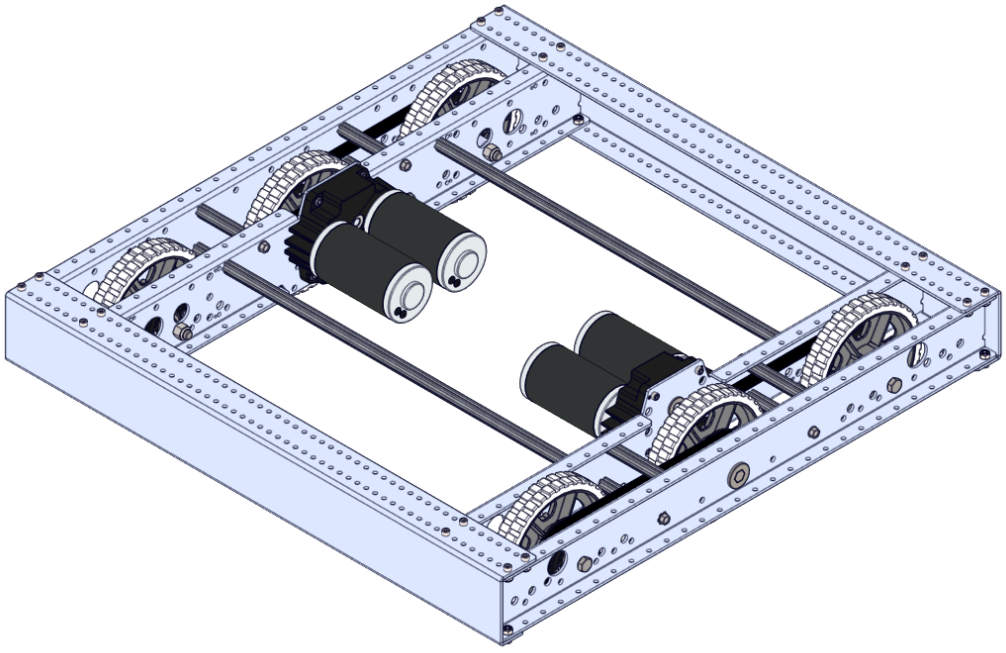
AndyMark®

User Guide

AM14U4 Chassis Base Kit for the 2019 FIRST® Robotics Competition

AM14U4

TOUGHBOX MINI



January 2019

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**, contact us via e-mail at **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**. Additional resources, layout prints, and CAD are available on the **AndyMark.com/KOP** web page.

AM14U4 Recommended Hand Tool List (not included)

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

Wheel Assembly Bill of Materials

Component	Part Number	Quantity	Part Photo
6" HiGrip Wheel	am-0940b	6	
500EX Hex Hub	am-2568	2	
Gates HTD 15mm wide, 160 Tooth Belt for Long Chassis	am-2266	4	
Gates HTD 15mm wide, 120 Tooth Belt for Wide Chassis	am-2704	4	
Gates HTD 15mm wide, 131 Tooth Belt for Square Chassis	am-2571	4	
Pulley Half, 42 Tooth	am-2234-half	16	
Wheel Screw Kit – (am-14U4_CK7)			
10-24 x 1.25" Thread Forming Screws	am-1266	48	
Bearing Kit – (am-14U4_CK8)			
1614ZZ Bearing	am-0209	8	
FR8ZZ - HexHD Bearing	am-2986	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**
5.95:1	**14T** (am-0034)	**50T** (am-0149)	**24T** (am-0177)	**40T** (am-0178)	**18.0 ft/sec**
7.31:1	**14T** (am-0034)	**50T** (am-0149)	**21T** (am-2564)	**43T** (am-2565)	**14.7 ft/sec**
8.45:1	**14T** (am-0034)	**50T** (am-0149)	**19T** (am-0176)	**45T** (am-0179)	**12.7 ft/sec**
10.71:1 (included)	**14T** (am-0034)	**50T** (am-0149)	**16T** (am-0747)	**48T** (am-0885)	**10.0 ft/sec**
12.75:1	**14T** (am-0034)	**50T** (am-0149)	**14T** (am-0151)	**50T** (am-0150)	**8.4 ft/sec**

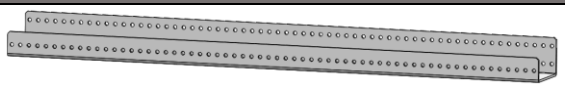
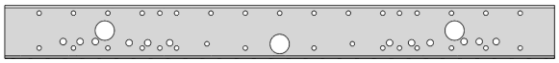
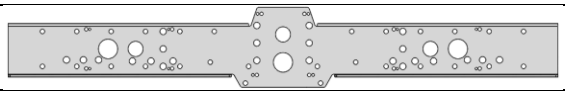
**AM14U4 speed estimation is based on calculations using 6" wheels, and one CIM motor per TB Mini running at 4100 rpm, or 75% of free speed.

Toughbox Mini Bill of Materials

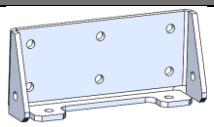
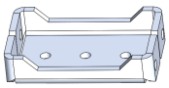
Component	Part Number	Quantity	Part Photo
TB Mini Housing	am-0650	1	
TB Mini Hex Output Shaft with Steel Dowel	am-2566a_K19	1	
TB Mini Small Hex Shaft	am-0152	1	

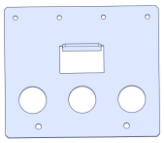
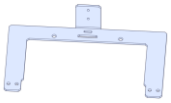
TB Mini Kit 1– am-14U4_TM1			
50 Tooth, 3/8" Hex Gear	am-0149	1	
14 Tooth, 8mm CIM Gear	am-0034	2	
16 Tooth, 3/8" Hex Gear	am-0747	1	
48 Tooth, 1/2" Hex Gear	am-0885	1	
TB Mini Kit 2 – am-14U4_TM2			
R6ZZ Bearing	am-0516	2	
FR6ZZ Bearing	am-0028	1	
FR8ZZ HexHD Bearing	am-2986	1	
Red Tacky Grease Pack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

AM14U4 Chassis Frame Bill of Materials

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

AM14U4 Additional Parts

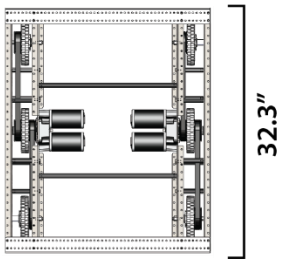
Bumper Hardware Included Parts			
Component	**Part Number**	**QTY**	**Part Photo**
Front/Corner Bumper Bracket	am-3961	4	
Side Mount Bumper Bracket	am-3962	8	
AM14U4 – Bumper Hardware Kit – AM-3966h			
10-32 RHS x 3.750”	am-1502	12	
10-32 Wing Nut	am-1483	25	
#8 Phillips Flat Head Wood Screw	am-1387	50	
Note: Additional items are needed for bumper assembly including pool noodles, robust red and blue fabric, industrial staples and corner brackets. For supplies, visit **AndyMark.com.**			

Battery Tray Parts			
Component	**Part Number**	**QTY**	**Part Photo**
10-32 x 0.5 SHCS	am-1002	10	
1/4-20 x 0.75” Thread Rolling Screw	am-1310	4	
10-32 Nylock Jam Nut	am-1063	10	
6-32 x 0.750 HHS	am-1424	2	
6-32 Nylock Jam Nut	am-1419	2	
500 Churro, 3.375"	am-2569	2	
Battery Strap	am-3965	1	
Battery Bottom Plate	am-3959	1	
Battery C-Plate	am-3958	1	
Battery Clamp	am-3960	1	

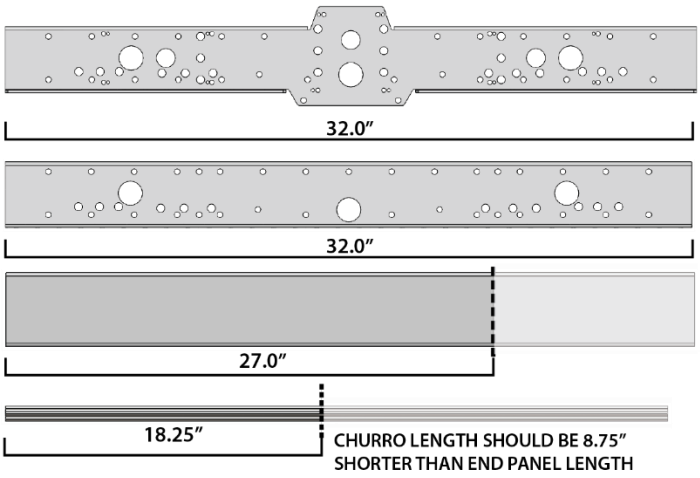
Frame Diagrams & Cut Lines:

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.



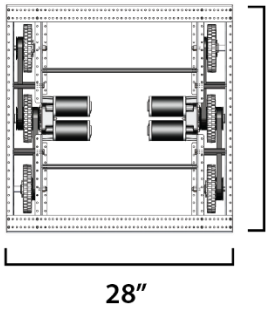
NO CUTS ARE NEEDED ON THE INNER PLATE OR OUTER PLATE

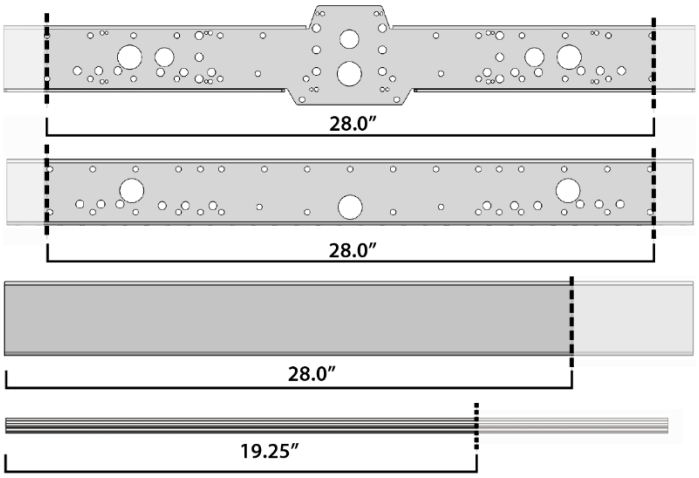
CUT END PLATE ON ONE END.

CHURRO LENGTH SHOULD BE 8.75″ SHORTER THAN END PANEL LENGTH

CUT CHURRO TO 18.25″

SQUARE CHASSIS





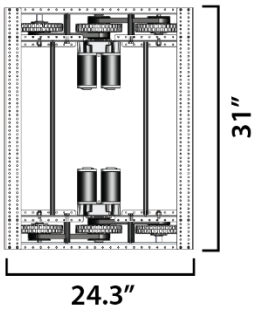
CUT 2″ OFF OUTER PLATE ON BOTH ENDS.

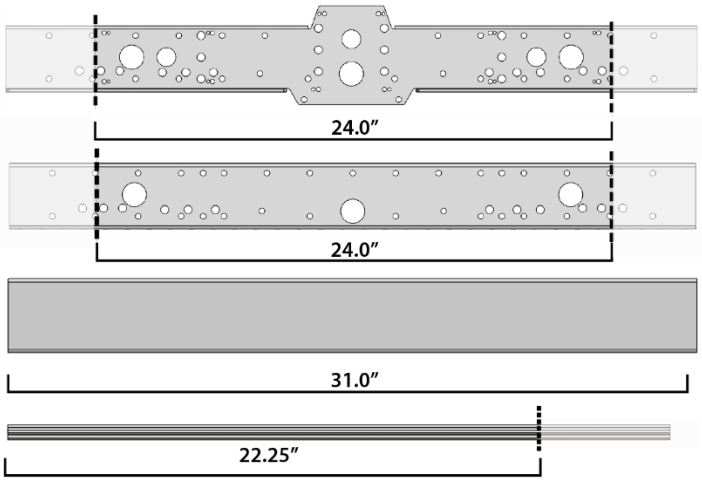
CUT 2″ OFF INNER PLATE ON BOTH ENDS.

CUT 3″ OFF END PLATE AT ONE END.

CUT CHURRO TO 19.25″

WIDE CHASSIS





CUT 4″ OFF OUTER PLATE ON BOTH ENDS.

CUT 4″ OFF INNER PLATE ON BOTH ENDS.

NO CUTS ARE NEEDED ON THE END PLATE.

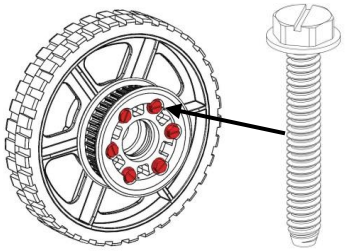
CUT CHURRO TO 22.25″

6" HiGrip Wheel and Pulley Assembly Instructions

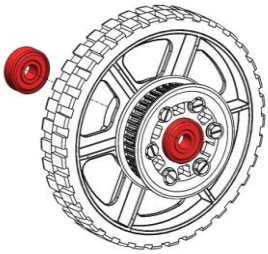
Outer Wheels (QTY 4)

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

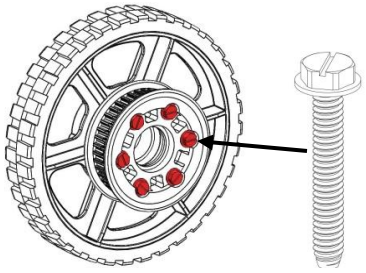
NOTE: Tighten the screws in a star pattern to ensure the pulley aligns evenly on the wheel.

Center Wheels (QTY 2)

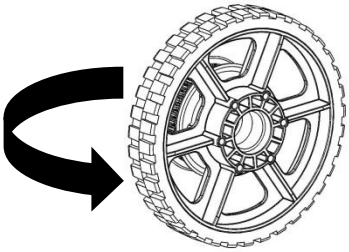
Step 1: Add two pulley halves (am-2234-half) to the wheel (am-0940b).

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.



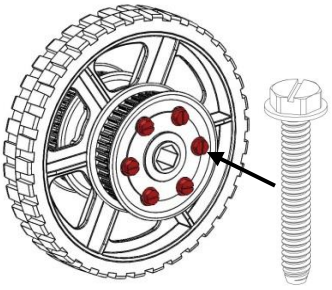
Step 3: Flip wheel over.



Step 4: Add two more pulley halves (am-2234-half) to the wheel.

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

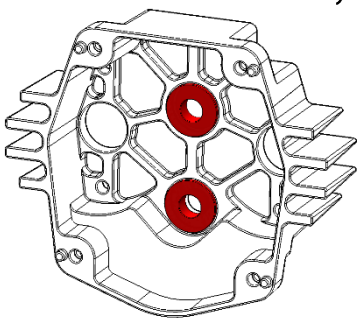
Step 6: Add six 10-24 x 1.25" (am-1266) thread forming screws to attach the pulley and hub to the wheel.



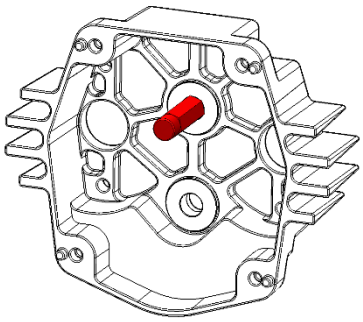
2X

Toughbox Mini Assembly Instructions – Build 2 gearboxes per chassis

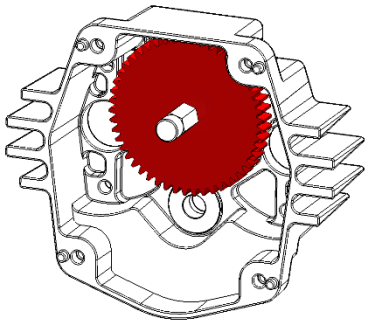
Step 1: Press two R6ZZ bearings (am-0516) into the two center holes of the TB Mini Housing (am-0650). Ensure they are fully seated and inserted all the way into the housing.



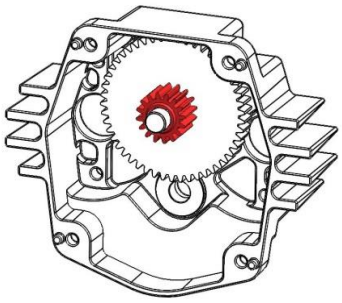
Step 2: Insert the TB Small Hex Shaft (am-0152) into R6ZZ bearing closest to the flat edge of the housing.



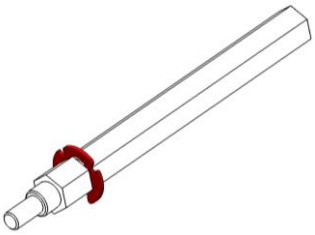
Step 3: Place the 50 tooth gear (am-0149) on the TB Small Hex Shaft with the **small round boss touching the bearing** and the flat side of the gear facing up.



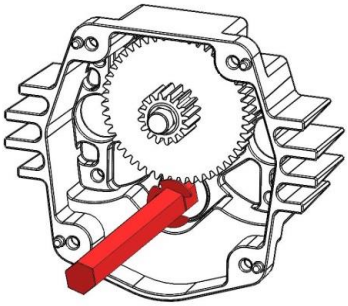
Step 4: Place the 16 tooth gear (am-0747) on the TB Small Hex Shaft with **flat side down touching the 50 tooth gear.**



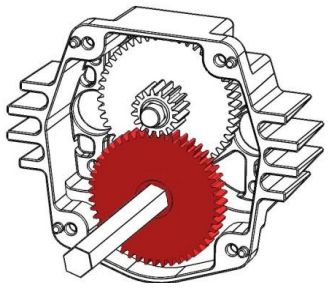
Step 5: Tap the 1/2" E-Clip (am-0206) onto the groove on the TB Hex Output Shaft (am-2566a_K19).



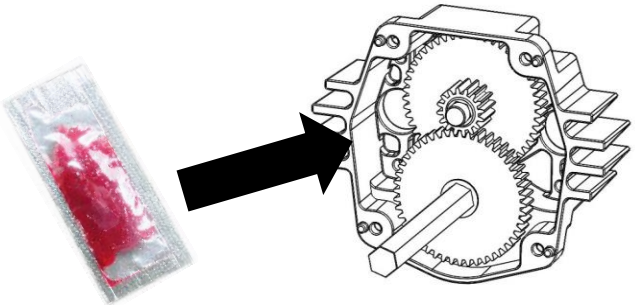
Step 6: Insert the small end of the TB Hex Output Shaft (am-2566a_K19) into the other R6ZZ bearing.



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

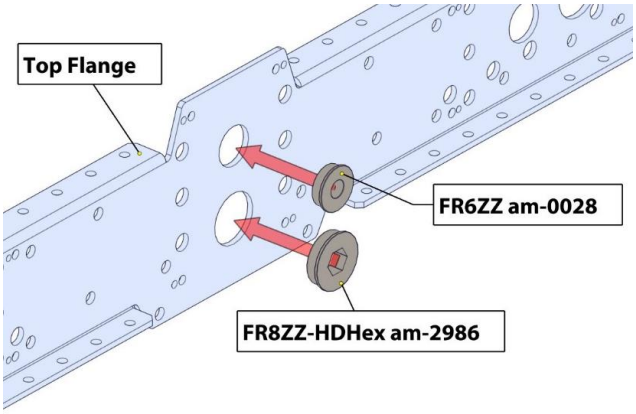


Step 8: Apply Red Tacky Grease (am-2768) to all of the gear teeth.

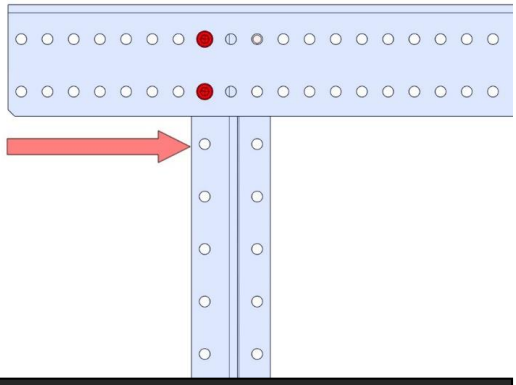


Chassis Assembly Instructions

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.

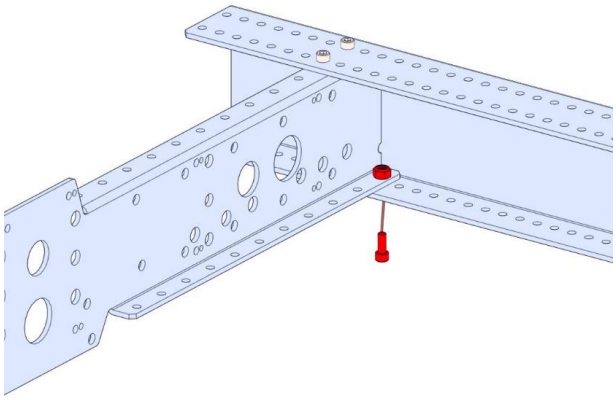


Step 2: Attach the top flange of an Inside Plate to the top (large) flange of an End Plate (am-3920) at the 8th hole in from the end with two 10-32 x 0.500 socket head screws (am-1002) and two 10-32 Nylock nuts (am-1042).

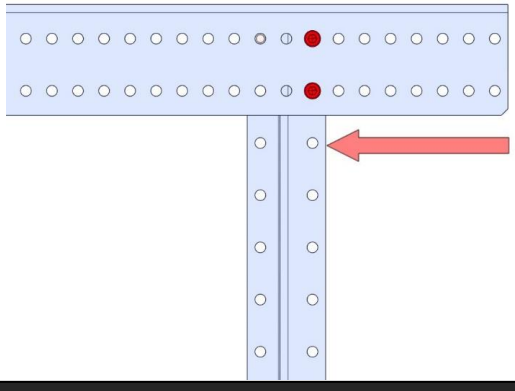


NOTE: The top flange of the Inside Plate should point toward the short side of the End Plate

Step 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.

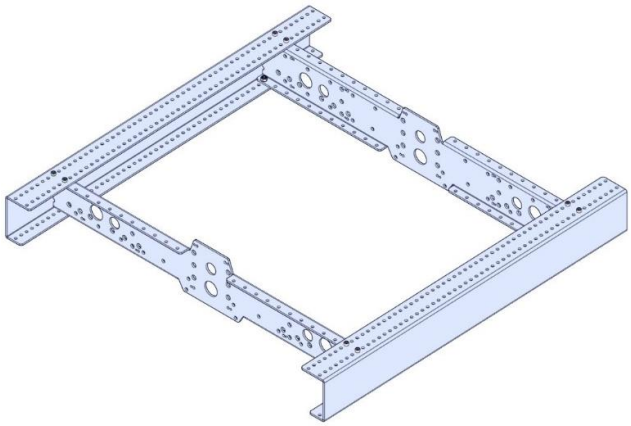


Step 4: Repeat steps 2-3 on to attach the other Inside Plate to the End Plate.

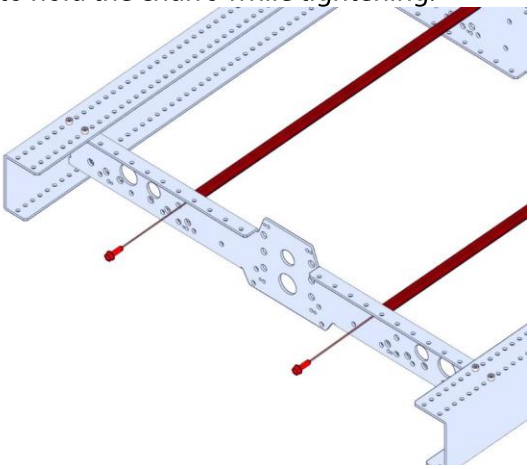


NOTE: The top flange of the Inside Plate should point toward the short side of the End Plate

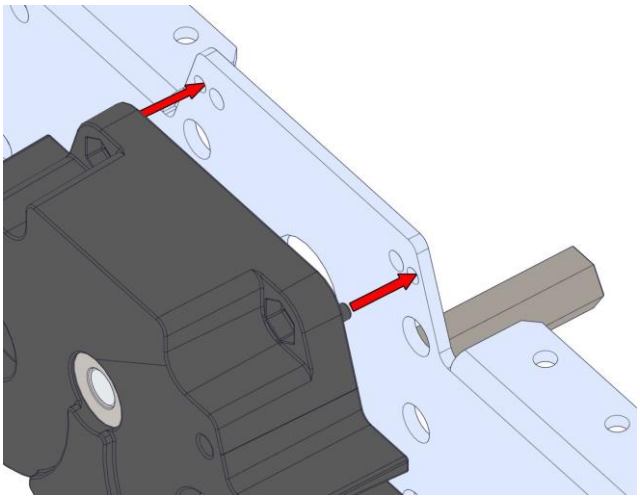
Step 5: Attach the other End Plate to the other end of the Inside Plates.



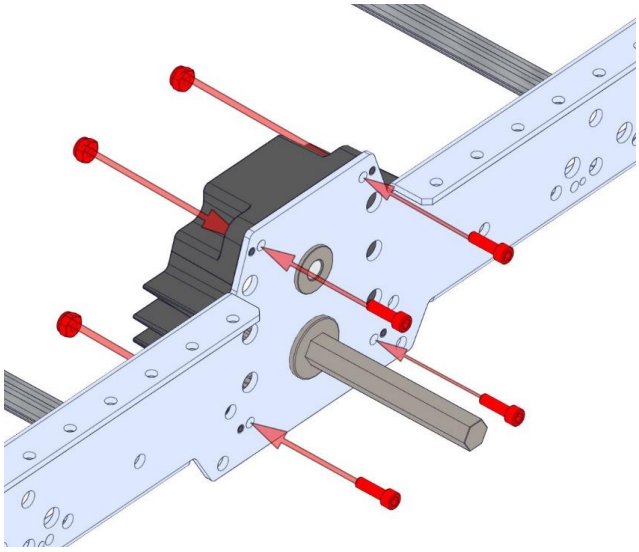
Step 6: Attach the two (cut to length) Long Churros between the Inside Plates using four ¼-20 x 0.750" thread forming screws (am-1310). A ½" wrench can be used to hold the churro while tightening.



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.

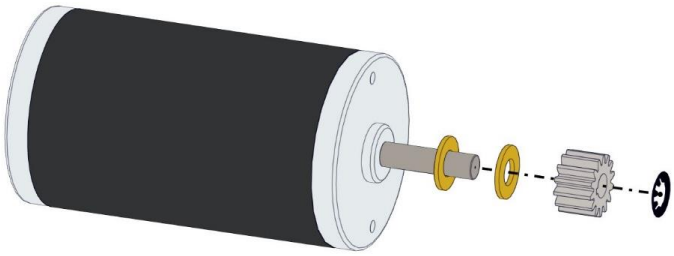


Step 8: Attach one Toughbox Mini to each Inside Plate with four 10-32 x 0.75"SHCS (am-1047) and four 10-32 Nylock nuts (am-1042). The nuts will fit into the hex pockets on the Toughbox Mini housing and will hold the nut while tightening.



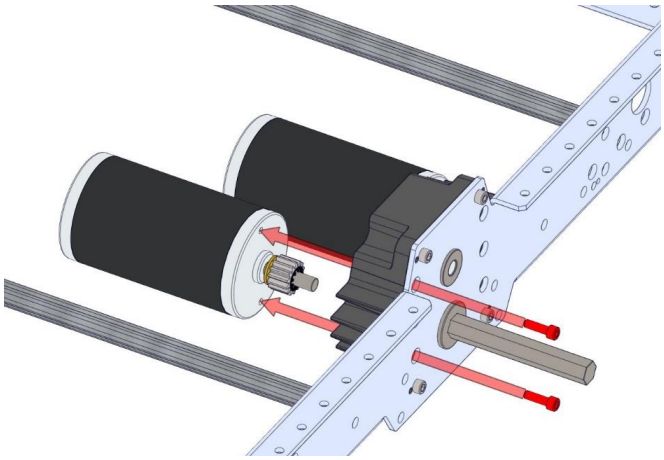
NOTE: Be careful not to overtighten these screws. The gears should spin freely when the shaft is rotated by hand.

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.

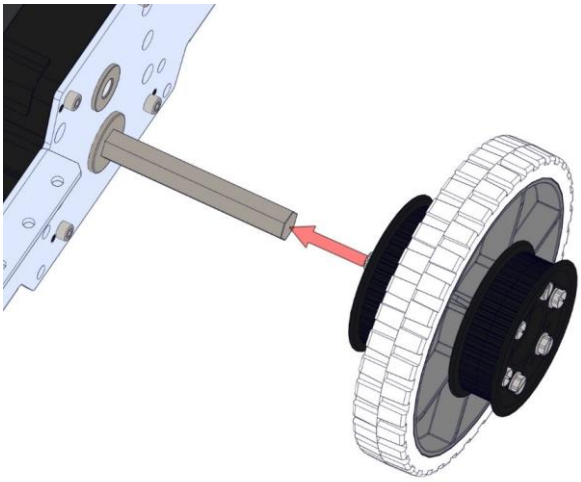


NOTE: Each drive gearbox can accept up to 2 motors. Repeat this step for each motor.

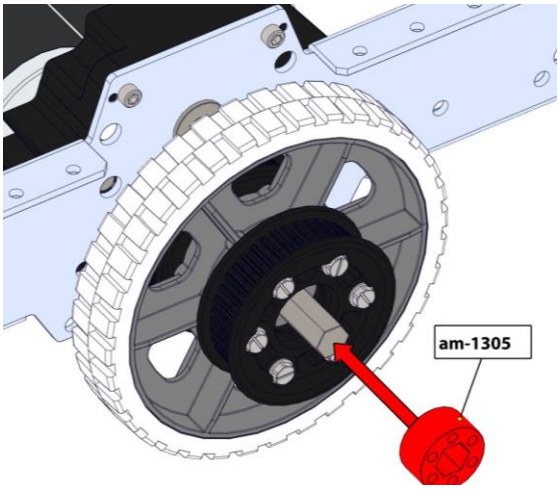
Step 10: Line up the CIM motors with the mounting holes in each Toughbox Mini. Secure each motor with gears installed to the Toughbox Mini housing using two 10-32 x 0.625" SHCS w/ Nylon Patch (am-1120).



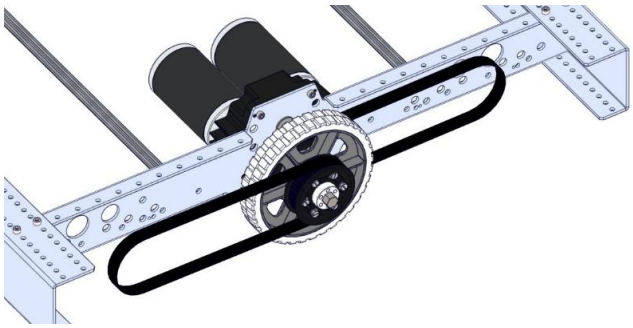
Step 11: Place a Center Wheel Assembly onto each Toughbox Hex Output Shaft with the aluminum hub facing towards the Inside Plate.



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.

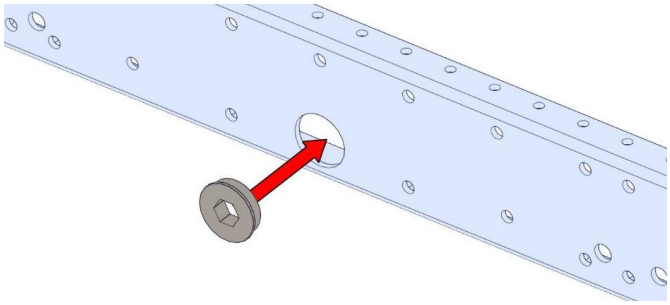


Step 13: Select the appropriate belts for your chassis configuration, and loop one belt over each Pulley on each Center Wheel Assembly.

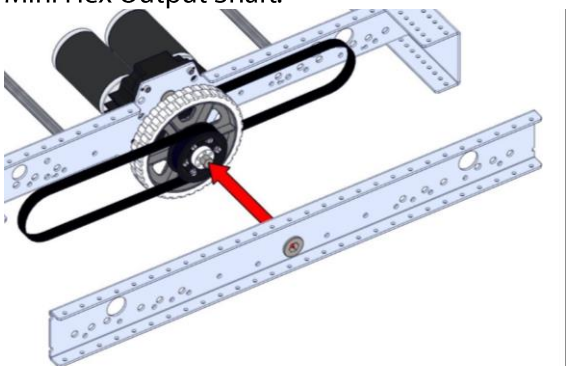


The long chassis requires 160 tooth belts (am-2266).
The wide chassis requires 120 tooth belts (am-2704).
The square chassis requires 131 tooth belts (am-2571).

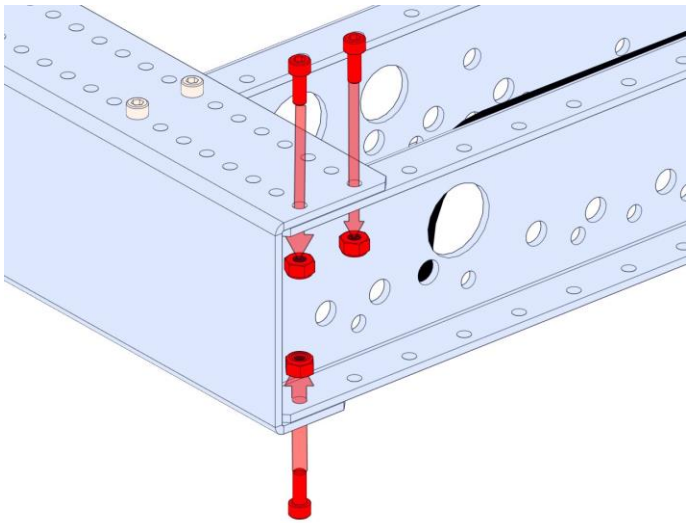
Step 14: Press the FR8ZZ-HexHD Bearing (am-2986) into the center hole of each Outside Plate (am-3921). The bearing flange will be on the side **opposite** the plate flanges to ensure the bearings do not fall out during operation.



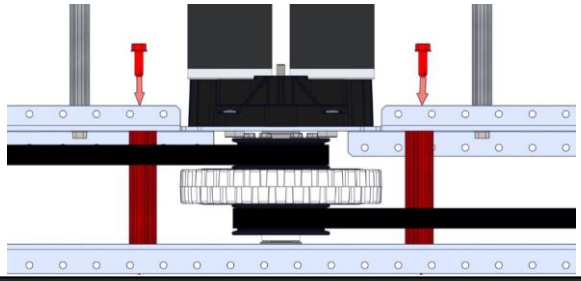
Step 15: Place each Outside Plate into the ends of both End Plates with the flanges of the Outside Plate pointing away from the Inside Plate. Ensure the Hex Bearing is aligned to and installed on the Toughbox Mini Hex Output Shaft.



Step 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).



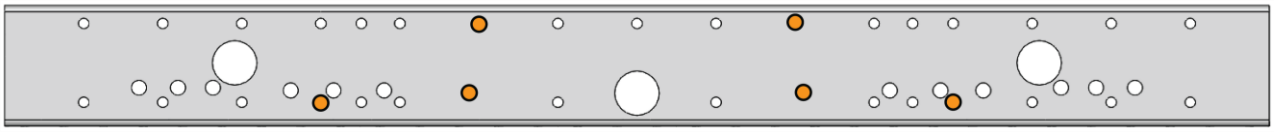
Step 17: Attach four 3.375" Churro Standoffs (am-2569) with 1/4-20 x 0.75" Thread Forming Screws (am-1310) onto each Inside Plate. A 1/2" wrench can be used to hold the churro while tightening. Make sure to loop belts over the churro to ensure the belts have a straight path from axle to axle.



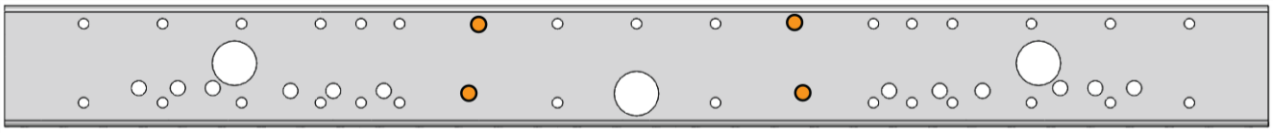
NOTE: The Churro Standoffs are intended to help with the structure of the chassis. Be sure to install four on each Inner Plate.

Recommended Support Churro Locations

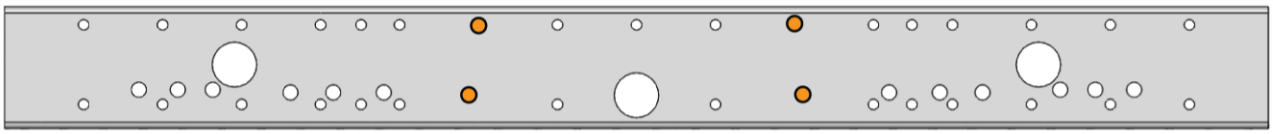
LONG CHASSIS



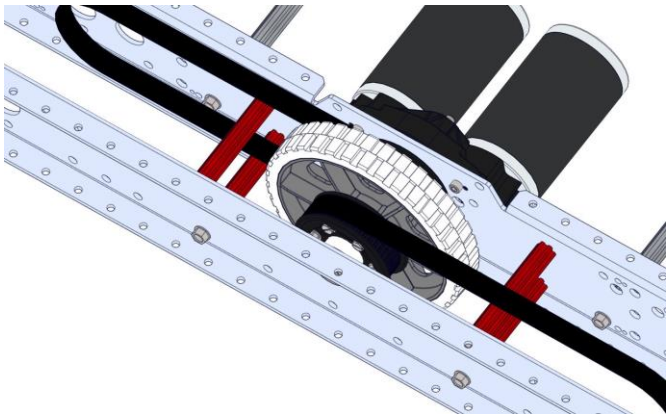
SQUARE CHASSIS



WIDE CHASSIS

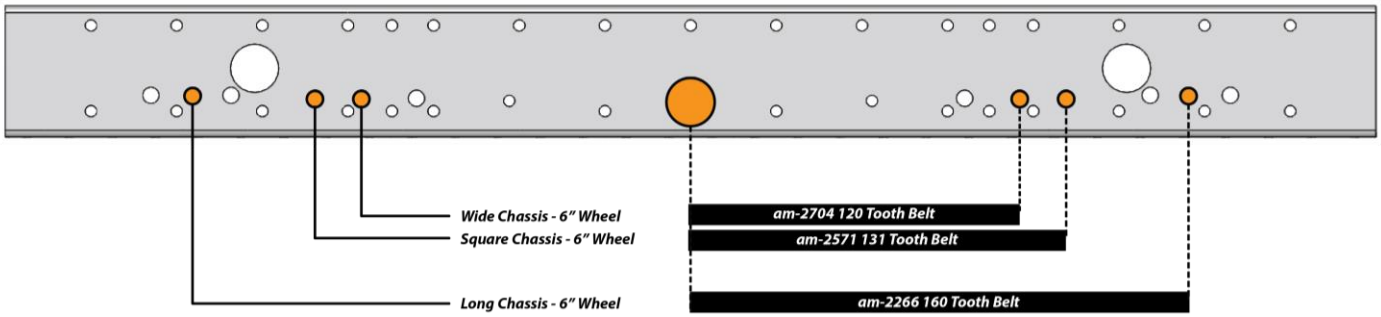


Step 18: Secure the Outside Plates to each Churro Standoff using 1/4-20 x 0.75" thread forming screws (am-1310). A 1/2" wrench can be used to hold the Churro Standoffs while tightening.



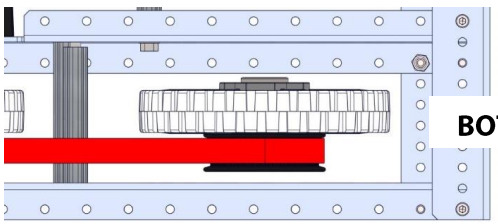
Step 19: There are different axle bolt locations for each chassis configuration. Locate the hole to match the chosen belt and frame size.

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.

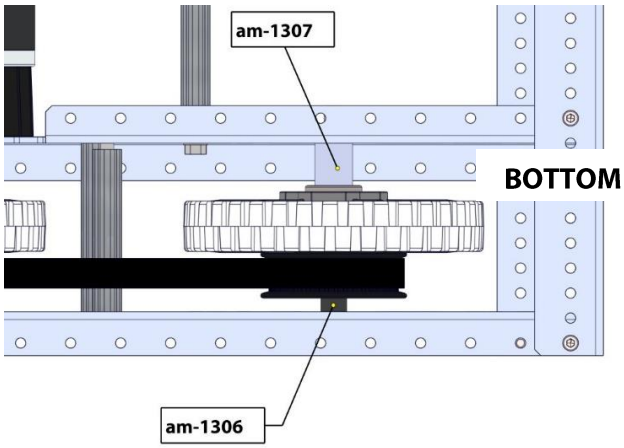
Step 20: Take an Outer Wheel Assembly, loop the belt onto the pulley, and insert the wheel between the Inside and Outside Plates. Ensure the belts are straight. One assembly will have the pulley closer to the outside plate, the other closest to the inside plate.



BOTTOM VIEW

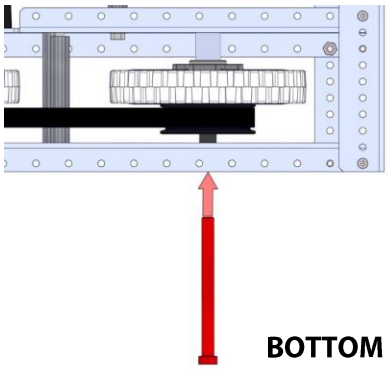
NOTE: The belts should be parallel to the side plates.

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.



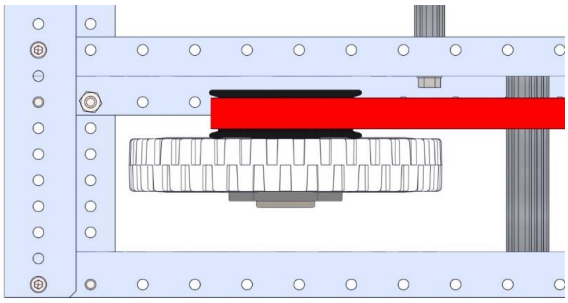
BOTTOM VIEW

Step 22: There are different axle bolt locations for each chassis configuration. Slide a ⅜" axle bolt (am-1297) through the spacers and wheel assembly, with the head of the bolt pointing away from the chassis.



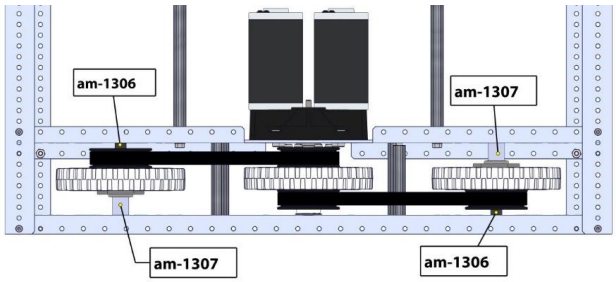
BOTTOM VIEW

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.



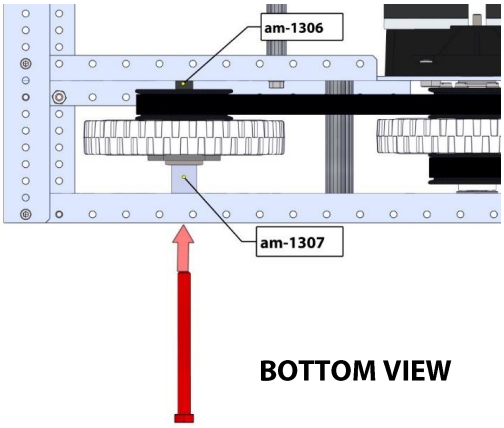
BOTTOM VIEW

Step 24: For the belt runs that are closest to the 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.



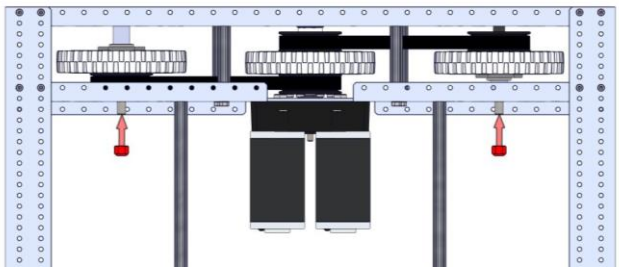
BOTTOM VIEW

Step 25: Slide a ⅜" axle bolt (am-1297) through the spacers and wheel assembly, with the head of the bolt pointing away from the chassis.

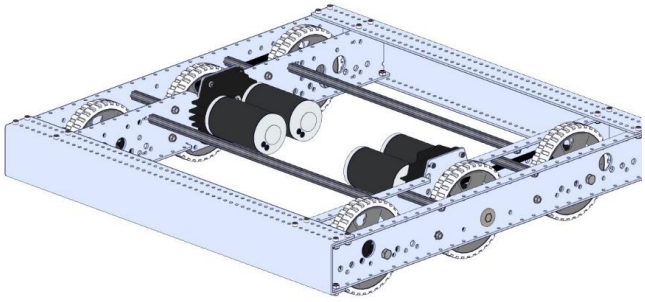


BOTTOM VIEW

Step 26: Install one ⅜-16 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.



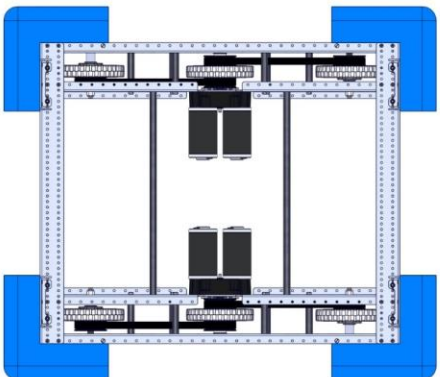
Step 27: Repeat steps 19 through 23 to install wheels on other side of chassis.



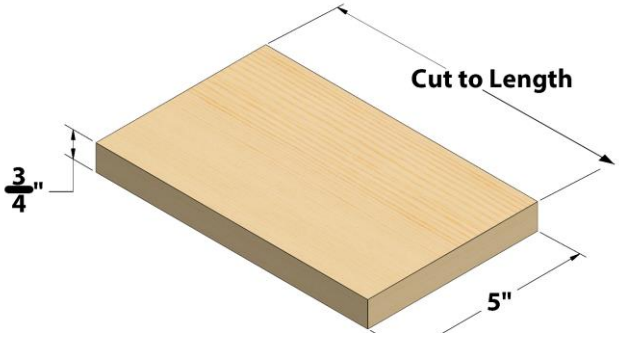
AM14U4 Bumper Attachment Suggested Method

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

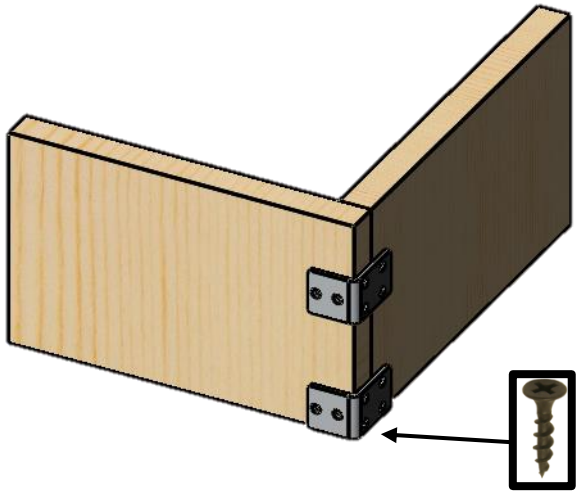
Step 1: Plan out which edges of the drive base frame perimeter will be covered with bumpers. Ensure this design complies with all bumper rules. Brackets should be attached to the frame in the corners, at the ends of bumper segments, and behind any long bumper lengths.



Step 2: Cut ¾" 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.



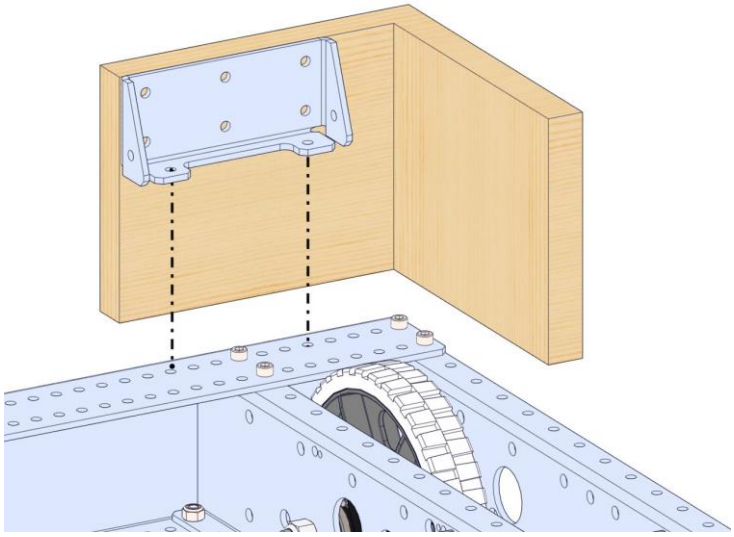
Step 3: Bumpers can either be made in straight sections or in sections that wrap around corners.



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.

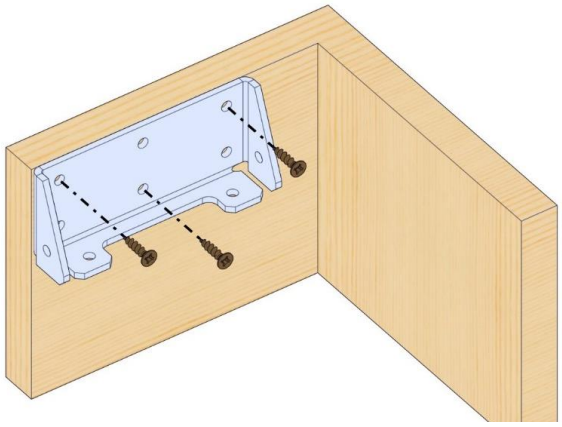
If building corner bumpers, the Front Brackets should be placed at edges of the front wood sections for support.

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

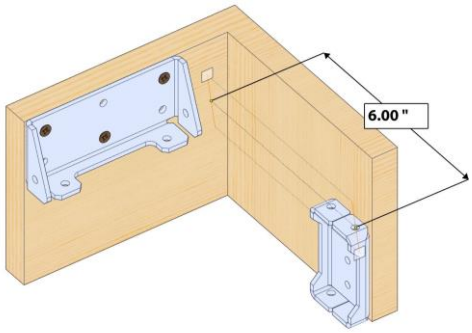


Tip: To ensure that bumpers designed to wrap around corners are rigid, it is recommended that the corner edge be strengthened with angled corner connectors such as am-3066 (not included).

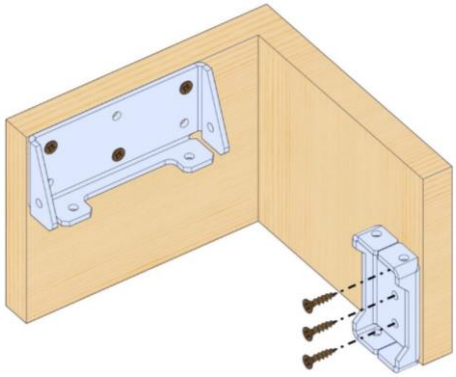
Step 5: Install three #8 wood screws (am-1387) into each Front Bracket as shown below.



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.



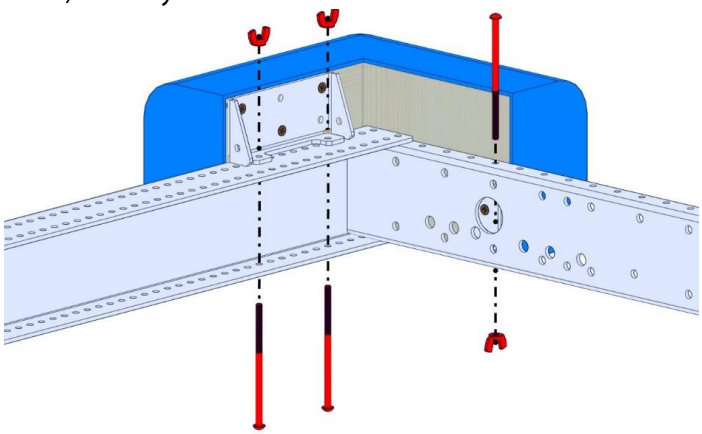
Step 7: Install three #8 wood screws (am-1387) into each Front Bracket as shown below. For 2019 when using 6" wheels, the bottom edge of the wood planks can be aligned with the bottom of the Side Brackets.



Step 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 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.

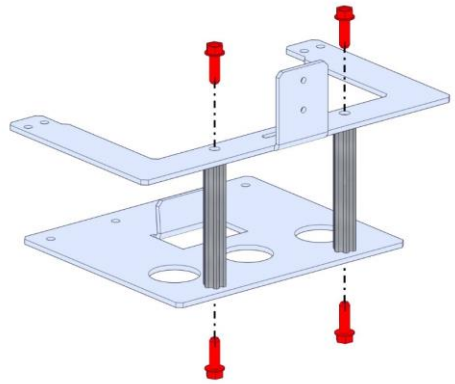
Step 10: Attach bumpers as shown with 10-32 x 3.75" round head screws (am-1502) and 10-32 wing nuts. (am-1387) for easy installation and removal.



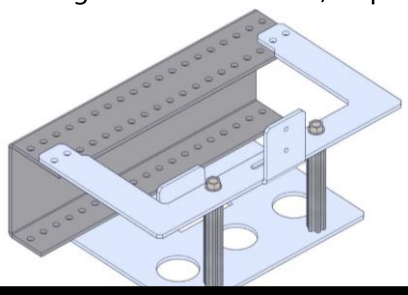
Note: On Side Brackets, the wing nuts must be installed on the bottom of the chassis in order to clear the bumper wood. Alternatively, #10-32 nuts can be used.

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 ¼-20 x 0.750" Thread Forming Screws (am-1310). Make sure the tabs on both plates are pointing upwards.

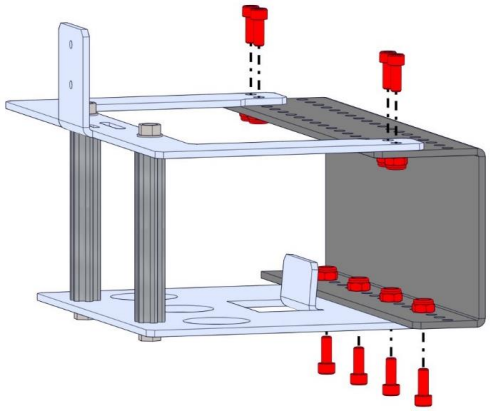


Step 2: Slide the assembly over the End Plate such that the Strap Clamp (am-3690) and Battery Strap (am-3965) are centered between the ends of the C Plate. The C Plate and Bottom Plate should be installed on the top and bottom of the flanges on the End Plate, respectively.

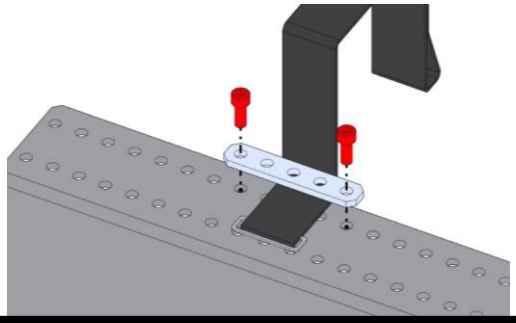


Note: The Assembly may need to be slightly flexed to fit over the flanges on the End Plate.

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

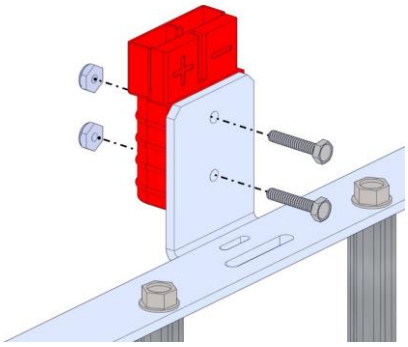


Step 4: Position the Battery Strap) underneath the Strap Clamp Plate, such that the loop (soft) side of the strap is facing upward and the metal clip faces towards the outside of the chassis. The strap should be centered on the C Plate. Attach the clamp using two #10-32 x 0.500" SHCS (am-1002) and #10-32 Nylock Jam Nuts (am-1063).



Note: These screws should be tight to retain the strap. The Strap Clamp Plate is expected to deform around the strap.

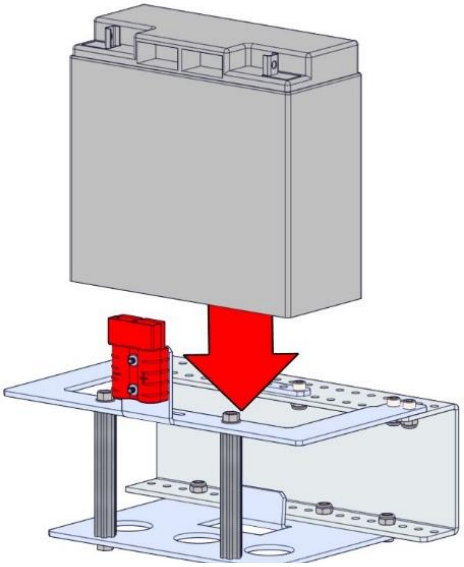
Step 5: Secure the Robot Side SB-Series Battery Connector to the tab on the C Plate using two #6-32 x 0.750" Hex Head Screws (am-1424) and #6-32 Nylock Jam Nuts (am-1419). The wires from this connector should go to your main robot breaker and power distribution panel.



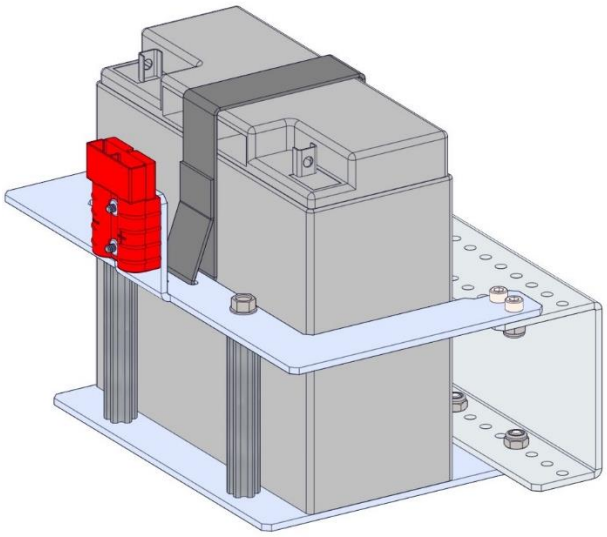
Note: The screws should be oriented such that the heads of the screws are on the Tab side.

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.