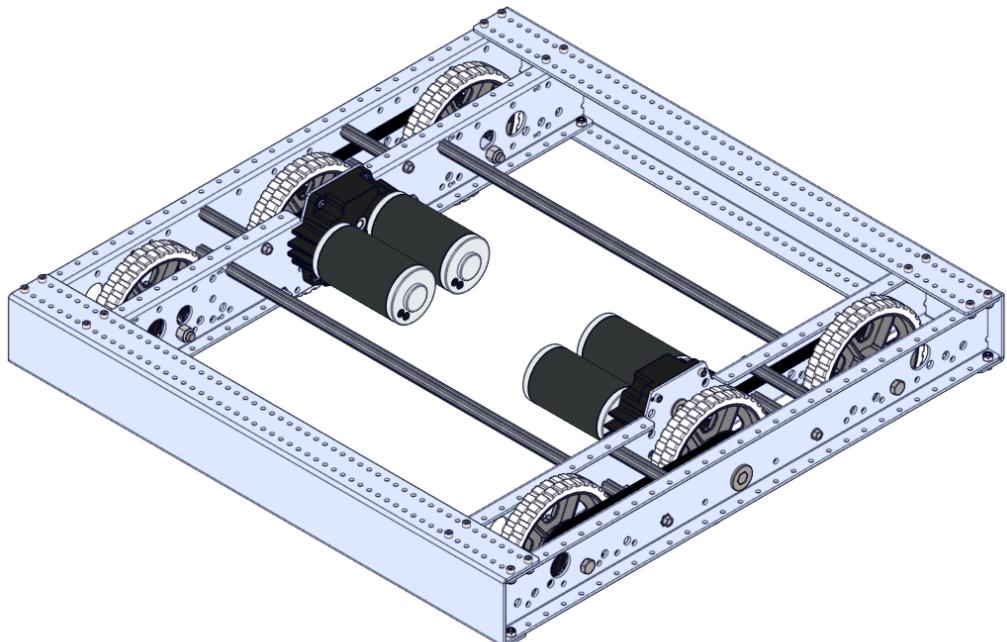




# User Guide

*AM14U4 Chassis Base Kit for the  
2019 FIRST® Robotics Competition*



# AndyMark – Your Robot Parts Experts

AndyMark, Inc. was founded in 2004 by Andy Baker and Mark Koors to design and sell unique mechanical parts for competition and educational robotics. Through their volunteer work with FIRST® Robotics Competition events they identified a niche market and began designing and selling robotics components for FIRST® teams. At that time, many designs were being shared and re-created, but finding the correct fabrication resources for these parts was difficult for some FRC teams. AndyMark has been a proud supplier to the FIRST® Robotics Competition since 2005.

## System Overview

The AM14U4 Drive Chassis Base Kit is designed to help teams accomplish the basics in the FIRST® Robotics Competition. The AM14U4 Base Kit includes standard AndyMark products and is designed to also work with additional AndyMark products.

## Additional Instructions Available

We encourage customers to seek product information at [AndyMark.com](http://AndyMark.com), contact us via e-mail at [support@andymark.com](mailto:support@andymark.com), or call Toll-Free **877-868-4770** with questions about any of our products.

Detailed assembly tips and instructional videos can be found at [AndyMark.com/FRCVideos](http://AndyMark.com/FRCVideos). Additional resources, layout prints, and CAD are available on the [AndyMark.com/KOP](http://AndyMark.com/KOP) web page.

## **AM14U4 Recommended Hand Tool List (not included)**

Component	Part Number	QTY	Part Photo
<b>Hammer</b>	Available at your local hardware store.	1	
<b>Cordless Drill or Driver</b>	Available at your local hardware store.	1	
<b>3/8" Magnetic Nut Setter</b>	<a href="#">am-2755</a>	1	
<b>5/16" Magnetic Nut Setter</b>	<a href="#">am-2754</a>	1	
<b>9/16" Socket, 3/8" Drive</b>	<a href="#">am-2743</a>	1	
<b>3/8" Socket, 3/8" Drive</b>	<a href="#">am-2740</a>	1	
<b>5/32" Ball End Hex Bit Driver</b>	<a href="#">am-2748</a>	1	
<b>3/8" Drive Quick Release Ratchet</b>	<a href="#">am-2753</a>	1	
<b>1/2" - 9/16" Open-End Wrench</b>	<a href="#">am-2746</a>	1	

## Wheel Assembly Bill of Materials

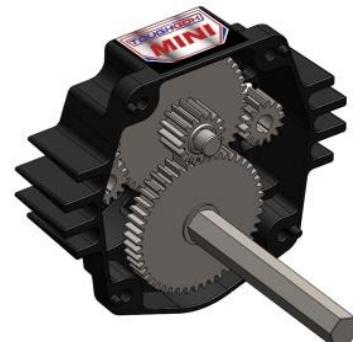
Component	Part Number	Quantity	Part Photo
6" HiGrip Wheel	<a href="#">am-0940b</a>	6	
500EX Hex Hub	<a href="#">am-2568</a>	2	
Gates HTD 15mm wide, 160 Tooth Belt for Long Chassis	<a href="#">am-2266</a>	4	
Gates HTD 15mm wide, 120 Tooth Belt for Wide Chassis	<a href="#">am-2704</a>	4	
Gates HTD 15mm wide, 131 Tooth Belt for Square Chassis	<a href="#">am-2571</a>	4	
Pulley Half, 42 Tooth	<a href="#">am-2234-half</a>	16	
<b>Wheel Screw Kit – (am-14U4_CK7)</b>			
10-24 x 1.25" Thread Forming Screws	<a href="#">am-1266</a>	48	
<b>Bearing Kit – (am-14U4_CK8)</b>			
1614ZZ Bearing	<a href="#">am-0209</a>	8	
FR8ZZ - HexHD Bearing	<a href="#">am-2986</a>	2	

## Toughbox Mini Overview

Each AM14U4 Chassis Base Kit includes two (2) **AndyMark** Toughbox Mini Gearboxes, unassembled ([am-2598 K19](#)). Each Toughbox Mini includes the parts needed to mount two 2.5" CIM motors ([am-0255](#)). Each gearbox has mounting holes for an optional encoder such as the USDigital E4T Optical Encoder ([am-3132](#)).

### Gearbox Specifications:

- Gear Profile: 20 DP, 14.5° pressure angle
- Gear Material: Cold-formed 4140 Steel
- Gear Ratio: 10.71:1
  - CIM Gear: 14 Tooth (8mm bore w/ 2mm keyway)
  - Large Cluster Gear: 50 Tooth (3/8" Hex bore)
  - Small Cluster Gear: 16 Tooth (3/8" Hex bore)\*
  - Large Output Gear: 48 Tooth (1/2" Hex bore)\*
- Output Shaft: 1/2" Hex, 4140 Steel
- Housing Material: Nylon 6/6 with long fiber reinforcements



\*To change the drive speed of the AM14U4, different gear ratios can be used in the Toughbox Mini. The AM14U4 features a center wheel directly driven by a TB Mini Hex Output Shaft. To change the ratio and drive speed, the standard 16 tooth Small Cluster Gear and 48 tooth Large Output Gear will need to be replaced with two gears totaling 64 teeth. The higher the ratio, the slower the output speed.

More information about these optional gears can be found at "[AndyMark.com/TBmini](#)".

Ratio	CIM Gear	Lg. Cluster	Sm. Cluster	Lg. Output	AM14U4 Speed**
<b>5.95:1</b>	<b>14T (<a href="#">am-0034</a>)</b>	<b>50T (<a href="#">am-0149</a>)</b>	<b>24T (<a href="#">am-0177</a>)</b>	<b>40T (<a href="#">am-0178</a>)</b>	<b>18.0 ft/sec</b>
<b>7.31:1</b>	<b>14T (<a href="#">am-0034</a>)</b>	<b>50T (<a href="#">am-0149</a>)</b>	<b>21T (<a href="#">am-2564</a>)</b>	<b>43T (<a href="#">am-2565</a>)</b>	<b>14.7 ft/sec</b>
<b>8.45:1</b>	<b>14T (<a href="#">am-0034</a>)</b>	<b>50T (<a href="#">am-0149</a>)</b>	<b>19T (<a href="#">am-0176</a>)</b>	<b>45T (<a href="#">am-0179</a>)</b>	<b>12.7 ft/sec</b>
<b>10.71:1 (included)</b>	<b>14T (<a href="#">am-0034</a>)</b>	<b>50T (<a href="#">am-0149</a>)</b>	<b>16T (<a href="#">am-0747</a>)</b>	<b>48T (<a href="#">am-0885</a>)</b>	<b>10.0 ft/sec</b>
<b>12.75:1</b>	<b>14T (<a href="#">am-0034</a>)</b>	<b>50T (<a href="#">am-0149</a>)</b>	<b>14T (<a href="#">am-0151</a>)</b>	<b>50T (<a href="#">am-0150</a>)</b>	<b>8.4 ft/sec</b>

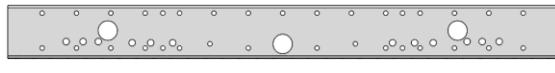
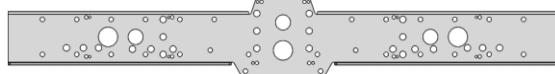
\*\*AM14U4 speed estimation is based on calculations using 6" wheels, and one CIM motor per TB Mini running at 4100 rpm, or 75% of free speed.

### Toughbox Mini Bill of Materials

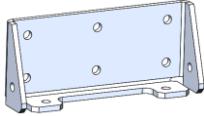
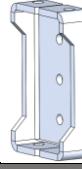
Component	Part Number	Quantity	Part Photo
<b>TB Mini Housing</b>	<a href="#">am-0650</a>	1	
<b>TB Mini Hex Output Shaft with Steel Dowel</b>	<a href="#">am-2566a_K19</a>	1	
<b>TB Mini Small Hex Shaft</b>	<a href="#">am-0152</a>	1	

TB Mini Kit 1– am-14U4_TM1			
<b>50 Tooth, 3/8" Hex Gear</b>	<a href="#">am-0149</a>	1	
<b>14 Tooth, 8mm CIM Gear</b>	<a href="#">am-0034</a>	2	
<b>16 Tooth, 3/8" Hex Gear</b>	<a href="#">am-0747</a>	1	
<b>48 Tooth, 1/2" Hex Gear</b>	<a href="#">am-0885</a>	1	
TB Mini Kit 2 – am-14U4_TM2			
<b>R6ZZ Bearing</b>	<a href="#">am-0516</a>	2	
<b>FR6ZZ Bearing</b>	<a href="#">am-0028</a>	1	
<b>FR8ZZ HexHD Bearing</b>	<a href="#">am-2986</a>	1	
<b>Red Tacky Grease Pack</b>	<a href="#">am-2768</a>	1	
TB Mini Kit 3 – am-14U4_TM3			
<b>2x2x10mm Machine Key</b>	<a href="#">am-1121</a>	2	
<b>5/16" Washer</b>	<a href="#">am-1009</a>	4	
<b>8mm Retaining Clip</b>	<a href="#">am-0033</a>	2	
<b>10-32 x 0.625" SHCS with Nylon Thread Lock Patch</b>	<a href="#">am-1120</a>	4	
<b>10-32 x 0.75" SHCS</b>	<a href="#">am-1047</a>	4	
<b>10-32 Nylock Nut</b>	<a href="#">am-1042</a>	4	
<b>1/2" E-Clip Ring</b>	<a href="#">am-0206</a>	1	

## AM14U4 Chassis Frame Bill of Materials

Component	Part Number	QTY	Part Photo
AM14U4 End Plate	<a href="#">am-3920</a>	2	
AM14U4 Outer Plate	<a href="#">am-3921</a>	2	
AM14U4 Inner Plate	<a href="#">am-3922</a>	2	
500 Churro, 24.25"	<a href="#">am-2974</a>	2	
<b>AM14U4 – Churro Screw Kit – AM14U4_CK1</b>			
1/4-20 x 0.75" Thread Rolling Screw	<a href="#">am-1310</a>	28	
<b>AM14U4 – Axle Kit – AM14U4_CK2</b>			
3/8-16 x 4.25" HHS Bolt	<a href="#">am-1297</a>	4	
3/8-16 Nylock Nut	<a href="#">am-1054</a>	4	
<b>AM14U4 – Spacer Kit – AM14U4_CK3</b>			
0.570" Hex Spacer	<a href="#">am-1305</a>	2	
Plastic Spacer 0.280"	<a href="#">am-1306</a>	4	
Plastic Spacer 0.850"	<a href="#">am-1307</a>	4	
<b>AM14U4 – Frame Hardware Kit – AM14U4_CK4</b>			
10-32 x 0.5" SHCS	<a href="#">am-1002</a>	24	
10-32 Nylock Nut	<a href="#">am-1042</a>	24	
<b>AM14U4 Churro Kit – am-14U4_CK5</b>			
500 Churro, 3.375"	<a href="#">am-2569</a>	8	

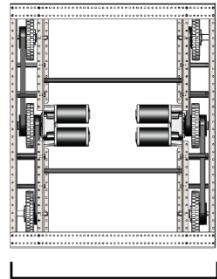
## AM14U4 Additional Parts

Bumper Hardware Included Parts						
Component	Part Number	QTY	Part Photo			
<b>Front/Corner Bumper Bracket</b>	<a href="#">am-3961</a>	4				
<b>Side Mount Bumper Bracket</b>	<a href="#">am-3962</a>	8				
AM14U4 – Bumper Hardware Kit – AM-3966h						
<b>10-32 RHS x 3.750"</b>	<a href="#">am-1502</a>	12				
<b>10-32 Wing Nut</b>	<a href="#">am-1483</a>	25				
<b>#8 Phillips Flat Head Wood Screw</b>	<a href="#">am-1387</a>	50				
<p><b>Note:</b> Additional items are needed for bumper assembly including pool noodles, robust red and blue fabric, industrial staples and corner brackets. For supplies, visit <a href="#">AndyMark.com</a>.</p>						
Battery Tray Parts						
Component	Part Number	QTY	Part Photo			
<b>10-32 x 0.5 SHCS</b>	<a href="#">am-1002</a>	10				
<b>1/4-20 x 0.75" Thread Rolling Screw</b>	<a href="#">am-1310</a>	4				
<b>10-32 Nylock Jam Nut</b>	<a href="#">am-1063</a>	10				
<b>6-32 x 0.750 HHS</b>	<a href="#">am-1424</a>	2				
<b>6-32 Nylock Jam Nut</b>	<a href="#">am-1419</a>	2				
<b>500 Churro, 3.375"</b>	<a href="#">am-2569</a>	2				
<b>Battery Strap</b>	<a href="#">am-3965</a>	1				
<b>Battery Vertical Mount Strap Clamp</b>	<a href="#">am-3960</a>	1				

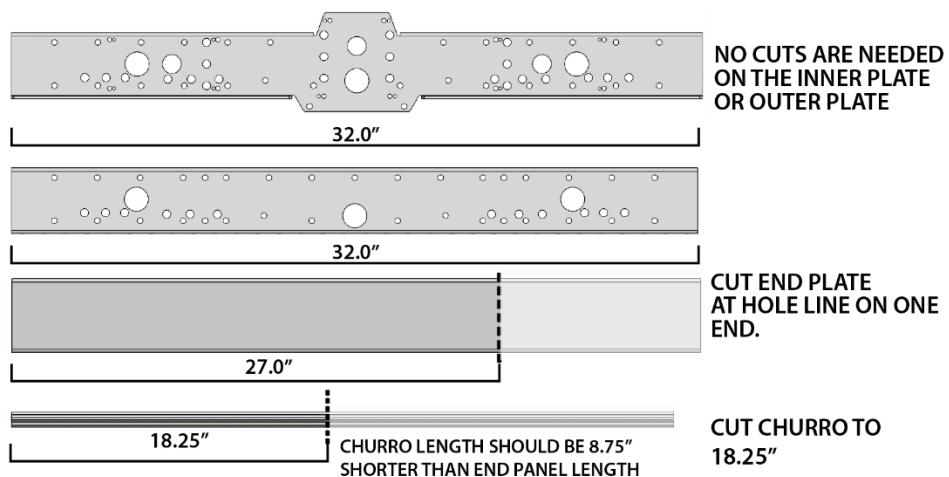
## Frame Diagrams & Cut Lines:

The AM14U4 is designed for multiple configurations. Chassis pieces **should be measured** and cut down to size; some possible configurations are shown below. Ensure that your final frame size complies with all current rules. Belts for **LONG, SQUARE** and **WIDE** configurations are included in the full AM14U4 Kit.

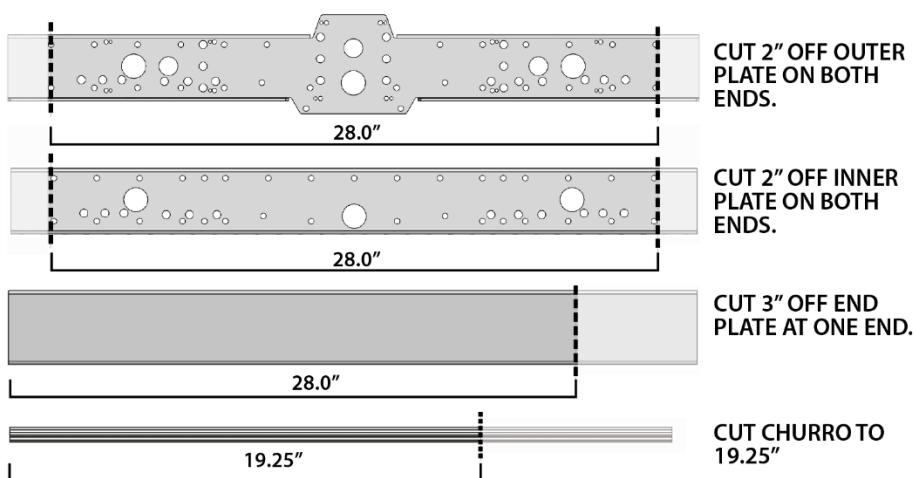
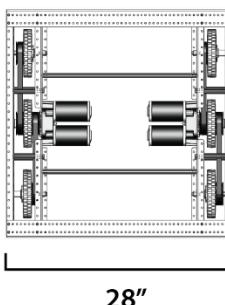
### LONG CHASSIS



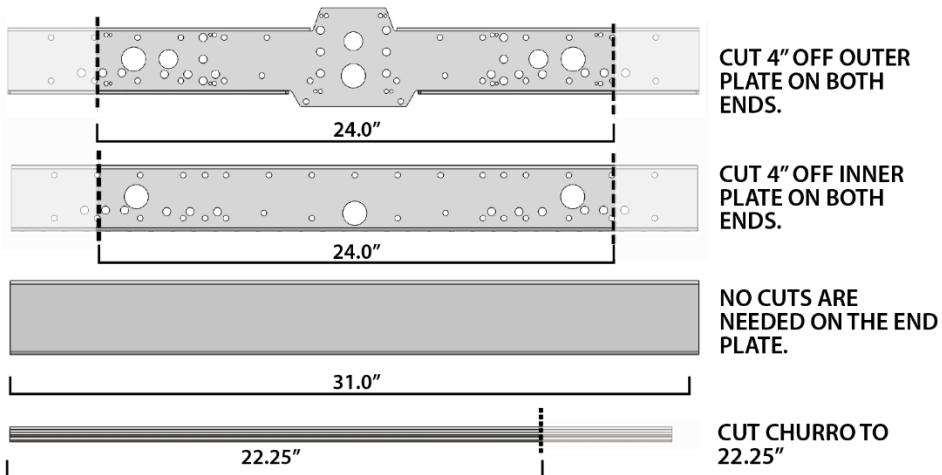
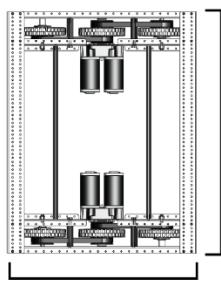
**NOTE:** Ensure your final frame size complies with all robot perimeter rules.



### SQUARE CHASSIS



### WIDE CHASSIS



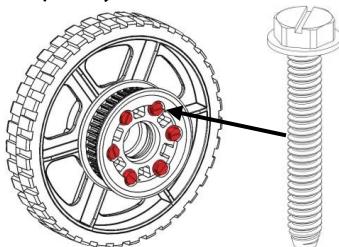
# 6" HiGrip Wheel and Pulley Assembly Instructions

## Outer Wheels (QTY 4)

**Step 1:** Add two pulley halves (am-2234-half) to the wheel (am-0940b).



**Step 2:** Using six 10-24 x 1.25" (am-1266) thread forming screws, attach the pulley halves to the wheel.



**Step 3:** Press two 1614ZZ bearings (am-0209) into each side of the wheel/pulley.



**4X**

**NOTE:** Tighten the screws in a star pattern to ensure the pulley aligns evenly on the wheel.

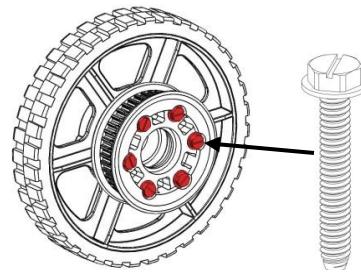
## Center Wheels (QTY 2)

**Step 1:** Add two pulley halves (am-2234-half) to the wheel (am-0940b).

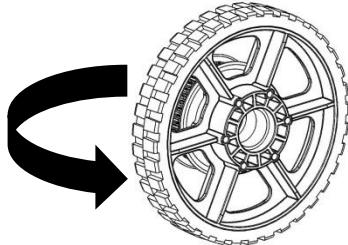


**NOTE:** Tighten the screws in a star pattern to ensure the pulley aligns evenly on the wheel.

**Step 2:** Using six 10-24 x 1.25" (am-1266) thread forming screws attach the pulley halves to the wheel.



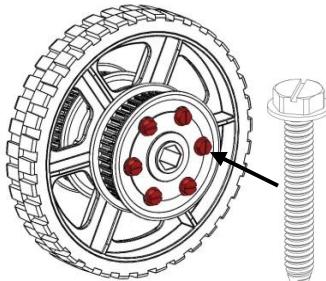
**Step 3:** Flip wheel over.



**Step 5:** Insert one 500EX Hex Hub (am-2568) into the pulley on one side of the wheel.



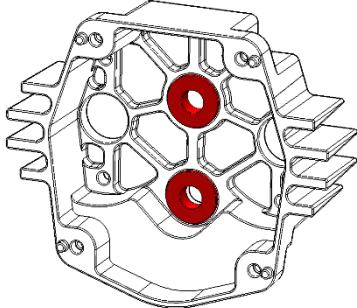
**Step 6:** Add six 10-24 x 1.25" (am-1266) thread forming screws to attach the pulley and hub to the wheel.



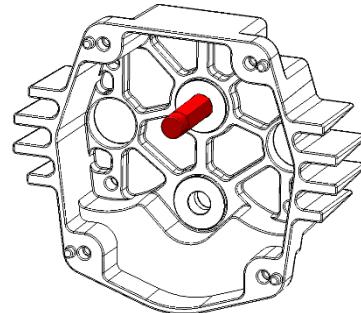
**2X**

## Toughbox Mini Assembly Instructions – Build 2 gearboxes per chassis

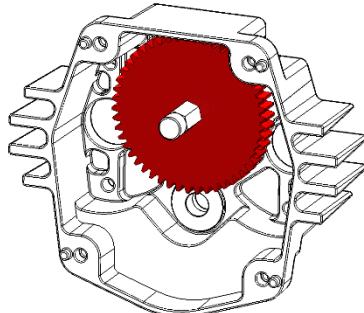
**Step 1:** Press two R6ZZ bearings (am-0516) into the two center holes of the TB Mini Housing (am-0650). Ensure they are fully seated and inserted all the way into the housing.



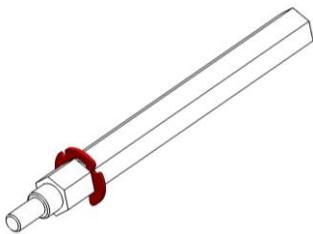
**Step 2:** Insert the TB Small Hex Shaft (am-0152) into R6ZZ bearing closest to the flat edge of the housing.



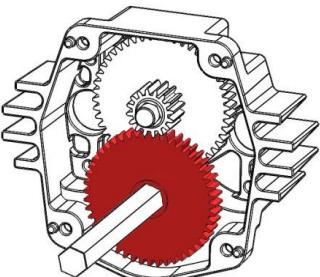
**Step 3:** Place the 50 tooth gear (am-0149) on the TB Small Hex Shaft with the **small round boss touching the bearing** and the flat side of the gear facing up.



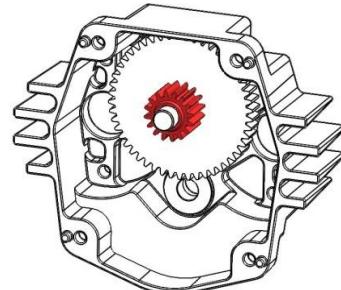
**Step 5:** Tap the 1/2" E-Clip (am-0206) onto the groove on the TB Hex Output Shaft (am-2566a\_K19).



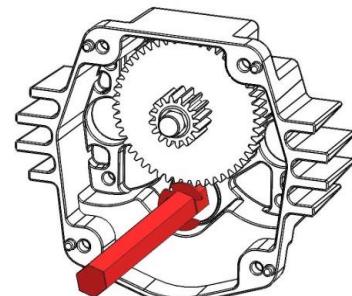
**Step 7:** Place the 48 Tooth Gear (am-0885) on TB Hex Output Shaft **flat side down touching the 1/2" E-Clip**.



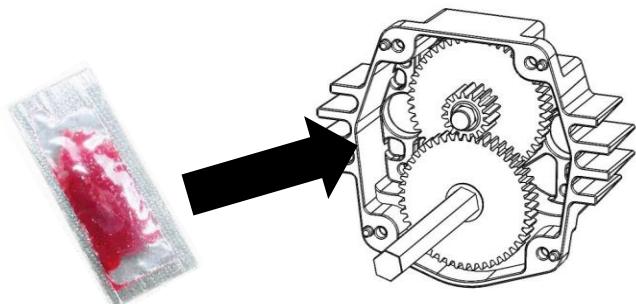
**Step 4:** Place the 16 tooth gear (am-0747) on the TB Small Hex Shaft with **flat side down touching the 50 tooth gear**.



**Step 6:** Insert the small end of the TB Hex Output Shaft (am-2566a\_K19) into the other R6ZZ bearing.

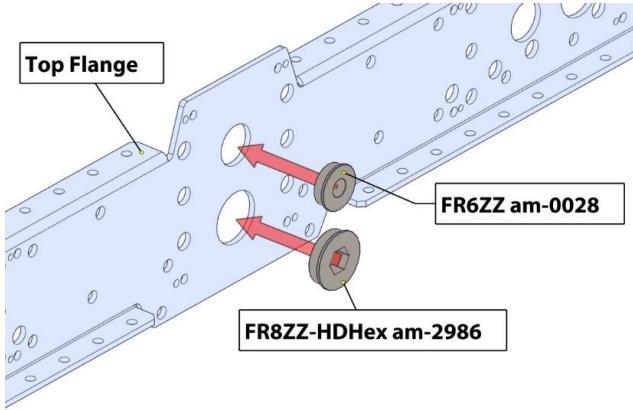


**Step 8:** Apply Red Tacky Grease (am-2768) to all of the gear teeth.

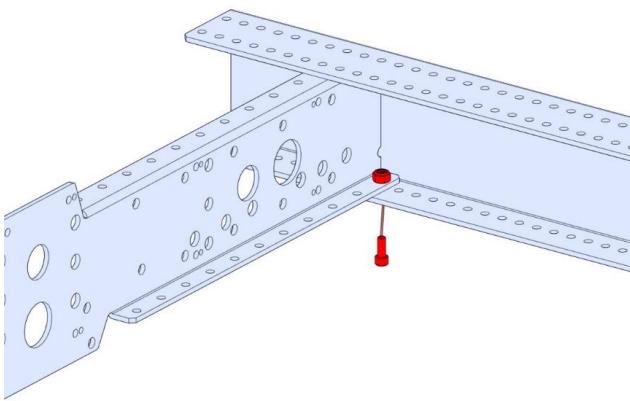


## Chassis Assembly Instructions

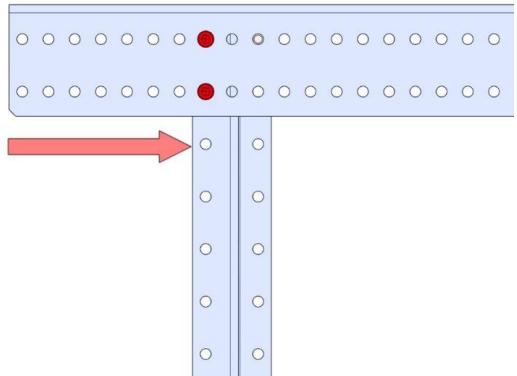
**Step 1:** Press a FR6ZZ (am-0028) and a FR8ZZ-HexHD (am-2986) bearing into the center holes on each Inside Plate (am-3922). Make sure the **bearing flanges are on the same side** as the bottom flange of the Inside Plate.



**Step 3:** Secure the bottom flange to the End Plate with an additional 10-32 x 0.500 socket head screw and 10-32 Nylock nut.

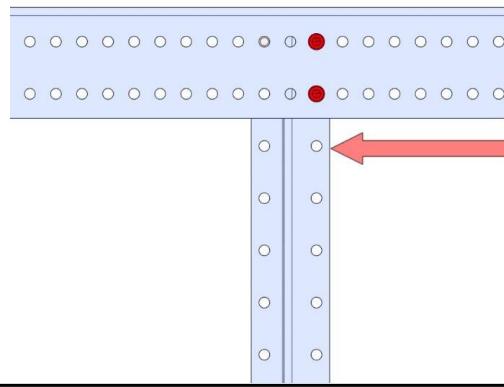


**Step 2:** Attach the top flange of an Inside Plate to the top (large) flange of an End Plate (am-3920) at the 8th hole in from the end with two 10-32 x 0.500 socket head screws (am-1002) and two 10-32 Nylock nuts (am-1042).



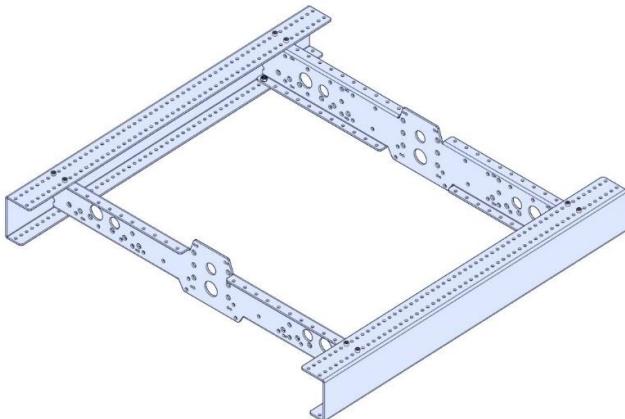
**NOTE:** The top flange of the Inside Plate should point toward the short side of the End Plate

**Step 4:** Repeat steps 2-3 on to attach the other Inside Plate to the End Plate.

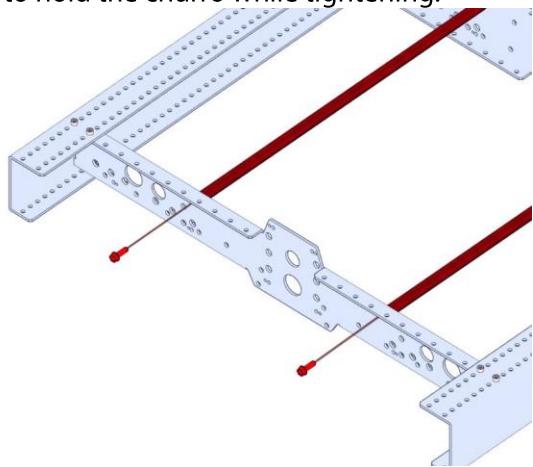


**NOTE:** The top flange of the Inside Plate should point toward the short side of the End Plate

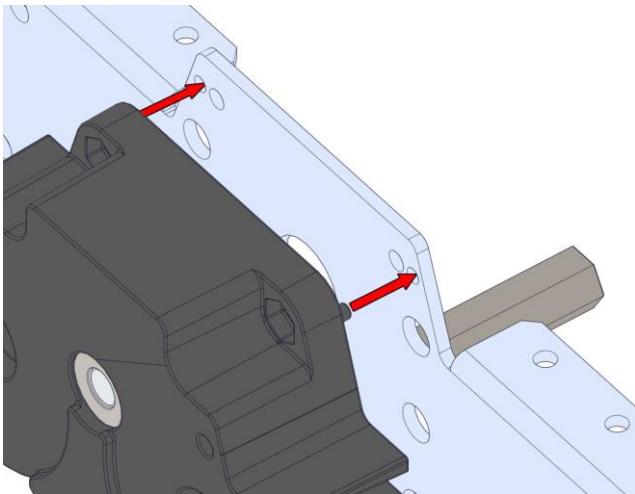
**Step 5:** Attach the other End Plate to the other end of the Inside Plates.



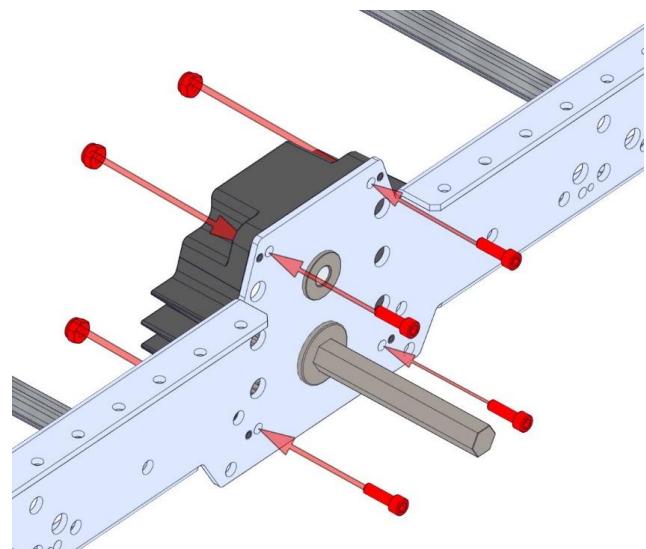
**Step 6:** Attach the two (cut to length) Long Churros between the Inside Plates using four 1/4-20 x 0.750" thread forming screws (am-1310). A 1/2" wrench can be used to hold the churro while tightening.



**Step 7:** Place one Toughbox Mini onto each Inner Plate ensuring the shafts are inserted into the flanged side of the bearings, and using the plastic studs to align the housing. The top flange of the Inside Plate will be facing away from the gearbox.

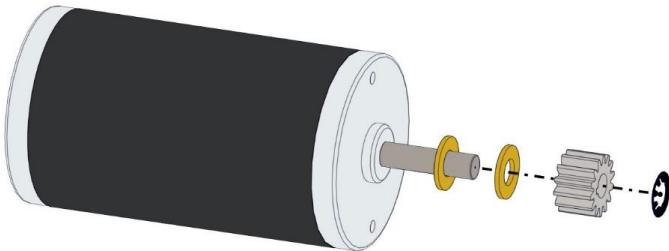


**Step 8:** Attach one Toughbox Mini to each Inside Plate with four 10-32 x 0.75"SHCS (am-1047) and four 10-32 Nylock nuts (am-1042). The nuts will fit into the hex pockets on the Toughbox Mini housing and will hold the nut while tightening.



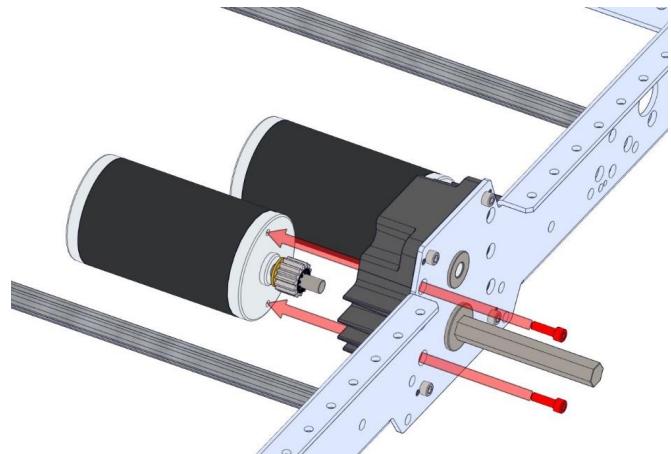
**NOTE: Be careful not to overtighten these screws.  
The gears should spin freely when the shaft is rotated by hand.**

**Step 9:** Slide two 5/16" washers (am-1009) onto each CIM motor shaft against the round boss of the motor. Place the Machine Key (am-1121) into the keyway of the motor shaft. Slide the 14 tooth (am-0034) gear onto the shaft up to the washers, while aligning the keyway of the gear to the key. Use a 7/16" socket to press the 8mm Retaining Clip (am-0033) onto the face of the gear, with the tabs of the clip pointing toward the motor shaft.

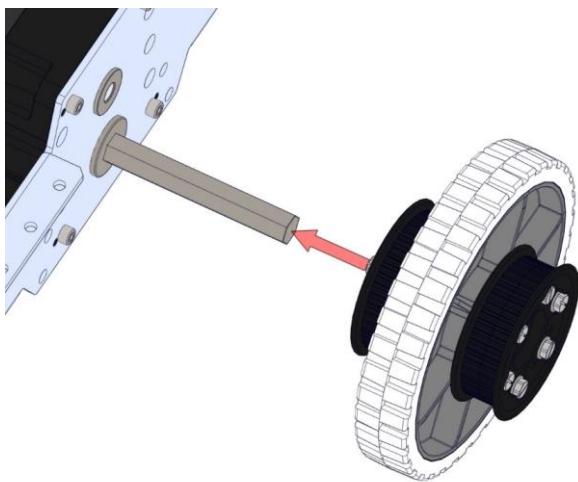


**NOTE:** Each drive gearbox can accept up to 2 motors. Repeat this step for each motor.

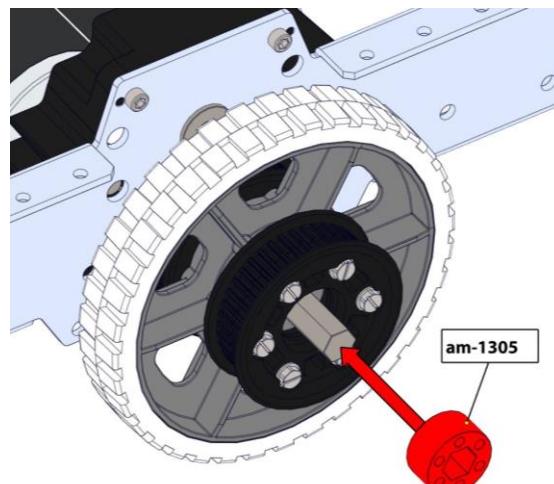
**Step 10:** Line up the CIM motors with the mounting holes in each Toughbox Mini. Secure each motor with gears installed to the Toughbox Mini housing using two 10-32 x 0.625" SHCS w/ Nylon Patch (am-1120).



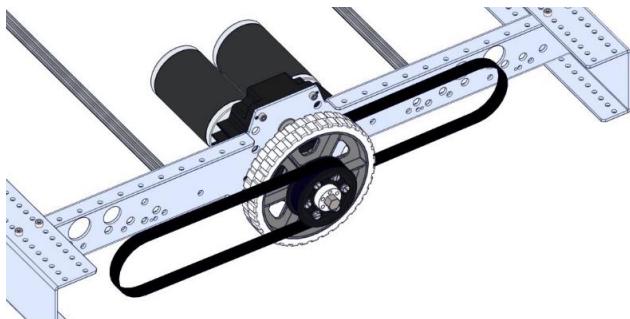
**Step 11:** Place a Center Wheel Assembly onto each Toughbox Hex Output Shaft with the aluminum hub facing towards the Inside Plate.



**Step 12:** Place the Hex Spacer (am-1305) onto each Toughbox Mini Hex Output Shaft and press into the round cavity in the pulley. The shaft will help align the spacer hex bore with the wheel hub hex bore.

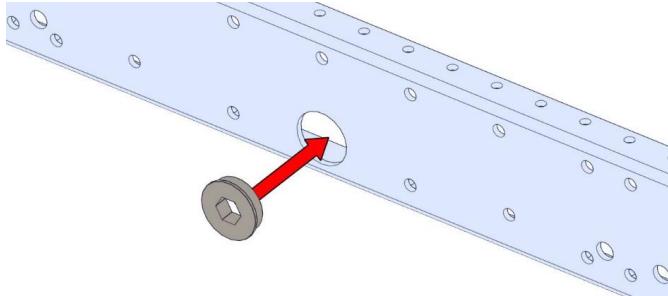


**Step 13:** Select the appropriate belts for your chassis configuration, and loop one belt over each Pulley on each Center Wheel Assembly.

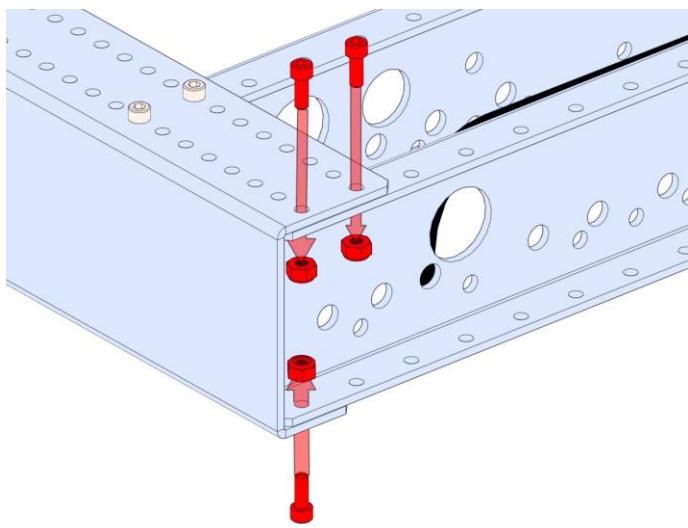


The long chassis requires 160 tooth belts (am-2266).  
The wide chassis requires 120 tooth belts (am-2704).  
The square chassis requires 131 tooth belts (am-2571).

**Step 14:** Press the FR8ZZ-HexHD Bearing (am-2986) into the center hole of each Outside Plate (am-3921). The bearing flange will be on the side **opposite** the plate flanges to ensure the bearings do not fall out during operation.

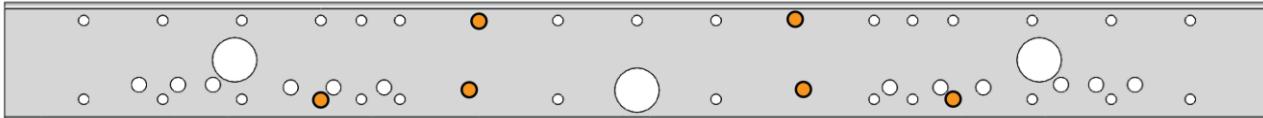


**Step 16:** Secure the Outside Plates to each End Plate using six 10-32 x 0.500 socket head screws (am-1002) and two 10-32 Nylock nuts (am-1042).

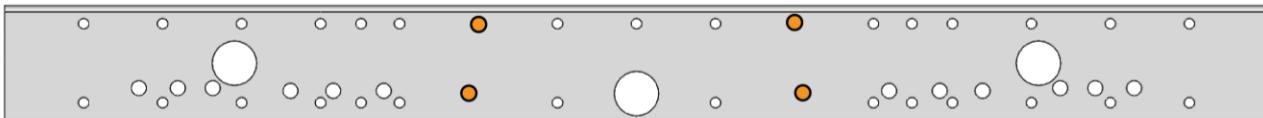


Recommended Support Churro Locations

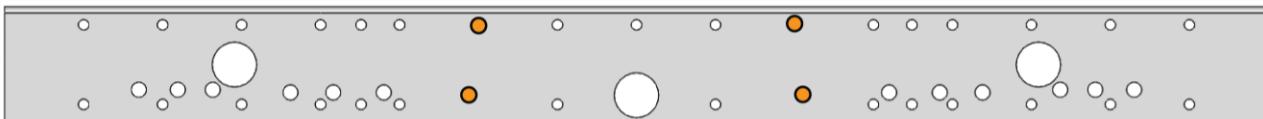
#### LONG CHASSIS



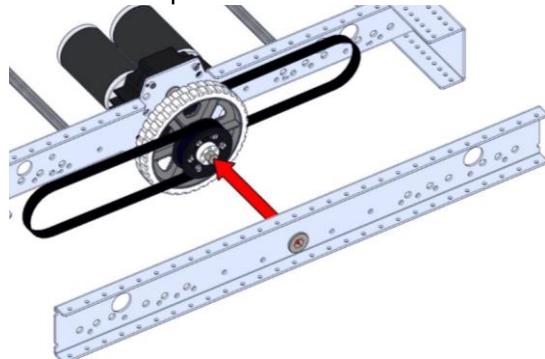
#### SQUARE CHASSIS



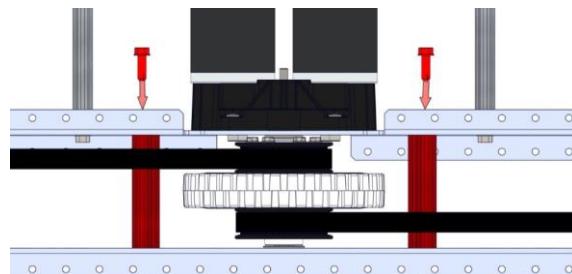
#### WIDE CHASSIS



**Step 15:** Place each Outside Plate into the ends of both End Plates with the flanges of the Outside Plate pointing away from the Inside Plate. Ensure the Hex Bearing is aligned to and installed on the Toughbox Mini Hex Output Shaft.

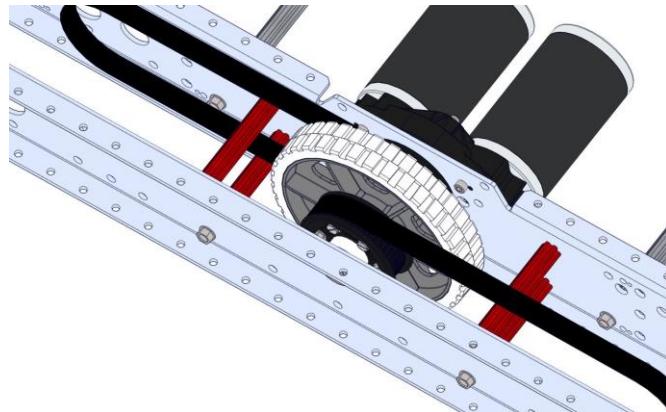


**Step 17:** Attach four 3.375" Churro Standoffs (am-2569) with 1/4-20 x 0.75" Thread Forming Screws (am-1310) onto each Inside Plate. A 1/2" wrench can be used to hold the churro while tightening. Make sure to loop belts over the churro to ensure the belts have a straight path from axle to axle.



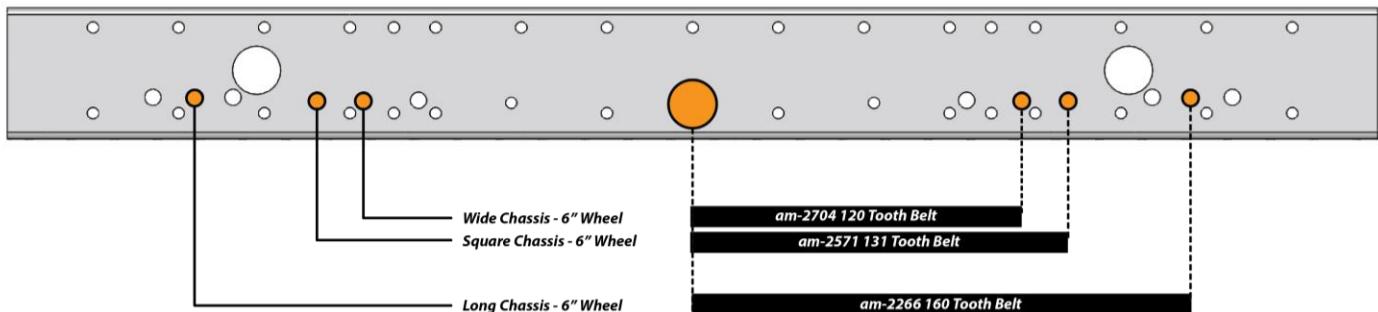
**NOTE:** The Churro Standoffs are intended to help with the structure of the chassis. Be sure to install four on each Inner Plate.

**Step 18:** Secure the Outside Plates to each Churro Standoff using 1/4-20 x 0.75" thread forming screws (am-1310). A 1/2" wrench can be used to hold the Churro Standoffs while tightening.



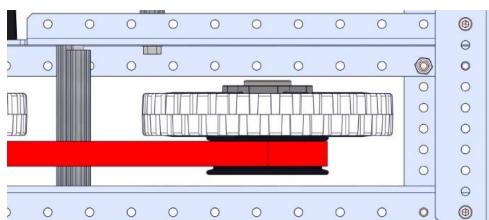
**Step 19:** There are different axle bolt locations for each chassis configuration. Locate the hole to match the chosen belt and frame size.

Hole Diagram for 6" Wheels



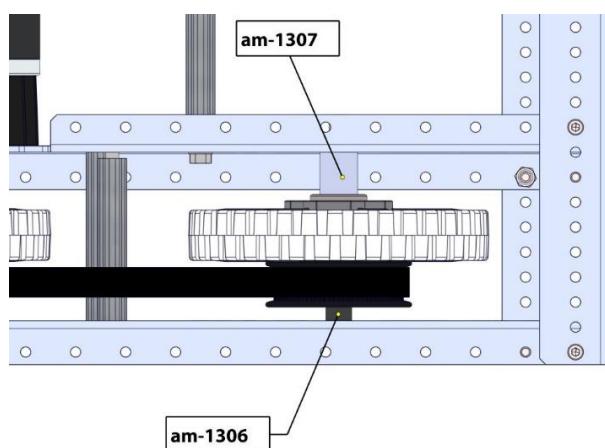
**NOTE:** Axle bolts must be installed from the outside of the chassis. If they are inserted into the Inside Plate first, the included bumper hardware will not fit.

**Step 20:** Take an Outer Wheel Assembly, loop the belt onto the pulley, and insert the wheels between the Inside and Outside Plates. Ensure the belts are straight. One assembly will have the pulley closer to the outside plate, the other closest to the inside plate.

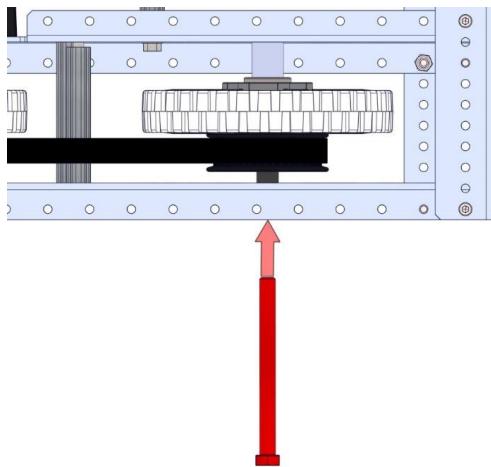


**NOTE:** The belts should be parallel to the side plates.

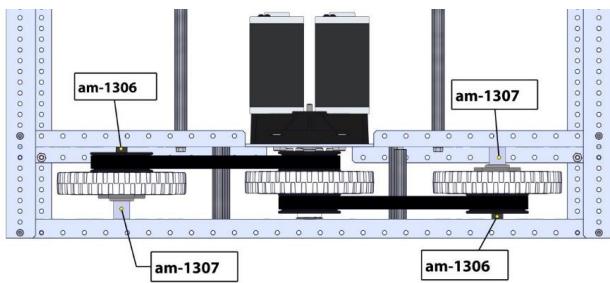
**Step 21:** For the pulleys that are closest to the Outside Plate, the Short Axle Spacer (am-1306) will be closest to the outside plate. The Long Axle Spacer (am-1307) will be closest to the inside plate.



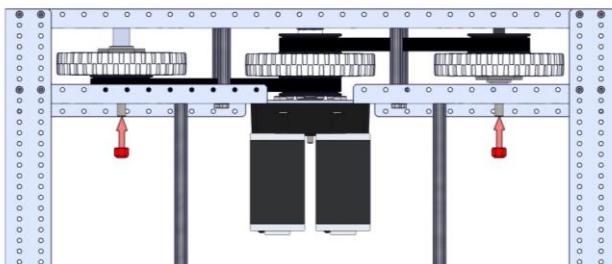
**Step 22:** There are different axle bolt locations for each chassis configuration. Slide a  $\frac{3}{8}$ " axle bolt (am-1297) through the spacers and wheel assembly, with the head of the bolt pointing away from the chassis.



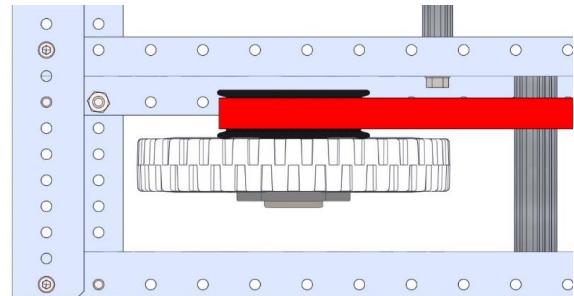
Inside Plate, the Short Axle Spacer (am-1306) will be closest to the Inside Plate. The Long Axle Spacer (am-1307) will be closest to the Outside Plate.



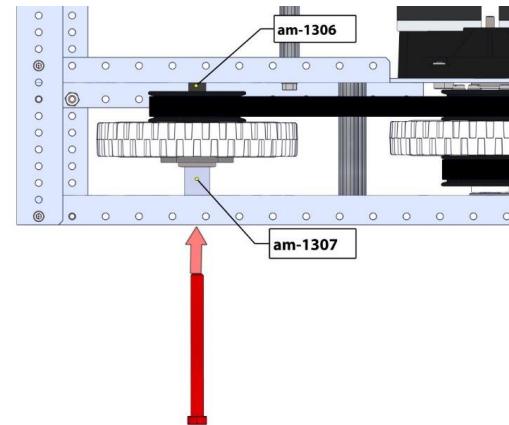
**Step 26:** Install one  $\frac{3}{8}$ -16 Nylock Nut (am-1054) on each Axle Bolt. Tighten the bolt and nut until the spacers just begin to touch Inside and Outside Plates. The wheels should still easily turn, and the axle bolts should be able to spin with a light turn of a wrench.



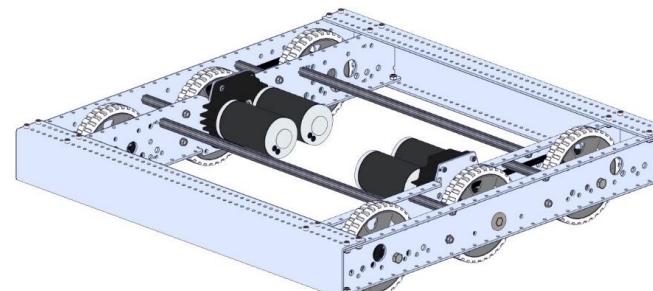
**Step 23:** Add another Outer Wheel Assembly to the other end of the chassis. Loop the belt onto the pulley and insert the assembly between the Inside and Outside Plates. This assembly should have its pulley facing opposite of the first assembly.



**Step 25:** Slide a  $\frac{3}{8}$ " axle bolt (am-1297) through the spacers and wheel assembly, with the head of the bolt pointing away from the chassis.



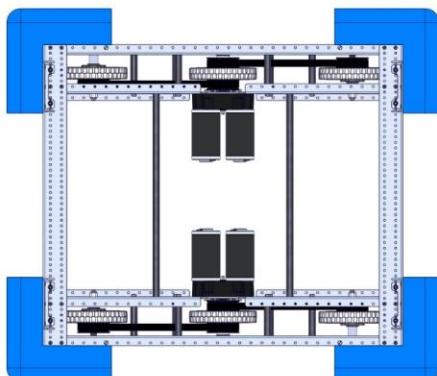
**Step 27:** Repeat steps 19 through 23 to install wheels on other side of chassis.



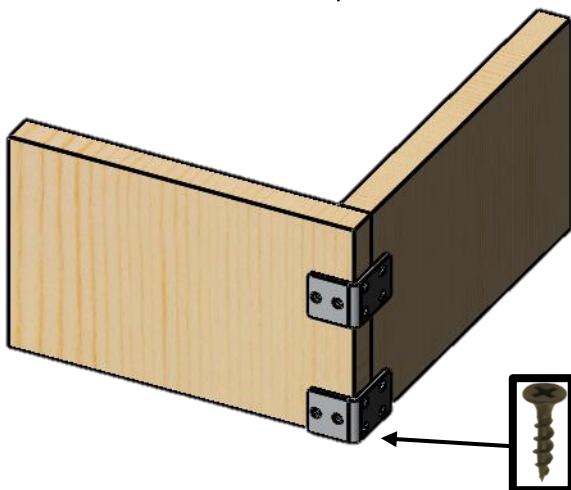
## **AM14U4 Bumper Attachment Suggested Method**

**NOTE:** Additional tools and materials are needed to complete a bumper set

**Step 1:** Plan out which edges of the drive base frame perimeter will be covered with bumpers. Ensure this design complies with all bumper rules. Brackets should be attached to the frame in the corners, at the ends of bumper segments, and behind any long bumper lengths.

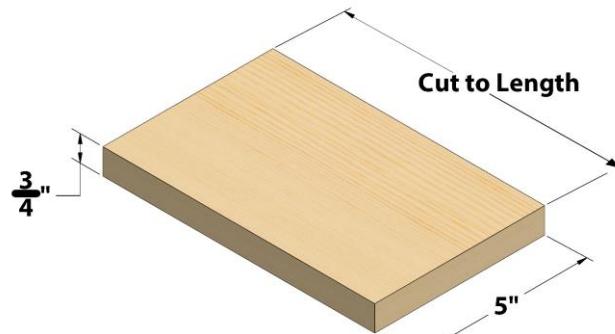


**Step 3:** Bumpers can either be made in straight sections or in sections that wrap around corners.



**Tip:** To ensure that bumpers designed to wrap around corners are rigid, it is recommended that the corner edge be strengthened with angled corner connectors such as am-3066 (not included).

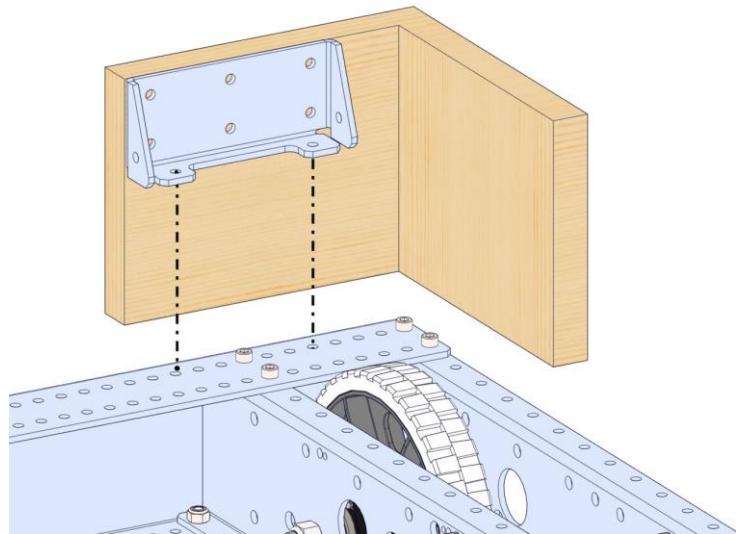
**Step 2:** Cut  $\frac{3}{4}$ " wood into bumper planks that are 5" tall and to desired lengths ensuring it meets the minimum length according to the current rule manual. For corner sections that overlap, a longer plank may be needed to comply with bumper rules. For the corner bumper configuration, 8 planks are needed for each red set and blue set of bumpers. Each section should measure an integer number of inches to align with chassis frame holes.



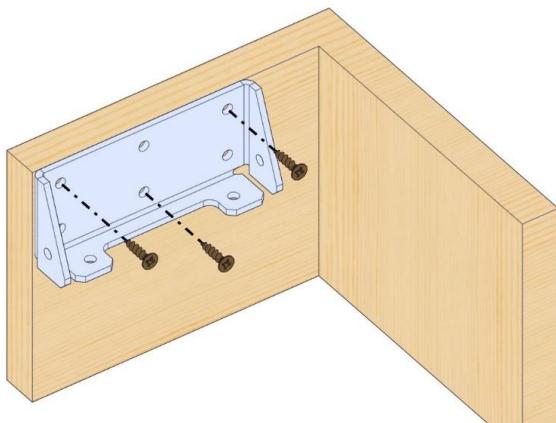
**Step 4:** Use either a single plank or a corner section of wood planks to align the Front Brackets (am-3961) on the End Plates.

If building corner bumpers, the Front Brackets should be placed at edges of the front wood sections for support.

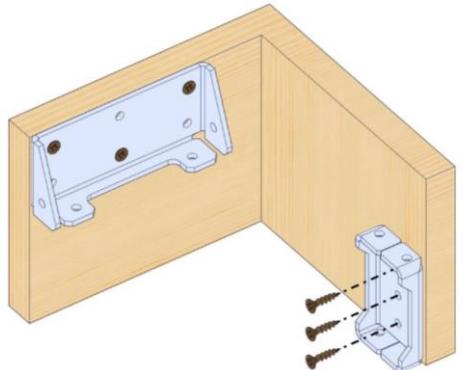
For 2019 when using 6" wheels, the top edge of the wood planks can be aligned with the top of the Front Brackets.



**Step 5:** Install three #8 wood screws (am-1387) into each Front Bracket as shown below.



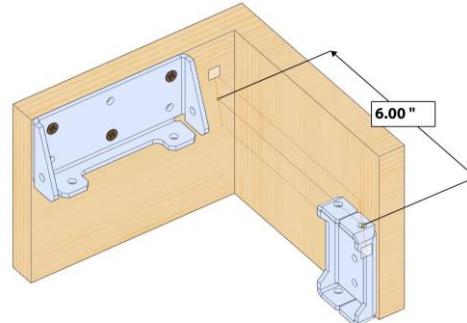
**Step 7:** Install three #8 wood screws (am-1387) into each Front Bracket as shown below. For 2019 when using 6" wheels, the bottom edge of the wood planks can be aligned with the bottom of the Side Brackets.



**Step 9:** Wrap fabric tightly around noodles. No noodles should be showing after wrapping. Staple fabric evenly along edge of bumper and trim any extra fabric. You will need to access the holes and hardware to attach bumpers frequently.



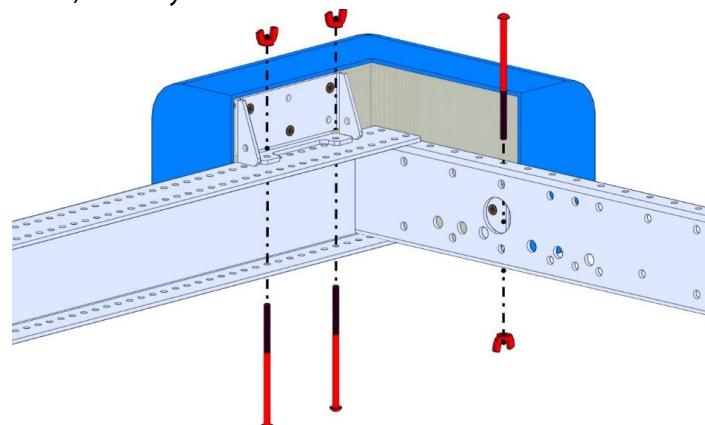
**Step 6:** For corner bumpers, align Side Bracket (am-3962) to the bottom edge and end edges of the bumper plank. For full length bumpers, measure and mark a whole number of inches from the inside edge of the front wood and align the far edge of the side bracket along that mark.



**Step 8:** Cut noodles to a length that matches the wood planks. Cut fabric large enough to wrap around noodles and wood with enough extra for stapling. If adding team numbers onto fabric it may be useful to do this before adding to bumper segments.



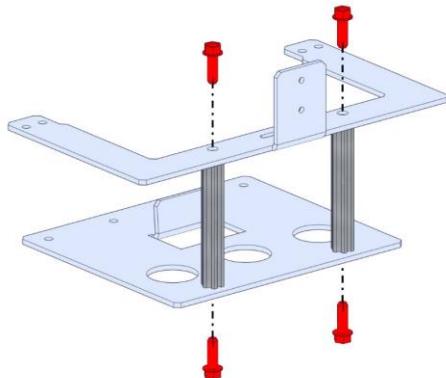
**Step 10:** Attach bumpers as shown with 10-32 x 3.75" round head screws (am-1502) and 10-32 wing nuts. (am-1387) for easy installation and removal.



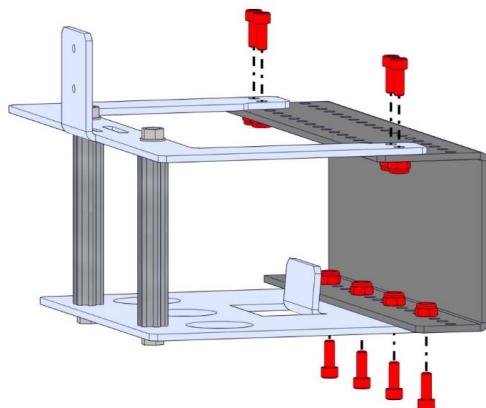
**Note:** On Side Brackets, the wing nuts must be installed on the bottom of the chassis in order to clear the bumper wood. Alternatively, #10-32 nuts can be used.

## AM14U4 Battery Tray Attachment

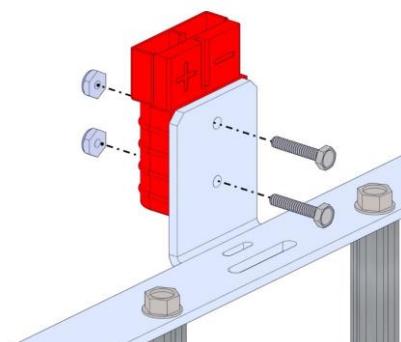
**Step 1:** Place two 3.375" Churros (am-2569) between the Bottom Plate (am-3959) and the C Plate (am-3958). Secure the Churros to the plate with four 1/4-20 x 0.750" Thread Forming Screws (am-1310). Make sure the tabs on both plates are pointing upwards.



**Step 3:** Secure the Assembly to the End Plate using eight #10-32 x 0.500" SHCS and #10-32 Nylock Jam Nuts.



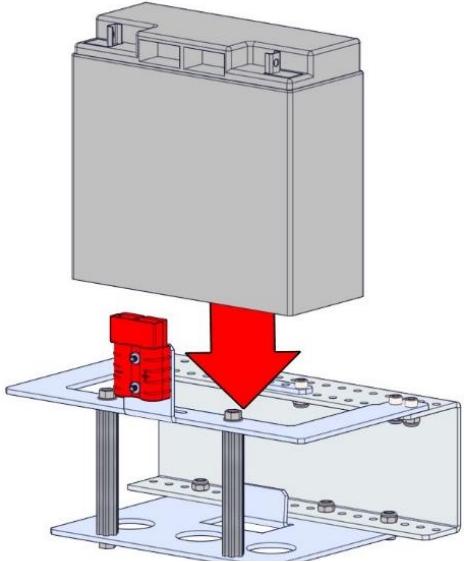
**Step 5:** Secure the Robot Side SB-Series Battery Connector to the tab on the C Plate using two #6-32 x 0.750" Hex Head Screws (am-1424) and #6-32 Nylock Jam Nuts (am-1419). The wires from this connector should go to your main robot breaker and power distribution panel.



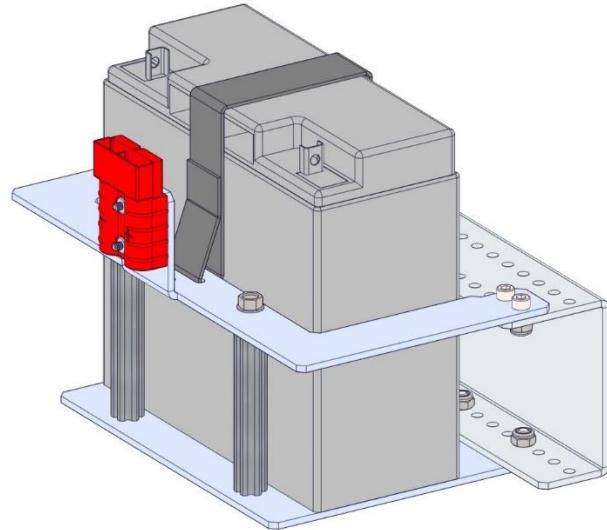
**Note:** The screws should be oriented such that the heads of the screws are on the Tab side.

## **Battery Installation**

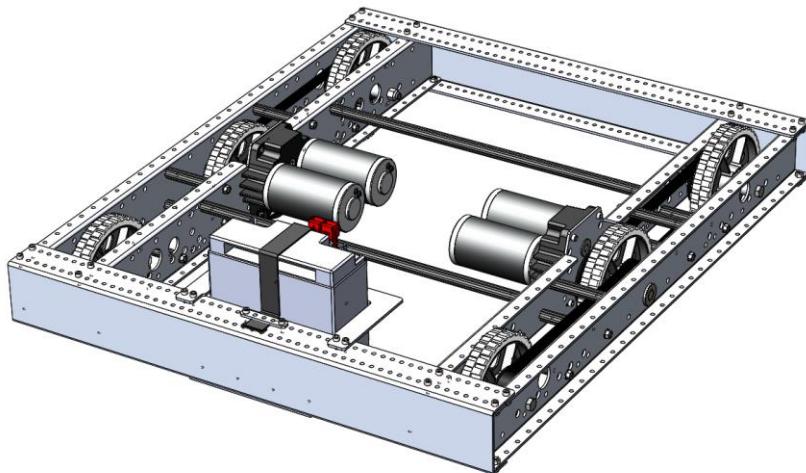
**Step 6:** Install the Battery into the Battery Tray with leads facing upward and on the same side as the SB Connector into the Battery Tray, and loop the Strap between the leads of the Battery.



**Step 7:** Loop the strap between the body of the Battery and the C Plate of the Battery Tray. Loop the strap upward through the large slot in the C Plate and pull it tight.



**Step 8:** Plug the SB connector from the battery into the SB connector mounted to the tray. Secure with a cable tie around both connectors through the small slot in the C Plate to ensure the battery will stay connected during match play.



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