

1

2

B

B

A

A

XY Frame Assembly



Created by:
Joshua Vasquez

last edited:
10/19/2019

SCALE: 1:3 SHEET 1 OF 36

2

1

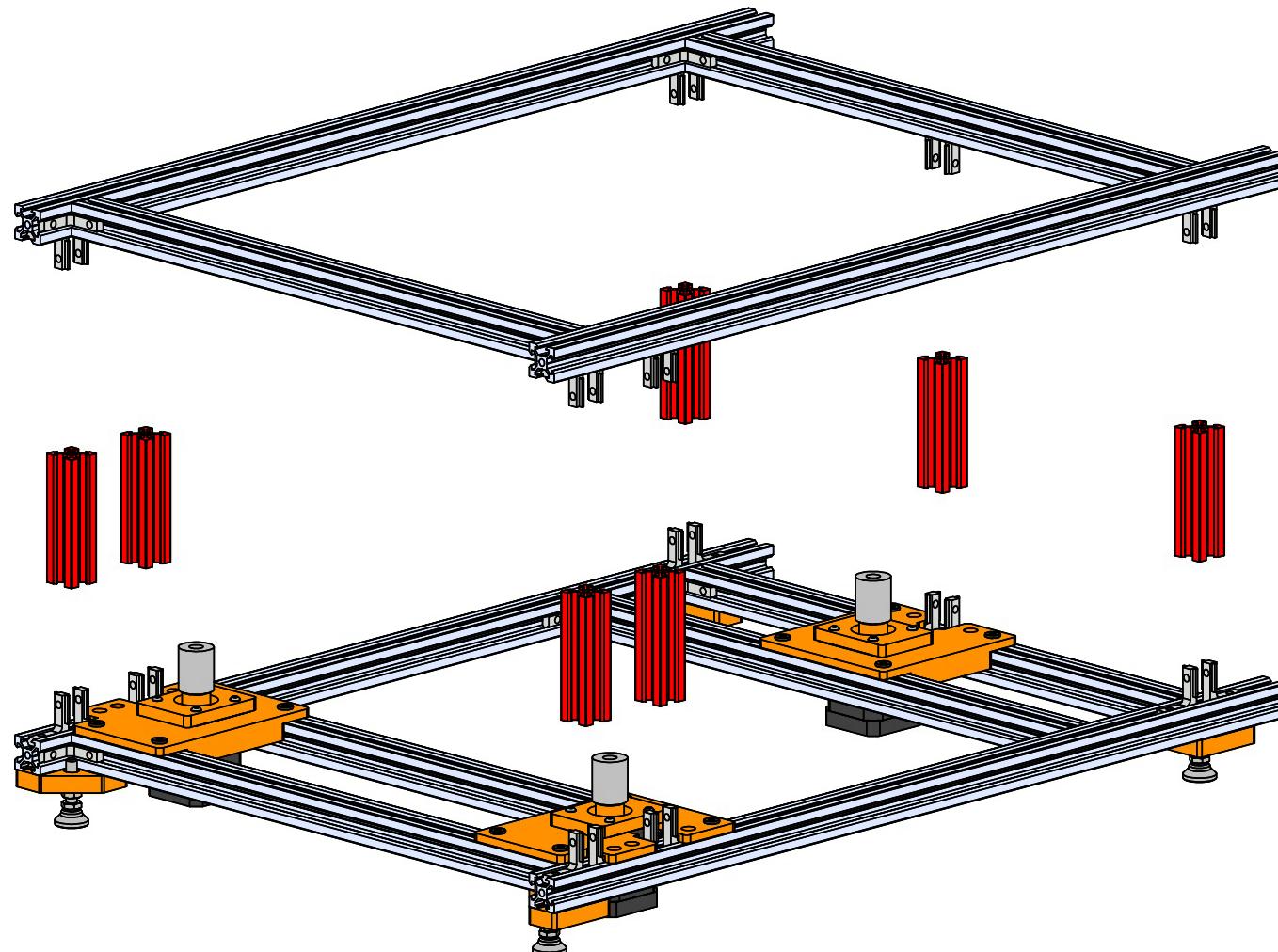
2

1

This next process aligns the Inside-Corner Brackets to ensure a square frame.
 Using the temporary short extrusions, slide the top frame onto the completed Lower frame assembly.

B

B



A

A

Tighten all Inside-Corner Brackets on the lower frame first to set their location. Then tighten the screws for all Inside-Corner Brackets attached to the upper frame.

With all set screws tightened, the Inside-Corner Bracket positions should be fixed on the upper and lower frames.

Now, loosen all set-screws connecting the red extrusions only and separate the frames, removing the red extrusions.

Set aside the lower frame.

Upper Bracket Alignment 1



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 Joshua Vasquez

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 10/19/2019

SCALE: 1:4

SHEET 2 OF 36

2

1

2

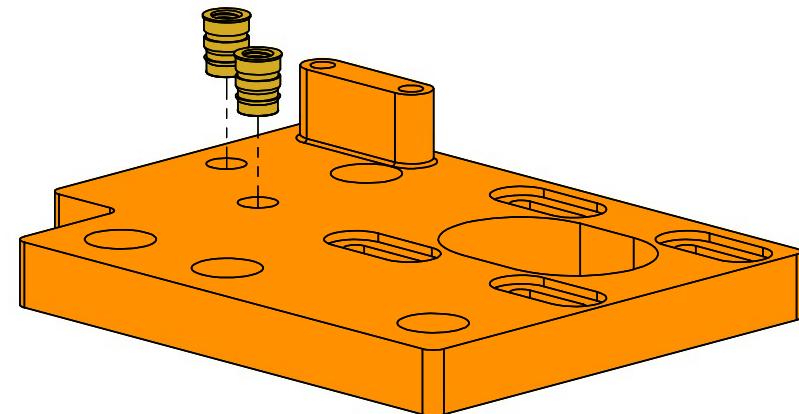
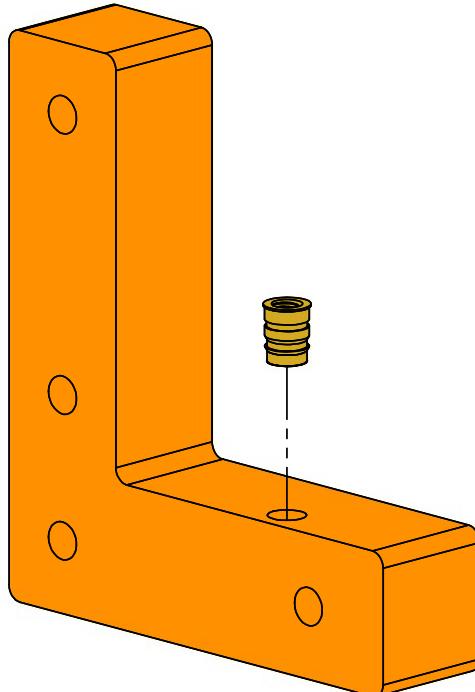
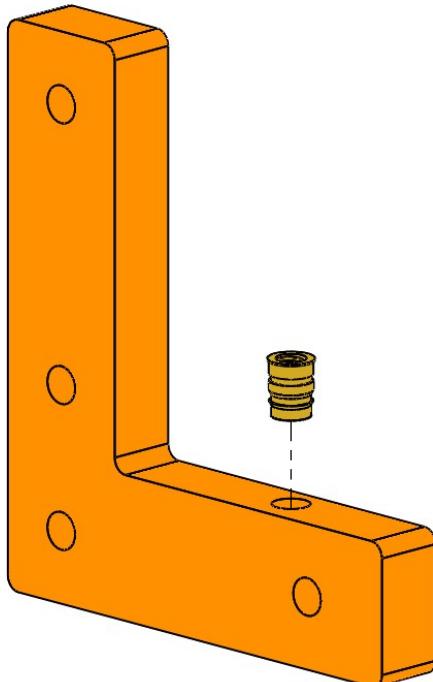
1

Install all heat-set inserts with the plate-press technique.

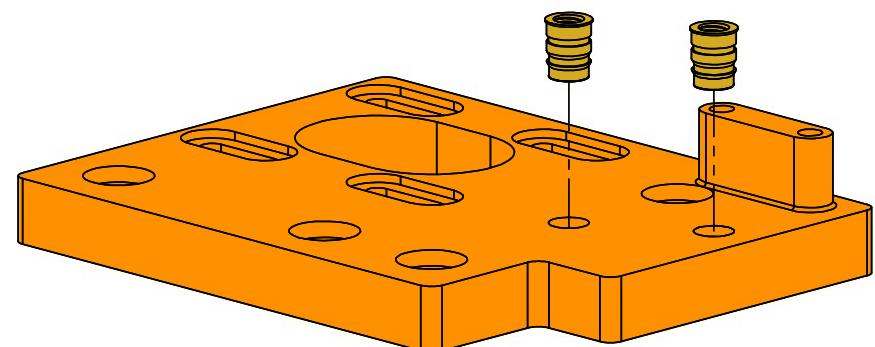
More information on the plate-press technique can be found here:

<https://hackaday.com/2019/02/28/threading-3d-printed-parts-how-to-use-heat-set-inserts/>

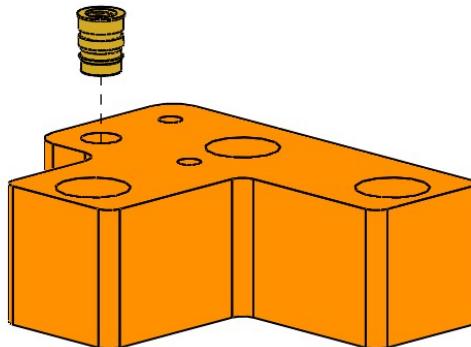
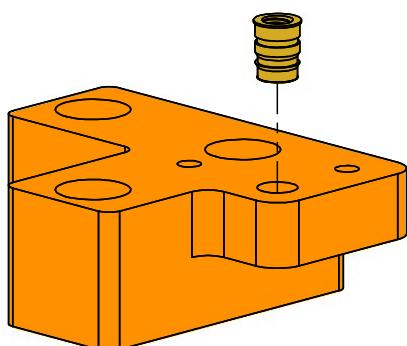
B



B



A



A

Heat-Set Insert Installation



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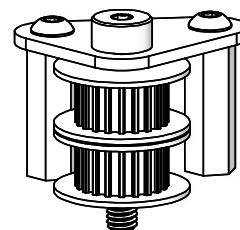
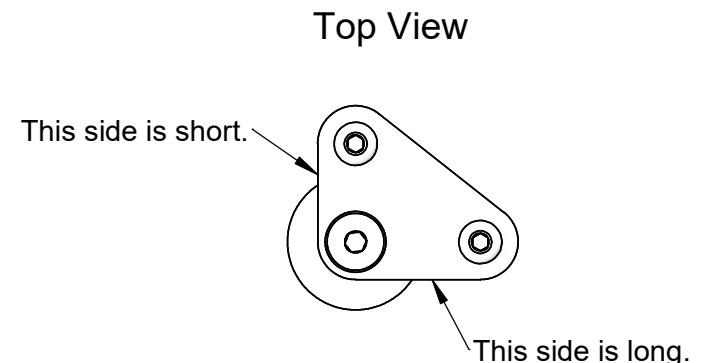
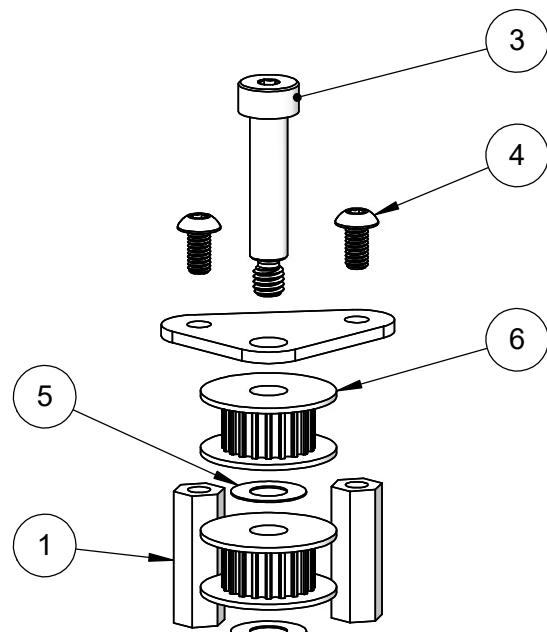
SCALE: 1:1 SHEET 3 OF 36

2

1

2

1



ITEM NO.	DESCRIPTION	QTY.
1	M3 18mm standoff, 6mm wide	2
2	Corner Pulley Reinforcement Plate	1
3	M4 shoulder screw, 20mm-l, 5mm-d	1
4	M3 Buttonhead Screw, 6mm long	2
5	M5 Shim, 0.2mm thick	2
6	20T Idler pulley, 2GT, 5mm bore	2

2

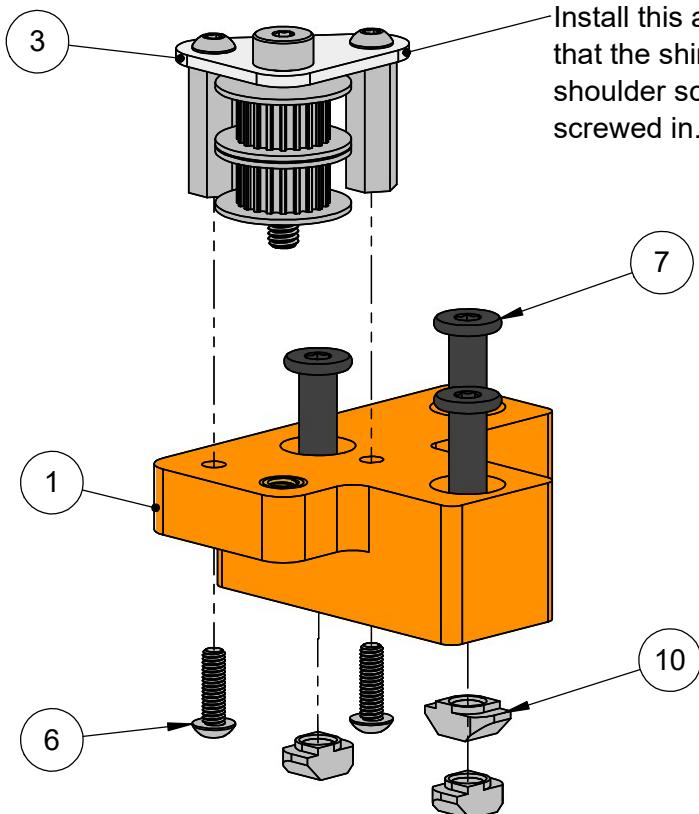
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Left Corner Pulley Assembly		
	Created by: Joshua Vasquez	last edited: 10/19/2019
	SCALE: 1:1	SHEET 4 OF 36

2

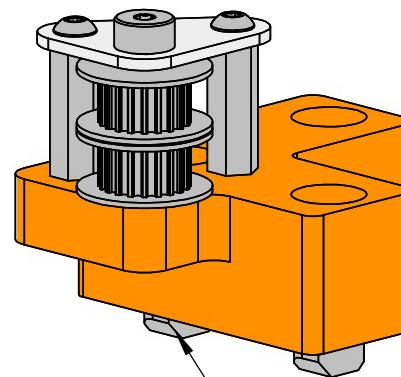
1

B



Exploded View

Install this assembly upside-down such that the shim seats properly on the shoulder screw as the entire assembly is screwed in.



Assembled View

Keep these T-Nuts loose, only two full turns; they will be tightened into the frame later.

A

ITEM NO.	DESCRIPTION	QTY.
1	Left Corner Plate with Insert Installed	1
3	Left Corner Pulley Assembly	1
6	M3 Buttonhead Screw, 10mm long	2
7	M5 x 0.8 Screw, Low Profile. 20mm	3
10	M5 Drop-In T-Nut for 20x20 Extrusion	3

2

1

Left Corner Pulley Plate Assembly



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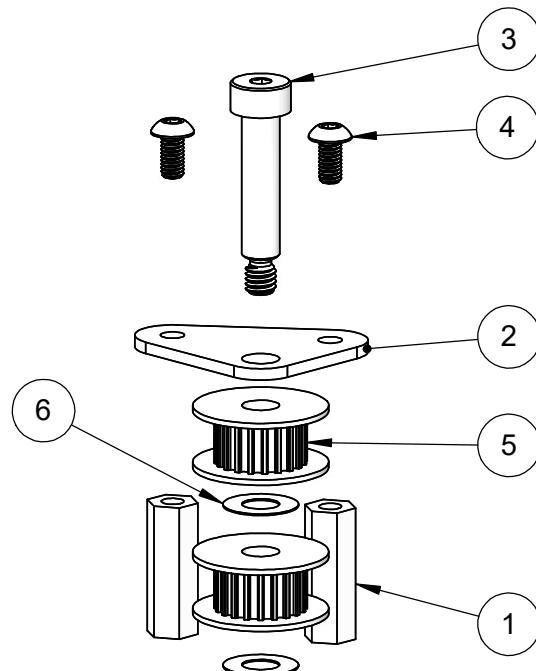
SCALE: 1:1 SHEET 5 OF 36

B

A

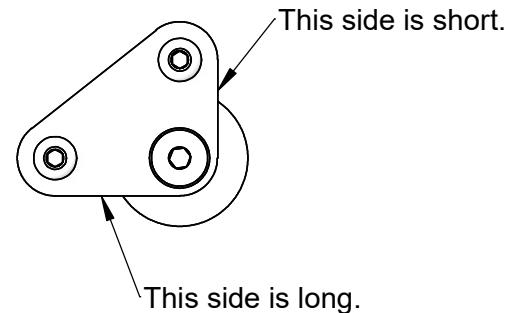
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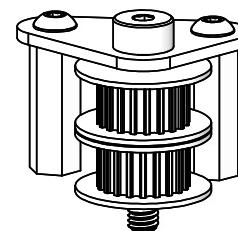


Exploded View

Top View



Note the plate orientation! Also note that this orientation is different from the prior pulley assembly.



Assembled View

ITEM NO.	DESCRIPTION	QTY.
1	M3 18mm standoff, 6mm wide	2
2	Corner Pulley Reinforcement Plate	1
3	M4 shoulder screw, 20mm-l, 5mm-d	1
4	M3 Buttonhead Screw, 6mm long	2
5	20T Idler pulley, 2GT, 5mm bore	2
6	M5 Shim, 0.2mm thick	2

Right Corner Pulley Assembly



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SCALE: 1:1 SHEET 6 OF 36

2

1

B

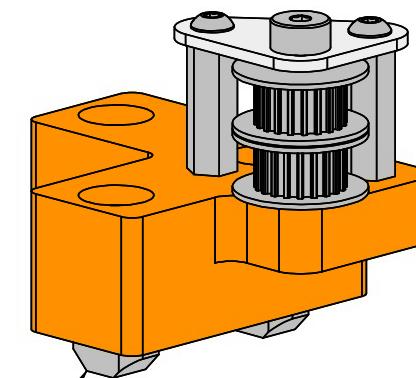
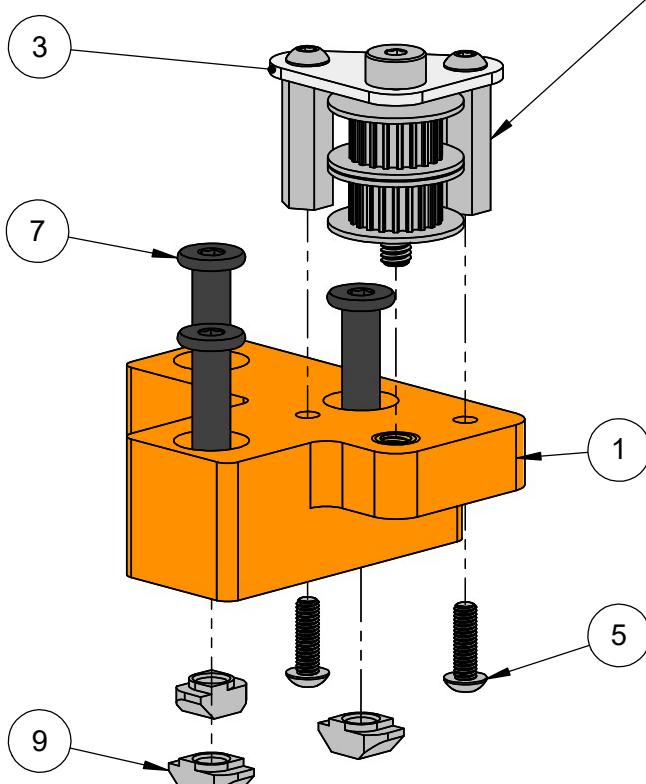
B

A

A

2

1



B

B

ITEM NO.	DESCRIPTION	QTY.
1	Right Corner Plate with Insert Installed	1
3	Right Corner Pulley Assembly	1
5	M3 Buttonhead Screw, 10mm long	2
7	M5 x 0.8 Screw, Low Profile. 20mm	3
9	M5 Drop-In T-Nut for 20x20 Extrusion	3

2

1

Right Corner Pulley Plate Assembly



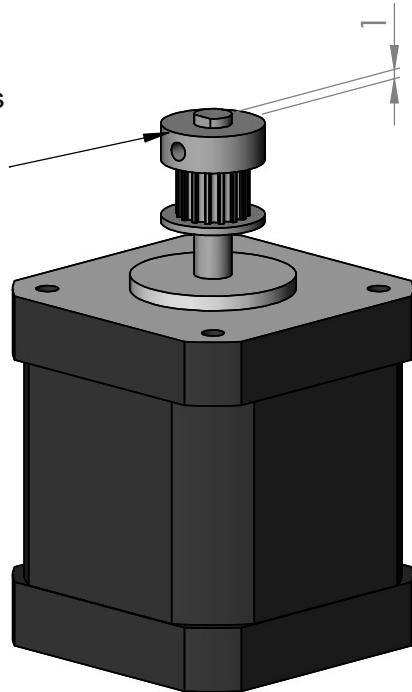
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SCALE: 1:1 SHEET 7 OF 36

Make two assemblies.

B

Tighten down all setscrews. If your drive pulley has multiple setscrews, ensure that at least one setscrew engages the flat surface of the shaft.



B

A

A

ITEM NO.	DESCRIPTION	QTY.
1	16-T 2GT Drive Pulley for 6mm belt	1
2	Nema 17 Stepper Motor	1

Drive Motor Assembly		
	Created by: Joshua Vasquez	last edited: 10/19/2019
	SCALE: 1:1	SHEET 8 OF 36

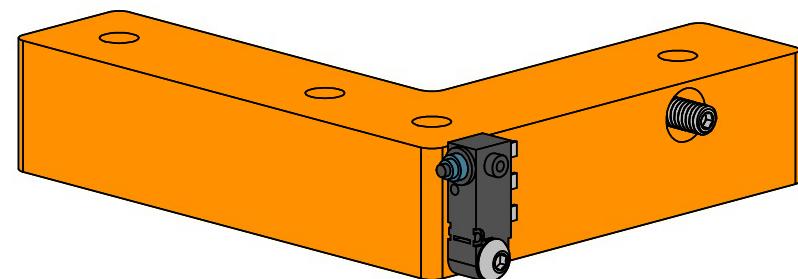
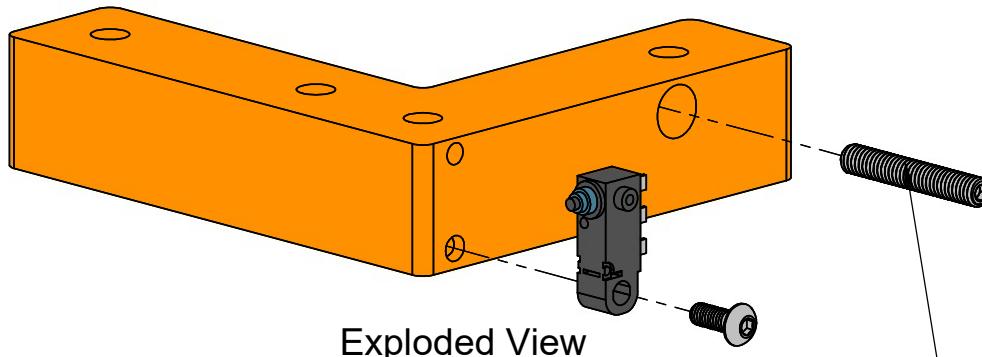
2

1

Solder 300mm of 26AWG stranded wire to the two outer leads as shown below. Then install the crimp pins and connector housing included in the Duet kit. Note that polarity does not matter, but the wires must be connected to the outer sockets of the connector.

B

B



Install this setscrew with 4-6 turns. It will be readjusted later.

A

A

ITEM NO.	DESCRIPTION	QTY.
1	Dust-Proof Limit Switch with wiring	1
2	M3 Buttonhead Screw, 8mm long	1
3	Tall Motor Corner Plate with Insert	1
4	M4 Set Screw, 25mm long	1

Y Limit Switch Installation



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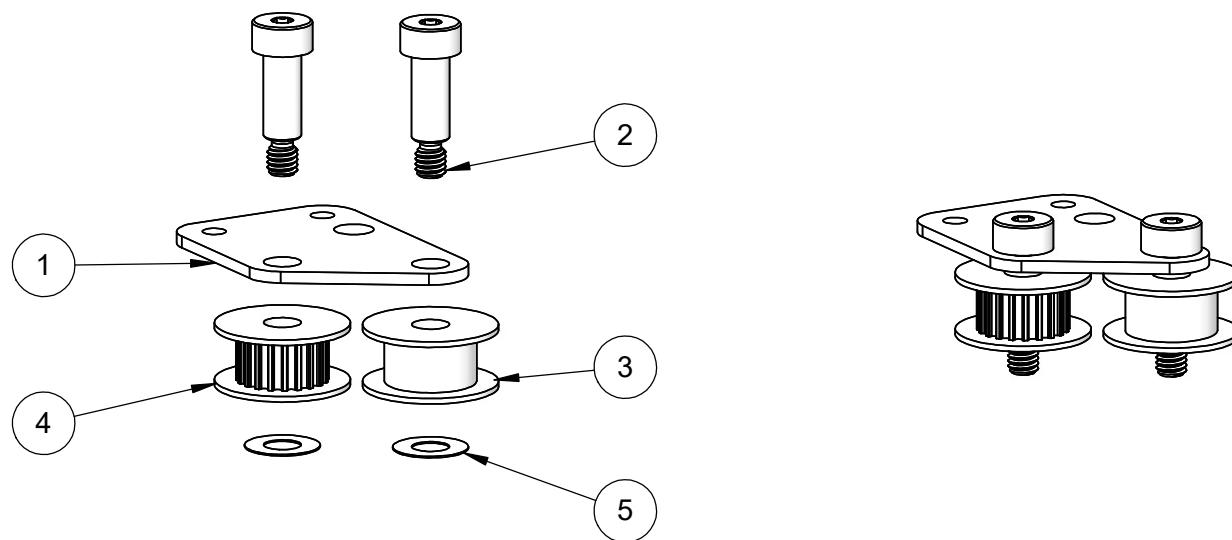
SCALE: 1:1 SHEET 9 OF 36

2

1

2

1



ITEM NO.	DESCRIPTION	QTY.
1	pulley reinforcement plate for motor	1
2	M4 shoulder screw, 12mm-l, 5mm-d	2
3	20T toothless idler, 5mm bore	1
4	20T Idler pulley, 2GT, 5mm bore	1
5	M5 Shim, 0.2mm thick	2

1

2

Left Motor Pulley Assembly



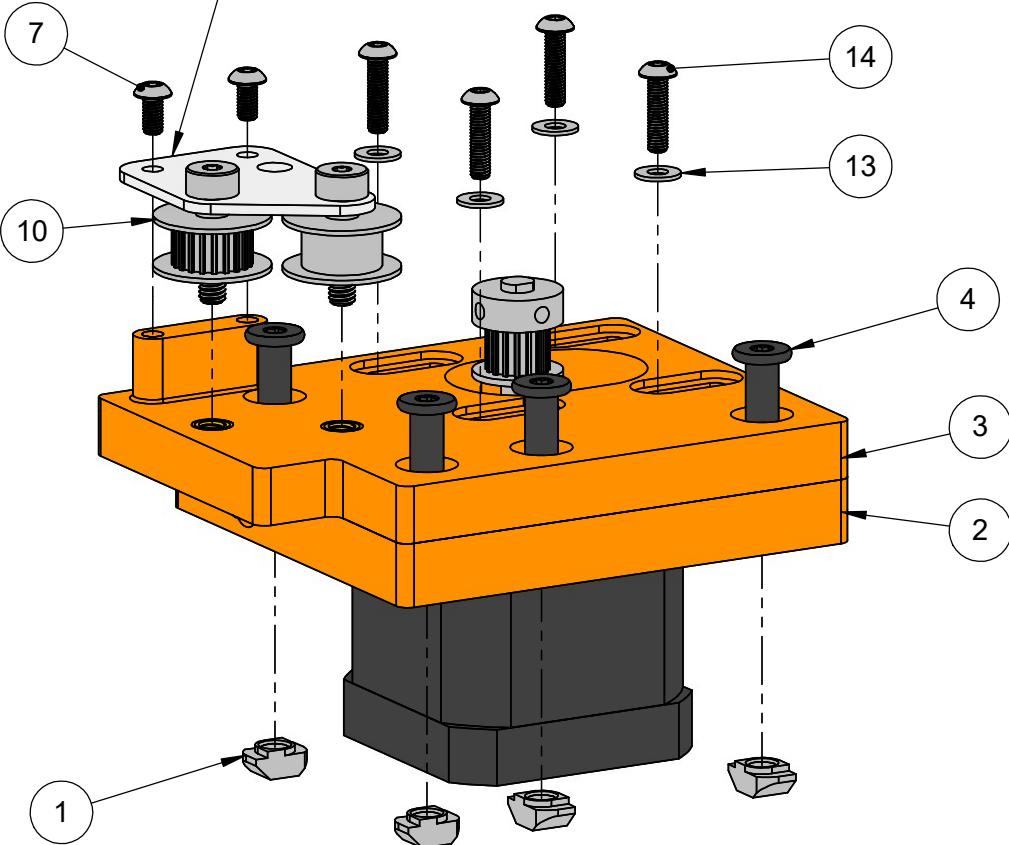
Created by:
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SCALE: 1:1 SHEET 10 OF 36

2

1

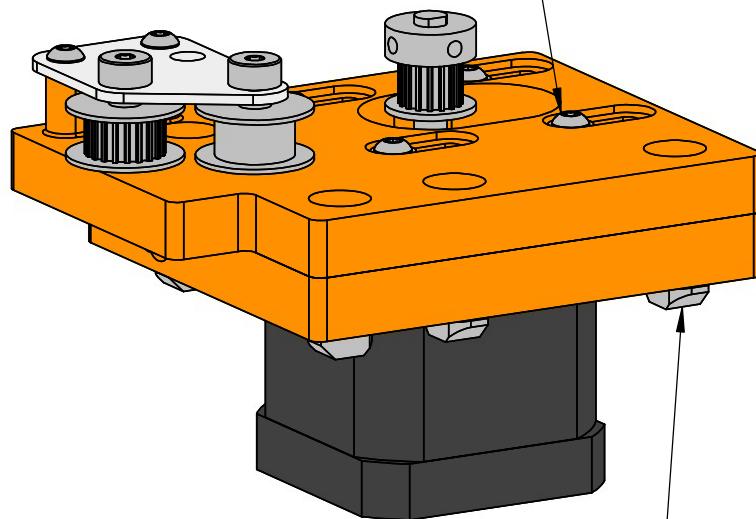
Install the pulley assembly from the prior step with the parts oriented upside-down such that the shim-stock seats properly on the shoulder screw during installation.



Exploded View

ITEM NO.	DESCRIPTION	QTY.
1	M5 Drop-In T-Nut for 20x20 Extrusion	4
2	Short Motor Corner Plate Spacer Assembly	1
3	Left Motor Plate with Inserts	1
4	M5 x 0.8 Screw, Low Profile. 20mm	4
5	Stepper with Drive Pulley	1
7	M3 Buttonhead Screw, 6mm long	2
10	Left Motor Pulley Assembly	1
13	M3 Washer	4
14	M3 Buttonhead Screw, 12mm long	4

Do not fully-tighten the motor screws. They will be tightened later.



Assembled View

Keep these T-Nuts loose, only two full turns; they will be tightened into the frame later.

Left Motor Plate Assembly



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SCALE: 7:8 SHEET 11 OF 36

2

1

B

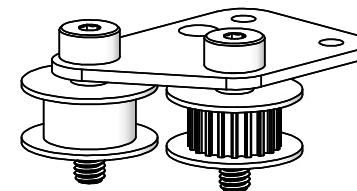
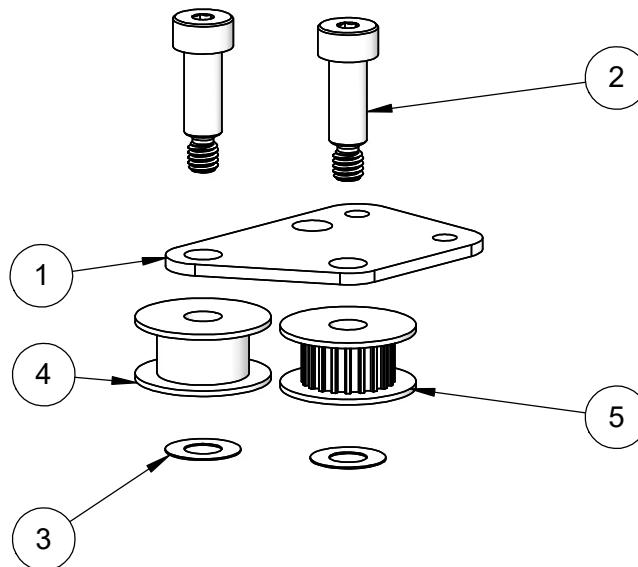
A

2

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B

B



ITEM NO.	DESCRIPTION	QTY.
1	pulley reinforcement plate for motor	1
2	M4 shoulder screw, 12mm-l, 5mm-d	2
3	M5 Shim, 0.2mm thick	2
4	20T toothless idler, 5mm bore	1
5	20T Idler pulley, 2GT, 5mm bore	1

Right Motor Pulley Assembly



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SCALE: 1:1 SHEET 12 OF 36

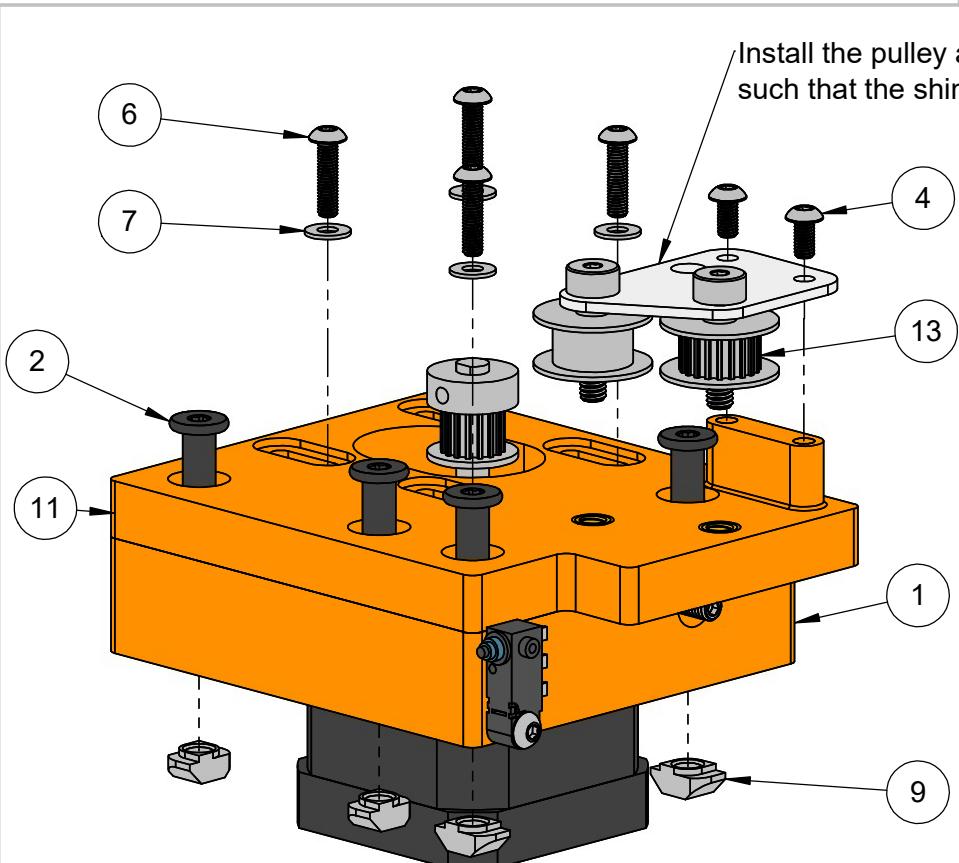
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1

A

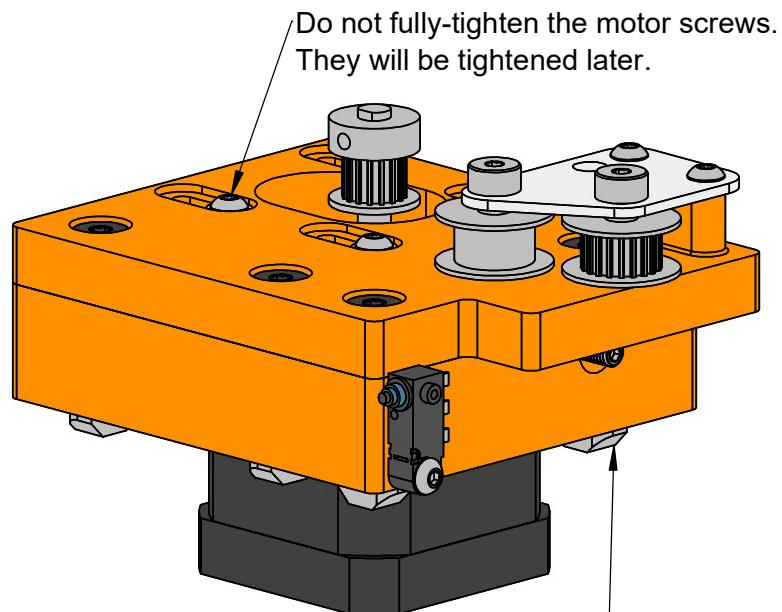
A

2



Exploded View

1



Assembled View

ITEM NO.	DESCRIPTION	QTY.
1	Tall Motor Corner Plate Spacer Assembly	1
2	M5 x 0.8 Screw, Low Profile, 30mm	4
4	M3 Buttonhead Screw, 6mm long	2
6	M3 Buttonhead Screw, 12mm long	4
7	M3 Washer	4
8	Stepper with Drive Pulley	1
9	M5 Drop-In T-Nut for 20x20 Extrusion	4
11	Right Motor Plate with Inserts	1
13	Right Motor Pulley Assembly	1

Keep these T-Nuts loose, only two full turns;
they will be tightened into the frame later.

Right Motor Plate Assembly



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SCALE: 7:8 SHEET 13 OF 36

2

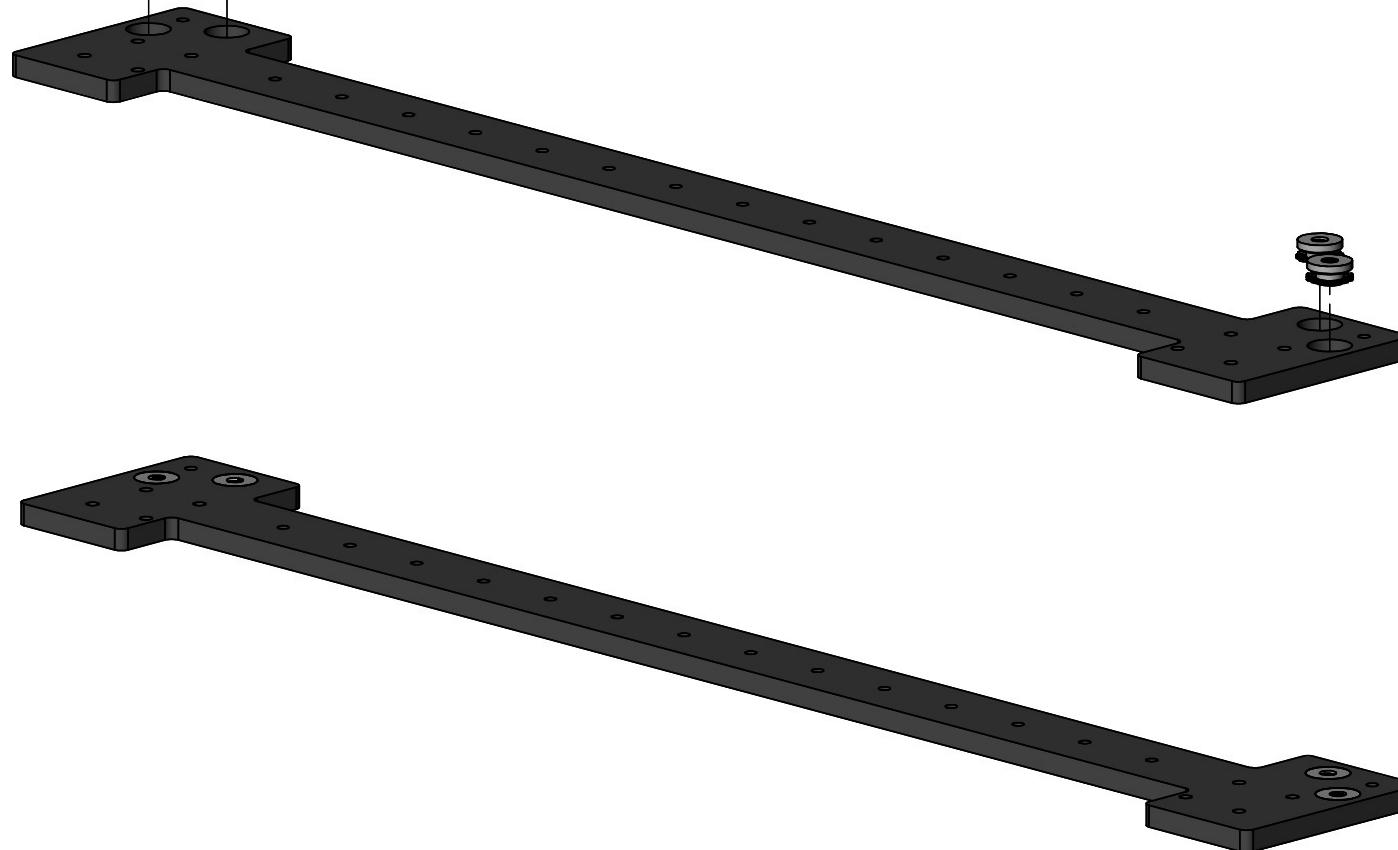
1

B

A

2

1



B

B

A

A

ITEM NO.	DESCRIPTION	
1	crossbar plate	1
2	M4 insert for composites, 6mm tall	4

Crossbar Insert Installation



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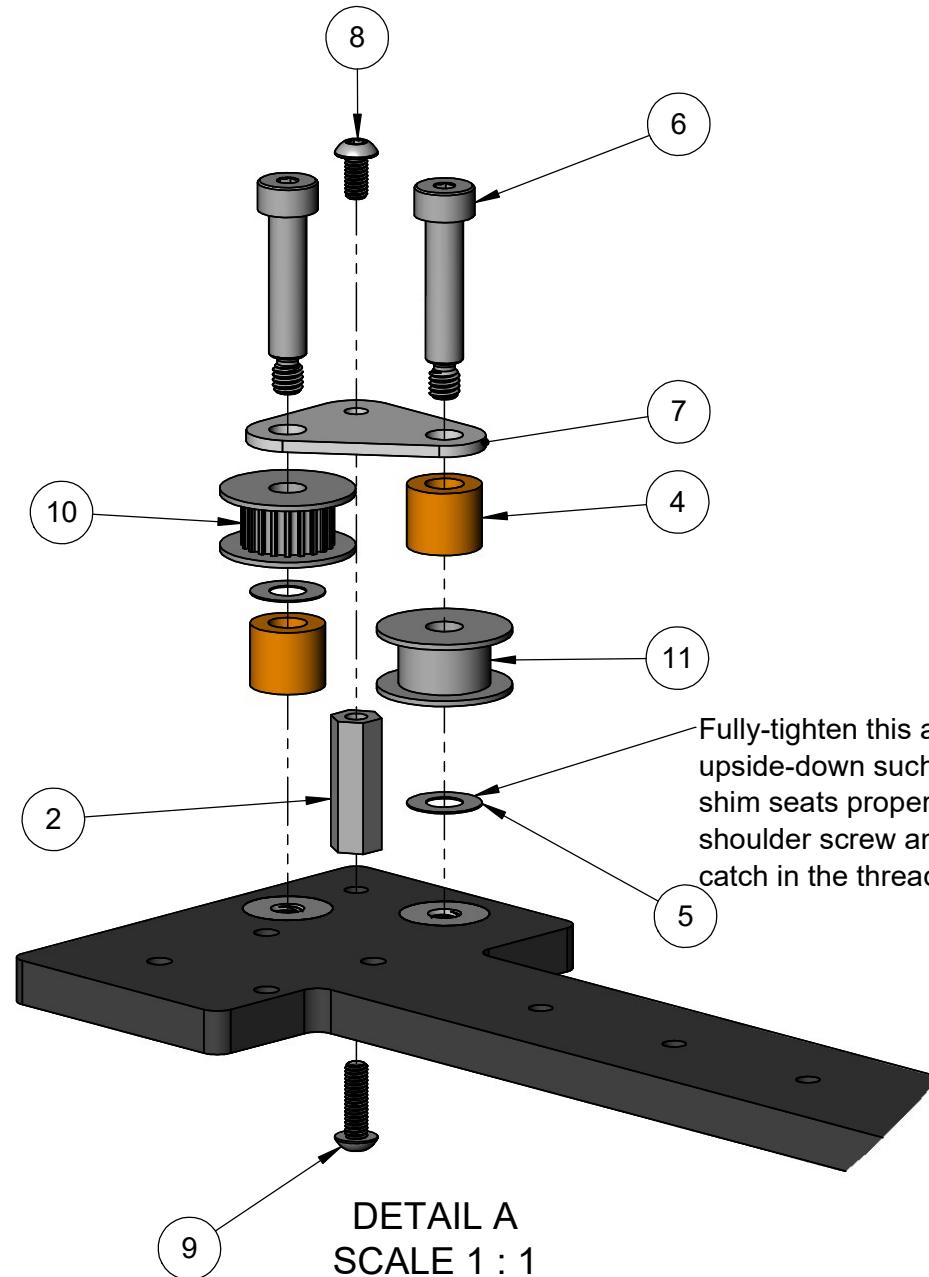
SCALE: 1:2 SHEET 14 OF 36

2

1

2

1



ITEM NO.	DESCRIPTION	
1	crossbar with inserts	1
2	M3 18mm standoff, 6mm wide	1
4	Printed Pulley Spacer	2
	M5 Shim, 0.2mm thick	2
5	M4 shoulder screw, 20mm-l, 5mm-d	2
6	Crossbar Pulley Reinforcement Plate	1
7	M3 Buttonhead Screw, 6mm long	1
8	M3 Buttonhead Screw, 10mm long	1
9	20T Idler pulley, 2GT, 5mm bore	1
10	20T toothless idler, 5mm bore	1
11	20T toothless idler, 5mm bore	1

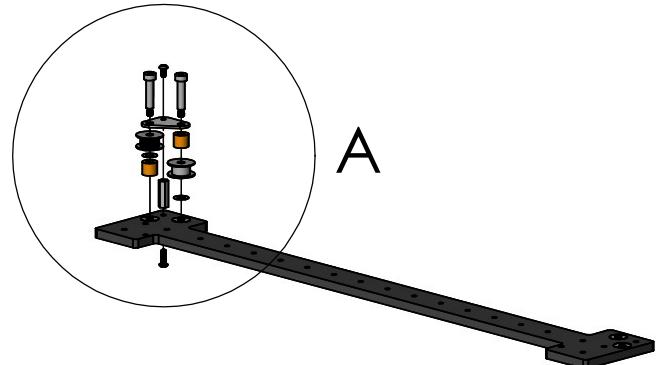
Left Crossbar Pulley Assembly		
	Created by: Joshua Vasquez	last edited: 10/19/2019
	SCALE: 1:5	SHEET 15 OF 36



1

2

B



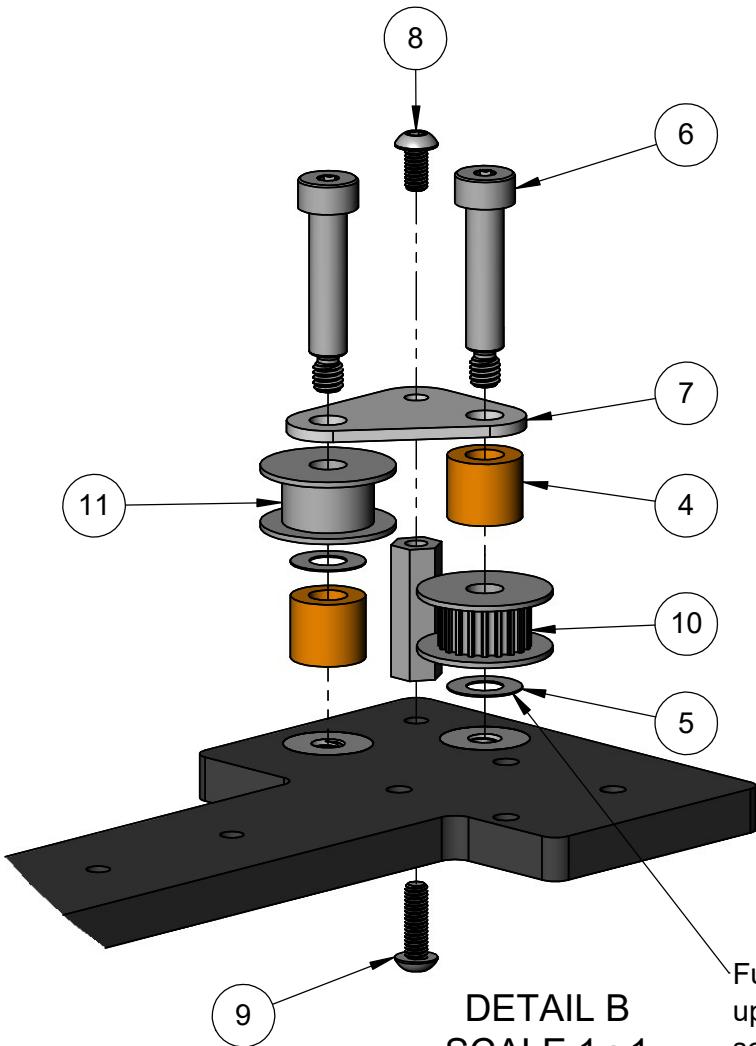
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2

1

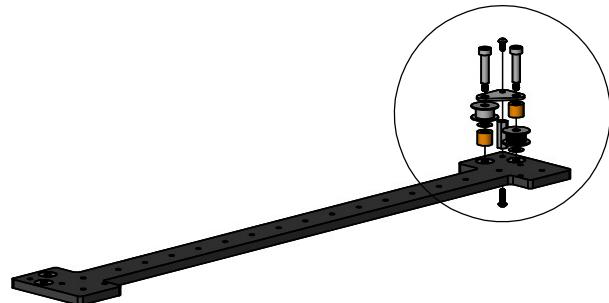
B

Note that this assembly is NOT merely a mirrored version of the previous one.
Ensure that the pulleys are installed in the order shown.



DETAIL B
SCALE 1 : 1

Fully-tighten this assembly upside-down such that this shim seats properly on the shoulder screw and doesn't catch in the threads.



ITEM NO.	DESCRIPTION	
1	crossbar plate with inserts	1
2	M3 18mm standoff, 6mm wide	1
4	Printed Pulley Spacer	2
5	M5 Shim, 0.2mm thick	2
6	M4 shoulder screw, 20mm-l, 5mm-d	2
7	Crossbar Pulley Reinforcement Plate	1
8	M3 Buttonhead Screw, 6mm long	1
9	M3 Buttonhead Screw, 10mm long	1
10	20T Idler pulley, 2GT, 5mm bore	1
11	20T toothless idler, 5mm bore	1

2

1

Right Crossbar Pulley Assembly



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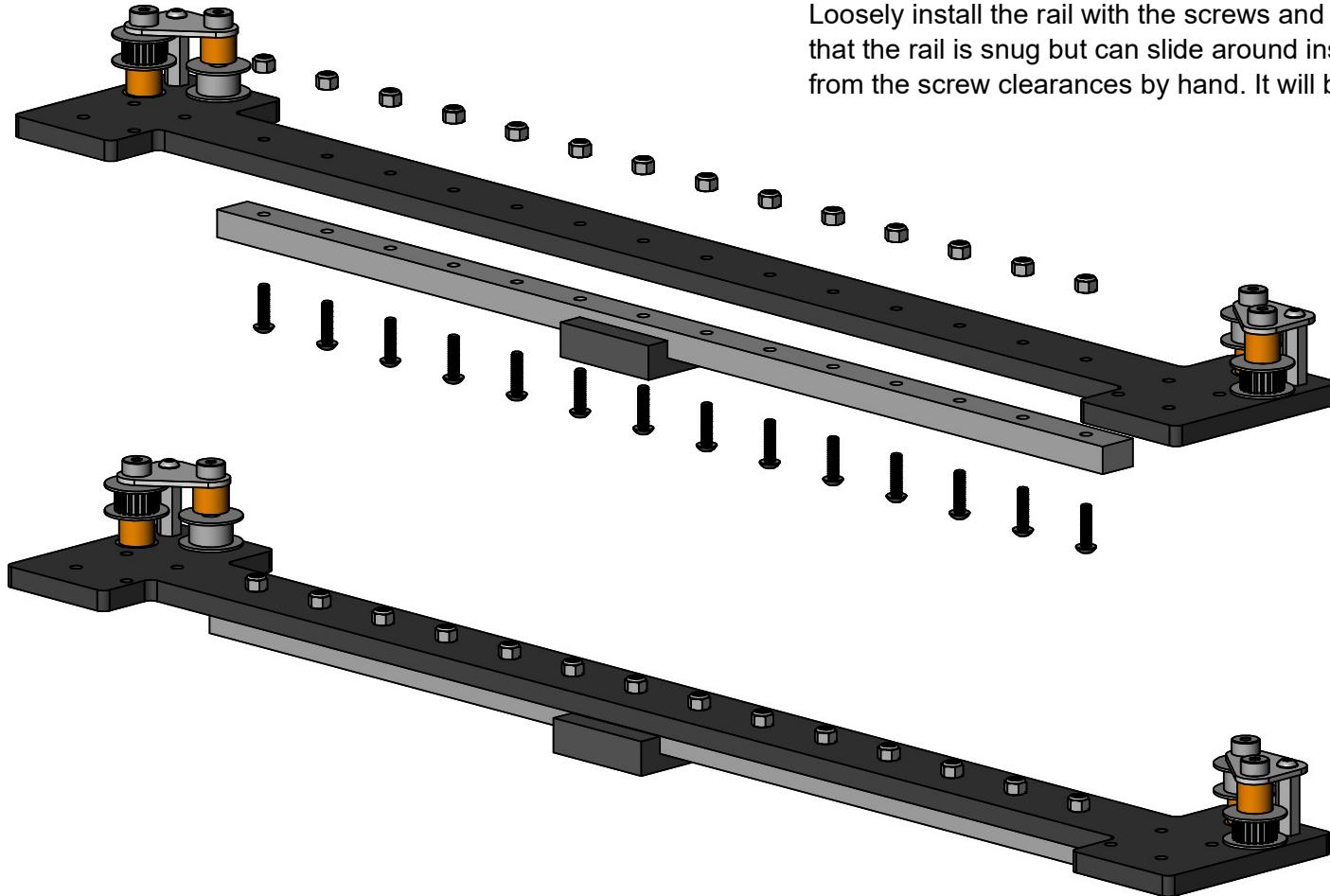
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SCALE: 1:5

SHEET 16 OF 36

2

1



Loosely install the rail with the screws and lock nuts such that the rail is snug but can slide around inside the holes from the screw clearances by hand. It will be tightened later.

ITEM NO.	DESCRIPTION	QTY.
1	crossbar with pulley assemblies	1
10	M3 Buttonhead Screw, 12mm long	14
11	M3 Locknut	14
12	MGN12 Rail, 350mm	1
13	MGN12C Carriage Block	1

Crossbar Rail Installation



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SCALE: 1:2 SHEET 17 OF 36

2

1

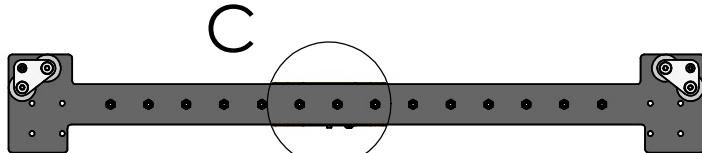
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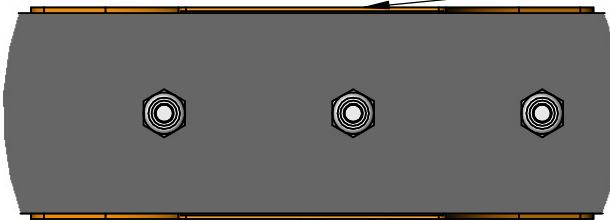
Securely fasten the center carriage to the crossbar, ensuring that the clearances below are met.

B

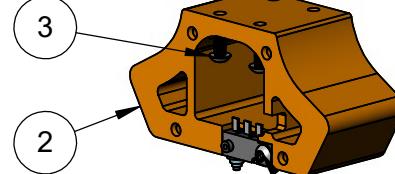
B



Top View



DETAIL C
SCALE 1 : 1



This limit switch should have wires attached to it (not shown in the rendering above).

Ensure that when the carriage is installed, it clears the crossbar on both sides. Otherwise, the carriage will bind when it slides back-and-forth.

ITEM NO.	DESCRIPTION	QTY.
1	Crossbar Assembly	1
2	Carriage Center Assembly	1
3	M3 Buttonhead Screw, 8mm long	4

2

1

Carriage Center Installation



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SCALE: 1:2 SHEET 18 OF 36

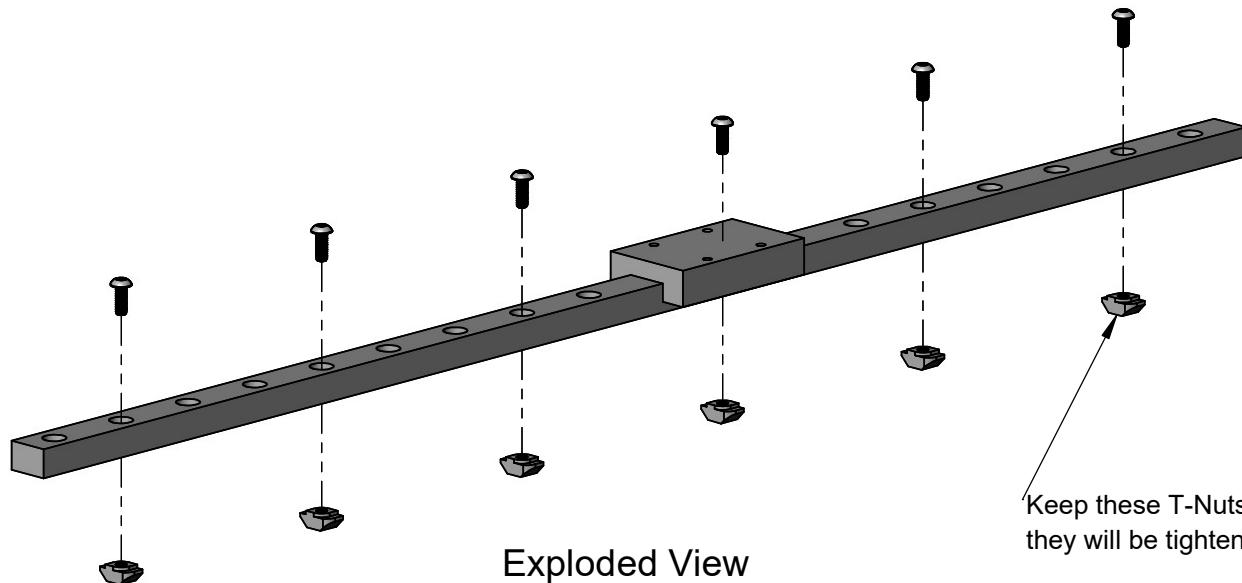
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A

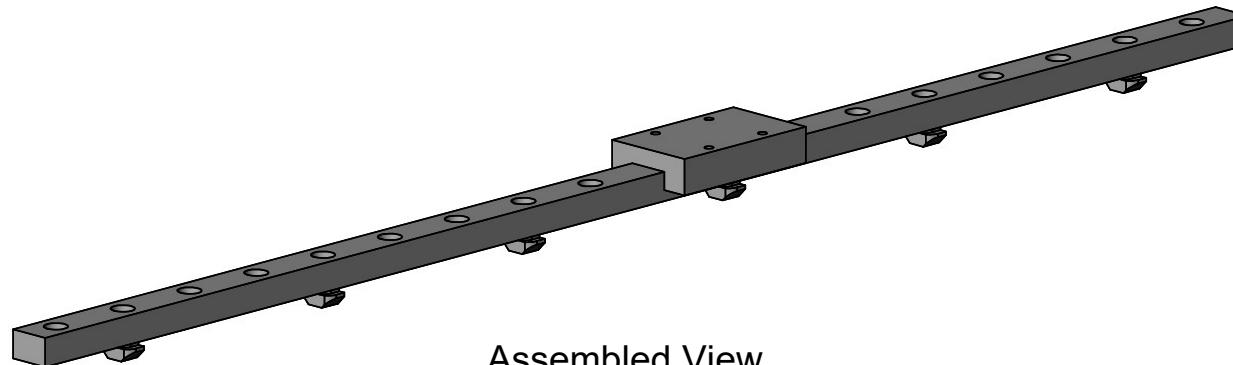
2

1

Make 2 Assemblies.



Exploded View



Assembled View

ITEM NO.	DESCRIPTION	QTY.
1	MGN12 Rail, 450mm	1
2	MGN12H Carriage Block	1
3	M3 Buttonhead Screw, 8mm long	6
4	M3 Drop-In T-Nut for 20x20 Extrusion	6

Y Rail Assembly



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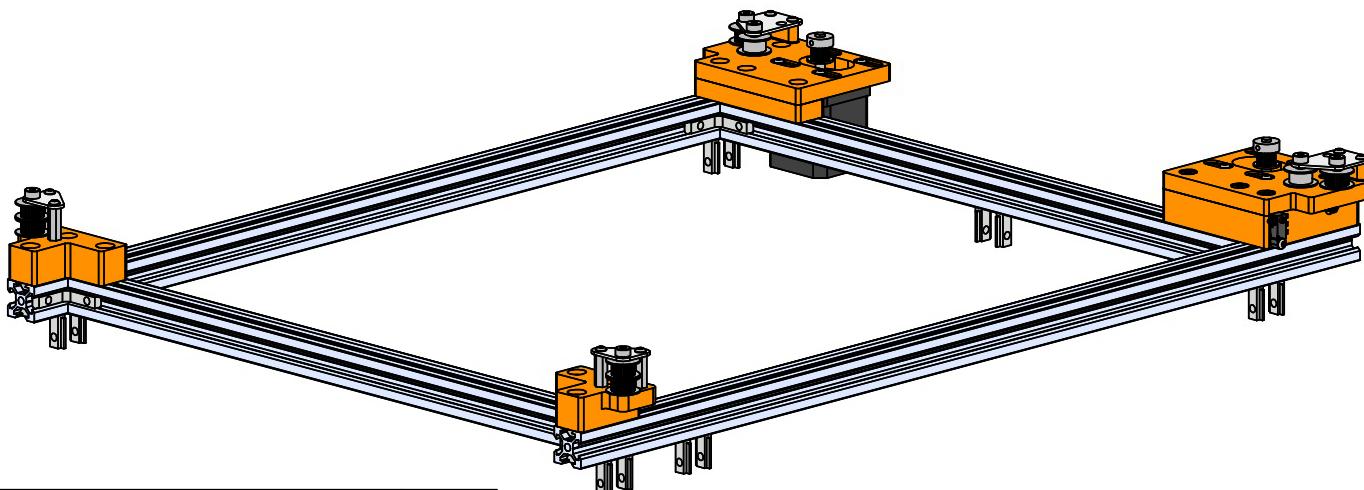
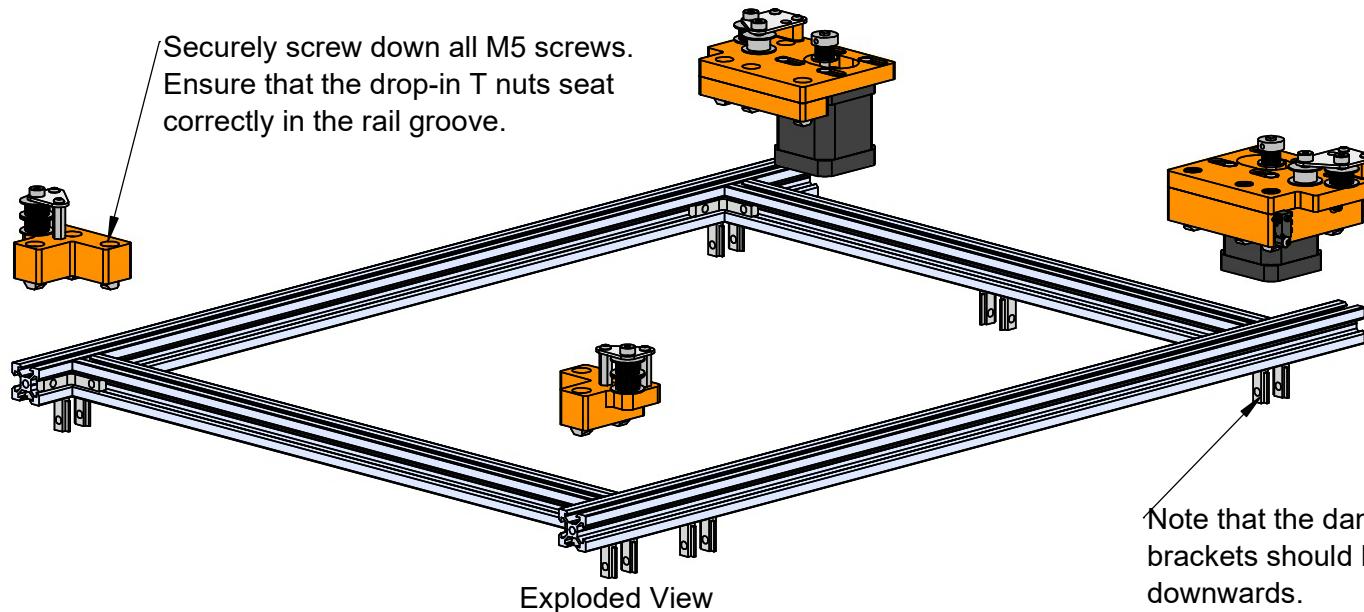
SCALE: 1:2 SHEET 19 OF 36

2

1

2

1



ITEM NO.	DESCRIPTION	QTY.
1	CoreXY Frame Assembly	1
2	Left Corner Pulley Plate Assembly	1
3	Right Corner Pulley Plate Assembly	1
4	Left Motor Plate Assembly	1
5	Right Motor Plate Assembly	1

Plate Installation



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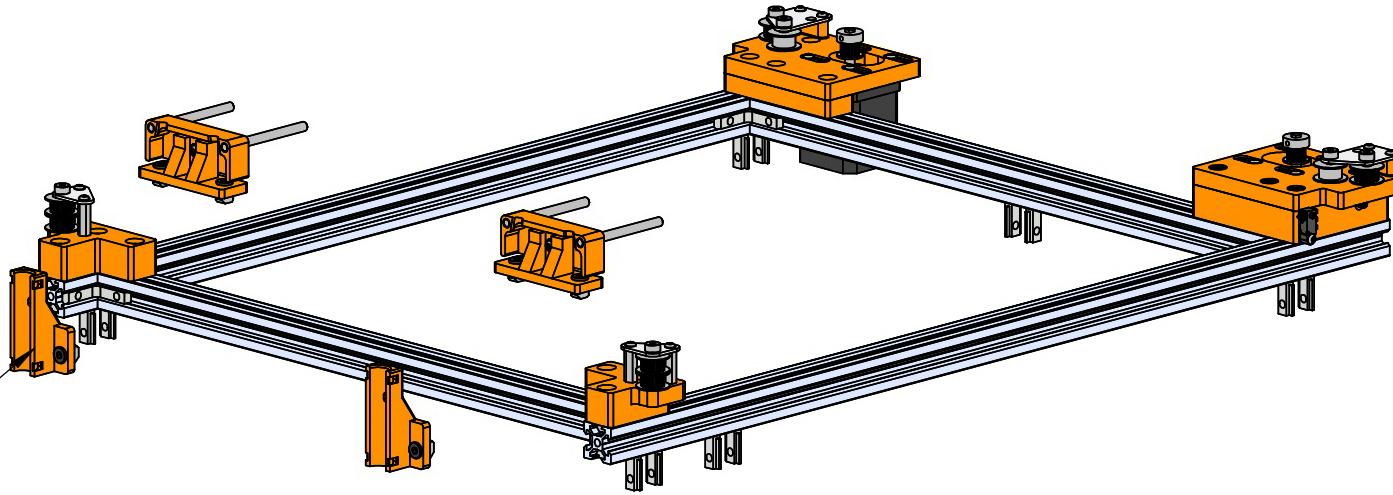
SCALE: 1:4 SHEET 20 OF 36

2

1

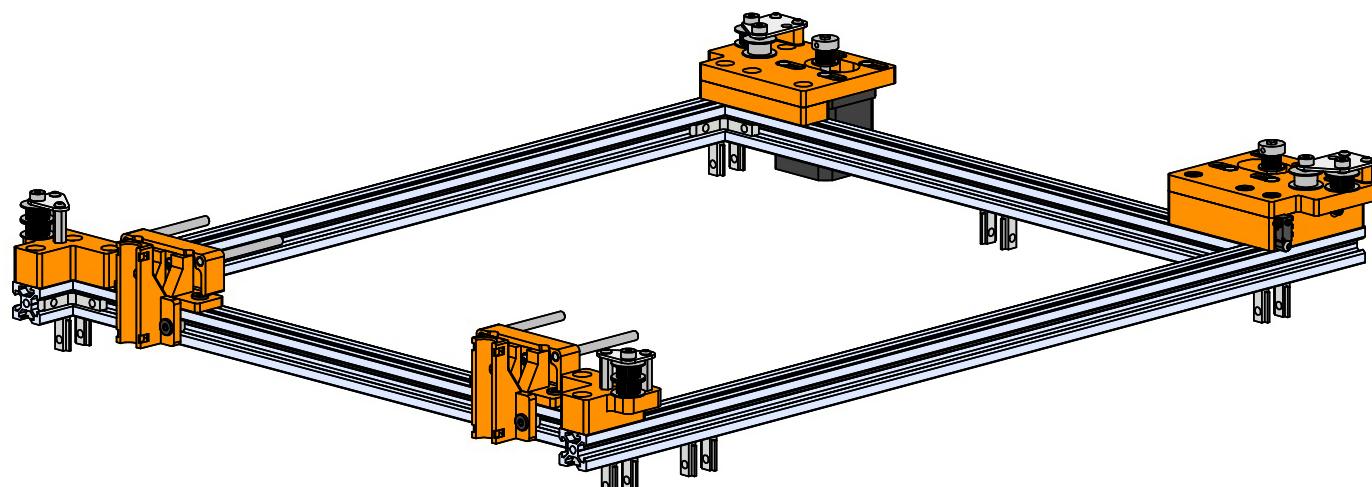
2

1



The exact location of these four assemblies doesn't matter as we will dial them in upon first power-up.

Exploded View



Assembled View

ITEM NO.	DESCRIPTION	QTY.
1	CoreXY Frame Assembly	1
6	Adjustable Parking Post	2
7	Tool Cable Management Assembly	2

Tool Post Installation



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Joshua Vasquez

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SCALE: 1:4

SHEET 21 OF 36

2

1

B

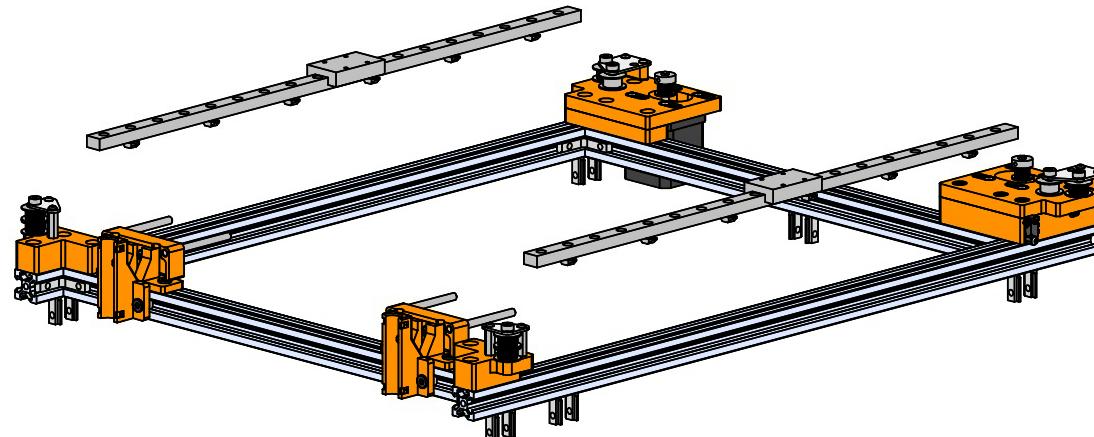
A

2

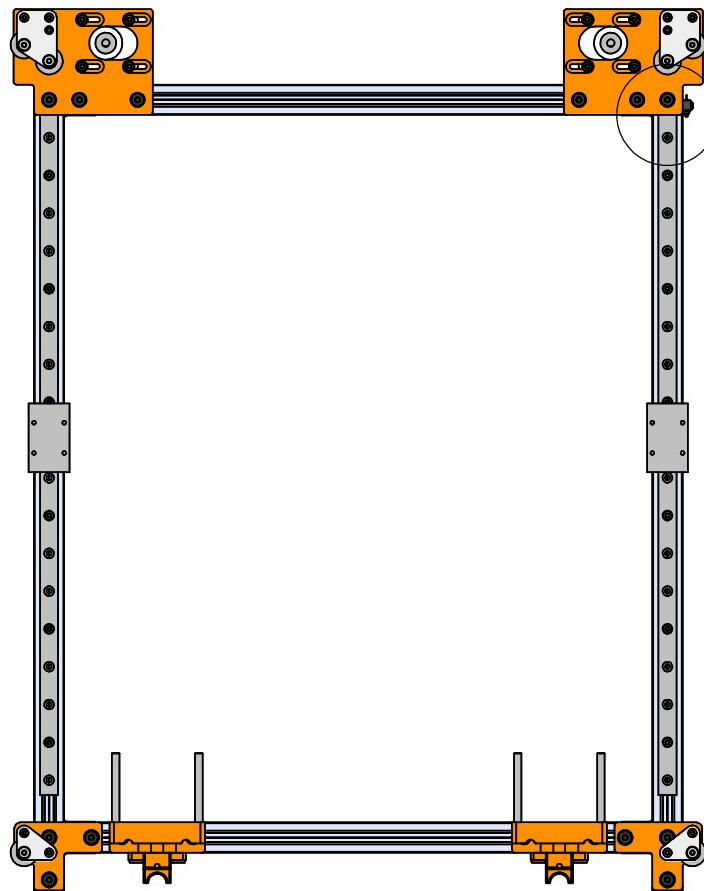
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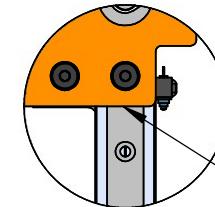
B



Install the Y rails snugly, but do not yet fully-tighten them.



K



DETAIL K
SCALE 2 : 5

Note that the rails are flush with the motor brackets.

A

A

Y Rail Installation



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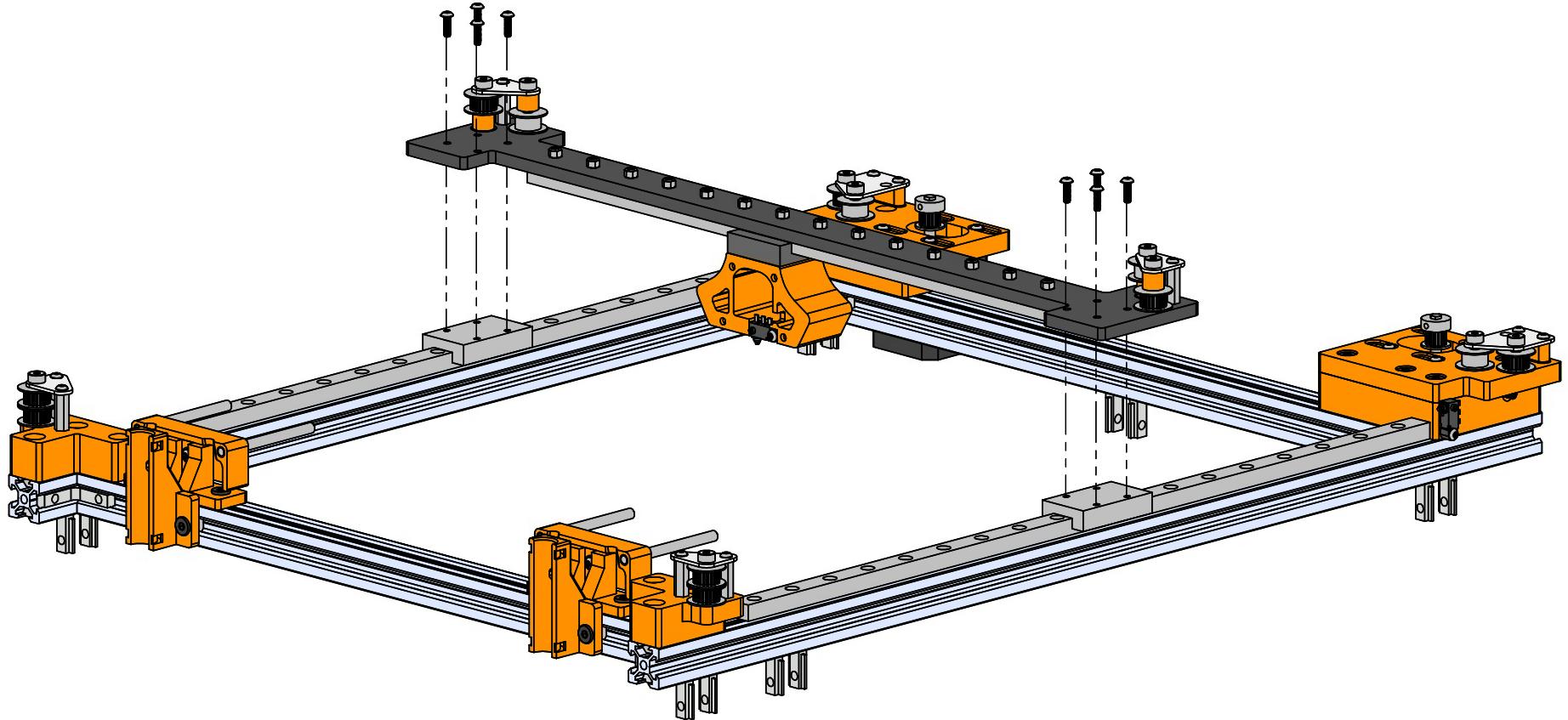
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SCALE: 1:5

SHEET 22 OF 36

2

1



Install the Crossbar in the orientation shown above. Secure it with fasteners snugly, but do not fully tighten it.

ITEM NO.	DESCRIPTION	QTY.
1	CoreXY Frame Assembly with Y Rails	1
7	M3 Buttonhead Screw, 10mm long	8
8	Crossbar Assembly with Carriage Center	1

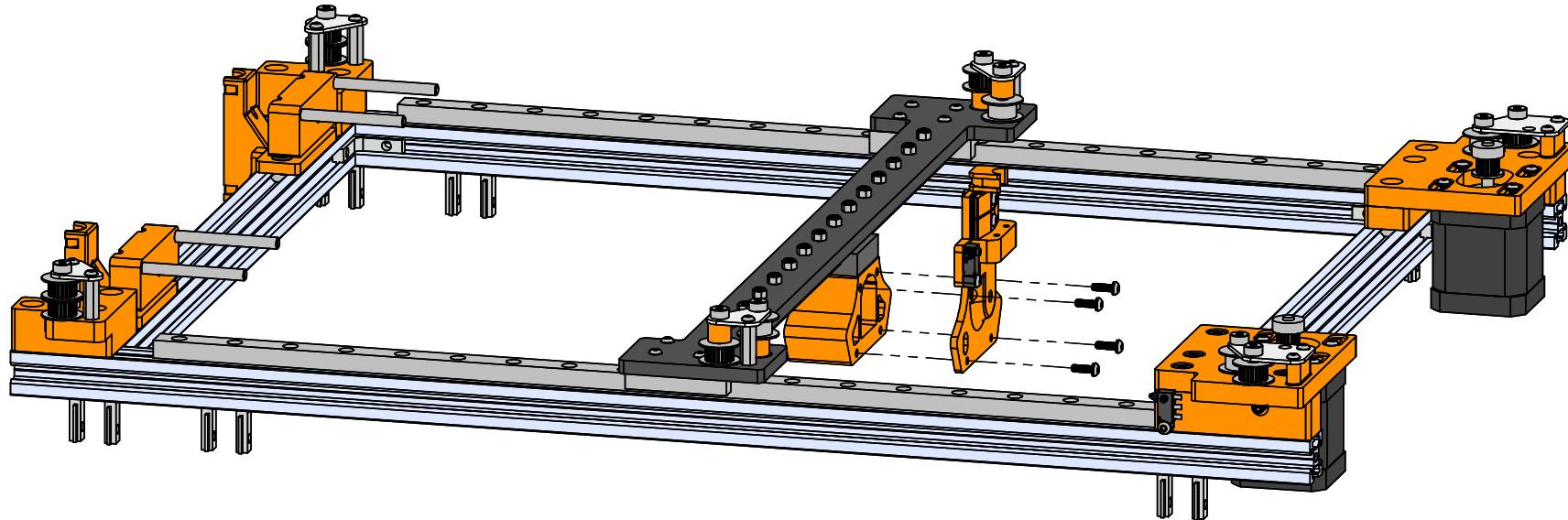
Crossbar Installation		
	Created by: Joshua Vasquez	last edited: 10/19/2019
	SCALE: 1:3	SHEET 23 OF 36

2

1

B

B



Install the carriage back plate assembly with 4 screws.

A

A

ITEM NO.	DESCRIPTION	QTY.
1	CoreXY Frame with Carriage Center Assembly	1
7	M3 Buttonhead Screw, 10mm long	4
9	Carriage Back Plate Assembly	1

Carriage Back Installation



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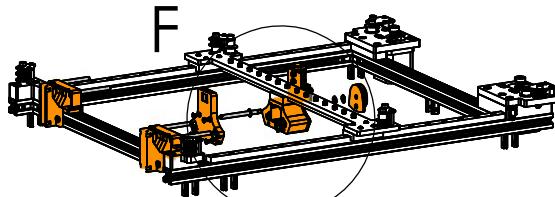
SCALE: 1:3 SHEET 24 OF 36

2

1

2

1

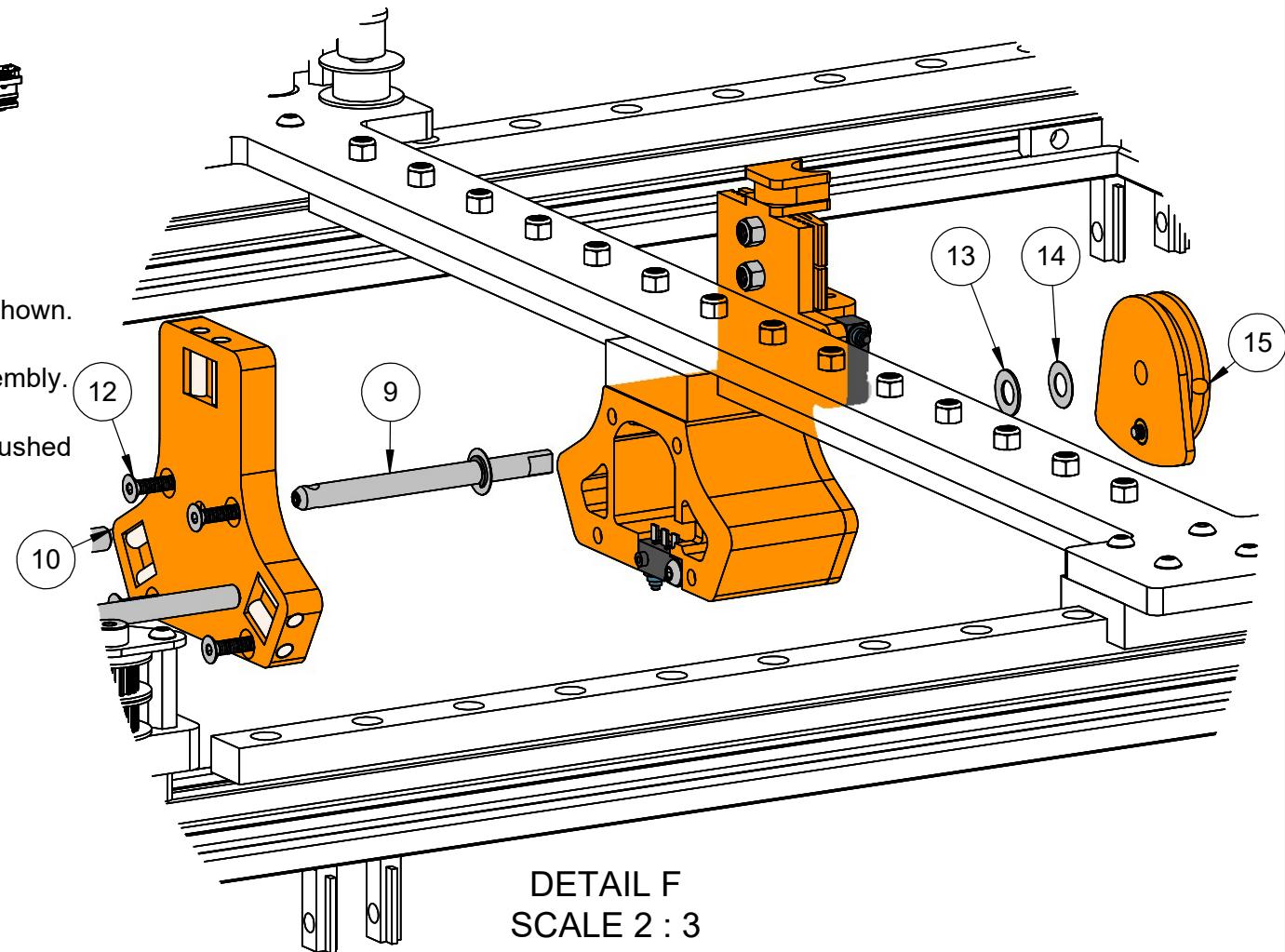


B

Install the remaining carriage items as shown.

Tip: start by inserting the twist-lock assembly.

Ensure that the twist-lock assembly is pushed all the way into the Carriage back plate.



A

A

ITEM NO.	DESCRIPTION	QTY.
9	Toolchanger Twist-Lock Assembly	1
10	Toolchanger Coupling Plate Assembly	1
12	M3 Flathead Screw, 16mm long	4
13	M5 Belleville Disc Spring	1
14	M5 Shim, 0.2mm thick	1
15	Toolchanger Pulley Assembly	1

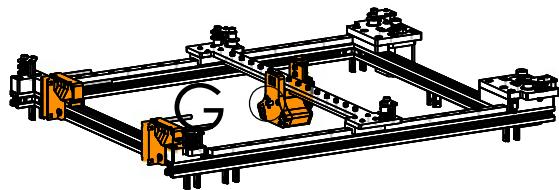
Full Carriage Assembly		
	Created by: Joshua Vasquez	last edited: 10/19/2019
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2

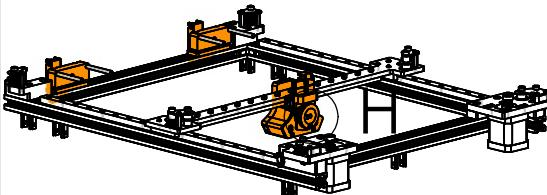
1

2

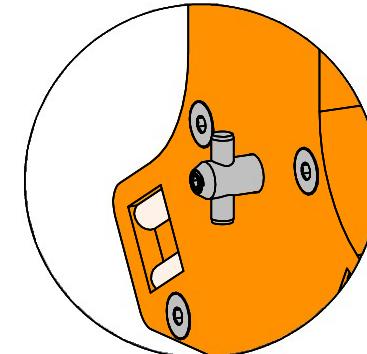
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B

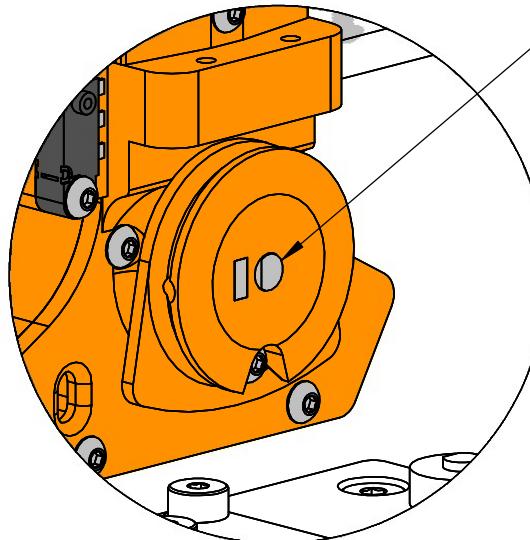


B



DETAIL G
SCALE 1 : 1

Center the 3mm dowel pin and tighten it with the setscrew.



DETAIL H
SCALE 1 : 1

Fasten down the pulley setscrew ensuring that it engages the flat part of the twist-lock shaft.

A

Twist Lock Orientation Check



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2

1

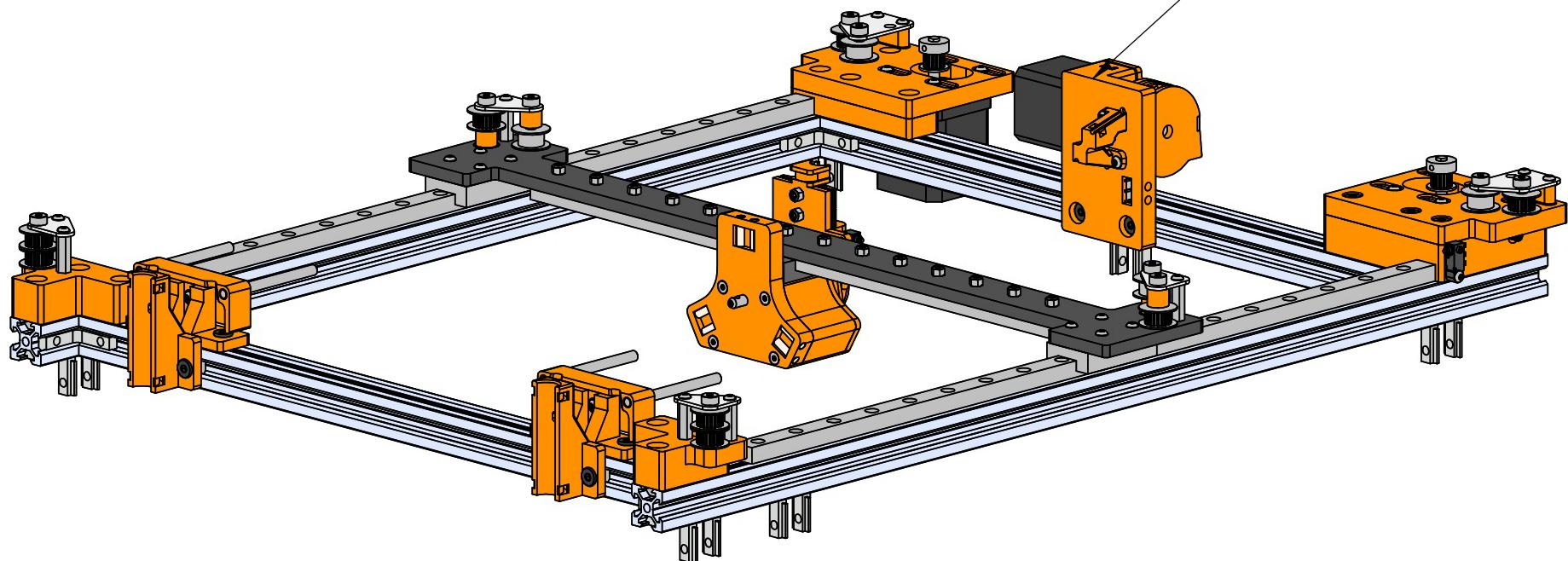
2

1

Install the Lock Actuator in the temporary position shown below. This orientation makes subsequent wire-rope threading easier.

B

B



A

A

Lock Actuator Temporary Fixturing



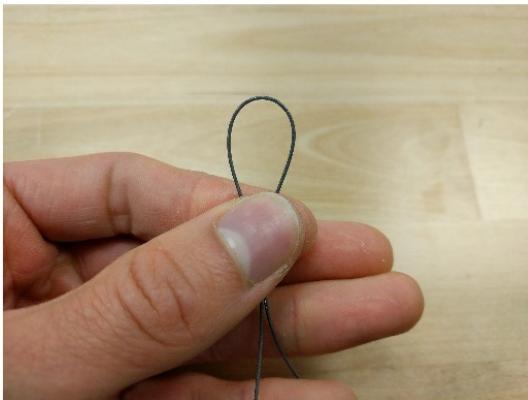
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SCALE: 1:3	SHEET 27 OF 36

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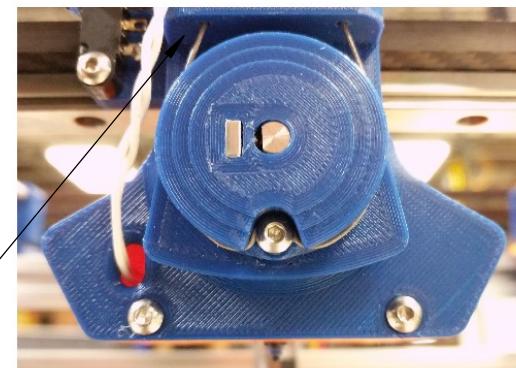
2

Take 1600mm of wire rope and form a loop around the halfway point with your fingers.



1

Fasten the loop under the pulley's buttonhead screw. Note: you may need to unscrew it to fit it under the screw head.



Spool the corresponding loose ends through the two adjacent holes in the Carriage Back Plate.

Note: there should not be any twists. Each loose end should fit through the closest hole.

B

B

A

A

2

1

Carriage-Side Control Cable Installation



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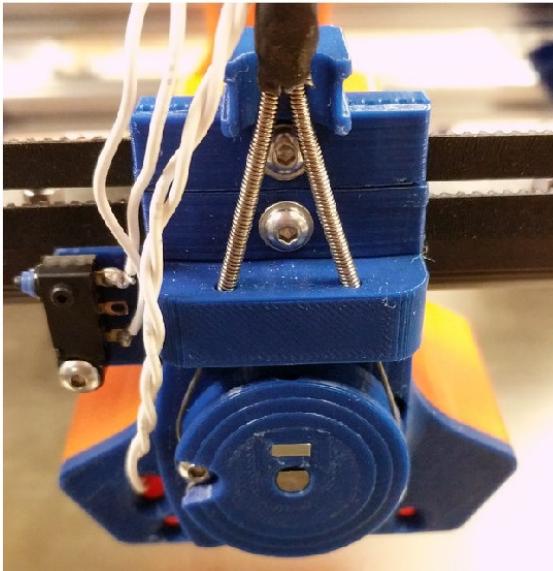
2

1

Either zip-tie the two spring guides together at several points to create one bundle
 OR
 thread the spring guides into a length of nylon sleeving and heat-shrink the tips.

B

B



A

A

Thread the two loose ends through the entire length of both spring-guides until each spring guide seats into the back carriage coupler plate.

ITEM NO.	DESCRIPTION	QTY.
1	600mm Spring Guide	2

Carriage-Side Spring Guide Installation



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2

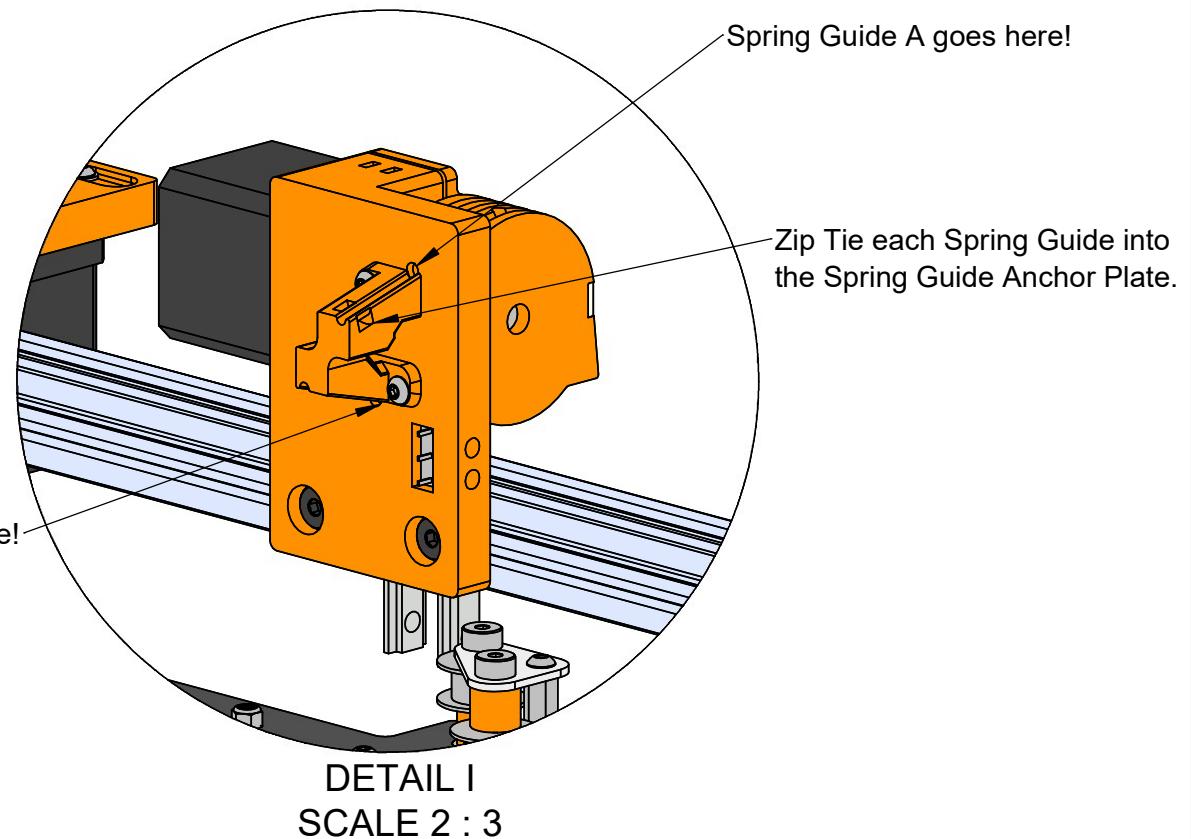
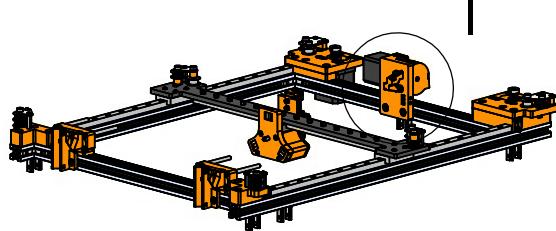
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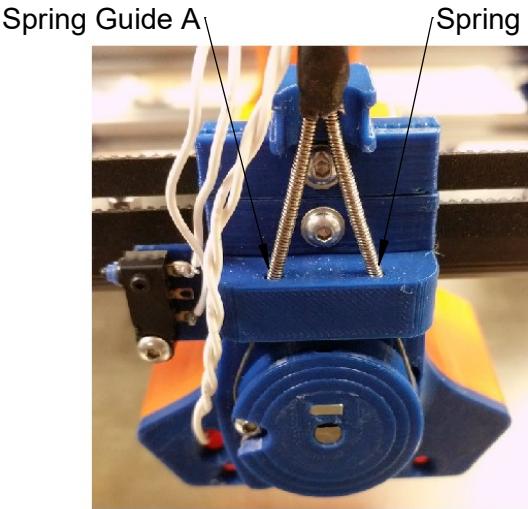
1

Continue threading each wire rope end into the Lock Actuator in the locations shown below. Firmly install the spring guide all the way into the hole until it reaches its hard stop.

B



A



2

1

Lock Actuator Spring Guide Installation



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2

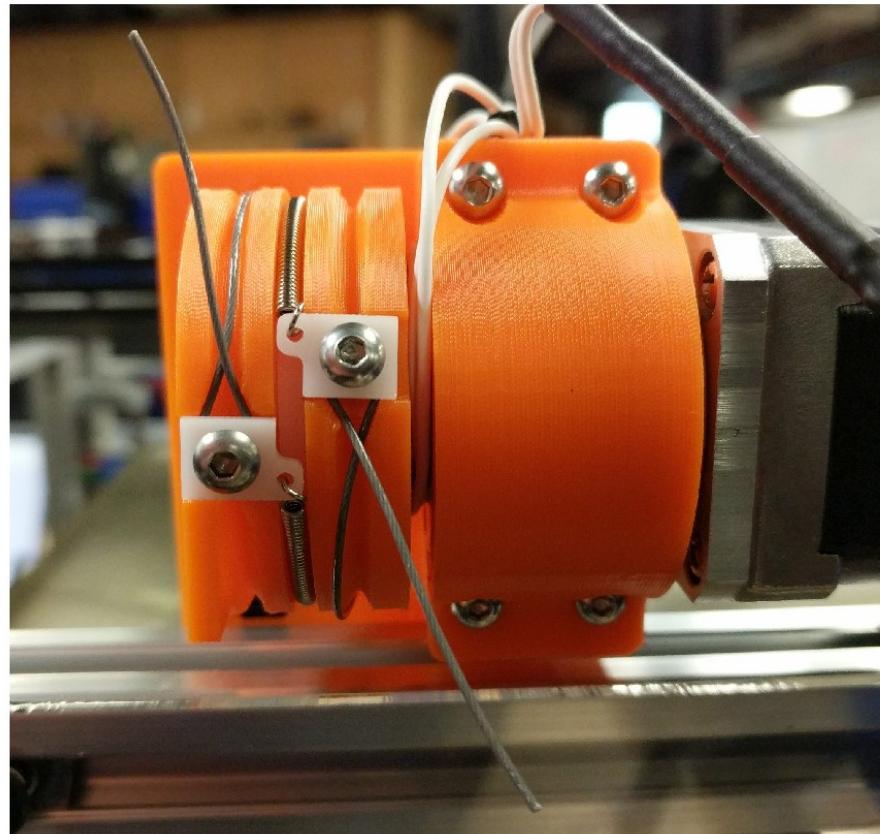
1

Center the lock actuator such that the cinch plates are approximately centered.

Loosen both cinch plates on the Lock Actuator. Loop each wire rope end into each corresponding cinch plate as shown below. Take out all the slack and tighten both cinch plates gently. Keep the cinch plates loose enough such that tugging on the wire would cause them to slip. In the next step we will fasten them down in the proper alignment.

B

B



A

A

Lock Actuator Pulley Cinching



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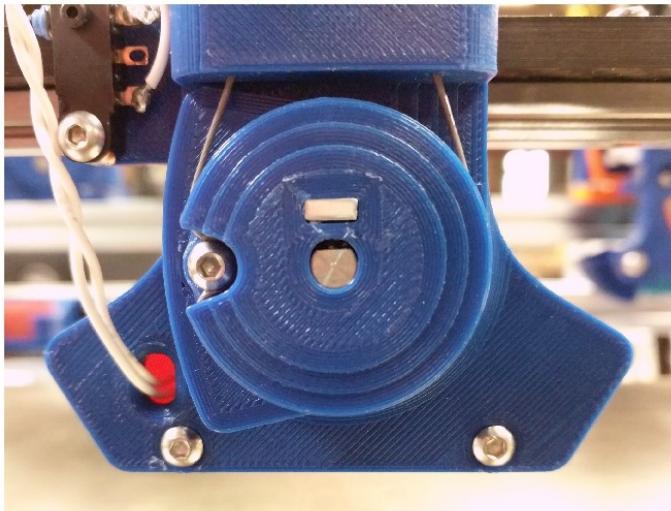
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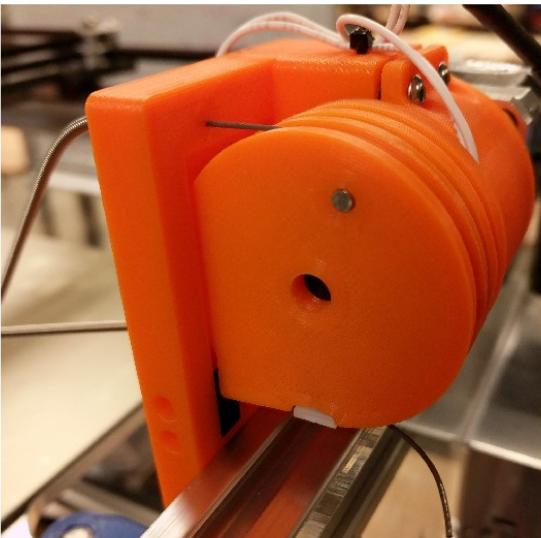
2

1

2



Hold the carriage-side pulley in this configuration.



1

By hand, manually twist the pulley on the carriage until it is in the fully unlocked position as shown on the left.

Put one hand on the pulley to hold it in this position and prevent it from rotating.

B

B

With one hand on the carriage-side pulley, rotate the lock actuator pulley such that it is clicking the external switch. In this process, one wire rope should slip while the other one should stay under tension.

Now let go of the carriage side pulley. With a hex key, fully-tighten down both cinch plates such that the wire rope can no longer slip.

Note: you may need to rotate the Lock Actuator pulley to a neutral position to tighten down the cinch plates. This is fine, but ensure that the wire ropes do not slip any further in the process. If they do, restart this procedure from the last page.

A

A

Lock Actuator Tension Check



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2

1

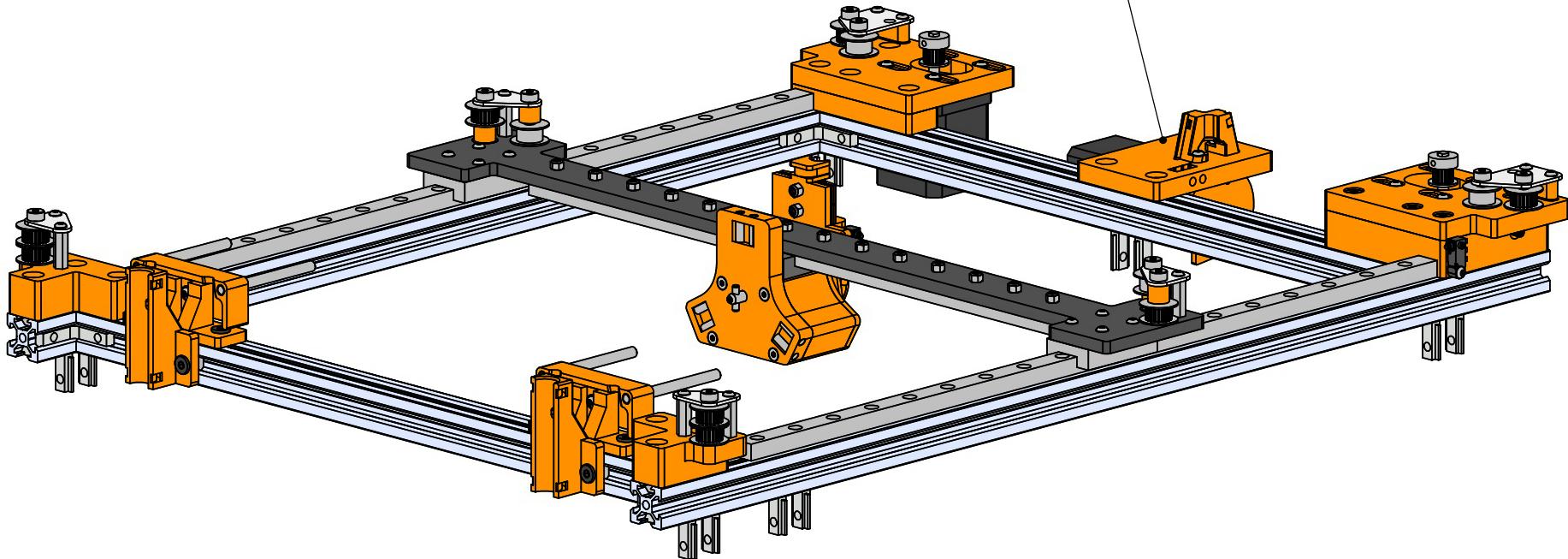
2

1

Reinstall the lock actuator in the original position.

B

B



Ensure that the crossbar can slide up-and-down the Y-rail by hand, and then fully tighten all Y-rail screws.

A

A

Lock Actuator Final Installation



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2

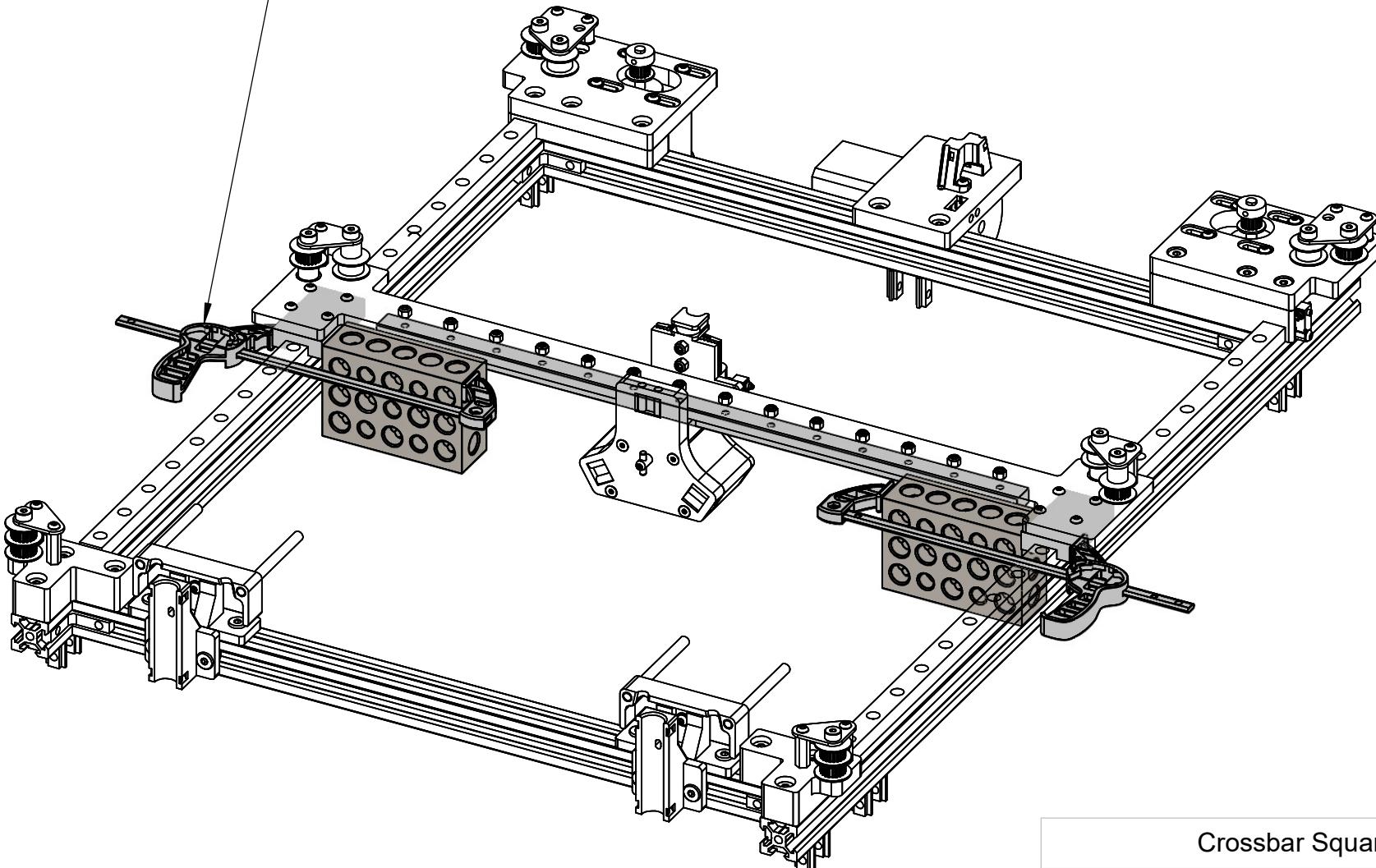
1

Do this part on a table or other flat surface.

With two *1-2-3 blocks*, align the loose x-rail with the carriages on the y-rails by pushing both blocks into the corners ensuring that both contacting faces of all parts are fully flush to the *1-2-3 blocks*. Gently apply clamps to hold the blocks in this position. Fully-tighten all remaining loose screws in this configuration. When done, remove the blocks.

B

B



A

A

Crossbar Squaring



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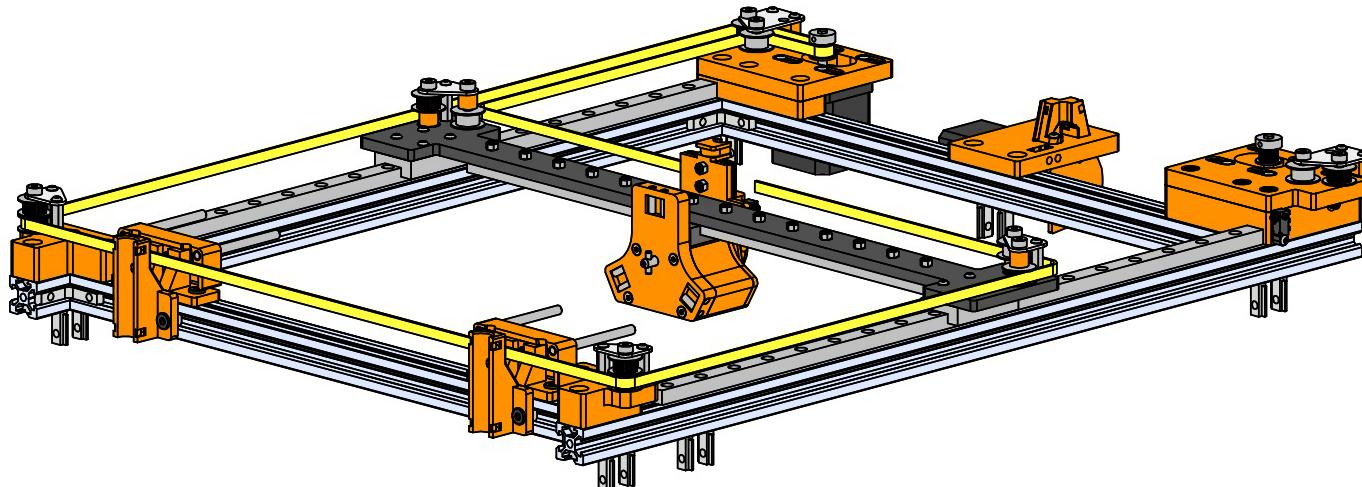
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10/19/2019

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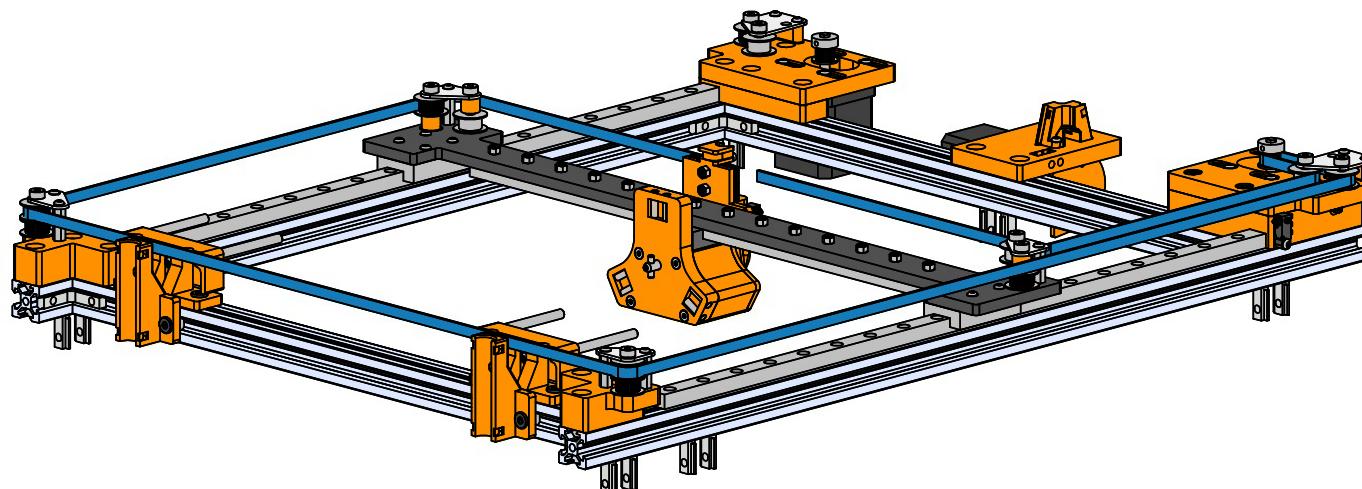
1



B

B

Install the lower belt by following the pattern shown above and tightening both ends into the carriage. Only 4-5 timing belt teeth need to seat into the carriage, and the belt will feel extremely loose in this configuration. Then do the same for the upper belt pattern shown below.



A

A

ITEM NO.	DESCRIPTION	QTY.
1	CoreXY Frame	1
2	2GT Timing Belt, 6mm wide, 2m long	2

Belt Installation



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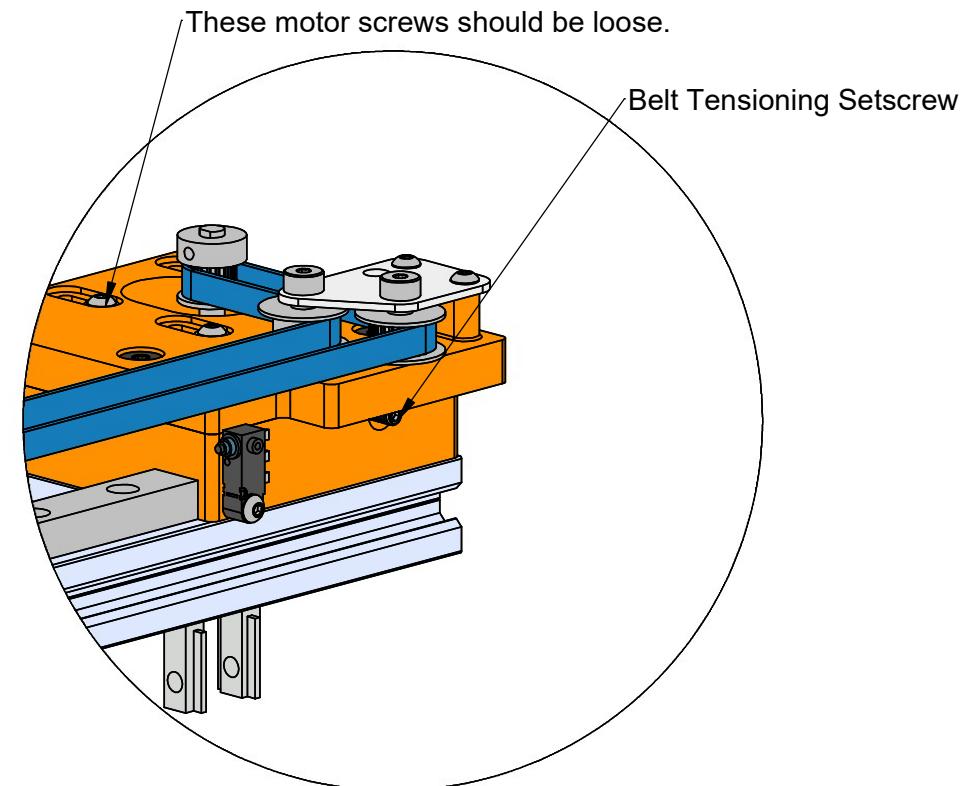
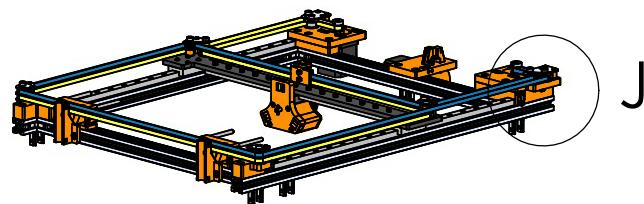
2

1

2

1

First ensure both drive motors are loose and can slide back-and-forth in their slots when pushed by-hand. Then locate the tensioning setscrews on each sides of the motor corner plates.



DETAIL J
SCALE 2 : 3

Install the Gates Carbon Drive App to a smartphone. With your smartphone microphone near the belt and the app running, *pluck* the belt like a guitar string and measure the frequency. Gradually increase belt tension by tightening the setscrew until the measurements average 50Hz. Do this process on both belts. When done, tighten down the motor screws.

Your XY Frame is complete!

Belt Tensioning		
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2

1