

MANNETRON

ENGINEERING THE ART OF MOTION

ROTATIONAL CASTING MACHINE

OPERATIONS MANUAL & METHODS

DOC001_Rev-E

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1. INTRODUCTION TO ROTATIONAL CASTING MACHINES

1.1 GETTING STARTED

Thank you for choosing a Mannetron rotational casting machine—we're glad to have you on board. This machine is designed to help you produce consistent, high-quality hollow cast parts more efficiently than manual methods. Whether you're making statues, furniture, memorabilia, training tools, or other cast components, this system is designed to simplify the process and improve your results.

If anything is unclear, or if you would like help with your specific setup or application, please don't hesitate to contact us.

> CONTACT MANNETRON
>
> **Email: rotomold@mannetron.com**
> **Phone: +1 269-962-3473**

We're always here to support you and ensure you get the best possible results from your machine.

1.2 ABOUT THIS MANUAL

This manual is designed to help you safely set up, operate, and maintain your machine, while also providing practical guidance on materials, molds, and process development based on our experience. You don't need to learn everything in this manual before getting started—many sections are intended as a reference that you can return to as questions come up or as you develop new molds and casting processes.

> **IMPORTANT NOTE ON SAFETY**
>
> **Before operating the machine, all users should read and understand Section 1.3 (Safety), along with the basic operating instructions relevant to their machine and process.**

1.3 SAFETY

Before operating the machine for the first time, all operators should read and understand this section. Many of the safety features described below rely on proper operating procedures being followed.

Intended Use

This machine is designed to rotate molds, parts, or containers in multiple axes to evenly distribute user-supplied materials over their internal surfaces.

The machine is intended for industrial or workshop use and must only be operated by trained personnel.

Use of this machine for any purpose other than that described above is considered improper use and may result in unsafe conditions.

General Safety Rules

- Install and operate the machine in a controlled area where accidental access to moving components can be prevented.
- Untrained personnel must not enter or pass through the machine's motion envelope while it is operating.
- Do not operate the machine if any guarding or fencing has been removed, damaged, or modified.
- The machine is painted safety yellow to improve the visibility of the moving components. Operators must remain aware of frame movement at all times.
- The machine operates from a standard 120 VAC grounded electrical supply and uses internally powered DC motor circuits. Always connect the machine to a

properly grounded outlet, and disconnect or isolate electrical power before performing maintenance.

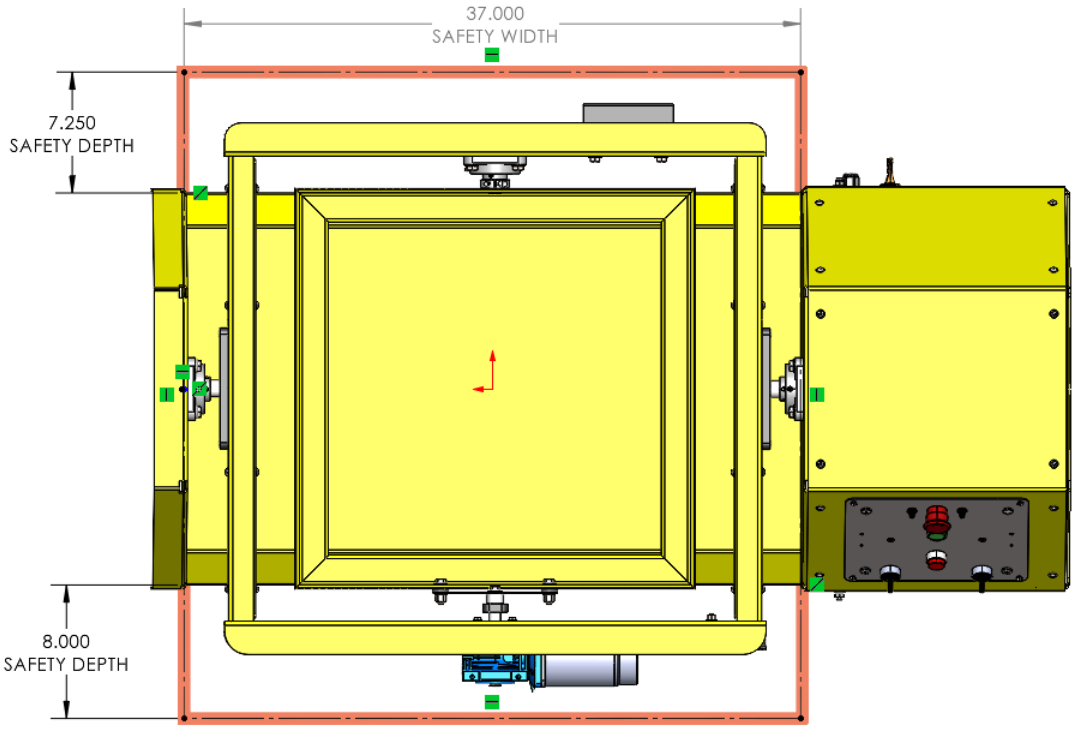
Work Area and Access Control

The rotating frames create a defined motion envelope that must be kept clear during operation.

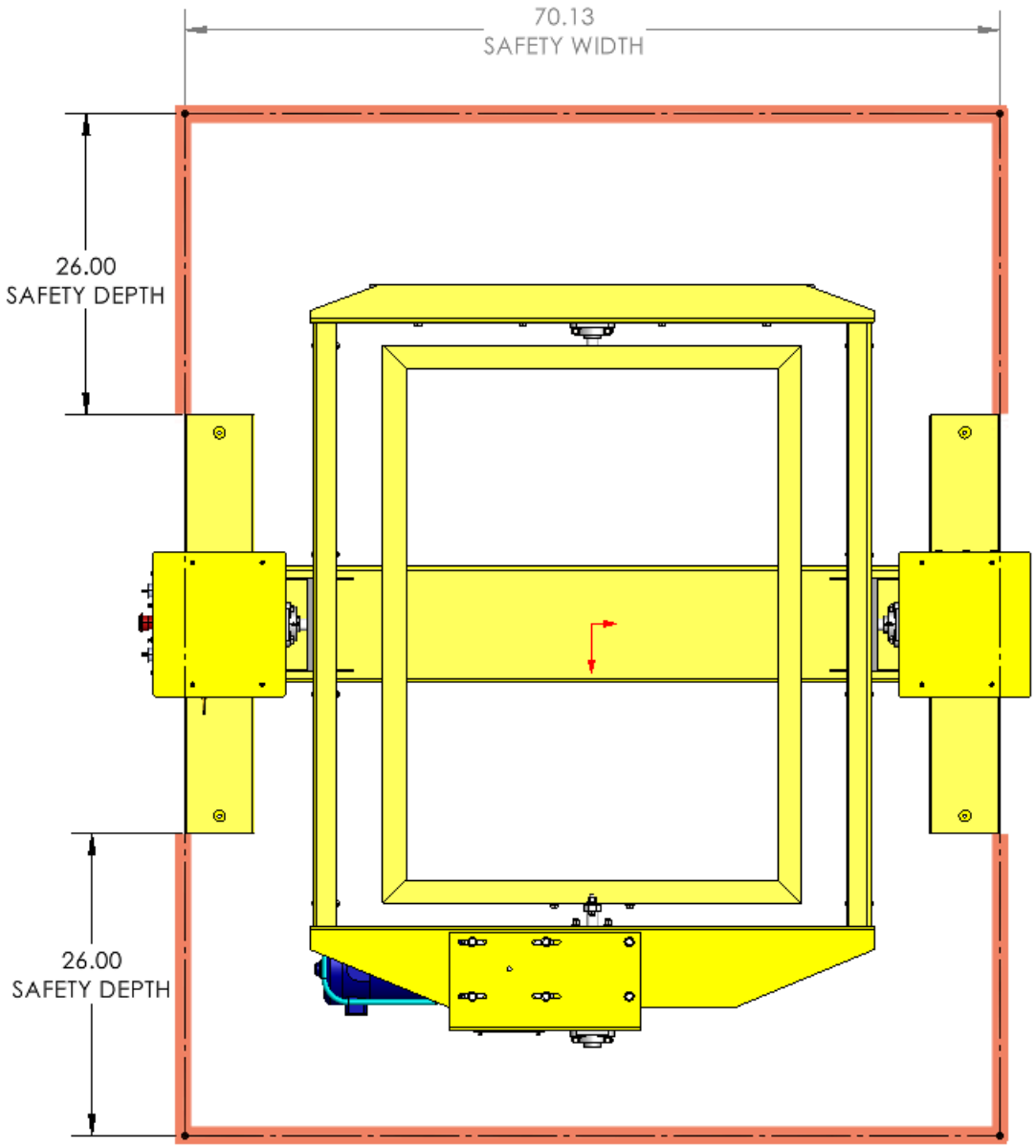
- We recommend using high-visibility tape, paint, or safety mats on the floor to mark out the safety perimeter around the rotating frame's motion envelope (see the following pages for top-down diagrams for each machine). This is especially important where other employees, visitors, or customers may be present, as the floor markings provide a clear visual reminder to stay outside the machine's motion envelope while it is operating.
- The area within this motion envelope must be kept clear of all personnel, tools, and other objects during operation.
- Larger machines include side fencing to restrict access; operators should approach only from the front or rear.
- Smaller machines have a reduced motion envelope but require the same level of awareness when stepping or reaching into the work area.

> ⚠ **WARNING**
>
> **Never enter or reach into the machine's motion envelope while either frame is moving.**

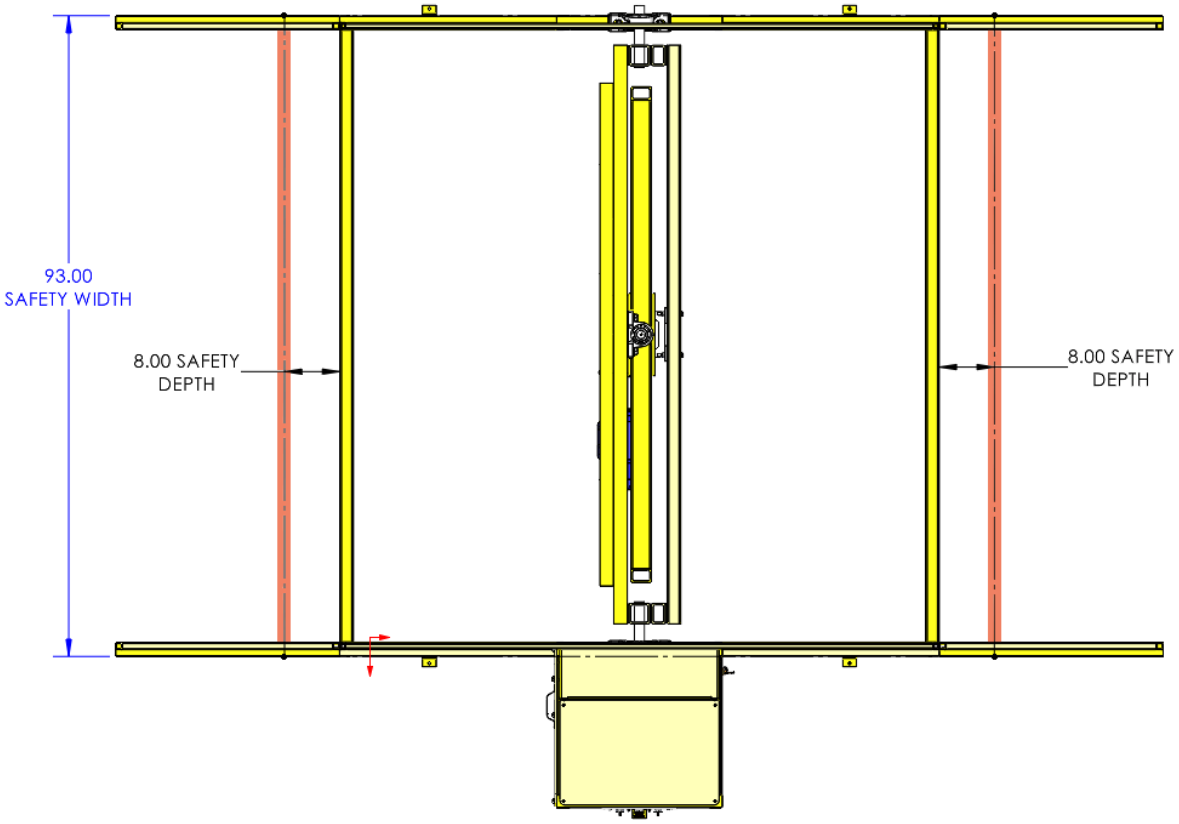
2'x2' Safety Envelope



3'x4' Safety Envelope



6'x6' Safety Envelope



Safe Operation

- Never leave the machine operating unattended.
- Always maintain awareness of frame position and movement.
- Use the jog controls to bring both frames to a complete stop before loading, unloading, or making adjustments.
- Do not reach into or enter the motion envelope until the machine is in a **Safe State**.

> **SAFE STATE**
>
> - **Both frames stopped**
> - **Motion visually confirmed to have ceased**
> - **Jog switches OFF**
> - **(During maintenance) Emergency stop engaged**

Installation and Stability

- The installation area must provide sufficient clearance for the full range of motion of the machine.
- If 2'x2' units are placed on a table or other raised surface, the surface must be stable and capable of supporting at least 650 lbs, including the weight of the machine, mold, and materials.
- Install 3'x4' and 6'x6' units on a flat, stable floor.
- For additional security, 6'x6' units are equipped with holes in the base to allow for them to be securely fastened to the ground. See *Section 3.2 (Securing Machines)* for further details.

Users are responsible for ensuring the installation complies with applicable workplace safety regulations, electrical codes, and any insurance requirements for their facility.

Maintenance Safety

- The machine must be fully stopped before any maintenance or servicing is performed.
- Electrical power must be disconnected or isolated prior to maintenance.
- Only qualified personnel should perform maintenance tasks.

Optional Safety Enhancements

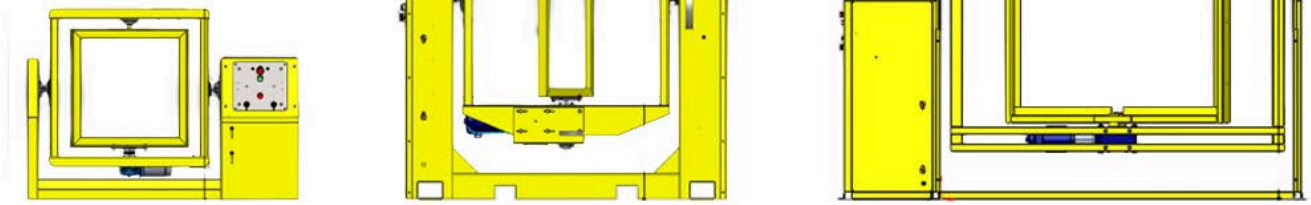
Pressure-sensitive safety mats may be integrated into the control system to stop the machine if the monitored area is entered. Integration guidance is available from Mannetron upon request.

Residual Risks

Despite the safety measures incorporated into the machine design, residual risks cannot be completely eliminated. Operators should remain aware of the following:

- Contact with moving frames may result in minor injury such as bruising.
- Pinch points exist between moving components, particularly between the inner and outer frames.
- Unplanned frame movement may occur if controls are used improperly.
- Maintenance activities may present hazards if the machine is not fully stopped and isolated from power.

2. MACHINE OVERVIEW & COMPONENTS



2' x 2'

3' x 4'

6' x 6'

2.1 MACHINE COMPONENTS

Each machine consists of three primary structural elements:

- **Stationary Frame** – The fixed base structure that supports the machine and houses the control panel.
- **Outer Frame (Main Gimbal)** – The larger rotating frame mounted to the stationary structure.
- **Inner Frame (Inner Gimbal)** – The smaller rotating frame mounted within the outer frame that supports the mold.

The inner and outer frames rotate independently in both directions at adjustable speeds. Together, they produce the multi-axis motion required to distribute material evenly throughout the mold.

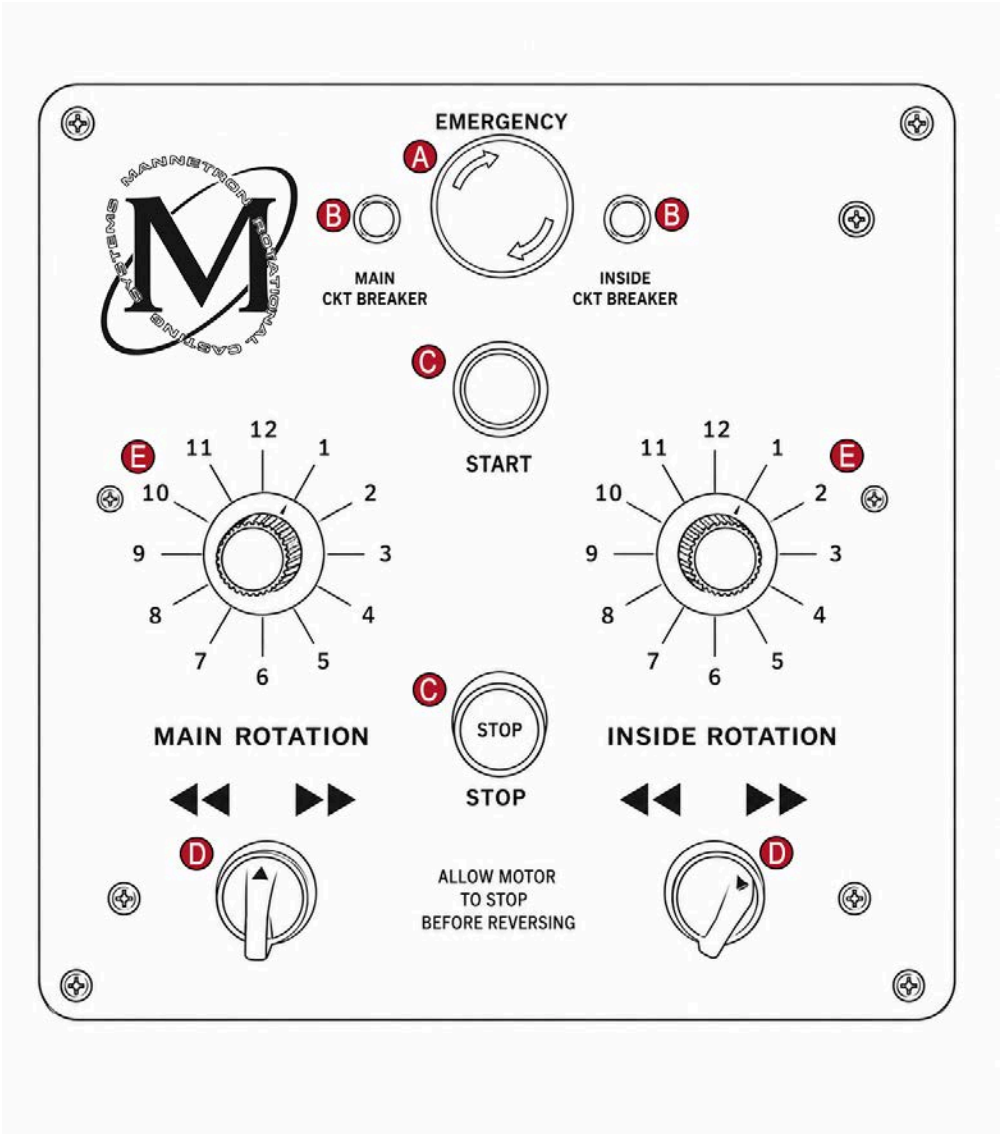
Although both frames rotate simultaneously, each serves a different purpose during the casting process:

- The **inner frame** provides continuous rotation of the mold, helping to keep material in motion and preventing it from settling or pooling.This motion is primarily responsible for maintaining the spiral flow of material inside the mold.
- The **outer frame** changes the orientation of the mold as it rotates, allowing gravity to move the material across different internal surfaces for more even coverage.

Working together, these two motions move the material through the mold in a controlled spiral path, allowing the internal surfaces to be coated as evenly as possible.

2.2 CONTROL PANEL OVERVIEW

The major controls are identified in the diagram below and described on the following pages.



A) Emergency Stop (E-Stop)

The Emergency Stop (E-Stop) is intended for emergency situations and whenever maintenance or servicing is being performed.

Engaging the E-Stop button will cut all power to the control panel and motors. To release, rotate the button until it pops outward. The green power button can then be used to turn the machine on.

> IMPORTANT
>
> **Machines are typically shipped with the emergency stop engaged. The machine will not turn on until the E-Stop is released.**

B) Power Fuse Resets

These buttons reset the motor protection fuses for the inner and outer frames.

If a fuse trips (for example, due to overload caused by too much weight on the machine, or the mold obstructing the rotation of the frames):

1. Turn off the machine power.
2. Determine and handle the cause of the overload.
3. Set both jog switches to the center (OFF) position.
4. Press the appropriate fuse reset button until it clicks.
5. Restart the machine.

If the machine does not resume normal operation after resetting the fuse, contact Mannetron for technical support.

C) Power Controls

- **Start Button (Green):** Turns machine power ON
- **Stop Button (Red):** Turns machine power OFF

> IMPORTANT
>
> **Before pressing the Start button, ensure that both jog switches are in the OFF (center) position. This prevents sudden or unexpected movement when the machine is powered on.**

D) Jog Switches (Inner and Main)

The jog switches control the motion of the two rotating frames:

- **Inner Switch:** Controls the inner frame (mold support frame)
- **Main Switch:** Controls the outer frame

Each switch has three positions:

- Forward
- OFF (center position)
- Reverse

> ⚠ **WARNING**
>
> **Rotating frames must be allowed to come to a full stop before reversing direction. Failure to do so can overload and damage the motor and/or control panel.**

These switches are used to:

- Start, stop, and position frame rotation
- Adjust positioning of molds
- Control direction of movement

> **RECOMMENDED PRACTICE**
>
> **During normal production, we recommend stopping the rotating frames by returning the jog switches to the OFF position rather than using the Stop button.**
>
> **This allows the control panel to remain powered, making it easy to reposition the mold for inspection, additional pours, or removal before resuming operation.**

E) Speed Controls

The speed controls determine both the **rotation of each frame** and the **ratio between them**, which has a major influence on material flow inside the mold. See *Section 4.4 (Rotating Frame Speeds)* for additional information on the function and use of these speed controls.

Two independent dials are provided:

- **Inner Speed Dial** – Controls the rotation speed of the inner frame (the mold support frame).
- **Main Speed Dial** – Controls the rotation speed of the outer frame.

2.3 MOLD PLACEMENT AREA

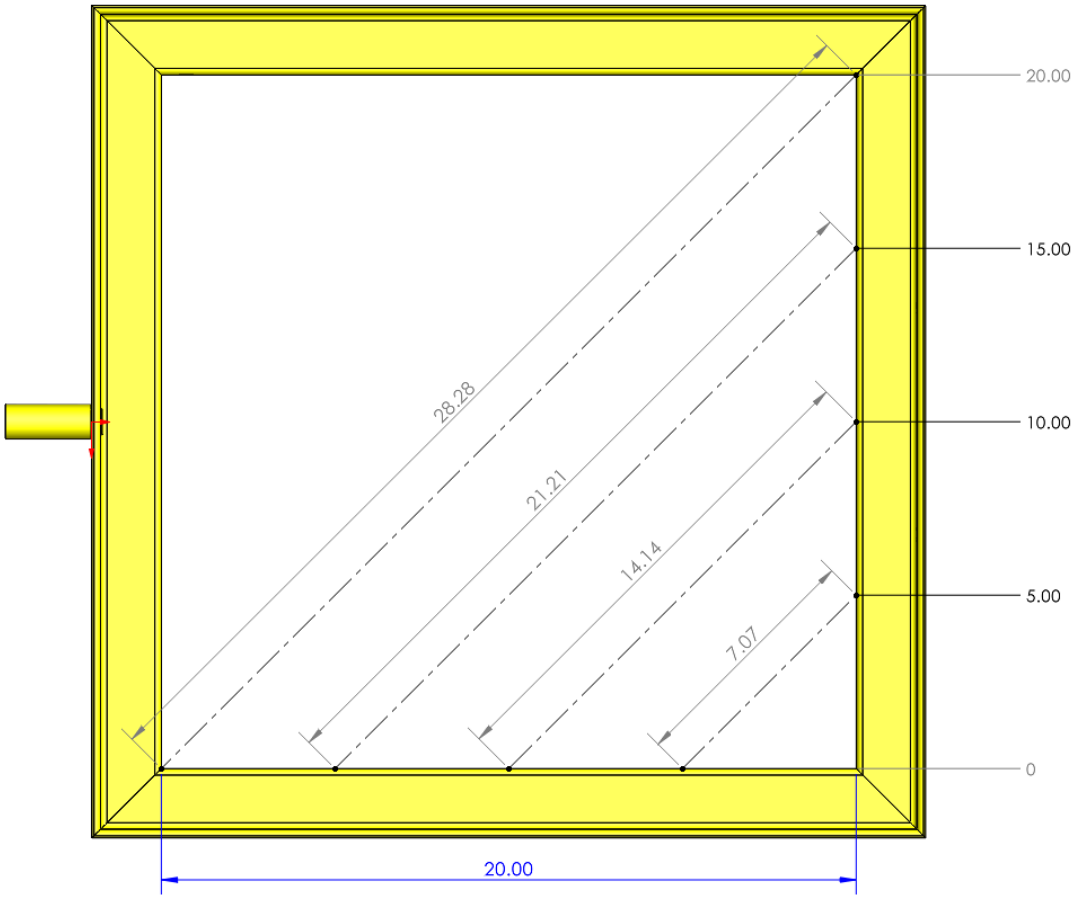
The inner frame of each rotational casting machine serves as the primary mold mounting area. The available mounting space for each machine size is shown on the following pages.

Molds must be securely mounted and properly balanced to ensure safe operation and consistent casting results. Additional details on the mounting process are provided in *Section 4.5 (Mold Mounting)*.

2'x2' Mold Placement Area

The 2'×2' inner frame (gimbal) is constructed from L-shaped bar. The internal dimensions are 20" × 20", and the flat surfaces of the L-shaped bar may also be used for clamping.

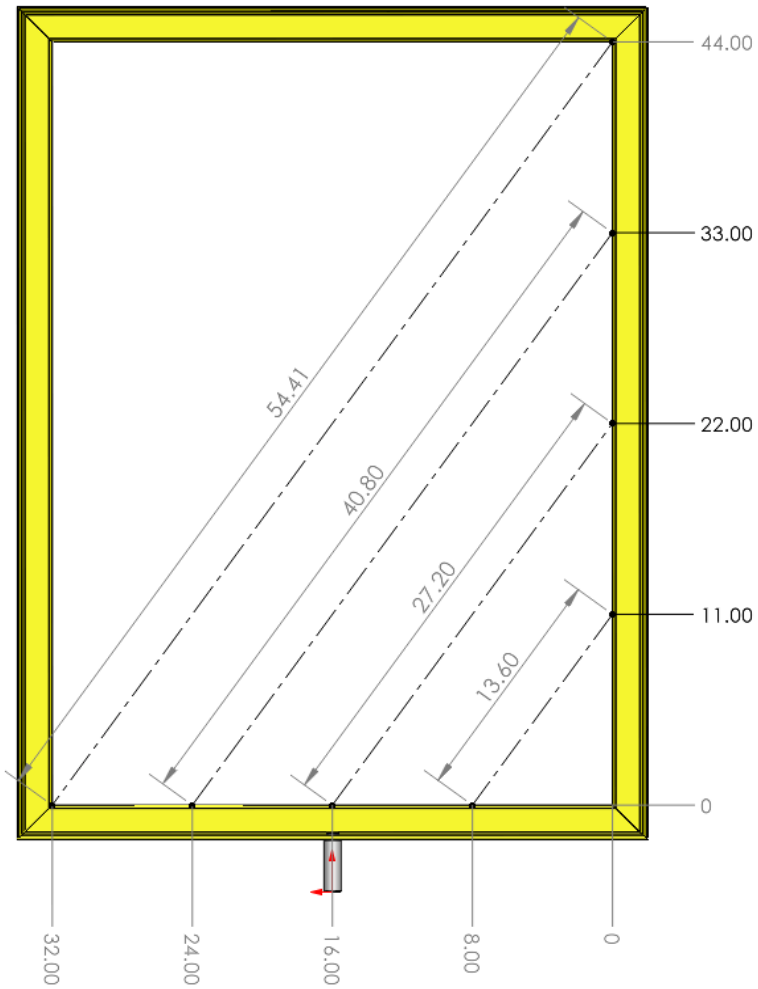
Longer molds may be positioned diagonally within the frame. Always rotate the frames at the lowest possible speed using the jog switches to verify that the mounted mold clears the outer frame throughout the full range of motion before beginning production.



3'x4' Mold Placement Area

The 3'×4' inner frame (gimbal) is constructed from L-shaped bar. The internal dimensions are 44" × 32", and the flat surfaces of the L-shaped bar may also be used for clamping.

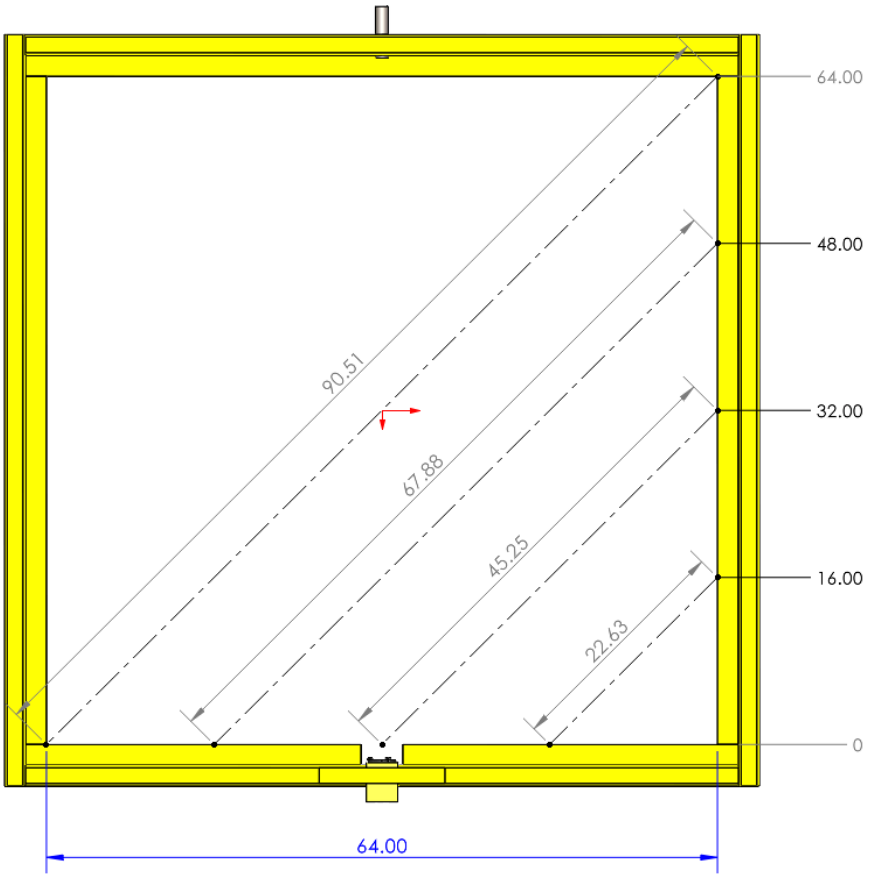
Longer molds may be positioned diagonally within the frame. Always rotate the frames at the lowest possible speed using the jog switches to verify that the mounted mold clears the outer frame throughout the full range of motion before beginning production.



6'x6' Mold Placement Area

The 6'× 6 inner frame (gimbal) is constructed from square tubing with an integrated flat mounting surface welded to the inside of the frame. The internal dimensions are 64" × 64", and this flat surface may be used for clamping.

Longer molds may be positioned diagonally within the frame. Always rotate the frames at the lowest possible speed using the jog switches to verify that the mounted mold clears the outer frame throughout the full range of motion before beginning production.



3. PLACEMENT OF & SETTING UP YOUR MACHINE

3.1 POSITIONING & SPACE REQUIREMENTS

The machine should be installed in an indoor location that provides sufficient space for safe operation and maintenance. The installation area should allow the machine to complete its full range of motion without contacting walls, equipment, stored materials, or other obstructions.

- The machine must not be placed in walkways, travel paths, or areas where untrained personnel may pass through or accidentally enter the motion zone during operation.
- Clear access to both the front and rear of the machine allows for greater ease of operation.
- We recommend clearly marking out the full motion envelope of each machine on the floor using high-visibility tape, paint, or safety mats. See section *1.3 (Work Area and Access Control)* for diagrams.

Handling and Access Considerations

Space should be provided to allow for:

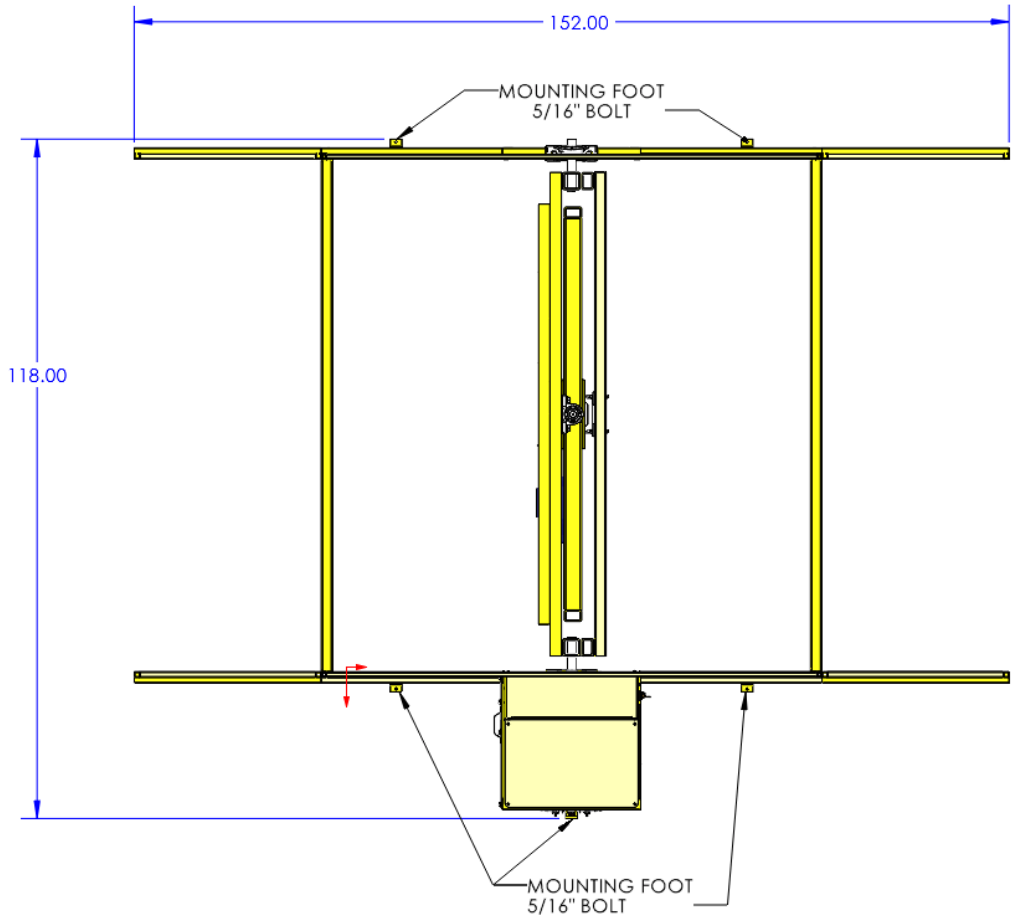
- Loading and unloading molds.
- Movement of large or heavy molds.
- Use of lifting or handling equipment, such as forklifts, pallet jacks, dollies, or lift tables (where required).

Planning for access during installation will improve both safety and efficiency during operation.

3.2 SECURING MACHINES

Where possible, 6’x6’ machines should be secured to the ground using the designated holes in their frames, as shown in the below diagram.

Although the 6'x6' machine can operate without being anchored, securing it to the floor provides an additional level of security in ensuring that the machine stays in place and does not shift or move. This is most important when expecting to deal with full molds at the upper level of the machine’s weight capacity, or in regions where seismic activity is a known factor.



3.3 FLOOR PROTECTION & WORK AREA PREPARATION

Floor Markings

We recommend clearly marking out the motion envelope of the machine on the floor using high-visibility tape, paint, or safety mats. See section *1.3 (Work Area and Access Control)* for diagrams.

This is especially important where other employees, visitors, or customers may be present, as the floor markings provide a clear visual reminder to stay outside the machine's range of motion while it is operating.

Replaceable Coverings

Rotational casting can result in drips or spills from molds during operation. Taking a few simple steps to protect the surrounding area will make cleanup much easier and help protect the workspace.

We recommend:

- Laying down tar paper, cardboard, or another disposable floor covering beneath and around the machine.
- *For 2'x2' and 3'x4' units:* Laying thick paper or adhesive plastic over, or wrapping heavy-duty plastic stretch wrap around the lower portion of the stationary frame (beneath the rotating frames).

- In some applications - particularly when using open funnel plugs that may allow more material to escape during rotation - it may be helpful to wrap portions of the frame with disposable stretch wrap to catch drips and simplify cleanup.



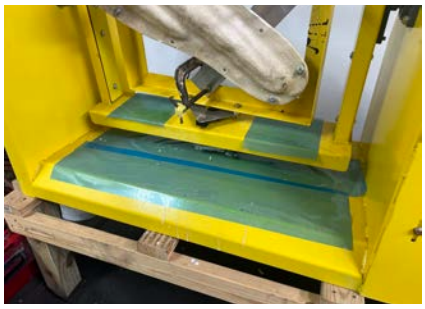
Cardboard laid underneath the frames



Cardboard/tar paper underneath machine and over frame base



Tar Paper taped down underneath machine



Adhesive plastic on frame base and outer frame



Stretch wrap around outer frame



Stretch wrap around outer frame

Important Considerations

When using floor and machine coverings, keep the following in mind:

Prevent Trip and Entanglement Hazards

- Tape down seams and edges securely, particularly in walking areas.
- Avoid bunching, wrinkles, or uneven surfaces that could create slip or trip hazards.
- Keep all floor coverings clear of the rotating frames and other moving parts.
- Ensure that no material can catch, drag, or become wrapped around the machine during operation.

Maintain the Work Area

- Replace floor coverings as they become worn or heavily contaminated.
- Clean up excess spills promptly to help extend the life of the coverings and maintain a clean workspace.

Maintain Safety Markings

- If the machine's motion envelope is marked using tape or paint, ensure those markings remain clearly visible when replacing floor coverings.
- Where pressure-sensitive safety mats are used, ensure that floor coverings do not interfere with their operation.

These measures are not required for machine operation, but they are strongly recommended to help maintain a safe, clean, and efficient work area.

3.5 ELECTRICAL REQUIREMENTS

Each machine is designed to operate using standard grounded electrical service. Proper electrical setup is required for safe and reliable operation.

Electrical Installation Requirements

- The machine must be connected to a properly grounded outlet
- Electrical installation should comply with all local electrical codes and regulations
- Do not use ungrounded outlets, damaged cords, or modified plugs
- Avoid using extension cords whenever possible. If one must be used, it should be properly grounded and rated for the machine's electrical load.

Standard Power Requirements

Machine Size	Voltage	Frequency	Required Branch Circuit	Receptacle Type	Plug Type	Cord Length
2’ x 2’	120V	60 Hz	15 Amp	Grounded	Type B	~20 ft
3’ x 4’	120V	60 Hz	15 Amp	Grounded	Type B	~20 ft
6’ x 6’	120V	60 Hz	15 Amp	Grounded	Type B	~20 ft

ELECTRICAL LOAD

The branch circuit ratings shown above are installation requirements and should not be interpreted as the machine's normal operating current. Actual current draw varies depending on operating conditions, mold weight, balance, and rotational speed.

For example, a 2'x2' machine operating at full speed with a balanced mold has been measured at approximately 4 amps during normal operation.

International and Custom Configurations

Machines supplied for use outside of standard North American electrical systems may include:

- Internal transformers
- Region-specific plug types
- Modified electrical specifications

For these machines, machine-specific electrical documentation is available upon request at time of purchase.

4. OPERATING THE ROTATIONAL CASTING MACHINE

4.1 THE IMPORTANCE OF EXPERIMENTATION & DOCUMENTATION

Unlike many manufacturing processes, there is no single set of speed settings or operating procedures that will produce successful results for every mold, material, or application.

Each combination of mold design, material, wall thickness, cure time, temperature, and desired finish will behave differently. Because of this, developing a successful casting process almost always involves a period of testing and adjustment.

This is a normal part of rotational casting. Even experienced users should expect to perform test runs whenever working with a new mold, material, or part design.

When first developing a new process or working with new material, we recommend making one adjustment at a time. Observing the results before changing another variable makes it much easier to understand how the mold and material are behaving. Careful documentation then allows successful results to be repeated with confidence.

When developing a new part, it is often helpful to document factors such as:

- Material ratios
- Number of fills (also called pours or coats)
- Mounting positions and angles
- Use of counterweights
- Inner and outer frame speeds
- Frame speed ratios
- Duration of each spin cycle
- Material cure times
- Environmental conditions, where relevant

Keeping accurate records will help you:

- Reproduce successful parts consistently
- Improve quality and repeatability between production runs
- Reduce development time for future projects
- Build a reliable understanding of how your materials behave during rotational casting

It is completely normal for a new mold or material combination to require several test runs before the desired results are achieved. Careful testing, observation, and documentation are an important part of developing a reliable casting process.

4.2 MACHINE WEIGHT CAPACITY

Why Weight Matters

The weight of the mold has a significant effect on both machine performance and long-term reliability. Exceeding the recommended weight limits can lead to poor machine operation and may cause premature wear or damage to the motors, gearboxes, and electrical components.

When calculating mold weight, always include:

- The mold itself
- All casting material inside the mold
- Any mounting fixtures, brackets, counterweights, or other items attached to the rotating frame

---

Balanced vs. Unbalanced Loads

- A **balanced load** is one where the weight is distributed evenly about the axis of rotation, allowing the machine to rotate smoothly.
- An **unbalanced load** has more weight concentrated on one side of the rotating frame. Even if the total weight is relatively low, an unbalanced mold places significantly greater stress on the machine and may require counterweights to restore proper balance.

Whenever possible, molds should be mounted and balanced before operation.

Counterweights

Counterweights are additional weights attached to the mold or inner frame to help balance unevenly shaped molds during rotation.

They are not commonly needed, but can be useful when a mold cannot be balanced simply by adjusting its position within the frame.



Example of a counterweight in use

Maximum Recommended Load Capacity

Machine	Maximum Balanced Weight	Maximum Unbalanced Weight
2’x2’	100 lbs (45 kg)	50 lbs (22 kg)
3’x4’	300 lbs (136 kg)	100 lbs (45 kg)
6’x6’	1500 lbs (680 kg)	250 lbs (113 kg)

Signs That a Machine May be Overloaded

If the mold is too heavy or poorly balanced, you may notice one or more of the following:

- Difficulty starting or maintaining rotation at the selected speed.
- Excessive vibration or shaking during rotation.
- Jerky or uneven frame movement.
- Motors struggling to maintain the selected speed.
- Unusual noise from the motors or gearboxes.
- Circuit breakers tripping during operation.

If any of these occur, stop the machine and reduce or rebalance the load before continuing.

Repeated operation with an overloaded or poorly balanced mold can shorten the life of the motors, gearboxes, bearings, and control panel components, and may result in unnecessary repairs.

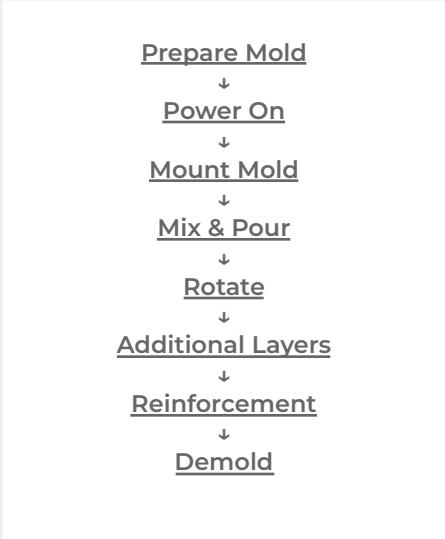
4.3 STANDARD OPERATIONAL PROCESS

The following process is a baseline method that Mannetron has used successfully for many years. Different materials, mold design, part requirements, and your own preferences may alter this process, but this is intended to provide a practical starting point.

This section provides an overview of the typical production process. Later sections explain many of these steps in greater detail.

Before beginning, ensure all required materials, tools, and documentation of materials, quantities, and timing are prepared and easily accessible.

Process Steps



A) Prepare the mold

- Inspect the mold for any debris or remaining material from previous uses and dust out as needed using blown air or a cloth.
- Apply mold release liberally to all internal surfaces.
- Assemble the parts of the mold, and fasten along the seam lines using any provided hardware.
- Ensure all seams are properly sealed to prevent leaks and minimize flash (thin excess material escaping at parting lines.)

B) Power On the Machine

- Ensure both jog switches are in the center “OFF” position.
- Press the green **Start** button to power on the machine.

C) Mount the mold

- Use the jog switches as needed to position the frames.
- Secure the mold within the inner frame (see *Section 4.5 (Mold Mounting)* for additional information).
- Ensure the mold is positioned to allow access to any pour holes that will be used during the casting process.

D) Mix and Pour the First Layer

> IMPORTANT
>
> **Once mixing begins, the available working time for the material becomes limited. The timing of subsequent pours is critical, as additional layers must be applied before the**

previous layer has fully cured in order to ensure proper adhesion.

It is especially important to ensure all tools, materials, and documentation are ready before beginning this step.

- Mix your material according to the manufacturer's specified ratios.
- Add fillers if required (see *Section 6.3 (Fillers)* for additional information.)
- Pour the mixture into the mold through the designated pour hole or funnel cork.
- Secure pour hole with plug or cork, unless using a funnel cork.

E) Start Rotation

- Start both inner and outer frame rotation using your selected speeds (see *Section 4.4 (Rotating Frame Speeds)* for additional information.)
- Set an external timer for the amount of time you plan to rotate the mold for before adding the next layer of material.

RECOMMENDED PRACTICE

It can be helpful to pay attention to the sound of the material as it moves around inside the mold, if it is audible (in some cases it may not be, due to the mold type or the behaviour of the material itself).

Over time, you will become familiar with how your chosen material normally sounds as it moves through the mold. Changes in that sound can often provide an early indication of issues, such as the material being too liquid and 'sloshy' (which may cause bubbles), or the material solidifying too quickly leading to insufficient coverage or 'snowballs' (see *Section 4.6 (Troubleshooting Common Casting Issues)*).

> ⚠ **WARNING**
>
> **Do not step into or reach into the motion envelope until it reaches a safe state. Wait for the machine to come to a full stop before approaching.**

F) Apply Additional Layers

- When your timer goes off, stop the rotating frames using the jog switches. Reposition the mold as needed to inspect coverage through the pour hole before adding the next layer.

> **RECOMMENDED PRACTICE**
>
> **We recommend using a borescope camera with a light attachment to inspect internal coverage between pours. This can help confirm whether additional layers are required and identify areas that may not be receiving adequate material coverage.**

- Apply additional pours of your material as needed to fully coat the interior of the mold and reach the desired thickness. Timing is critical on this step to ensure proper bonding between layers:
    - Allow enough time for material to distribute evenly
    - But do not allow the material to fully cure before adding the next layer

G) Add Reinforcement (Optional)

- A rigid urethane foam or other material (often lighter and less expensive than the outer casting material) can be added to the inside of your part, using the same method as the outer layers.

  This is especially useful in larger parts or other cases where it is important to add increased rigidity and strength - such as when making parts that may be used as furniture or used to support human weight.

  This reinforcement should be added:

  - After the outer material has fully coated the mold
  - Before the outer layer has fully cured to ensure proper adhesion, though this is typically less critical than on the layers of outer material

H) Demold the Part

- Once the final layer has cured sufficiently to retain its shape during demolding, bring your frames to a stop using the jog switches so that the mold is in a position that will allow for removal.
- Dismount your mold from the machine, then open it and take the part out. This is a good time to inspect your part as per *Section 4.6 (Troubleshooting Common Casting Issues)*.
- You now have a completed part. Trim any flash, clean the part as required, and prepare the mold for its next production cycle.

> RECOMMENDED PRACTICE
>
> **Following each production run, noting any changes and any observations regarding part quality can help make future production runs more consistent and reduce overall time.**

> ⚠ **WARNING**
>
> **When producing hollow cast parts <u>ALWAYS</u> include one or more drilled holes in unobtrusive areas that will not be covered, and ensure the holes are still present after any paint or other coating is applied. The air inside sealed parts can expand or contract with temperature changes, and if no ventilation holes are provided parts can crack open from the pressure.**

4.4 ROTATING FRAME SPEEDS

Function of the Frames

The inner and outer frames each play a different role in how material moves through the mold.

- The **inner frame** provides continuous rotation of the mold, keeping the material moving and helping to prevent it from pooling or dripping. This motion creates the spiral flow that distributes material around the internal surfaces.
- The **outer frame** changes the orientation of the mold, allowing gravity to move the material across different surfaces. Its effect is influenced by factors such as material viscosity and cure time.

Working together, the two frames create the multi-axis motion required to move material through the mold in a controlled spiral ("candy cane") path.

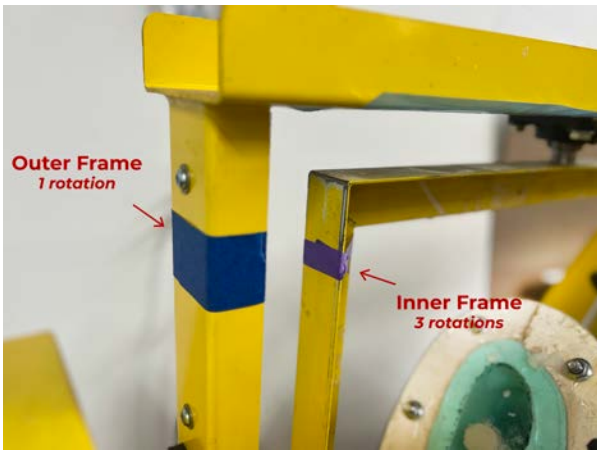
> IMPORTANT
>
> **The Two Speed Numbers You'll Be Working With**
>
> - The **number of rotations** made by the inner frame during the time it takes for the outer frame to make a complete turn.
> - The **speed setting** number as indicated on the control panel dial.
>
> **When developing a new process, the operator uses the number of rotations (the ratio between the two frames) to determine suitable control panel speed settings. Once good settings have been found, the control panel speed settings can be recorded and reused for future production.**

Selecting a Starting Speed

The relationship between the two frame speeds is generally more important than the absolute speed of either frame.

A good starting point for many applications is approximately a **3:1 ratio** of inner-frame rotations to outer-frame rotations.

One way to estimate this ratio is to place a piece of coloured tape on each frame and observe the rotation. As a starting point, the inner frame should complete approximately three rotations for every one rotation of the outer frame.



Visualizing the Starting Ratio

This ratio provides a good starting point because:

- The outer frame continually changes the orientation of the mold.
- The inner frame keeps the material moving in a continuous spiral path.

From this point, adjustments can be made to suit the mold and material being used.

Adjusting Speed for Different Applications

The optimum speed settings will vary depending on:

- Mold size and geometry
- Material viscosity
- Material cure or set time
- Desired wall thickness of the finished part
- Level of surface detail

Material Considerations

As a starting point:

- **Thicker or higher-viscosity materials** generally require slower speeds, allowing more time for the material to flow from one end of the mold to the other.
- **Thinner materials or those with a shorter pot life** often benefit from higher speeds to maintain continuous movement and prevent pooling.

Mold Considerations

Certain mold geometries may also require further adjustment:

- **Larger molds** often perform better at slower speeds, giving the material more time to travel throughout the mold.
- **Long, narrow molds** may benefit from being mounted with their length aligned to the inner frame's axis of rotation. Increasing the inner frame speed can then help move material in a spiral along the length of the mold.
- **Complex shapes** or molds with difficult-to-reach areas may require adjustments to the ratio between the inner and outer frames to encourage material to flow into those regions.

Every new mold and material combination will require some testing and adjustment before the optimum settings are found. Once you have achieved the desired results, record the control panel speed settings for both the inner and outer frames so they can be reproduced consistently in future production runs.

4.5 MOLD MOUNTING

The inner frame serves as the primary mold mounting area. Molds must be securely mounted and properly balanced to ensure both safe operation and consistent casting results. Diagrams of the mold placement area for each machine are provided in *Section 2.3 (Mold Placement Area)*.

> **IMPORTANT**
>
> **Always test your mounting method before starting the casting process by fully rotating both frames to ensure that the mold is securely fastened in any direction and will not collide with the outer frame, and that any clamps are not hanging loose.**

Mounting Methods

Molds can be supported and secured in three main ways:

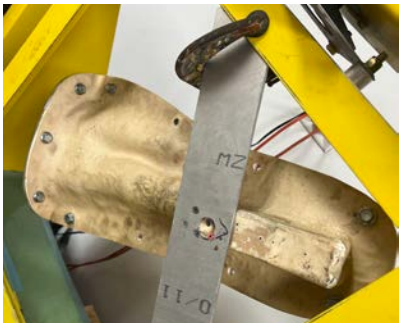
1. The mold can be directly mounted to the inner frame.
2. Wooden, angle iron, or fabricated metal bars or brackets can be fastened to the inner frame, and the mold can be mounted to those items.
3. Longer bars or brackets can be temporarily attached or permanently glassed into the mold, and these can be fastened to the inner frame.

Your chosen method will depend on elements such as the relative size of your mold to the frame, the mold shape, and how frequently you will need to take your mold on and off your machine.

Quick clamps and c-clamps can be used to fasten the mold to any supports, or in some cases nuts can be glassed into the mold cradle and threaded rod can be used to fasten it in place.



Metal square rod glassed into mold



Mold cradle screwed onto metal plate, clamped onto frame



Mold cradle bolted to angle iron, clamped to frame



Angle iron bolted to frame, clamped against angle iron glassed into mold



Mold cradle parting planes bolted to frame



Wood square rod glassed into mold

Critical Requirement: Load Balancing

Proper weight distribution is **essential** for:

- Smooth and stable machine operation
- Preventing unnecessary load on motors and components
- Ensuring consistent material flow inside the mold

Imbalance can lead to:

- Uneven coating
- Poor part quality
- Increased mechanical strain on the machine

Recommended Balancing Procedure

1. **Initial Placement**
   Position the mold as close to the center of the inner frame as possible and secure it using your preferred mounting method.
   - Ensure all clamps and supports are tight
   - If using C-clamps, secure the handles (e.g., with tape) to prevent them from swinging loosely.
2. **Initial Test Rotation**
   Run the machine at a low speed with the mold empty to verify:
   - No interference with the outer frame
   - Smooth and stable rotation
3. **Balancing Adjustments**
   If the mold is unevenly shaped or weighted:
   - Adjust positioning as needed
   - Add counterweights to offset heavier areas
4. **Dynamic Considerations**
   As material is added and begins coating the inside of the mold, the weight distribution may change.
   - In rare cases, additional counterweights may be required during operation
   - New molds should be monitored closely during initial runs

> IMPORTANT
>
> **Counterweights are rarely needed as typically centering the mold is sufficient, but are especially helpful when dealing with off-center or complex mold shapes.**

Mold Positioning for Filling

The orientation of the mold on the machine should be planned based on the positions of any pour holes that will be used when adding material:

- Position any fill openings for easy access
- Aim to avoid positions that require awkward pouring angles or working against gravity

Proper positioning will:

- Reduce the time taken to pour mixed material into the mold
- Support better material distribution during rotation
- Reduce spills or inconsistencies

Process Development & Documentation

When evaluating mold placement, record:

- Mold orientation within the frame
- Mounting locations and support methods
- Counterweight locations and amounts
- Pour hole locations

- Any observed effects on material flow or part quality

Successful mold placement arrangements are often as important as speed settings. Keeping detailed records will help ensure that molds can be mounted consistently in future production runs.

4.6 TROUBLESHOOTING COMMON CASTING ISSUES

The following table lists some of the most common issues encountered during rotational casting, along with their possible causes and suggested solutions.

Index: Troubleshooting Common Casting Issues

Weight & Coverage 56
Thin or Uncoated Areas 56
Part Too Heavy 57
Part is Unbalanced 58
During Rotation or Demolding of Part 59
'Snowballs' Inside Mold 59
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Surface Finish of Part 64
Unexpected Dents in Finished Part (Rubber Boot Molds) 64
Excessive Surface Bubbles 65
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Weight & Coverage

Thin or Uncoated Areas

What you observe:

- Thin wall sections.
- Bare spots.
- Material missing from part of the mold.

Possible causes:

- Not enough material.
- Material not reaching all areas.
- Material curing too quickly.
- Material too thick and viscous.
- Material too thin and liquidy.

Things to try:

✓ Inspect coverage between pours using a lighted borescope.

✓ Adjust mold position or frame speed ratio to allow the material to reach thin spots.

✓ Change the direction of rotation if that will allow material to reach thin spots.

✓ Consider prefilling difficult areas (see *Section 4.6 (Prefilling Portions of Your Mold)*).

✓ In narrow molds, or where the material is not flowing to segments of the mold, it may be helpful to add additional pour holes.

✓ If material is too thick or cures too quickly, consider a slower-curing or lower-viscosity material.

✓ If material is too thin or takes too long to solidify, consider a thicker or faster-curing material.

Part Too Heavy

What you observe:

- Finished part weighs more than intended.

Possible causes:

- Too much material added.
- Additional pours added to compensate for poor coverage.

Things to try:

✓ Review your documented pour quantities.

✓ Improve coverage before adding more material (See troubleshooting guide for *Thin or Uncoated Areas* above).

Part is Unbalanced

What you observe:

- One side of the part is heavier or lighter than expected.

Possible causes:

- Material cures too quickly, causing it to collect in one area.
- Mold has a segmented form that traps material, keeping it from flowing to areas of the mold.
- Poor material distribution.
- Clumps forming due to too much material added at once or mold getting too hot.

Things to try:

✓ Review your documented pour quantities.

✓ If there are noticeable areas with poor coverage, follow the recommendations for *Thin or Uncoated Areas* above.

✓ If a clump has formed inside the part, follow the recommendations for *'Snowballs' Inside Mold* below.

During Rotation or Demolding of Part

‘Snowballs’ Inside Mold

What you observe:

- A loud thumping, clunking, or rattling coming from inside the mold while it is rotating.

Possible causes:

- Material has formed a ‘snowball’ (a clump of partially cured material) inside the mold or outer layers of the part. This is usually caused by:
  - Adding too much material at once.
  - Material curing too quickly.
  - Or the mold getting too hot.

Things to try:

⚠ Stop the machine immediately if a snowball is suspected. Continuing to rotate the mold may damage both the mold and the part.

✓ Reduce the amount of material poured per pour.

✓ Test the working time of your material outside of the mold to ensure it is mixed correctly, and that no extra moisture has gotten into it.

✓ Adjust your process to match the speed of the pot life, or try an alternate material.

✓ If the issue does not resolve, see the section *Mold Getting Too Hot* below.

RECOMMENDED PRACTICE

In some cases, parts with snowballs can be repaired by:

- Removing the snowball through a small cut out, which can be repaired using bondo or small amounts of casting material.
- If weight is not a concern, urethane foam or similar material can be directed into the mold to fix the snowball in place.

Mold Getting Too Hot

What you observe:

- Snowballs forming inside the mold.
- Part sticking to mold walls despite mold release being used.
- Cracks in or peeling surface layer of silicone boot.

Possible causes:

- Mold is overheating due to ambient temperatures.
- Material chemical temperatures are too high.
- Mold is not given enough time to 'rest' between uses.

Things to try:

✓ Check the temperature of the mold in between production runs. If it is hot to the touch, give it time to cool before starting on a new part.

✓ In cases where high production is needed, it may be more economical to create multiple duplicate molds that can be alternated, as opposed to frequently repairing or replacing a single mold.

✓ If ambient room temperature is high, try using fans or A/C to lower temperature around machine.

✓ If possible, cool the material in a colder part of the building or fridge unit.

✓ If the above still doesn't handle the issue, check with your material supplier as they sometimes have additives that will lower the working temperature of their materials.

Material 'Sloshing' Inside Mold

What you observe:

- Material sounds wet and more 'sloshy' as it moves through the mold than expected.
- Part has poor coverage or too-thin spots.
- The surface of the part has an excess of pock marks or small bubbles.

Possible causes:

- Material contains too much moisture.
- The pot-life of the material is too slow.

Things to try:

✓ Confirm the materials were mixed correctly and have not been affected by moisture or age.

✓ Test the working time of your material outside of your mold to ensure it is as expected (see *Section 4.7 (Cup Testing Materials)* for more information. Adjust the timing of your process to match the pot life, or consider trying an alternate material.

✓ See section on *Surface Bubbles* below for additional handlings.

> RECOMMENDED PRACTICE
>
> **For many materials, some liquid "sloshing" before the material begins to cure is completely normal. As you become familiar with your materials and molds, you will also**

become familiar with how they normally sound during rotation.

If you notice the sound changes significantly from previous successful runs, or if it is accompanied by defects such as poor coverage or excessive bubbles, it may indicate that your process or material has changed from previous runs.

Surface Finish of Part

Unexpected Dents in Finished Part (Rubber Boot Molds)

What you observe:

- Part has dents or misshaped sections.

Possible causes:

- Debris is trapped between the rubber boot and cradle.
- Boot was not fully seated in cradle before casting.

Things to try:

✓ Dust off any debris from the rubber boot and the cradle before assembling the mold.

✓ Use gloved hands to press the rubber boot into the cradle, paying particular attention to any sections with detail or undercuts.

Excessive Surface Bubbles

What you observe:

- Excess of bubbles or welts in the surface of the part.
- Excess of bubbles inside walls of clear parts.

Possible causes:

- Material curing too quickly while rotating.
- Materials mixed too vigorously.
- More complex fine detail or undercuts in mold leading to air bubbles.
- Materials too old or contaminated by moisture.
- Fillers or additives may create additional bubbles.

Things to try:

✓ Check for moisture contamination in materials, particularly with urethanes. It should be noted that even a few drops of excess moisture can cause material to turn to foam instead of a solid.

✓ Mix materials carefully to minimize entrapped air.

✓ Pour the material in carefully and slowly, allowing it to cascade along the sides of the mold instead of directly into the cavity, creating as smooth an outer surface as possible.

✓ Prefill complex or detailed sections of the mold.

✓ In some cases, dusting molds with talc powder can help reduce the number of surface bubbles.

✓ When dealing with complex fine detail or undercuts, materials with longer cure time tend to produce fewer bubbles as the material has more time to settle into the detail of the mold.

✓ Where an option, de-gas the material by placing it in a vacuum chamber before pouring it into the mold, or remove the filled mold from the machine and place it in a pressure pot before it has time to completely cure.

IMPORTANT

The processes involved in mixing and rotating liquid chemicals naturally introduce air into materials, leading to bubbles in one degree or another.

These can be minimized using the above recommendations, but should be considered when planning the required surface finish, or when dealing with clear materials.

RECOMMENDED PRACTICE

Some methods of repairing bubbles in parts include:

- Minor surface bubbles can be filled using bondo or small amounts of matching cast materials.
- In clear parts, internal bubbles can sometimes be filled by drilling small holes and injecting mixed casting material into the part using a small syringe.

Excessive Flash at Seams

What you observe:

- Material leaking out of mold and leaving excess flash at seam lines.

Possible causes:

- Mold not fully closed or clamped.
- Debris trapped at seam lines preventing it from sealing correctly.

Things to try:

✓ Clean the mold parting surfaces before assembling the mold.

✓ Ensure the mold is fully closed and clamped before pouring in chemicals.

✓ If the problem continues, inspect the parting surfaces for wear or damage and repair if necessary.

4.7 ADDITIONAL TIPS FOR SUCCESSFUL ROTATIONAL CASTING

Prefilling Portions of Your Mold

If material is not reaching or fully coating a specific area of your part, one effective technique is to prefill that section of the mold before or during the casting process.

This can be done in the following ways:

- **Direct Prefill (Accessible Sections)**
  If the mold design allows access to the area in question, material can be poured directly into that section before the mold is fully assembled and mounted on the machine. The mold should then be assembled, sealed and mounted as normal before rotation begins.
- **Angled Prefill (Inaccessible Sections)**
  If the area cannot be directly accessed, a pre-measured amount of material can be poured into the mold, which is then manually held at a specific angle to allow the material to flow into the desired region before normal rotation begins.

Successful prefilling often requires some experimentation on the amount of material used and the precise positioning of the mold.

Cup Testing Materials

When working with a new resin, filler, or additive - or when evaluating older material that has been in storage - it can be helpful to perform a simple "cup test" before pouring material into a mold.

A cup test allows you to observe how the material behaves during mixing and curing, check it against the manufacturer's specifications, and identify any unexpected changes before committing to a full casting cycle.

To perform a cup test:

1. Apply mold release to the inside of a disposable paper cup.
2. Prepare the material using the intended mix ratio, fillers, or additives.
3. Start a timer as soon as the material begins mixing.
4. Slowly rotate and tilt the cup by hand, allowing the material to flow around the inside surface.
5. Observe and record:
    - How easily the material flows.
    - Whether it coats the sides of the cup evenly.
    - When it begins to gel.
    - When it becomes fully solid.
    - Any unusual behavior, such as excessive bubbles, separation, or incomplete curing.

If the material remains very thin and does not readily coat the walls of the cup, it may require longer rotation times than expected, or the material itself may not be suitable for the intended application. Likewise, if it begins to gel almost immediately, it may not have sufficient working time to coat a complex mold before curing.

Comparing your observations with the manufacturer's published specifications can help confirm that the material is performing as expected. Recording these results also provides a useful starting point when determining rotation times and refining the casting process.

> RECOMMENDED PRACTICE
>
> **It can be helpful to label the cup (or the result of the cup test if the cup is removed) with relevant details such as material name, mix ratio, filler percentage, ambient temperature, and the observed gel and cure times.**
>
> **Keeping key samples as records can provide a useful reference when comparing materials or troubleshooting future casting issues.**

Mold Fill Funnel Corks

For larger molds and those that require multiple pours, a mold fill cork can allow material to be added without removing the plug from the mold. .



Funnel cork in a mold

To create these corks:

1. Apply mold release to the inside of a 12oz paper cup and the outside of a metal tube large enough to pour material through.
2. Position the tube in the centre of the cup and secure it with tape or wooden sticks.
3. Pour RTV silicone into the cup around the tube and allow it to cure.
4. Remove the paper cup and metal tube.
5. Position the tube inside the rubber cork so that it extends into the mold area by 1-½” to 3”, and then place it firmly into the mold cork hole so the added pressure holds the metal tube in place.,

The tube allows additional material to be poured into the mold without removing the cork. During rotation, the end of the tube inside the mold extends above the flowing material for much of the cycle, helping to reduce leakage while still allowing additional pours to be made.

Borescope Cameras:

We strongly recommend using a borescope camera that can be inserted into your mold's fill hole, especially when dealing with bulky or oddly shaped molds. This allows you to inspect internal coverage between fills without opening your mold, making it much easier to see if additional material is required.



Using a borescope to check internal coverage through a funnel cork

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5. CREATING MOLDS FOR USE IN ROTATIONAL CASTING

The mold you choose plays a major role in the quality, durability, and repeatability of your finished parts.

The methods described in this chapter are based on Mannetron's experience over more than four decades of rotational casting. They are approaches we have found to be reliable across a wide range of applications, but they are not the only methods available.

We encourage you to experiment with different materials and techniques, work closely with your material suppliers, and adapt your processes to suit your specific application. Every project is different, and developing a reliable process is an important part of successful rotational casting.

RECOMMENDED PRACTICE

A step-by-step visual walkthrough showing the making of a rubber boot mold and cradle is available on our website's manual page. Although the guide demonstrates one particular mold type, many of the principles and techniques are applicable to rotational casting molds in general.

If you have questions during the moldmaking or casting process, please don't hesitate to contact us. We're always happy to share our experience and discuss possible solutions based on what has worked for us in the past.

5.1 SELECTING A MOLD TYPE

Selecting the most appropriate mold type depends primarily on the shape and level of detail of the finished part, along with your expected production volume and budget.

Mold Type	Part Requirements	Typical Advantages & Limitations
Rubber Mold	**Fine detail or undercuts**	✓ Can be used to replicate high levels of surface detail ✓ Allows for complex molds with undercuts ✗ Mold material costs typically higher ✗ Shorter mold life ✗ Typically produces fewer parts before the rubber boot requires replacement or repair
Hard Tool Mold	**Smooth surfaces and no undercuts**	✓ Mold material costs typically lower ✓ Longer mold life ✓ Produces more parts before needing repair or replacement ✗ Not suitable for parts with undercuts or detail that would prevent the part from being removed from the mold
Hybrid Mold	**Has a mixture of both**	✓ Generally uses less rubber than a full rubber boot mold ✓ Allows for limited undercuts ✓ Allows for sections of fine detail ✗ Mold material costs are higher than simple hard tool molds ✗ Generally more complex to fabricate

5.2 RUBBER MOLDS AND RUBBER BOOT MOLDS

Rubber molds are best suited for parts requiring fine surface detail, organic shapes, or negative draft (undercuts). Because the mold is flexible, it can be removed from parts that would lock into a rigid mold while still accurately reproducing fine textures such as fur, engraved lettering, and skin detail.

Solid Rubber Molds

Solid rubber molds are made entirely from rubber and therefore require considerably more mold material than rubber boot molds. Because rubber is typically the more expensive mold material, solid rubber molds are most commonly used for smaller parts rather than large castings that benefit most from being rotationally hollow cast.



Solid rubber mold of a model heart

Provided they can be sealed to keep material from flowing out as the mold rotates, solid rubber molds can still be used in rotational casting.

Rubber Boot Molds

In this approach, a relatively thin and flexible rubber layer is used to form the mold surface, and this layer is supported by a rigid outer shell (commonly referred to as a cradle or mother mold). The outer shell holds the rubber boot in its correct shape during rotation, allowing the mold to maintain its shape.



Rubber boot mold of a mannequin head with complex facial and hair detail

Rubber boot molds are by far the most common mold type used for rotational casting because they provide nearly all the detail of a solid rubber mold while using significantly less rubber, making them much more economical for larger parts.

Maximizing Mold Life

Rubber molds offer excellent detail and flexibility, but they have a shorter expected life span than hard tool molds. Proper care can significantly extend their usable life, but eventually they will require repair or replacement.

In many applications, rubber boot molds can produce approximately 20–50 parts before requiring replacement of the boot, although their actual life varies considerably.

Factors that affect mold life include:

- Casting material and its chemical properties
- Rubber boot thickness
- Careful use of mold release
- Heat buildup and allowing the mold to cool between cycles
- General handling and storage

> **IMPORTANT**
>
> **Older rubber molds that have been stored for extended periods may also require repouring before returning to production, as rubber properties can change over time even when the mold is not being used.**

> **RECOMMENDED PRACTICE**
>
> **Minor tears or worn areas can often be repaired with 100% silicone 1 caulk, extending the usable life of the mold before a complete repour becomes necessary.**

Typical Materials for Rubber Molds and Cradles

Rubber:

- RTV (Room Temperature Vulcanizing) silicone
- Urethane elastomer
- Brushed-on latex

Cradle:

- Urethane or polyester resin reinforced with fiberglass
- Polyurethane or epoxy resin system
- Rigid polyurethane foam
- Wood or plastic boxes (most useful for smaller parts)
- Other sufficiently rigid material capable of supporting the rubber boot during casting

Repair:

- 100% Silicone 1 caulk (silicone 2 will not adhere to cured silicone or standard rubber)

Cleaning:

- Microfiber cloth
- Water + Dawn dish soap (to aid in periodically scrubbing out mold release build up)
- Avoid harsh solvents or aggressive cleaners

5.3 HARD TOOL MOLDS

Hard tool molds (rigid molds) are typically used for parts with simple geometry, smooth surfaces, and little to no undercuts. Unlike rubber molds, they rely on carefully designed parting lines rather than flexibility to allow the finished part to be removed.



Large polyester hard tool mold mounted on a rotational casting machine

---

Production Capability

Hard tool molds are often the preferred choice for repeat production where the part geometry allows their use. Compared with rubber molds they generally:

- Typically require less mold material than full rubber molds, making them less expensive to construct
- Produce a significantly greater number of parts before repair or replacement
- Maintain their shape well over long production runs

With proper use of mold release and routine cleaning, hard tool molds can often remain in service for years - in some cases multiple decades.

Their primary limitation is part removal. If a part contains undercuts or deep detail that cannot be accommodated by suitable parting lines or multiple mold sections, a rubber or hybrid mold is generally required.

Typical Materials for Hard Tool Molds

Mold:

- High-temperature, low-shrink tooling polyester reinforced with fiberglass
- Epoxy systems, typically applied as a surface coat and backed with a fiberglass laminate for strength
- Molds formed from aluminum or steel, as long as they are not too heavy for the machine
- 3D Printed molds, providing the molding surface has been post-processed by sanding and/or coated with epoxy or similar material

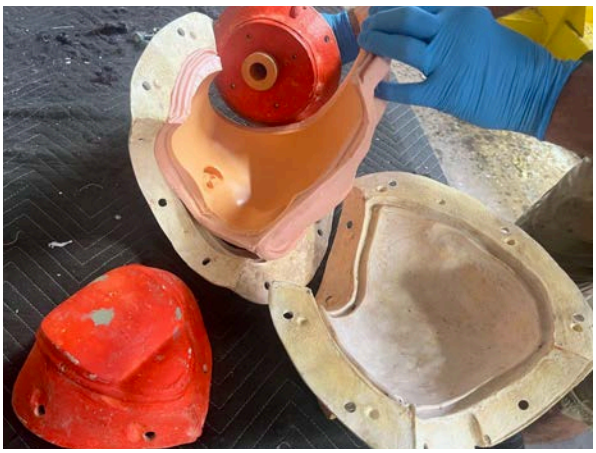
Cleaning:

- Microfiber cloth
- Water + Dawn dish soap (to aid in periodically scrubbing out mold release build up)
- Avoid harsh solvents or aggressive cleaners

5.4 HYBRID MOLDS

Hybrid molds combine rubber and rigid tooling into a single mold. They are typically used when a part contains both fine detail or undercuts **and** larger areas that are smooth or structural.

Rubber is used only where flexibility is needed to reproduce detail or release undercuts - for example, for facial features, fingers, ears, sharp corners, and engraved lettering. The remaining areas are constructed as hard tooling, providing greater durability while reducing the amount of rubber required.



Example of a hybrid mold, using a rubber boot for facial features and hard tooling for the base and top of head

Using rubber only where it is needed means that if those detailed sections eventually wear out, they can often be repaired or repoured without rebuilding the entire mold. This can reduce material costs over the life of the mold.

Hybrid molds generally require more planning during design and construction than either full rubber or full hard tool molds. However, for many complex parts they provide the best balance of fine detail, durability, service life, and long-term operating cost.

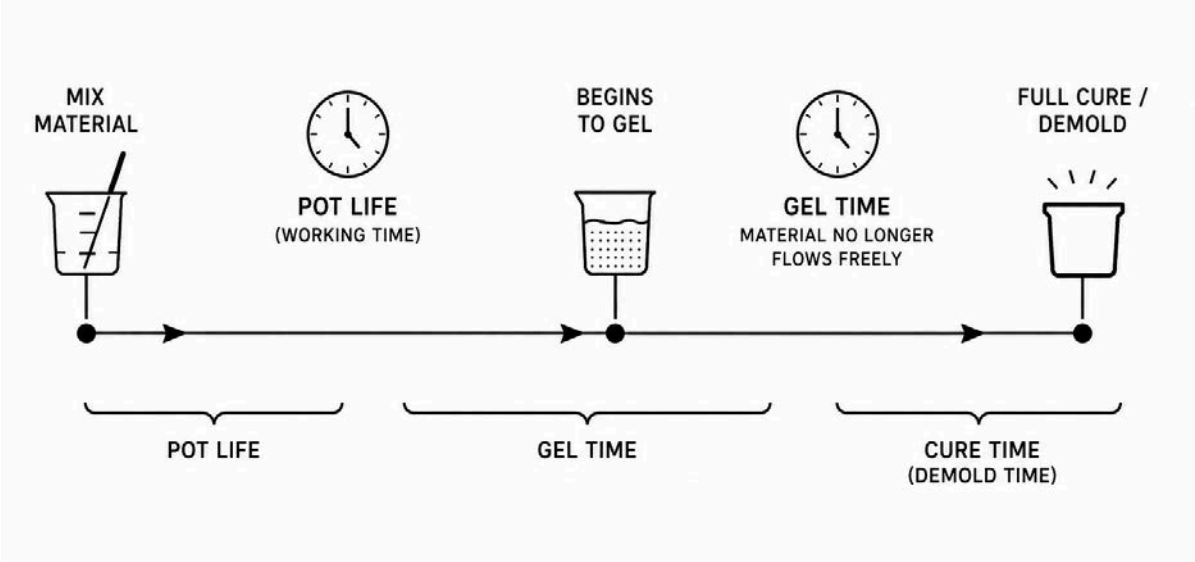
6. SUGGESTED CASTING MATERIALS

The material selected for a part has a significant influence on its appearance, strength, weight, flexibility, and overall performance. While polyurethane resins are the most common materials used in rotational casting, many other materials can also be used successfully depending on the application.

This chapter provides an overview of the materials most commonly used on Mannetron rotational casting machines and some of the considerations when selecting them.

6.1 UNDERSTANDING MATERIAL TIMING

When selecting a casting material, you will sometimes see terms such as **pot life**, **gel time**, and **cure time** listed on the manufacturer's data sheet. These are described in more depth in the following pages.



It should be noted that different manufacturers measure these times in different ways, and in some cases don't list gel time as a separate item - as such, it is always important to test samples of materials before starting production (see *Section 4.7 (Cup Testing Materials)* for more information).

Pot Life

Pot life (sometimes called **working time**) is the amount of time after mixing that the material remains fluid enough to be poured and to move through the mold before it begins to thicken or gel.

This is the time available to measure, mix, add any fillers or pigments, and pour the material into the mold.

Gel Time

Gel time is the point at which the material changes from a freely flowing liquid into a soft gel. At this stage, the material starts to become less and less able to flow easily through the mold.

For rotational casting, gel time is often one of the most important material properties. Ideally, the material should remain fluid long enough to coat the entire mold, but begin to gel before it has an opportunity to pool or collect into "snowballs."

Not all manufacturers publish a separate gel time. If it is not listed on the technical data sheet, your material supplier may be able to provide additional guidance on the material's flow and gel characteristics.

Cure Time (Demold Time)

Cure time (sometimes called demold time) is the amount of time required for the material to harden sufficiently for the part to be removed from the mold.

A shorter cure time generally allows parts to be produced more quickly, while a longer cure time increases the amount of time the part must remain in the mold before it can be removed.

6.2 MATERIALS FOR PART PRODUCTION

Polyurethane Resin

Polyurethane resins are the most commonly used casting materials for rotational casting due to their excellent balance of strength, durability, versatility, and cost. They are available in a wide range of hardnesses and formulations, making them suitable for everything from lightweight display pieces to durable production parts.



White polyurethane resin street art sculptures. Image courtesy of Prop Art Studio

For many applications, we recommend starting with a polyurethane resin having approximately a **3-minute pot life** and a **Shore D hardness of around 70**, then adjusting from there based on your application and results.

The way a material transitions from a liquid to a gel and finally to a fully cured solid has a significant impact on the casting process. If the material remains fluid for too long, it may pool or form a "snowball" inside the mold, while also increasing production time. If it gels or cures too quickly, it may not reach all areas of the mold, fully reproduce fine detail, or allow trapped air bubbles to escape before solidifying.

Most suppliers offer polyurethane resins in standard colors such as black, white, clear, or tan. Many also offer pre-colored systems or concentrated pigments that can be added during mixing to produce a wide range of custom colors.

Common suppliers include:

- Polytek
- Alumalite
- RAMPF
- Composite One
- Smooth-On

When comparing materials, pay particular attention to the pot life, gel characteristics, and cure time listed on the supplier's technical data sheet, as these will significantly affect the rotational casting process.

Clear Polyurethane Resin

Clear polyurethane resins can be used to produce attractive, durable parts that resemble glass while being significantly more impact-resistant. They are commonly used for display pieces, decorative components, illuminated display components, and other applications where transparency is desired.



Tinted clear polyurethane resin parts

Producing high-quality clear parts is generally more demanding than casting opaque materials. Mixing, pouring, and the rotational casting process can become introduce or trap air within the material. While these bubbles may be invisible in opaque castings, they are often noticeable in clear parts.

Several factors can help improve clarity, including:

- Careful material mixing and pouring techniques.
- Selecting a material with an appropriate working and cure profile.
- Careful control of rotation speeds and speed changes throughout the casting process.
- Maintaining a standard ambient temperature (not too hot or cold).
- Vacuum degassing the material during its pot life, where appropriate.

Even when small bubbles are present, careful control of their size and distribution using techniques such as pouring material in along the sides of your mold instead of into the center can significantly improve the appearance of the finished part.

Clear materials are often less forgiving than opaque materials, so developing a successful process typically requires additional experimentation. Small changes in

rotation speed, speed ratio, timing, or material selection can noticeably affect the appearance of the finished part.

We strongly recommend documenting every trial when developing a clear casting process. Many successful processes involve multiple speed changes during the casting cycle - for example, beginning with slower rotation before increasing speed later in the cure, and then again later. The optimum sequence will vary depending on the material, mold geometry, and desired finish.

RECOMMENDED PRACTICE

Producing consistently high-quality clear parts often requires multiple speed changes throughout the casting cycle. For higher-volume production, a programmable rotational casting machine can automatically execute these speed profiles, improving repeatability while reducing operator involvement.

While these machines represent a significant investment and in most cases careful manual control is entirely sufficient, they can be beneficial for higher-volume production or where repeatability is particularly important.

Polyurethane Foam

Polyurethane foam (whether rigid or flexible) is commonly used to reinforce hollow castings while adding relatively little weight. Once the outer shell has largely cured, foam can be poured into the cavity to provide structural support and improve stiffness without significantly increasing weight.



Cast polyurethane part with urethane foam rotated interior

It can also be used to create soft or slightly flexible parts, though urethane rubbers are more typically used where a smoother surface is needed as foams tend to have more texture.

Other Materials

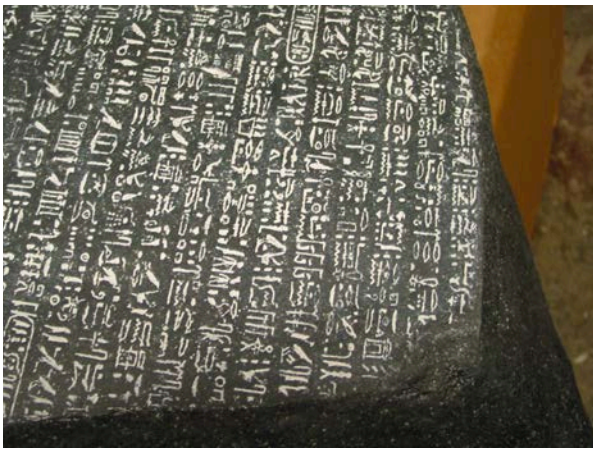
Although polyurethane resins account for the majority of rotational cast parts, they are by no means the only option. Depending on the application, materials such as polyurethane rubbers, polyester resins, plaster/gypsum, nylon-based systems, and many others may also be suitable. Each material behaves differently and will require process development to determine the optimum casting procedure.



Polyurethane rubber coating over foam interior frosting shaped seat cushions

6.3 FILLERS

One of the greatest advantages of rotational casting is the wide variety of fillers and additives that can be used with the base material. These allow both the casting process and the finished properties of a part to be tailored to a particular application in ways that would not be possible using the resin alone.



Polyurethane Rosetta Stone replica with crushed aggregate filler
Image courtesy of the Freeman Institute Foundation

Depending on the material chosen, fillers may be mixed directly into the resin before pouring, added between coats, brushed or dusted onto the mold surface, or incorporated into the resin by the manufacturer before it reaches you.

Many fillers serve several purposes at once. For example, the same filler may alter the appearance of a part while also changing its weight, stiffness, viscosity, or curing characteristics. Likewise, many applications can be achieved using several different filler types. Because of this, there is rarely a single "correct" filler for any particular application.

When selecting fillers, the goal is to achieve the desired result while keeping the material fluid enough to flow freely throughout the mold. Keep in mind that fillers can also change how the resin behaves during casting, including its viscosity, pot life, gel characteristics,

cure time, and overall flow. Finding the best combination for a particular application usually requires some experimentation.

The following pages describe some common fillers and additives that we have found useful over the years. This list is intended as a starting point rather than a complete summary of the possibilities available.

RECOMMENDED PRACTICE

Experimentation is one of the keys to getting the most from fillers. Many fillers can be used individually or combined with others, and the same filler may behave differently depending on the resin system, filler ratio, or method of application.

Many fillers involve trade-offs. For example, a filler may increase stiffness while reducing impact resistance, or improve appearance while increasing the number of surface air bubbles. As such it is helpful to make only one change at a time, and document results.

Many suppliers offer small sample quantities for evaluation and are often happy to recommend fillers or additives based on your application.



Cold-cast bust made using clear polyurethane resin with bronze powder mixed into the resin and brushed onto the mold surface prior to casting

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Common Fillers

Filler /Additive	Typical Uses & Notes
Calcium carbonate (ground limestone / crushed marble)	One of the most widely used fillers. Commonly used to reduce material cost, increase stiffness, produce a stone-like appearance, increase density, and improve sanding characteristics. Often used in decorative castings and architectural pieces.
Magnesium silicate (Talc)	Used to reduce cost, improve stiffness, reduce shrinkage, and improve sanding. Can also be brushed into the mold before casting to help reduce trapped surface bubbles and help in adding a matte finish to parts.

Mineral aggregates	A broad category including crushed stone, granite, slate, gravel, and similar materials. Used to create natural textures, increase weight, and produce realistic stone or concrete effects.
Quartz sand / silica sand	Used where a coarse mineral texture, increased wear resistance, or anti-slip surface is desired. Often incorporated into decorative or architectural castings.
Glass microspheres	Hollow glass spheres used to reduce weight and density while maintaining overall part size. Particularly useful where lightweight parts are required without significantly increasing wall thickness. Can also be used to improve dimensional stability and reduce shrinkage
Ceramic microspheres	Similar to glass microspheres but often offer greater compressive strength and heat resistance.
Chopped fiberglass strands	Used where significant reinforcement is required. Often added between coats to improve strength, stiffness, and impact resistance in larger structural parts
Milled fiberglass fibers	Short fiberglass fibers mixed directly into the resin before pouring. Provide reinforcement throughout the casting while remaining easier to mix than longer chopped strands.
Carbon fibers	High-strength reinforcement used where exceptional stiffness, strength-to-weight ratio, or low weight are required. Generally more expensive than fiberglass.
Bronze, aluminum, copper, or other metal powders	Can be brushed onto the mold surface or mixed into the material. Used for cold-casting to create convincing metallic finishes. Once cured, the surface can be brushed, scrubbed, polished, or coated to enhance the metal effect.
Wood flour / wood	Produces wood-like appearance and texture, adding a more natural

fibers	feel to the finished part. Can also be combined with pigments to simulate different wood species.
Crushed glass / frit	Decorative filler used to create sparkling, crystalline, translucent, or geode-like effects. Often combined with clear or tinted polyurethane resins.
Mica flakes	Decorative filler used to produce pearlescent or shimmering finishes.
Pigments / colorants	Used to produce solid, translucent, or custom colors. Available as liquid or powder systems and can often be combined with other fillers to create decorative effects.
Accelerators / retarders	Modifies the working and cure characteristics of the resin. Used to shorten or lengthen cure times to better suit the casting process or environmental conditions.
UV stabilizers	Helps reduce discoloration, chalking, and degradation caused by prolonged exposure to sunlight. Particularly beneficial for outdoor parts or those exposed to ultraviolet light.

6.4 OTHER MATERIALS

Mold Release

Mold release is one of the most important materials used during rotational casting. Proper use of mold release makes parts easier to remove from the mold while helping to reduce wear and extend mold life.

Many resin suppliers recommend specific mold releases that are compatible with their materials. These are generally available in paintable and non-paintable formulations, as well as spray-on, wipe-on, and paste wax versions.

The best choice will depend on your resin, mold material, finishing process, and personal preference.

General Guidelines

- Apply mold release according to the manufacturer's instructions.
- Remove dust or loose residue between production cycles using a clean microfiber cloth or similar soft material.
- Clean away built-up mold release as needed. Excessive buildup can gradually reduce surface detail or affect the finish of the part.
- Wax mold releases generally require cleaning of build up more frequently than spray-on products.
- Even paintable mold releases should be cleaned off before painting the finished part, following your paint supplier's recommendations.

Common mold releases include:

- Rexco Partall® Paste #2 (paste wax)
- Polytek Pol-Ease® 2300 (non-paintable)

- Polytek Pol-Ease® 2500 (paintable)

Talc (Magnesium Silicate)

In addition to being used as a filler, talc can also be applied directly to the mold surface before casting.

A light dusting of talc can act as a mold release, and can also help to reduce trapped surface bubbles, particularly in detailed molds or when using materials that tend to trap air against the mold surface. In some cases, this also adds a matte surface finish.

UV Protective Coatings

Most polyurethane resins will gradually yellow or change color when exposed to ultraviolet (UV) light. This can occur outdoors in direct sunlight, but also indoors over long periods or where natural daylight is present.

While some resins contain UV stabilizers, these generally slow the process rather than preventing it completely.

For parts that will be displayed outdoors or in brightly lit environments, we recommend applying a high-quality UV-resistant paint or clear coating compatible with your resin system.



Comparison of unpainted polyurethane and UV-protected polyurethane after prolonged exposure to direct sunlight.

7. MACHINE MAINTENANCE

7.1 IMPORTANCE OF MACHINE MAINTENANCE

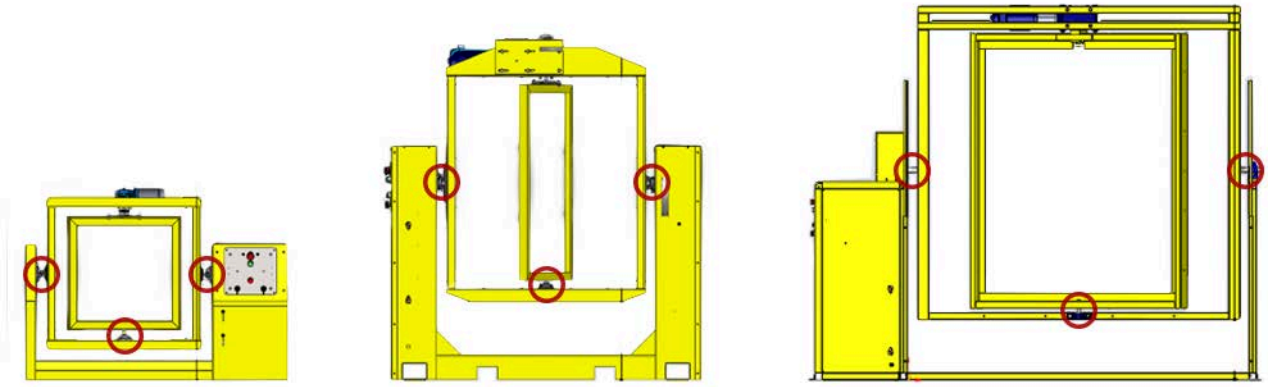
Regular inspection and maintenance will help ensure reliable operation, reduce downtime, and maximize the service life of your machine.

Many of our machines have remained in daily use for decades, and most maintenance involves little more than monitoring for changes in sound or operation, lubrication, and occasional replacement of normal wear items.

This chapter describes the recommended maintenance procedures for your machine. If you have questions about servicing, repairs, or replacement parts, please contact us. We're always happy to offer advice and help keep your machine running.

7.2 BEARINGS

Each machine includes three pillow block bearings as shown by the red circles in the below diagram. There is no pillow block on the motorized side of the inner frame.



Each bearing is equipped with a grease fitting to allow for easier lubrication using a standard grease gun.

Any bearing grease that matches DIN KP2K-30 grease such as SKF LGNL 2 or Lucas Red"N"Tacky can be used for all Rotational Casting machine sizes.

We recommend lubricating the bearings approximately every 6 months during regular use.

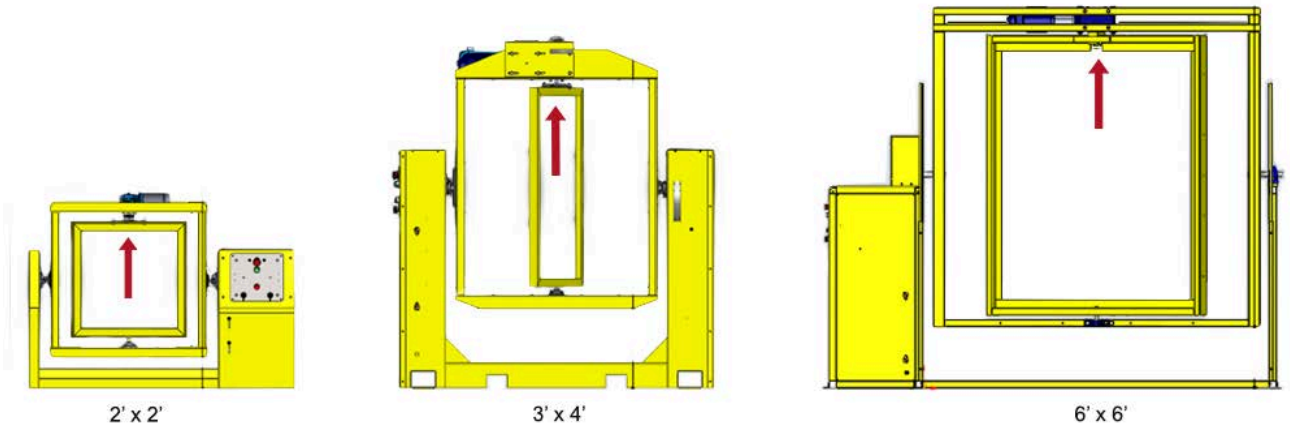
Machines operating intensively, in dusty environments, or under heavy loads may require more frequent lubrication. Machines that are used infrequently should still be inspected periodically to ensure the bearings remain properly lubricated.

7.3 GEARBOXES

Gearbox Positioning

During normal operation, some minor oil seepage through the breather vents of the gearboxes used on the rotational casting machines is to be expected.

It is recommended to position the outer frame so the motor/gearbox faces upward when the machine is not in use, as shown in the below diagram. Positioning the frame in this way can help keep leaking to a minimum.



Gearbox Recommended Oil Type

Below is a list of common gearbox manufacturers used in Mannetron's Rotational Casting machines.

GEARBOX MANUFACTURER/MODEL TYPE	RECOMMENDED LUBRICANT
Grove Gear (3'x4' & 6'x6' Machines)	Mobil Glygoyle 460 PAG synthetic lubricant (e.g. Mobil SHC 634)
Cleveland Gear (3'x4' & 6'x6' Machines)	ISO VG 460 Synthetic Gear Oil (e.g. Mobil SHC 634)
Boston Gear (6'x6' Machines)	Sealed, and does not require routine oil checks. Should only be monitored for leaks and/or physical damage. Contact Mannetron if found.
Motovario / Amer (2'x2' Machines)	ISO VG 460 Synthetic Gear Oil (e.g. Mobil SHC 634)
Rio / Kaxieli (2'x2' Machines)	ISO VG 460 Synthetic Gear Oil (e.g. Mobil SHC 634)

> **NOTE ON 2x2 GEARBOXES**
>
> **If your 2x2 gearbox's serial plate lists no manufacturer but calls out model number KNMRV030 or NMRV030 or has no plate at all, follow the instructions for Motovario gearboxes or contact us for clarification.**

If replacement lubricant is required and the gearbox model cannot be identified as above, contact Mannetron before adding oil.

Checking the Gearbox Oil Level

It is important to periodically check the gearbox oil level, as operating a gearbox with low oil can result in increased wear, overheating, or in some cases can cause the gearbox to fail.

Gearbox designs vary between machine models and manufacturing years. **Whenever possible, identify the gearbox manufacturer and model and follow the manufacturer's instructions for checking the oil level.** For older gearboxes or where this information is no longer available, the following provides a general overview.

The general process for checking the oil level is as follows:

1. **Position the gearbox for access.**
   Use the jog controls to position the rotating frames so the gearbox is level and accessible. If checking the gearbox inside the tower, remove the appropriate tower cover.

2. **Disconnect power.**
   Switch off the machine, engage the Emergency Stop, and disconnect the machine from its power source. If the machine has recently been running, allow time for the gearbox oil to settle.

3. **Check the oil level.**
   Remove the appropriate oil-level plug. On gearboxes with a side level plug, the oil should normally be visible at or near the bottom of the opening. If the gearbox only has an upper plug, use a clean dipstick or cable tie to check the level; as a general guideline, the gearbox should be approximately half full.

   Do not remove a plug from the bottom of the gearbox, as this will allow the oil to drain out.

4. **Top up if needed.**
   If the oil level is low, slowly add the lubricant recommended for that gearbox. Avoid overfilling.

5. **Reinstall the plug.**
   Reinstall and securely tighten the plug before returning the machine to service.

COMMON GEARBOX QUESTIONS

Q: My gearbox has oil around it. Is this normal?

A: Small amounts of oil around the breather vent can be normal. Large amounts of oil, rapidly increasing leakage, or oil dripping continuously should be investigated.

Q: How often should I check the oil?

A: Annually for most machines. Machines over 10 years old or in heavy continuous service should be checked every six months.

Q: The sound my machine makes when it runs has gotten louder/changed, what should I do?

A: Check that the pillow block bearings are properly lubricated and check the gearbox oil levels. If the issue continues, contact Mannetron.

Q: What happens if I fill up the gearbox past the recommended level?

A: Overfilling the gearbox can cause additional leaking, overheating and reduced performance.

Q: What should I do if I have any other questions?

A: If you are unsure of any step, or run into an issue not covered in this manual, contact Mannetron.

7.4 MACHINE TROUBLESHOOTING

Check These Items First

Over the years, we've found that many machine performance issues are ultimately traced back to mold loading rather than a fault with the machine itself.

- The mold weight is within the machine's recommended capacity (see *Section 4.2 (Maximum Recommended Load Capacity)*).
- The mold is properly balanced within the rotating frame.

These two factors account for many of the operating issues we see, including excessive vibration, unusual noises, poor rotation, intermittent motor performance, and overloaded control panel circuits.

Once these items have been checked, use the troubleshooting table below to investigate other possible causes.

Troubleshooting Table

WATCH FOR	ACTION TO TAKE
Excessive vibration, unusual noises, or changes in the smoothness of the rotation.	Inspect bearings for proper lubrication and verify gearbox oil levels.
Frame ‘skipping’ or ‘jumping’ as it rotates, or frame moves too easily when wiggled by hand. (3’x4’ or 6’x6’ units only)	Check for looseness in belts.
Motor getting jerky, so frames jerk	Check motor brushes to see if replacements are

or stop intermittently at low rotational speeds	needed.
Signs of leakage from gearboxes	Minor seepage around seals or breather vents may occur and is not typically a concern. New leaks, increasing leakage, or significant oil loss should be investigated. Check the gearbox oil level and inspect the source of the leak.
Machine will not turn on when pressing the start button	Verify machine is plugged into working power. Ensure the Emergency Stop is released and verify that neither circuit breaker has tripped.

Service & Technical Support

If you encounter a problem that cannot be resolved as above, or if any clarification is needed, please contact Mannetron by phone or email.

To help us diagnose the issue, we may request:

- Photographs or video of the problem
- The machine serial number, motor and/or gearbox model number, date of manufacture, or purchase date (if known)
- A description of the operating conditions when the issue occurred

In many cases, we can provide guidance that allows repairs to be completed on-site.

For more complex issues, we may recommend sending a motor, gearbox, control panel, or other component to Mannetron for evaluation. Where possible, we will provide a quotation for repair following inspection.

If repair is not practical, we can often supply replacement parts directly or in some cases provide manufacturer part numbers and supplier information so that parts can be sourced locally.

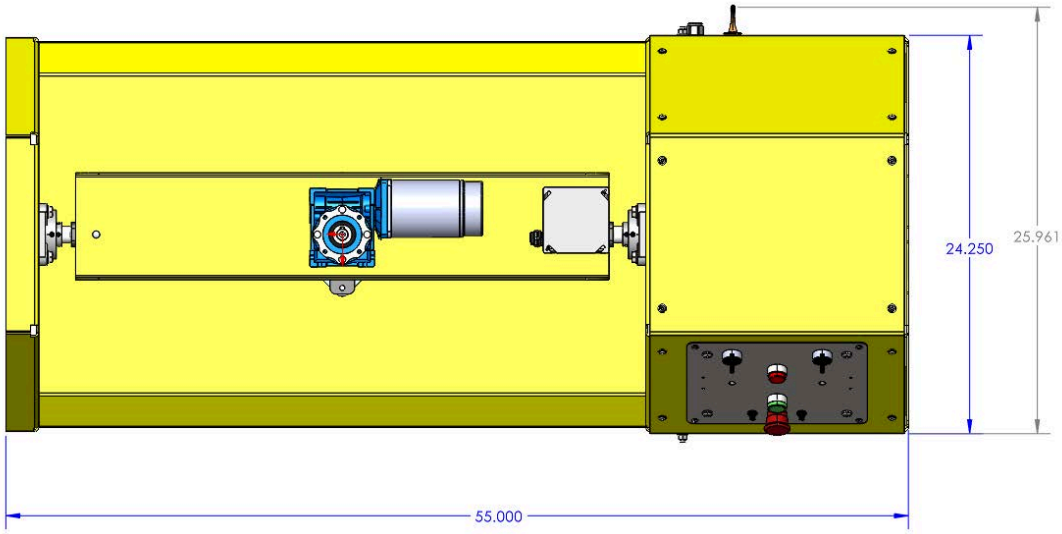
CONTACT MANNETRON

Email: rotomold@mannetron.com
Phone: +1 269-962-3473

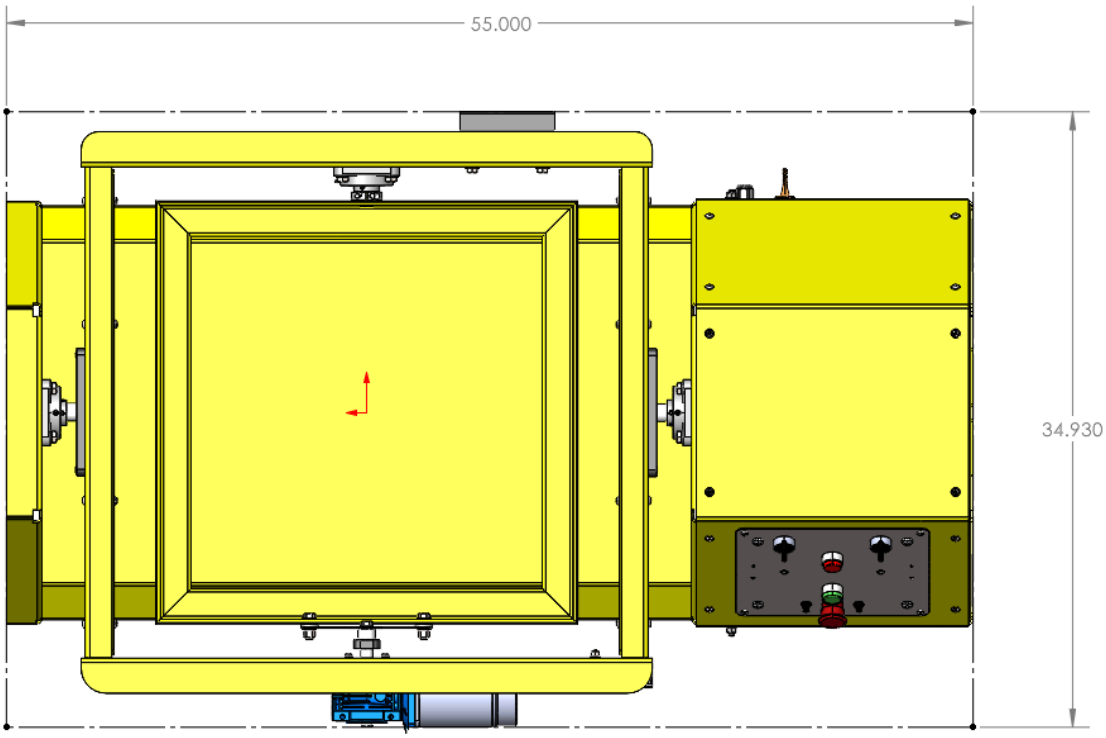
APPENDIX

2'x2' Rotational Casting Machine Dimensions

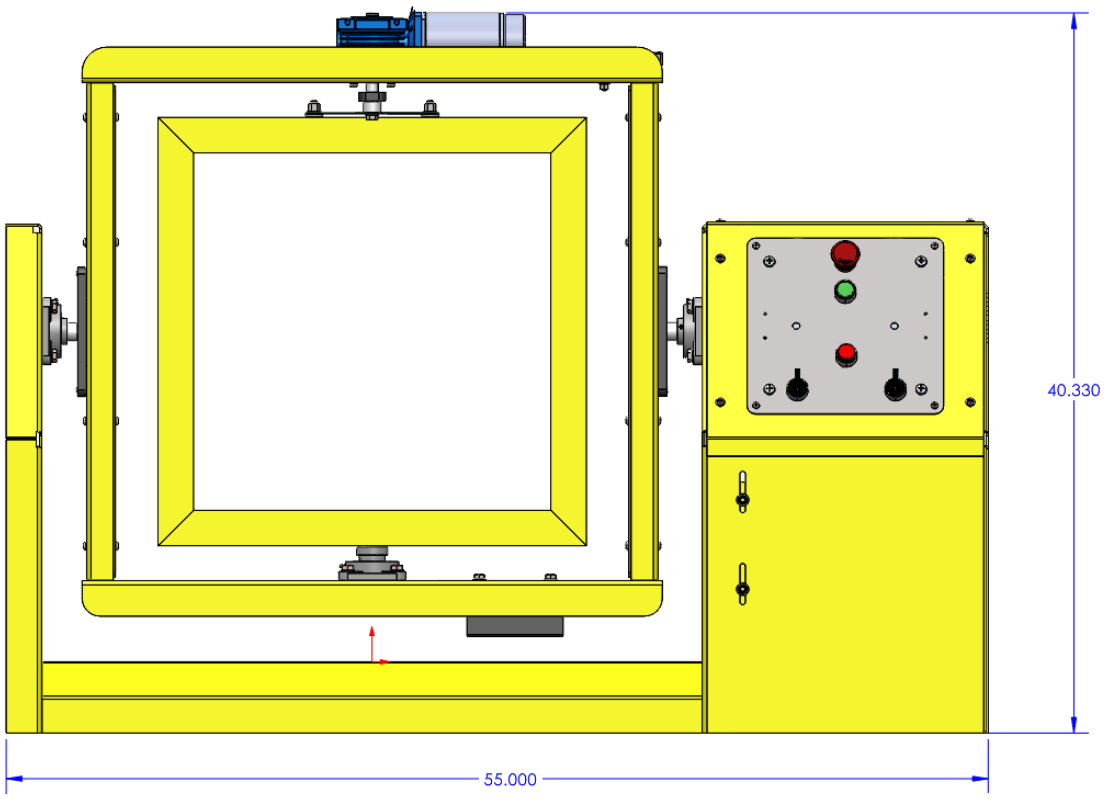
TOP DOWN VIEW (FRAMES AT CENTER POSITION)



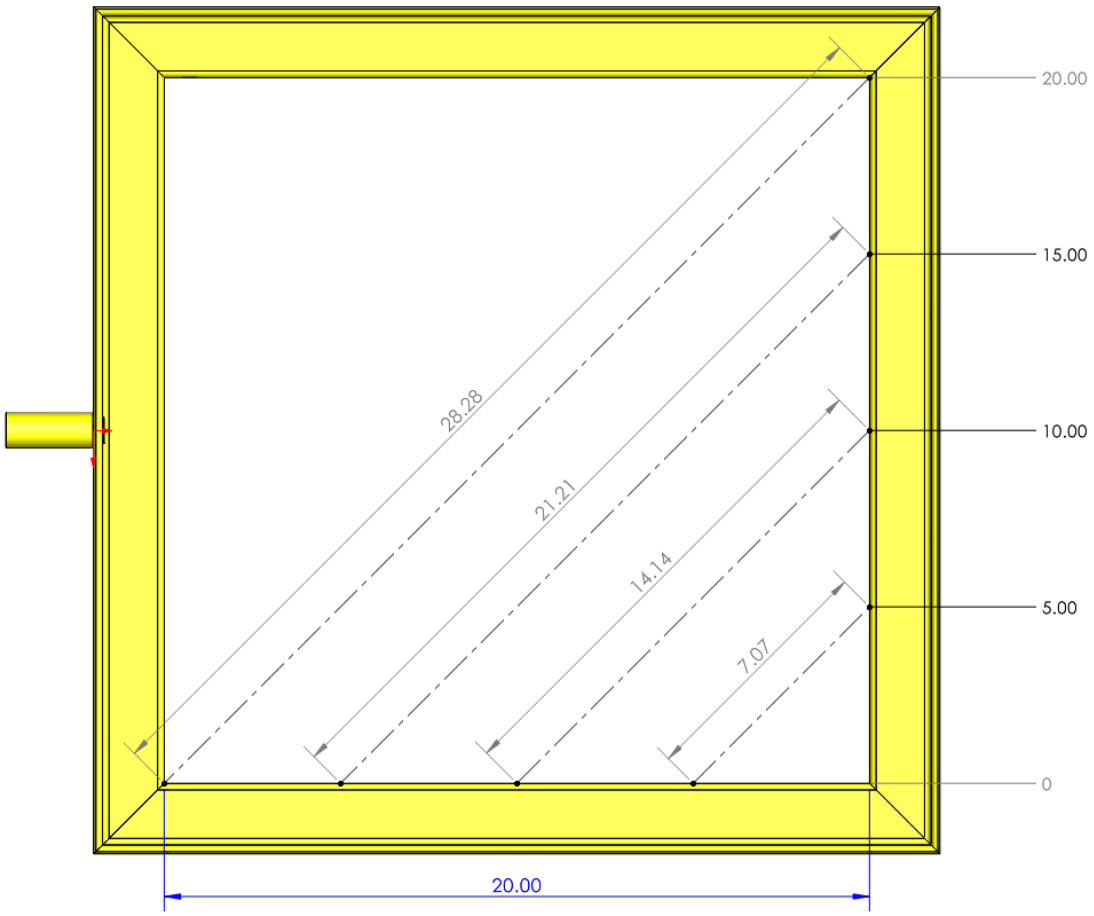
TOP DOWN SAFETY ENVELOPE VIEW (FRAMES FLAT)



FRONT VIEW

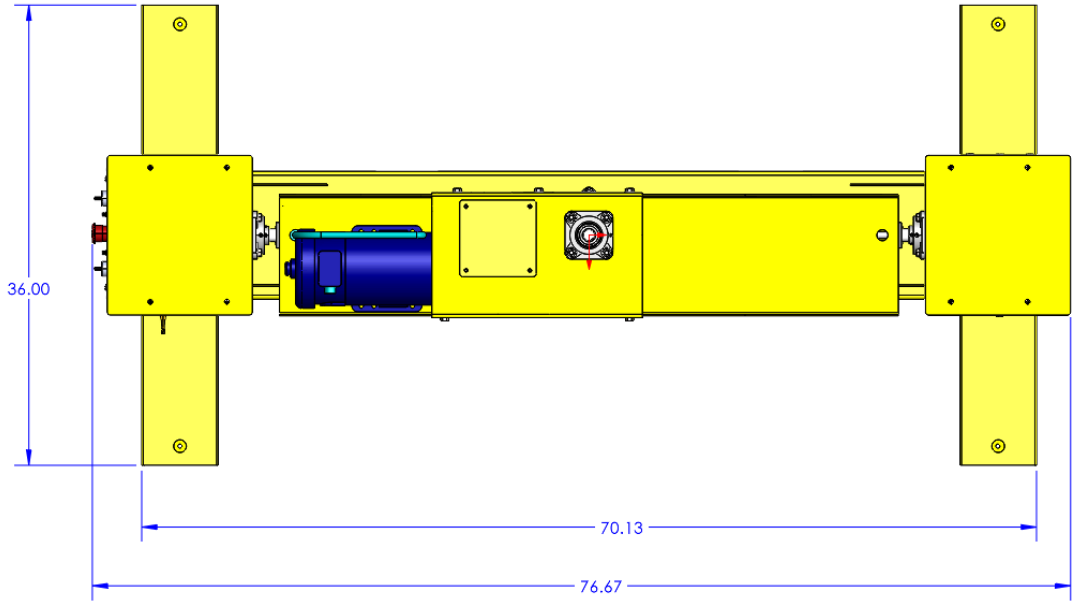


INNER FRAME MOLD PLACEMENT AREA

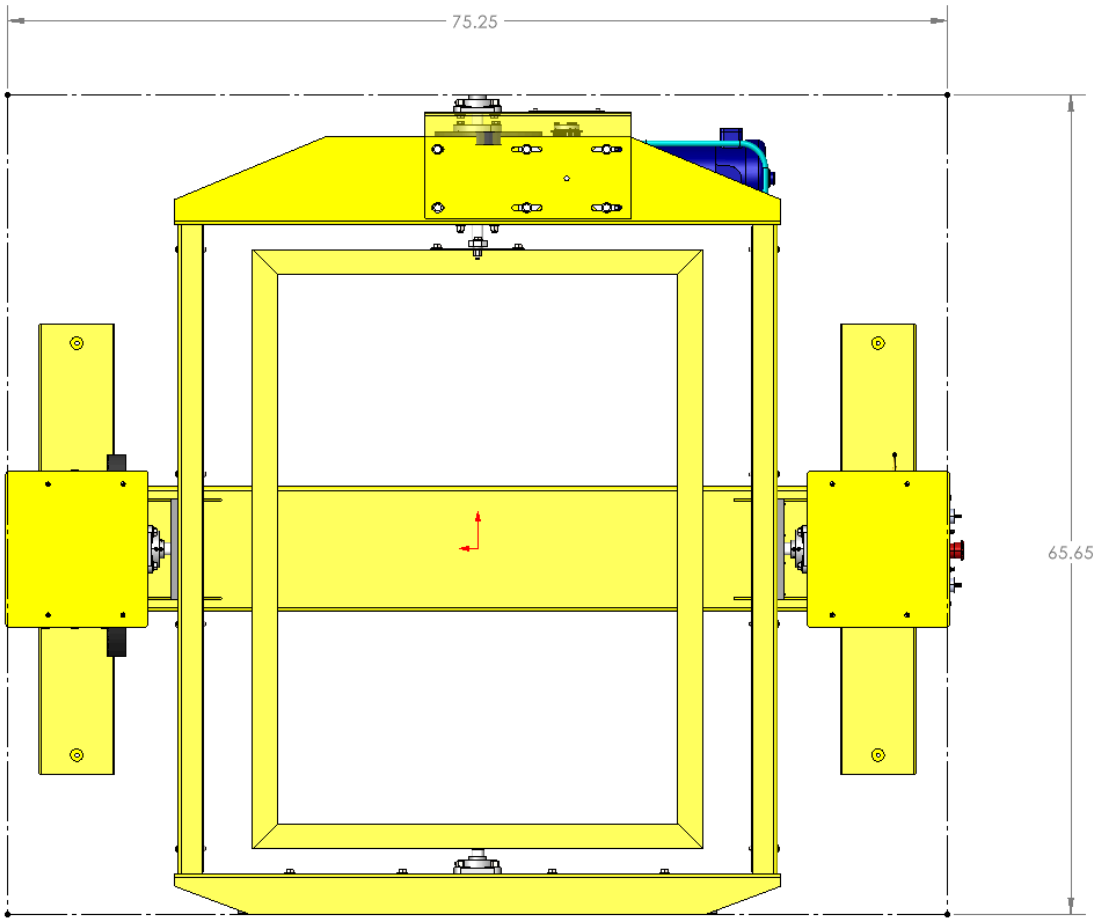


3'x4' Rotational Casting Machine Dimensions

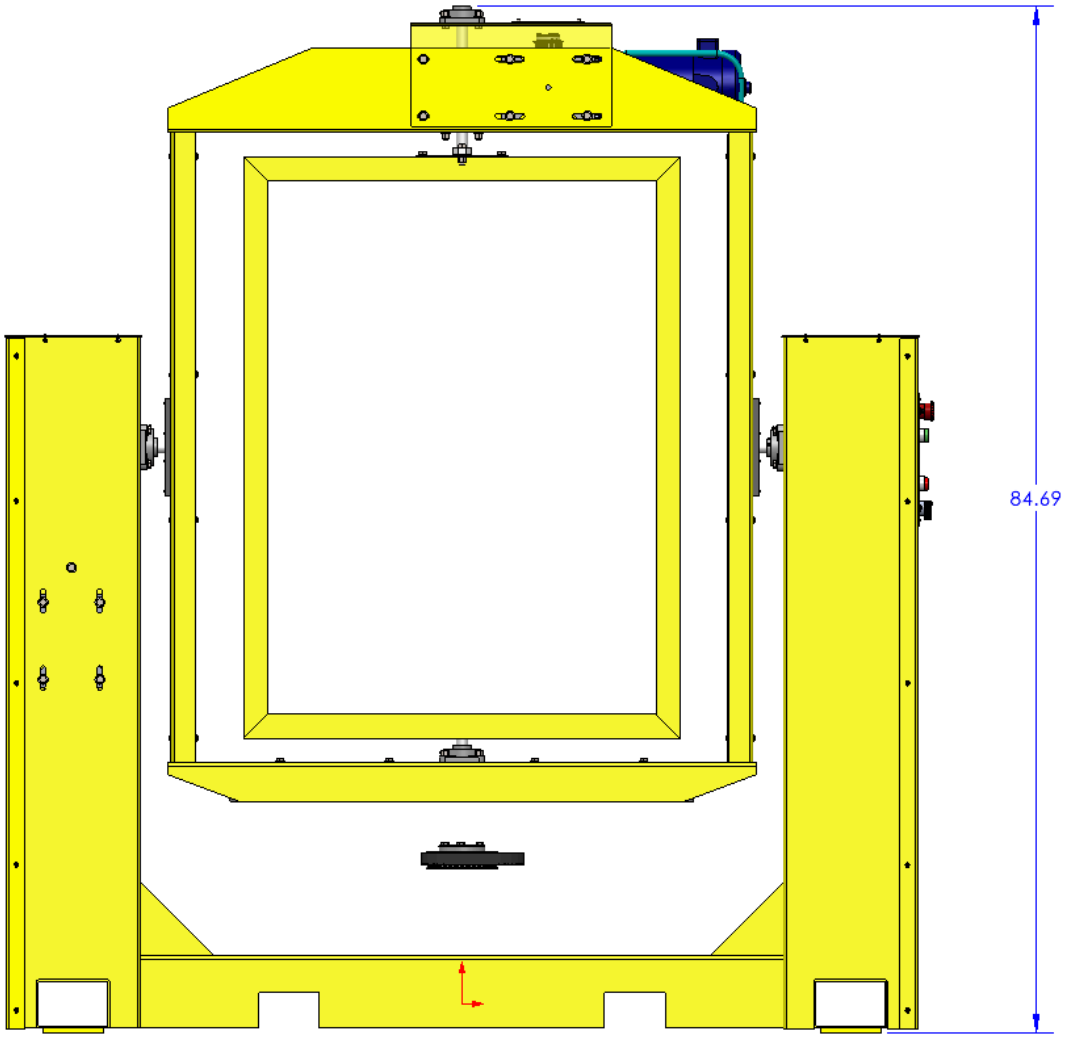
TOP DOWN VIEW (FRAMES AT CENTER POSITION)



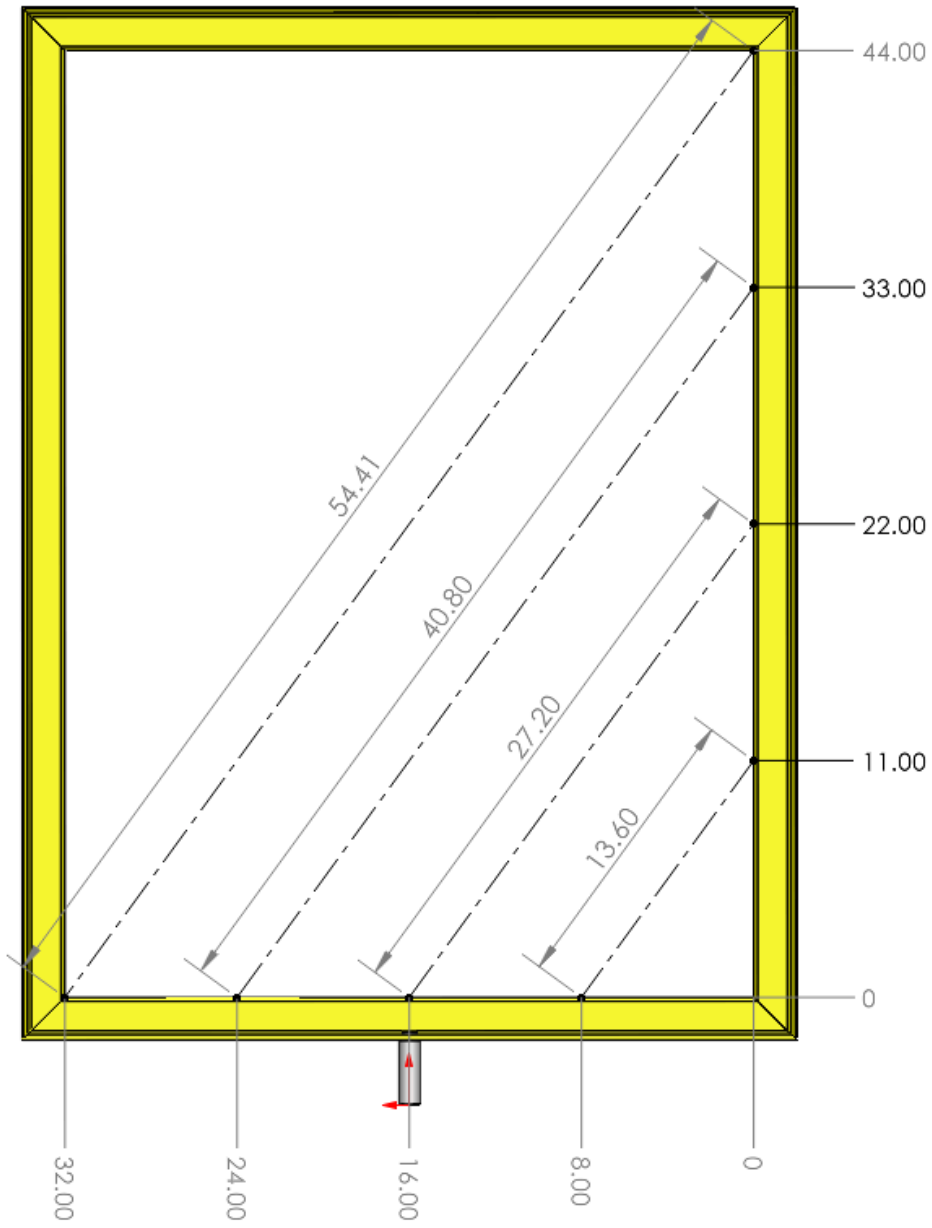
TOP DOWN SAFETY ENVELOPE VIEW (FRAMES FLAT)



FRONT VIEW

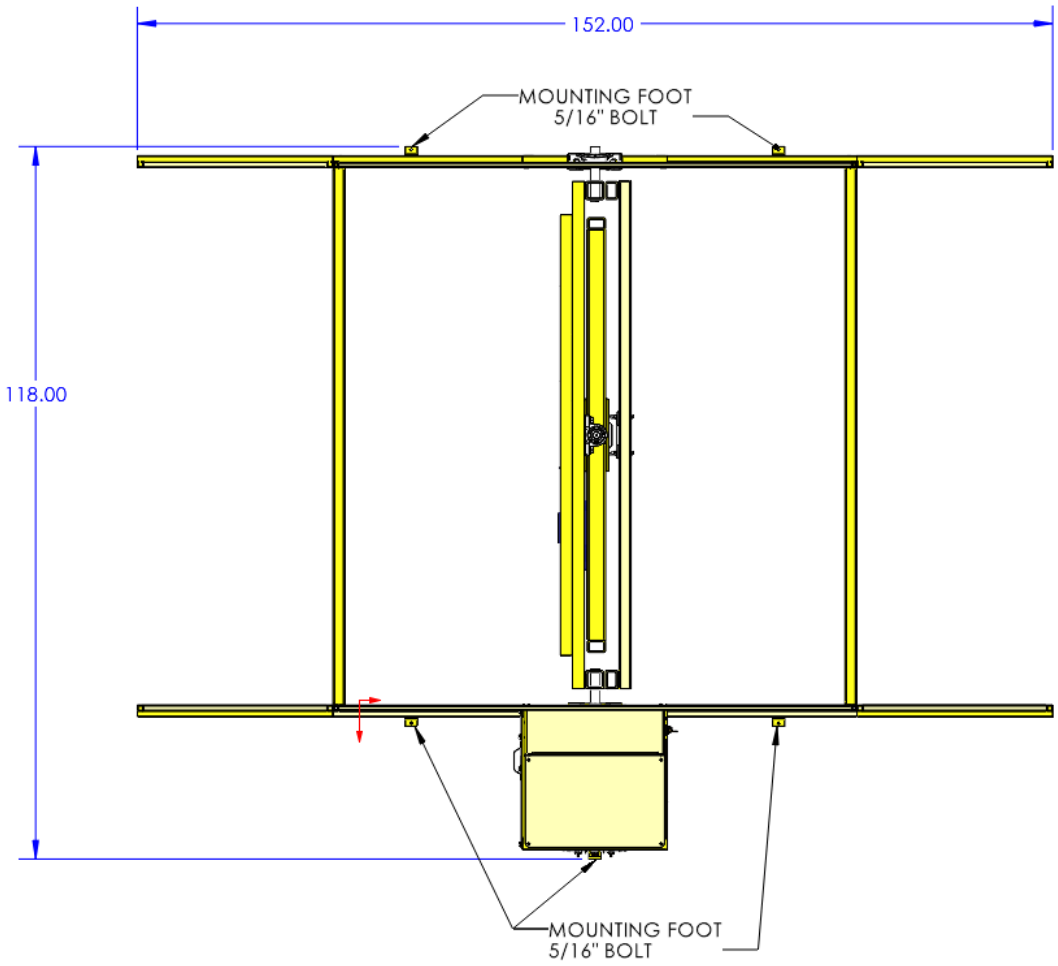


INNER FRAME MOLD PLACEMENT AREA

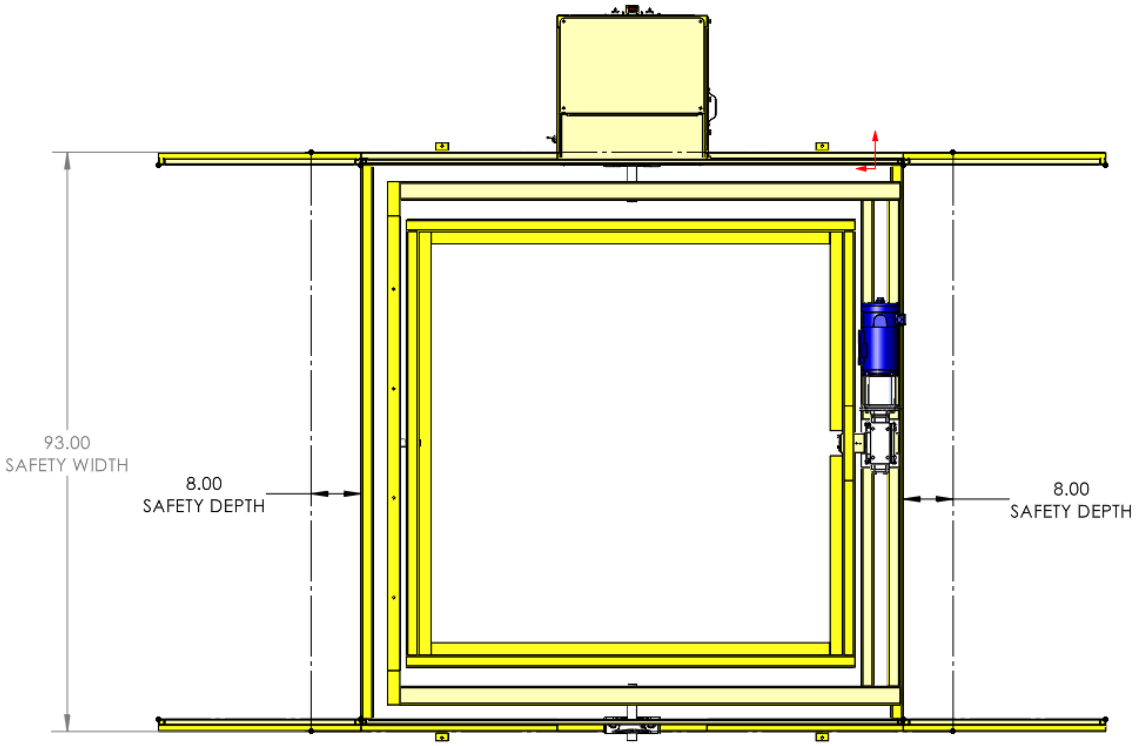


6’x6’ Rotational Casting Machine Dimensions

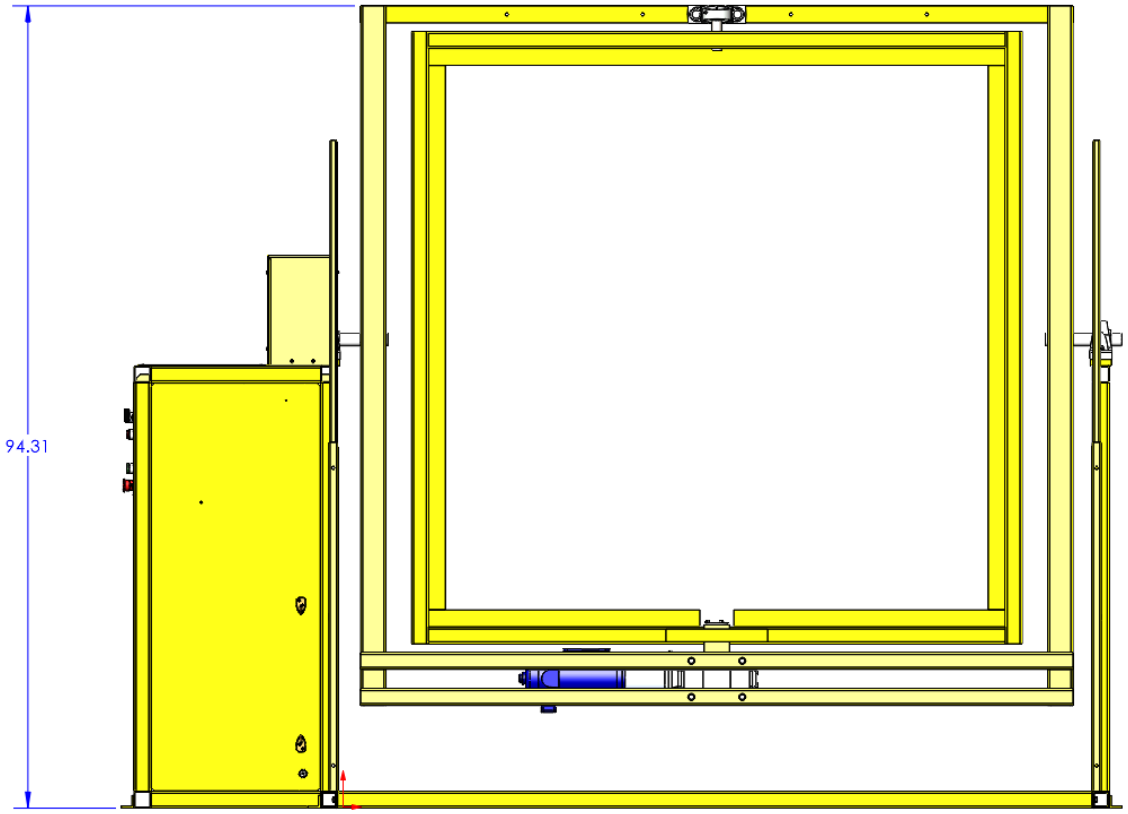
TOP DOWN VIEW (FRAMES AT CENTER POSITION)



TOP DOWN SAFETY ENVELOPE VIEW (FRAMES FLAT)



FRONT VIEW



INNER FRAME MOLD PLACEMENT AREA

