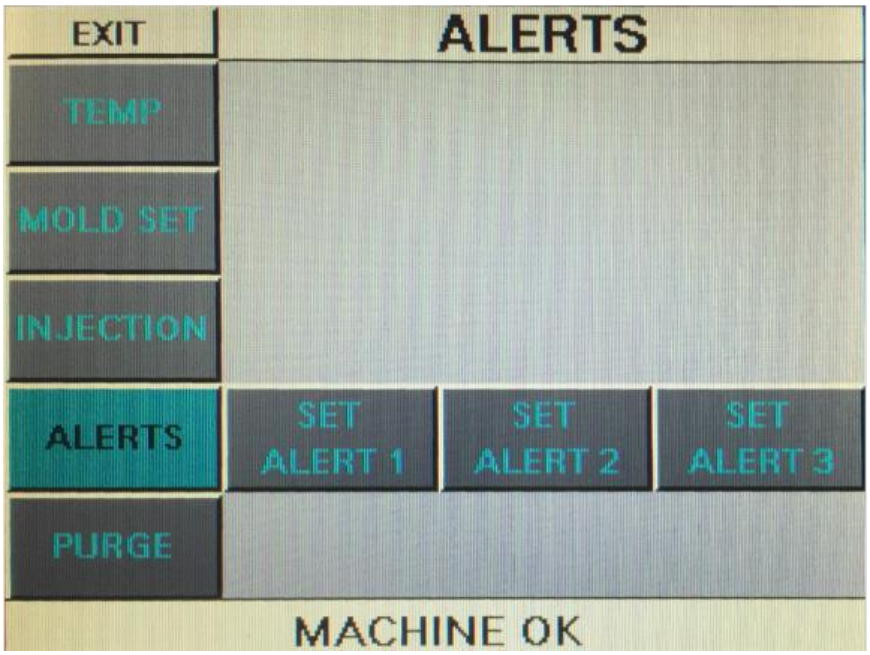


Figure 17: Alert set up screen

In this screen (Fig. 17), the user can input three different alerts that can appear after a certain number of molding cycles. Pushing one of the "Set Alert #" buttons will display the screen shown below.

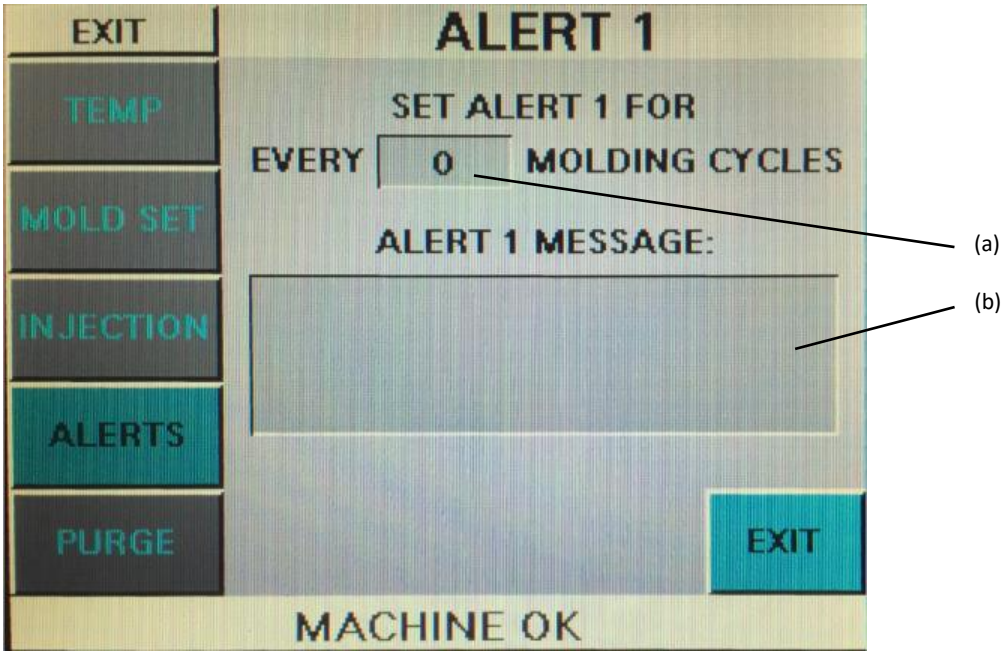


Figure 18: Set alert screen

This screen lets you specify the alarm interval (a) at which the alarm message entered in (b) will be displayed during production mode. Push each of the boxes (a) or (b) to adjust the molding cycle count (a) and message (b). Once the specified molding cycle count has been reached during production mode the

message entered in (b) will be displayed and further molding cycles will be inhibited unless the alarm message is acknowledged by the operator by pushing the “OK” button. To exit the screen press the “EXIT” button in the lower right hand corner.

4.2.11 Purge set up screen

Figure 19: Purge set up screen

Pressing the “Purge” button will start material flow through the nozzle for the duration the button is pushed. Ensure that purged material is captured by a suitable, heat resistant container! Always wear eye protection, gloves and protective clothing when handling hot material!
Clean any leftover material from the nozzle bracket after purging is complete!

WARNING!
Molten material is hot and can cause severe burns. When reservoir is empty, the nozzle may sputter because of air. Always wear eye protection, gloves and protective clothing when purging and handling hot material!

4.2.12 Password set up screen

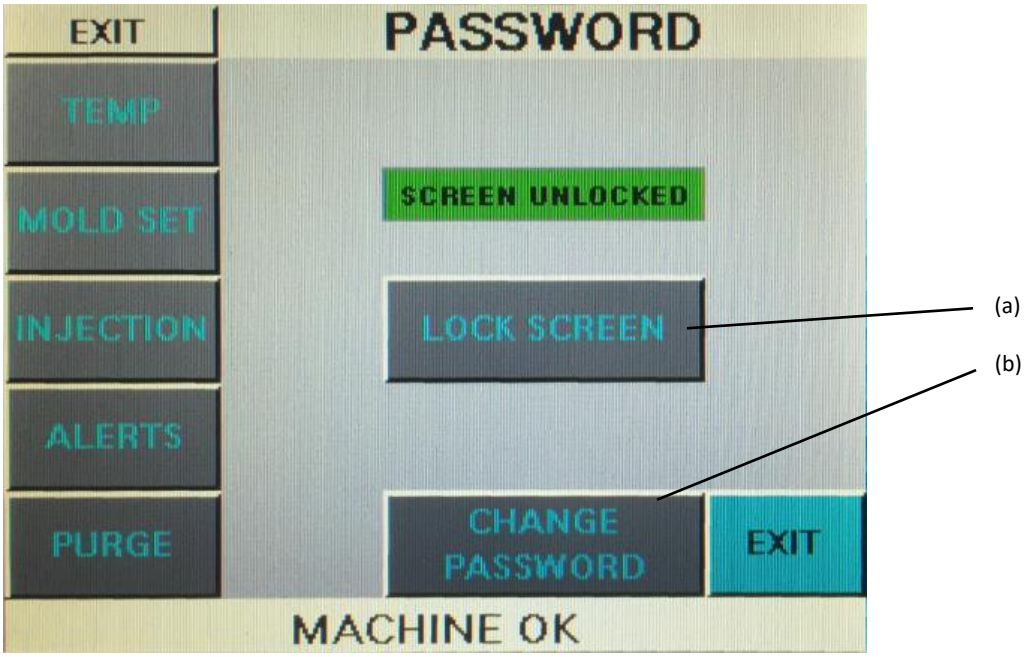


Figure 20: Password set up screen

Pressing the “Password” button will bring the user to the password setup screen. Pressing “Lock Screen” (a) will disable the user from changing all other machine settings. To unlock the screen, the user must return to the password setup screen and enter the correct password. Pressing “Change Password” (b) will allow the user to enter a new password. By default, the password is set to “0”. When the password is set to “0”, the function is disabled and the screen cannot be locked.

4.2.13 Program set up screen

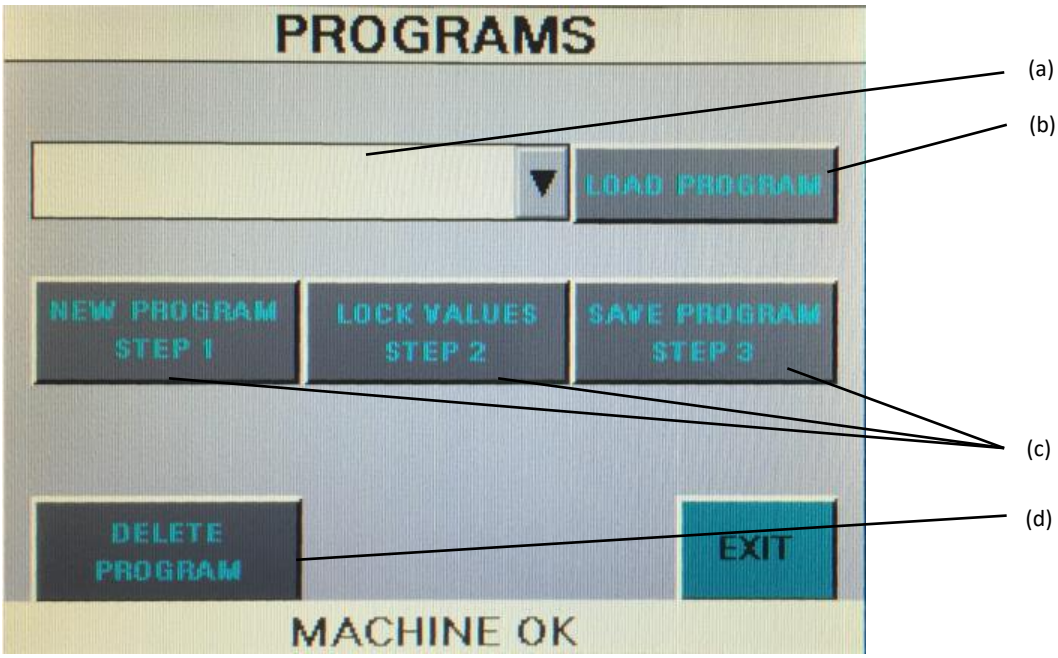


Figure 21: Program set up screen

Pressing “Program” brings the user to the program setup screen. This function saves the current injection parameter settings as a program. The program is assigned a name and can be loaded at any time. To save a new program, press “New Program Step 1” (b) to create a new program. “Lock Values Step 2” (b) will assign the values to the new program, and “Save Program Step 3” (b) will save the program into the screen. Press the drop down menu (a) to select existing programs. Press “Delete Program” (d) to delete the program shown in the drop down menu (a).

4.2.14 Weekly timer set up screen

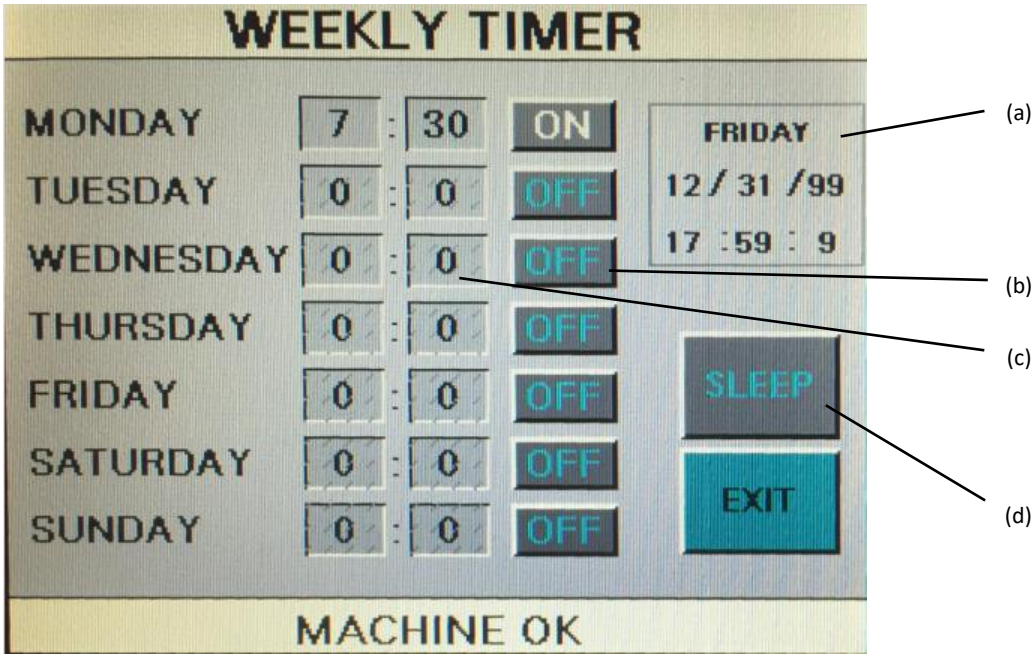


Figure 22: Weekly timer set up screen

Pressing "Weekly Timer" will bring the user to the weekly timer setup screen. The weekly timer will enable the machine to automatically exit sleep mode and turn on all heaters at a specified time and date. This function can be useful by setting the timer to turn on the heaters one hour prior to the start of a work shift. By the time the work shift begins, the machine will be ready for injection molding.

To enable the weekly time, the desired time to turn on the heaters must be entered in field (c) for the desired day. The "ON/OFF" button for the day must be pressed to display "ON". The current date and time can be changed by pressing the field (a). To enter sleep mode, press the button "Sleep" (d) to display the screen shown in Figure 23. To exit sleep mode manually, press either machine button.

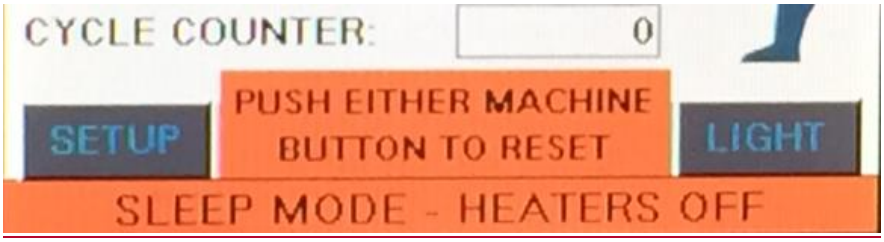


Figure 23: Sleep Mode

4.2.15 Material set up screen

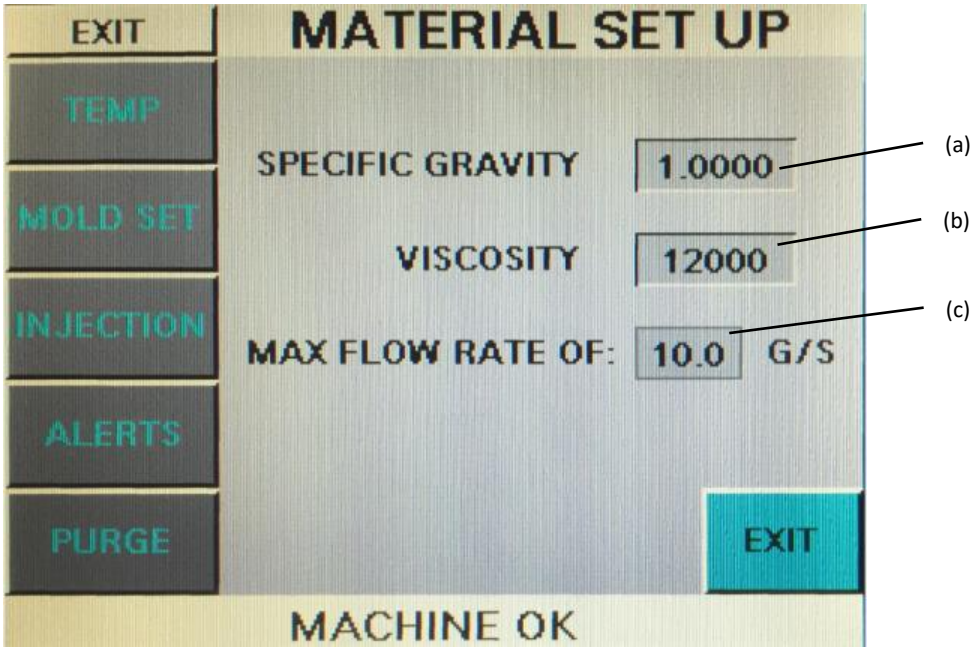


Figure 24: Material set up screen

Pressing “Material” will bring the user to the material set up screen. This screen allows to user to enter the specific gravity and viscosity of the molding material in the reservoir. Specific gravity is entered in field (a), and viscosity is entered in units of centipoise in field (b). The maximum flow rate (c) will automatically adjust depending on the values entered for specific gravity and viscosity. This automatic adjustment will affect the maximum flow rate that can be entered into the fill steps on the injection screen.

4.3 Mold-set Installation

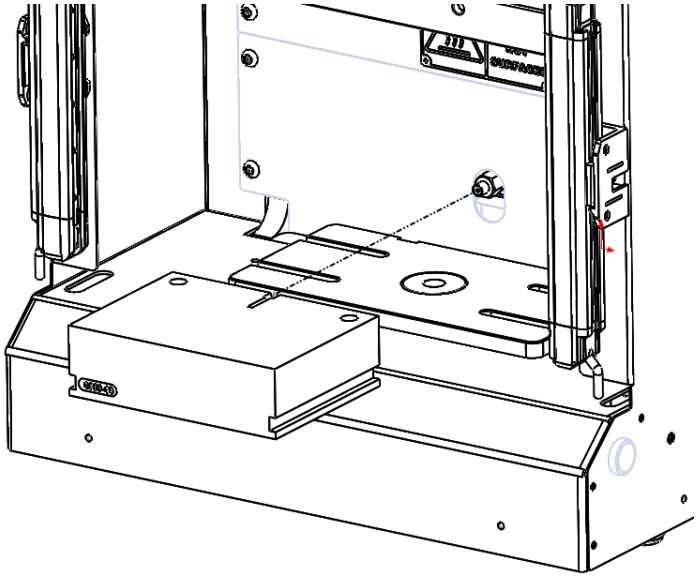


Figure 25: Install the lower half

Carefully place the lower mold-set half on the lower platen as shown in Figure 25. Ensure the mold is lined up correctly so the nozzle tip slides into the mold.

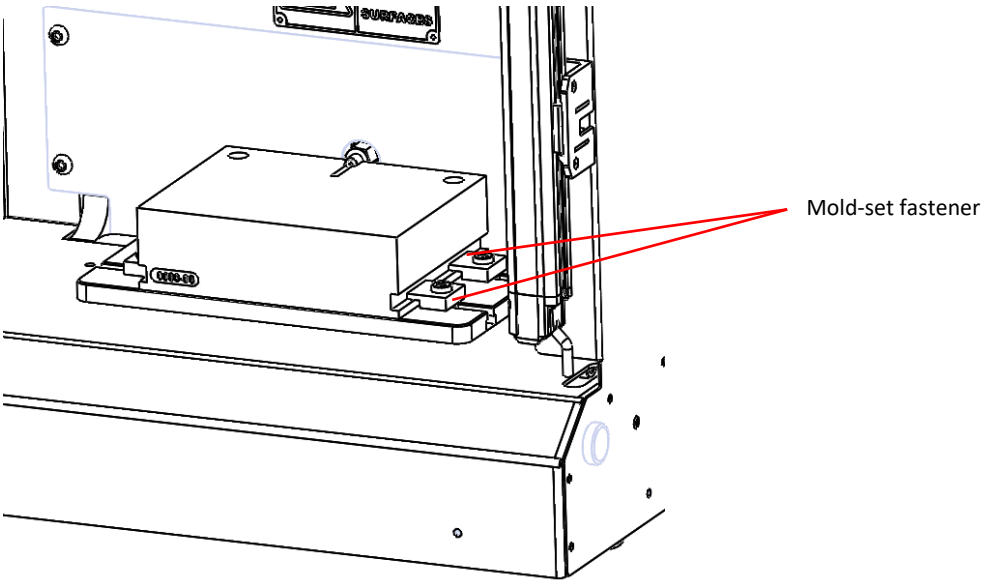


Figure 26: Install the mold–set fasteners

Install the mold-set fasteners. At least one fastener should be installed on each side of the mold. The bolts of the mold-fastener only need to be “hand-tight”.

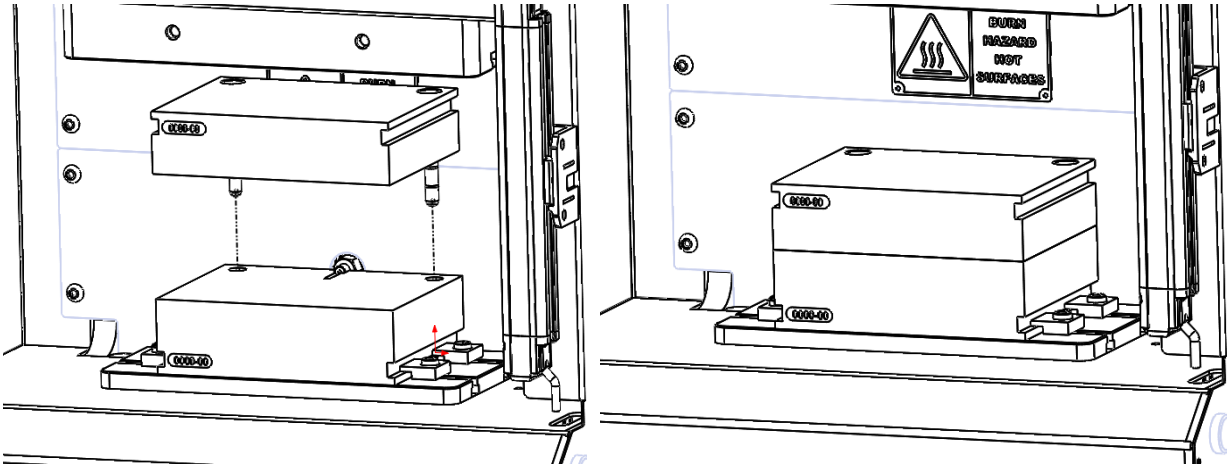


Figure 27: Place upper mold half

Place the upper mold-half on the lower mold half. The guide pins may need to be lubricated to easily slide them into the bushings.

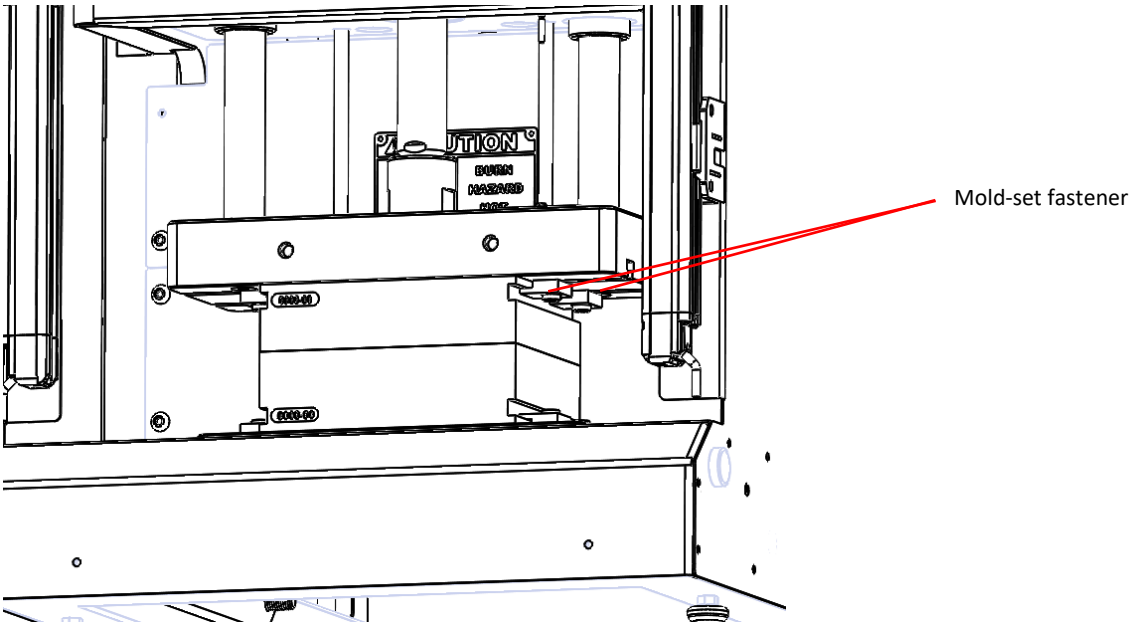


Figure 28: Install upper mold-set fasteners

Lower the clamp by using the clamp touch screen controls as outlined in Section 4.2.6 until the clamp sits on top of the upper mold half. Install at least one mold-set fastener on each side of the upper mold half. The bolts of the mold-fastener only need to be “hand-tight”. Raise the clamp using the touch screen controls.

Mold-set Removal:

- Lower the upper mold-platen until the mold-set is completely closed.
- Loosen the upper mold fasteners and slide them away from the upper mold half.
- Raise the mold set clamp to the top position.
- Loosen the lower mold fasteners and slide them away from the lower mold half.
- Carefully pull the mold-set away from the nozzle.

4.4 Machine start up and production

Starting up the Mold-man™ 1050 molding machine is very simple. Please follow these guidelines:

- Confirm air and water supply to the machine.
- Turn on Main Power Supply switch at the right hand side of machine.
- Ensure that there is enough material in the reservoir for the intended production.
- Approximately 30-45 minutes is required before machine is ready for production. During that phase the touch screen will display the message “Temperature low” in the status bar of the touch screen.
- The message “Machine OK” will be displayed on the bottom of the screen once all components have reached operating temperatures indicating that the machine is ready for production.
- Position components to be molded in the lower mold half cavity.
- Activate the actuation buttons momentarily.
- The clamp will close and machine will start the injection sequence of the molding cycle.
- The injector nozzle will open and start filling the cavity. After injection time is complete, the cooling cycle starts.
- When the cooling cycle is completed, the mold-set will open.
- The machine is ready for the next cycle.

4.5 Purging material

WARNING!
Molten material is hot and can cause severe burns. When reservoir is empty, the nozzle may sputter**.** Always wear eye protection, gloves and protective clothing when handling hot material! Ensure that the purged material is captured by a suitable, heat resistant container.

Locate a suitable, heat resistant container below the nozzle tip. Start purging and ensure that the container does not overflow. Remove the container after material has cooled down.

4.6 Normal stop

Turn off the Main Power Switch at the machine.

4.7 Emergency stop

Push the red E-STOP button. All heaters will turn off and air will be vented from the pneumatic system. Pull the E-STOP button to reset machine.

4.8 Emergency stop

	Light curtain interrupted	**E-stop activated**
Clamp motion	Stops clamp motion.	Stops clamp motion. Release E-stop.
Injection	No effect, injection continues.	Stops injection. Release E-stop, clamp automatically retracts to the top after a few seconds.*)

5.0 Mold-set run-in

5.1 Purpose

This is intended to aid in the run-in or troubleshooting of a Low Pressure Molding application on a Moldman 6000/6200 machine. It gives basic guidelines for how to approach a "first shot" as well as how to dial in the optimum molding parameters. We offer separate documents for Component Design for Low Pressure Molding and Mold-set Design for Low Pressure Molding. The information herein is based on guidelines in these other documents having been followed.

This document offers:

- Guidelines for mold-set run-in
  - Mold-set preparation
  - Component fit
  - Shot size estimation
  - Material selection
  - Selection of first shot molding parameters
  - Molding parameter optimization: Quality and productivity

These guidelines will give a starting point for over-molding of new components and for future optimization of parameters. This optimization will focus on product quality first and then productivity.

5.2 Mold-set Run-in

Before molding in a new mold-set, the mold-set must be prepared by cleaning and applying mold-release agent. Mold release application is critical as you will be molding with adhesives.

It is also the time to confirm that the components to be over-molded fit correctly in the mold-set cavity (ies). Always have some "dummy components" available for initial run-in. These can be unpopulated circuit-boards or non-functional components.

5.3 Mold-set Preparation

These guidelines are based on the mold-set being manufactured according to "Mold-set Design for Low Pressure Molding". When a new mold-set is put into service, the first order of business is to clean it and treat it with mold-release agent. Cleaning can be done soap and water or alcohol for mold-inserts.

If the mold-set is equipped with ejector system, a more gently cleaning is recommended: Wiping off the surfaces with an alcohol-soaked rag. After cleaning and drying all surfaces should be treated with mold-release agent. The operation and smooth spring-back of the ejectors should be confirmed.

5.4 Component Fit

It is always important to confirm that the components to be over-molded fit correctly in the mold-set cavity (ies). If a mold-set has been manufactured based on a solid model only, it is not unusual to find that the actual components differ a bit from the model. The solid model does not account for manufacturing tolerances.

It is critical to confirm that the shut-off areas fit well. If wires or cable exit the cavity, the shut-off around them must be snug. Any shut-off around connectors must have less than 0.05mm (0.002") clearance or material will flash out. Confirm that fully populated circuit-boards fit correctly and are not "riding" on some taller-than-expected components. Make sure the halves close fully with components in the cavities.

5.5 Shot size estimation

Before molding the first component, you should have a good idea about how large the shot is. Make a good estimate by basic area-times- thickness calculation. The estimate should be for total shot including all cavities and runners. The expected shot size combined with the total parting-line area (in square centimeters, cm^2, or square inches, sq.in.) of the shot will allow you to choose initial molding parameters. You want to make sure that you fill the cavity(ies) completely but do not over-pack components or flash the mold-set. Flashing the mold-set can happen if the total force from injecting into the cavity exceeds the clamping force of the machine. This will lead to scrapped parts and could present a burn hazard.

The Mold-man 1050 machine Injection Screen is designed for you to enter show shot size in grams and grams-per-second flow rate. It will then calculate the flow time required. With a specific gravity very close to 1, one gram of material represents a volume of very close to one cubic centimeter (cm^3). Processing temperatures will affect this relationship but for the purpose of estimating a first shot, it is close enough. Measure the component size in centimeters and the volume calculation (say, length time width time thickness) will come out in cubic centimeters. This is approximately the same number as the shot size in grams.

Most shapes are comprised of box and cylinder shapes or a combination of these. Basic calculations are:

Box volume:	Length x Width x Height	
Cylinder volume:	Length x Diameter x π/4	(where π/4 ~ 0.785)

Deduct the volume of the component to be over-molded – it is the shot size that we are estimating!

5.6 Material Selection

The grade of material to be used is based on application requirements. The technical requirements in terms of adhesion, hardness, electrical properties, resistance to fluids, temperature etc will be important in selecting one or more suitable molding compounds. Most of this information is available from the manufacturer. However, adhesive properties cannot readily be determined without testing. There are a vast amount of different substrates (circuit-board solder masks, wire and cable jacket, connector shells etc) that might be over-molded, and adhesion testing is recommended.

For molding the first shot and general optimization using amber material instead of black should be considered. This will allow immediate feedback about quality beyond the surface.

5.7 First shot molding parameters

Weigh the component(s) before molding. You will need this in order to determine the exact shot size.

The material technical data sheet should offer information about recommended processing temperature. Start out in the middle of the recommended range. For most Polyamide based adhesives, this is in the range of 400F to 430F. For Polyolefin based adhesives it may be from 350F to 400F.

Set the processing temperature. The Mold-man 6000/6200 machines have different temperature zones: Reservoir and Manifold Set reservoir temperature at 25F below the processing (injection) temperature to preserve the material. Set the manifold at the processing temperature. Set the mold-set (chiller) temperature to be relative warm (85F).

First shot parameters depend on the application. The following can be used as starting point:

1. Total shot less than 30 gram (30 cc):
    - enter 75% of the calculated total shot size in FILL 1

- set fill rate to 5 grams per second
- Set packing pressure at 150#
- Set packing time at 60 seconds
- Set cooling time at 60 seconds

2. Total shot more than 30 gram (30 cc)
    - enter 75% of the calculated total shot size in FILL 1
    - set fill rate to 10 grams per second
    - Set packing pressure at 150#
    - Set packing time at 60 seconds
    - Set cooling time at 60 seconds

Note that the cycle-times are very long. This is for safety reasons only. When you mold a first shot, you do not know what the correct parameters are – do not burn yourself by trying to shorten cycle times too much!. Longer cycle times will allow the molding compound to cool down thus minimizing the chance of getting burned. Cycle time optimization takes place after achieving good molding results.

Be careful! If anything un-expected happens activate the E-stop immediately. Do not touch anything – wait five minutes and be very careful not to get burned.

Unusual events may include:

- Molding compounds coming out of the mold-set
- Mold-set flashing (parting-line separation)
- Wires, cables or connectors getting pushed out or leaking molding compound

If any of these events take place, the next step is to determine why and rectify this. This may simply be by adjusting the molding pressure: Reduce it by 50%. Or you could have over-estimated the shot size: Reduce it by 50%. Make big steps initially – fine tuning will follow. It may also be because the mold-set does not offer adequate shut-off or component support: Fix this.

Once you are able to mold a complete shot, the first thing to do is weighing it. Include the runner. Now calculate the shot weight by deducting the original (before molding) weight. This is the shot size. This value is critical for shot optimization as well as cost calculation.

5.8 Molding parameter optimization

Initially the focus is only on quality of the molded components. Optimization (shortening) of cycle time is very easy and is the last step to perform.

Optimization consists of:

1. Ensuring complete over-molding without holes or surface voids
2. Ensuring that molding compound does not reach unintended areas (shut-off areas, inside connectors etc)
3. Minimizing internal voids
4. Optimizing surface quality
5. Cycle time optimization

The starting point for this optimization is evaluating the first shot:

- Did the component get fully over-molded (encapsulated)?
- Did molding compound bleed into unintended places?
- Are there voids inside (only obvious with amber material)
- Is the surface acceptable?

5.9 Complete Encapsulation

When a larger area (several cm^2 or ½ sq.in.) is not covered the material has not filled the cavity correctly. The molding parameters may need adjusting:

- It may be necessary to increase shot size entered in FILL 1 (use 10% increments)
- It may be necessary to increase packing pressure (use 10% increments)
- It may be required to increase the temperature so that the material has lower viscosity and flows better (use 20F increments)

The most common reason for incomplete encapsulation is entrapment of air. This can happen where flow fronts meet as the molding compound flows around the components. The low injection pressure does make Low Pressure Molding more prone to air-voids than conventional injection molding. This is addressed by additional venting of the mold-set. Local vent pins can readily be added almost anywhere.

If a thinner section of over-mold does not flow correctly it may be because the above guidelines were not followed. A local vent pin is still the best initial approach to fixing this. Alternatively it may be necessary to modify the cavity shape or consider a two-step over-molding process.

5.10 Bleeding into unintended places

If bleeding into connectors, cables or keep-out areas, there are several potential approaches:

- Improve shut-off if applicable.
- Reduce temperature and/or pressure.
- Pre-seal component if practical.
- Gate closer to problem as this will fill problem area before cavity is pressurized.
- Implement two-step over-molding with first step at very low temperature and pressure to cover leak prone areas.

5.11 Internal voids

There are two kinds of voids:

1. Entrapped air caused by flow problems.
2. Vacuum voids caused by inadequate cavity packing.

Entrapped air can be caused by flowing too fast into the cavity. The molding compound may be “over-shooting” a tall component instead of gently flowing over it and down behind it. First approach should be to reduce flow rate by 50% to see if this cures it. If this helps, the injection can be fine-tuned by using the available FILL steps to slow down and accelerate flow as necessary. It can also be caused by flow fronts that meet and trap air below a circuit-board or similar. In this case it may be necessary to move the gate point or add vent holes in the board. Entrapped air cannot readily be vented out as it is not on the surface of the molded component.

Vacuum voids can be found in several places:

1. Overly thick material sections. After the runner system is frozen off it can no longer compensate for material contraction because of cooling. Very thick sections remain hot and even liquid for some time. The outer surfaces that touch the mold-set cavity cool off first. Inside the thick sections gradually cool down and contract. This can create local vacuum because the outer shape is already frozen solid. This relatively large vacuum can lead to single round bubbles in the thicker sections.
2. By components that sit high on a circuit-board or at cable ends. These voids are caused by the same situation as described above but appear in thinner sections. Here there is an air source: There is air trapped below the chips or inside the cable jacket. A small amount of vacuum will “suck out this air”. These voids will normally be tear-shaped and have the thin end “point” to the air source.

Vacuum voids can sometimes be minimized or eliminated by one or more of the following:

- Increase packing time and or pressure
- Increase mold-set temperature (to keep runner system liquid)
- Lower molding material temperature
- Slower cavity fill
- Under-fill components that sit high
- Seal end of cables
- Using more mold release agent (which may result in the outer surface sinking down instead having internal voids forming.)

It may be necessary to modify the over-mold shape to thin out the thicker sections in order to completely eliminate internal voids. Alternatively a two-step over-molding process can be implemented.

5.12 Surface quality

Molded surface may have various imperfections:

1. Shiny spots or lines
2. Matte/shiny transitions
3. Sink or dimples
4. Blisters
5. Rings or “tears” in gate area or opposite to gate

Shiny spots or lines are typically caused by trapped air. They are common where flow fronts meet, in cavity corners. Better venting is the solution.

Matte to shiny transitions can be difficult to get fully rid off as it is an indirect result of the gentle flow employed in Low Pressure Molding. When material flows into the mold-set cavity, it immediately starts solidifying as it touches the cool mold-set. For larger components it takes several seconds to fill the cavity and actually pressurizing it. The first material has thickened by then and does not get “pushed into the cavity surface” as much as the thinner material flowing in later. This is what causes the shiny to matte transition. I order to minimize this, the mold-set can be run warmer and the flow rate into the cavity be increased. Hot and fast often gives the best surface but higher inflow rate may in turn cause air entrapment or surface voids.

Sink cannot be completely avoided because the molding compounds are un-filled and thus contract a lot. However excessive sink is indicative of:

- Too short packing time
- Too low packing pressure
- Undersized or overly long runner system
- Too small or too long gate or
- Incorrectly located gate(s)

Dimples are indicative of much too short packing time.

Blisters are typically an indication that the molding compound is not dry. These small, thin-skinned blisters often are forming in the direction of the flow away from the gate. The correct fix is to dry the material but sometimes the moisture will flash off if the material is left at temperature for an hour or two in the melt reservoir.
Rings or tear-formed outlines in the gate area or across from the gate are often caused by the initial flow into the mold cavity. This flow can sometimes squirt and hit the cavity across from the gate causing the tear shaped outline. Or the flow will flow into the cavity forming an initial ring at the gate. In either case this material will cool off and when the cavity fills up and flows up around it local matte/shiny transitions occur. Often this can be improved by flowing into the cavity much more slowly: Use FILL 1 to just fill the runner system at a much slower flow rate (maybe 1 to 3 gram per second) and then accelerate the inflow by using FILL 2 to fill the cavity faster. This may require several adjustments but can make a significant difference.

5.13 Productivity

After achieving the best quality molded component possible, it is time to optimize the process from a production stand point. This means lowering processing temperatures, shortening the molding cycle time, and setting up the molding station to be efficient.

Lowering the injection temperature and the mold-set (chiller) temperature will allow shorter cycle times. Lower the temperatures in 10F increments until quality deteriorates. The go back up 10F. This will be the processing temperatures.

The minimum molding cycle time is determined by when a component is packed out correctly and when it is cool enough to handle by operators. For some applications the depth of ejector marks can be the deciding factor. Reduce cooling time first: Reduce by 50%. If components are still OK and can be handled, reduce by 50% again. Otherwise increase by 50% of the last reduction etc. If cool time gets below 5 seconds and parts are still fine, the next step is to reduce packing time. Use the same approach. Note that of the total cycle time only fill time and packing time contribute to product quality. They must be as long as necessary to optimize quality. Cool time mainly ensures that the molded product can be handled.

Set up the molding station so that there is an obvious flow of products. Add any external fixtures to easy component handling and maximize production.

6.0 Maintenance

6.1 General guidelines

WARNING!
Qualified personnel must carry out all maintenance. Maintenance personnel must be familiar with the operation and maintenance of this equipment. They should furthermore be familiar with general safety regulations at the work location.

WARNING!

Maintenance personnel must wear appropriate personnel protection equipment including gloves and safety glasses.

WARNING!

Prior to performing any maintenance on the machine, all utilities must be turned off and disconnected this includes electrical power, air and water supply. Parts of the machine are pneumatically operated and contain fluids under pressure even after the machine has been disconnected from all utilities. Fluid pressure must be safely bled off prior to any maintenance or injury could occur.

WARNING!

The equipment processes materials at temperature up to 475°F. The melt unit, manifold and nozzle are HOT! The hot molten material can cause severe burns! Always wear protective, heat resistant gloves and protective clothing! Always use safety glasses! Do not touch molten material! Even hardened material can still be very hot! Parts of the machine can remain hot for up to 8 hours after machine is turned off.

6.2 Mold-man 1050 maintenance intervals

	Machine part	Maintenance procedure	Interval*
6.2.2	Reservoir	Clean	Every 300 hours or as needed
6.2.3	Material Filter	Replace	Every 300 hours
6.2.4	Teflon Sleeve	Replace	Every 900 hours or as needed
6.2.5	External Panels	Clean	Every 12 month or as needed
6.2.6	Enclosure Air Filters	Clean	Every 12 month or as needed
6.2.7	Pneumatic Air Filter	Replace cartridges	Every 12 month or as needed

6.2.1 Maintenance Access

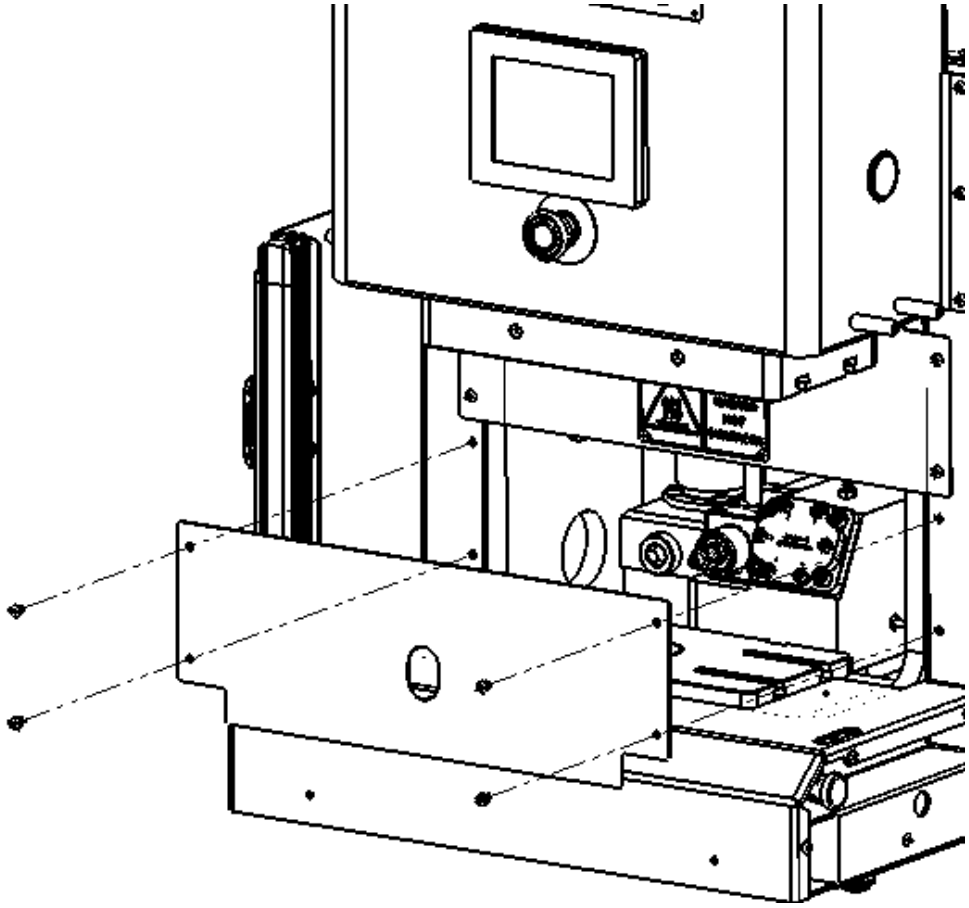


Figure 29: Maintenance Access

The reservoir drain plug and the filter housing can be accessed by removing the bottom front panel just behind the molding platens as shown in the Figure above. Remove the four M8 screws to remove the panel. The top panel can also be removed if desired.

6.2.2 Cleaning of Reservoir

Cleaning of the melt reservoir is critical to successful operation of the machine and must be performed regularly as outlines in section 6.2. The melt-on-demand reservoir was specifically designed to reduce material degradation in the reservoir, so it may not need to be cleaned as often if material is continuously processed through the reservoir and does not sit for long periods of time. All heaters will automatically turn off after two hours of machine inactivity, but certain materials will still degrade quickly enough to produce charred material that will negatively affect the molding process. The cleaning operation is performed as follows:

- Turn the machine on and set the reservoir and manifold temperatures to melt the material (refer to section 4.2.4)
- Use the purge function to empty the reservoir (refer to section 4.2.12)

WARNING!
Molten material is hot and can cause severe burns. When reservoir is empty, the nozzle may sputter because of air. Always wear eye protection, gloves and protective clothing when handling hot material!

NOTE!
Ensure that the purged material is captured by the suitable heat resistant container.

- Reduce the reservoir temperature to the softening point of the molding material, typically 275°F (135°C) to 290°F (143°C). Material at higher temperatures will be much easier to clean off, but reducing the temperature to the material softening point is safer for the operator.
- Remove the reservoir cover (refer to section 6.2.1)
- Position a suitable heat resistant container under the drain plug (b) as shown on Figure 30 on the front side of machine. If this area is not easily accessible, place the container underneath the nozzle instead to prepare to purge material through the nozzle in a later step
- Carefully remove the drain plug (b) and the sealing washer (a) from the reservoir using a 17 mm allen wrench.
- Clean reservoir using wooden or high temperature plastic spatula or paint stick to remove any charred material. Be very careful not to damage the PTFE reservoir tube.
- Lift as much of the loose charred material out the reservoir as feasible.
- Virgin thermoplastic material can be added to the reservoir to speed up the cleaning process. After material is added, use the wooden paint stick to scrub the fins and reservoir walls while the material is still in solid pellet form.
- Increase the reservoir temperature back to operating temperature and drain the material form the reservoir after it is completely melted. If the drain plug was removed, clean the threaded holes and the plugs of material. The plugs are carefully reinstalled along with the sealing washer and tightened to 8 ft-lb (11 Nm) torque. Alternatively, use the purge function to purge the degraded material through the nozzle and into a drain pan. Degraded material will be flushed through the filter, so the filter will need to be removed before continuing production to ensure bits of char do not appear in over-molded components.

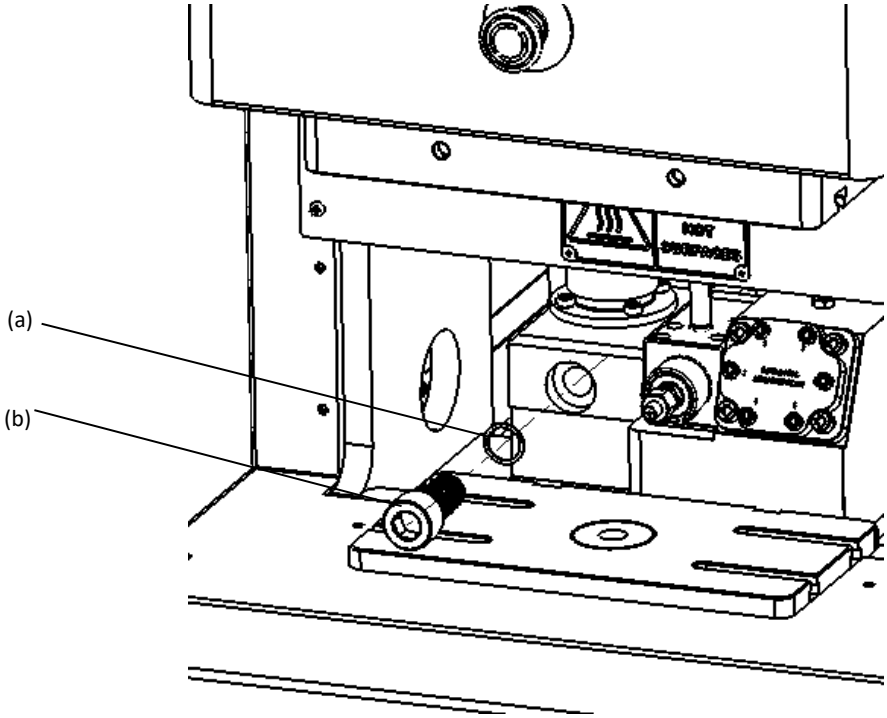


Figure 30: Reservoir Drain Plug

6.2.3 Replacing the Material Filter

Changing the filter is critical to successful operation of the machine and must be performed regularly as outlined in section 6.2. It is performed as follows:

- For filter change, first heat manifold and reservoir to the material softening point typically around 275°F (135°C) to 290°F (143°C).
- Remove six bolts (a) and carefully remove the filter lid (b) with O-ring (c)
- Pull out old filter (d) with needle-nose pliers or by engaging screwdriver into small filter opening.
- After carefully cleaning out any excess material, install new filter with large opening downwards.
- Wipe off mating surfaces, install a new O-ring (c) in filter lid (b)
- Use high temperature anti seize compound on clean threads of bolts (a) and lightly tighten them while following the pattern shown in figure 6-13. Continue to follow the tightening pattern and tighten the bolts to 7 ft-lb (10 Nm). It is important to not over-torque the bolts and damage the threads. A manifold with damaged threads will need to be replaced.
- For part numbers and a complete exploded view of the manifold assembly, please see the drawings beginning in Section 8.3.

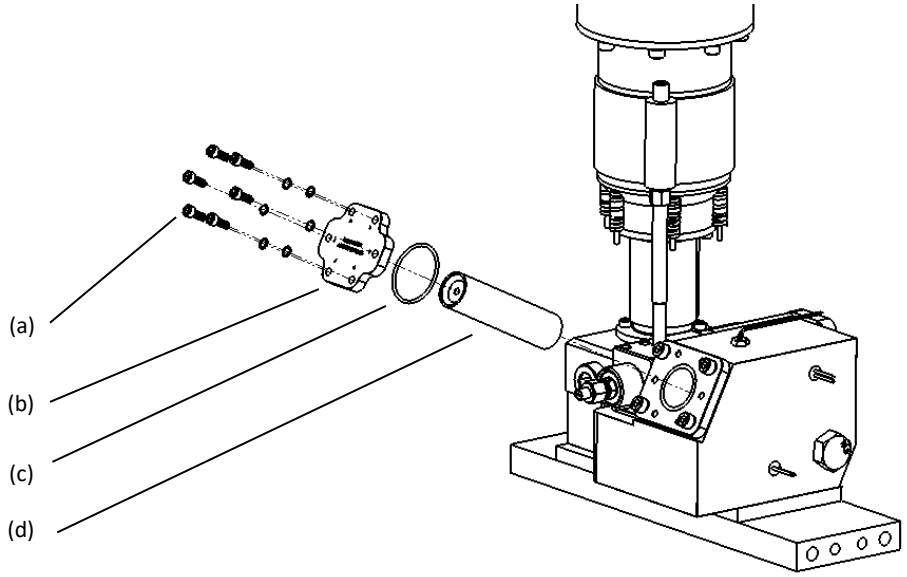


Figure 31: Filter

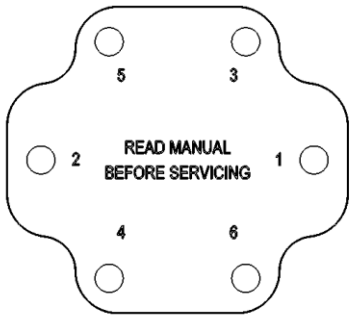


Figure 32: Filter lid bolt tightening patter

6.2.4 Replacing the Teflon Sleeve

Replacing the Teflon Sleeve must be performed regularly as outlined in section 6.2. Refer to Figure 33 when following the steps below. The Teflon Sleeve is item #14. The procedure is performed as follows:

- Remove the front panel as shown in Figure 30, and remove the top panel as shown in Figure 35.
- The temperature of the material in the nozzle must be at the softening point (about 275°F or 135°C) before disassembly. Either set the manifold temperature of the machine to heat up the nozzle before removal, or use a heat gun after the nozzle is removed.
- Remove the two pneumatic hoses connected to the back of the nozzle assembly. Be sure to mark one or both of the hoses to remember the proper configuration when re-installing the hoses later.
- Remove the 4 M5x6 socket head cap screws (Item #2) and remove the nozzle assembly by lifting the assembly upward. Remove the the pressure transducer (Item #1) to remove the nozzle assembly more easily, though it is possible to remove the nozzle with the transducer still attached. Disconnect main power from the machine and remove the quick-disconnect electrical cable from the transducer before removing the transducer from the nozzle.
- Disassemble the nozzle assembly by removing the four M5x85 socket head cap screws (Item #21 in the drawing) and pull pneumatic cylinder with the pin from the rest of the assembly.
- Remove and replace the nozzle sleeve (item #14).
- Assemble the nozzle assembly by reversing the previous steps.
- Before re-installing the nozzle assembly, replace the 13x1.5mm O-ring (item #9). Ensure the mating surface on both the nozzle and the manifold is completely clean. Material left in this area will create a leak path for material to flow during the injection process.
- Mount the nozzle assembly to the manifold with the 4 M5x6 socket head cap screws and tighten them in a cross pattern to 4 ft-lb (5.4 Nm).
- If the pressure transducer was removed, reinstall it and tighten it to 18.5 ft-lb (25 Nm).

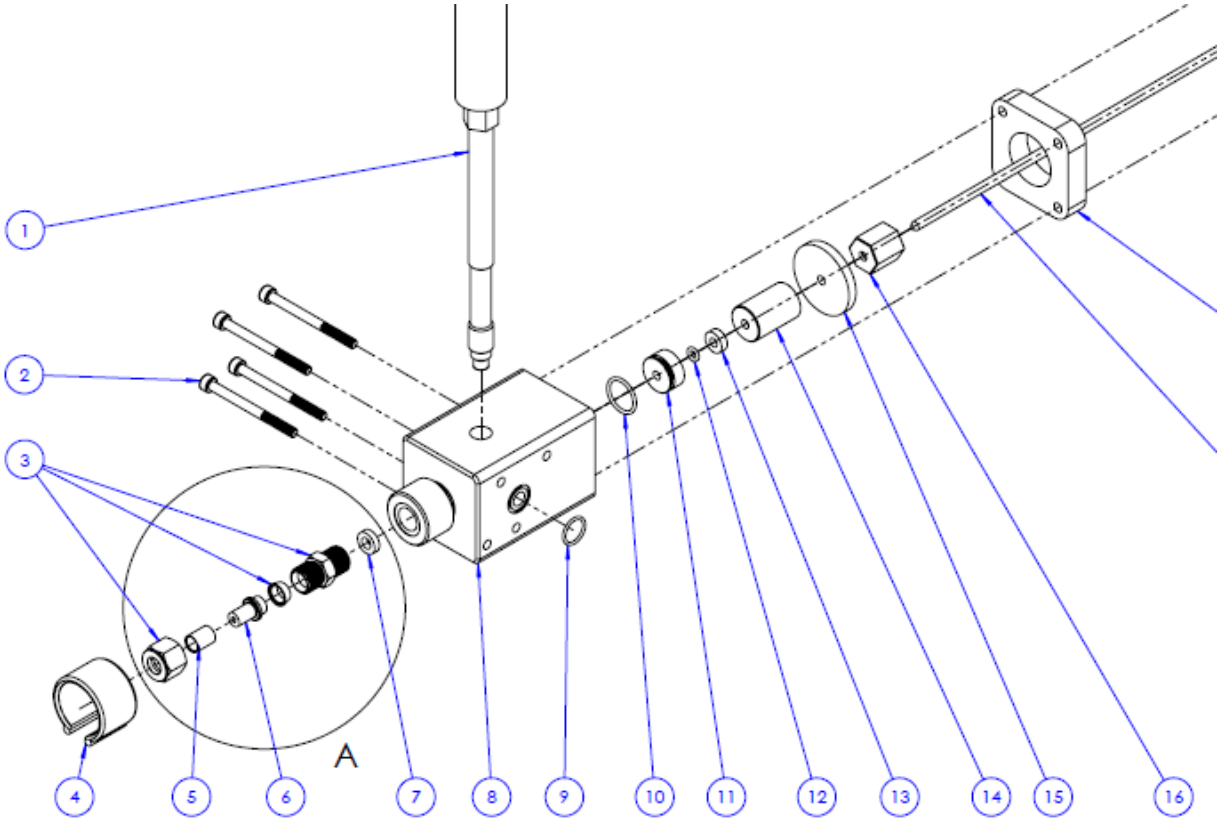


Figure 33: Screenshot of exploded nozzle assembly drawing. The Teflon Sleeve is shown as item #14.

6.2.5 External Panels

External panels are cleaned with lukewarm soapy water using a soft sponge. Rinse off with clean water and dry with absorbing cloth. Difficult spots can be removed with rubbing alcohol on a soft rag and then cleaned with soapy water as described above.

6.2.6 Enclosure Air Filters

Figure 34: Enclosure Air Filter

The machine has two air filters, one on each enclosure door. Remove the louvered section of the air filter by inserting a small screw driver in the provided access slot as shown in figure 33 and carefully levering the screwdriver towards you. Remove the filter media and clean with compressed air. Reinstall filter media and louvered section.

6.2.7 Pneumatic Air Filters

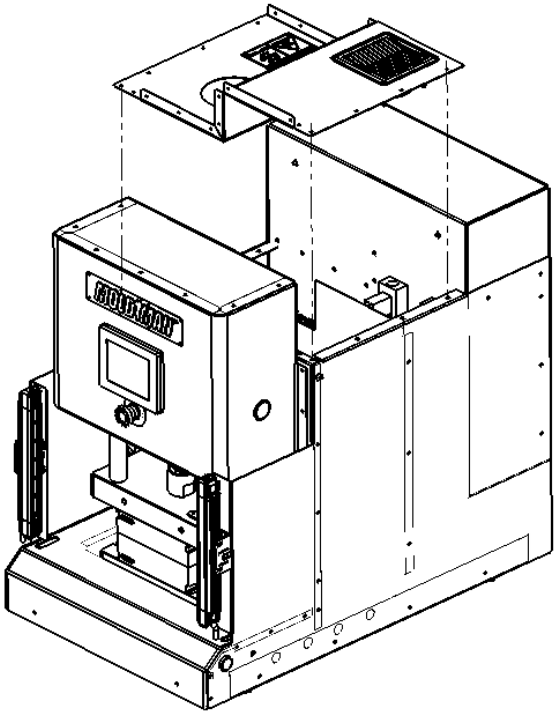


Figure 35: Removing the top panel

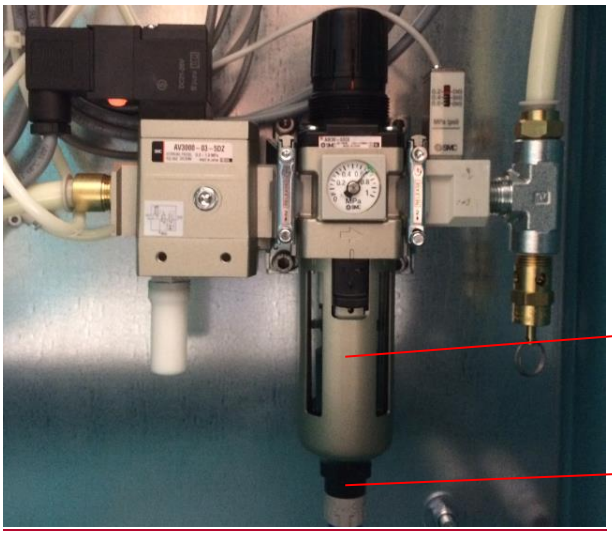


Figure 36: Air filter

To gain access to the air filter, access the pneumatic system by removing the top panel as shown in Figure 34. To drain potential water accumulation from the air filter open the screw (b) as shown in Figure 35 at the bottom of the bowl. Use a suitable container and/or rags to collect the water.

WARNING!

Before replacing the air filter cartridges, turn off the machine and disconnect the air supply to the machine!

Before replacing the air filter turn off the machine and disconnect the air supply to the machine! Rotate the bowl (b) to remove them and discard the old cartridges and replace them with new ones. Reinstall the bowl (b) making sure that it is securely fastened.

7.0 MM1050 Machine Troubleshooting

7.1 Troubleshooting Matrix

Issue	Possible Causes	Corrective action
Machine injects too little/no material	Material Filter Contaminated/Filter installed the wrong way	Replace the material filter as outlined in section 6.2.3.
	Pump suction blocked by foreign object or degraded material	Remove the pump and remove foreign object.
	Pump suction is cavitating due to material not falling into pump	Clean the PTFE portion of the reservoir to keep material from sticking to the sides of the reservoir. Use a wooden paint stick to push the material down into the pump. For stickier materials, pressurize the reservoir at 5 PSI.
	Incorrect specific gravity value entered for material used	Enter correct specific gravity value into the material setup screen
	Wrong injection settings	Enter correct injection settings
	Air supply to pressure low	Supply machine with correct air pressure. Ensure the pressure gauge on the side of the machine reads at least 100 PSI.
	Nozzle pin not attached to pneumatic cylinder	Attach the nozzle pin to the pneumatic cylinder
	Pump motor not turning	Check cable connection to pump motor
Machine injects too much material	Incorrect specific gravity value entered for material used	Enter correct specific gravity value into the material setup screen
	Wrong injection settings	Enter correct injection settings

Issue	Possible Causes	Corrective action
Mold Flashes	Air Pressure to machine low	Supply machine with correct air pressure. Ensure the pressure gauge on the side of the machine reads at least 100 PSI.
	Wrong injection settings. Clamp force required to keep clamp closed with current injection settings exceeds maximum clamp force of machine (1 ton).	Enter correct injection settings
Manifold or reservoir temperature not increasing/increasing slowly	Fuses blown	Check fuses. See section 7.3
	Solid state relay defective	Replace solid state relay
	Heater defective	Check heater cartridge resistance. See section
Manifold or reservoir temperature rising above set point	Solid state relay defective	Replace solid state relay

7.2 "MOLD PRESSURE TOO HIGH" Error

The error "MOLD PRESSURE TOO HIGH" will appear on the bottom of the screen when the injection system is attempting to inject material, either during an injection cycle or while the purge button is pressed, but the pressure transducer is measuring a pressure reading higher than 1800 PSI. When the error is activated, the software is programmed to immediately stop motor motion to prevent damage from occurring to the pressure transducer or to the sealing components in the machine.

WARNING!

Multiple instances of the "MOLD PRESSURE TOO HIGH" error will result in failed O-rings and other sealing interfaces in the injection system, resulting in leak paths. The various sealing interfaces are not designed to withstand multiple instances of pressure spikes at pressures above 1800 PSI at temperatures of 375º F or above. If the error appears multiple times, monitor the areas around the nozzle, manifold, and reservoir to check for leaks. If a leak is spotted, the O-ring on that particular sealing interface has failed and will need to be replaced.

There are several possible causes for the error:

1. The total number of mass (grams) entered in the FILL steps of the injection parameters exceed the maximum amount of mass that can be contained in the volume of the mold-set cavities.
    a. For example, if 10 grams is entered in Fill Step 1, but the cavity can only contain 7 grams, the machine will still attempt to inject 10 grams of material into the cavity. After the cavity is full, the back-pressure in the injection system increases until the pressure transducer measures 1800 PSI or higher. At this point, the error is activated and injection stops. Because the injection cycle stops before the packing step begins, this will likely result in incomplete encapsulation.
    b. It is recommended that about 90-95% of the total required mass to over-mold the part and the runner is entered into the fill step. The remaining 5-10% of volume is filled in during the packing step. For example, if a total of 10 grams is needed to fill the runner and over-mold the part, then about 9-9.5 grams should be entered in the fill steps.
2. A cold section of material is formed in the nozzle and is blocking flow:
    a. If the nozzle heater has malfunctioned, the nozzle will not be hot enough to process material and will form a cold section. Measure the resistance of the heater to determine if it has been damaged. Refer to section 7.2 for troubleshooting instructions.

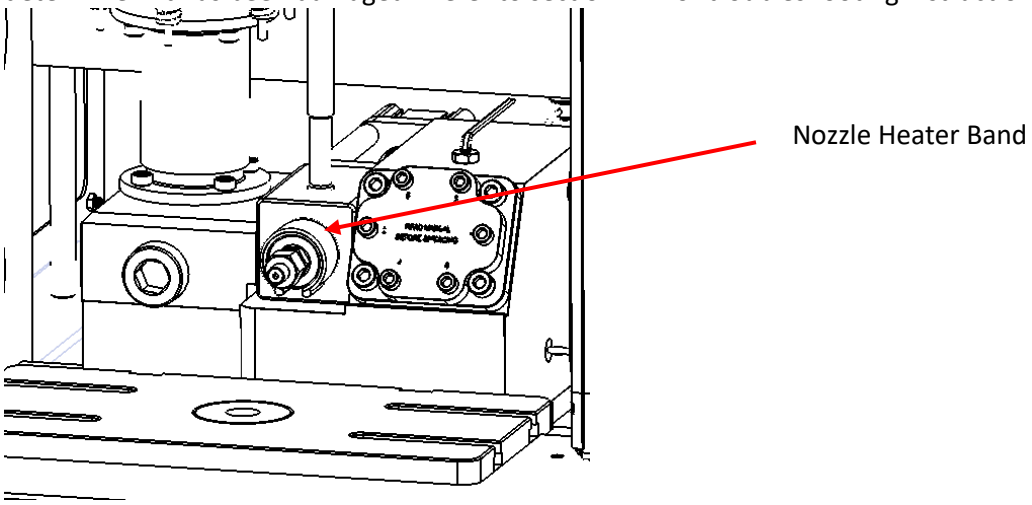


Figure 37: Nozzle heater band location

b. If the backside of the mold-set is touching the nut on the nozzle, the mold-set will immediately pull heat from the nozzle and cool down the nozzle. The drop in temperature is not large enough for the temperature sensor to detect, but may result in a high pressure error. Ensure that at an air gap of at least 1mm exists between the mold-set and the nozzle nut as shown in Figure 38.

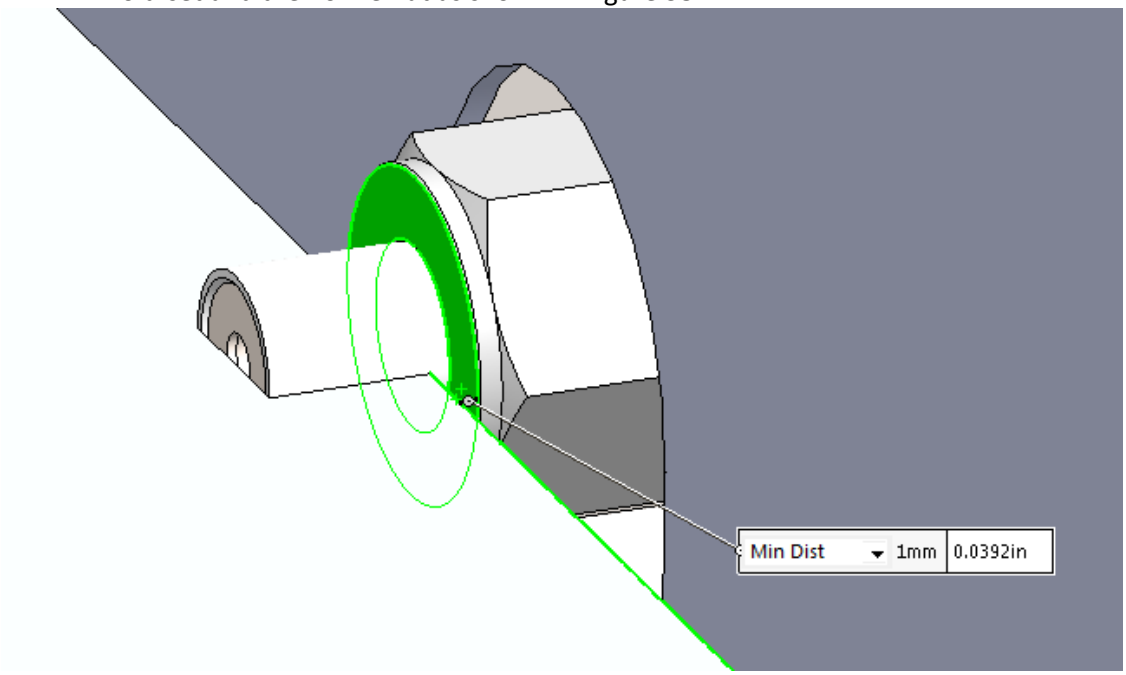


Figure 38: Allow a 1m gap between the backside of the mold and nozzle nut

3. Immediately after the injection cycle begins and the motor and pump begin turning, the pressure transducer will measure an initial spike in pressure as the material begins to move, but the pressure will quickly taper off. If this initial spike in pressure is higher than 1800 PSI, the error will trigger and the injection cycle will stop. There are two parameters that can be changed to decrease the pressure spike.
    a. Increase Manifold and Reservoir Temperature settings: Higher viscosity materials will result in higher back pressures, and a higher initial pressure spike. Material viscosity is also proportional to temperature. To decrease material viscosity, increase material temperature.
    b. Decrease injection flow rate, or use the multiple fill steps to slowly ramp up the flow rate: A high flow rate will result in a higher pressure spike as the material starts moving. Alternatively, the fill steps can be used to slowly ramp up the injection speed. Higher viscosity materials, such as copolyesters, cannot be injected at high flow rates. Some copolyester materials can only be injected at maximum flow rates as low as 3 grams/second.
4. The pressure transducer may require resetting. See the following section (Pressure transducer calibration function) for instructions on how to reset the pressure.

7.3 Temperature control loop troubleshooting

Remove the back panel from machine to gain access to the electrical enclosure.

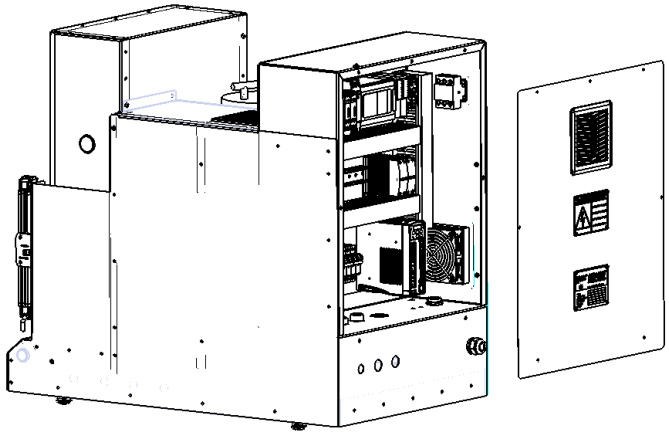


Figure 39: Back panel removed

There are several possible causes for the problem:

a. A fuse has been blown. The LED on the fuse blocks will illuminate red if a fuse is blown. Continuity across fuses can also be checked to verify that a fuse has not been blown.

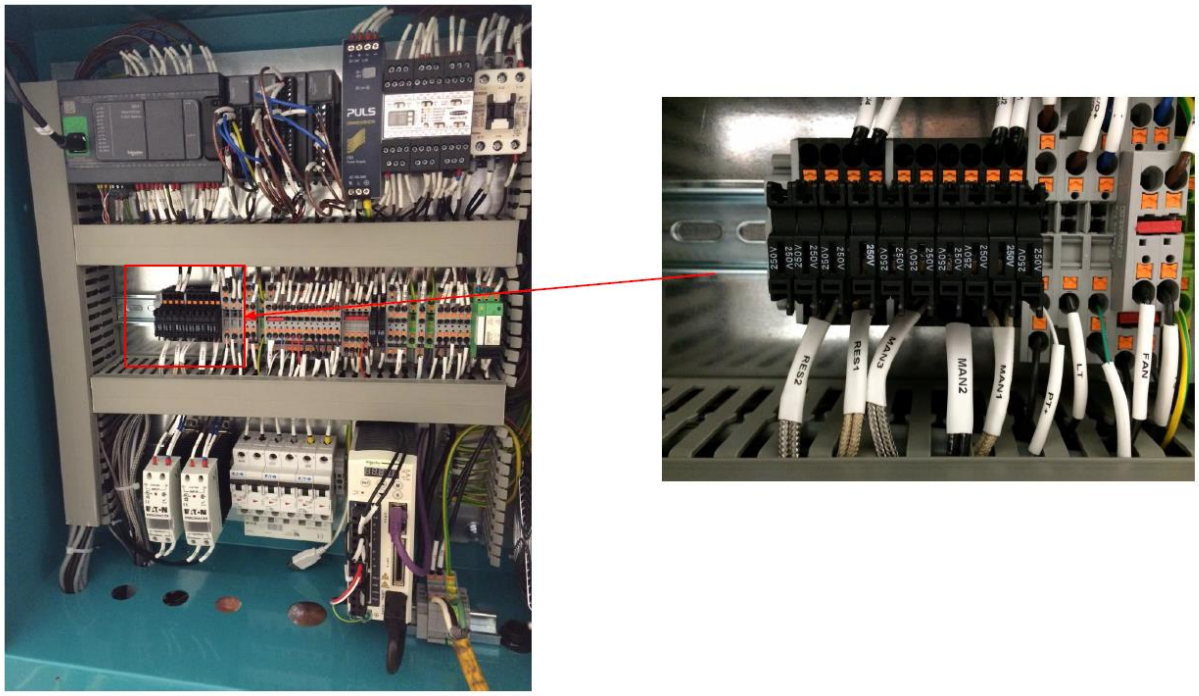


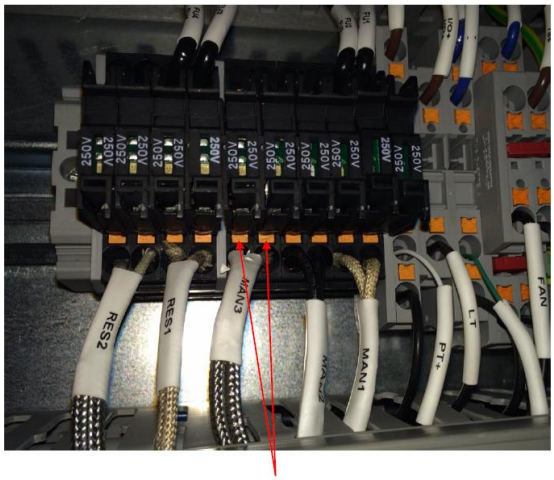
Figure 40: Fuse block location

- The fuse blocks are shown in Figure 40
- The manifold heaters are labeled MAN1, MAN2, and MAN3.
- The reservoir heaters are labeled RES1 and RES2.

Figure 41: Opening a fuse block

- To open a fuse block, use a flat-head screwdriver and follow the pictures shown in Figure
- The fuse block will flip upward, then flip open on the side to access the fuse.

b. A heater is malfunctioning or has been damaged. To check heater resistances, follow the steps below.



- Resistances:
  - MAN1: 61 Ohms
  - MAN2: 113 Ohms
  - MAN3: 595 Ohms
  - RES1: 58 Ohms
  - RES2: 85 Ohms

Figure 42: Heater resistance values

- To remove wires, use a flathead screwdriver to push the orange buttons as shown in Figure 42. Pull the wires at the same time.
- Use a multi-meter to check the resistance of each pair of wires. The measured values should match the values shown above within a tolerance of +/- 10% Ohms.

8.0 Machine Calibration/Verification

8.1 Temperature sensor and analog input module operation verification

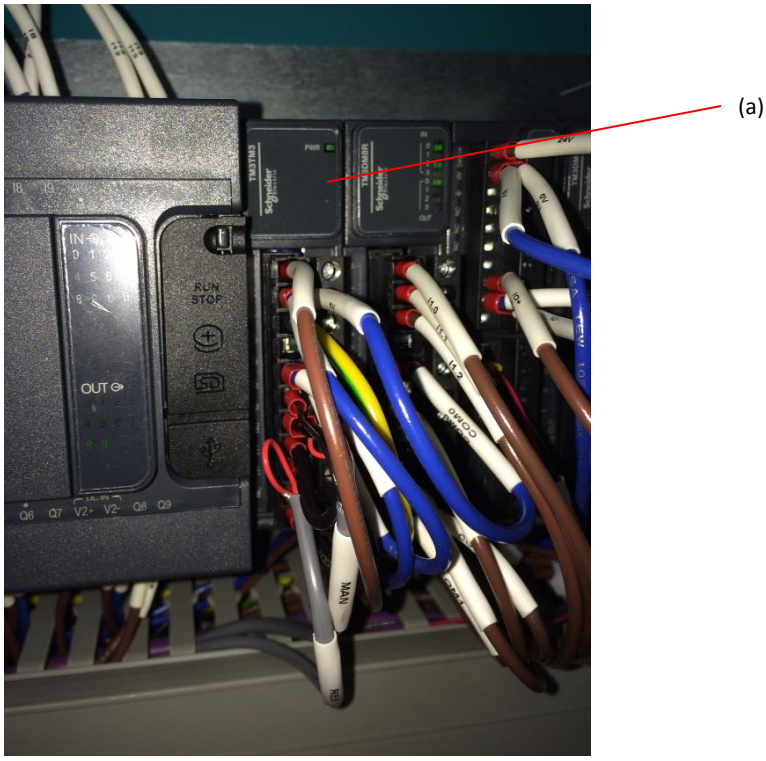


Figure 43: Analog Input Module

The MM1050 machine has two temperature sensors, one for the reservoir and one for the manifold. Both temperature sensors are 2 wire PT 100 sensors that are terminated directly into an analog input module. The module can be found in the upper left hand corner of the electrical enclosure, is attached to the right side of the PLC, and it is labeled “TM3TM3” (a).

Temperature Sensor	Terminals
Reservoir	I1+, I1-
Manifold	I0+, I0-

To verify the operation of the analog input module, remove a temperature sensor from its termination and install a resistor across the terminals. A 108 Ohm resistance should result in a 68 F +/-1.5% readout, a 176 Ohm resistance should result in 392 F +/- 1.5% readout. Ensure that power to machine is disconnected prior to performing this test.
To test the temperature sensors, simply set the temperature to 68F or 392F. After the process temperature has attained the set-point and stabilized, the resistance can be measured between the terminals for the different temperature loops as outlined in the table above. The jumper wire connected from the negative terminal to the NC terminal will need to be disconnected from the NC terminal before measuring resistances between the positive and negative terminals to receive the correct readings.

8.2 Pressure transducer calibration function

Note: This feature is available for machines with software revision 12v3 or newer. Please contact Moldman Systems LLC for a software update and instructions.

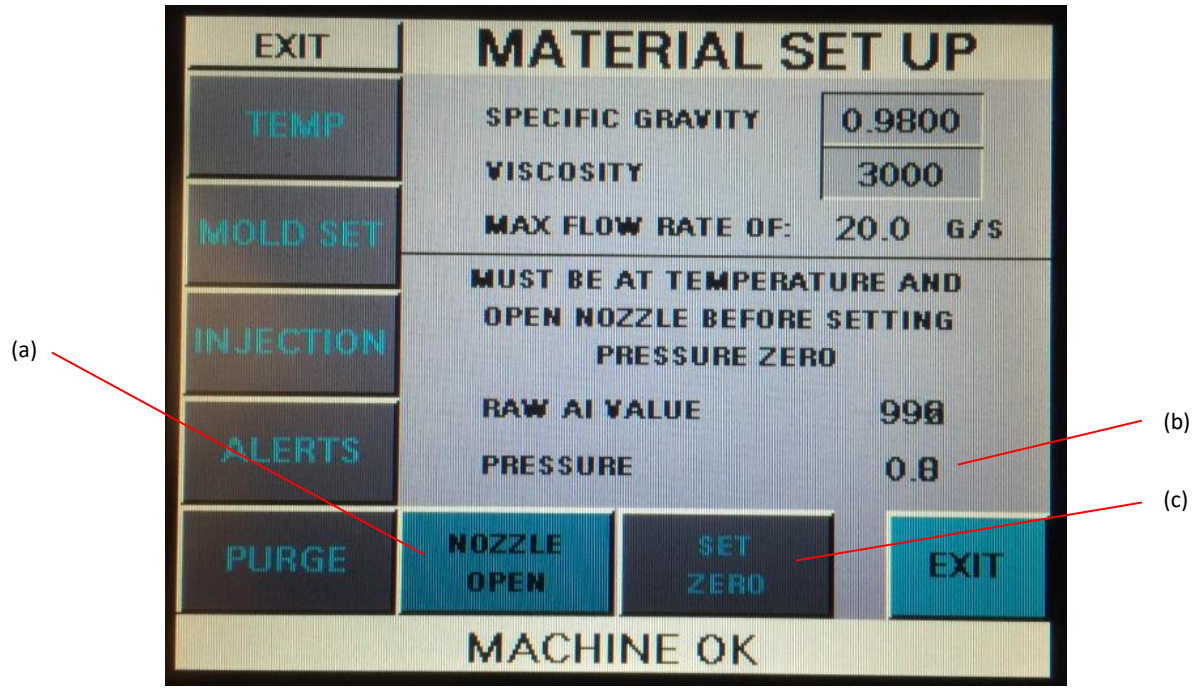


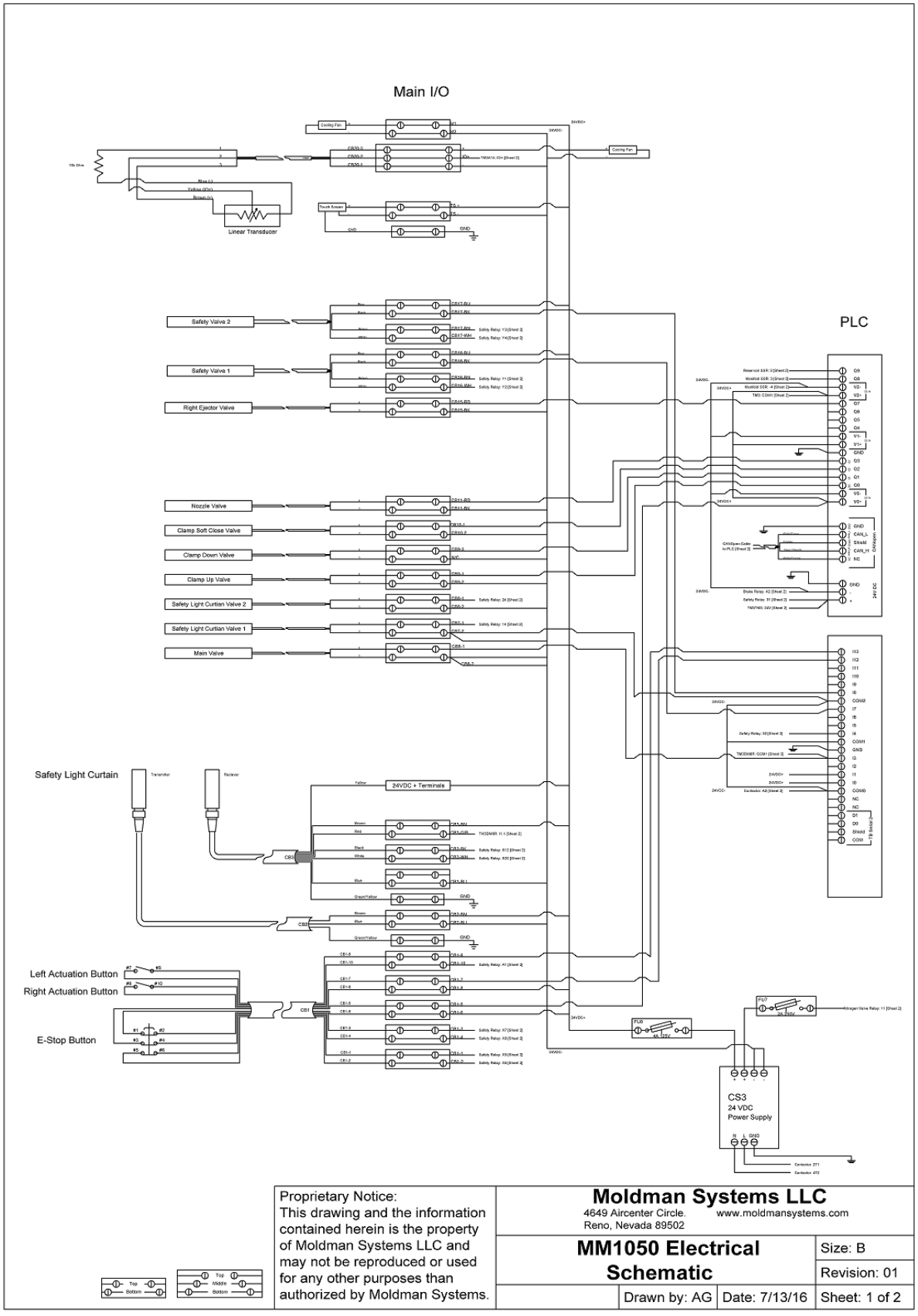
Figure 44: Pressure transducer zero screen

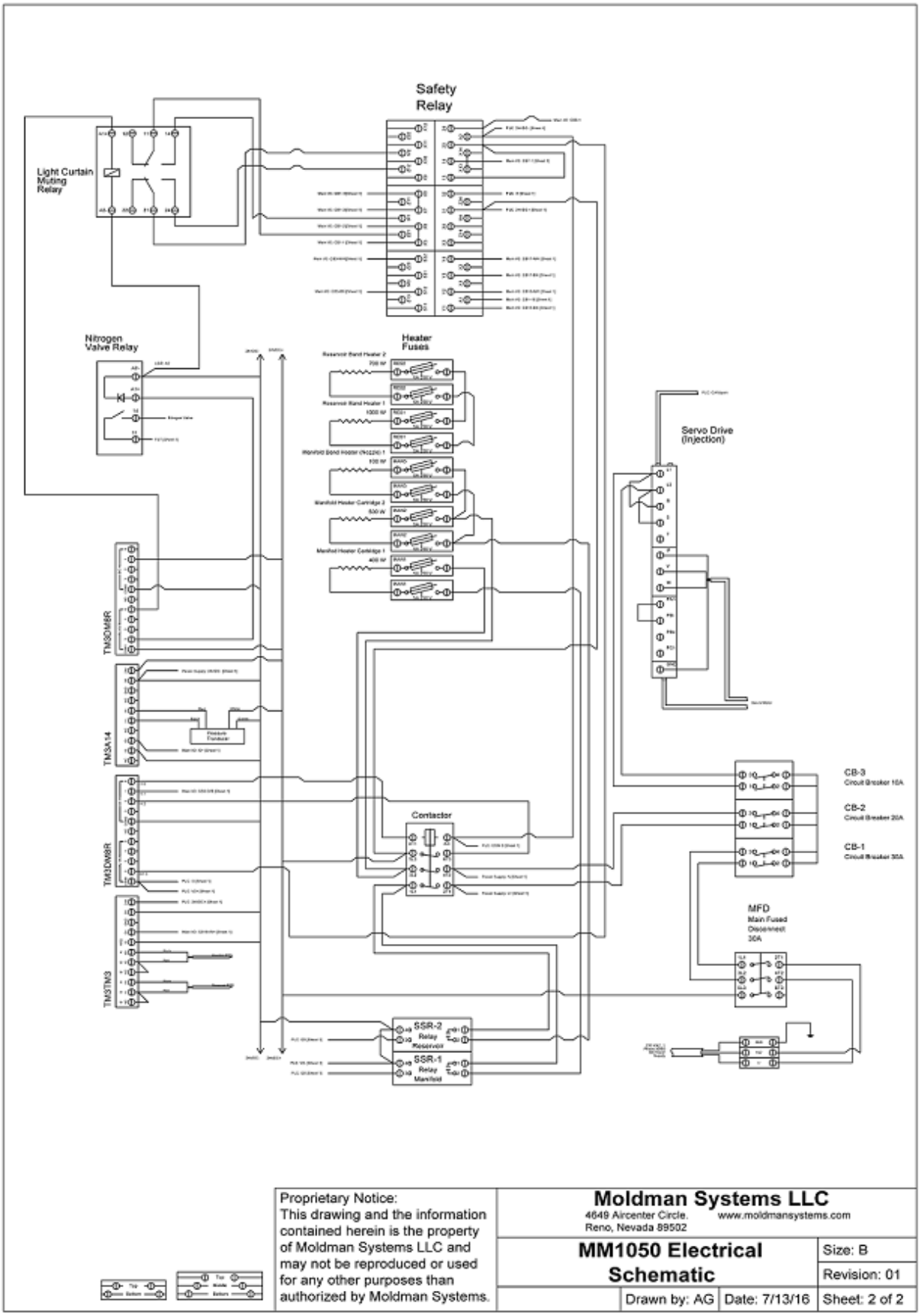
This screen allows the user to calibrate the pressure transducer. To access this screen from the production screen, press “SETUP”, then “MATERIAL”. To successfully calibrate the transducer, first increase the reservoir and manifold temperatures to operating temperature (about 400° F), press “NOZZLE OPEN/CLOSED” (a) to open the nozzle and relieve pressure in the system, then press “SET ZERO” (c). The displayed pressure (c) will display “0” +/- 0.2. Close the nozzle before continuing operation of the machine.

9.0 Drawings/Schematics

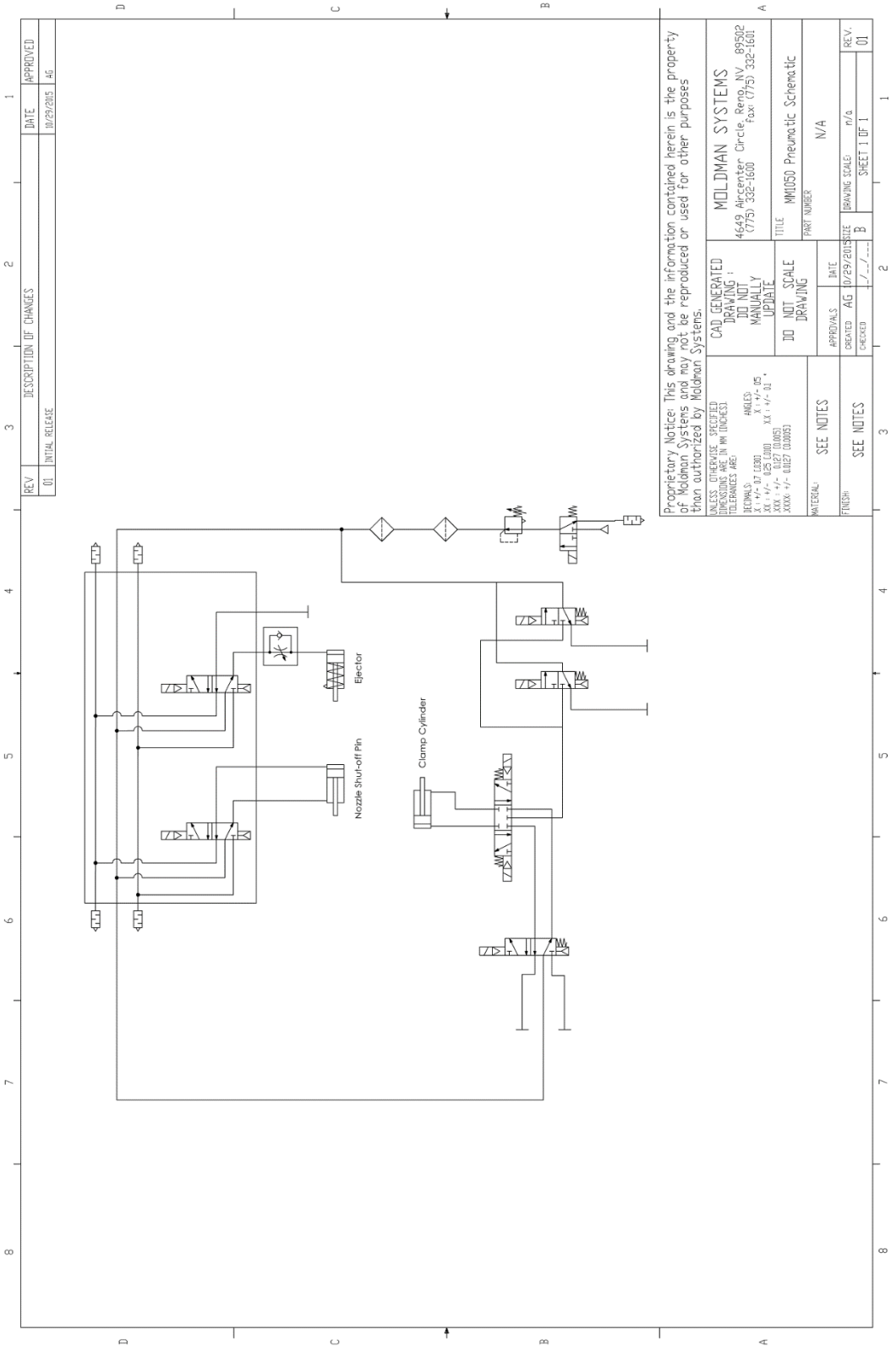
9.1 Wiring Schematics

Low resolution wiring schematics can be found on the following pages. Please contact Moldman Systems for higher resolution PDF files.

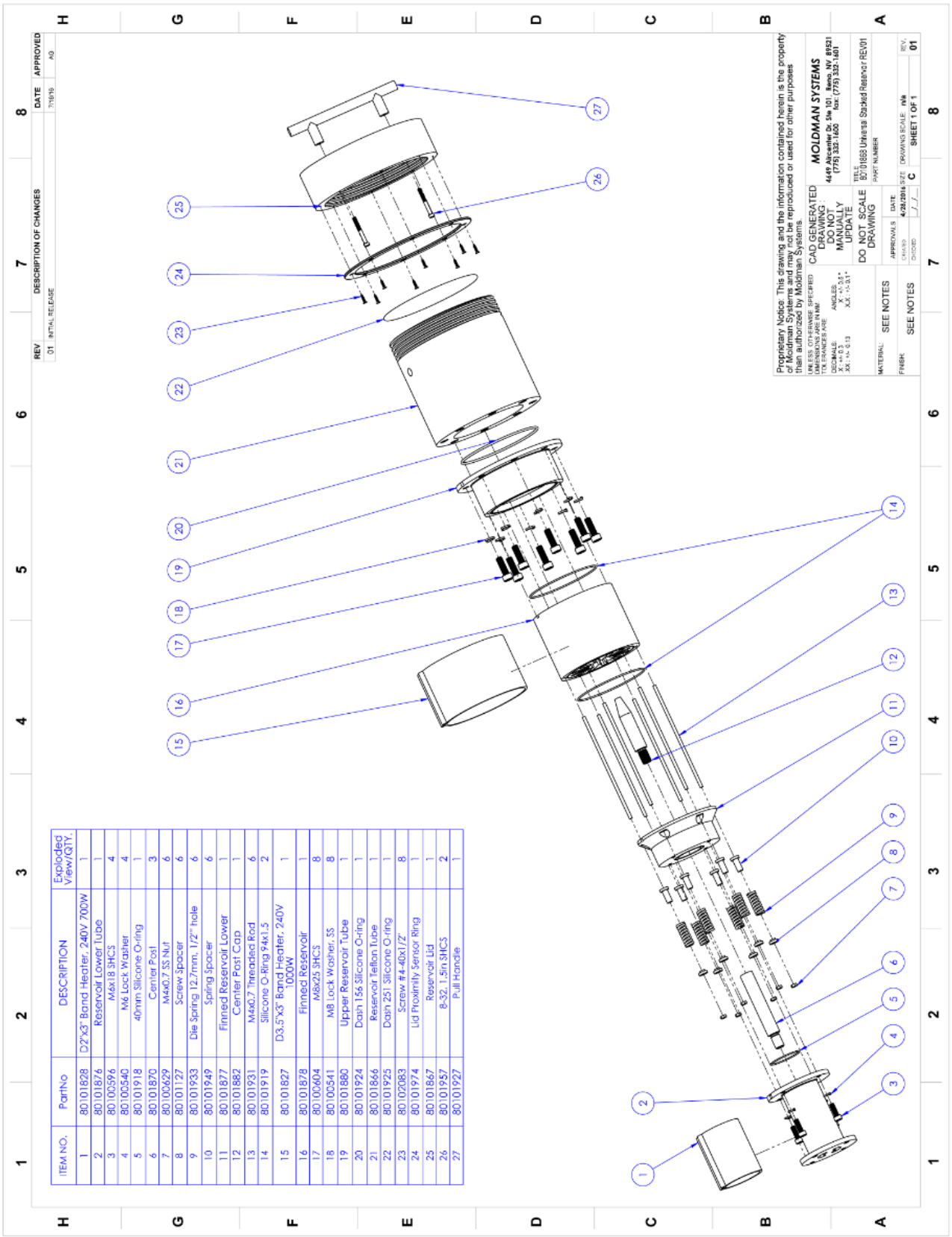




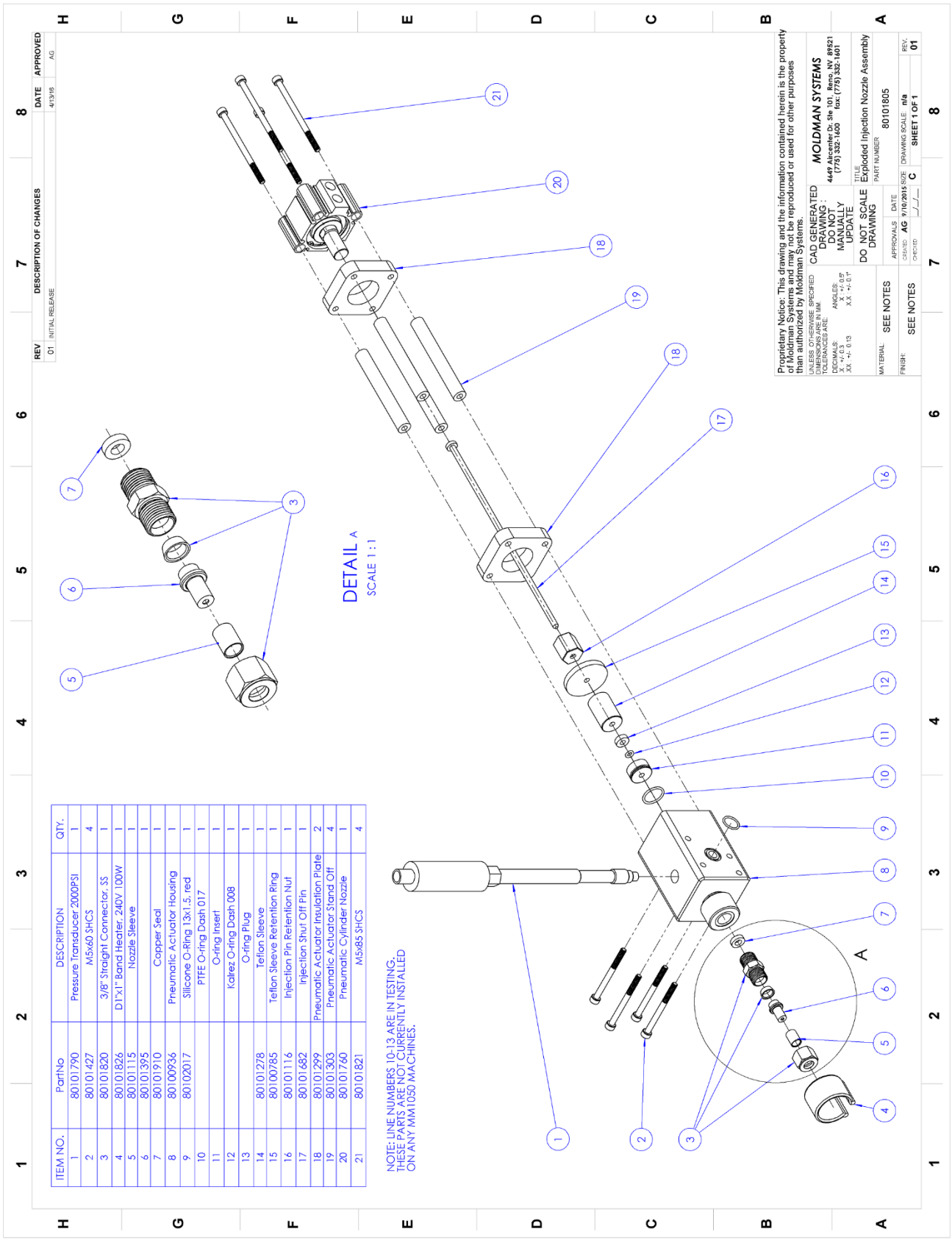
9.2 Pneumatic Schematic



9.3 Mechanical Drawings



ITEM NO.	PartNo	DESCRIPTION	Exploded View/QTY.
1	80101828	D2"x3" Band Heater, 240V 700W	1
2	80101876	Reservoir Lower Tube	1
3	80100596	M4x18 SHCS	4
4	80100540	M4 Lock Washer	4
5	80101918	40mm Silicone O-ring	1
6	80101870	Center Post	3
7	80100629	M4x0.7 SS Nut	6
8	80101127	Screw Spacer	6
9	80101933	Die Spring 12.7mm, 1/2" hole	6
10	80101949	Spring Spacer	6
11	80101877	Finned Reservoir Lower	1
12	80101882	Center Post Cap	1
13	80101931	M4x0.7 Threaded Rod	6
14	80101919	Silicone O-Ring 94x1.5	2
15	80101827	D3.5"x3" Band Heater, 240V 1000W	1
16	80101878	Finned Reservoir	1
17	80100604	M8x25 SHCS	8
18	80100541	M8 Lock Washer, SS	8
19	80101880	Upper Reservoir Tube	1
20	80101924	Dash 156 Silicone O-ring	1
21	80101866	Reservoir Teflon Tube	1
22	80101925	Dash 251 Silicone O-ring	1
23	80102083	Screw #4-40x1/2"	8
24	80101974	Lid Proximity Sensor Ring	1
25	80101867	Reservoir Lid	1
26	80101957	8-32, 1.5in SHCS	2
27	80101927	Pull Handle	1



ITEM NO.	PartNo	DESCRIPTION	QTY.
1	80101790	Pressure Transducer 2000PSI	1
2	80101427	M5x60 SHCS	4
3	80101820	3/8" Straight Connector, SS	1
4	80101826	D1"X1" Band Heater, 240V 100W	1
5	80101115	Nozzle Sleeve	1
6	80101395		1
7	80101910	Copper Seal	1
8	80100936	Pneumatic Actuator Housing	1
9	80102017	Silicone O-Ring 13x1.5, red	1
10		PTFE O-ring Dash 017	1
11		O-ring Insert	1
12		Kalrez O-ring Dash 008	1
13		O-ring Plug	1
14	80101278	Teflon Sleeve	1
15	80100785	Teflon Sleeve Retention Ring	1
16	80101116	Injection Pin Retention Nut	1
17	80101682	Injection Shut Off Pin	1
18	80101299	Pneumatic Actuator Insulation Plate	2
19	80101303	Pneumatic Actuator Stand Off	4
20	80101760	Pneumatic Cylinder Nozzle	1
21	80101821	M5x85 SHCS	4