Calibration

Table of contents

1. Introduction

The RoboRail is a versatile machine that combines a plasma unit and a robot to cut metal profiles.
The images on page 16 show an overview of the different shapes of material for use with the RoboRail.

Due to certain reasons, it might be necessary to perform a calibration of the machine to maintain/repair its proper functioning. This document describes the calibration procedures of various components of the RoboRail.

1.1 Text indicators

In this document:
- Bullet points: ❖ refer to the § with the specified calibration procedure
- Bullet points: ▪ describe the steps to perform
- Bullet points: ➢ describe the result of the step(s)
- Bullet point: ◆ refers to an image at the bottom of the corresponding paragraph (§)
- *Text written in italics:* gives a short explanation about the calibration
- **Text written in bold:** refers to instructions on the screen of the remote control

1.2 Controls

1.2.1 Remote control | screen

The calibration procedures are controlled by the remote control. This is the screen (on an adjustable arm) on the control unit. The remote control contains an emergency button (🔴) that you must/can use in some calibration procedures to stop the RoboRail.

Do **not** use the **power on/off button** on the control panel of the robot cell (refer to § 1.2.2) to stop the RoboRail during calibration to prevent loss of settings.

1.2.2 Control panel | robot cell

On the side of the robot cell, underneath the control unit cabinet, there is a control panel with two key switches:

POWER		MAINTENANCE	
OFF	ON		
To **de-energize** the RoboRail	To **energize** the RoboRail	Maintenance mode **off**	Maintenance mode **on**

For calibration purposes:
- **Power** switch must be **on** (key to the right)
- **Maintenance** switch must be **on** (key to the right)

In the **Maintenance** mode the safety mechanisms of the cell door are overridden.

1.2.3   Control panel | trolley

On the trolley there is a control panel with two switches:

CHUCK CLAMP		TROLLEY MOVE	
OFF	ON	Y+	Y−
To **open** the rear chuck	To **close** the rear chuck	To move the trolley to the **front** (to the front chuck)	To move the trolly to the **rear** (away from the front chuck)

1.3   Responsible persons

The calibration procedures that are written in this document are exclusively reserved for mechanics.

1.4   Related documents

- RoboRail operator's manual
- schematics, as appropriate
- parts lists
- components supplier instruction handbooks
- documents, drawings, data sheets and declarations

You can find these documents on the Internet Customer Portal.

1.5   Safety

Wear personal protective equipment (PPE) during the calibration procedure(s).

During calibration, make sure to remain at a safe distance from moving parts of the machine. This also applies to persons who enter the work area.

Obey the safety instructions as written in the operator's manual of the RoboRail.

1.6   Components

The images on pages 16 to 18 show an overview of the main components of the RoboRail.

1.7   Calibration types

This document describes the calibration procedure of the components that follow:

- Front chuck
- Rear chuck
- Trolley

- Robot (base and tool)
- Infeed table + sliders
- Bogies

2. Troubleshooting

#	Problem / symptom	Possible cause	Solution	Calibration procedure
1	Poor cutting quality	Front chuck is not level	Do a calibration of the chuck rotation (front chuck)	❖ § 3.1
		Rear chuck is not level	Do a calibration of the chuck rotation (rear chuck)	
		The front and rear chucks are not aligned	Do an alignment calibration of the chucks	❖ § 3.5
		Incorrect position of the robot	Do a tool calibration of the robot	❖ § 3.2
			Do a base calibration of the robot	❖ § 3.3
		Poor material quality	Use material that complies with the specifications and tolerances; ■ refer to the RoboRail operator's manual	
			Correct the differences in the material offset window on the remote control	
2	Incorrect product size	Incorrect home position of the trolley	Do a calibration of the trolley	❖ § 3.4
		Incorrect position of the robot, e.g. because it has hit something	Do a tool calibration of the robot	❖ § 3.2
			Do a base calibration of the robot	❖ § 3.3
3	The bogies are too low or too high to load the material	Incorrect position of the trolley	Do a calibration of the trolley	❖ § 3.4
4	Material on the infeed table is not in the middle of the bogies	Incorrect infeed position	Do a calibration of the infeed sliders	❖ § 3.6

Calibration

#	Problem / symptom	Possible cause	Solution	Calibration procedure
5	Issues when loading the material: - it is not easy to center the material on the bogies - material may fall from the bogies - infeed sliders get stuck on the material when trying to retract - any other problem to load the material	Infeed position of the material is not defined and/or not correctly configured	Do a calibration of the infeed position of the material	❖ § 3.7
6	A crash against (a part of) the RoboRail	A forklift truck or other vehicle has crashed into it	Do a calibration of the part(s) that was/were affected by the crash	Depends on the specific part(s)

3.   Calibration procedures

To go to the calibration menu:
- Put the RoboRail in **Maintenance** mode (refer to § 1.2.2).
- Select the **Calibration** button on the remote control.

Subsequently:
- Select the desired calibration mode as explained below.

3.1   Calibration of chuck rotation

Calibration of the chuck rotation makes sure that the home position of both chucks is level. If one the chucks (or both chucks) is not level, it can have a negative effect on the cutting quality.

This calibration procedure applies to the front and rear chuck.

Necessary tool:

    Spirit level

To make sure that the home position of the chucks is level, do the procedure that follows:
- Make sure that a jaw set is installed on the chucks.
- Select **Home chucks** to put the chucks at their home position.
- Make sure that jaw no. 4 is on top (◆ Image 1).
- Put a spirit level in the middle of the chucks or on top of it (front: ◆ Image 1| rear: ◆ Image 2).

If one of the chucks (or both) is not level:
- In the **Calibration** menu: select the button **Chuck rotation calibration**.
- Select **Go to step 1** to go to the next screen.
- Select **Home chucks** to put the chucks at their home position.
- Select **Go to step 2** to go to the next screen.
- Push the **Emergency** button on the remote control to stop the motors.
- Manually turn the chuck (or both) until it is level.
- Push the **Emergency** button again to release it.
- Push **Reset and enable high power** on the remote control (bottom center of the screen).
- Select **Only press this button once the chucks are level!** to confirm the position of the chuck.
- Select **Go to step 3** to go to the next screen.
- Select **Home chucks**.
- Put again a spirit level in the middle of the chuck or on top of it.

If the chuck is level:
- Select **DONE**.
- ➢ The home position of the chuck is level.

If the chuck is still not level:
- Select **Return to step 2**.
- Repeat the calibration procedure as described above.
- ➢ The home position of the chuck is level.

If you actually turned the chuck manually to put it level, you must redefine the base location of the robot.

In that case:

- Continue with § 3.3 to do a base calibration of the robot.

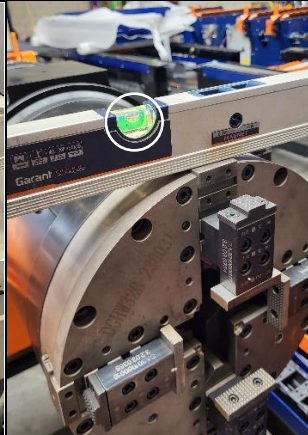| Image 1 | Level on top of the front chuck; jaw no. 4 on top | Image 2 | Level on top of the rear chuck |

3.2 Tool calibration of the robot

Tool calibration makes sure that the robot exactly knows the position of the torch, including the distance of the torch above the material. This calibration procedure can be important if the torch is bent due to the heat of the cutting process.

Before you start:
- Make sure that there is no material inside the cutting cell.
- Make sure that you have equipped the torch with 125 A consumables (◆ Image 3).
  (Consumables of 65 A are 3 mm too short for calibration purposes.)
- Make sure that the cutting cell is closed.

In case of large cutting faults (>10 mm / ⅜") before calibration:
- Put the robot in **Slow mode** (bottom left of the screen) so you can stop it before it hits the sensor or the robot cell.
- If this happens during the calibration process: push the **Emergency** button on the remote control to stop the robot.

For the tool calibration of the robot, do the procedure that follows:
- In the **Calibration** menu: select the button **Tool calibration**.
- Inside the cutting cell: remove the cover of the tool sensor.
- Select **I have removed the sensor cover and equipped the 125amp consumables**.
- Select **Continue**.
- Select **Start tool calibration**.
- Tool calibration consists of three moving and turning cycles to set the torch position offsets correctly. This value is automatically saved.
- Make sure that the laser beam touches the black (=upper) part of the torch (◆ Image 4).
  If it touches the white (=lower) part of the torch: contact the HGG service department.

When the tool calibration is completed:
- Select **Done**.
- Select **Return to home**.
- Install the cover of the tool sensor.
- ➤ The torch position is correct.

If the tool calibration of the robot did not solve the problem:
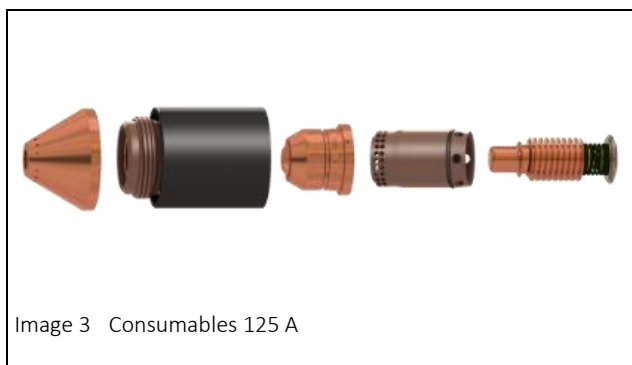- Continue with § 3.3 to do a base calibration of the robot.
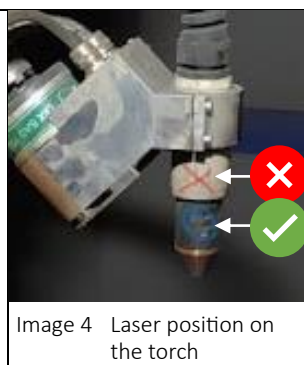

| Image 3 | Consumables 125 A | Image 4 | Laser position on the torch |

3.3   Base calibration of the robot

Base calibration makes sure that the 0 point of the robot is actually the 0 point. It sets the correct position of the robot related to the entire system.

The RoboRail is supplied with a tube (L = 2 m, 120 x 120 mm*) as reference part. If this tube is not available anymore, you must take an alternative square tube – with very accurate dimensions – that you use as a reference part.
Dimensions of the alternative tube: min. 120 x 120 mm | max. 200 x 200 mm*

> * <u>For USA:</u>   - dimensions of the reference tube are L = 7 ft, 4 x 8", thickness = ⅛"
> - dimensions of an alternative tube must be min. (min. 5 x 5" / max. 8 x 8")

<u>Before you start:</u>
- Make sure that the conveyor mode plate is removed and that a regular chuck clamp is installed.

<u>For the base calibration of the robot, do the procedure that follows:</u>
- In the **Calibration** menu: select the button **Base calibration**.
- Select **Go to step 1**.

<u>If you use the reference tube supplied with the RoboRail:</u> **
- Select **Use default measurement tube**.

> **   <u>For USA, if you did not receive the square tube but the 4 x 8" tube or if you did not receive any tube:</u>
> - skip this instruction and continue with the next ("If you use an alternative square tube:")
> - enter the dimensions in mm (1" = 25.4 mm)

<u>If you use an alternative square tube:</u>
- Accurately measure the outside dimensions of the tube (height and width).
- Enter the height and the width of the tube (in mm) on the screen (or use the arrow keys to do so). Max. value: 200 mm.
- Select **Submit values**.

<u>Subsequently:</u>
- Select **Conveyor is removed** to confirm that the conveyor mode plate is removed and that a regular chuck clamp is installed.
- Select **Open front chuck**.
- On control panel of the trolley: set the switch CHUCK CLAMP to OFF to open the rear chuck.
- Slide the reference tube or the alternative tube into the machine.
- Select **Close front chuck**.
- On control panel of the trolley: set the switch CHUCK CLAMP to ON to close the rear chuck.
- Select **Move trolley forward** and/or **Move Trolley backward** to slide the tube into the robot cell. (Alternative: use the switch [Y+] / [Y−] on the control panel of the trolley to move the trolley to the front / rear.)
- Make sure that the tube is below the torch.
- Select **Go to step 4**.
- Select **Start calibrating the base**.

- ➤ The robot measures the position of the top and sides of the reference tube and defines the base location.
- ➤ The remote control shows a pop-up message to confirm that the calibration was successful.
- ▪ When the machine completed the movement: select **Done**.
- ▪ Release the tube and remove it from the machine.
- ▪ Select **Return to home** to exit this calibration screen.

3.4   Calibration of the trolley

Calibration of the trolley sets the correct position of the trolley related to the robot. If the home position of the trolley is not correct, it can cause incorrect product sizes.

For the calibration of the position of the trolley, do the procedure that follows:
- In the **Calibration** menu: select the button **Trolley position calibration**.
- Select **Go to step 1**.
- Select **Home the trolley** to move the trolley to the rear.
- Accurately measure the distance between the rear of the trolley and the hook (◆ Image 5).
- Enter the distance (in mm) on the screen (or use the arrow keys to do so).
- Select **Submit values**.
- Select **Home trolley**.

Subsequently, to make sure that the home position of the trolley is correct:
- Accurately measure the distance between the rear of the trolley and the hook again.
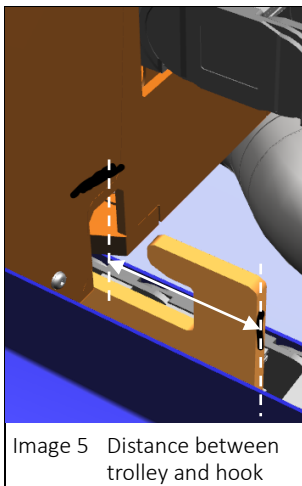
If the distance **=** 35 mm (1⅜"):
- ➢ Calibration of the trolley was successful.
- Select **Return to home**.

If the distance is **≠** 35 mm (1⅜"):
- Repeat the calibration procedure.

Subsequently:
- Continue with § 3.5 to align the front and rear chucks.

Image 5   Distance between trolley and hook

3.5 Alignment calibration of the chucks

Calibration of the chucks makes sure that the front and rear chucks are aligned with each other. If they are not aligned, it can have a negative effect on the cutting quality.

The RoboRail is supplied with a tube (L = 2 m, 120 x 120 mm*) as reference part. If this tube is not available anymore, you must take an alternative square tube – with very accurate dimensions – that you use as a reference part.
Dimensions of the alternative tube: min. 120 x 120 mm | max. 200 x 200 mm*

> ** <u>For USA</u>:   - dimensions of the reference tube are L = 7 ft, 4 x 8", thickness = ⅛"*
> *   - dimensions of an alternative tube must be min. min. 5 x 5" / max. 8 x 8"*

<u>To verify if alignment of the front and rear chucks is necessary, do the procedure that follows</u>:
- In the **Calibration** menu: select the button **Alignment calibration**.
- Select **Continue**.

<u>If you use the reference tube supplied with the RoboRail</u>: **
- Enter profile width: **120,00** (mm) on the screen (or use the arrow keys to do so).
- Enter profile height: **120,00** (mm) on the screen (or use the arrow keys to do so).
- Enter **Submit values**.

> ***   <u>For USA, if you did not receive the square tube but the 4 x 8" tube or if you did not receive any tube:</u>*
> *   - skip this instruction and continue with the next ("If you use an alternative square tube:")*
> *   - enter the dimensions in mm (1" = 25.4 mm)*

<u>If you use an alternative square tube</u>:
- Accurately measure the outside dimensions of the tube (height and width).
- Enter the width and the height of the tube (in mm) on the screen (or use the arrow keys to do so). Max. value: 200 mm.
- Select Submit values.

<u>Subsequently</u>:
- Select **Open front chuck**.
- Load the tube.
- Select **Close front chuck**.
- Select **Continue**.
- Select **Approach material**. The field **Laser value** on the screen shows a certain value.
- Use the switch [Y+] on the control panel of the trolley (or the arrow button ◀◀ on the screen) to move the trolley fully forward.
- Keep an eye on the **Laser value** on the screen and move the trolley to the rear with switch [Y–] (or the arrow button ▶▶ on the screen). Make sure that the laser beam continues to hit the material.
- Select **Finish**.

If the laser value changes more than **2** (mm) you must align the chucks.

<u>For the procedure to align the chucks</u>:

- Contact the HGG service department.

3.6   Calibration of the infeed | home position

Calibration of the infeed table makes sure that the home position of the infeed sliders is correct. In this position the sliders put the material in the center of the bogies.

Necessary tool:

Measuring tape

For the calibration of the position of the infeed table, do the procedure that follows:
- In the **Calibration** menu: select the button **Infeed calibration**.
- Select **Continue**.
- Select **Home infeed** to move the infeed sliders to their home position. In this position the sliders are fully retracted and they are near the end stops.
- Select **Continue**.
- Accurately measure the distance between the end of the slider and the end stop of the infeed table (this is the hook behind the slider) (◆ Image 6). It does not matter which slider you measure.
- Enter the distance (in mm) on the screen (or use the arrow keys to do so).
- Select **Submit value**.
- Select **Continue**.
- Select **Home infeed**.

Subsequently, to make sure that the home position of the sliders is correct:
- Accurately measure the distance between the end of the slider and the end stop of the infeed table again.

If the distance **=** 5 mm (⅕"):
- ➢ Calibration of the infeed table was successful.
- Select **Return to the main screen**.

If the distance is **≠** 5 mm (⅕"):
- Select **Go back to the previous step** and repeat the procedure.

Side view   Top view

Image 6   Distance between end of slider and end stop
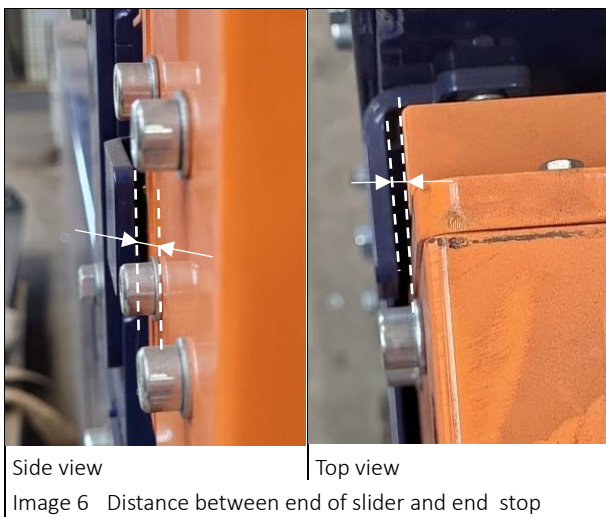
3.7 Calibration of the infeed | material

This calibration procedure sets the correct infeed position of the material. An incorrect position can cause problems to load the material and incorrect cutting positions.

For the calibration of the infeed position of the material, do the procedure that follows:
- In the **Calibration** menu: select the button **Infeed material position calibration**.
- Select **Continue**.
- Select **Home infeed** to put the infeed at its home position.
- Select **Home trolley** to move the trolley to the rear. This is a safe position of the trolley during the calibration process.
- Select **Continue**.
- Select **Infeed forward** and/or **Infeed backward** to move the infeed just after the centerline of the bogies (♦ Image 7). In this position the infeed sliders are at 1 to max. 5 mm ($\frac{1}{25}$ to max. $\frac{1}{5}$") after the center of the bogies.
- Select **Submit position**.
- Select **Finish**.

Image 7   Position of the infeed sliders

Calibration

Metal profiles | shapes

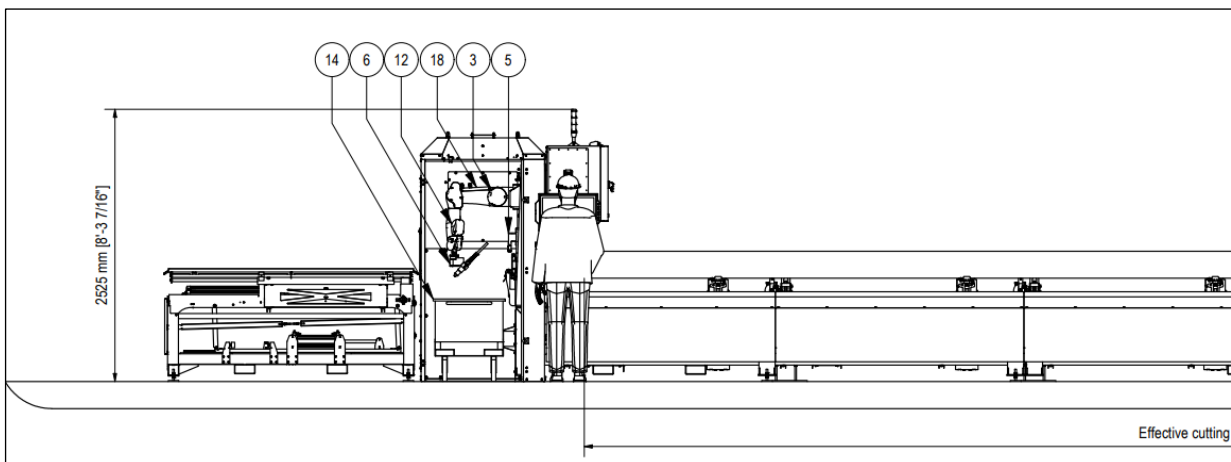|				
Round tube/pipe	Square tube	Channel	Flat bar	Angle

Components
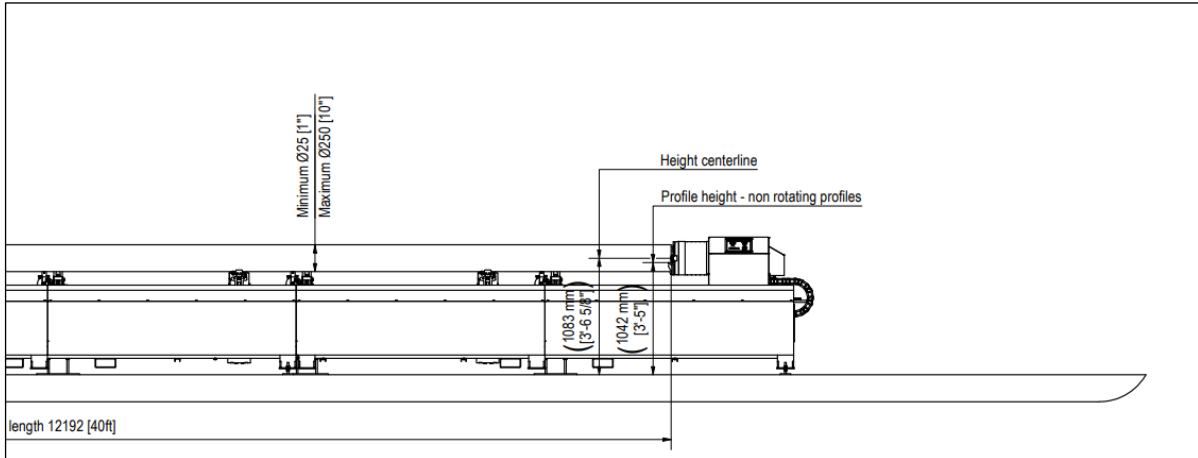
Main components of the RoboRail (refer to the images below):

A. Front chuck (#5)
B. Trolley with rear chuck (#4)
C. Infeed table (#16)
D. Cutting cell (#13)
E. Robot (#3)
F. Torch
G. Control unit (#9)
H. Bogies (front / middle / rear)
I. Conveyor mode plate
J. Controls
  - Remote control (#10)
  - Power / maintenance switches
  - Trolley controls
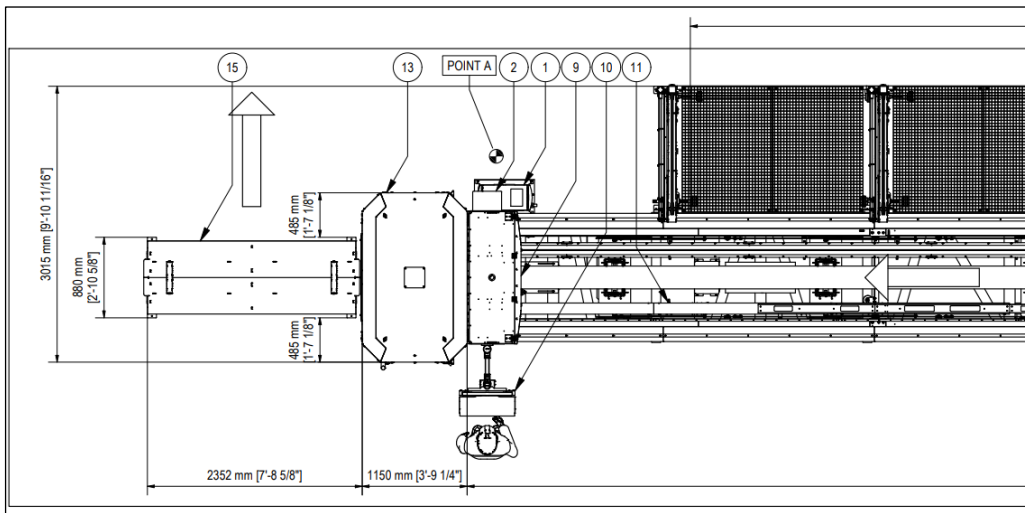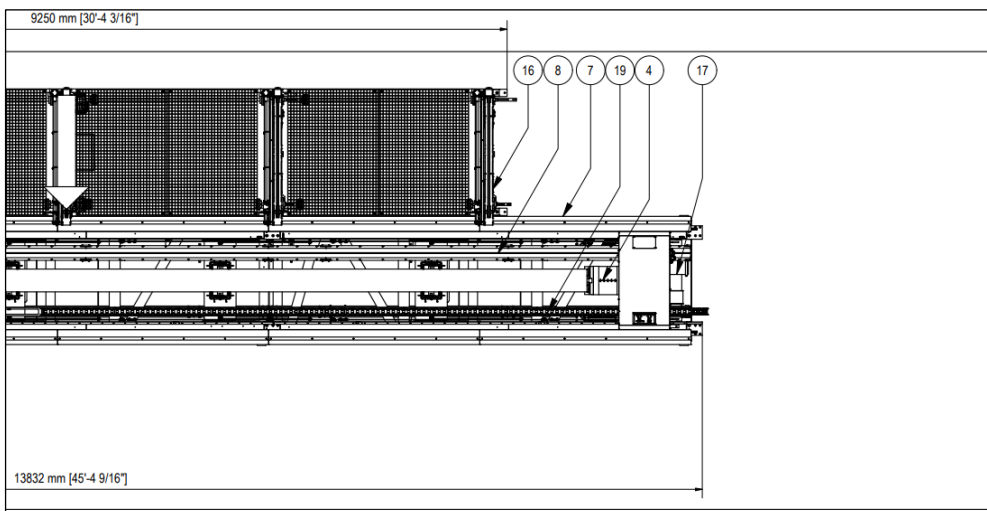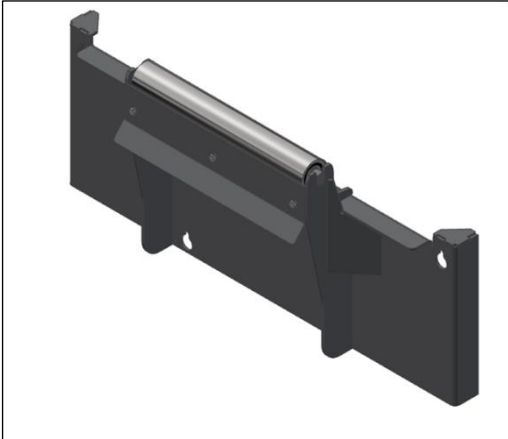

Side view | left part

Calibration

Side view | right part

Top view | left part

Top view | right part

Conveyor mode plate