

# Major Assembly 1:

## Team Element Hub – Simple Build – Lower Hub

### TE-22001-Multiple & TE-22001-Single

*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

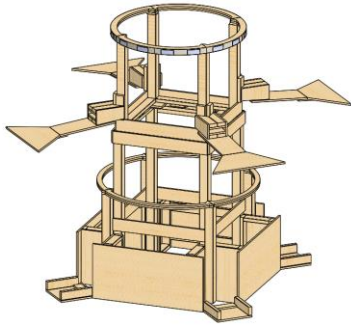
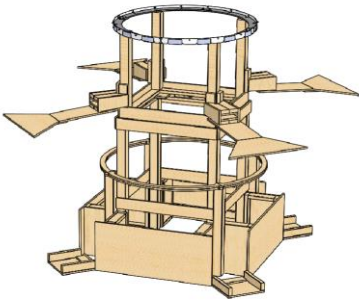
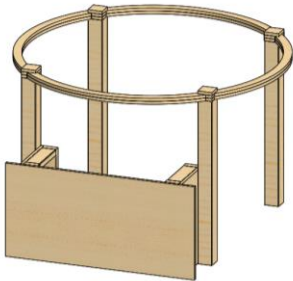
# 1 OVERVIEW OF TEAM ELEMENT HUB – SIMPLE

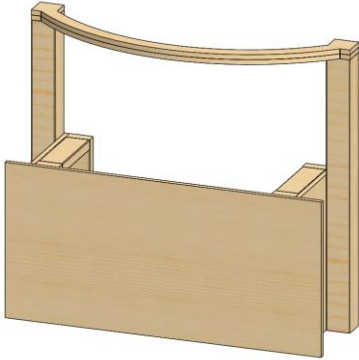
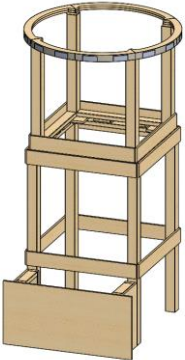
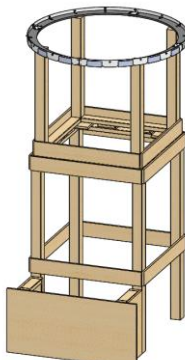
The Hub – Simple Build has 3 major assemblies, each with 2 configurations.

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

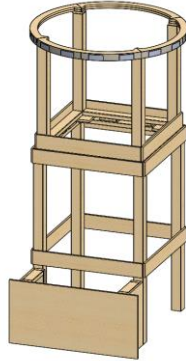
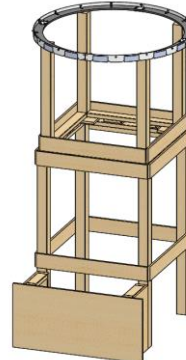
Simple Build – Lower Hub: TE-22001 Multiple & TE-22001-Single

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

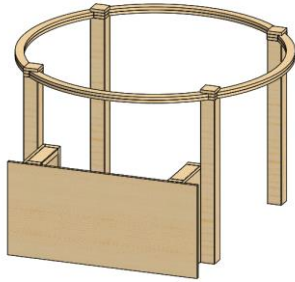
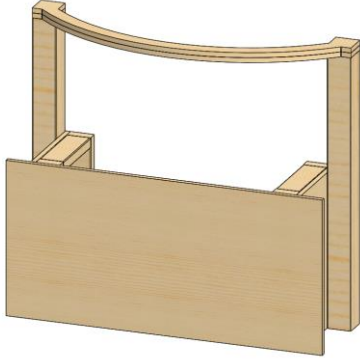
Simple Build – Full Hub		
<p>TE-22000</p> <p>Hub - Simple Build - Full Hub Assembly</p>		<p>Represents all key features from the Field, including a full Upper Hub top ring, a full Upper Hub Vision Ring, four Upper Exits, a full Lower Hub top ring, four Fenders, and four Lower Exits.</p>
<p>TE-22000-AM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

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

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

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

## 1.2 TEAM ELEMENT HUB – SIMPLE BUILD – LOWER HUB (TE-22001-MULTIPLE & TE-22001-SINGLE)

Simple Build – Lower Hub		
<p>TE-22001-Multiple</p> <p>Hub - Simple Build - Full Lower Hub + 1/4 Fender Assembly</p>		<p>Represents key features from the Lower Hub including a full Lower Hub top ring and one Fender assembly.</p>
<p>TE-22001-Single</p> <p>Hub - Simple Build - 1/4 Lower Hub + 1/4 Fender Assembly Team will need to purchase AM-4672 from AndyMark for this assembly.</p>		<p>Represents key features from the Lower Hub including one quarter of a Lower Hub top ring and one Fender assembly.</p>

### 1.2.1 FILES INCLUDED IN TEAM ELEMENT HUB – SIMPLE BUILD – LOWER HUB

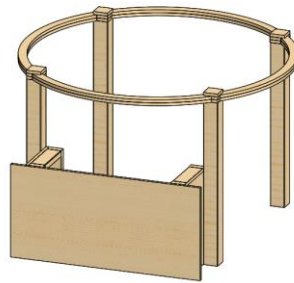
In this compressed folder, you will find all the PDF Drawings, SolidWorks CAD and Drawing Files, and STEP Files for these designs.

- PDF Drawings: For your convenience, all drawing files have been exported to PDF Format. There is one combined PDF File for TE-22001-Multiple and one combined PDF File for TE-22001-Single.
- 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.

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## 1.2.2 SHOPPING LIST FOR TE-22001-MULTIPLE

This is the shopping list for Team Element Hub – Simple – Lower Hub - Multiple.



### 1.2.2.1 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.

### 1.2.2.2 Materials Needed

#### General Material:

- 2” x 4” x 8’ Long Lumber – Qty 3
- 4” x 4” x 8’ Long Lumber – Qty 2
- 4’ x 8’ x ¾” Thick Plywood – Qty 2

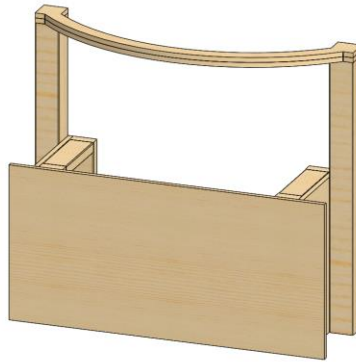
#### Hardware:

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

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### 1.2.3 SHOPPING LIST FOR TE-22001-SINGLE

This is the shopping list for Team Element Hub – Simple – Lower Hub - Single.



#### 1.2.3.1 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.

#### 1.2.3.2 Materials Needed

##### General Material:

- 2” x 4” x 8’ Long Lumber – Qty 3
- 4” x 4” x 8’ Long Lumber – Qty 2
- 4’ x 8’ x ¾” Thick Plywood – Qty 1

##### Hardware:

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

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C

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A

D

C

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A

4

3

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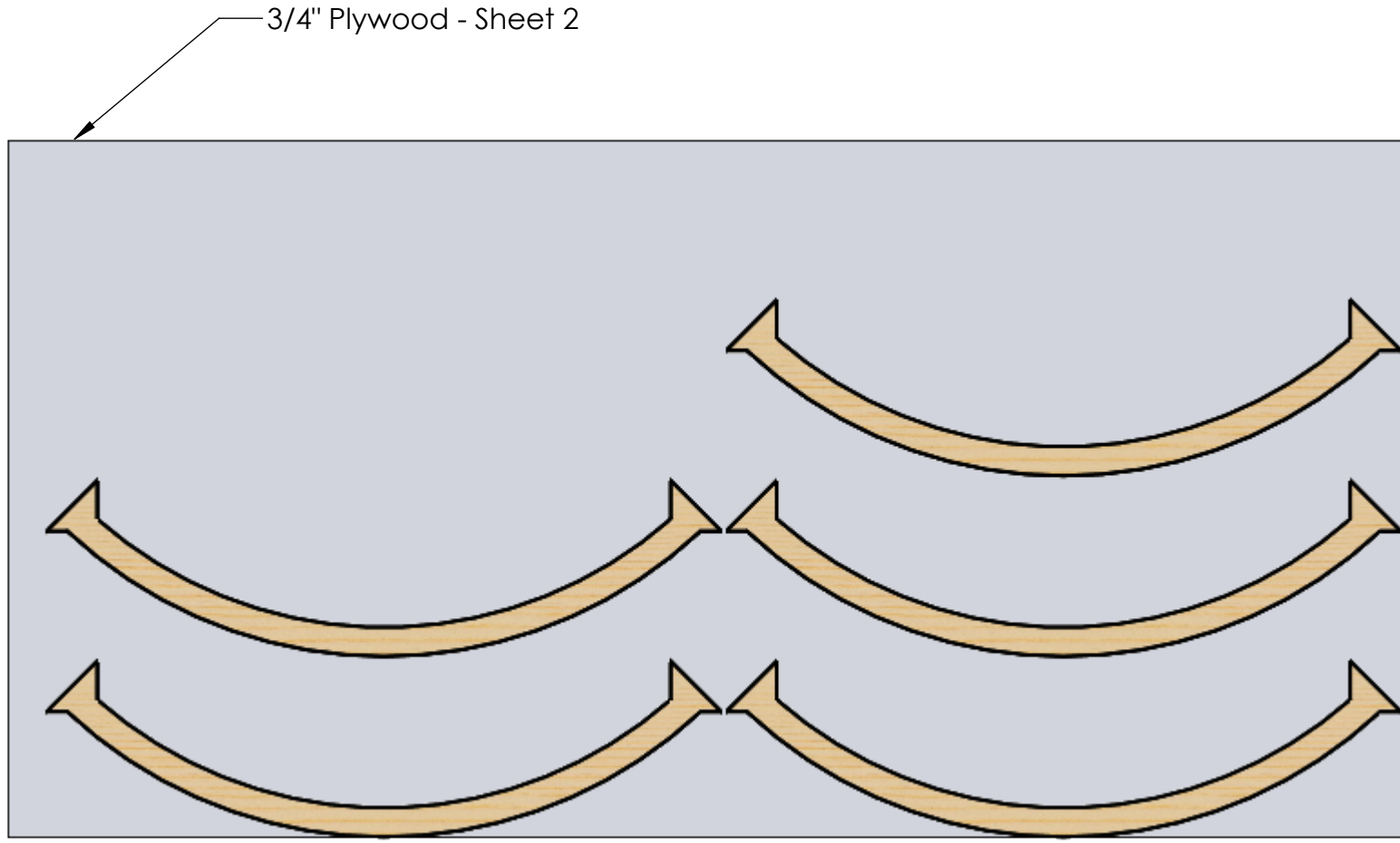
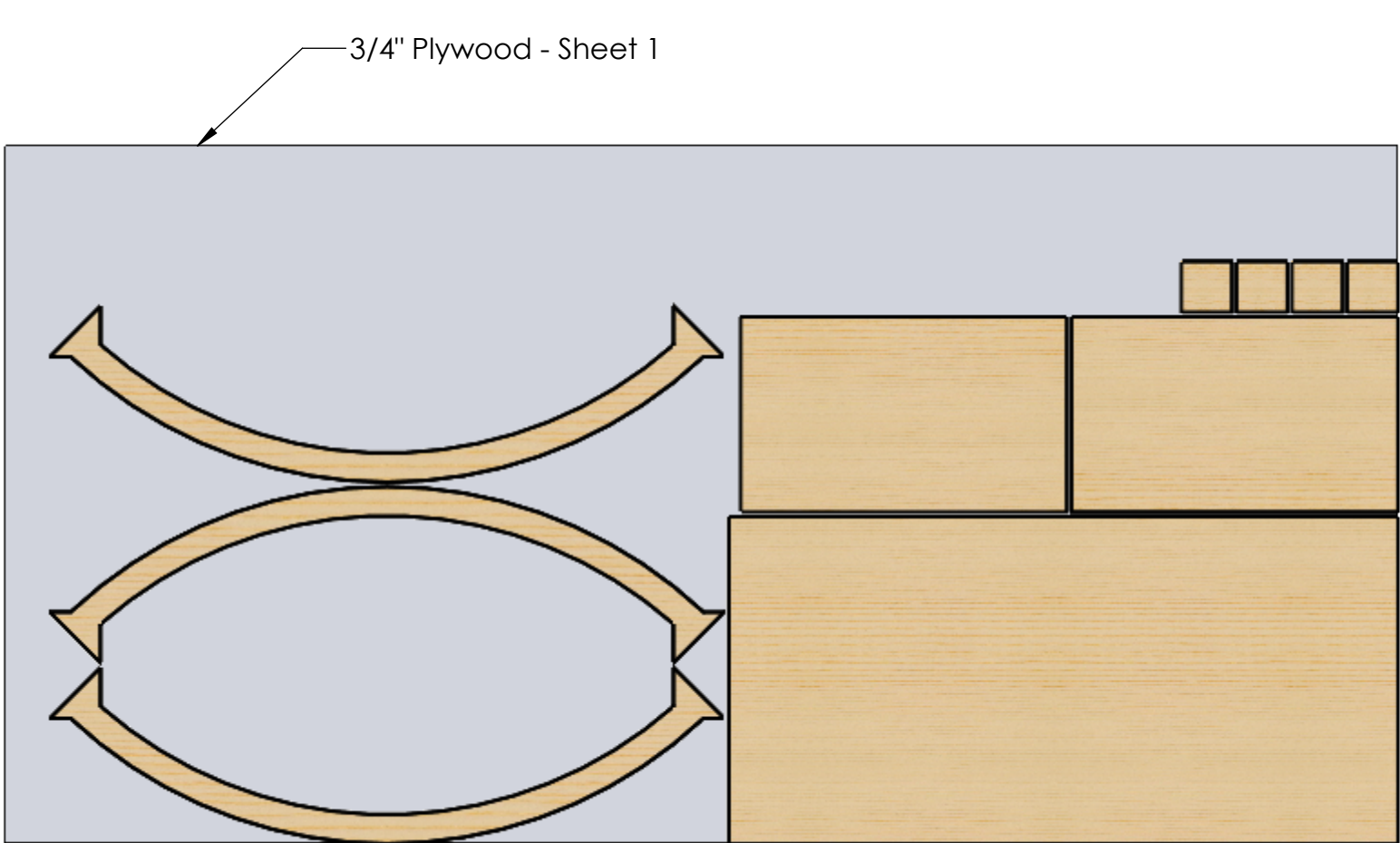
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2

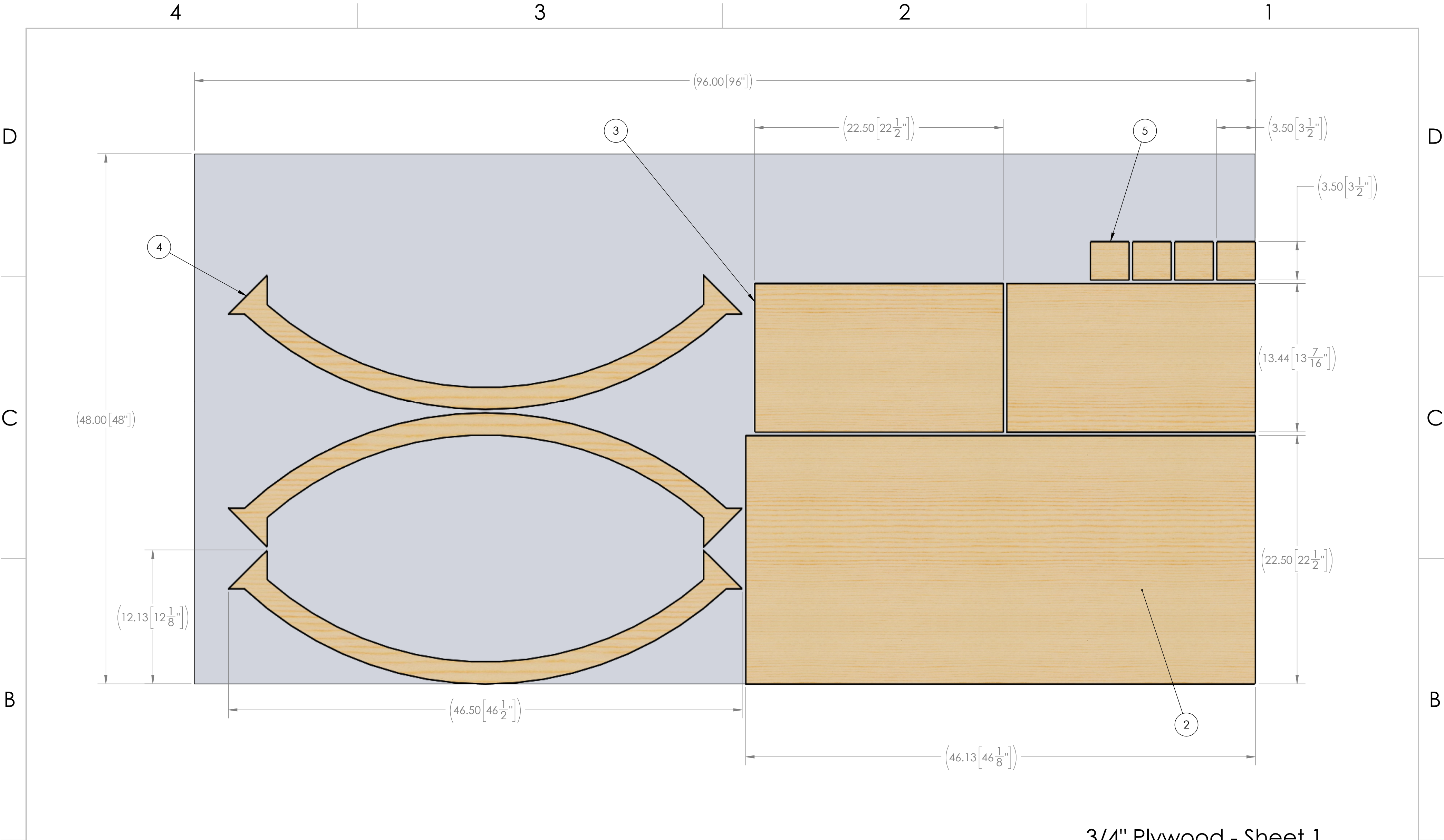
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- Notes:
1. Provided layouts show boxed-out cuts, meaning a rectangle can be drawn around a part without intersecting with another part's rectangle. More efficient layouts may exist at the cost of complexity.
  2. Parts are spaced 5/16" apart to ensure gap for blade thickness or other 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.

UNLESS OTHERWISE SPECIFIED:	FIELD	NAME	DATE	<div><div>FIRST ROBOTICS COMPETITION</div></div> <div><div>SOLIDWORKS Modeling Solutions Partner</div></div>		
	DRAWN	KAMC	1/5/2022			
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/2 ANGULAR: MACH ±1° BEND ±1° TWO PLACE DECIMAL ±.50	PROPRIETARY AND CONFIDENTIAL			TITLE:  Sheet Cut for Simple Hub - Lower Hub - Multiple		
	THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF <b>FIRST®</b> . ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF <b>FIRST®</b> IS PROHIBITED.					
MATERIAL/FINISH:	COMMENTS:			SIZE	DWG. NO.	REV
	REMOVE ALL BURRS AND SHARP EDGES.			C	Sheet Cuts TE-22001-Multiple	
DO NOT SCALE DRAWING				SCALE: 1:12		SHEET 1 OF 3





3/4" Plywood - Sheet 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	4ft x 8ft Sheet_Simple		1
2	TE-22012	HUB - Simple Build - Fender Front	1
3	TE-22016	HUB - Simple Build - Fender Side	2
4	TE-22021-Multiple	Hub - Simple Build - Lower Hub Ring - Multiple	3
5	TE-22022	Hub - Simple Build - Lower Hub Ring Connection Plate	4



UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES  
TOLERANCES:  
FRACTIONAL  $\pm 1/2$   
ANGULAR: MACH  $\pm 1^\circ$  BEND  $\pm 1^\circ$   
TWO PLACE DECIMAL  $\pm .50$

MATERIAL/FINISH:

DO NOT SCALE DRAWING

FIELD	NAME	DATE
DRAWN	KAMC	1/5/2022
PROPRIETARY AND CONFIDENTIAL		
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF <b>FIRST</b> . ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF <b>FIRST</b> IS PROHIBITED.		
COMMENTS: REMOVE ALL BURRS AND SHARP EDGES.		



TITLE:  
Sheet Cut for Simple Hub - Lower Hub - Multiple

SIZE	DWG. NO.	REV
C	Sheet Cuts TE-22001-Multiple	

SCALE: 1:6	SHEET 2 OF 3
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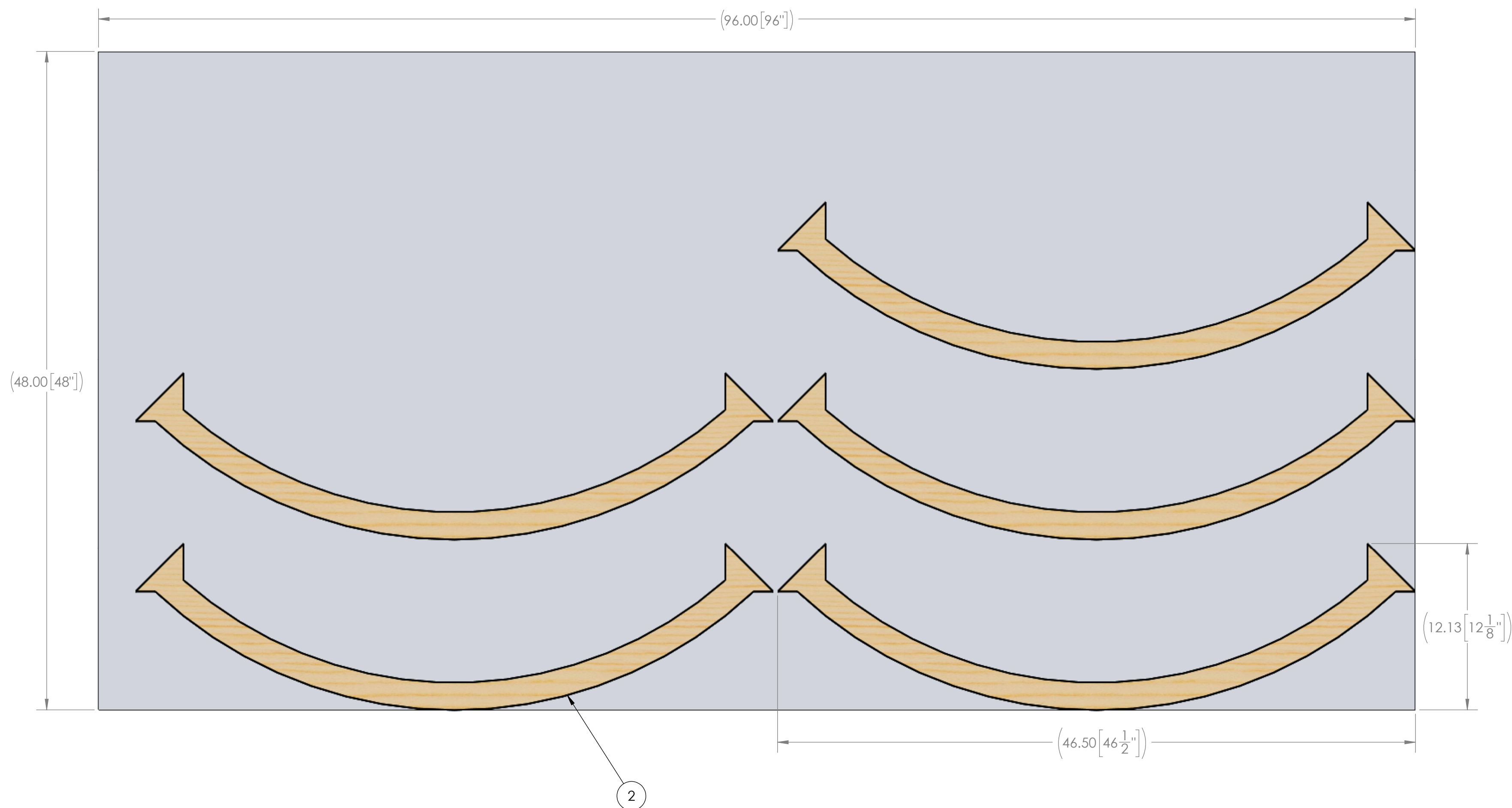
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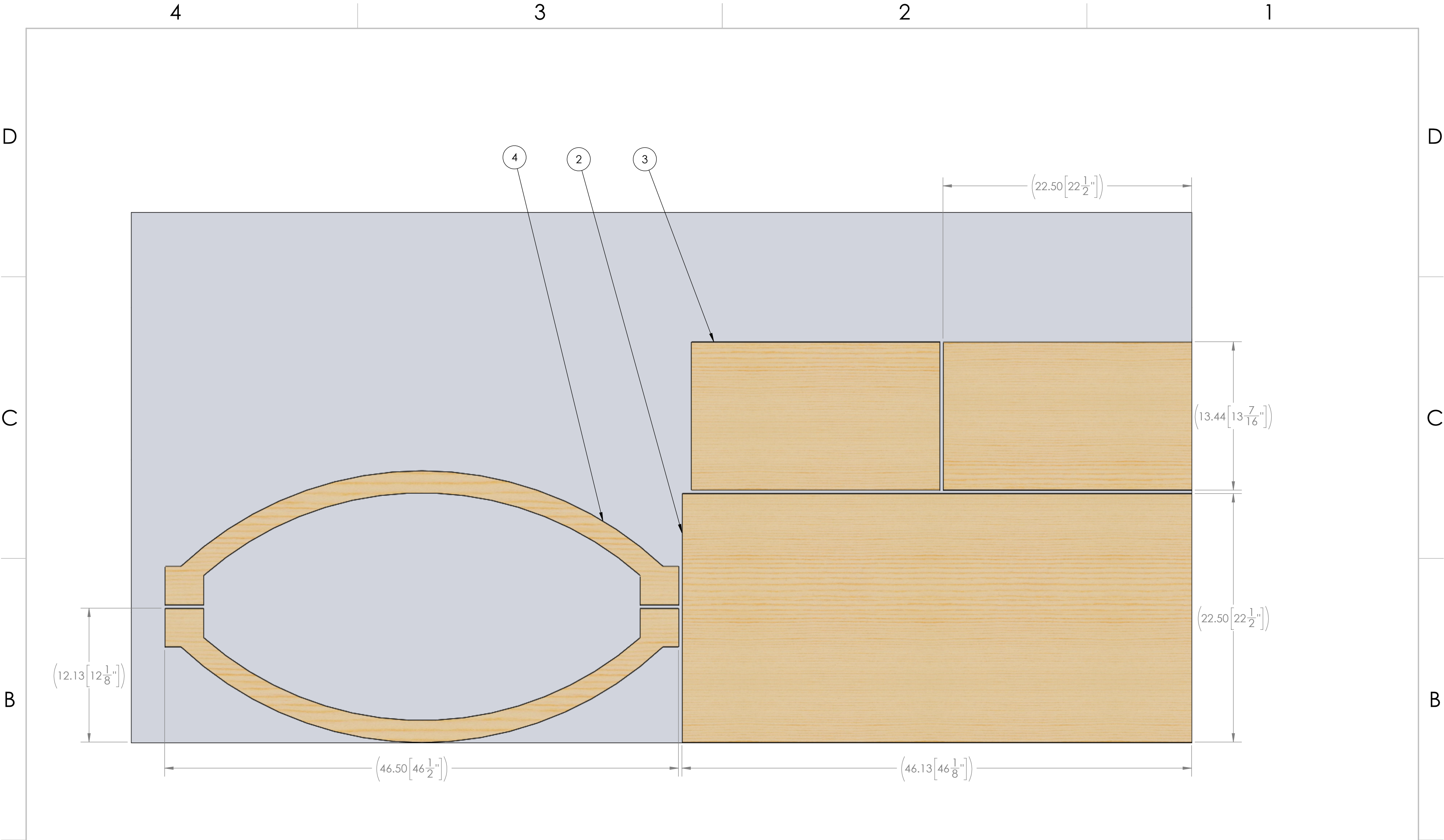


### 3/4" Plywood - Sheet 2

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	4ft x 8ft Sheet_Simple		1
2	TE-22021-Multiple	Hub - Simple Build - Lower Hub Ring - Multiple	5

UNLESS OTHERWISE SPECIFIED:	FIELD	NAME	DATE	<div> <b>FIRST</b> <b>ROBOTICS</b> <b>COMPETITION</b></div> <div></div>		
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL $\pm 1/2$ ANGULAR: $MACH \pm 1^\circ$ BEND $\pm 1^\circ$ TWO PLACE DECIMAL $\pm .50$	DRAWN	KAMC	1/5/2022	TITLE: <div>Sheet Cut for Simple Hub - Lower Hub - Multiple</div>		
MATERIAL/FINISH:	<b>PROPRIETARY AND CONFIDENTIAL</b>  THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF <b>FIRST®</b> . ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF <b>FIRST®</b> IS PROHIBITED.			SIZE	DWG. NO.	REV
				<div>C</div>	Sheet Cuts TE-22001-Multiple	
DO NOT SCALE DRAWING				SCALE: 1:6		SHEET 3 OF 3







- 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.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	4ft x 8ft Sheet_Simple		1
2	TE-22012	HUB - Simple Build - Fender Front	1
3	TE-22016	HUB - Simple Build - Fender Side	2
4	TE-22021-Single	Hub - Simple Build - Lower Hub Ring - Single	2

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



TITLE:  
**Sheet Cut for Simple Hub - Lower Hub - Single**

SIZE	DWG. NO.	REV
<b>C</b>	Sheet Cuts TE-22001-Single	

SCALE: 1:6	SHEET 1 OF 1
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## Simple Low Lumber Cuts

Number	Cut Identifier	Material Size				Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
1	Fender A	2x4	Length	Trim Off	Drop	HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Side Horizontal 2x4			HUB - Simple Build - Fender Side Horizontal 2x4																				
						Fender A - 1/4			Fender A - 2/4			Fender A - 1/4			Fender A - 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
						22.5	TE-22015	0.25	22.5	TE-22015	0.25	10.438	TE-22014	0.25	10.438	TE-22014	0.25																		
Number	Cut Identifier	Material Size				Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
2	Fender A	2x4	Length	Trim Off	Drop	HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Vertical 2x4			HUB - Simple Build - Fender Side Horizontal 2x4			HUB - Simple Build - Fender Side Horizontal 2x4																				
						Fender A - 4/4			Fender A - 3/4			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
						22.5	TE-22015	0.25	22.5	TE-22015	0.25	10.438	TE-22014	0.25	10.438	TE-22014	0.25																		
Number	Cut Identifier	Material Size				Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
3	Fender B	2x4	Length	Trim Off	Drop	HUB - Simple Build - Fender Front Horizontal 2x4			HUB - Simple Build - Fender Front Horizontal 2x4																										
						Fender A - 1/2			Fender A - 2/2																										
						Cut	Part	Blade	Cut	Part	Blade																								
						31	TE-22011	0.25	31	TE-22011	0.25																								
Intentionally Left Blank																																			
Number	Cut Identifier	Material Size				Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
1	Lower Hub Vertical	4X4	Length	Trim Off	Drop	HUB - Simple Build - Ring 1			HUB - Simple Build - Ring 2																										
						Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut		
						39.563	TE-22025	0.25	39.563	TE-22025	0.25																								
Number	Cut Identifier	Material Size				Cut 1			Cut 2			Cut 3			Cut 4			Cut 5			Cut 6			Cut 7			Cut 8			Cut 9			Cut 10		
2	Lower Hub Vertical	4X4	Length	Trim Off	Drop	HUB - Simple Build - Ring 3			HUB - Simple Build - Ring 4																										
						Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut			Cut		
						39.563	TE-22025	0.25	39.563	TE-22025	0.25																								