MAGNETRON

Where Design and Art meet Technology

ROTATIONAL CASTING MACHINE

OPERATIONS MANUAL & METHODS

DOC001_Rev-C

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Rotational Casting Machine Operators Guide

I) Getting Started

Well done! You have made a wise investment purchasing this machine. With the knowledge we have obtained for this process and our commitment to servicing your needs you will be able to produce more figures, objects, and any other hollow-cast pieces without the difficulties of manual methods.

The following information is intended to give you a basic understanding of your machine, and of the materials and processes you will be using.

II) The Control Panel

The control panel is the same on all models:

A) Emergency Stop Button
This button is used when there is a need to quickly stop the machine. **DO NOT** use this button for stopping and starting your machine - there are buttons for those functions marked stop/start and toggle.

Note: Our machines are usually shipped with the Emergency Stop Button activated. If so, rotate the button until it pops open before pressing the start button, or the start button will not turn on the machine.

B) Power Fuse Resets
These are resets for the motor fuses. If anything goes wrong or if a mold becomes stuck, the fuse for the frame will pop. If this occurs, turn the power off, put the toggle switches to the center off position, and push the fuse in.

You will hear a click when the fuse resets.

After the fuse is reset turn the power on and toggle the main and inner frame switch. The machine should rotate. If there is no movement, call our technical support line for further assistance.

C) Start

This button is used for turning on the machine power. When this button is on, it will have a green light. The toggle switches should be set in the vertical position (off) before the button is pushed as this will keep the machine from jerking when turned on.

D) Jog Switches

These switches are marked "**Inner**" and "**Main**".

The left switch, "Inner", turns on the motor powering the inner frame (also known as the inner gimbal). This is used to turn the rotation on and for positioning the molds and rotating the frames. This switch has a forward and reverse function and is used to start and stop the machine.

The right switch, "Main", turns on the motor powering the outer or "main" frame/gimbal and is used as above.

E) Speed Settings

These are used to set the ratio between the frames. It is very important that you record these settings and the results that you get when running a new mold so you can modify or duplicate them.

"Inner Speed dial": This dial allows you to set the speed of rotation for the inner frame (the one that supports your molds). This motion is responsible for keeping the fluid in the mold from dripping and keeping the material in the mold moving in a spiral motion.

"Main Speed dial": This dial allows you to set the speed of rotation for the outer or "Main" frame. The speed can be adjusted for material viscosity and set times. The size of the mold and the detail of the part determine the machine speed.

We suggest that the ratio between the main and the inner are 1 to 3 with the outer or main being the slower one. We usually set starting speeds of 9 rpms on the main and 27 rpms on the inner.

The ratio and speed can be changed as you experiment with your casting material viscosity and with different molds, as different shapes and materials may require different variations of speed.

III) Mold Placement Area on Machine

The inner frame of your machine is the mold placement area. Molds are supported by securing wooden or angle iron sections across the frame and then C-clamping the molds to these supports. Metal bars can also be fabricated which are then bolted to the parting planes on the molds. The molds then become supporting structures themselves and can be arranged to suit your needs.

It is very critical that the mold weight is balanced on the rotating frames.

This aspect of rotationally casting is both necessary to keep your machine running smoothly without overloading your motor, and even more critically, is how you keep the material flowing smoothly in a spiral inside your mold.

One procedure for balancing your mold might go:

1) Place your mold in the center of your inner frame, secure with clamps, fabricated bars, bungee cords, etc – however it is best secured for your needs.

If you are using C-clamps make sure that the handle will not swing out and hit the frame. This can be done by using masking tape to hold the handle in place.

2) Test the rotation on speed #2 to ensure that the empty mold does not interfere with the outer frame.

3) If the mold is oddly shaped and/or weighted, it may need counterweights to compensate for the higher weight/mass areas of your mold. Depending on the shape of the part, as the material gradually coats the inside of your mold you may require more counterweights to compensate and keep your rotation flowing smoothly. New molds should be monitored carefully to determine what coutnerweights are required - though it should be noted that they are not always needed.

Mold fill hole positioning will be based on factors such as hand or automatic pouring equipment. You should arrange the molds so that the pour holes for the resin or gypsum are on the same plane where possible, to avoid fighting gravity as you pour in material.

IV) Machine Maintenance

A) Lubrication

Bearings: There are 4 pillow bearings, each having grease fittings in them. Lubricate these once a month. You can purchase a small grease gun from any local hardware store.

Gearbox: Add oil according to the service tag. Use only the recommended weight. You can find the oil weight needed on the label of the motor that is on your machine.

B) Belts

Tighten belts at the first sign of main frame slippage. Check the condition of the belts every month and if they are cracked or frayed we recommend that you call us to order replacements.

C) Safety

Check the tightness of bolts on the entire machine regularly. Most of the nuts are nylocks and should never loosen but it is a good policy to check them.

There is little chance of electric shock as your machine is powered by low voltage direct current (DC). You should make sure that the outlet has a ground.

Keep the area where frames rotate clear to avoid collisions with people or objects.

You should check with your insurance company for what they feel would be the best way to comply with their policy requirements. By request, Mannetron can add modifications to newly constructed machines to link to safety mats.

Recommended Mold Material for use in Roto-Casting

The below are methods we have used frequently over the past three decades. These are not the only methods of creating molds, and you may wish to experiment further, but we find these methods workable.

When choosing a mold type/method, start from the question – what is your end product? If your part is finely detailed, you may want to use a rubber mold, or rubber boot. If your part is smooth and without negative draft, then a hard tool mold may be preferable, as typically hard tool molds (when used with mold release) tend to last longer and produce more parts before needing repair/replacement.

You may find a part that has both smooth and detailed aspects, in which case it may be more workable to create a mold that is both hard tool and rubber at the respective segments.

I) Suggested Materials for Mold Making

Rubber Molds or Rubber Boot:

RTV (Room Temperature Vulcanizing) silicone

Urethane Elastometers

Brushed-on Latex

Mold Cradles (also called mold cases, mold jackets and mother molds) for use with an internal Rubber Boot:

Polyester resin reinforced with fiberglass matting (thick, thin and very thin "veil cloth")

Polyurethane High temperature epoxy

Urethane with fiberglass reinforcement

Urethane hard/rigid foams

"Hard Tool" Molds (no rubber boot):

High temperature tooling polyester (low shrink) reinforced with fiberglass

Epoxy (as a surface coat, and then adding a laminate build with fiberglass reinforcement)

II) Suggested Materials for Part Production

Urethane:
We suggest a urethane that has a 3 minute pot life, and a shore 70D hardness level. There are many manufacturers of this type of resin.

The length of time the material is stringy is very important. If it remains soft too long a 'snowball' will result (a mass of material that forms a ball inside your mold). Ask your supplier if there is an accelerator for this.

Please note: the pot life is affected by fillers. The time will increase and de-mold time will be affected. If you choose a urethane elastomer, ask the supplier for an accelerator and indicate to them that a shorter pot life is desired.

Foam:
Foam is used as a part reinforcer (whether rigid or flexible). This is usually done after the main shell or surface has been fully coated with your main outer material to near a complete cure.

Mold Release:
Mold release is a critical component in smoothly removing parts from your molds, and in preserving your molds.

There are paintable and non paintable mold releases available for multiple types of part production material. You should check with you material supplier for compatible products.

In terms of application, some options are spray-on, and some would need to be wiped on. Both of these will work in rotational casting, so this would follow your own preference.

Other Materials:
While Mannetron generally uses a shore 70D Urethane (with variations of filler),

there are many other materials that can be used in part production, such as plaster/gypsum, urethane rubbers, polyester, nylon urethanes, or a multitude of other options. All of these would take some experimentation and R&D, based on your needs.

III) Fillers

There are many fillers that can be used with your main material. A key factor in determining your filler type and ratio is in aiming to thicken to a viscosity that still flows in your mold, while gaining as much as possible of the intended benefit of the filler. You can contact your resin supplier for suggestions of appropriate fillers.

The below can in some cases be combined. This varies depending on the material, the size/shape of the mold, and other factors, so takes some experimentation and R&D.

For Strength:
1/8" and 1/4" and 2" chopped fiberglass strand (added between coats) or 1/32" and 1/64" milled fibers added into the resin.

For Reduced Weight:

Microscopic, glass bubbles or solid glass beads (i.e. "Q-Cells", "Micro-Spheres", "Extendo-Spheres") Contact your material supplier to see if they have a variation of this product.

For Reducing Shrinkage:
Glass beads can also be used to reduce shrink. Your material supplier can assist you with this.

IV) Key Factors for Successful Roto-Casting

Frame Speed:
We start at an outer/inner ratio of 1/3 (i.e. 9 revolutions per minute on the outside/main and 27 rpm on the inner) and then work from there. The speed is determined by the material being used, size and detail of the piece. If the mold is large and the material is thick you will slow down the speeds to give the material

more time to move end to end. If the material is thin or the pot life is very fast the speed must be increased.

Frame Speed Ratio Variations:
We generally keep the ratio at 1 to 3 with the slower being the main frame, but there are occasions where this will need to be varied.

In the case of a long and thin mold, the mold would need to mounted along the inner frame spinning axis line, and you would need to increase the inner frame speed to move the material in a spiral motion along the mold's length.

In some cases the mold has a shape that inhibits the material from going into certain areas. The ratio may have to be changed so that the material can get into the missed areas.

Borescope Cameras:
If you work with bulky or oddly shaped molds, it can be worth investing in a borescope camera that you can insert into your fill hole. This allows you to inspect the inside of your mold between fills to verify if your material has coated the interior of your mold, or to see if additional coats may be needed.

Experimentation & Documentation:
Each new part you manufacture may take some experimentation and R&D to finalize aspects such as:

- Material ratios
- Number of fills/pours/coats
- Mounting positions/angles
- Possible counterweights
- Frame speed
- Duration of spin segments per each coat
- Time of cure of your material

It is important to document as you go and keep your records in order to replicate parts again in the future, and to build up your knowledge base of how your chosen materials react in rotational casting, and of rotationally casting parts in general.

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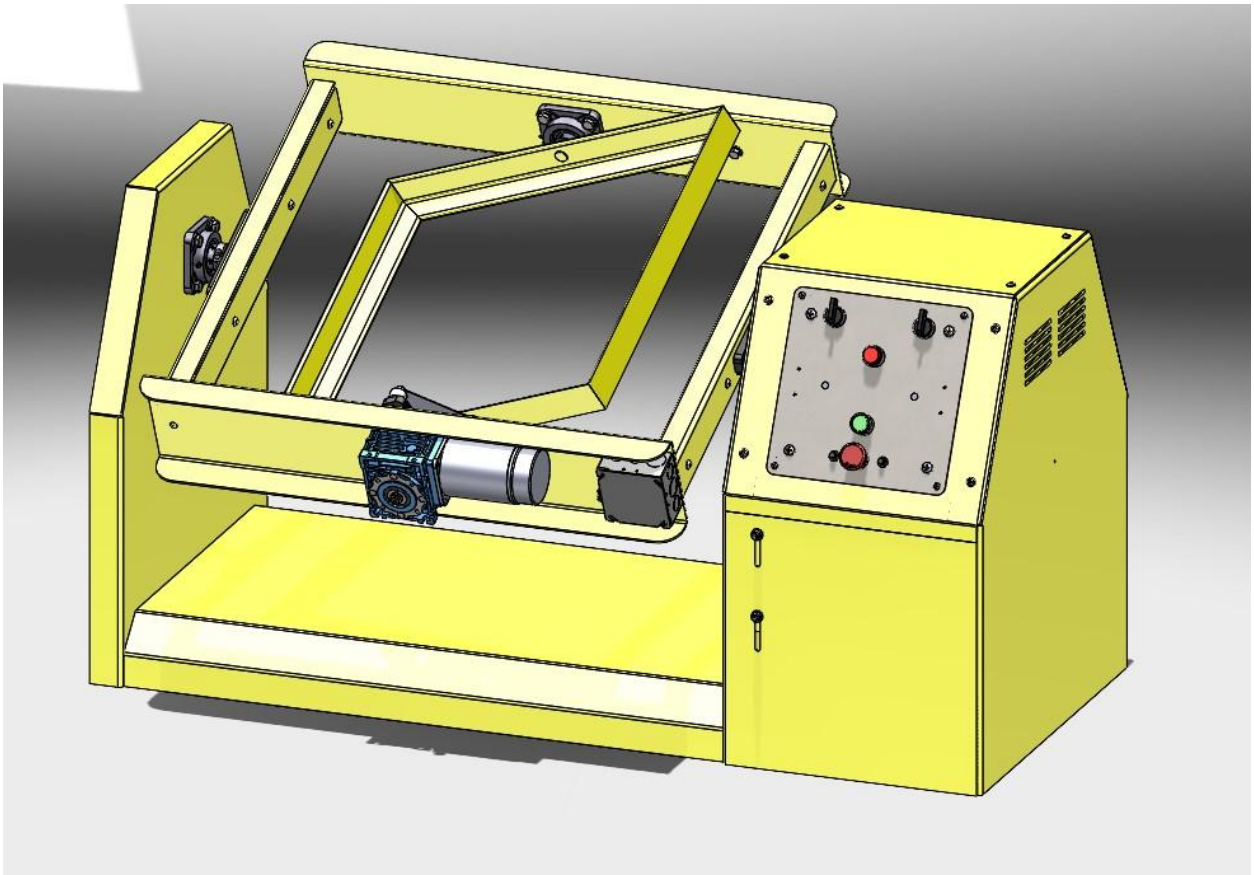
For any additional questions, please contact our technical team

rotomold@mannetron.com

269-962-3474

APPENDIXES

2x2 Rotational Casting Machine



The overall maximum exterior dimensions of this machine are:

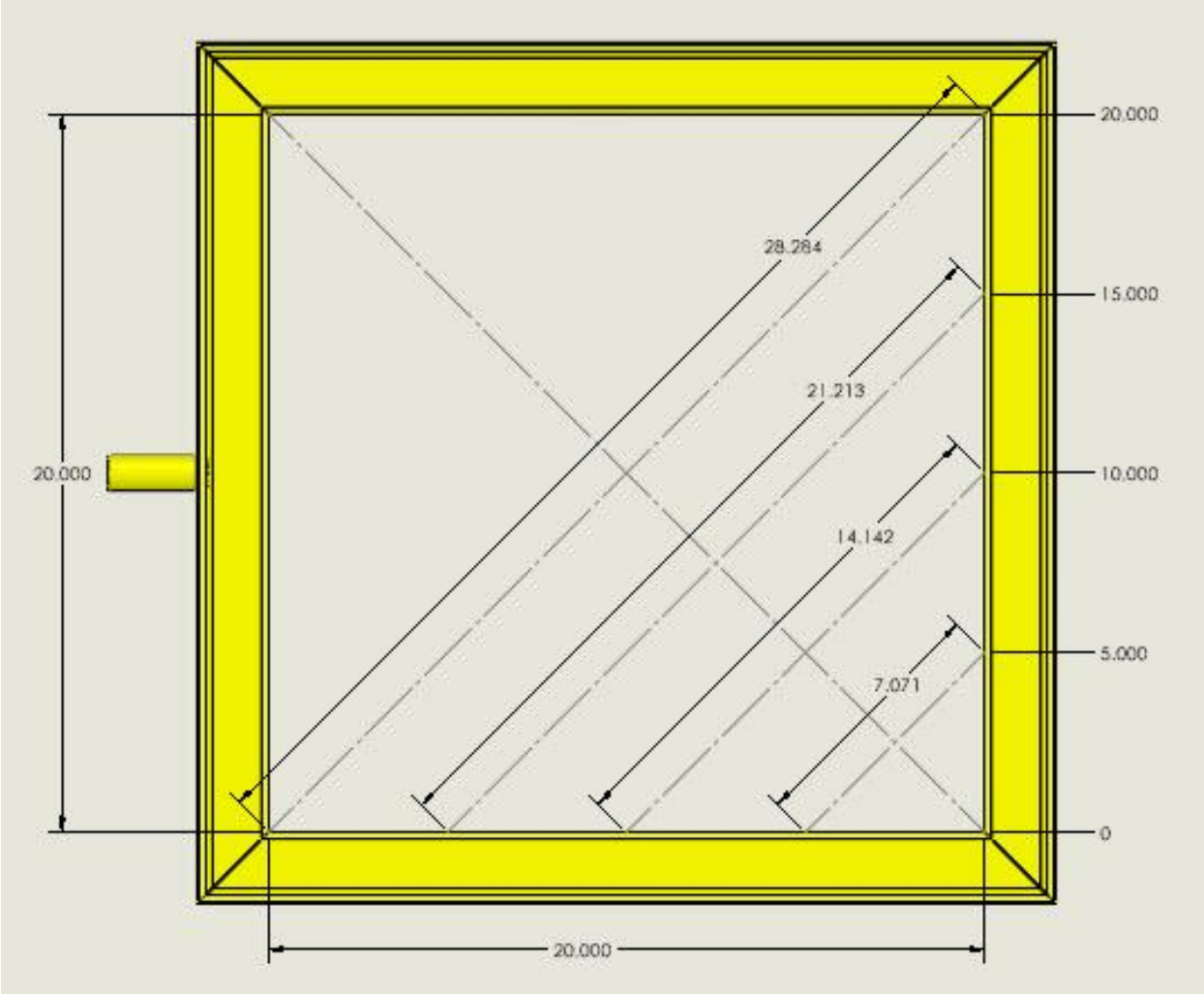
Height: 38.46”

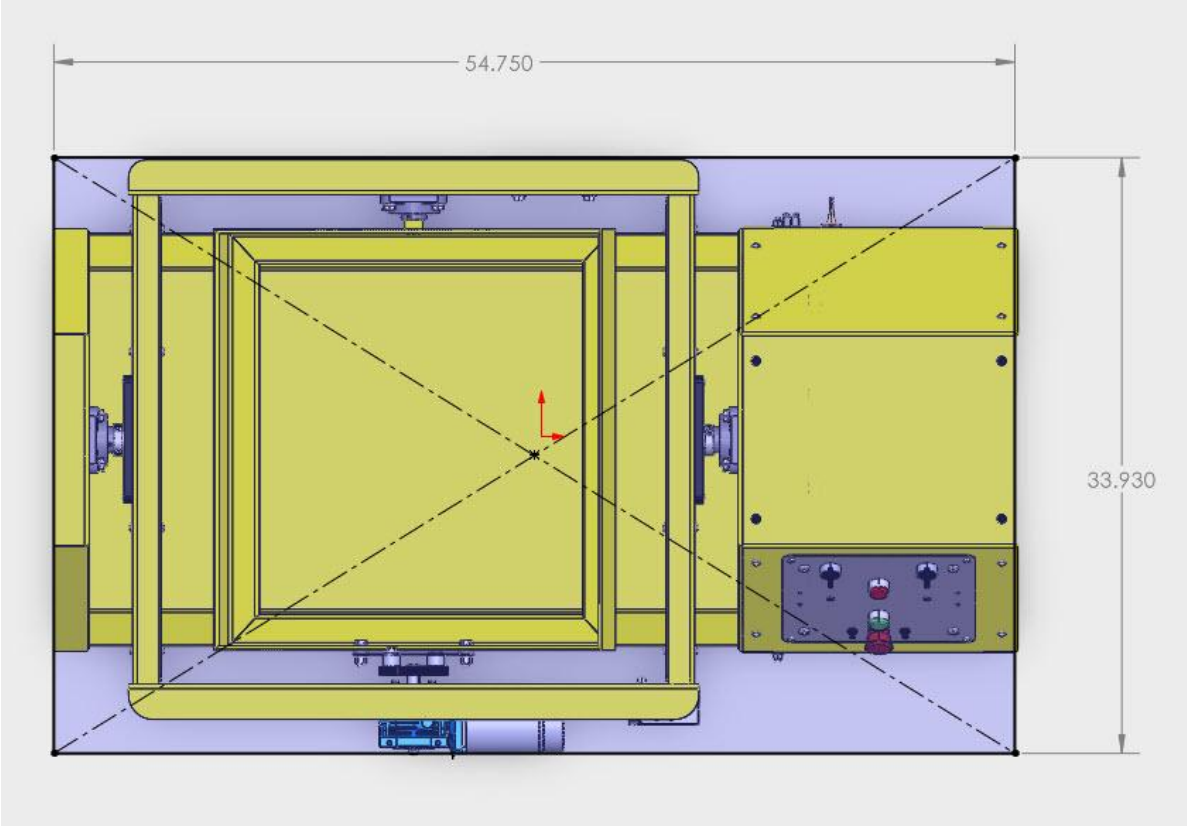
Length: 54.75”

Depth: 33.93”

The 2x2 inner frame/gimbal is constructed from L shaped bar. The internal dimensions of the inner gimbal are 20”x20”, while the flat of the L shaped bar is also available as a clamping area.

Longer molds can also be placed diagonally, though care must be taken to ensure they do not interfere with the outer gimbal.

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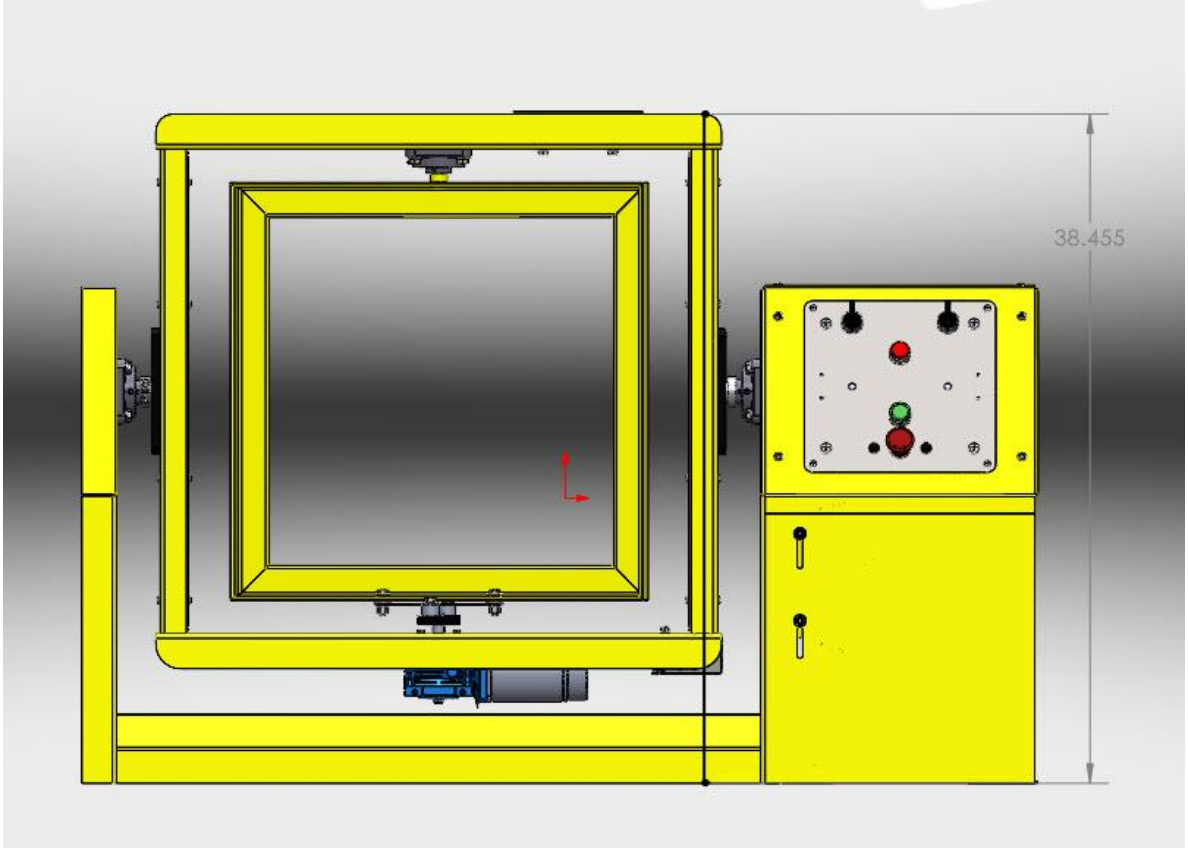
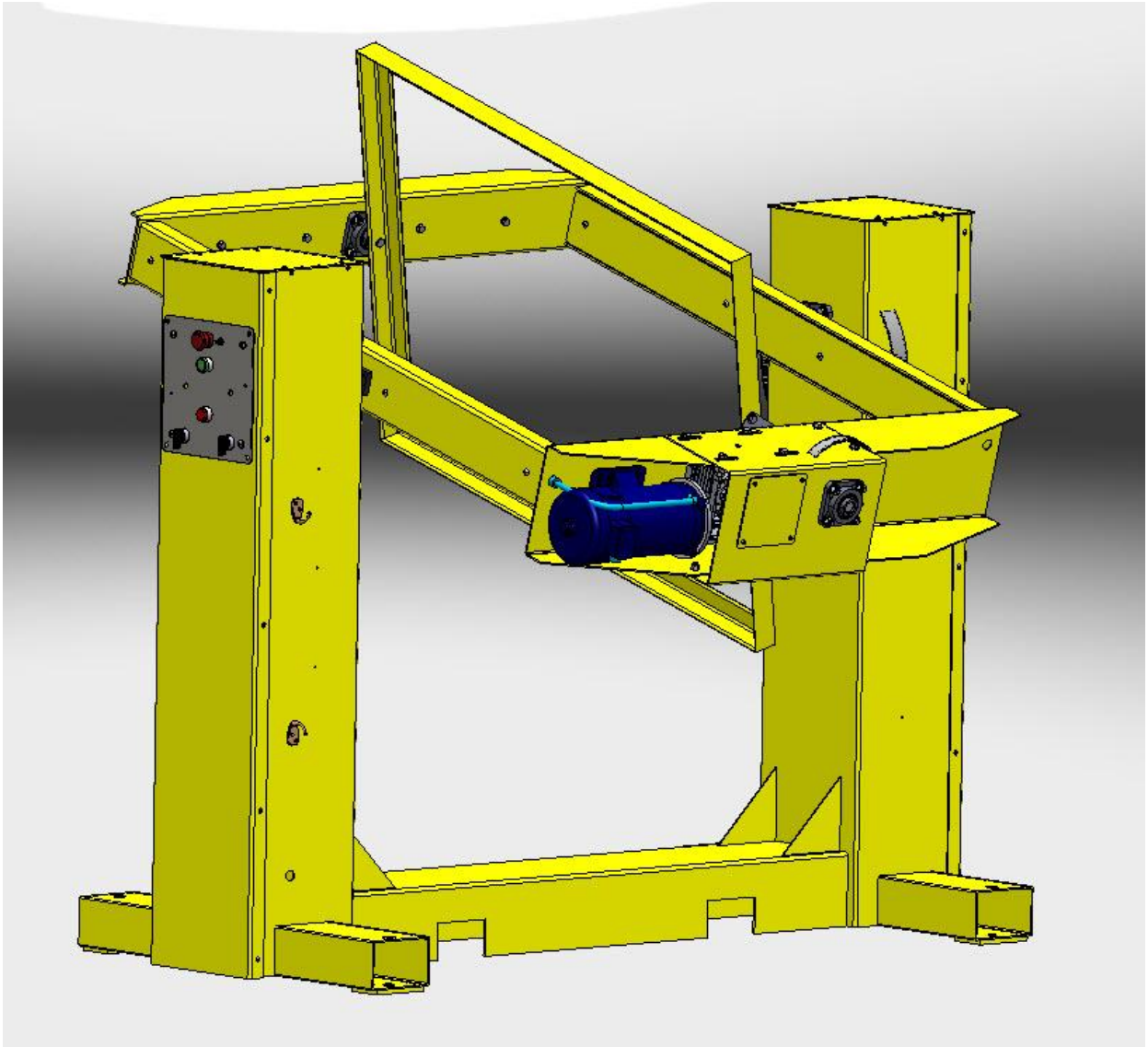

38.455

3x4 Rotational Casting Machine



The overall maximum exterior dimensions of this machine are:

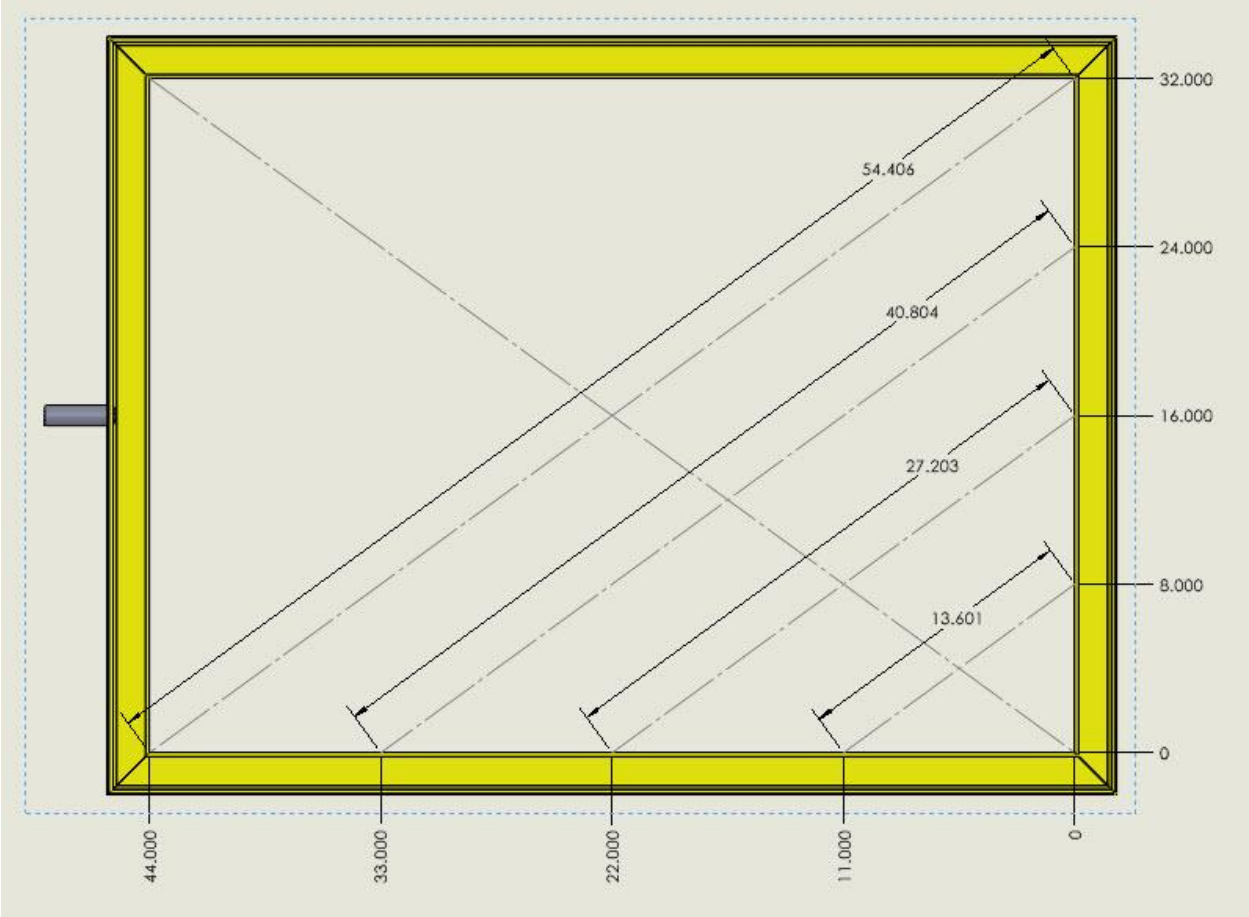
Height: 77.17”

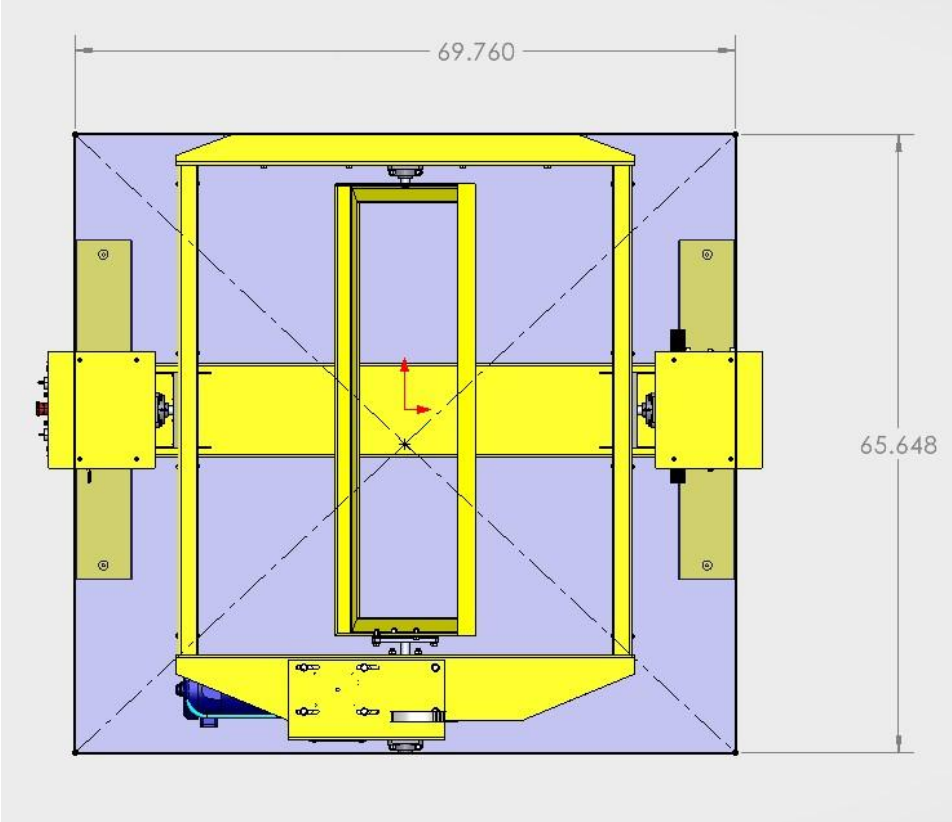
Length: 65.65”

Depth: 69.76”

The 3x4 inner frame/gimbal is constructed from L shaped bar. The internal dimensions of the inner gimbal are 44”x32”, while the flat of the L shaped bar is also available as a clamping area.

Longer molds can also be placed diagonally, however care must be taken to ensure they do not interfere with the outer gimbal.

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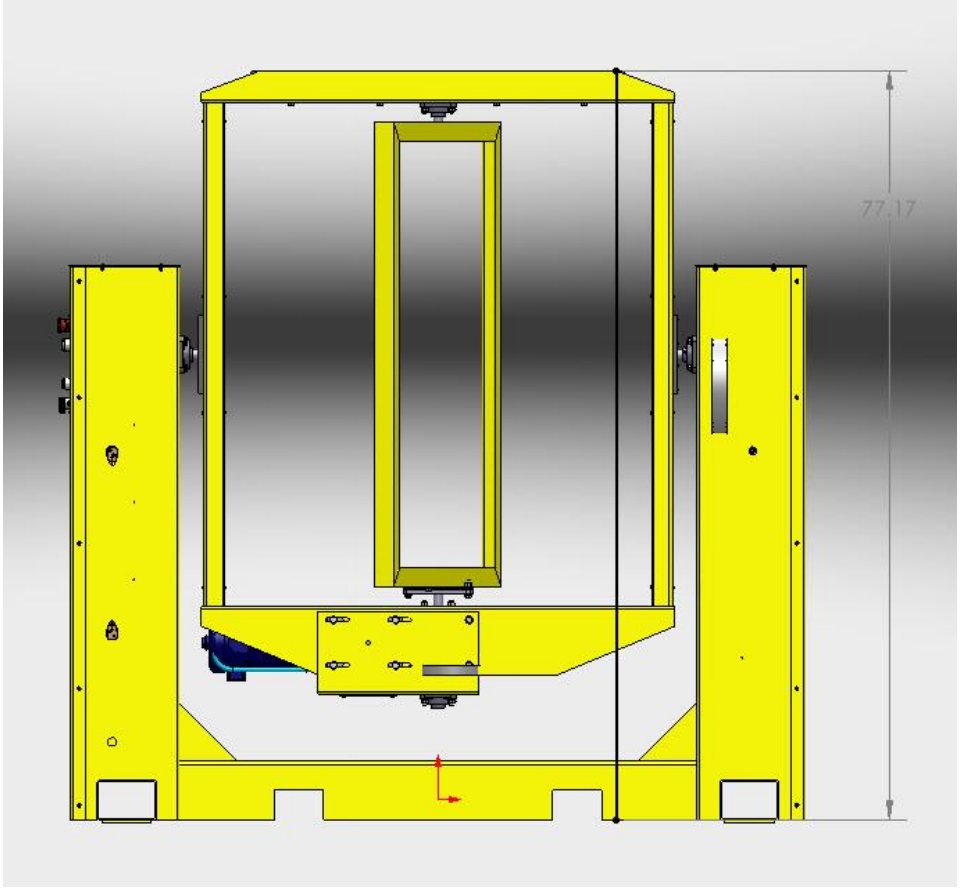
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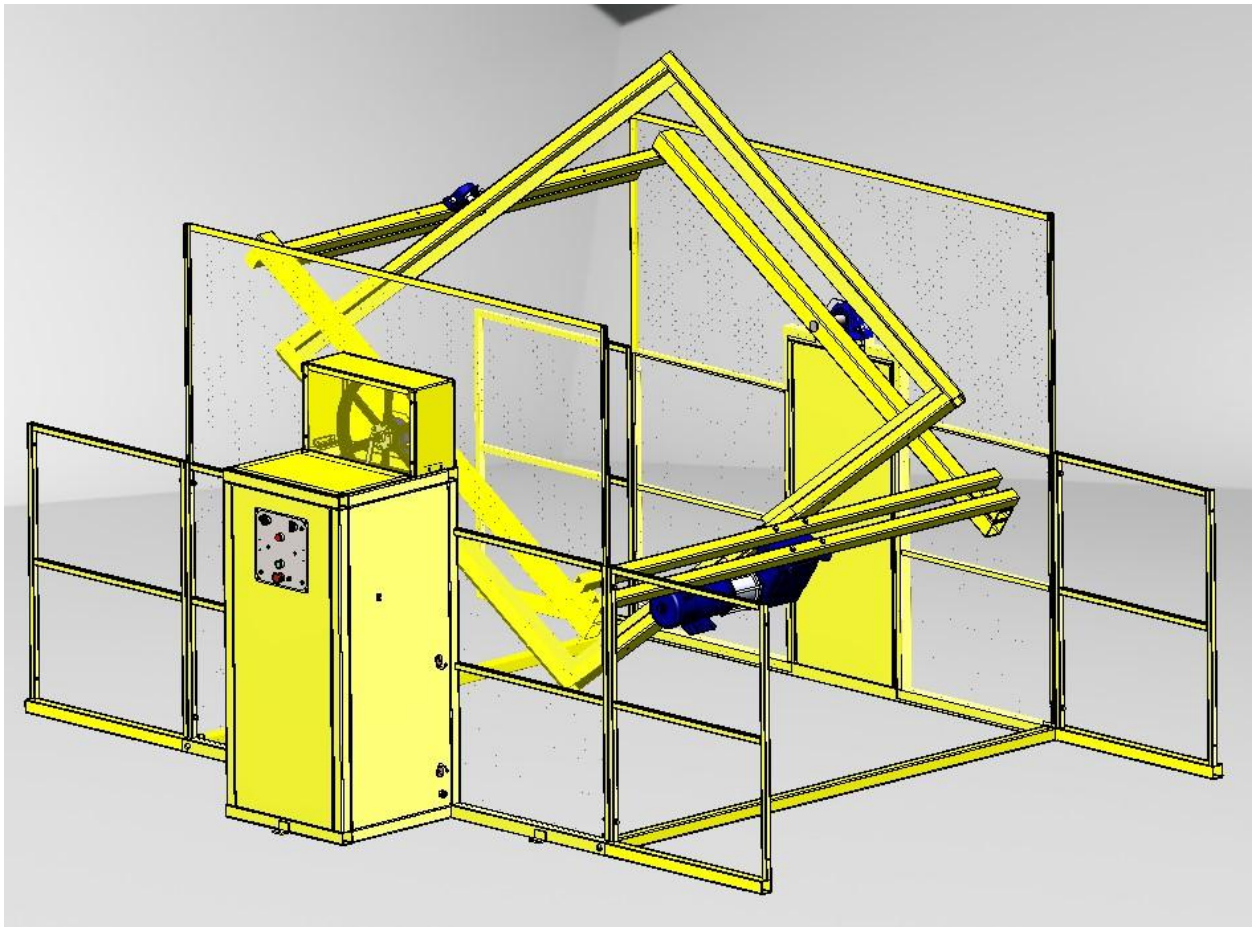
6x6 Rotational Casting Machine



The overall maximum exterior dimensions of this machine are:

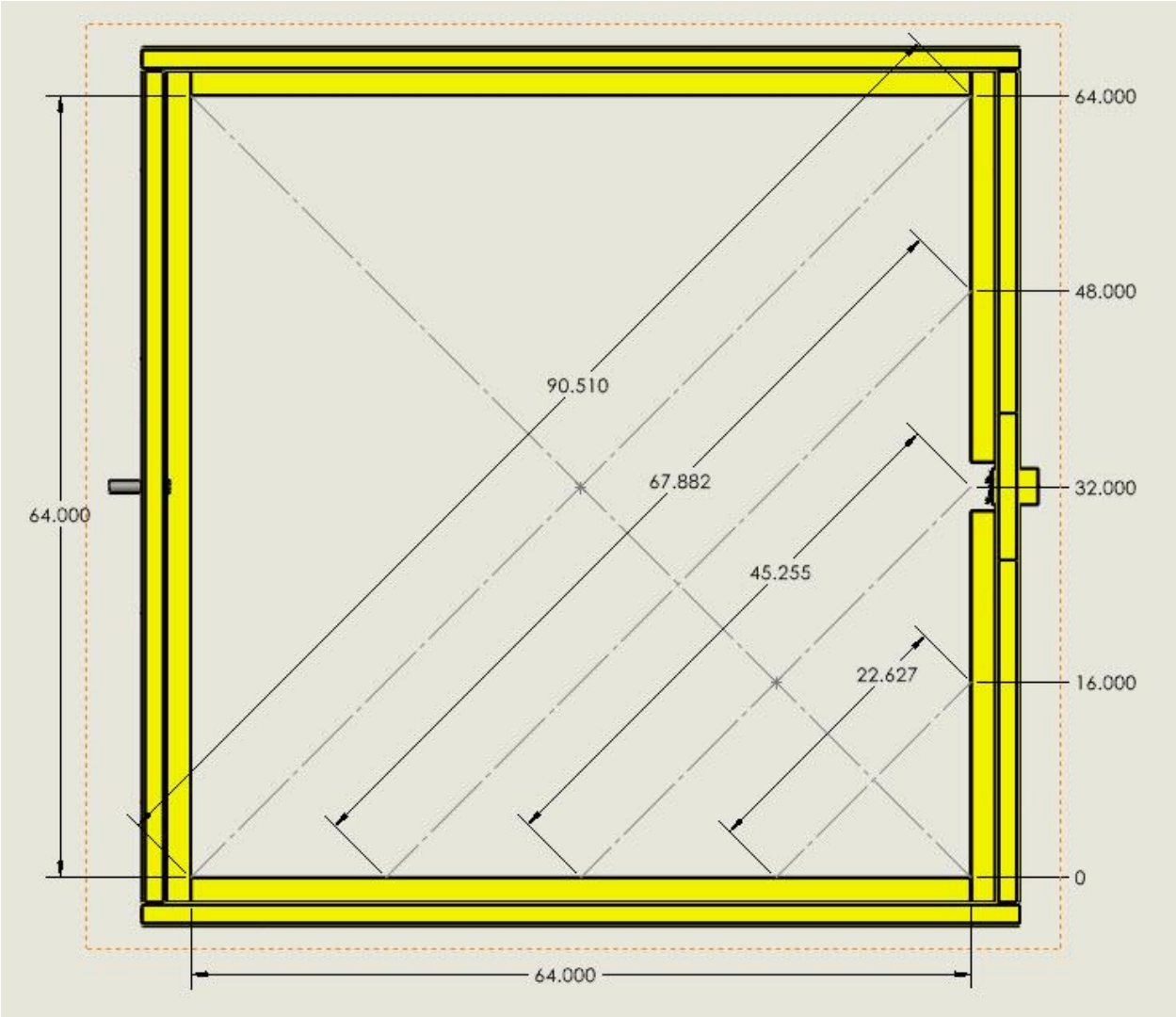
Height: 94.06”

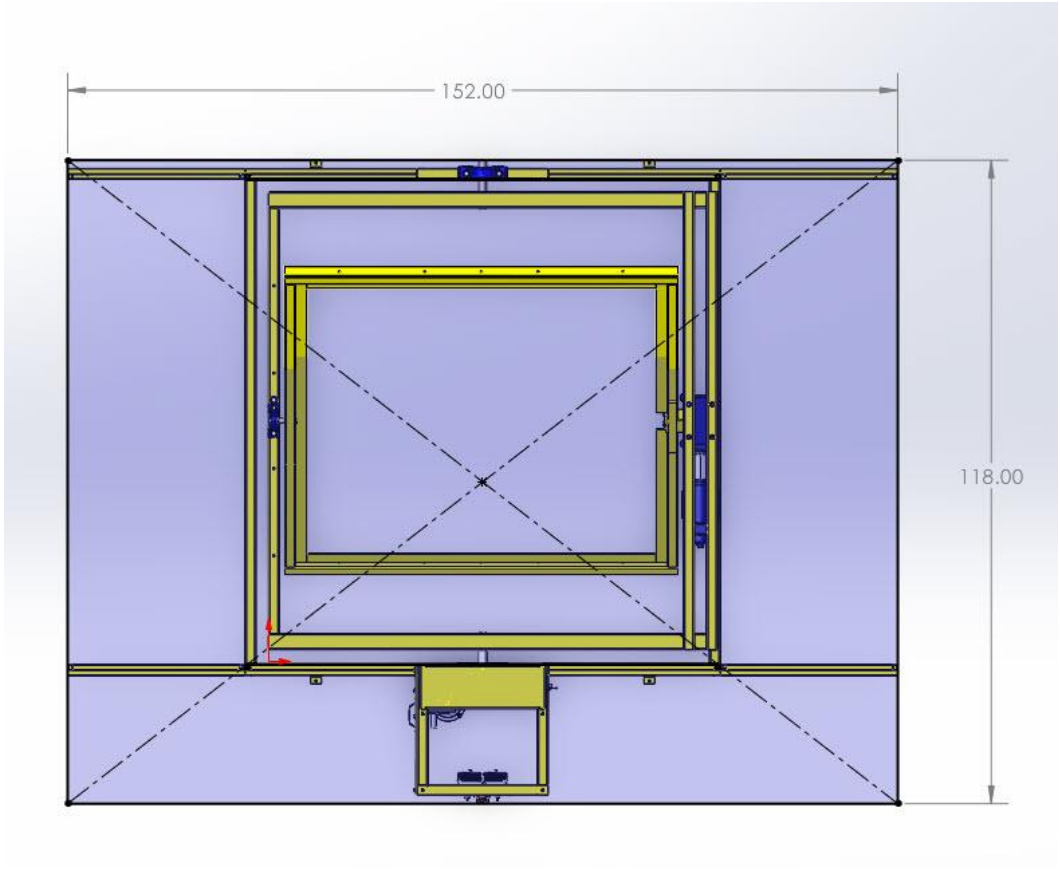
Length: 152.00” with safety gates attached / 87.00” without safety gates attached

Depth: 118.00”

The 6x6 inner frame/gimbal is constructed from square tube with an added flat plane welded to the inside of the frame. The internal dimensions of the inner gimbal are 64”x64”, while the flat plane is also available as a clamping area.

Longer molds can also be placed diagonally, however care must be taken to ensure they do not interfere with the outer gimbal.

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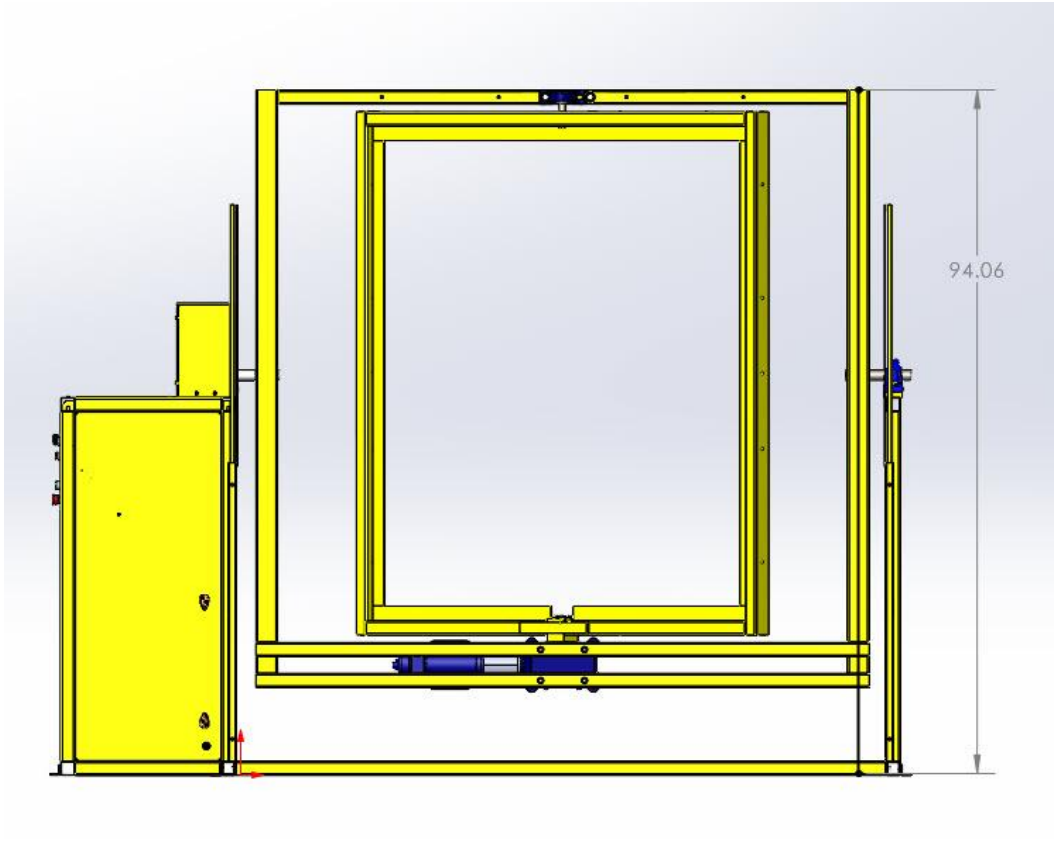
118.00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