Major Assembly 1:
Team Element Hub – Simple Build – Upper Hub
TE-22002 & TE-22002-AM

This document includes an overview of the Simple version of the Team Element Hub, a shopping list for needed materials, and cut sheets referenced by FIRST in the creation of the shopping list.

- The Team Element Hubs create key geometries that are found on the 2022 Rapid React Field
- There are 2 categories of Team Element Hubs for teams to choose from – Complex and Simple.
- AndyMark sells a few different field elements that can integrate into the Simple or Complex Hubs
    - AM-4671 – Upper Hub -> Complex Build
    - AM-4672 – Upper Hub Vision Ring -> Simple Build
    - AM-4673 – Passive Agitator -> Complex Build
    - AM-4674 – Active Agitator -> Complex Build

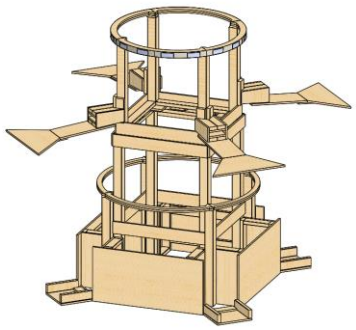
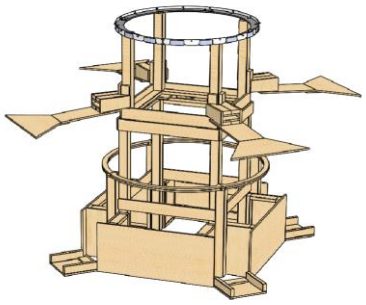
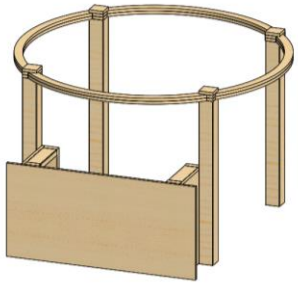
1 OVERVIEW OF TEAM ELEMENT HUB – SIMPLE

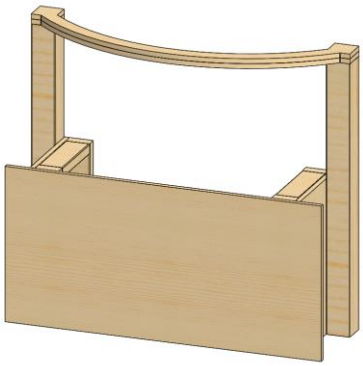
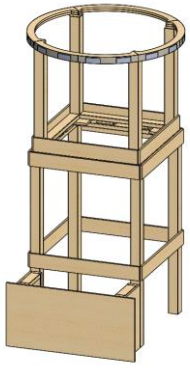
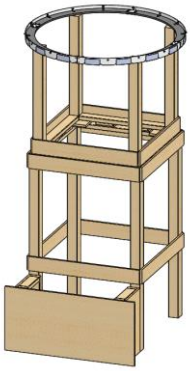
The Hub – Simple Build has 3 major assemblies, each with 2 configurations.

Simple Build – Full Hub: TE-22000 & TE-22000-AM

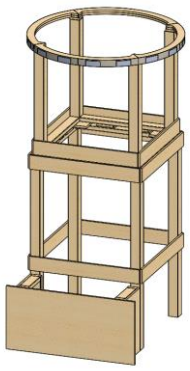
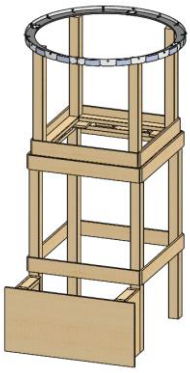
Simple Build – Lower Hub: TE-22001 Multiple & TE-22001-Single

Simple Build – Upper Hub: TE-22002 & TE-22002-AM

Simple Build – Full Hub		
TE-22000 Hub - Simple Build - Full Hub Assembly		Represents all key features from the Field, including a full Upper Hub top ring, a full Upper Hub Vision Ring, four Upper Exits, a full Lower Hub top ring, four Fenders, and four Lower Exits.
TE-22000-AM Hub - Simple Build - Full Hub Assembly with AndyMark Ring AM-4672 Note: Team will need to purchase AM-4672 from AndyMark for this assembly.		Represents all key features from the Field, including AndyMark's AM-4672 Upper Hub top ring and Vision Ring Assembly, four Upper Exits, a full Lower Hub top ring, four Fenders, and four Lower Exits.
Simple Build – Lower Hub		
TE-22001-Multiple Hub - Simple Build - Full Lower Hub + 1/4 Fender Assembly		Represents key features from the Lower Hub including a full Lower Hub top ring and one Fender assembly.

TE-22001-Single Hub - Simple Build - 1/4 Lower Hub + 1/4 Fender Assembly Team will need to purchase AM-4672 from AndyMark for this assembly.		Represents key features from the Lower Hub including one quarter of a Lower Hub top ring and one Fender assembly.
Simple Build – Upper Hub		
TE-22002 Hub - Simple Build - Full Upper Hub + 1/4 Fender Assembly		Represents key features from the Upper Hub including a full Upper Hub top ring and one Fender assembly.
TE-22002-AM Hub - Simple Build - Full Upper Hub for AndyMark Ring AM-4672 + 1/4 Fender Assembly Note: Team will need to purchase AM-4672 from AndyMark for this assembly.		Represents key features from the Upper Hub including a AndyMark's AM-4672 Upper Hub top ring and Vision Ring Assembly and one Fender assembly.

1.1 TEAM ELEMENT HUB – SIMPLE BUILD – FULL HUB (TE-22000 & TE-22000-AM)

Simple Build – Upper Hub		
TE-22002 Hub - Simple Build - Full Upper Hub + 1/4 Fender Assembly		Represents key features from the Upper Hub including a full Upper Hub top ring and one Fender assembly.
TE-22002-AM Hub - Simple Build - Full Upper Hub for AndyMark Ring AM-4672 + 1/4 Fender Assembly Note: Team will need to purchase AM-4672 from AndyMark for this assembly.		Represents key features from the Upper Hub including a AndyMark's AM-4672 Upper Hub top ring and Vision Ring Assembly and one Fender assembly.

1.1.1 FILES INCLUDED IN TEAM ELEMENT HUB – SIMPLE BUILD – UPPER HUB

In this compressed folder, you will find all the PDF Drawings, SolidWorks CAD and Drawing Files, and STEP Files for these designs.

- PDF Drawings: For your convenience, all drawing files have been exported to PDF Format. There is one combined PDF File for TE-22002 and one combined PDF File for TE-22002-AM.
- SolidWorks CAD Files: All SolidWorks files required to build or modify the assembly.
- STEP Files: STEP files of the assembly are included for the convenience of non-SolidWorks users.

1.1.2 SHOPPING LIST FOR TE-22002 & TE-22002-AM

This is the shopping list for Team Element Hub – Simple – Upper Hub.

OR

1.1.2.1 Material Notes

- Plywood and Hardboard Sheets – quality of plywood is up to the user. Plywood of lower qualities may contain voids and may warp more than high quality plywood. All dimensions listed are “nominal”. For example ½” plywood is typically 15/32”.
- Lumber - quality of lumber is up to the user. Please keep in mind that lumber of lower qualities may warp more than high quality lumber. All dimensions below are the “mill cut” dimensions. For example, 2” x 4” lumber is really 1½” x 3½”.
- Wood screw quantities are approximate and should account for having spares left over.

1.1.2.2 Materials Needed

General Material:

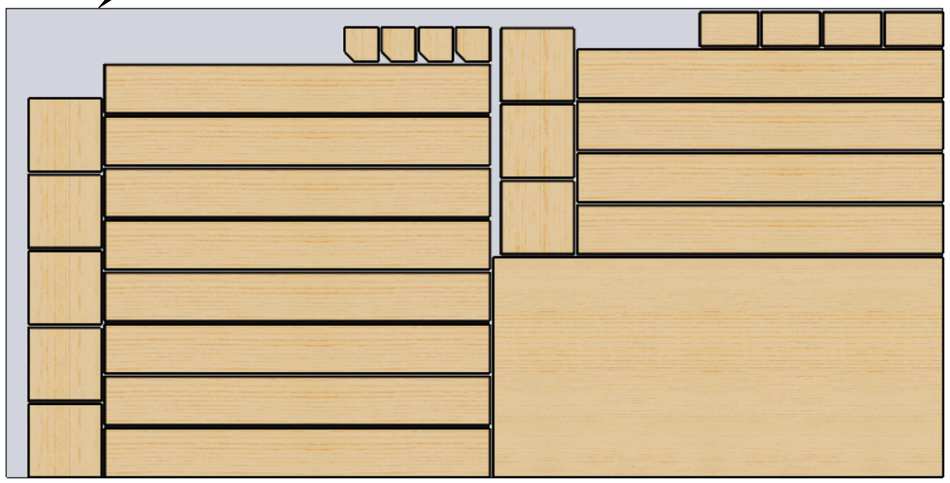
- 2” x 4” x 8’ Long Lumber – Qty 6
- 4” x 4” x 8’ Long Lumber – Qty 6
- 4’ x 8’ x ¾” Thick Plywood – Qty 2
- Standard Size Poster Board (22” x 28” x 0.010” thick) – Qty 1
    - Substitution of other flexible material acceptable
    - This can be omitted if building TE-22002-AM and using AndyMark’s Upper Hub Top Ring & Vision Ring Assembly (AM-4672)

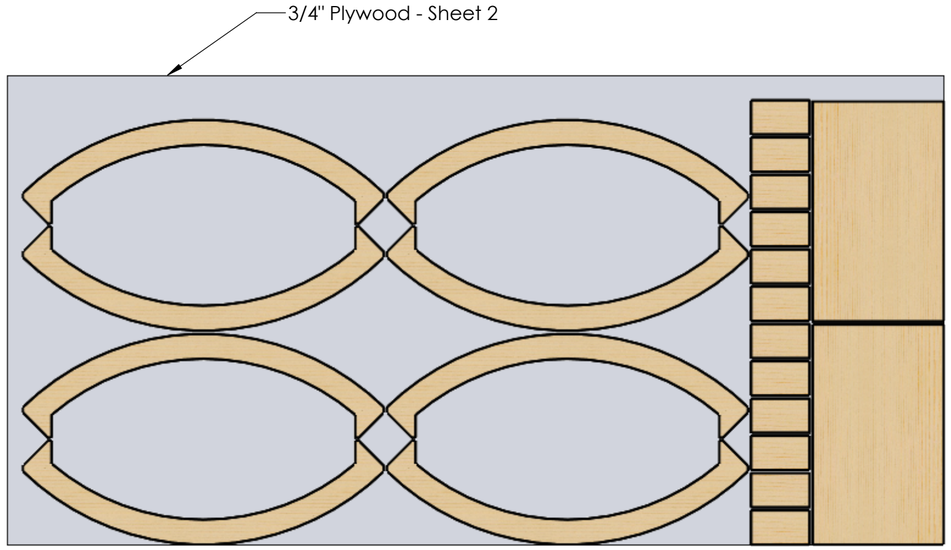
Hardware:

- #8 Wood Screw x 1.25” Long – Approximately ½ lb.
- #8 Wood Screw x 2” Long – Approximately 2 ½ lbs.
- #8 Wood Screw x 2.5” Long – Approximately ½ lb.
- #8 Wood Screw x 3” Long – Approximately ½ lb.
- #10 Wood Screw x 3.5” Long – Approximately 1 ½ lbs.

Misc. Items:

- 2” wide 3M 8830 Scotchlite Reflective Material – 80”
- Wood staples, thumb tacks, tape, etc. to attach TE-22070 (Vision Ring) to Upper Hub
    - This can be omitted if building TE-22002-AM and using AndyMark’s Upper Hub Top Ring & Vision Ring Assembly (AM-4672)





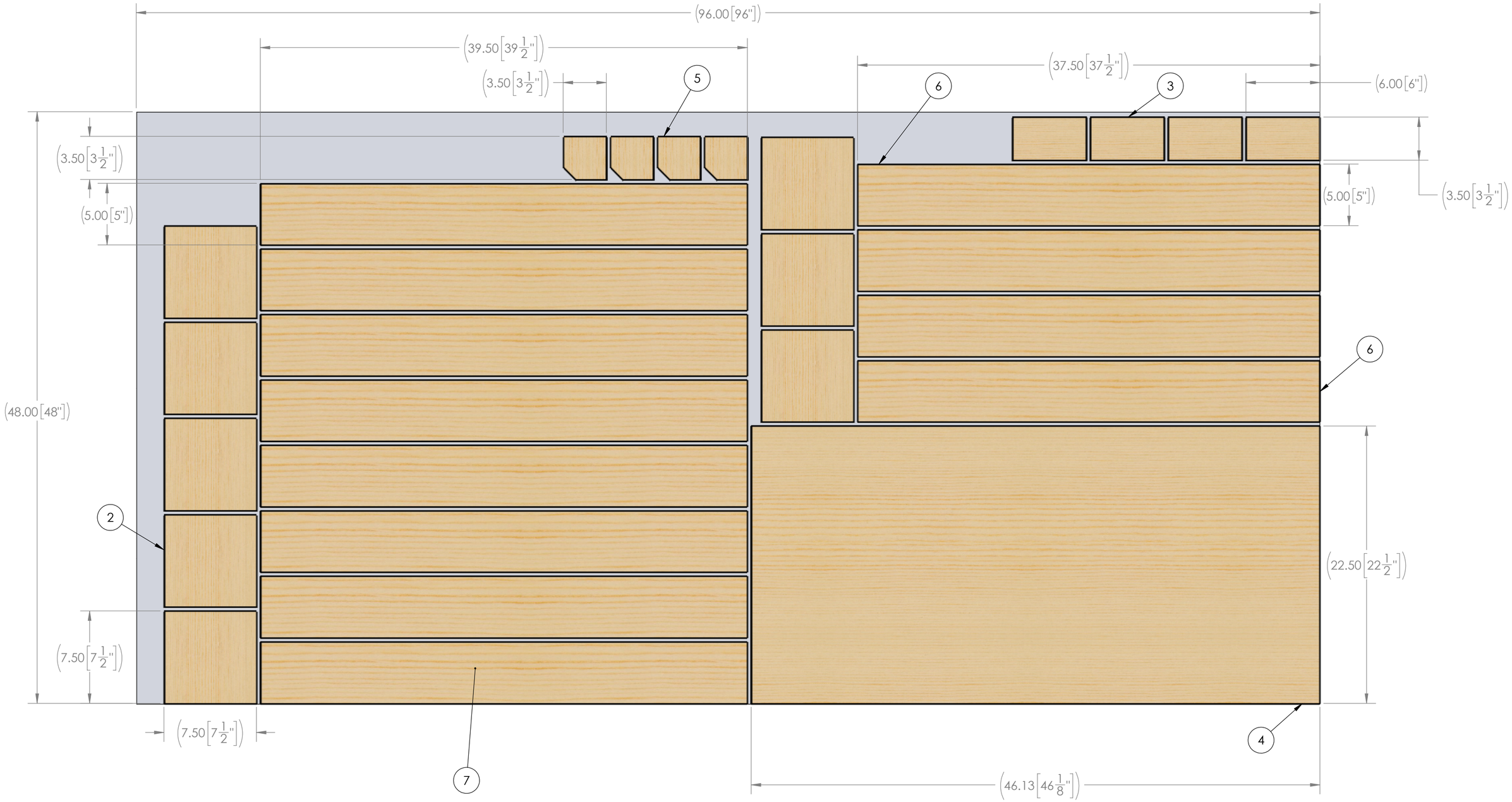
Notes:
1. Provided layouts show boxed-out cuts, meaning a rectangle can be drawn around a part without intersecting with another part's rectangle. More efficient layouts may exist at the cost of complexity.
2. Parts are spaced 5/16" apart to ensure gap for blade thickness or other cutting tool.
3. These cuts reflect how we specified material usage on the shopping list.
4. Plywood grain has been considered in layouts.
5. Dimensions provided are for reference. See the drawing for each part for most accurate dimensions.
6. Parts that can be omitted if building TE-22002-AM are noted on following sheets.

UNLESS OTHERWISE SPECIFIED:	FIELD	NAME	DATE
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/2 ANGULAR: MACH ±1° BEND ±1° TWO PLACE DECIMAL ±.50	DRAWN	KAMC	1/5/2022
MATERIAL/FINISH:	**PROPRIETARY AND CONFIDENTIAL** THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF ***FIRST®***. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF ***FIRST®*** IS PROHIBITED.		
DO NOT SCALE DRAWING	**COMMENTS:** REMOVE ALL BURRS AND SHARP EDGES.		

FIRST ROBOTICS COMPETITION — SOLIDWORKS Modeling Solutions Partner

TITLE:
Cut List - Simple Hub - Upper Hub + 1/4 Fender

SIZE	DWG. NO.	REV
C	Sheet Cuts TE-22002	
SCALE: 1:12	SHEET 1 OF 3	



Note: If building TE-22002-AM, you do not any qty of (5)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	4ft x 8ft Sheet_Simple		1
2	TE-22005	Hub - Simple Build - Upper Hub Square Connection Plate	8
3	TE-22006	Hub - Simple Build - Upper Hub 2x4 Connection Plate	4
4	TE-22012	HUB - Simple Build - Fender Front	1
5	TE-22032	Hub - Simple Build - Upper Hub Ring Connection Plate	4
6	TE-22037	Hub - Simple Build - Upper Hub Goal Rectangle Connection Plate	4
7	TE-22043	Hub - Simple Build - Upper Hub Base Rectangle Connetion Plate	8

3/4" Plywood - Sheet 1

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/2
ANGULAR: MACH ±1° BEND ±1°
TWO PLACE DECIMAL ±.50

MATERIAL/FINISH:

DO NOT SCALE DRAWING

FIELD	NAME	DATE
DRAWN	KAMC	1/5/2022

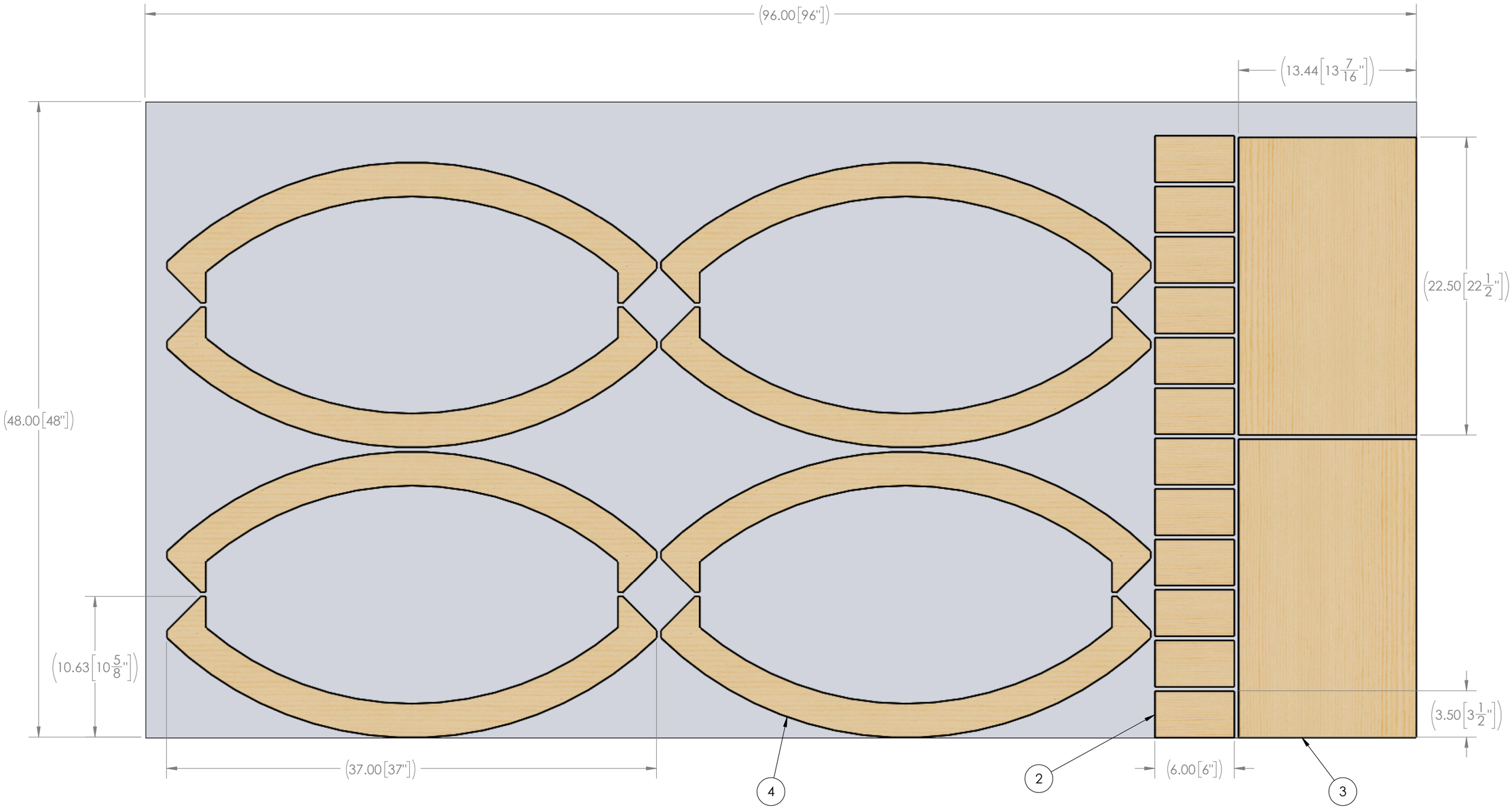
COMMENTS:
REMOVE ALL BURRS AND SHARP EDGES.

FIRST ROBOTICS COMPETITION — SOLIDWORKS Modeling Solutions Partner

TITLE:
Cut List - Simple Hub - Upper Hub + 1/4 Fender

SIZE	DWG. NO.	REV
C	Sheet Cuts TE-22002	

SCALE: 1:6 | SHEET 2 OF 3



3/4" Plywood - Sheet 2

Note: If building TE-22002-AM, you do not need any qty of (4)

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	4ft x 8ft Sheet_Simple		1
2	TE-22006	Hub - Simple Build - Upper Hub 2x4 Connection Plate	12
3	TE-22016	HUB - Simple Build - Fender Side	2
4	TE-22031	Hub - Simple Build - Upper Hub Ring	8

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/2
ANGULAR: MACH ±1° BEND ±1°
TWO PLACE DECIMAL ±.50

MATERIAL/FINISH:

DO NOT SCALE DRAWING

FIELD	NAME	DATE
DRAWN	KAMC	1/5/2022

COMMENTS:
REMOVE ALL BURRS AND SHARP EDGES.

FIRST ROBOTICS COMPETITION — SOLIDWORKS Modeling Solutions Partner

TITLE:
Cut List - Simple Hub - Upper Hub + 1/4 Fender

SIZE	DWG. NO.	REV
C	Sheet Cuts TE-22002	

SCALE: 1:6 | SHEET 3 OF 3

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
1	Fender & Goal	2x4				HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Side Horizontal 2x4			Hub - Simple Build - Upper Hub Goal 2x4																			
						Fender A - 1/4			Fender A - 2/4			Fender A - 1/4			Goal 1/4																			
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	3.0625	**22.5**	TE-22015	0.25	**22.5**	TE-22015	0.25	**10.4375**	TE-22014	0.25	**30.5**	TE-22035	0.25																	

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
2	Fender & Goal	2x4				HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Side Horizontal 2x4			Hub - Simple Build - Upper Hub Goal 2x4																			
						Fender A - 4/4			Fender A - 3/4			Fender A - 2/4			Goal 2/4																			
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	3.0625	**22.5**	TE-22015	0.25	**22.5**	TE-22015	0.25	**10.4375**	TE-22014	0.25	**30.5**	TE-22035	0.25																	

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
3	Fender	2x4				HUB - Simple Build - Fender Front Horizontal 2x4			HUB - Simple Build - Fender Front Horizontal 2x4			HUB - Simple Build - Fender Side Horizontal 2x4			HUB - Simple Build - Fender Side Horizontal 2x4																			
						Fender A - 1/2			Fender A - 2/2			Fender A - 3/4			Fender A - 4/4																			
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	6.125	**31**	TE-22011	0.25	**31**	TE-22011	0.25	**10.4375**	TE-22014	0.25	**10.4375**	TE-22014	0.25																	

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
4	Fender A	2x4				Hub - Simple Build - Upper Hub Goal 2x4			Hub - Simple Build - Upper Hub Base 2x4																									
						Goal 3/4			Base 1/4																									
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	26.5	**30.5**	TE-22035	0.25	**32.5**	TE-22041	0.25																							

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
5	Fender A	2x4				Hub - Simple Build - Upper Hub Goal 2x4			Hub - Simple Build - Upper Hub Base 2x4																									
						Goal 4/4			Base 2/4																									
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	26.5	**30.5**	TE-22035	0.25	**32.5**	TE-22041	0.25																							

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
6	Fender A	2x4				Hub - Simple Build - Upper Hub Base 2x4			Hub - Simple Build - Upper Hub Base 2x4																									
						Base 3/4			Base 4/4																									
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	24.5	**32.5**	TE-22041	0.25	**32.5**	TE-22041	0.25																							

Intentionally Left Blank

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1 - Length is NOT -AM Part			Cut 2 - Length is NOT -AM Part			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub			Hub - Simple Build - Upper Hub																										
1	Upper Hub Goal	4X4				Goal 1/4			Goal 2/4																										
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	17.375	**36.0625**	TE-22036	0.25	**36.0625**	TE-22036	0.25																							

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1 - Length is NOT -AM Part			Cut 2 - Length is NOT -AM Part			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub			Hub - Simple Build - Upper Hub																										
2	Upper Hub Goal	4X4				Goal 3/4			Goal 4/4																										
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	17.375	**36.0625**	TE-22036	0.25	**36.0625**	TE-22036	0.25																							

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub																													
3	Upper Hub Base	4X4				Base 1/4																													
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	25.375	**64.375**	TE-22042	0.25																										

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub																													
4	Upper Hub Base	4X4				Base 2/4																													
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	25.375	**64.375**	TE-22042	0.25																										

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub																													
5	Upper Hub Base	4X4				Base 3/4																													
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	25.375	**64.375**	TE-22042	0.25																										

Number	Cut Identifier	Material Size	Length	Trim Off	Drop	Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
						Hub - Simple Build - Upper Hub																													
6	Upper Hub Base	4X4				Base 4/4																													
						Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade	Cut	Part	Blade
			96	6	25.375	**64.375**	TE-22042	0.25																										