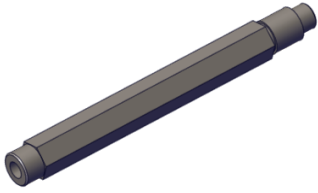


AndyMark Drive Base Toughbox Output Shaft (am-4722) Quality Issue Resolution & Solutions for Teams



Issue Description: Due to a manufacturing issue, some of the AndyMark Toughbox Output Shafts (am-4722) that are included in the 2023 AndyMark AM14U5 Drive Base Kits have a non-concentric $\frac{3}{8}$ " bearing end. The out of tolerance shafts will cause the wheel mounted to them, as well as the surrounding frame, to wobble during operation. In the worst cases it can cause the gearboxes to bind.

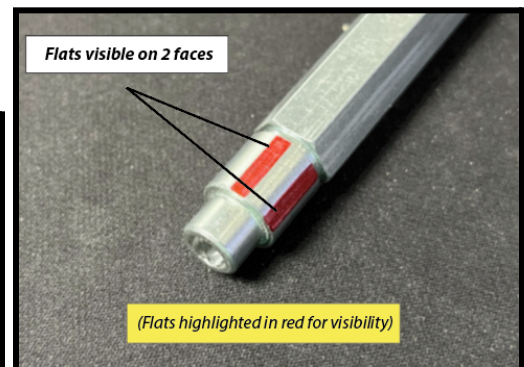
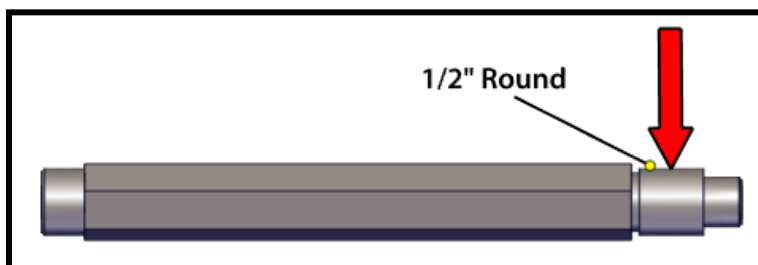
AndyMark Recommendation: AndyMark will provide **two (2) replacement shafts** to any team who has received shafts out of tolerance. Teams may request a replacement shaft by following the link and placing an order on the *FIRST* Choice website. <https://firstchoicebyandymark.com/am-shaft>

These shafts are available free of charge/zero(0) *FIRST* Choice credits, and will either ship for free by themselves or can be added to your teams next 2023 *FIRST* Choice order.

We apologize for this inconvenience and thank you for your understanding. For additional technical support contact support@andymark.com

How to tell if your shaft is out of compliance: AndyMark Engineering has determined that there are a few ways to tell if your shaft needs to be replaced:

1. **Observe the $\frac{1}{2}$ " round portion of the shaft.** If your team has not yet assembled your AM14U5 Chassis, observe the $\frac{1}{2}$ " round portion of the back end of the output shaft. Shafts that are out of compliance likely will have flat portions on this round segment that align with two or three of the six hex faces. A good shaft will have no flats or 6 equally sized flats around the round portion.



2. **Observe Chassis.** If your team has already assembled your AM14U5 Chassis with Toughbox Mini Gearboxes and your shafts have this issue, you may see the following effects.
 - a. **Eccentric Shaft Rotation** - When the gearbox is assembled the output shaft may appear “wobbly” and the output end may move up and down while rotating. The motors attached to the gearbox may wobble as well.
 - b. **Frame Warping** - When operated, if the output shaft is out of compliance it may cause chassis frame rails to flex while the shaft rotates.
 - c. **Gearbox Binding** - When the drive base is fully assembled, the wheels should be able to rotated by hand. Gearboxes with an out of compliance shaft may “bind” or “lockup” and the wheels will be difficult to rotate by hand or under motor power.

All of these effects may be caused by a non-concentric shaft. If your team runs into any of the above issues, take the above steps to **acquire a replacement shaft**.

Alternative Solutions: For best performance, AndyMark recommends only using shafts that are within tolerance for concentricity. If a team is unable to wait for or acquire a replacement there are a few pathways to improve performance.

1. **Use an older Toughbox Mini Gearbox.** Using a Kit of Parts Toughbox Mini Classic from a previous season will work as a replacement. The 2023 version has a different ratio and a different e-clip groove location, but the mounting points and output shaft geometry are the same. In order to ensure the gearbox components will work together, the simplest solution is replacing both gearboxes as complete units instead of replacing individual components.
2. **Use an older Toughbox Mini Output Shaft.** Teams that have an older output shaft may be able to use this as a replacement, but will need to swap out gears to maintain compatibility.
 - a. **Using 2022 Gearbox Shaft (am-2566b)** - This shaft is identifiable by the $\frac{1}{2}$ " round end on the output side, and $\frac{1}{2}$ " hex end next to the e-clip groove. Note that the $\frac{1}{4}$ " pins at either end were optional and may not be present on your shaft.

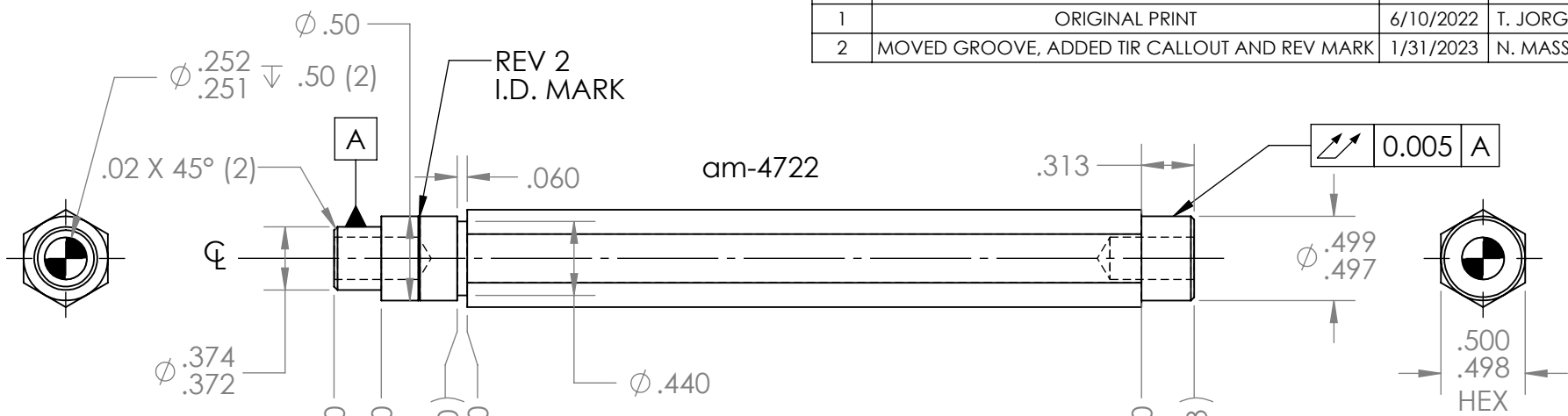


- **To use this shaft in your 2023 Toughbox Mini, the output gear pair will also need to be from 2022 or earlier.** These gears are identifiable by their flat face on one side. The output gear needs to have a matching cluster gear in order to properly mesh together in the gearbox (total number of teeth on both gears need to add to 64). Note that the ratio of prior ToughBoxes was 10.71:1 and the ratio this year is 8.45:1. These ratios need to match on both sides of the chassis.
- b. **Using a 2021 or prior Gearbox Shaft (am-2566/am-2566a)** - This shaft is identifiable by the $\frac{1}{2}$ " hex output end of the shaft.



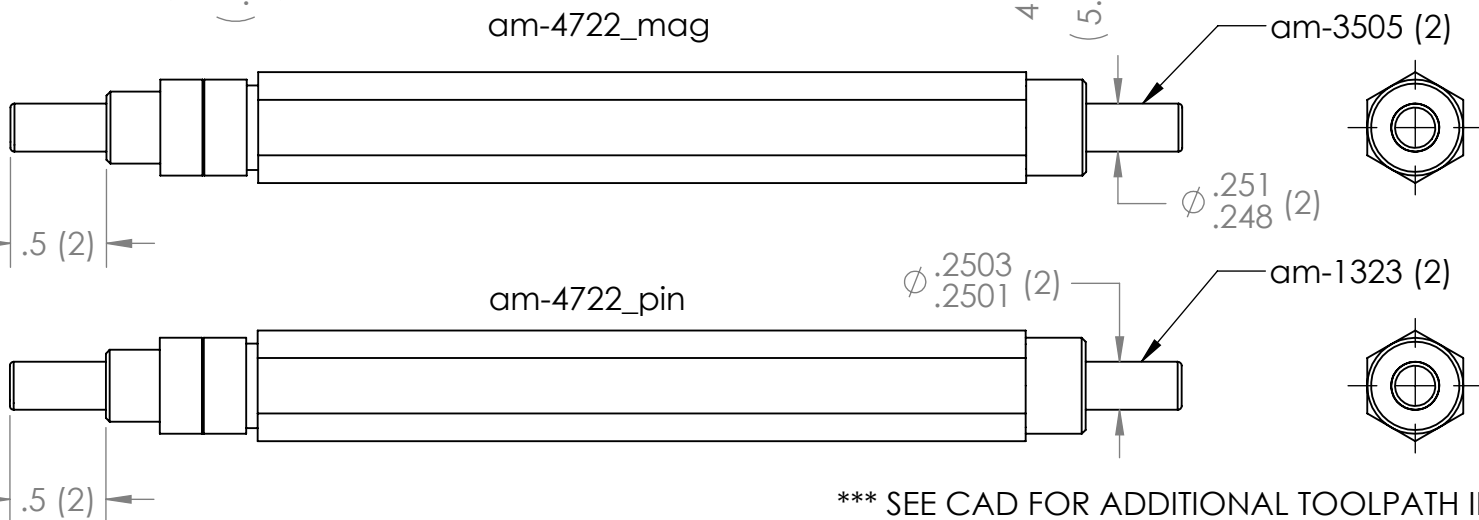
- **To use this shaft in your 2023 Toughbox Mini, the output gear pair will also need to be from 2022 or earlier.** These gears are identifiable by their flat face on one side. The output gear needs to have a matching cluster gear in order to properly mesh together in the gearbox (total number of teeth on both gears need to add to 64). Note that the ratio of prior ToughBoxes was 10.71:1 and the ratio this year is 8.45:1. These ratios need to match on both sides of the chassis.
 - Additionally, you will need a $\frac{1}{2}$ " **hex bearing** for the outer plate to accommodate the $\frac{1}{2}$ " hex output end.
3. **Make a New Shaft.** Teams that have access to and experience using a lathe can manufacture this shaft. Use the attached print to manufacture the shaft to the indicated specifications.
Note: The holes in the end are optional and are only needed if you plan to use encoders. The $\frac{1}{2}$ " round portion near the e-clip groove is not a feature needed for functional use in the AM14U5 Drive Base.
 4. **Modify the Output Gear.** This option will not correct the issue, but may alleviate some of the symptoms and may improve performance. It should only be used as a last resort. Some of the chassis flex can be reduced by sanding down the thickness of the 45 tooth output gear by ~ 0.01 ". This allows the output gear room to move slightly between the e-clip groove and the output hex bearing allowing it to absorb some of the wobble instead of transmitting it into the frame.

REVISION HISTORY			
REV.	DESCRIPTION	DATE	DRAWN BY
1	ORIGINAL PRINT	6/10/2022	T. JORGENSEN
2	MOVED GROOVE, ADDED TIR CALLOUT AND REV MARK	1/31/2023	N. MASSOUDA



NEODYMIUM MAGNET
FIELD ORIENTATION
NOT TIMED TO HEX

STEEL DOWEL
PIN



*** SEE CAD FOR ADDITIONAL TOOLPATH INFO***

UNLESS OTHERWISE SPECIFIED:		COMMENTS:	
DIMENSIONS ARE IN INCHES		DUAL DIMENSIONS ARE IN MILLIMETERS.	
TOLERANCES:		BREAK ALL SHARP EDGES.	
FRACTIONAL	±1/16		
ANGULAR: MACH	±1°		
ANGULAR: BEND	±5°		
ONE PLACE DECIMAL	±0.1		
TWO PLACE DECIMAL	±0.01		
THREE PLACE DECIMAL	±0.005		
FOUR PLACE DECIMAL	±0.0005		
MATERIAL	STEEL HEX SHAFT 1018, 1215, 12L14	NAME	DATE
FINISH	DEBURRED ZINC PLATED	CHECKED	PY 1/31/23
		ENG APPR.	
		MFG APPR.	
	DO NOT SCALE DRAWING	Q.A.	



TITLE:
**TOUGHBOX S AM14U5
HEX OUTPUT SHAFT**

SIZE	DWG. NO.	REV
A	am-4722	2
SCALE: 1:1		SHEET 1 OF 1

