

3S Trailer Suspension

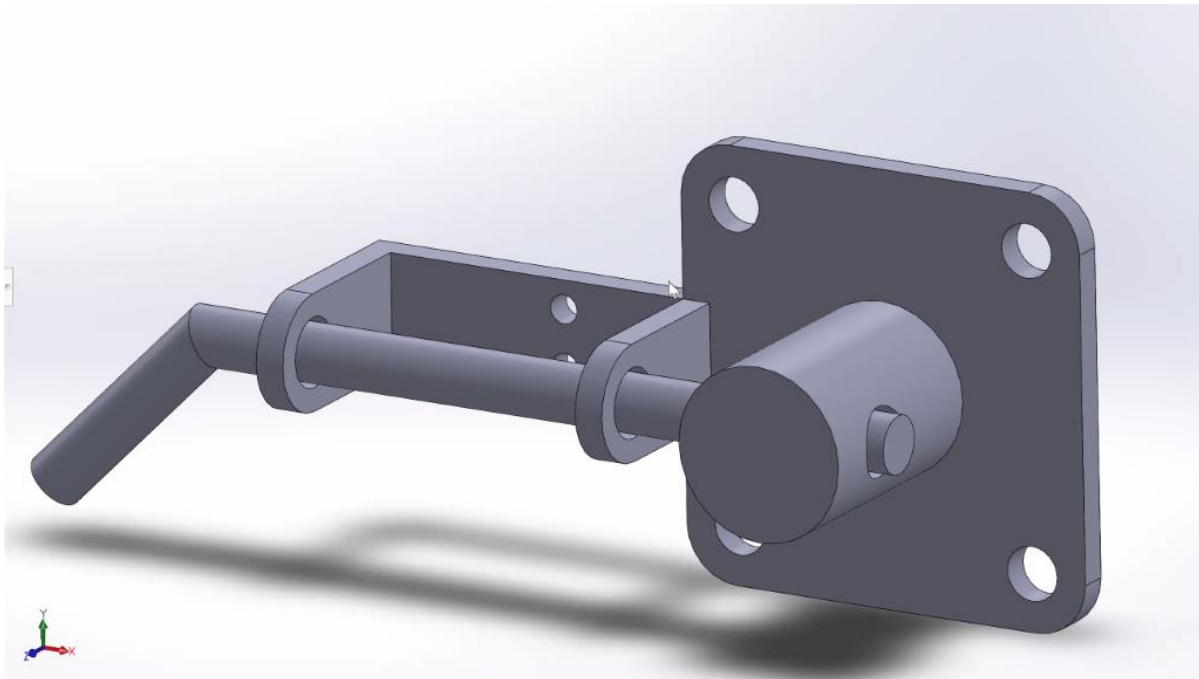
Meeting # 13

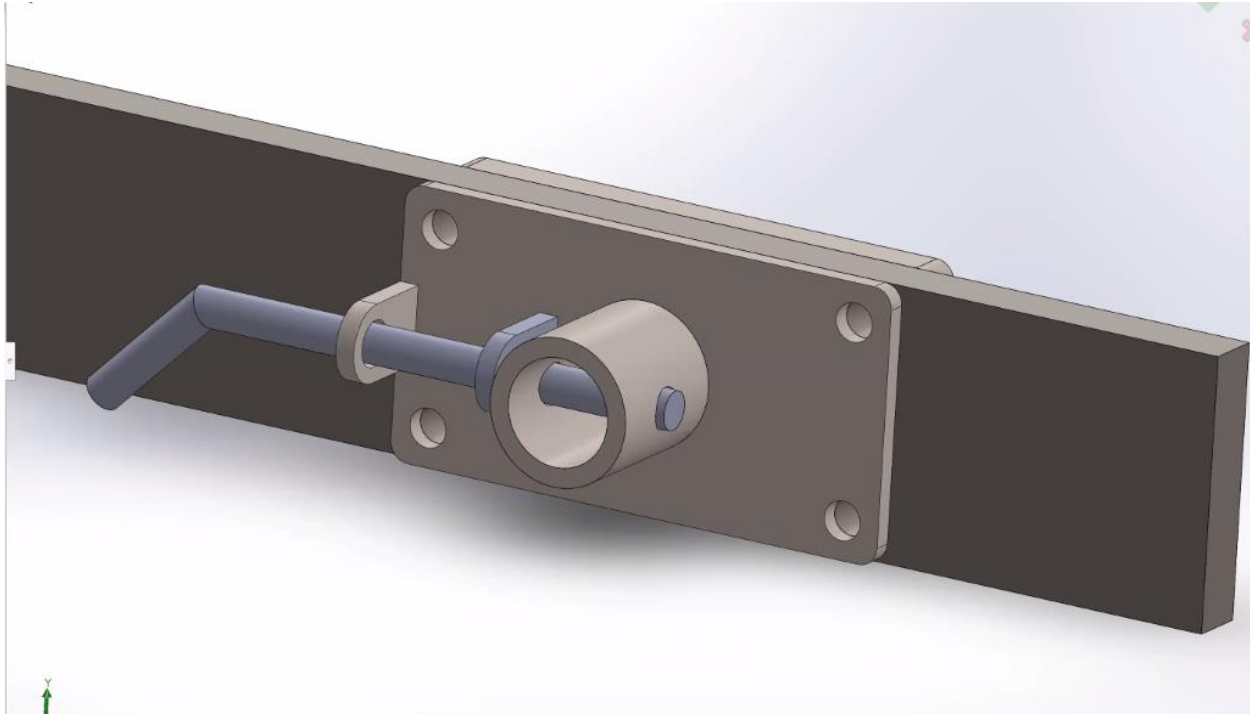
Start Date & Time: Wednesday, 7/8/2020, 8:00pm

Members Present: Caitlin, Robert

End Time: 11:00pm

Last Meeting:





- Angle of the lever arm - has that been factored in?
- Spring - user would never lose the pin - make it easier for user to lock it back into place by themselves
- Spacer is same pattern and bolt size
- Rubber stopper
- Didn't want flanged bearing rubbing up against the spacer
- Keep the steel pipe as a whole - cost trade off because of more bearing would out cost the 2 bearings - protective sleeve for the axle - easier to install
- Welded cap on the outside - set screw radial bearings?
- Would it be best to mount the axle flush?
- Don't need the rubber on the spacer!
- Don't mind expanding the spacer to the bolt pattern!
- Make sure the hardware doesn't interfere with the rest of the trailer
- Lock pin - what is going to keep it from shutting back in?
- Arm is angled - in resting position - Swenson doesn't think it matters - doesn't care what the arm angle is
- On the bar - use finite element method - for stress concentrations
- He needs a design for the small-scale prototype - the most mature
- We need a clear plan - doesn't see the plan
- Nothing in here to show the mount of springs
- And wheels and tires mounting
- Axle needs to be right below the frame
- Willing to purchase the springs, tires, and PLA for us

- Pick a date for our design review between now and the 20th
- We want 1-inch gap between frame and steel axle

Today's Objectives:

- Discuss findings from work done since last meeting
- Start Value Proposition
- Start Design review
- Set a design review date Between now and the 20th
- Start Design Validation plan
- Portfolio for Snapshot 1

Notes:

Notes:

Lever ratio options, based off the 4 different spring Stiffnesses used in Excel Calculation file:

Stiffness (lb/in)	90% stiffness	Lever Ratio	Min Desired Stiffness
K = 112	100.8	19.75/6.25 = 3.16	100.14
K = 114.3	114.3	23.75/8 = 2.96875	113.46
K = 138	124.3	22.75/8 = 2.84375	123.65
K = 105	94.5	20.25/6.25 = 3.24	95.26

NOTE: 20/6 = 3.33, w/ required stiffness of 90 lb/in

- Current design: 23/6.25 = 3.68, w/ required stiffness of 73.4 lb/in

- Square steel is the easiest to weld
- The spring won't fit on the lever arm - need to redo that

Analysis of lever ratio required to use springs from Century Spring catalog								Lever Ratio		Choice
Century Spring Part No.	Spring Rate (lb/in)	Max Load Limit (lb)	Force in spring at max loading conditions	2000	3500	6000				
73606	148	696	585	2.874	5.029	8.62			#1	
73642	127	667	571.75	2.998	5.247	8.995			#2	
73510	141	666	560.25	3	5.255	9.009			#3	
73545	146	631	521.5	3.17	5.546	9.508			#4	
73546	122	631	539.5	3.17	5.546	9.508			#5	
73390	139	614	509.75	3.257	5.7	9.77				
73599	136	595	493	3.361	5.882	10.084				
73600	111	595	511.75	3.361	5.882	10.084				
73272	140	581	476	3.442	6.024	10.327				
73443	143	577	469.75	3.466	6.07	10.398				
73444	120	577	487	3.466	6.07	10.398				
73635	117	570	482.5	3.508	6.14	10.526				
73636	96	570	498	3.508	6.14	10.526				
73503	127	545	449.75	3.67	6.422	11.009				
73504	105	545	466.25	3.67	6.422	11.009				
73323	138	542	438.5	3.69	6.4575	11.07				
73324	112	542	458	3.69	6.4575	11.07				

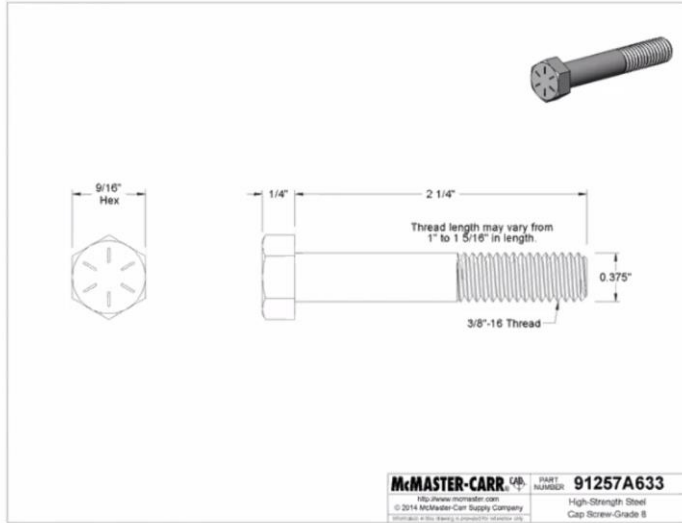
- Design validation plan
- What date do we want our design review??? From now till the 20th

Zinc Yellow-Chromate Plated Hex Head Screw

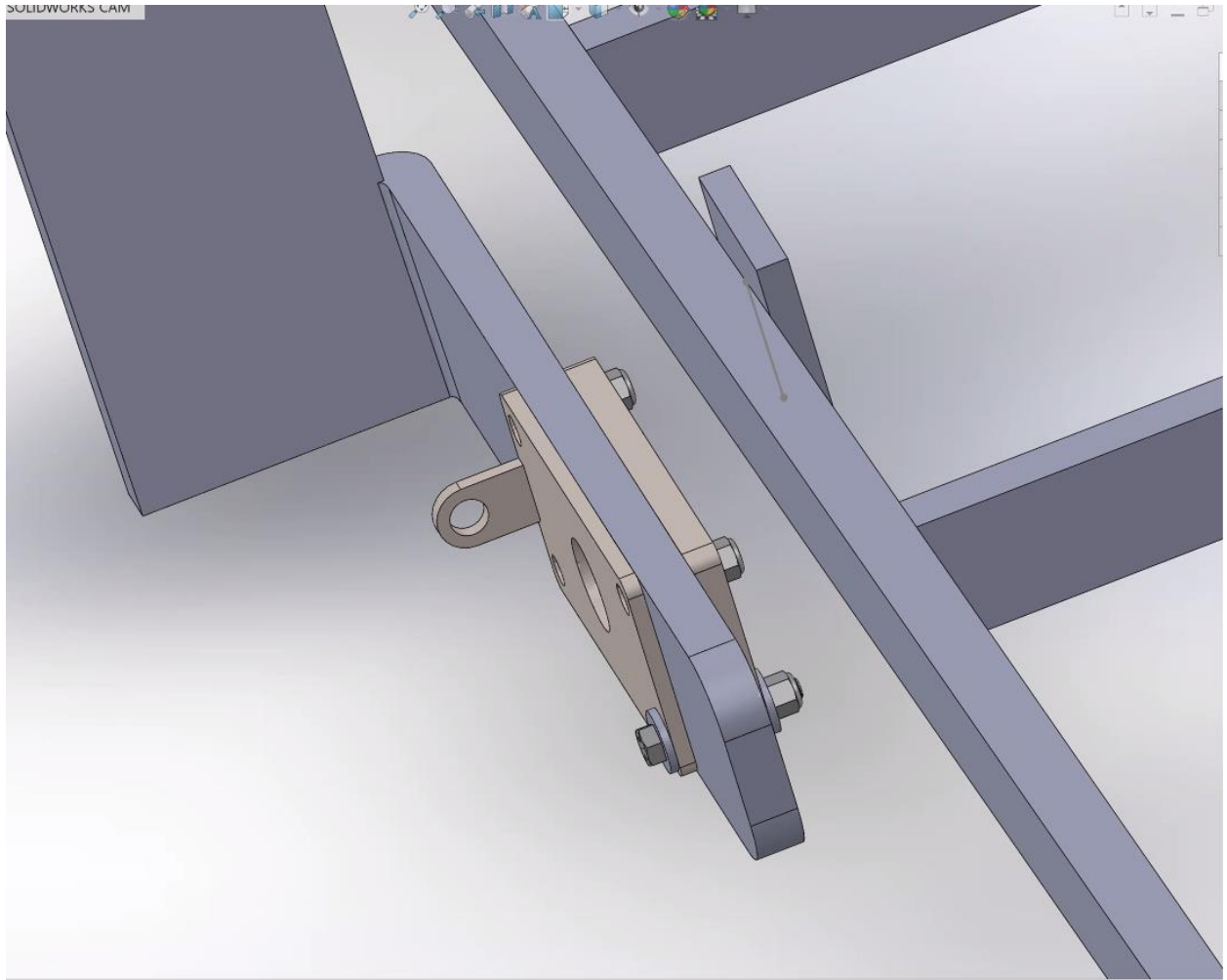
Grade 8 Steel, 3/8"-16 Thread, 2-1/4" Long, Partially Threaded

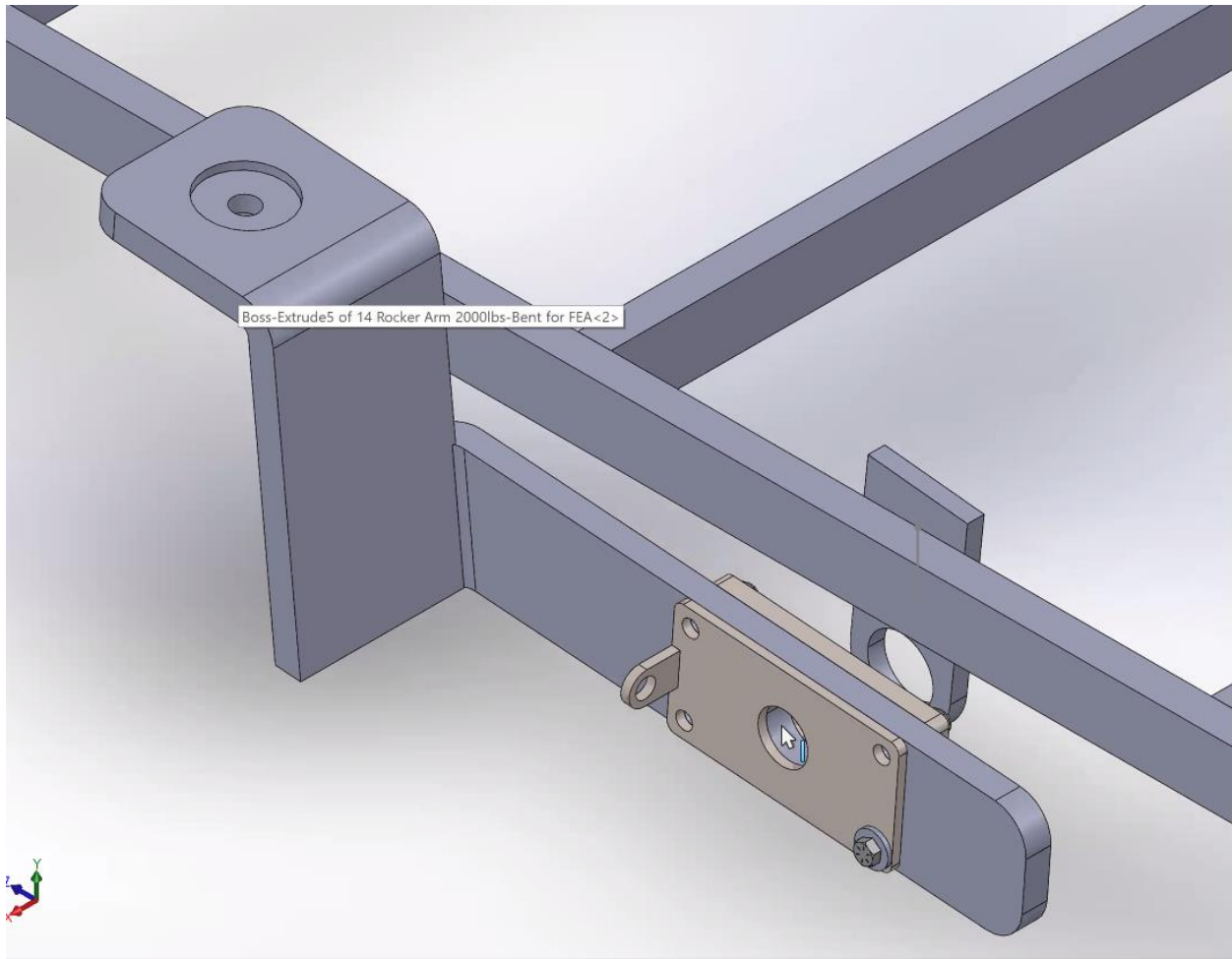


Zinc yellow-chromate plated steel screws resist corrosion in wet environments. Match the thread spacing of mating components. Coarse threads are the industry standard; choose these screws if you don't know the threads per inch. Screws that meet ASTM A354 BD or SAE J429 comply with specifications and testing requirements for material quality. Screws that meet ASME B18.2.1 or ASME B16.6.3 comply with specifications for dimensional standards.



The information in this 3-D model is provided for reference only. Details





2000lb axle - 1.375"

3500lb axle 2-3/4"

<https://www.southwestwheel.com/c-1248-3500-lbs-straight-dexter-trailer-axles.aspx>

6000lb axle 3"

<https://thetrailerpartsoutlet.com/products/6000-lb-dexter-trailer-axle-6k-electric-brake-6-lug>

Washers


Technical Specs			
Item	Flat Washer	Fits Bolt Sizes	3/8"
Flat Washer Type	Flat Washer	Washer Inside Dia.	13/32"
Washer Basic Material	Steel	Washer Outside Dia.	1"
System of Measurement	Inch	Thickness	0.063"
Washer Material Grade	Low Carbon	Washer Standards	ASME B18.221
Fastener Finish	Zinc Plated	Package Quantity	100

FABORY

GRAINGERCHOICE

3/8"x1" O.D., Flat Washer, Steel, Low Carbon, Zinc Plated, PK100

Item # 22UH04 Mfr. Model # U38400.037.0002 Catalog Page # 2088 UNSPSC # 31161807



Web Price ⓘ

\$6.75 / pkg. of 100

Shipping Weight **1.06 lbs.**

Country of Origin **Varies** | Country of Origin is subject to change.

Note: Product availability is real-time updated and adjusted continuously. The product will be reserved for you when you complete your order. [More](#)

Add to Cart

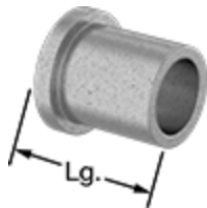
Confirm ZIP Code to determine availability.

[+ Add to List](#)

- Bearings - hot oiled lubricated flange bearing

2000lb - 1 3/8" shaft diameter

High-Load Oil-Embedded Flanged Sleeve Bearings



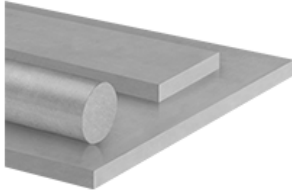
For Housing ID	Lg.	Flange OD	Flange Thick.	Dynamic Radia Load Capacity
SAE 863 Bronze Bearings				
For 5/8" Shaft Dia.				
7/8"	1 1/4"	1 1/4"	1/8"	2,750 lbs. @ 60
For 3/4" Shaft Dia.				
7/8"	1 1/2"	1 1/2"	1/8"	1,100 lbs. @ 60

For 1 3/8" Shaft Dia.				For 1 1/2" Shaft Dia.	For 1 3/4" Shaft Dia.	For 2" Shaft Dia.	For 2 1/2" Shaft Dia.	For 3" Shaft Dia.	For 3 1/2" Shaft Dia.	For 4" Shaft Dia.	For 4 1/2" Shaft Dia.	For 5" Shaft Dia.	For 5 1/2" Shaft Dia.	For 6" Shaft Dia.
1 5/8"	1"	2"	1/8"	4,450 lbs. @ 30 rpm	3,650 lbs. @ 30 rpm	Lubricated	ISO 460 Oil	-15° to 300°	2938T64	6.00				

McMaster Carr 2938T64

Pipe covering axle - ID of 1.626"

Alloy Steel



Stronger and harder than carbon steel, alloy steel is preferred for high-stress applications, such as axles, torsion bars, and drive shafts. It includes alloys 4130, 4140, 4340, ES2100, and 8620.

Easy to weld - fit bearing the best - felt the thicker wall would be stronger

Easy-to-Weld 4130 Alloy Steel Round Tubes



- Yield Strength:
6" lg. tubes: 80,000 psi
All other sizes: 70,000 psi
- Hardness:
6" lg. tubes: Rockwell C40 (Hard)
All other sizes: Rockwell C20 (Hard)
- Heat Treatable: Yes
- Max. Hardness After Heat Treatment:
6" lg. tubes: Not Rated
All other sizes: Rockwell C49
- Specifications Met: See table

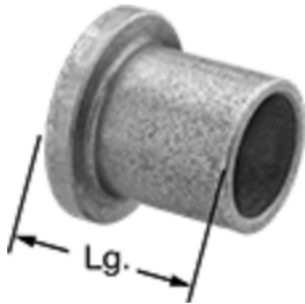
4130 alloy steel has a low carbon content that provides good weldability. It's often used for gears, fasteners, and structural applications.

OD	OD Tolerance	ID	Specifications Met	Straightness Tolerance	1 ft. Lg.	3 ft. Lg.	6 ft. Lg.
0.188"	Wall Thick. (-0.028" to 0.028" Tolerance)						
2"	-0.010" to 0.010"	1.624"	AMS-T-6736, MIL-T-6736B	0.030" per 3 ft.	89955K601	\$36.84	\$85.47 \$147.36

McMaster Carr 89955k601

3500lb - 2 3/4" shaft diameter

Oil-Embedded Flanged Sleeve Bearings



For
Housing ID Lg. Flange O
SAE 841 Bronze Bearings

For 1" Shaft Dia.

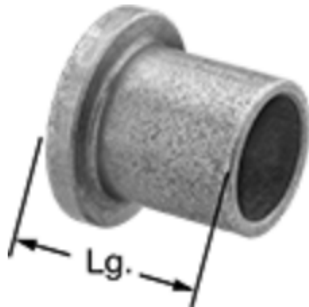
1 1/4"	3/4"	1 1/2"
1 1/4"	3/4"	1 1/2"
1 1/4"	1"	1 1/2"
1 1/4"	1"	1 1/2"
1 1/4"	1 1/4"	1 1/2"

For 2 3/4" Shaft Dia.
3 1/4" 1 1/2" 4" 3/16" 8,250 lbs. @ 30 rpm 10,500 lbs. @ 30 rpm Lubricated SAE 30 Oil -35° to 300° 6338K614 45.76

McMaster Carr 6338K614

6000lb - 3" shaft diameter

Oil-Embedded Flanged Sleeve Bearings



For Housing ID	Lg.	Flange O
SAE 841 Bronze Bearings		
For 1 1/4" Shaft Dia.		
1 1/2"	1/2"	1 11/16"
1 1/2"	3/4"	1 11/16"
1 1/2"	1"	1 3/4"
1 1/2"	1 1/4"	1 3/4"
1 1/2"	1 1/2"	1 3/4"

For 3" Shaft Dia.
 3 1/2" 2 3/8" 4" 3/8" 14,250 lbs. @ 30 rpm 8,750 lbs. @ 30 rpm Lubricated SAE 30 Oil -35° to 300° [6338K615](#) 39.95

McMaster Carr 6338K615

Oil-Embedded Thrust Bearings



Startup friction causes these porous bronze bearings to release a thin layer of oil on the bearing's surface. They are also known as Oilite® bearings.

Note: Dynamic load capacity is the maximum load a bearing can withstand at a given shaft speed. If your application's load and speed requirements are below the values listed, the bearing will work.

For technical drawings and 3-D models, click on a part number.

For 3/8" Shaft Dia.
 5/8" 1/16" 390 lbs. @ 120 rpm Lubricated SAE 30 Oil -35° to 300° [5906K565](#) .70

For Next Time:

- Send Swenson links to purchase materials
- Pick a Design review Date
- Finalize our 3D model

Comments/Concerns/Reflections from Today:

N/A

Next Meeting Time & Date: **Thursday, 7/9/2020 @ 9:30am**