MACHINE SOLUTIONS INC.

USER MANUAL

# BEAHM DESIGNS TIPPING SYSTEM

## Model 510-A

BEAHM DESIGNS

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# WELCOME

Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new 510-A Tipping System machine. At MSI, we are dedicated to bringing innovative process development solutions to both medical device and nonmedical organizations. The MSI proprietary segmental technology has been successfully implemented in manufacturing clean rooms on five continents, and continues to expand – meeting, growing, and facilitating the abilities of device companies around the globe. MSI looks forward to helping your organization provide life-improving devices to your customers, today and tomorrow.

# MACHINE DESCRIPTION

The Beahm Designs Inc. Model 510-A is a system for the purpose of thermo-forming the ends of thermoplastic tubing's and materials by advancing the material into a heated tooling. Once the material is loaded on the system all process parameters are controlled by the system.

# SAFETY

- Enclosure heating can occur when using a small nozzle at flow rates above 35 scfh.
- Use of eye protection when working with compressed gases and heated materials is advised.
- The maximum observed Sound Pressure Level is below 70 dBA.
- Die jaws will become hot during operation and, depending on temperature set point, can cause severe skin burns if contact occurs.

**Caution: high voltage. Remove power and use safety precautions when servicing.**


**Caution: hot surface. Contact may cause burn. Allow to cool before servicing.**


**Caution: pinch point. Keep hands and body parts clear while in operation.**

# User Alerts

Do not use or otherwise operate the machine in any manner other than that in which it is explicitly intended. Examples: Do not attempt to sit on or climb on the equipment, do not place heavy objects or containers of liquid on the machine, do not to insert any foreign objects into the machine and do not attempt to bypass any guards.

**Note: The equipment is not for use with materials that can decompose or ignite below the maximum operating temperature of the machine. Hazards are materials that outgas hazardous substances and or ignite. (260°C/500°F).**

**Note: This equipment is not for use in an ATEX environment.**

# Contents

Included with the system are the following contents:

- Tipping System
- IEC Power Cord
- Compressed Air Supply Hose Assembly

# Installation

1. Place the system on a level, sturdy surface.
2. Connect the power cord to the main control unit.
3. Connect the air supply hose assembly to the system and then to a clean, dry, and filtered compressed air source.

# SET UP AND CONFIGURATION

Considerable differences exist between the setup of each application based on tipping die type, material, and size as well as material to be tipped. The following instructions are provided as guidelines and the actual set up may differ based on experimentation and refinement to attain the most efficient process.

### Tipping Die Mounting

- The standard die tooling is designed to constrain the die between two bushings, one at each end of the die. The bushings are then clamped by the tooling mount bracket. This configuration provides a convenient means to mount many die configurations and materials with minimal tooling cost and avoids special flange requirements on the die.

### Grip Positioning

- The material insertion stage can be adjusted along the main tooling rail to allow the grip assembly to accommodate various product configurations, tipping die tooling and/or grip head styles. Typically, the grips should be positioned as close to the entrance of the tipping die to minimize compression of the material during the insertion step.

### Grip Heads

- The standard grip heads feature flat, silicone faced surfaces and are effective for most mid to low durometer materials. Larger diameters and higher durometers may require contoured grips in conjunction with the optional high force grip pneumatics.

### Tipping Die Positioning

- The die mount assembly can be adjusted along the tooling rail and allows for the thermal nozzle to engage the die for optimal heating of the material to be tipped.

### System Options

- Many optional accessories are available to enhance the functionality of the system and improve process yield. Contact Machine Solutions sales department or visit our web site www.machinesolutions.com for more information on available accessories and to request a quote.
  Examples of available accessories are:
  -Vision systems with or without on-screen crosshair line generators.
  -Laser line generators.
  -Extended product support trays/guides.
  -Product grip nests/alignment tooling.

# SYSTEM CONTROLS AND FUNCTIONS

Located on the front and rear panels are the following controls and/or displays and their function:

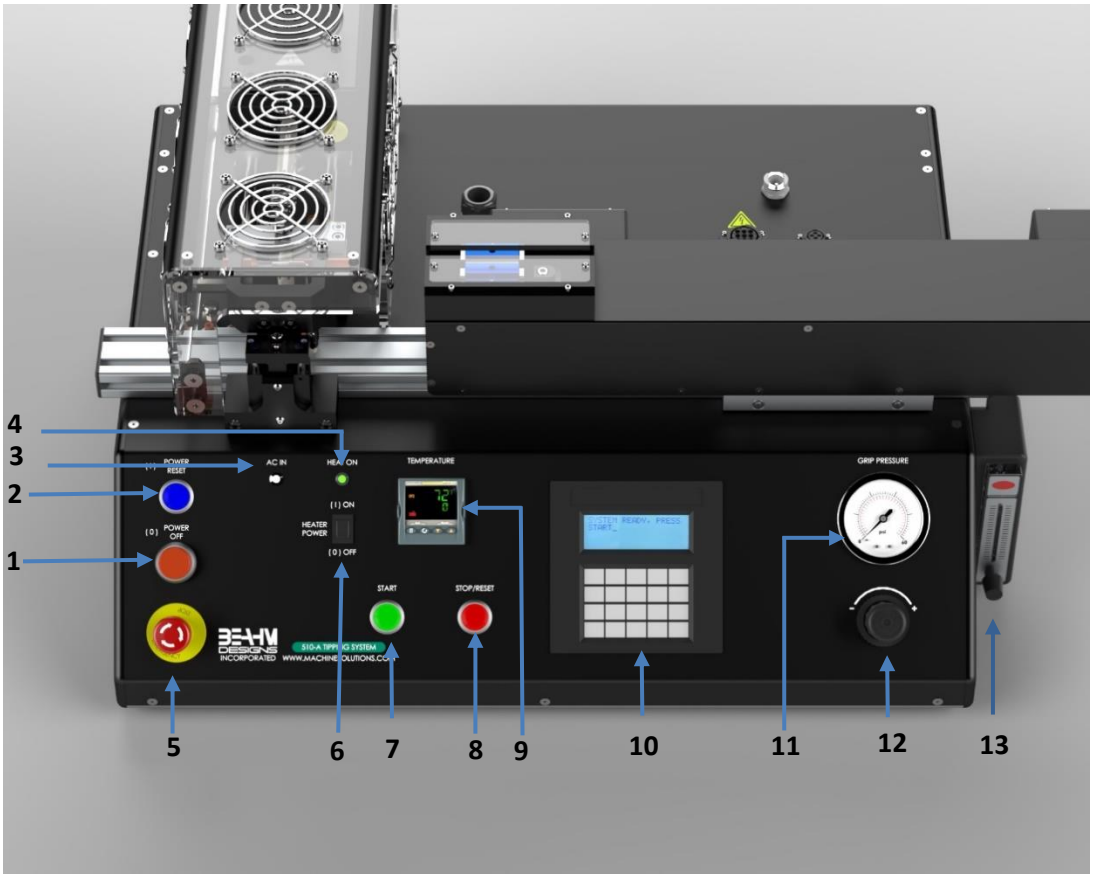


**Figure 1. 510-A Auto Tipping System Front Panel Controls (Shown with optional safety cover)**

**Table 1. Front Panel Controls and Functions**

| | Description | Function |
|---|---|---|
| 1 | Power OFF Button | Cut all the Power to the machine. |
| 2 | Power Reset Button | Reset the machine, after E-stop is reset. |
| 3 | Power ON Indicator | Indicates when system power on by illuminating, off when not illuminated. |
| 4 | Heater ON Indicator | Indicates when heater is on by illuminating, off when not illuminated. |
| 5 | E-Stop | Cut all the Power to the machine, Reset the E-stop by rotating the switch clockwise until it pops out again. |
| 6 | Heater Power ON/OFF Switch | Turns heater power on and off. |
| 7 | Start Button | Initiates process sequence. |
| 8 | Stop/Reset Button | Interrupts the process sequence and resets the system timer. |

| | | |
|---|---|---|
| 9 | Temperature Controller | Controls the temperature of the material forming. |
| 10 | Parameter Keypad | Used to enter process parameters other than temperature, flow rates, and pressure. |
| 11 | Gripper Pressure Gauge | Displays the pressure applied to the Gripper actuation cylinder. |
| 12 | Gripper Pressure Regulator | Regulates the pressure of the Gripper actuation cylinder. |
| 13 | Heater Air Flow Meter | Regulates the air flow rate for turn on/off the heater by switch. (Switch internal and preset to 35 scfh) |


**Figure 2. 510-A Auto Tipping Back Panel**

**Table 2. Back Panel Controls and Functions**

| | Description | Function |
|---|---|---|
| 14 | Air Connection | Supplies air to machine |
| 15 | Main Power Switch | Toggles system power and air on and off. |
| 16 | Power Entry Module | Connects to power cord. |

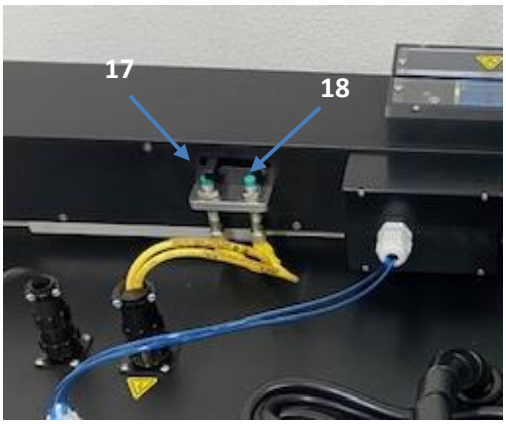


**Figure 3. Home and Overtravel Proximity Sensors**

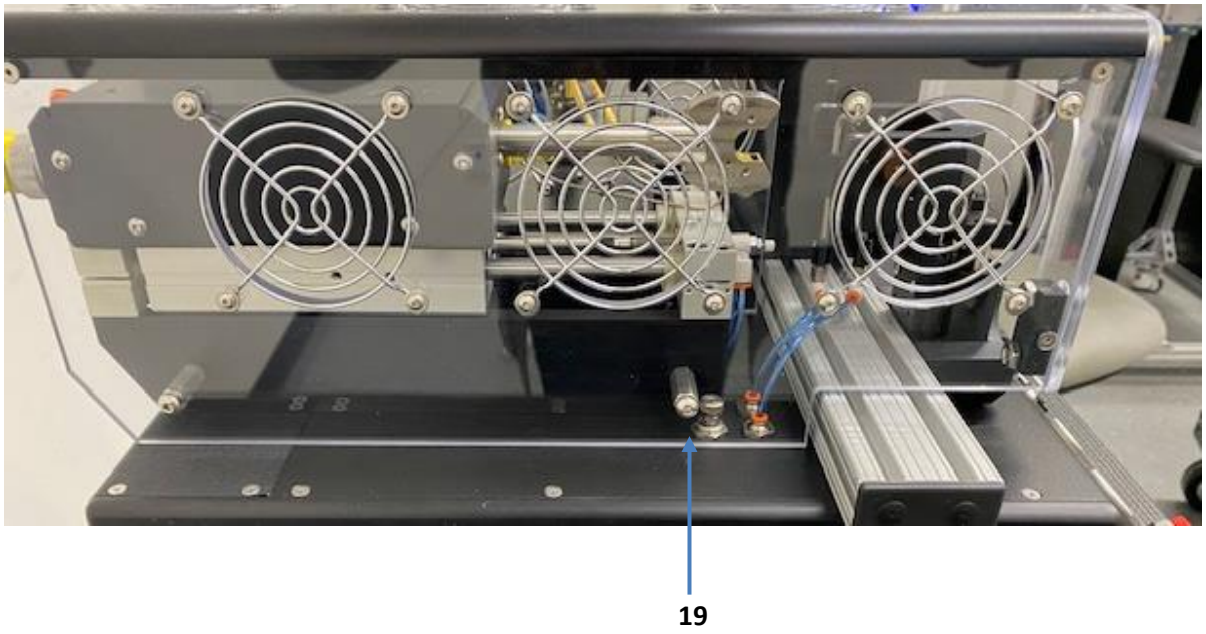


**Figure 4. Cooling Air Flow Control**

**Table 3. Sensors and Cooling Air Flow Controls and Functions**

| | Description | Function |
|---|---|---|
| 17 | Home Proximity Sensor | Homing the machine before process sequence start. |
| 18 | Overtravel Proximity Sensor | Overtravel sensor when the insertion depth is over 20 mm. |
| 19 | Cooling Air Flow Control | Regulates the Cooling air flow rate on the die tool |

# PARAMETER SETTINGS

Insertion Depth

- This is the distance the material will be inserted into the tipping die tooling.
- Key the value and depress ENTER on the keypad.

Insertion Speed

- This is the speed the material is advanced into the tipping die tool to form the required geometry.
- Key in the value and depress ENTER on the keypad.

Pre-Heat/Insertion Delay Duration

- This is the duration of the time that the thermal nozzle heats the die and material prior to insertion.
- Key in the value and depress ENTER on the keypad.

Heat Soak Duration

- This parameter holds the thermal nozzle in place to heat the die and material after insertion is complete.
- Key in the value and depress ENTER on the keypad.

Post Insertion Depth (Optional Feature)

- This parameter is custom to specific product configurations and is intended to add extra insertion force during the cooling cycle to reduce or eliminate the occurrence of voids.
- Key in the value and depress ENTER on the keypad.
- Post Insertion Speed is equivalent to the Insertion Speed.
- If the sum of the Insertion Depth and Post Insertion Depth is greater than 22mm, the machine will reset.

Cool Duration

- This is the duration of time the material is cooled in order to set the flared geometry prior to withdrawal from the tool.
- Key the value and depress ENTER on the keypad.

Setting temperature

- This is the temperature of the nozzle and typically is not at a set point that melts the material but softens it enough to thermoform it.
- Depress and hold the up or down arrow key of the temperature controller to scroll to the desired temperature. After 2 seconds the new value will be accepted, and the temperature will ramp to the new set point.

Adjust Heater Air Flow

- This is to adjust air flow rate to the heater and will allow heater to turn on when flow rate is greater than 35 scfh.

Adjusting Gripper Pressure

- Rotate the regulator knob clockwise or counterclockwise until the pressure gauge displays the desired value.

# CALIBRATION

**Important Notes:**
**It is recommended that calibration be performed by a certified service, preferably with the system in the location of use. Calibration procedures are the domain of these service providers.**
**Calibration refers to the process of verifying that each of the systems' instruments that control a process parameter is within manufacturers' specification.**
**Calibration DOES NOT refer to the process of measuring the temperature at the center of the tooling and "matching" the value to the temperature controller set point.**
**The measured value at the tooling may not match the temperature controller set point and the delta will increase towards the center of the nozzle.**

1. Calibrate the temperature controller annually.
2. Calibrate the thruster parameters annually.
3. Calibrate the pressure gauge annually.

# SYSTEM OPERATION

## *Temperature Controllers*


**Note: Auto tuning can be performed at any temperature set point within the system operating specifications however best results are attained at temperatures about 300°F**

Tuning Temperature Controllers (Eurotherm Model 3216e)

1. Ensure heater power is off and at room temperature.
2. Ensure heater air flow is set to a minimum of 35 scfh while temperature is ramping up.
3. Enter the process temperature setpoint using the "**up**" and "**down**" buttons.
4. Depress the "**scroll**" button until "**ATUNE**" appears.
5. Use the "**up**" or "**down**" button to select "**ON**".
6. Depress the "**scroll**" button once to return to main screen.
7. Switch the Heater ON/OFF to "ON".
8. The tune sequence will begin automatically in 60 seconds.
9. The system will resume standard operation automatically upon completion of tune sequence. No further action is required. If fluctuation persists, contact technical support.


**Warning: Thermal Nozzle is still hot, it's set at the autotune temperature. Shut off or turn down temperature when finished.**

## Temperature Controller Layout and Description of Button Actions

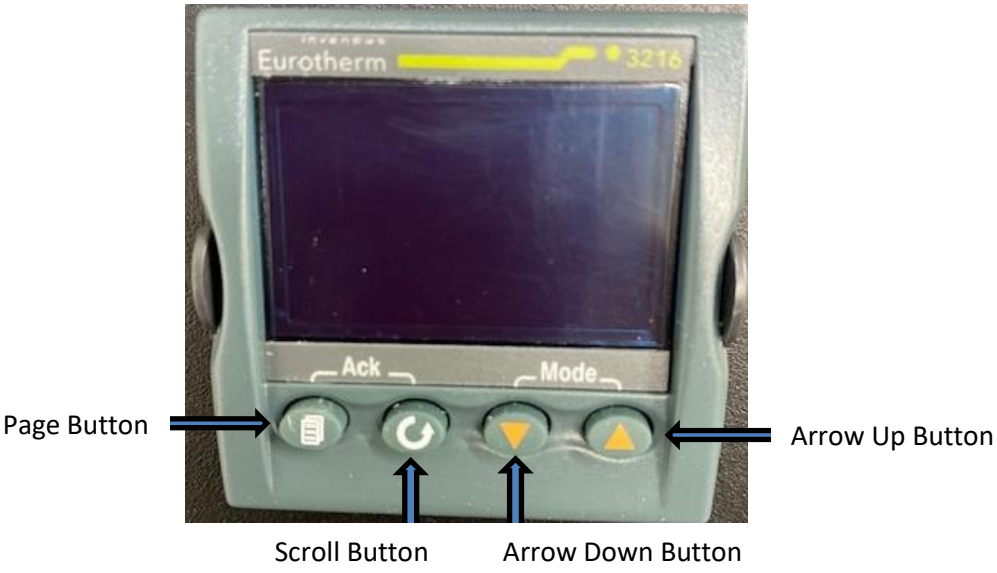


**Figure 5. Controller Layout**

# RUN PROCESS

1. Depress the "**START**" button, machine will return to home position.
2. Pass the material through the gripper and into the tipping die until resistance is met.
3. Depress the "**START**" button again
4. Product will move forward to insertion depth at insertion speed.
5. Upon completion of the process cycle, remove the material from the tipping die tool and gripper.

**Note: Motion will stop if the over travel sensor is triggered during run process.**

# MAINTENANCE

**Note: Ensure the machine is unplugged for any servicing or maintenance work.**


**Caution: pinch point/crush hazard. Keep fingers, hands, and clothing clear of moving parts.**


**Note: Perform these steps ONLY when the tooling is at room temperature.**

## *Cleaning*

1. Use 99% isopropyl alcohol to wipe down the outside of the machine. Do not attempt to clean the inside of the machine. The machine should not be washed down.
2. Cleaning should be with a soft dry cloth only.

## *Exchanging Tipping Die*

1. Loosen the distal die bushing clamp fastener.
2. While holding the tipping die, slide the bushing away from the die.
3. Slide the die out of the proximal bushing.

## *Exchanging Die Tooling Assembly*

1. Remove the two fasteners at the front of the “U-Bracket”.
2. Slide the assembly upwards.

## *Exchanging Grip Heads*

1. Remove the 4 fasteners from grip head.
2. Replace grip heads with alternates.
3. Re-install all fasteners.

## *Exchanging Thermal Nozzles*

1. Loosen the set screw at the top of the nozzle adapter.
2. Simultaneously slide the thermal nozzle and thermocouple connector forward.
3. Slide the alternate nozzle over the heater tube while simultaneously inserting the thermocouple connector into the jack.

## *Aligning Tooling*

**Note: Alignment MUST be performed with system power off and the thermal nozzle at room temperature.**

**Note: Alignment MUST be performed on a flat and reasonably level surface.**

1. Loosen the two fasteners securing the die tooling assembly to the tooling rail.
2. Loosen the two fasteners securing the material thrust assembly to the tooling rail.
3. Manually slide the thermal nozzle fully forward.
4. Adjust the Dampener on the slide to center the nozzle and the die tool.
5. Adjust the die tooling assembly left or right until the nozzle aligns with the form area of the die. Secure the two fasteners.
6. Adjust the Z-Axis of the die tooling such that the die is centered within the thermal nozzle.
7. Adjust the thruster assembly such that the grip shields are within .25” of the die tooling. Secure the two fasteners.

# DIAGNOSTICS AND TROUBLESHOOTING

**Table 4. Diagnostics and Troubleshooting**

| Issue | Possible Causes | Solution |
|---|---|---|
| Temperature not stable | • Nozzle has been replaced<br>• Thermocouple loose | • Auto-tune<br>• Re-install thermocouple(s) |
| S.br | • Sensor Break in Thermocouple wire<br>• Thermocouple Failure | • Verify all connection from Temperature controller to the Thermocouple Jack<br>• Replace Thermocouple |
| No Heat at the Nozzle | • Defective Heating Elements<br>• Defective Power Control<br>• Heater Air Flow too low | • Replace Heating Element<br>• Check the Heater Air Flow |
| Blank HMI screen | • HMI malfunction<br>• PLC malfunction | • Replace HMI<br>• Replace PLC |
| .Err code in display | • Temperature controller<br>• Software failure | • Replace temperature controller |
| System will not power on | • Emergency stop switch depressed<br>• IEC power cord not fully connected<br>• Power Not Reset<br>• Power switch in off position | • Rotate switch knob to engage<br>• Verify installation<br>• Depress Power Reset Button<br>• Switch power to on position |

# SPECIFICATIONS

**Table 5. System Specifications**

| Description | Range | Resolution | Accuracy |
|---|---|---|---|
| **Temperature** | 70-750° F | 1.0 deg. | +/- 0.25% F.S. |
| **Insertion Depth** | 0.1-22mm | 0.1mm | +/- 0.1mm |
| **Insertion Speed** | 0.1-15mm/sec. | 0.1mm | +/- 0.1mm |
| **Pre-Heat Duration** | 1-60 sec. | 1.0 sec. | +/- 0.1 sec. |
| **Heat Soak Duration** | 1-60 seconds | 1.0 sec. | +/- 0.1 sec. |
| **Post Insertion Depth** | 0-5mm | 0.1 mm+/- | +/- 0.1mm |
| **Cool Duration** | 1-60 seconds | 1.0 sec. | +/- 0.1 sec. |
| **Gripper Pressure** | 0-60 psi | 2.0 psi | +/-1.5% F.S. |
| **Heater Air Flow** | 20-50 SCFH | 5.0 SCFH | +/- 4% F.S. |

**Facilities Requirements**

- Voltage: 120-240 VAC 50/60 Hz.
- Wattage: 500 max.
- Compressed Air: 60-125 psi, 1.0 SCFM, filtered 50 micron or greater, oil and water free.

# CRITICAL PARTS

For replacement or spare parts, please contact us at service@machinesolutions.com, or call 928-556-3109.

**Table 6. Critical Parts List**

| Part Number | Description | Quantity |
|---|---|---|
| 1148096-001 | Keypad HMI | 1 |
| 1348043-001 | GRADE A GAUGE | 1 |
| 1343250-001 | 2-way pneumatic valve | 1 |
| 1330445-003 | 3-way pneumatic valve | 1 |
| 1131433-001 | Solid state relay | 1 |
| 1143312-001 | Power Supply | 1 |
| 119106-001 | Relay, PLC, 24VDC, DIN RAIL, 1PDT | 1 |
| 1145619-001 | 4PDT Relay | 1 |
| 1150440-001 | Temperature Controller | 1 |
| 110254-001 | Heating element | 1 |
| 1143786-001 | Proximity Sensor | 1 |

# CUSTOMER SUPPORT AND SATISFACTION

Machine Solutions Inc. is proud of the advanced engineering and quality construction of each piece of equipment that we build. It is our goal to provide equipment that exceeds the expectations of the customer. By implementing the highest standards and applying our experience to provide a quality product, we maintain an ongoing, positive working relationship with all our customers.
Machine Solutions Inc. welcomes your comments and inquiries about our products and services.

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# WARRANTY AND LIMITATIONS

## *General Warranty*

Machine Solutions Inc. (MSI) warrants its products to be free from defects in material and workmanship in normal everyday use and service for a period of one year from the date of shipment from the factory in Flagstaff, Arizona. MSIs obligation under this warranty shall be limited to the repairing or replacing of the product or parts thereof which upon MSIs inspection reveals them to be defective. MSI reserves the right and option to refund the purchase price in lieu of repair or replacement upon evaluation of the returned original part. Modifications, misuse, attempted repairs by others, improper calibration or operation shall render this guarantee null and void. MSI MAKES NO OTHER WARRANTY REGARDING THIS PRODUCT, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY. SPECIFICALLY, THERE IS NO WARRANTY OF MERCHANTABILITY OF THIS PRODUCT OR OF THE FITNESS OF THE PRODUCT FOR ANY PURPOSES. THE SUITABILITY OF THIS PRODUCT FOR ANY PURPOSE PARTICULAR TO THE CUSTOMER IS FOR THE CUSTOMER, IN ITS SOLE JUDGEMENT, TO DETERMINE. MACHINE SOLUTIONS, INC. ASSUMES NO RESPONSIBILITY FOR THE SELECTION OR USE OF THIS PRODUCT BY CUSTOMER. This product has not been tested or approved by the U.S. Food and Drug Administration or any other agency of the U.S. government. This product is not a consumer product as that term is defined in the Magnuson-Moss Warranty – Federal Trade Commission Improvement Act, 15 U.S.C. § 2301 et seq.

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## *Regulatory Matters*

All equipment validations, product validation, final product QC testing and other testing required by the U.S Food and Drug Administration are the sole responsibility of the customer. Machine Solutions, Inc. shall have no responsibility or liability for the performance of any interventional product on which this equipment is used.