GRAVITY CAR CHALLENGE 2019

Team Careless Broncos

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AUBURN UNIVERSITY Mechanical Engineering

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Project Definition:

For this project, groups of five students where challenged with designing a gravity propelled vehicle that would travel down a ramp and stop close to a predetermined point. However, this gravity car does not travel in a straight line, but instead travels a curved path. The car must navigate between two cans that are located halfway between the start and finish points. The can will be located 70cm and 100cm away from the straight line connecting the start and end points of the car. The car must be able to complete this curved shot from the distances of 9m and 12m. To achieve this desired result, two unique features had to be added to the standard model of the gravity car. The first feature that needed to be added is a braking system that would stop the car at the desired point. This braking system would be created by a wing nut that slides within a grove down a threaded axle until it is stopped by a rigid block. The second feature that would be added to the car is a method of breaking and adjusting one side of the frame of the car. By doing this, the car would have two different lengths, allowing the car to travel in a curved line. The adjustment of the frame must be able to be done to one thousandth of an inch, an must be repeatable. The other dimensions of the car must be based off the scaled model provided to us in the instructions. The second part of the project that needed to be designed and modeled is the ramp. The ramp must be based on the scaled model provided and contain a release mechanism and a sighting system. The ramp itself must be smooth and must meet the floor at less than a .03in step. The release mechanism must allow for a smooth and repeatable release. The sighting system must position a laser pointer at an angle that will align the ramp to where the car can complete a curved run. The sighting system must be firmly positioned so that it will not move between runs. Other than the simple constraints we were given, there were some more requirements that we also had to meet. The first of these other requirements was that it must follow the Science Olympiad ruleset. Also, the total cost of materials of the car must be less than 300 dollars. Another of these requirements is that 16 inches cubed of 3-d printed parts can be used. The last of these other requirements is that FEA must be used to analyze at least one part. It is also important to note that motion analyses will be used to determine if the car can travel the desired path. Once all these requirements are met, all desired components are to be compiled into the rest of this report.

Project Purpose:

There are a few primary skills being tested in this project. One purpose is to test our practical skills on SolidWorks. We are displaying our ability to model and draw a variety of different parts and assemblies. We are also forced to organize these files and drawings in a way that makes sense and allows for easy location of parts. The second concept that this project is testing is our ability to work well as a team. To complete this project in a timely manner, we are forced to collaborate and rely on our teammates. The ability to communicate and collaborate with other team members is a skill that will be very valuable moving forward. Finally, the last skill tested by this project is the ability to look at a problem and formulate an organized solution. We were given a problem and had to come up with a practical solution that would be designable and effective. We then had to organize these solutions in a way that is easily repeatable and understandable. By analyzing our team's ability to complete this task, we are being tested on our ability to operate in the workforce.

Teamwork:

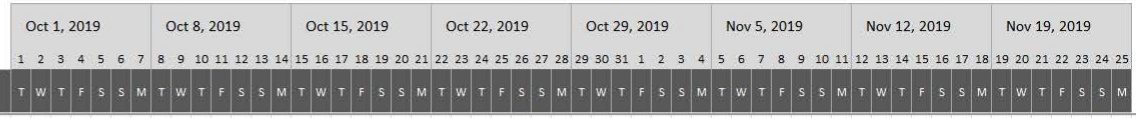
Communication and team organization are very important parts of any group-oriented project. Teamwork was especially interesting for this group because we did not know each other prior to becoming group member. What is even more interesting is that our group hailed from four different countries and three different continents. Thankfully, everyone was very fluent in English, so this did not end up being the problem. The first problem that we ran into as a team is establishing a method of communication. We decided to use GroupMe as our primary form of communication. GroupMe is a texting app that allows people to be added in group texts. We decided on GroupMe because every group member was familiar with the app, and the app allows for easy documentation of conversation. The next challenge that we were presented was finding a time to meet as a group. At the beginning of the assigned time we met about once every other week, but as time went on we decided to meet once a week to discuss what we needed to work on. We also made a gantt chart that defined all of the team members roles. The gantt chart also helped us stay on a good schedule. However, it was common for group members to go outside their roles if another member needed assistance. The next challenge that was faced was finding a way to share files with each other when not all the members were present. We decided to use the website GitHub to share the SolidWorks files with each other. GitHub basically acted as a third-party storage system where group members could upload and download files at will. Another good thing about using GitHub is it keeps a log of changed files, so that we could look back at our older designs if we needed to analyze a change. This ease of file sharing allowed group members to work independently, while also being in contact with other group members ideas. For files that did not come from SolidWorks, we used DropBox to share files. We used DropBox because it was easier to use on personal laptops and mobile devices. This allowed for access to information quicker than it would be available on GitHub. All of the group members were helpful and willing to work towards a common goal. There were no problems with attendance on work ethic. The workload was spread fairly evenly across group members, and members who were given less immediate responsibility still utilize their time by helping others with their work. The Gantt Chart and meeting logs used by the group are shown below.

Gravity Car

Careless Broncos
Project Lead: Felix

Project Start: Mon, 9/30/2019
Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
Phase 1: Theory				
Project Definition	Team	100%	9/30/19	10/7/19
Assign Roles	Team	100%	10/7/19	10/9/19
Arc and Track Calculations	Felix	100%	10/9/19	10/14/19
Rough Design on Paper	Team	100%	10/14/19	10/21/19
Phase 2: Solidworks Design				
Ramp and Release Mechanism Part	Andrew	100%	10/22/19	11/5/19
Frame Parts	Jp	100%	10/22/19	11/5/19
Rear Axle Parts	Aditya	100%	10/22/19	11/5/19
Front Axle Parts	Felix	100%	10/22/19	11/5/19
Sighting System Parts	David	100%	10/22/19	11/5/19
Drawings for All Parts	Team	100%	11/5/19	11/8/19
Phase 3: Car Assembly				
Front Axle	Felix	100%	11/6/19	11/13/19
Rear Axle	Aditya	100%	11/6/19	11/13/19
Frame	Jp	100%	11/6/19	11/13/19
Ramp and Release Mechanism	Andrew	100%	11/6/19	11/13/19
Sighting System	David	100%	11/6/19	11/13/19
Entire Assembly	Felix	100%	11/13/19	11/20/19
Drawings for All Assemblies	Team	100%	11/20/19	11/23/19
Phase 4: Testing				
FEA Testing	Team	100%	11/23/19	11/25/19
Motion Analysis	Team	100%	11/27/19	12/6/19
Final Report	Team	100%	11/27/19	12/6/19
Task 4			date	date
Task 5			date	date

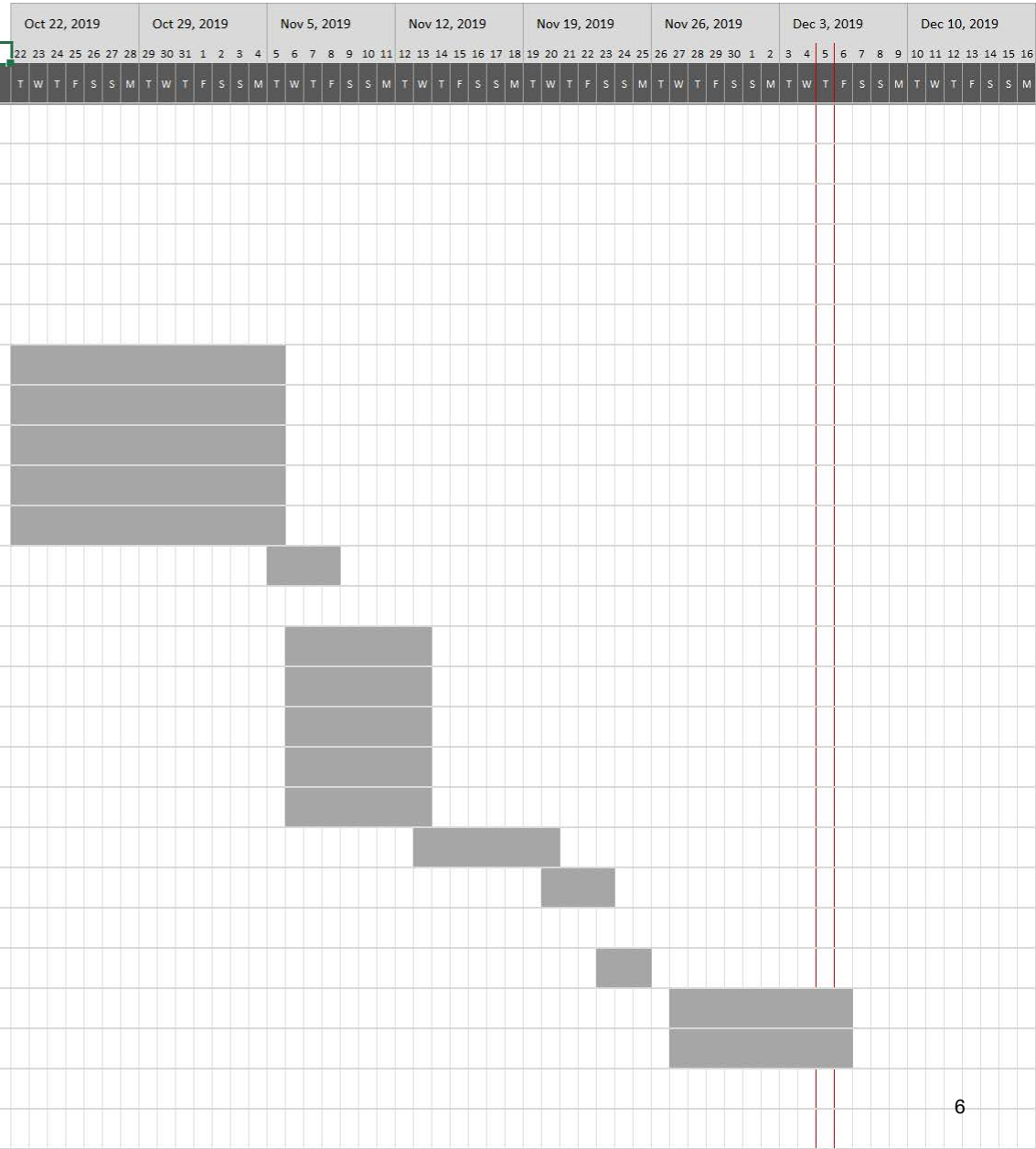


Gravity Car

Careless Broncos
Project Lead: Felix

Project Start: Mon, 9/30/2019
Display Week: 4

TASK	ASSIGNED TO	PROGRESS	START	END
Phase 1: Theory				
Project Definition	Team	100%	9/30/19	10/7/19
Assign Roles	Team	100%	10/7/19	10/9/19
Arc and Track Calculations	Felix	100%	10/9/19	10/14/19
Rough Design on Paper	Team	100%	10/14/19	10/21/19
Phase 2: Solidworks Design				
Ramp and Release Mechanism Part	Andrew	100%	10/22/19	11/5/19
Frame Parts	Jp	100%	10/22/19	11/5/19
Rear Axle Parts	Aditya	100%	10/22/19	11/5/19
Front Axle Parts	Felix	100%	10/22/19	11/5/19
Sighting System Parts	David	100%	10/22/19	11/5/19
Drawings for All Parts	Team	100%	11/5/19	11/8/19
Phase 3: Car Assembly				
Front Axle	Felix	100%	11/6/19	11/13/19
Rear Axle	Aditya	100%	11/6/19	11/13/19
Frame	Jp	100%	11/6/19	11/13/19
Ramp and Release Mechanism	Andrew	100%	11/6/19	11/13/19
Sighting System	David	100%	11/6/19	11/13/19
Entire Assembly	Felix	100%	11/13/19	11/20/19
Drawings for All Assemblies	Team	100%	11/20/19	11/23/19
Phase 4: Testing				
FEA Testing	Team	100%	11/23/19	11/25/19
Motion Analysis	Team	100%	11/27/19	12/6/19
Final Report	Team	100%	11/27/19	12/6/19
Task 4			date	date
Task 5			date	date



Entry Number: 1 Date 10/8/2019
Group Members Present:
David Chandler, Andrew Weir, Felix Lasch, Giampietro Nigro
Goals:
-Team introductions
-Establish basic team strengths and weaknesses
-Discuss basic design processes in the car
-Discuss which parts of the car to work on first
-Establish methods of communication and information sharing
Entry Number: 2 Date: 10/12/2019
Group Members Present: Aditya Patwardhan, Felix Lasch,
Meeting Goals: Filled in Aditya about the previous meeting
Entry Number: 3 Date: 10/18/2019
Group Members Present: All
Meeting Goal:
-Establish basic drawing standards and process
-Make sure each group member understands how to create and draw parts properly
-Designed the basic design of the ramp with materials and design processes included.
Entry Number 4: 11/1/2019
Group Members Present: All
Meeting Goal:
-assign more specific goals for all team members
-set a timeline for when we want certain drawings done
Entry Number 5: 11/8/2019
Group Members Present: All
Meeting Goal:
-basic updating on progress
-group brain stormed how to break and readjust frame
Entry Number 6: 11/15/2019
Group Members Present: All
Meeting Goal:
-update on progress
-start to make and draw assemblies
-fix common drawing errors
-complete FAE
Entry Number 7; 11/22/2019
Group Members Present: All
Meeting Goal:
-finish drawings and assemblies
-create stand in final report
-start motion analysis
Entry Number 8: 12/5/2019
Group Members Present: All
Meeting Goal:
-finish the project

Components:

Ramp:

For the ramp, the basic dimensions came from the scaled drawing we were provided. However, we shortened the height by a small amount so that we could fit the release mechanism on the top of the ramp. There are essentially two main assemblies that comprise the ramp: the ramp itself and the release mechanism. The ramp itself is primarily made from wood. Two pieces of plywood comprise the sides, while pieces of 2 x 4 hold these two sides together. We designed the two sides of the ramp to create a curve that was steep enough for the car to gain enough speed to reach the target, but also did not drive the car straight into the ground. We wanted the car to come out of the ramp as tangent as possible to the ground. To do this, we cut the end of the side off a little bit and allowed the top of the ramp to reach the ground without having any wood underneath. This allowed the ramp to meet the ground well under the .03 in step requirement. This also allowed for a fairly smooth transition from the ramp to the ground. The top of the ramp is made from a single sheet of galvanized steel. This piece of steel will be cut and molded to match the curve created by the two plywood sides and glued accordingly. We decided to use galvanized steel because it is cheap and easily moldable. It is also available in large quantities that would allow us to create the top from a single sheet of metal. We also decided to use a metal top in the first place because it is naturally smooth and can be molded to form a curve. The second assembly that makes up the ramp is the release mechanism. For our release mechanism, we have a hook like structure that is connected using dowels. This mechanism connects a hook to a lever using a dowel. The hook will be attached to back of the car and will pull up as someone pushes the lever on the dowel down. The mechanism will be mounted to the top of the ramp using pieces of 2 x 4 to act as supports. We decided on the hook design because it will add to a smooth release because every part of the hook releases the car at the same time. By using the hook and the position scale on the side of the ramp, the release can be easily duplicated at the same angle and height.

Ramp Sight:

The ramp sight is an assembly made up of a platform, laser, clamp, and screw angles. It is positioned on the right side of the ramp and its purpose is to show how to position the ramp. The laser pointer is positioned at an angle of 21.8 degrees using the clamps. This is the calculated angle for the short shot of 9 meter. The long shot is a lesser angle of 16.4 degrees. Any distance between 12 and 9 meters will be made using a target that is put the distance needed and will allow accurate position of the ramp.

Car Frame

The car frame consists of 3 main assemblies: the split frame, the front and back suspension. The front and back suspension accommodate the bearing for the axles and the axle break. Both the suspensions are part of different assemblies (Respectively the axle assembly and the rear axle assembly). The suspension is made of 0.5 in thick aluminum bar, which is rigid and keeps the corners of the frame square. The suspensions are connected by the split frame. Everything is put together by screws so it can be disassembled. The right side of the split frame length can be adjusted with a micrometer, welded to both the parts of the right frame and holding them together. A spring, guided by a clevis pin is pushing the frame against the micrometer, so there is always contact between the micrometer and the frame.

By turning the micrometer one side of the frame can be adjusted in length, while the other bends to make the car be able to drive in an arc.

Front axle

The front axle is made of two ¼-28 in threaded rod, which makes it robust and simultaneously the pitch is fine enough for the application. A wing nut, put on the spring travels on the threaded axle, when the car moves, till it hits a nut at the end, which blocs the front axle and stops the car. The thread size of the front axle is chosen, so that the wing nut as enough space between the bearings, so that the wing nut has enough space to travel before it hits the end stop. Also, the spring which prevents the car from stopping abrupt is calculated, so that it stores 1/3 of the maximum kinetic energy which equals the potential energy. The Axle is fitted in the bearings with two 3D-printed muffles to minimize clearance. The two parts of the axle are connected by an adapter and a one-way-bearing on the right wheel, so that they can spin independently if the car drives forward, but block if the wingnut hits the end stop.

Rear Axle:

The rear axle assembly unlike the front axle was much simpler and made up of less parts. Since it did not have to have its two wheels turning at different speeds it also did not need the adapter that was needed on the right wheel of the front axle. The right wheel of the rear axle was placed in line with the corresponding wheel in the front axle and thus the uneven sides of the car. The processes used to manufacture the parts for the rear axle were drilling, tapping and threading, chamfering, sawing, 3D printing. The machines/tools used in these processes were drill, taps and dies, belt grinder, band saw and a 3D printer. All parts that were not bought from McMaster-Carr were manufactured using the above-mentioned processes. It is similar to the front axle in a lot of aspects and even uses a lot of parts designed similarly albeit with different dimensions. The wheels used in the rear axle are the exact same as the ones in the front axle. No additional tools or materials than the ones already used in the front axle were used for the manufacture of this assembly's parts. Once all parts had been bought/manufactured, the assembly was put together and ready to attach to the frame of the car.

Wheels

The wheels have a diameter of 5" and have a width of 1". The fix them on the axle they are glued on a 3D printed muffle which is directly screwed on the axle. With this method they can be removed, they don`t wobble and they`re easy to center with an error lower than 0.010".

Data and Calculations:

Specifications of the car and ramp-

Car:

- Total mass = 1.24kg
- Width = 6.55”
- Length = 15”
- Volume of 3D printed material used= 1.63 inches^3

Ramp:

- Height=41”
- Length=17”

Calculation spring break-

potential energy = max. kinetic energy

$$E_{pot} = E_{kin,max}$$

Weight of car = 2.74lb = 1.24kg

$$E_{kin,max} = m \times g \times h = 1.24kg \times 0.75m \times 9.81\frac{m}{s^2} = 9.12J$$

$$E_{spring} = \frac{1}{3}E_{kin,max} = \frac{1}{3}9.12J = 3.04J$$

$$3.04J = \frac{1}{2}kx^2$$

$$1\frac{lb}{in} = 175.126\frac{N}{m}$$

$$1in = 0.0254m$$

$$E_{spring} = \frac{1}{2} \times Rate\left(\frac{lb}{in}\right) \times 175.126 \times (lentgth - compressed\ length) \times 0.0254in)^2$$

For the spring we used:

$$E_{spring} = \frac{1}{2} \times 1{,}511\frac{lb}{in} \times 175.126 \times (0.69in - 052in) \times 0.0254in)^2 = 2.5J$$

Which is the closed we could find to 3J with taking in account that we needed to have enough space for the spring to travel.

Calculation pitch front axle-

Wheel diameter – 5” = 0.127m

Max distance = 12.16 m + distance on ramp ≈ 12.7m

$$\frac{12.7m}{\pi \times 0.1m} = 31.83\ rev$$

¼-28 tread -> 0.907 mm pitch

$$31.83\ rev \times 0.907 \frac{mm}{rev} = \ 28.87mm = \ 1.136in$$

Min. space on axle for wing nut = 1.136in

Calculation max velocity-

Mass = 1.24kg

Height of center of mass = 0.78m

$$E_{pot} = m \times g \times h$$

$$E_{kin} = \frac{1}{2} \times m \times v^2$$

$$E_{pot} = \ E_{kin}$$

$$\cancel{m} \times g \times h = \frac{1}{2} \times \cancel{m} \times v^2$$

$$v = \sqrt{2 \times g \times h} = \sqrt{2 \times 9.81 \frac{m}{s^2} \times 0.78m} = 3.91 \frac{m}{s}$$

Arc Calculation-

The angle of curvature was calculated both using solidworks and matlab. We started by sketching everything by hand first. We considered the 2 limit distances, 9 and 12 meters. The obtain angles were 16.29° for the 12m and 21.8° for the 9m. The results are shown below in **Figure 1**, **Figure 2** and **Figure 3**. The MATLAB code for this calculation can be found in **Appendix A**.

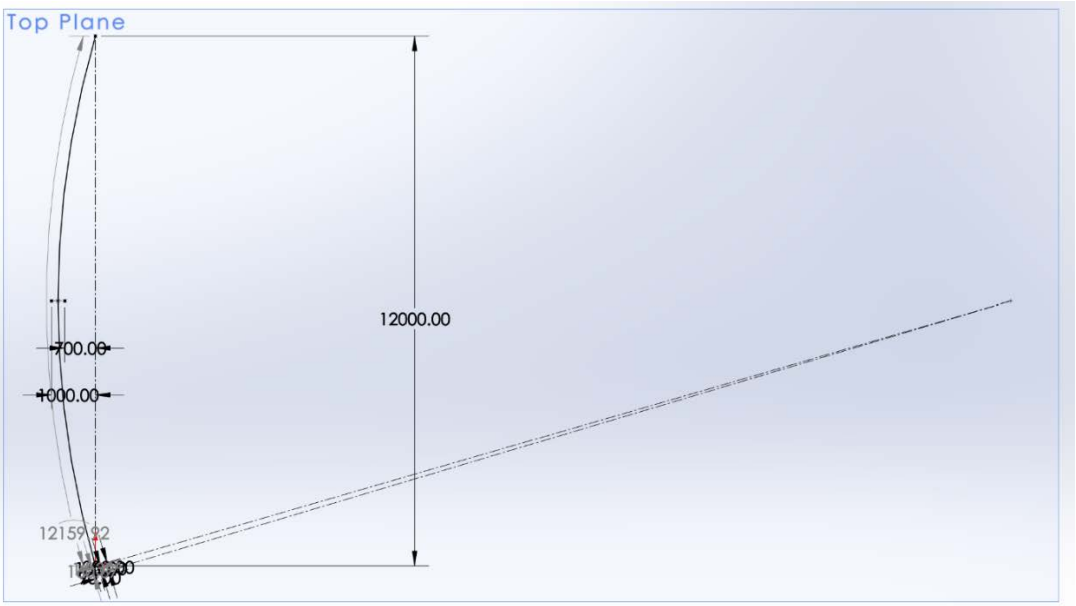


Figure 1: Arc Calculation

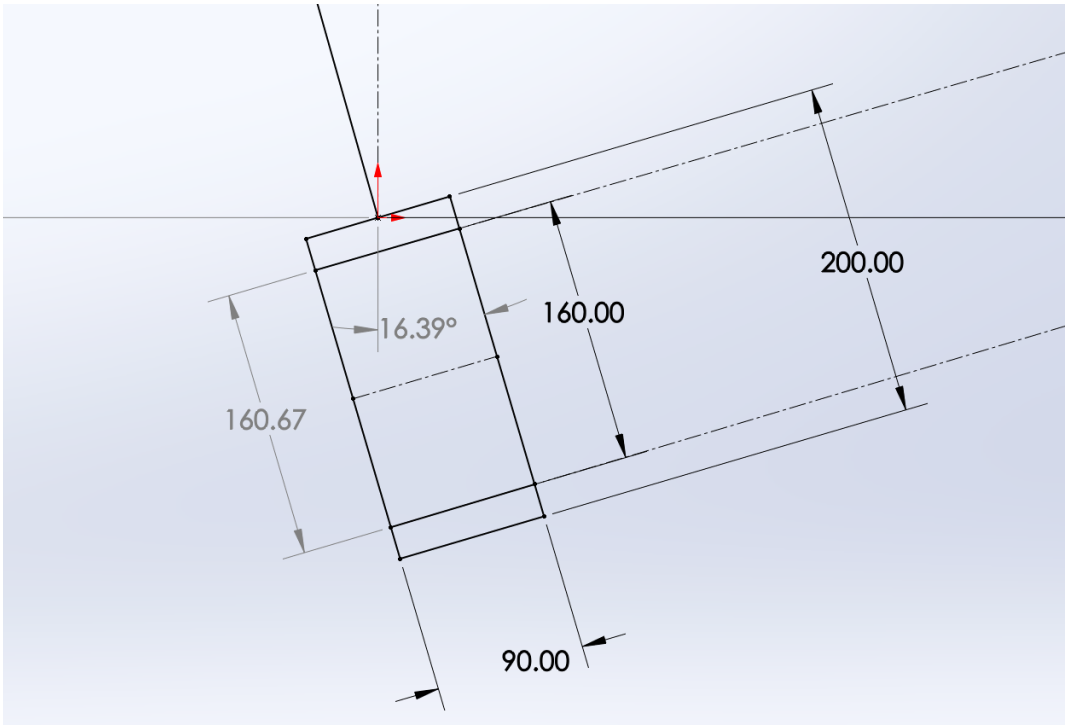


Figure 2: Angle Calculation 12m

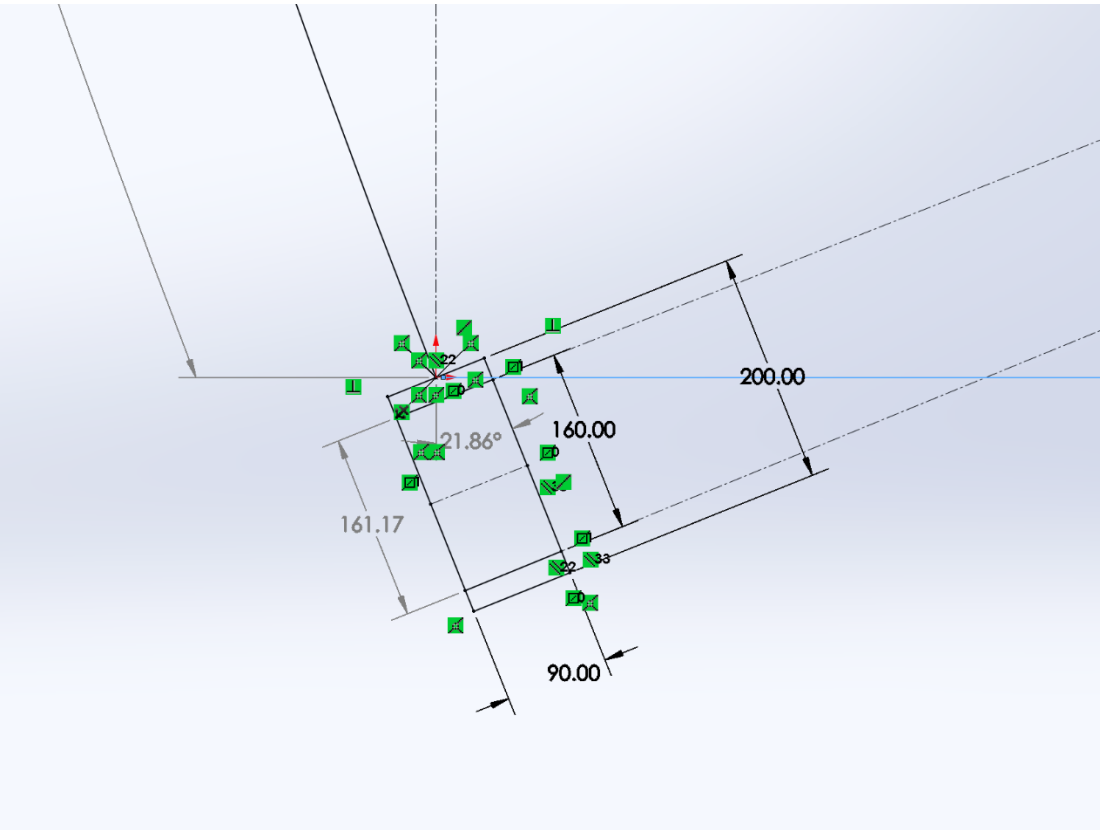


Figure 3: Angle Calculation 9m

FEA-

FEA was done after the assembly and the design of the car were already defined. The FEA was done with a simplified version of our frame, since we considered our split frame, composed by 3 different pieces and connected with a molded micrometer, a spring, pins and screws, as a whole piece. What we discovered was that applying a load on the split frame of 0.2 lbf the elongation for the most critical part of the frame is equal to 1.653 mm and the von mises stress is equal to 2.87e^6 N/m2. Since the yield stress of our material (Leathergrain Aluminum Sheet in Silver) is equal to 2.75e^8 N/m2 the result is acceptable, even though the applied load is very low but not far from the real load. FEA was a valuable tool and if we had started by doing it we would have probably increased the thickness of the

sides of the frame, which are only 0.02 inches thick, to have a more resilient car. The results are shown below in **Figure 4** and **Figure 5.**

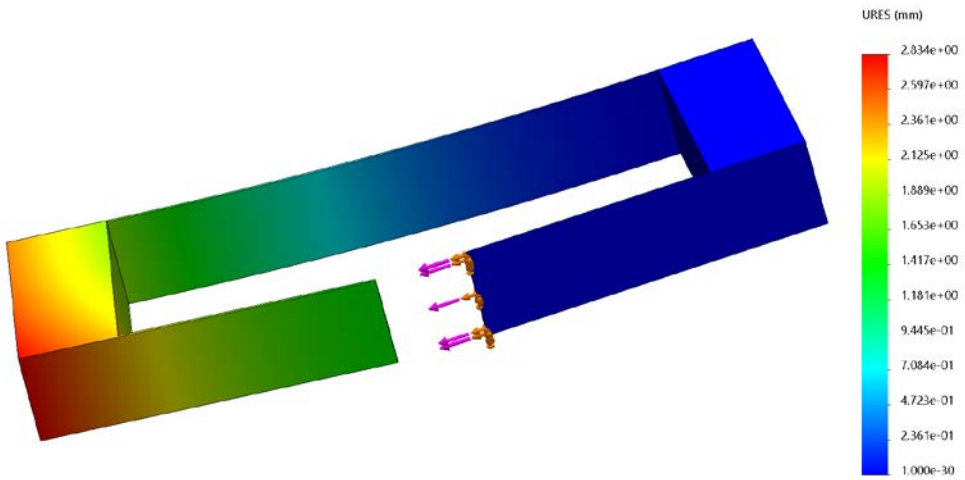


Figure 4: FEA Strain Analysis

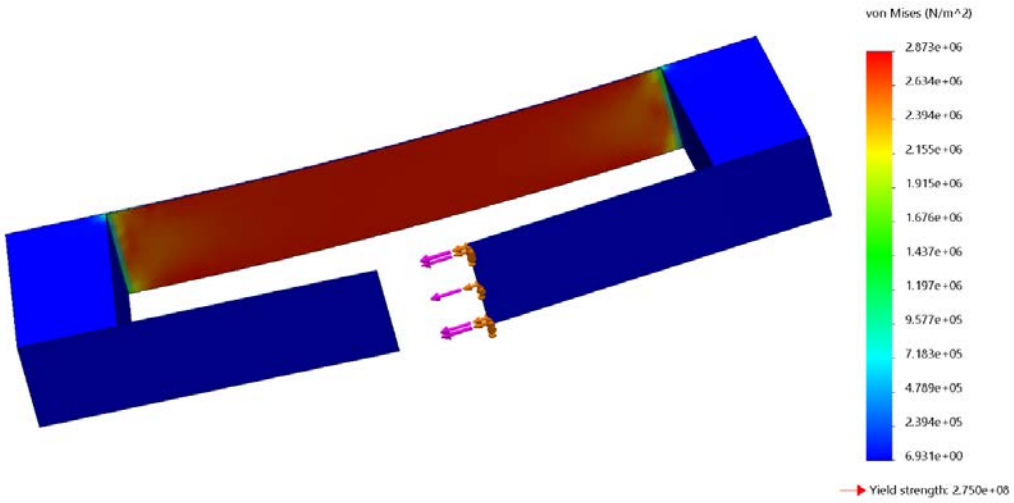


Figure 5: FEA Strain Analysis

Appendix A:

Matlab code for aiming the ramp-

```
clear all
close all
clc;

%----------------variales-----------------
L = 9;          % distance to target [m]

%----------------constatants--------------
d1 = 0.70;     % distance first can [m]
d2 = 1;       % distance second can [m]
wb = 0.16;     % wheel base [m]
tw = 0.09;     % track width [m]
%--------------placement signingsystem---
angleOffset = 16.21; % angle signing system [degrees]
distanceOffcet = 0.25; % position of signing system [m]

%----------------calculation--------------
d = (d1+d2)/2;              % average distance cans
r = (4*d^2+L^2)/(8*d);      % radius
s = 2*r*asin(L/(2*r));      % arclength
alpha = 2* atan(L/(2*(r-d))); % opening angle
beta = alpha/2;             % start angle ramp
beta_deg = beta*180/pi;     % start angle in degree
delta_L = (2*wb*tw)/(2*r-tw);  %length difference frame to drive arc
angleOffset = angleOffset*pi/180; %angleOffset in rad
distanceAim = abs(sin(beta-angleOffset)*L - distanceOffcet);

fprintf('arclength = %6.4fm\nanngle ramp = %6.4f°\ndistance aim at
target = %6.4fm\n', s,beta_deg, distanceAim);
fprintf('length-difference frame (delta L) =
%6.4fmm\n',(delta_L*1000));
```

output-

arclength = 9.2126m
anngle ramp = 21.3930°
distance aim at target = 0.5630m
length-difference frame (delta L) = 1.1715mm

Appendix B:

Drawing Package-

By signing this document below, I am confirming that every drawing in the drawing package has been looked over and approved by me, the group member of the Careless Broncos. I acknowledge that by signing this document will take the place of me signing each individual document as a matter of convenience. By signing this document, I agree to stand by each drawing in its entirety whether correct or incorrect.

SIGN BELOW

Andrew Weir anw0060

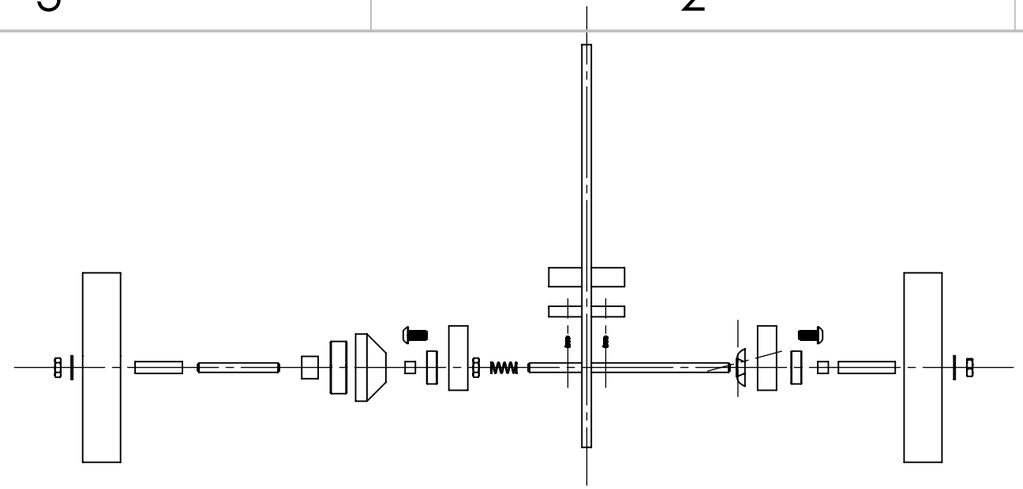
Gianpietro Nigro gzn0007

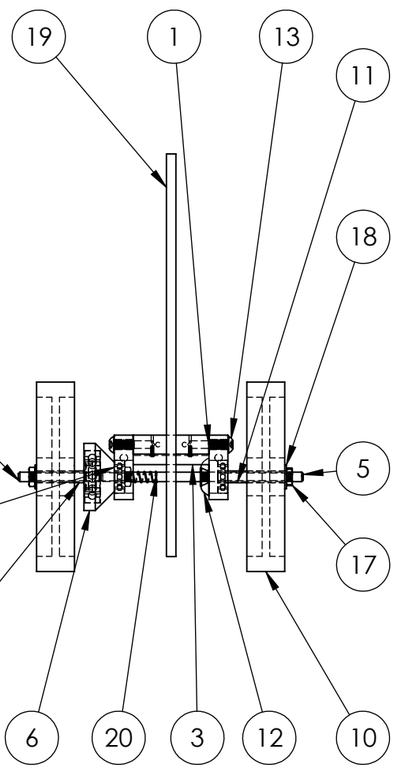
Felix Casoli fzl0029

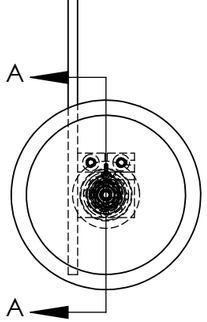
Mark Chartier dhc0064

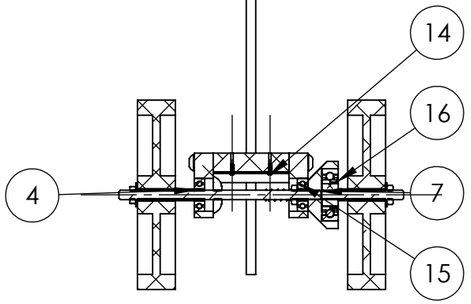
Aditya aqp0074

ITEM NO.	PART	Drawig Number	QTY.
1	Connection Front Suspension	P-002	1
2	Suspension Front	P-001	2
3	Slide Wing Nut	P-004	1
4	Muffle Bearing	P-006	2
5	Threaded Axle Front Left	P-003	1
6	Adapter One-Way-Bearing	P-008	1
7	Muffle One-Way-Bearing	P-007	1
8	Threaded Axle Front Right	P-009	1
9	Muffle Wheel Right	P-011	1
10	Wheel	P-005	2
11	Muffle Wheel Left	P-010	1
12	Wingnut	P-012	1
13	Button Head Hex Drive Screw 1-4-20	P-015	4
14	Button Head Hex Drive Screw 1-64	P-017	2
15	608 Ball Bearing	P-018	2
16	One-Way-Bearing	P-014	1
17	Stainless Steel Thin Hex Nut 1-4-28	P-016	3
18	316 Stainless Steel Washer	P-019	2
19	Wooden Rod	P-013	1
20	Compression Spring Break	P-046	1









SECTION A-A
SCALE 1 : 4

SAMPLE FABRICATION/ASSEMBLY PROCESS

STOCK DESC/DIMS	SEE BOM

1. screw together Connection Front Suspension(1) and Suspension Front(2) using screws(13)
2. push in bearings (15)
3. screw in Slide Wing Nut(3) with screws(14)
4. push in Muffle Bearing(4) in bearings(25)
5. put Wingnut(12), nut(17) and Compression Spring Break (20) on Threaded Axle Front Left(5)
6. while putting axle throught Muffle Bearing(4)
7. put Wheel(10) on Muffle Wheel Left(11), put them on Threaded Axle Front Left(5) and fix them in place with nut(17) and washer(18)
8. screw Adapter One-Way-Bearing(6) on the right side of the Threaded Axle Front Left, and push One-Way-Bearing(16) in
9. push in Muffle One-Way-Bearing(7) in One-Way-Bearing(16) and screw Threaded Axle Front Right(8) in
10. push Wheel(10) on muffle Wheel Right(9), glue it together and screw it on Threaded Axle Front Right(8)
11. fix Wheel in place with with nut(17) and washer(18)
12. Glue Wooden Rod in middle of ConnectionFront Suspesion about 1cm over ground

DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO: SEE PARTS LIST

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

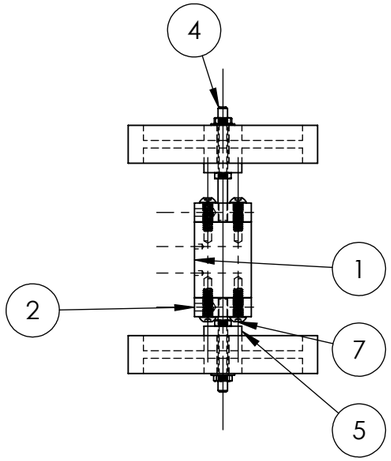
Careless Broncos

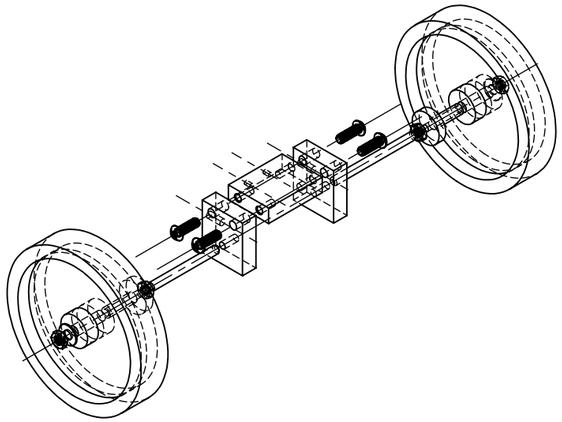
MATERIAL:	SEE PARTS LIST		
TITLE/DESC:	Fromt Axle Assembly		
FILE NAME:	Front Axle Assembly		
DWG. #:	A-001	REV #:	A
SCALE: 1:4	SIZE B		SHEET 1 OF 1

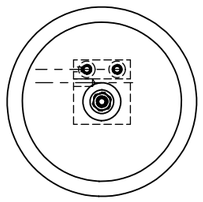
SAMPLE FABRICATION/ASSEMBLY PROCESS

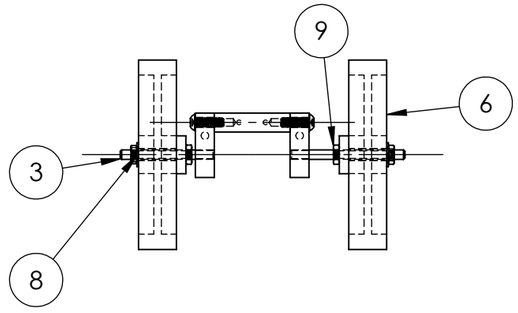
STOCK DESC/DIMS	SEE BOM

1. Screw Suspension Rear(2) to Connection Rear Suspesion(1) with screws(9)
2. screw threaded axle rear left(3) and right(4) into suspension rear
3. screw on one nut(9) on every side
4. screw on both muffle rear wheels(5) on rear axle
5. put Wheels(6) on rear muffles
6. put washers(8) and nuts(9) on rear axle and tighten the nuts to fix muffles in place









ITEM NO.	PART NUMBER	DRAWING NUMBER	QTY.
1	Connection Rear Suspention	P-020	1
2	suspension rear	P-021	2
3	threaded axle rear left	P-024	1
4	threaded axle rear right	P-023	1
5	muffle rear wheels	P-022	2
6	Wheel	P-005	2
7	Button Head Hex Drive Screw 1-4-28	P-015	4
8	316 Stainless Steel Washer	P-019	2
9	Stainless Steel Thin Hex Nut 1-4-28	P-016	4

DRAWN BY	DATE
Aditya Patwardhan	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	See BOM
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	
3rd Angle Projection	
MATERIAL:	See BOM
TITLE/DESC:	Rear Axle Assembly
FILE NAME:	Rear Axle Assembly
DWG. #:	A-002
REV #:	A
SCALE: 1:4	SIZE B / SHEET 1 OF 1

TOLERANCES:

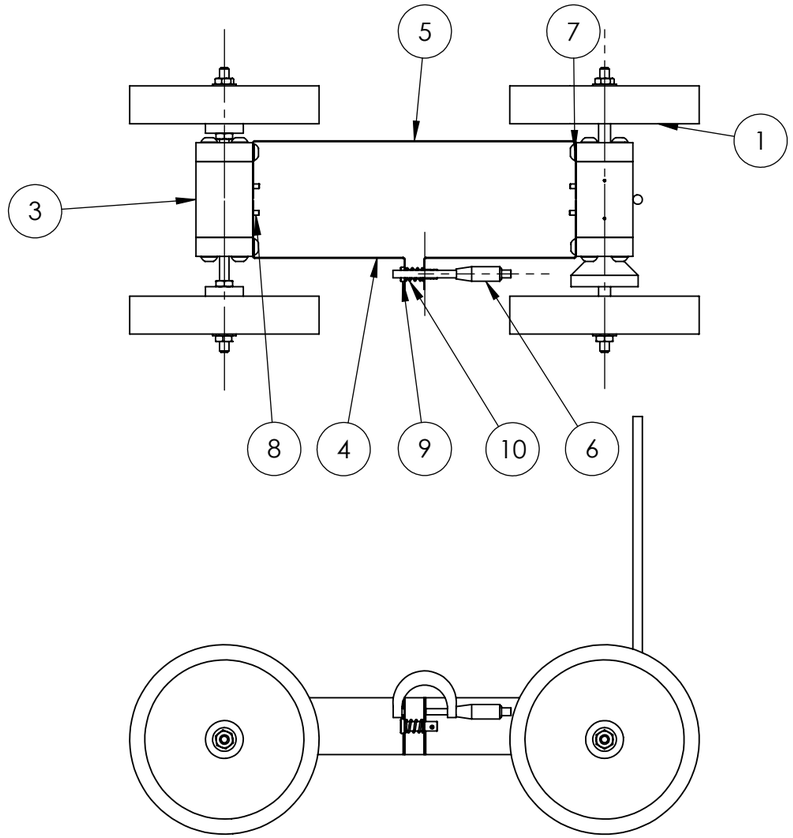
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

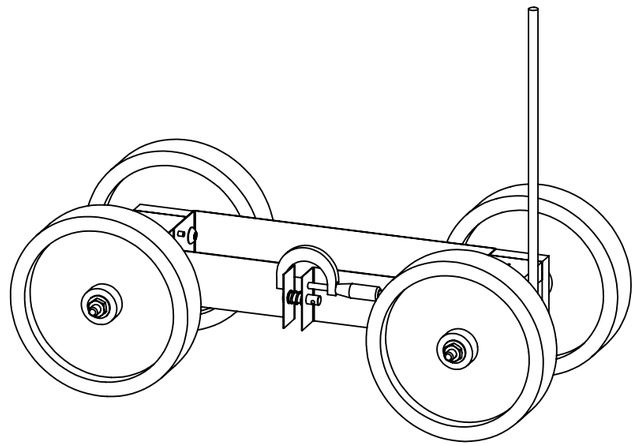
ITEM NO.	PART	Drawing Number	QTY.
1	Front Axle Assembly	A001	1
2	Frame 1 Front	P-028	1
3	rear axle assembly	A-002	1
4	Frame 1 Rear	P-029	1
5	Frame 2	P-30	1
6	micrometer	P-031	1
7	Button Head Hex Drive Screw	P-025	4
8	Dovel Pin	P-027	4
9	Clevis Pin	P-026	1
10	Compression Spring	P-32	1

SAMPLE FABRICATION/ASSEMBLY PROCESS

STOCK DESC/DIMS	SEE BOM

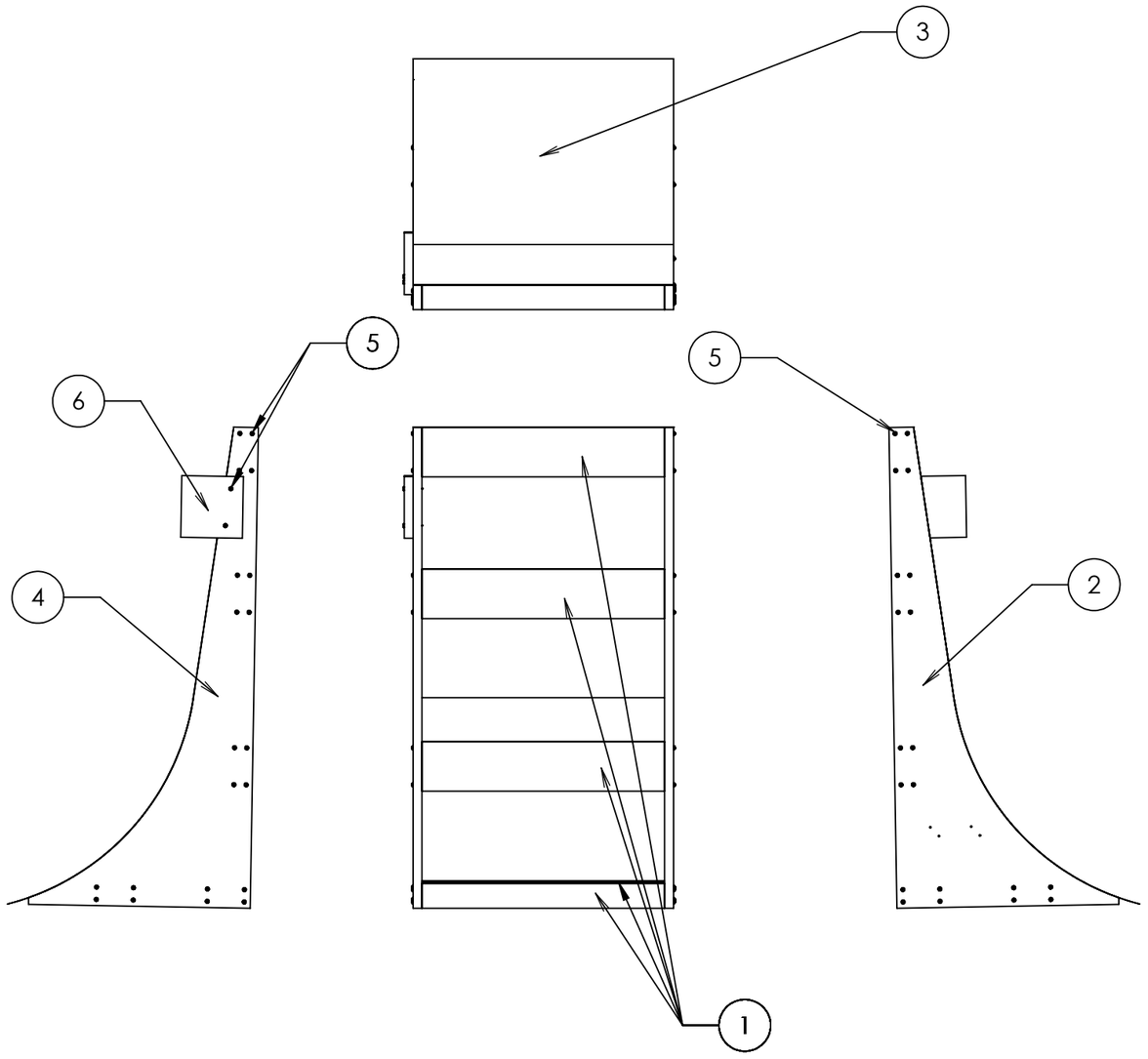
1. Weld the base of the head of the 0.25-Clevis Pin(9) to the frame 1 rear(4)
2. Insert the 2022N161_MIL. SPEC. compression spring(10) concentric to the Clevis Pin
3. Insert the the tip of the Clevis Pin in frame 1 front(2)
4. Weld the micrometer(6) to both frame 1 rear and frame 2 front above the pin
5. Using screws(7) and Dovel Pins(8) to attach both frame 1 front, frame 1 rear and frame 2 to the front axle assembly and to the rear axle assembly

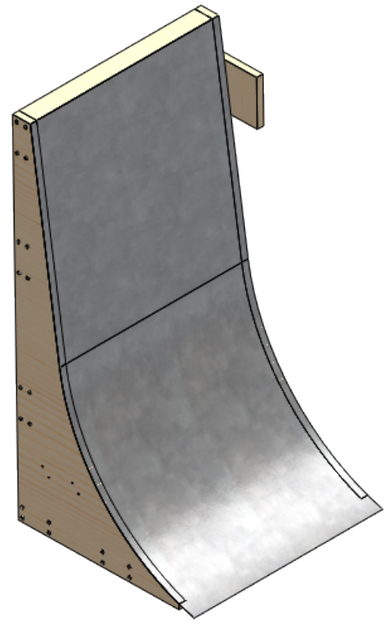




DRAWN BY	DATE
Giampietro Nigro	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	SEE PARTS LIST
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: SEE PARTS LIST
3rd Angle Projection	TITLE/DESC: Gravity Car Assembly
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Gravity car assembly (Split frame)
FRACTIONAL ±1/8"	DWG. #: A-003 REV #: A
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	SCALE: 1:4 SIZE **B** SHEET 1 OF 1
THREE PLACE DECIMAL ±0.005"	





ISOMETRIC VIEW

FOR REFERNCE ONLY
SCALE 1:12

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SEE BOM

1. ATTACH ITEM 6 TO ITEM 4 USING ITEM 5. SCREWS SHOULD BE INSERTED INTO THE PILOT HOLES ON THE APPROPRIATE SIDE OF THE WOOD AS INDICATED BY THE DRAWING.
2. ATTACH THE FIVE QUANTITIES OF ITEM 1 TO THE OTHER SIDE OF ITEM TWO USING ITEM 5. SCREWS SHOULD BE INSERTED INTO THE CORRECT PILOT HOLES AS INDICATED BY THE DRAWING.
3. ATTACH ITEM 2 TO THE FIVE QUANTITIES OF ITEM 1 USING ITEM 5. SCREWS SHOULD BE INSERTED INTO THE CORRECT PILOT HOLES AS INDICATED BY THE DRAWING.
4. ATTACH ITEM 3 TO THE TOP OF THE TOP OF THE CREATED STRUCTURE USING ITEM 7. WARP ITEM 3 UNTIL IT IS FLUSH WITH THE TOP OF THE STRUCTURE.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	P-035	Ramp Support	5
2	P-034	Ramp Right Side	1
3	P-036	Ramp Top	1
4	P-033	Ramp Left Side	1
5	P-037	Wood Screw No. 8 Size, 1-1/2" Long	42
6	P-038	Position Marker	1
7	-	Gorilla Glue 9oz Heavy Duty Construction Adhesive	AR

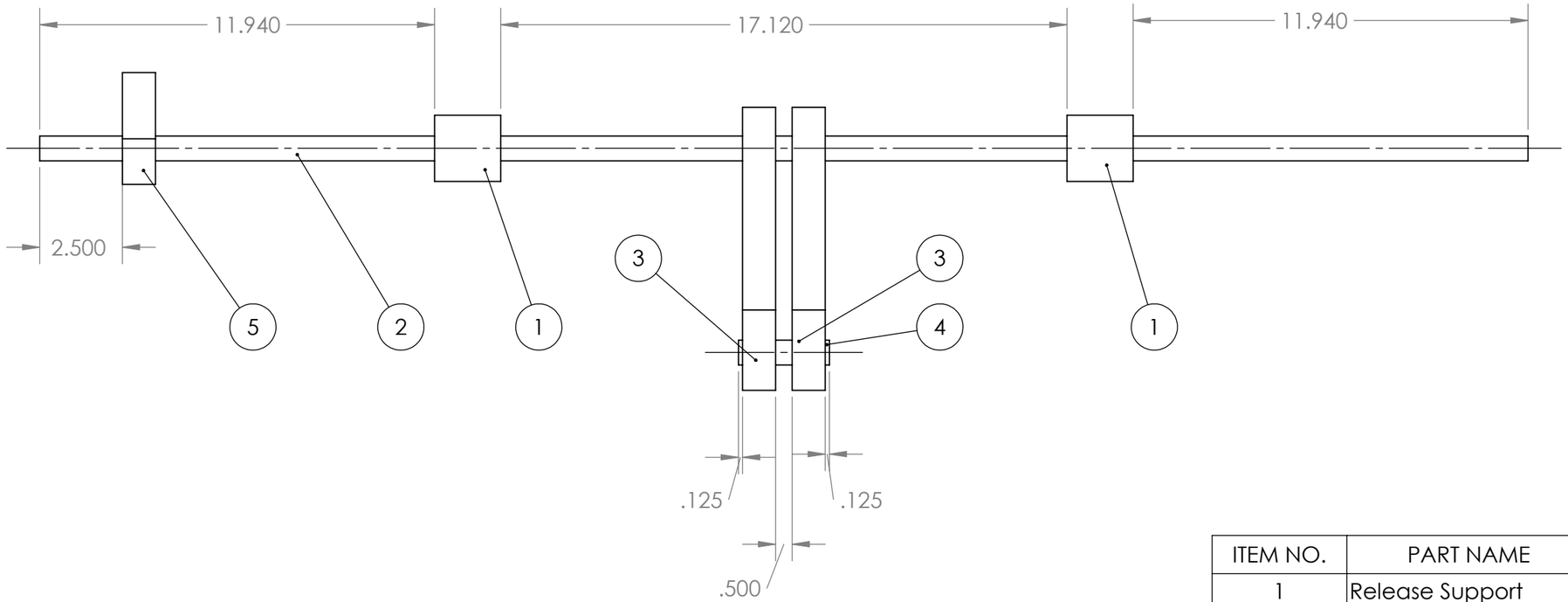
DRAWN BY	DATE
Andrew Weir	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	SEE PARTS LIST
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: SEE PARTS LIST
ANGLES ARE IN DEGREES	TITLE/DESC: Ramp
3rd Angle Projection	FILE NAME: Ramp
DWG. #: A-004	REV #: A
SCALE: 1:12	SIZE B / SHEET 1 OF 1

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

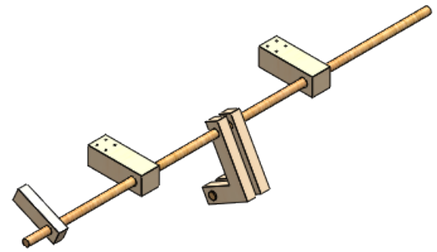
B



SAMPLE FABRICATION/ASSEMBLY PROCESS

STOCK DESC/DIMS	SEE BOM

1. CONNECT ITEM 5 TO ITEM 2 AT LOCATION SHOWN. DEPENDING ON TOLERANCES THIS MAY REQUIRE HAMMERING ITEM 5 INTO POSITION. USE ITEM 6 TO GLUE ITEM 5 UNTIL IT IS SECURED IN THE APPROPRIATE POSITION.
2. ATTACH ITEM 1 TO THE ITEM 2 AT LOCATION SHOWN. ITEM 1 SHOULD BE LOOSE AND CAN MOVE ALONG ITEM 2.
3. ATTACH THE TWO QUANTITIES OF ITEM 3 TO ITEM 4 AT APPROXIMATE LOCATIONS SHOWN. DEPENDING ON TOLERANCES THIS MAY REQUIRE HAMMERING THE ITEM 3 PARTS INTO POSTION. USE ITEM 6 TO FIRMLY GLUE THE ITEM 3 PARTS INTO PLACE.
4. ATTACH THE HOOK MADE IN STEP THREE TO ITEM 2 IN THE LOCATION SHOWN. DEPENDING ON TOLERANCES THE HOOK MAY NEED TO BE HAMMERED INTO LOCATION. USE ITEM 6 TO FIRMLY GLUE THE HOOK INTO PLACE.
5. ATTACH ANOTHER ITEM 1 TO ITEM 2 AT THE LOCATION SHOWN. THE ITEM 1 SHOULD BE LOOSE AND CAN FREELY SLIDE DOWN ITEM 2.



ISOMETRIC VIEW

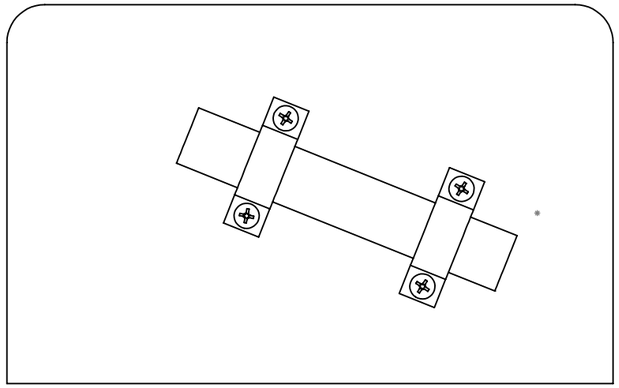
FOR REFERENCE ONLY
SCALE 1:12

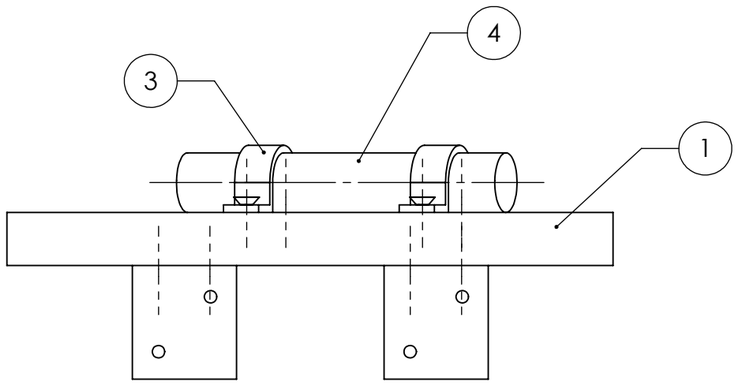
ITEM NO.	PART NAME	PART NUMBER	QTY.
1	Release Support	P-041	2
2	Release Dowel	P-040	1
3	Release Hook	P-042	2
4	Hook Dowel	P-043	1
5	Release Lever	P-039	1
6	Gorilla4 fl. oz. Wood Glue	-	AR

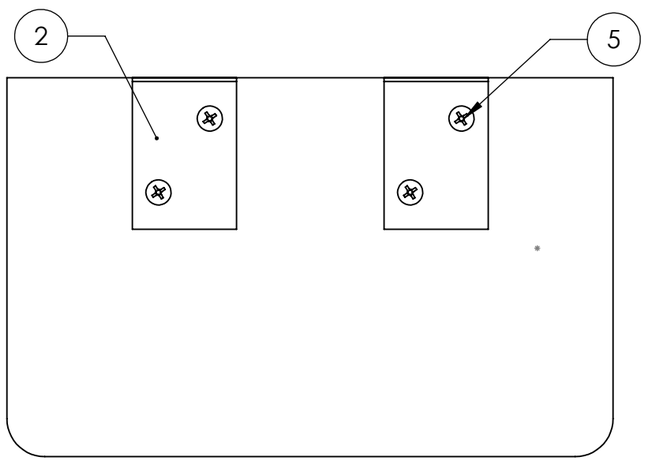
A

DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	SEE PARTS LIST
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: SEE PARTS LIST
ANGLES ARE IN DEGREES	TITLE/DESC: Release Mechanism
3rd Angle Projection	FILE NAME: Release Mechanism
TOLERANCES:	DWG. #: A-005 REV #: B
ANGULAR ± 1°	SCALE: 1:4 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

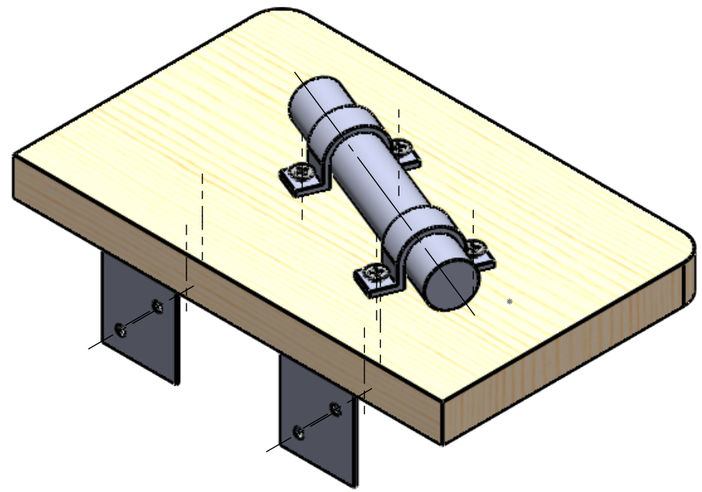






SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SEE BOM

1. Use item #5 to screw item #2 and #1 together as shown
2. use item#4 to position item #3 a shown
3. Use item #5 to screw Items # 4 and #1 together as shown



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	P-0045	RampSight	1
2	P-0046	screwangle	2
3	P-0047	LaserStrap	2
4	P-0048	laserpointer	1
5	P-0044	Sightscrew	8

DRAWN BY	DATE
Joe Ragan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

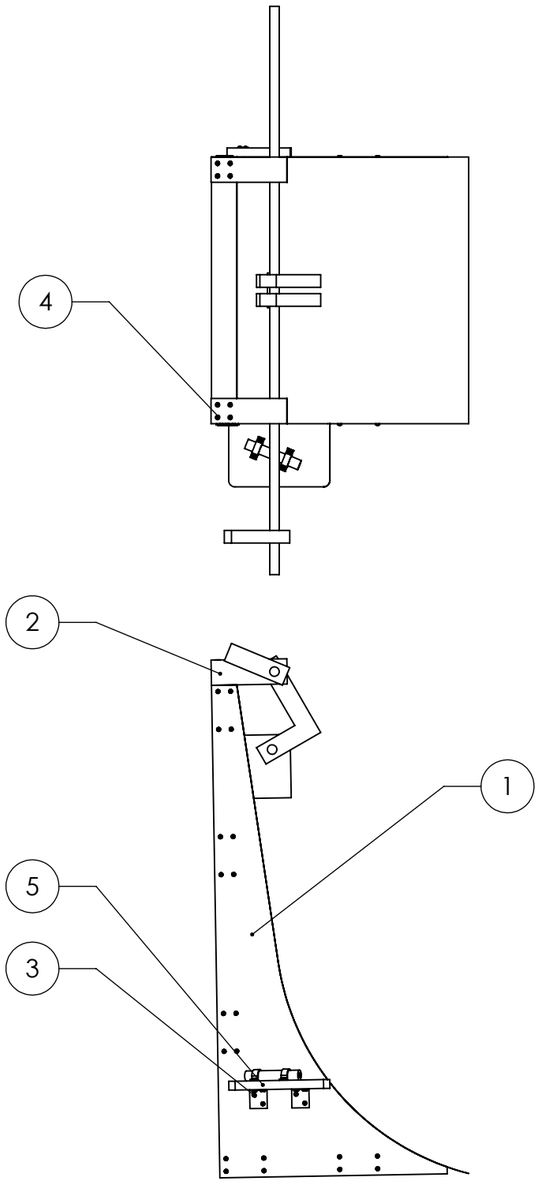
STOCK VENDOR INFO:	SEE PARTS LIST
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: SEE PARTS LIST
ANGLES ARE IN DEGREES	TITLE/DESC: Sight Assembly
3rd Angle Projection	FILE NAME: Assemsight
DWG. #: A-006	REV #: A
SCALE: 1:2	SIZE B / SHEET 1 OF 1

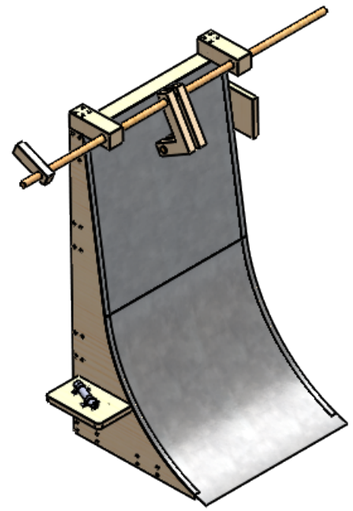
TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SEE BOM

1. ATTACH ITEM 2 TO ITEM 1 USING ITEM 4. THE SCREWS SHOULD BE PUT INTO APPROPRIATE PILOT HOLES AS SHOWN IN DRAWING.
2. ATTACH ITEM 5 TO ITEM 1 USING ITEM 3. THE SCREWS SHOULD BE PUT INTO APPROPTIATE PILOT HOLES AS SHOWN IN DRAWING.





ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:16

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	A-004	Ramp	1
2	A-005	Release Mechanism	1
3	P-037	Wood Screw No. 8 Size, 1-1/2" Long	4
4	P-049	Wood Screw Number 8 Size, 3" Long	8
5	A-006	Sighting System	1

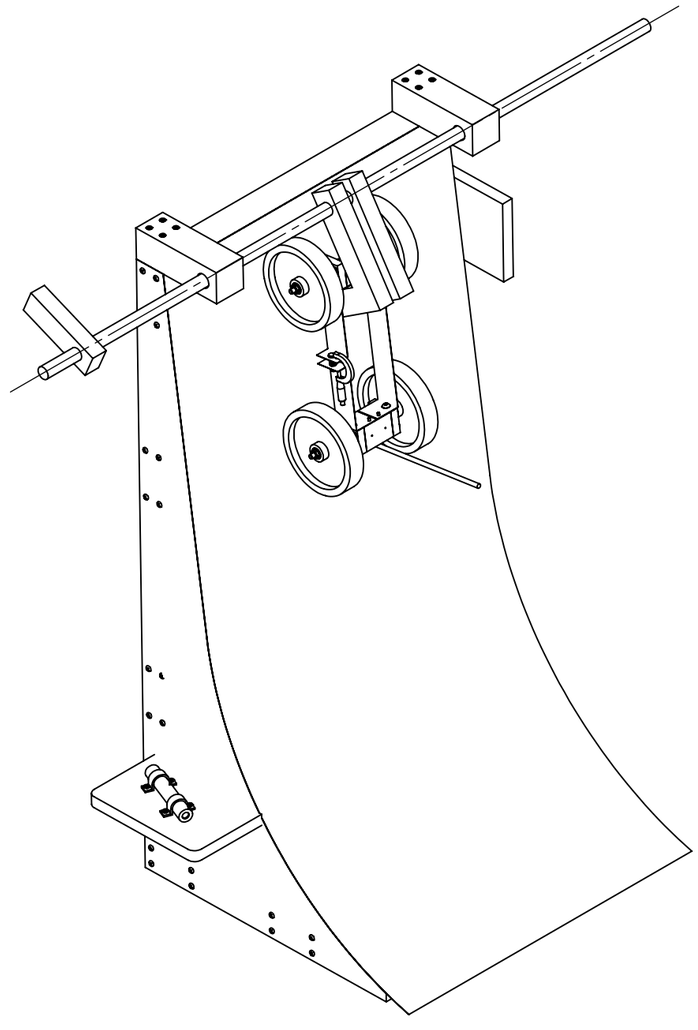
DRAWN BY	DATE
Andrew Weir	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	SEE PARTS LIST		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	Careless Broncos		
	MATERIAL:	SEE PARTS LIST	
	TITLE/DESC:	Assemly of all Ramp Components	
	FILE NAME:	Ramp System	
	DWG. #:	A-007	REV #: A
	SCALE: 1:16	SIZE B	SHEET 1 OF 1

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SEE BOM



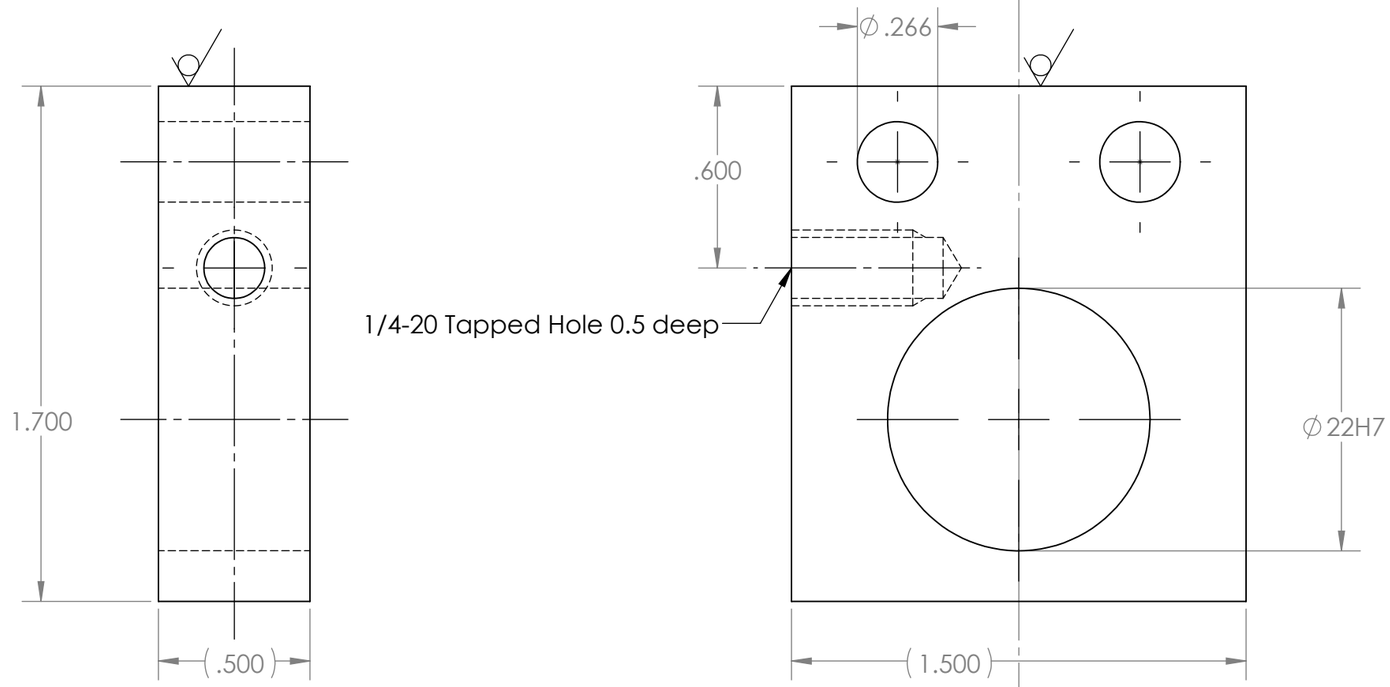
ITEM NO.	PART	Part Number	QTY.
1	Ramp System	A-007	1
2	Gravity car assembly (Split frame)	A-004	1

DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	SEE PARTS LIST
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: SEE PARTS LIST
	TITLE/DESC: Car on Ramp
TOLERANCES:	FILE NAME: Ramp and Car
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	DWG. #: A-008 REV #:
	SCALE: 1:16 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	6063 Aluminium Bar 1/2" x 1" x 4'

1. Cut material to 2" length
2. mill material to length of 1.7"
3. mark position of holes
4. center punsh holes
5. drill 0.266" holes
6. drill hole for 1/4-20 thread with #7 drill
7. drill 0.59" hole for fitting with 5564 drill
8. ream fitting with 22H7 reamer

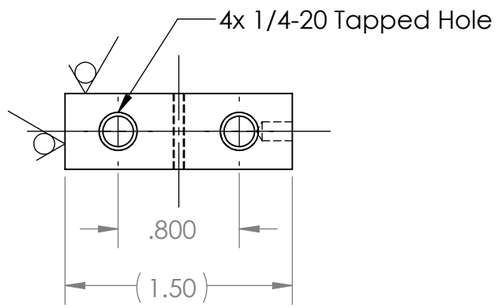


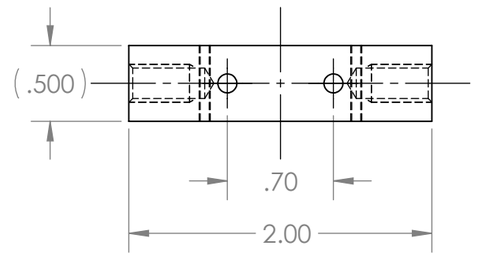
DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

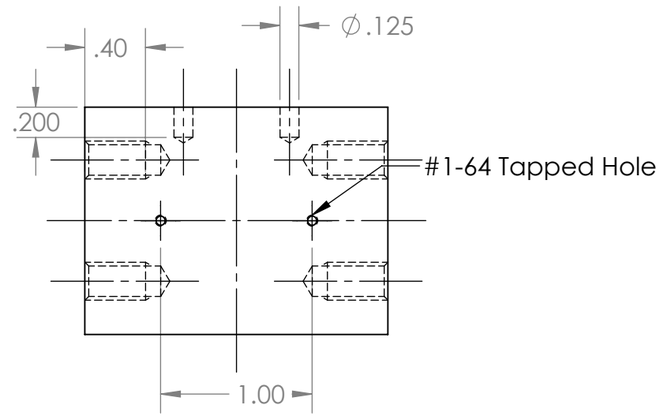
STOCK VENDOR INFO:	McMaster-Carr 89755K11
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: 6063-T5
ANGLES ARE IN DEGREES	TITLE/DESC: Front Suspension
3rd Angle Projection	FILE NAME: Suspension Front
TOLERANCES:	DWG. #: P-001 REV #: A
ANGULAR ± 1°	SCALE: 2:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	6063 Aluminium Bar 1/2" x 1" x 4'

1. cut aluminum bar to 4" length with band saw
2. mill sides to legth of 3.5"
3. mark and centerpuch holes
4. drill hole for 1/4-20 thread with #7 drill
5. drill holes for 1-64 thread with #53 drill
6. cut 1/4-20 thread
7. cut 1-64 thread





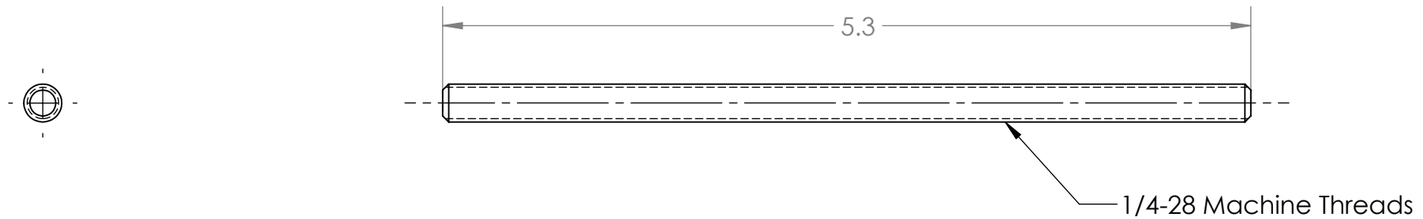


DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	MCMaster-Carr 89755k11
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: 6063-T5
3rd Angle Projection	TITLE/DESC: Connection Front Suspention
TOLERANCES:	FILE NAME: Connection Front Suspention
ANGULAR ± 1°	DWG. #: P-002 REV #: A
FRACTIONAL ±1/8"	SCALE: 1:1 SIZE **B** SHEET 1 OF 1
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Threaded Rod 1/4-20 x 3'

1. cut threaded rod to lenhgth of 7.28"
2. chamfer edges with belt grinder

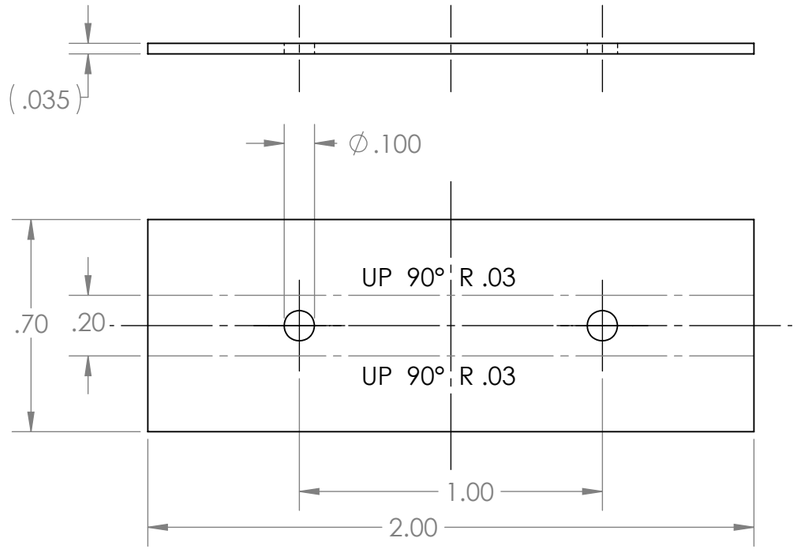


DRAWN BY	DATE
Felix Lasch	11/18/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 3313N11
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: Threaded Axle Front Left
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Threaded Axle Front Left
FRACTIONAL ±1/8"	DWG. #: P-003 REV #: A
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	SCALE: 1:2 SIZE **B** SHEET 1 OF 1
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	1075 Spring Steel Sheet 8"x12"x0.035"

1. cut sheet metal to desired length
2. burring all sides with belt grinder
3. mark and centerpunch holes
4. drill 0.1" holes
5. bend sheet metal at given points

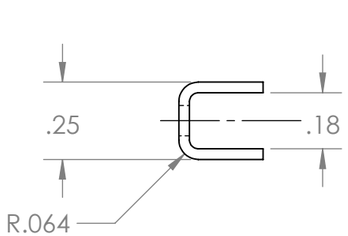


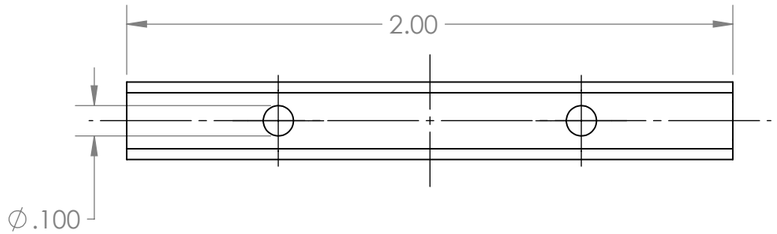
DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

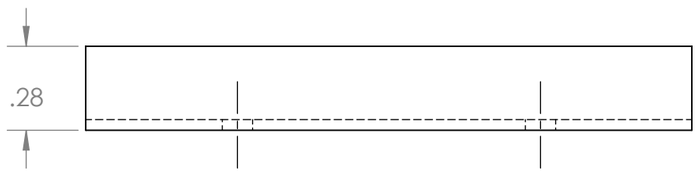
STOCK VENDOR INFO:	McMaster-Carr 9071K73
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: Slide Wing Nut
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Slide Wing Nut 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-004 REV #: A
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 2:1 SIZE **B** SHEET 1 OF 2

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	1075 Spring Steel Sheet 8"x12"x0.035"

1. cut sheet metal to desired length
2. burring all sides with belt grinder
3. mark and centerpunch holes
4. drill 0.1" holes
5. bend sheet metal at given points







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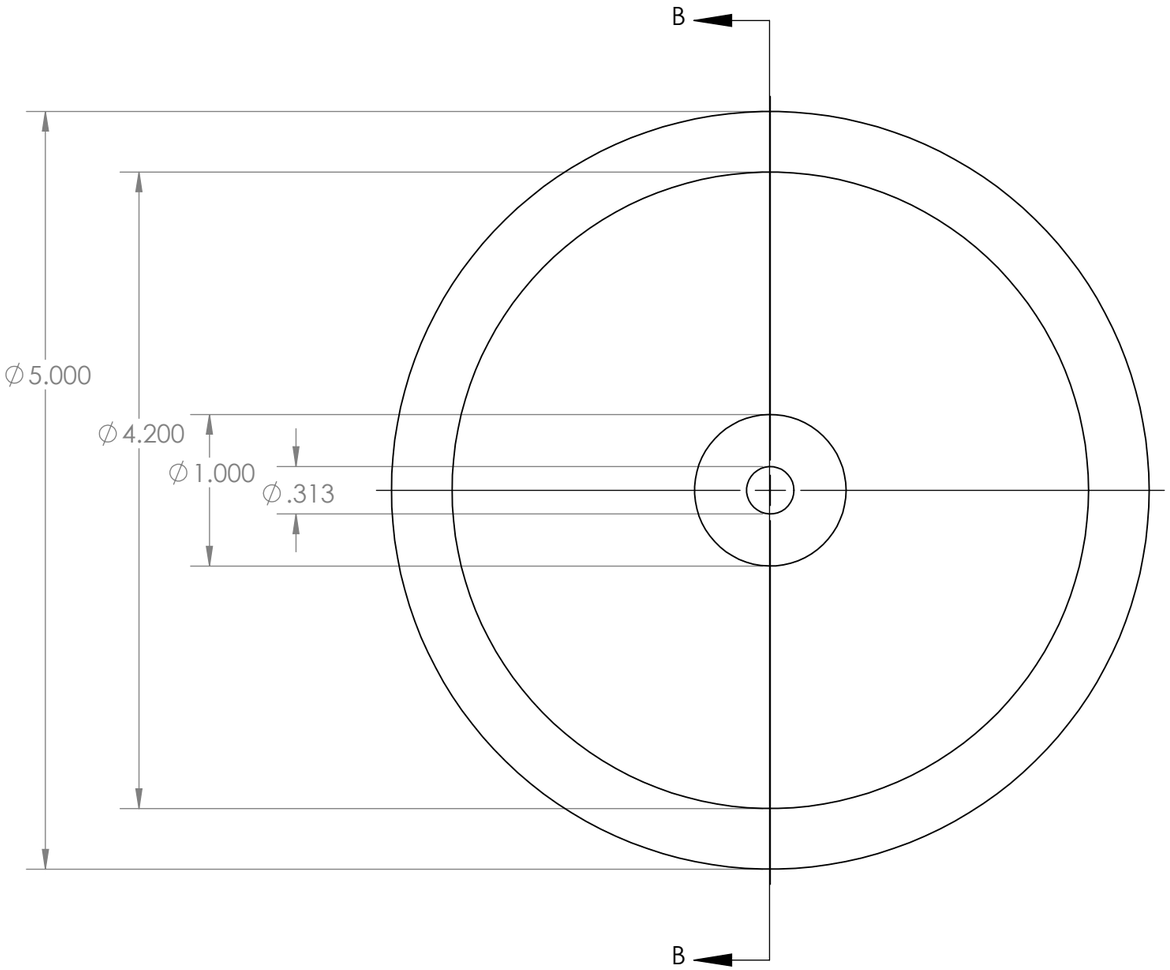
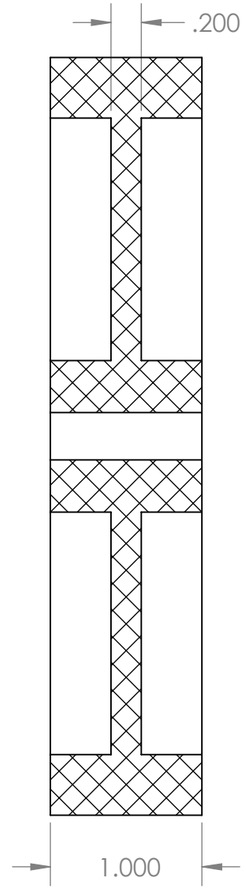
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 9071K73
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: Slide Wing Nut
TOLERANCES:	FILE NAME: Slide Wing Nut 2
ANGULAR ± 1°	DWG. #: P-004 REV #:
FRACTIONAL ±1/8"	SCALE: 2:1 SIZE **B** SHEET 2 OF 2
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Polzpropzlene Wheel 4"" Diameterx 1-1/4" wide

Manufacturer purchased item





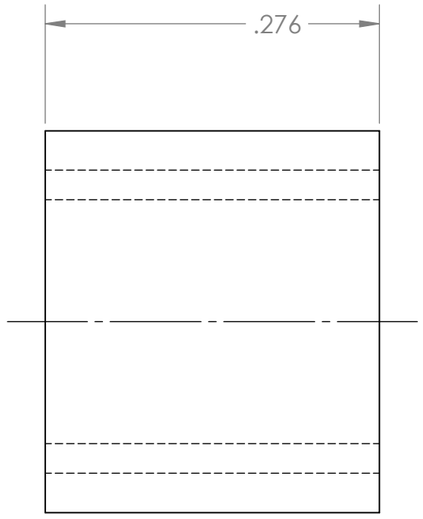
SECTION B-B

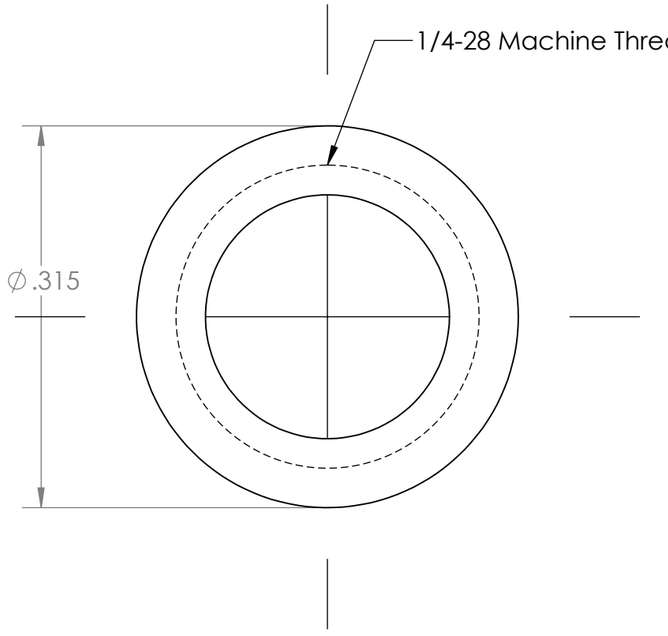
DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 2781T585
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: PP Copolymer
ANGLES ARE IN DEGREES	TITLE/DESC: Wheel
3rd Angle Projection	FILE NAME: Wheel
TOLERANCES:	DWG. #: P-005 REV #: A
ANGULAR ± 1°	SCALE: 1:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Muffle Bearing

1. print muffle with 3D-printer
2. recut 1/4-28 thread with tap cutter





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APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

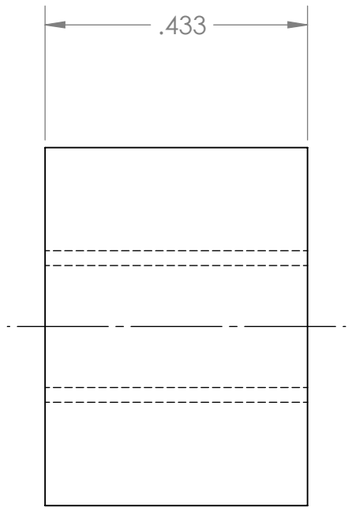
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

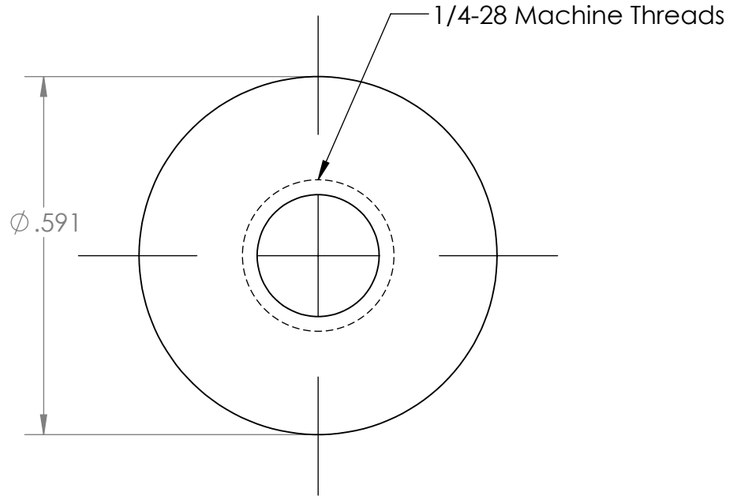
Careless Broncos

MATERIAL:	ABS		
TITLE/DESC:	Muffle Bearing		
FILE NAME:	Muffle Bearing		
DWG. #:	P-006	REV #: A	
SCALE: 8:1	SIZE **B**	SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Muffle One-Way-Bearing

1. print muffle with 3D-printer
2. recut 1/4-28 thread with tap cutter





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APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

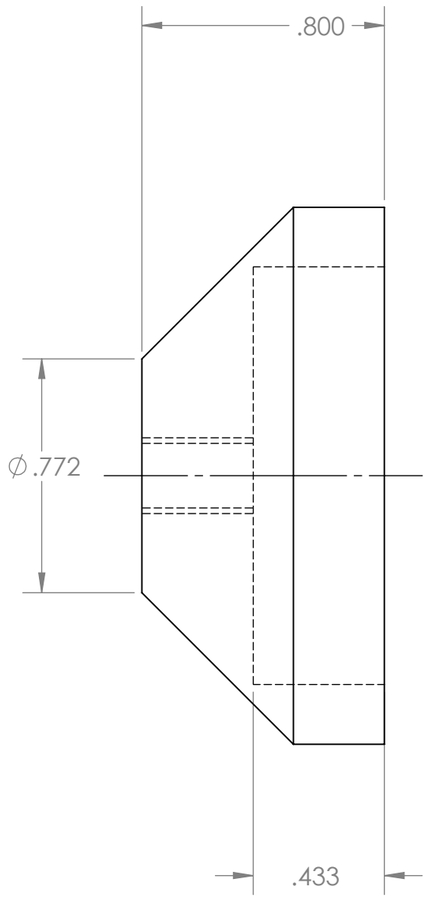
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

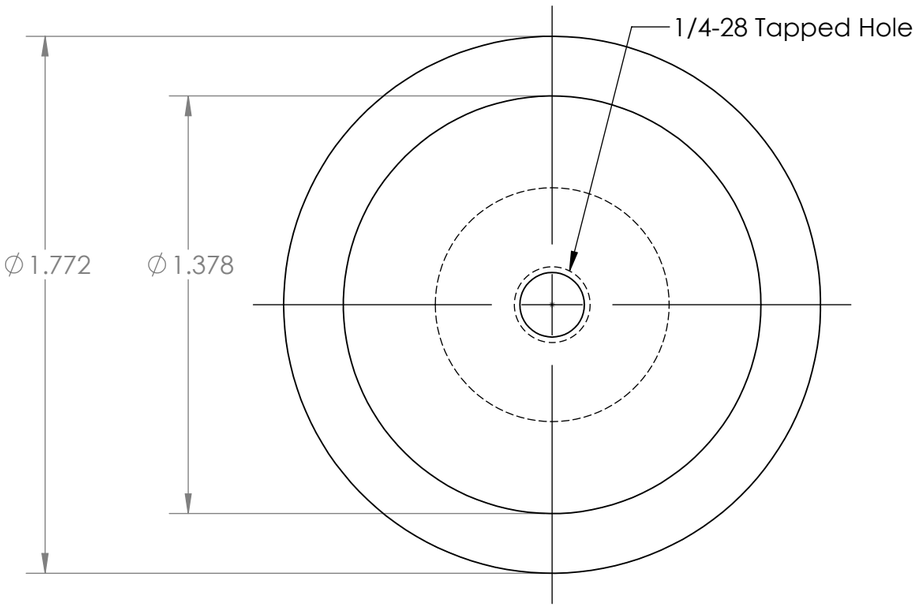
Careless Broncos

MATERIAL:	ABS		
TITLE/DESC:	Muffle One-Way-Bearing		
FILE NAME:	Muffle One-Way-Bearing		
DWG. #:	P-007	REV #:	A
SCALE: 4:1	SIZE **B**	SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Adapter One-Way-Bearing

1. print adapter with 3D-Printer
2. recut 1/4-28 thread with tap cutter





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Felix Lasch	11/21/2019
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AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

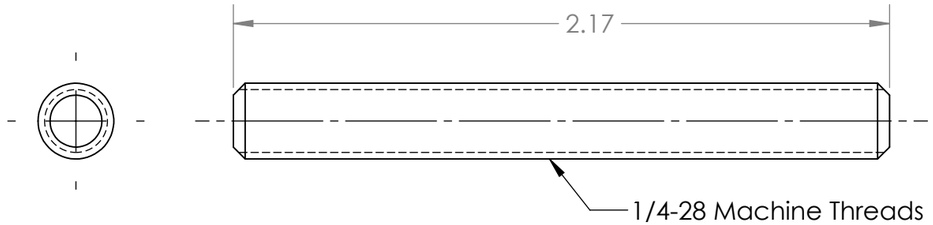
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

Careless Broncos

MATERIAL:	ABS		
TITLE/DESC:	Adapter One-Way-Bearing		
FILE NAME:	P8 Adapter One-Way-Bearing		
DWG. #:	P-008	REV #:	A
SCALE: 2:1	SIZE **B**	SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Threaded Rod 1/4-28 x 3'

1. cut rod to desired length
2. chamfer ends with belt grinder



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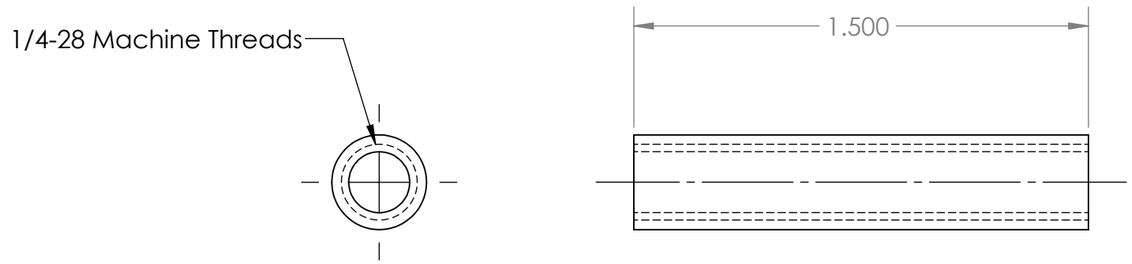
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 90322A660
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: AISI 1020
ANGLES ARE IN DEGREES	TITLE/DESC: Threaded Axle Front Right
3rd Angle Projection	FILE NAME: Threaded Axle Front Right
TOLERANCES:	DWG. #: P-009 REV #: A
ANGULAR ± 1°	SCALE: 2:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Muffle Wheel Left

1. print muffle with 3D-Printer
2. recut 1/4-28 thread with tap cutter



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APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

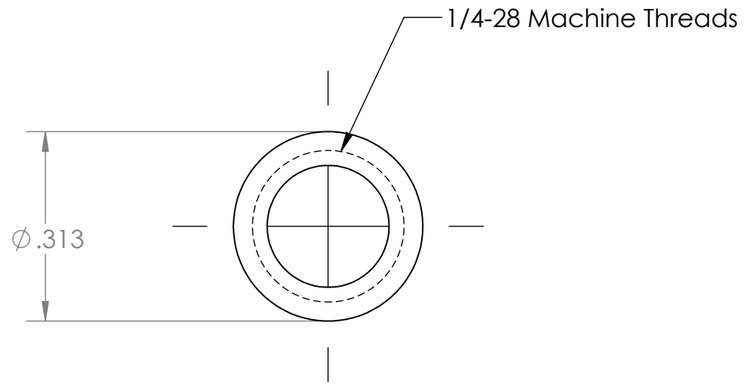
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

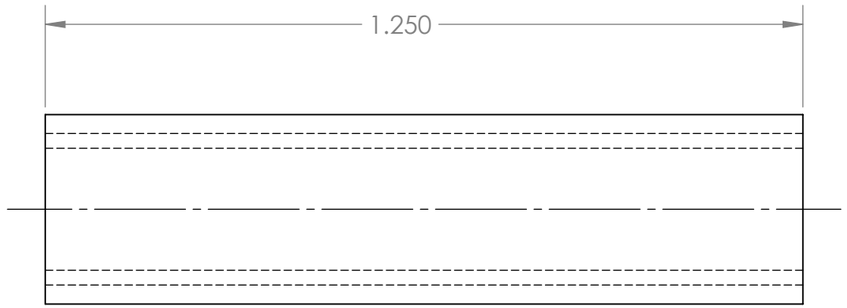
Careless Broncos

MATERIAL:	ABS		
TITLE/DESC:	Muffle Wheel Left		
FILE NAME:	Muffle Wheel Left		
DWG. #:	P-010	REV #:	A
SCALE: 2:1	SIZE **B**	SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Muffle Wheel Right

1. print muffle
2. recut 1/4-28 thread with tap cutter





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Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

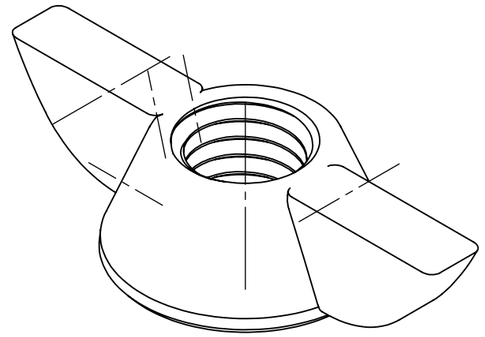
TOLERANCES:

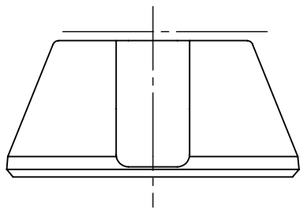
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

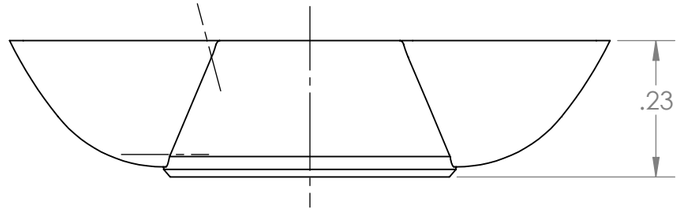
Careless Broncos

MATERIAL:	ABS		
TITLE/DESC:	Muffle Wheel Right		
FILE NAME:	Muffle Wheel Right		
DWG. #:	P-011	REV #:	A
SCALE: 2:1	SIZE **B**	SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Wingnut 1/4-28 tread size
1.	Cut wing nut at 0.23in with metal saw



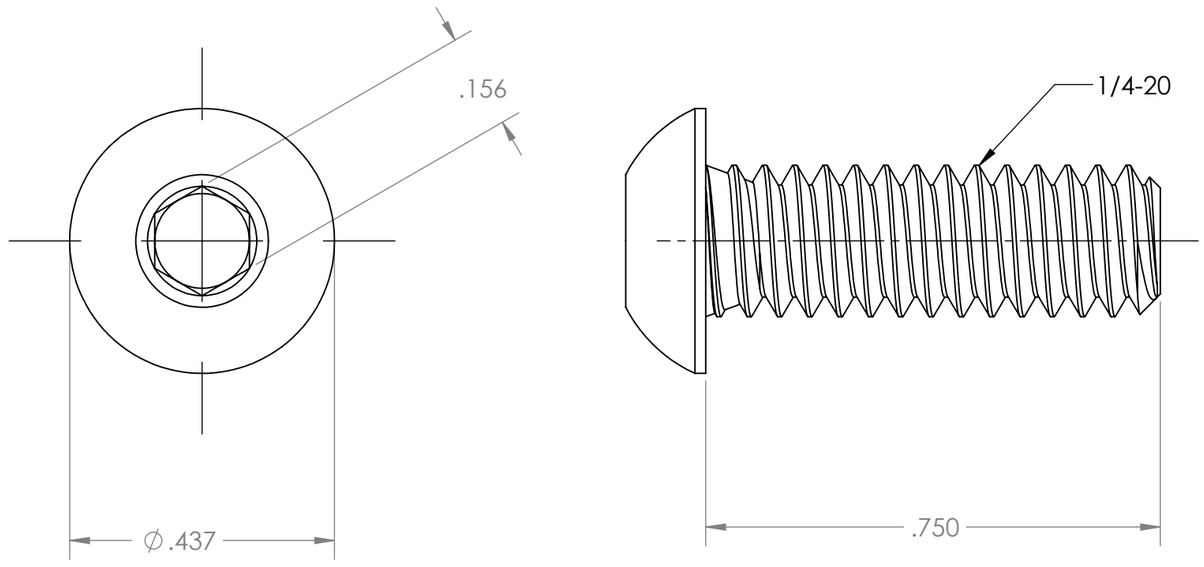




DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 92771A529
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: Brass
3rd Angle Projection	TITLE/DESC: Wingnut
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Wingnut
FRACTIONAL ±1/8"	DWG. #: P-012 REV #: A
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Button Head Hex Drive Screw 1/4-20
Manufacturer purchased item	



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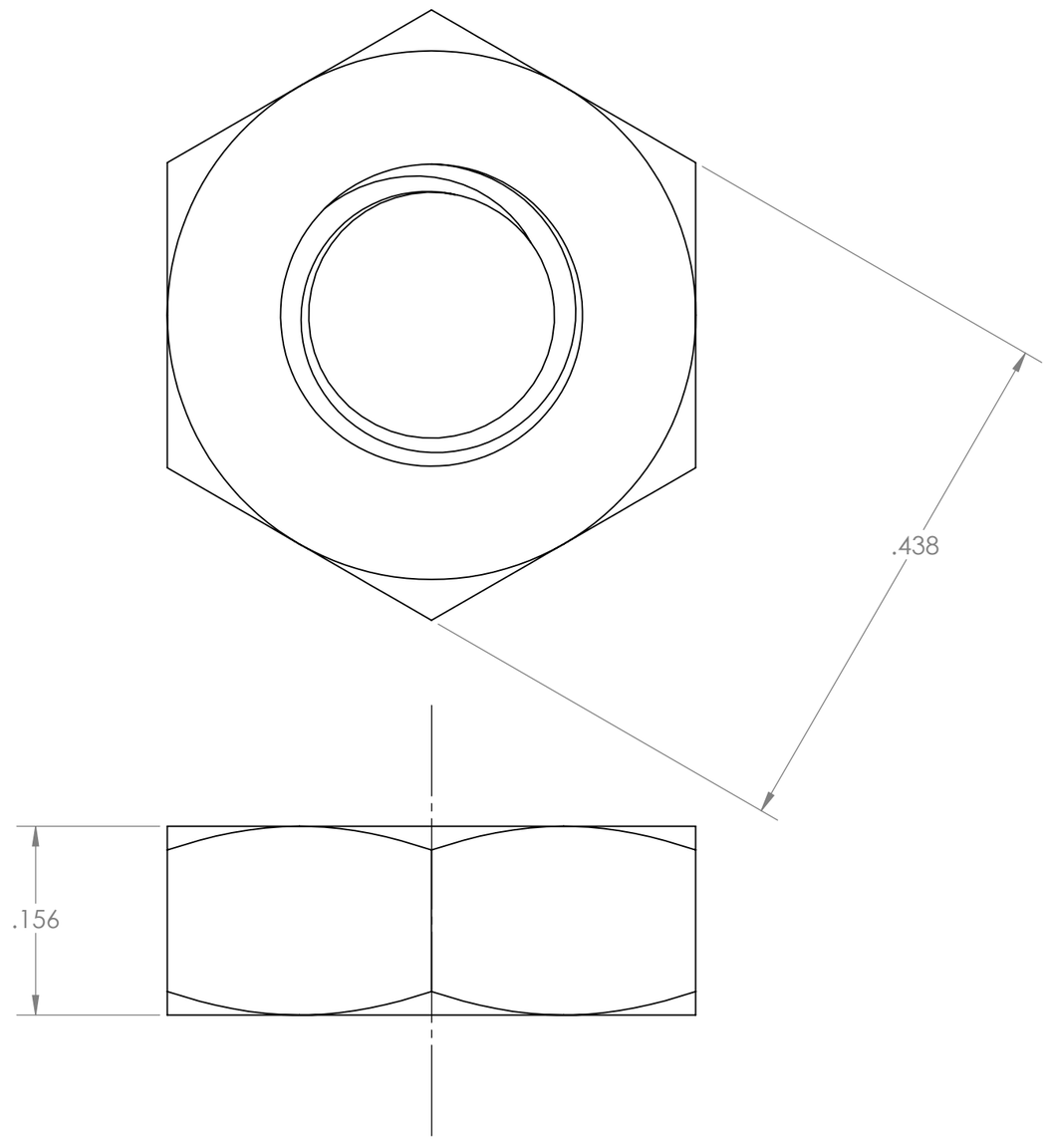
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 92949A540		
UNLESS OTHERWISE SPECIFIED:	Carless Broncos		
DIMENSIONS ARE IN INCHES	MATERIAL:	AISI Type 316L stainless steel	
ANGLES ARE IN DEGREES	TITLE/DESC:	Button Head Hex Drive Screw	
3rd Angle Projection	FILE NAME:	Button Head Hex Screw 1-4-20	
TOLERANCES:	DWG. #:	P-013	REV #:
ANGULAR ± 1°	SCALE: 4:1	SIZE **B**	SHEET 1 OF 1
FRACTIONAL ±1/8"			
ONE PLACE DECIMAL ±0.1"			
TWO PLACE DECIMAL ±0.05"			
THREE PLACE DECIMAL ±0.005"			

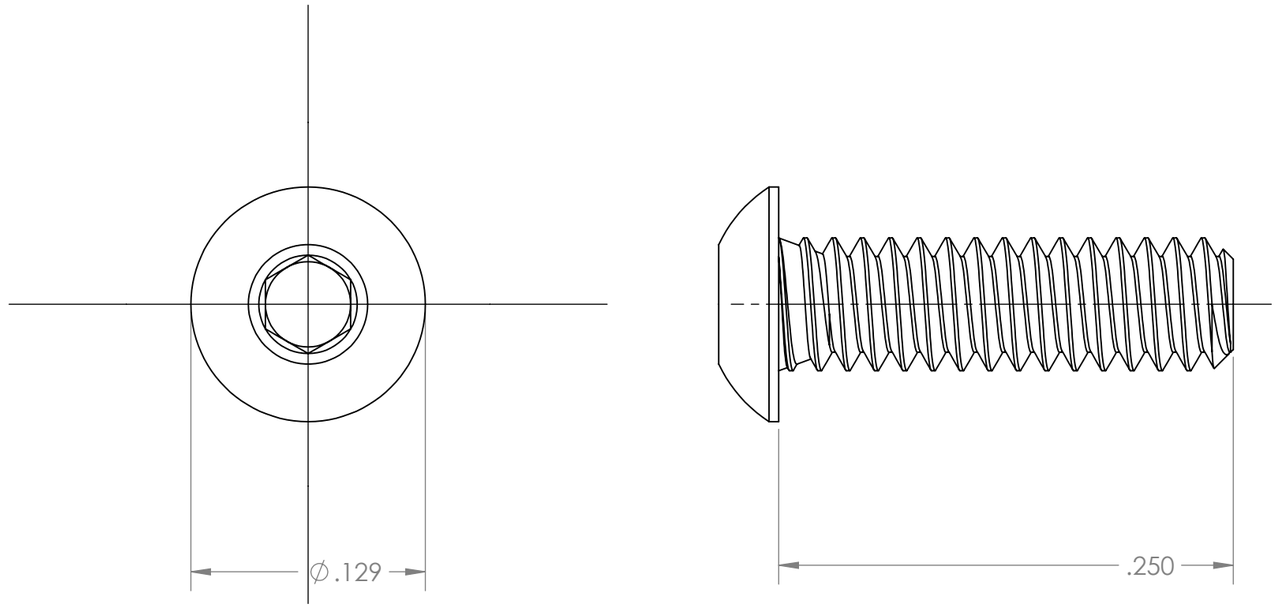
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Stainless Steel Thin Hex Nut 1/4-28
manufacturer purchased item	



DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr91847A429
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: AISI Type 316L stainless steel
ANGLES ARE IN DEGREES	TITLE/DESC: Stainless Steel Thin Hex Nut 1/4-28
3rd Angle Projection	FILE NAME: Stainless Steel Thin Hex Nut 1-4-28
TOLERANCES:	DWG. #: P-014 REV #:
ANGULAR ± 1°	SCALE: 8:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Button Head Hex Screw 1-64
manufactrurer purchased item	

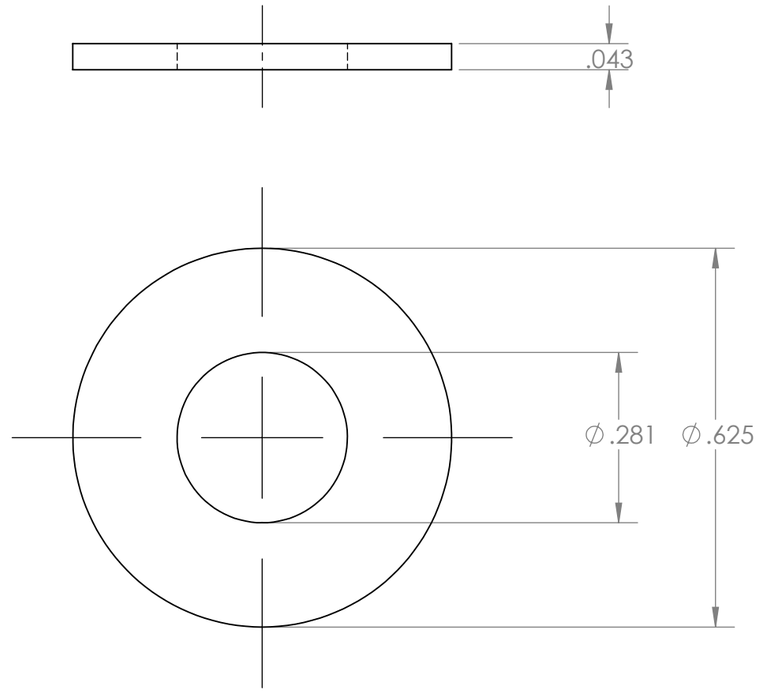


DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 92949A316
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: AISI Type 316L stainless steel
	TITLE/DESC: Button Head Hex Drive Screw 1-64
	FILE NAME: Button Head Hex Drive Screw 1-64
	DWG. #: P-015 REV #:
	SCALE: 12:1 SIZE B SHEET 1 OF 1

TOLERANCES:	
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

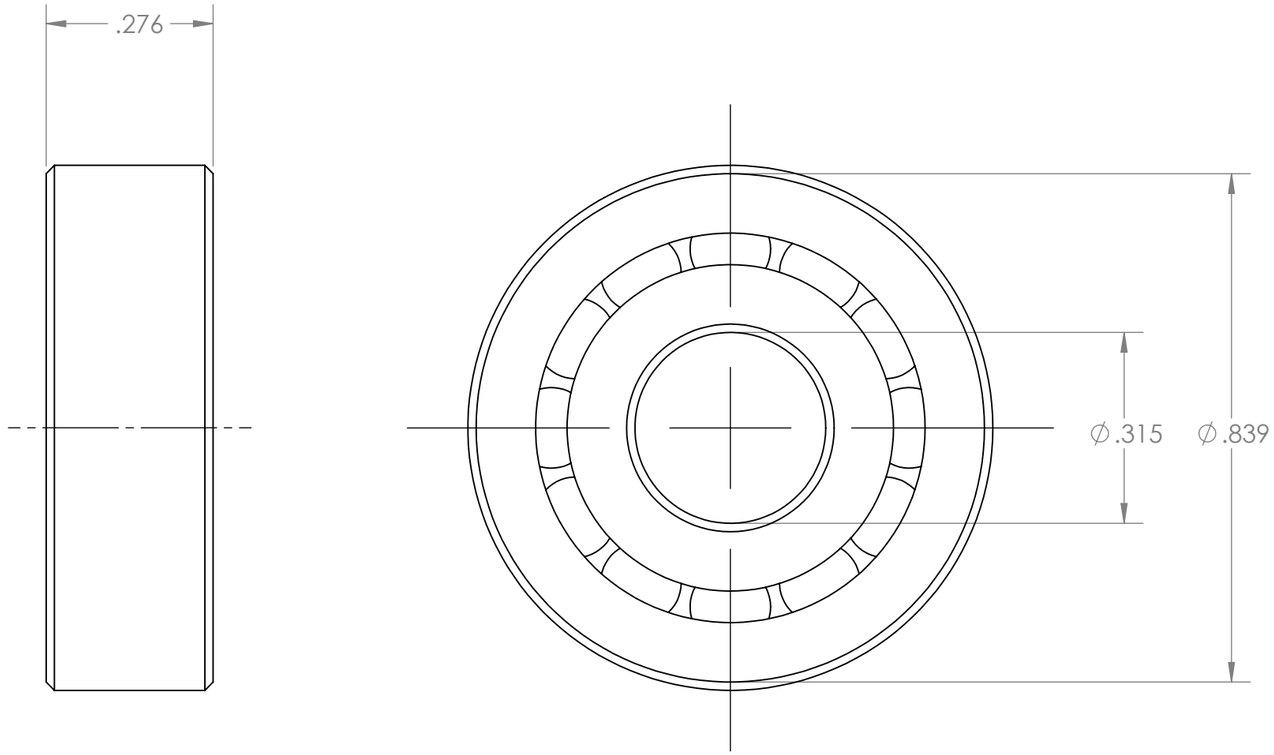
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Stainless Steel Washer 1/4
Manufacturer purchased item	



DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 90107A029
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: AISI Type 316L stainless steel
ANGLES ARE IN DEGREES	TITLE/DESC: Stainless Steel Washer 1/4
3rd Angle Projection	FILE NAME: 316 Stainless Steel Washer
TOLERANCES:	DWG. #: P-016 REV #:
ANGULAR ± 1°	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

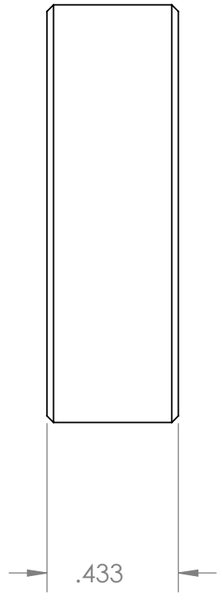
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	608 Ball Bearing
Manufacturer purchased item	

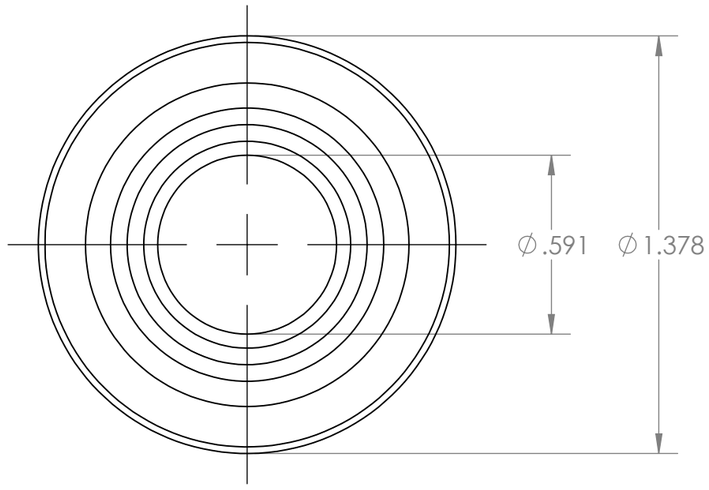


DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 5972K91
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: 608 Ball Bearing
TOLERANCES:	FILE NAME: 608 Ball Bearing
ANGULAR ± 1°	DWG. #: P-017 REV #:
FRACTIONAL ±1/8"	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	One-Way-Bearing
Manufacturer purchased item	

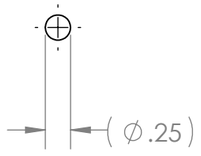


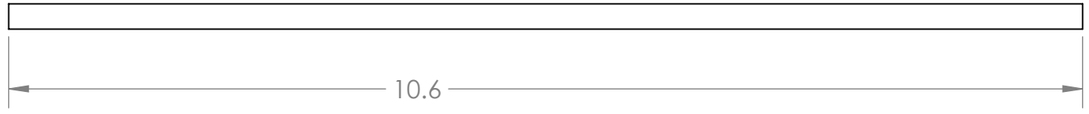


DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: One-Way-Bearing
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: One-Way-Bearing
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-018 REV #:
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 2:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Wooden Rod
1. Cut Rod to length	



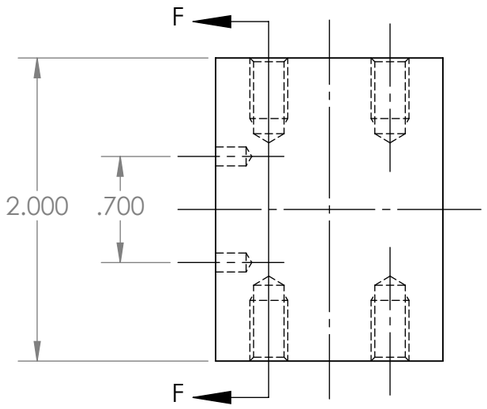


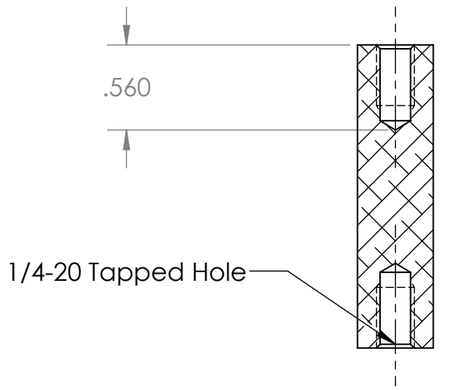
DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Home Depot #203360194
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: Oak
3rd Angle Projection	TITLE/DESC: Wooden Rod
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Wooden Rod
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-019 REV #: A
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 1:2 SIZE **B** SHEET 1 OF 1

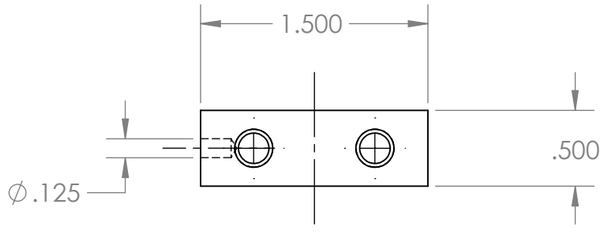
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	6063 Aluminium Bar 1/2" x 1" x 4'

1. cut aluminum bar to 2" length with band saw
2. mill sides to legth of 1.5"
3. mark and centerpunch holes
4. drill hole for 1/4-20 thread with #7 drill
5. drill 1/8" holes
6. cut 1/4-20 thread





SECTION F-F
SCALE 1 : 1



DRAWN BY	DATE
Aditya Patwardhan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

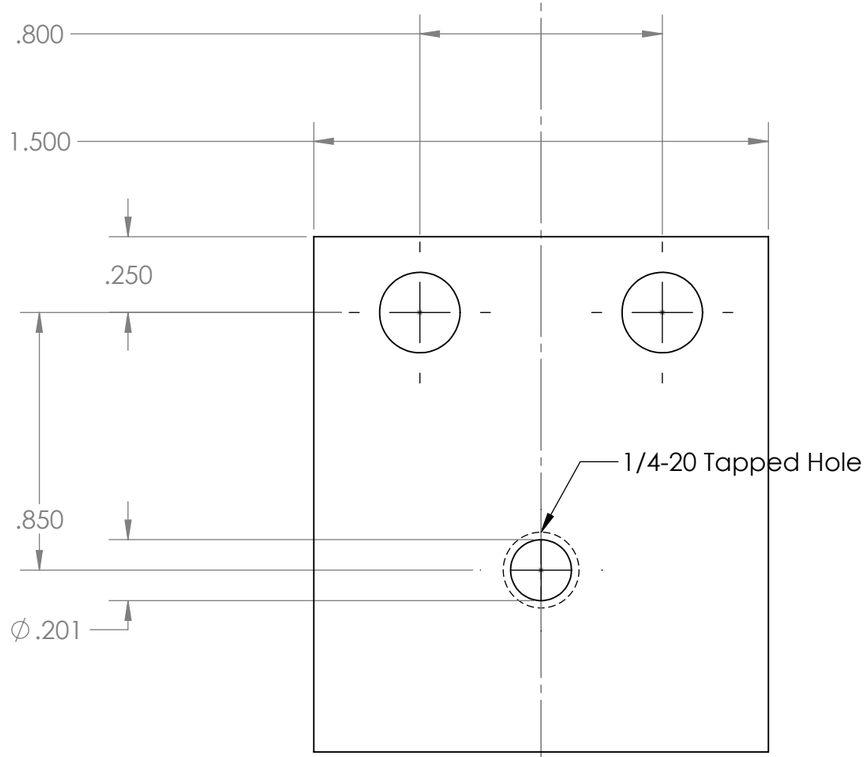
STOCK VENDOR INFO:	McMaster Carr 89755k11		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	Careless Broncos		
	MATERIAL:	6063-T5	
	TITLE/DESC:	Connection Rear Suspension	
	FILE NAME:	Connection Rear Suspention	
	DWG. #:	P-020	REV #: A
	SCALE: 1:1	SIZE B	SHEET 1 OF 1

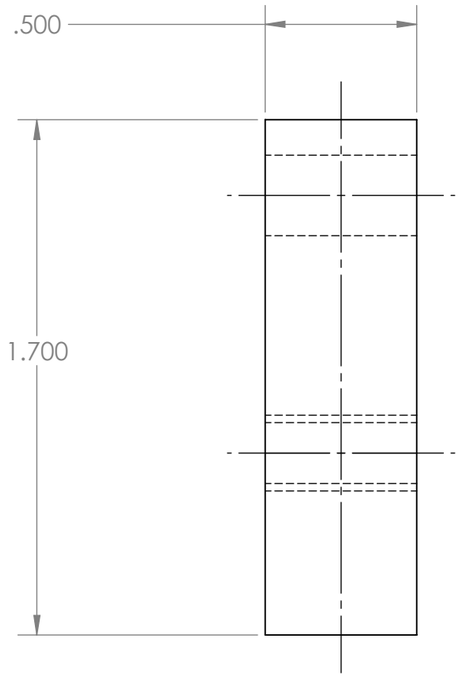
TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Architectural 6063 Aluminum Bar 1/2" Thick, 2" Wide

1. Mill the 2" wide bar to 1.70" wide.
2. Drill and thread the 1/4-20 holes at given location.
3. Drill the two 17/64 holes at given location.





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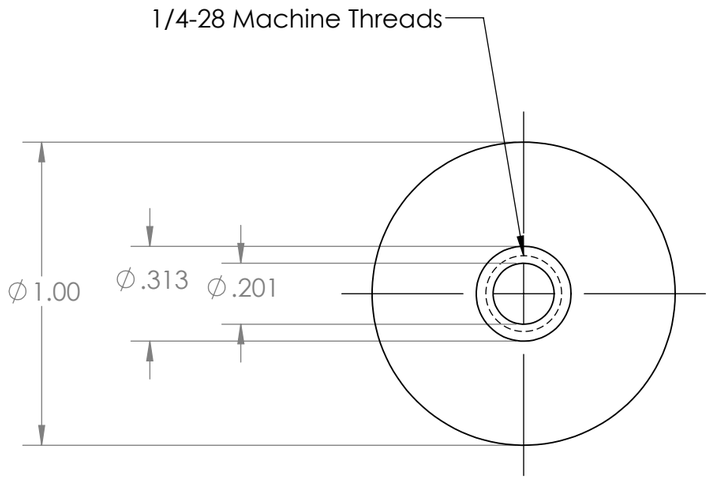
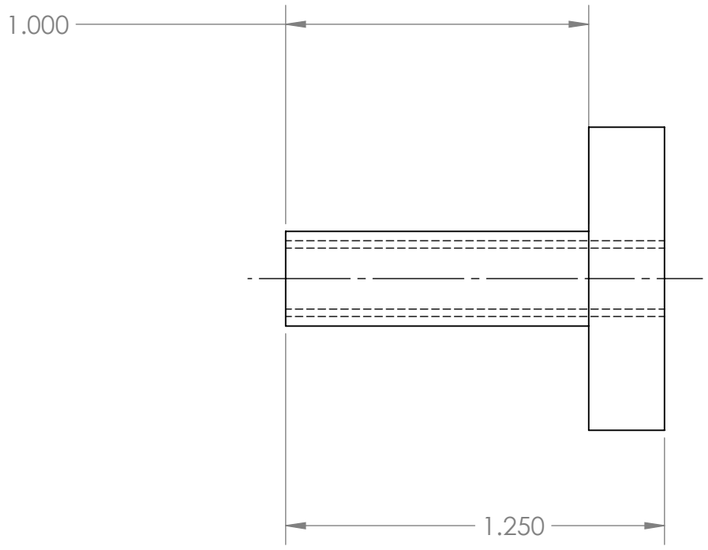
Aditya Patwardhan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster Carr 89755K14
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: 6063-T5
	TITLE/DESC: suspension
TOLERANCES:	FILE NAME: suspension rear
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	DWG. #: P-021 REV #: A SCALE: 2:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Low-Carbon Steel Rod 1" Diameter

1. Off the 1' steel rod, cut two parts 1.5" each for both muffles
2. Lathe one end down to given dimensions.
3. Drill and tap 1/4-20" holes in the center of both rods.





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APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

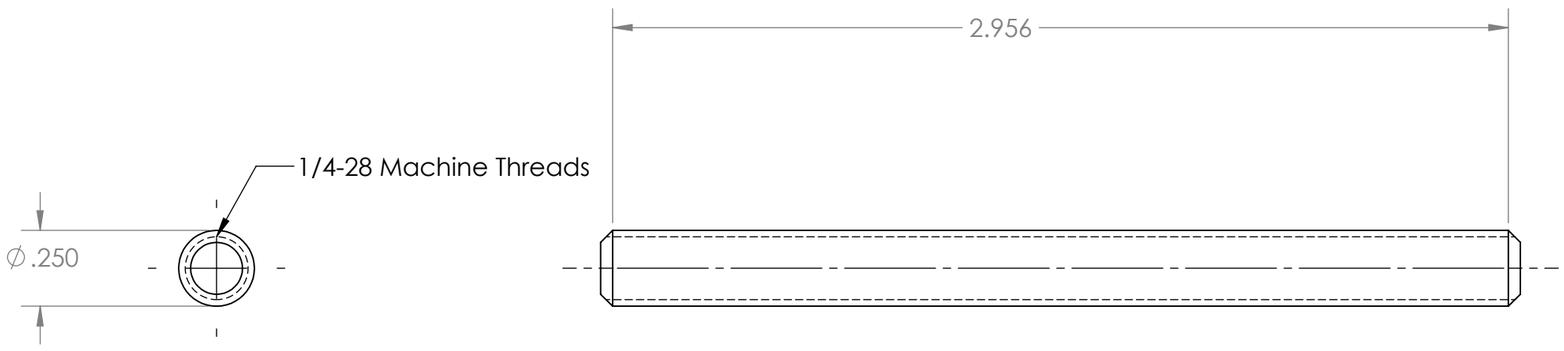
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

Careless Broncos

MATERIAL:	AISI 1020
TITLE/DESC:	Muffle
FILE NAME:	muffle rear wheels
DWG. #:	P-022
REV #:	A
SCALE: 2:1	SIZE B
SHEET 1 OF 1	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Threaded Rod 1/4-28 x 3'

1. Cut threaded rod to a length of 3.366
2. Chamfer the edges with a belt grinder



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Aditya Patwardhan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

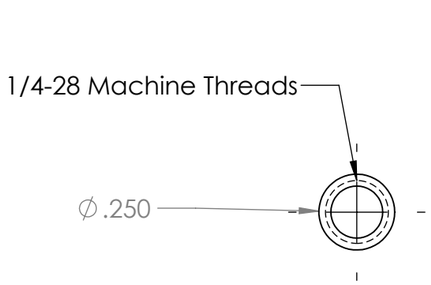
STOCK VENDOR INFO:	McMaster-Carr 90322A660		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	Careless Broncos		
	MATERIAL:	AISI 1020	
	TITLE/DESC:	Threaded Axle	
	FILE NAME:	threaded axle rear right	
	DWG. #: P-023	REV #: A	
	SCALE: 2:1	SIZE B	SHEET 1 OF 1

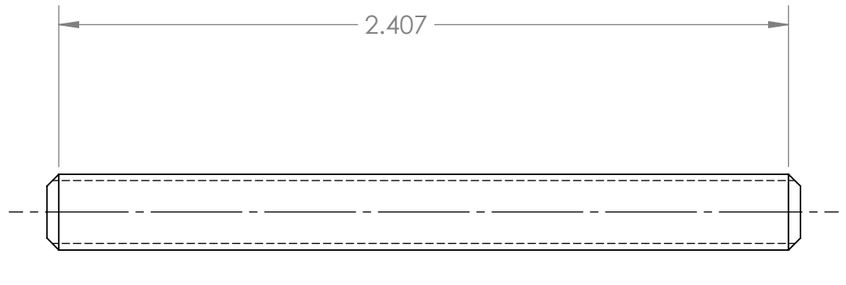
TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Threaded Rod 1/4-28 x 3'

1. Cut threaded rod to a length of 2.677
2. Chamfer the edges with a belt grinder





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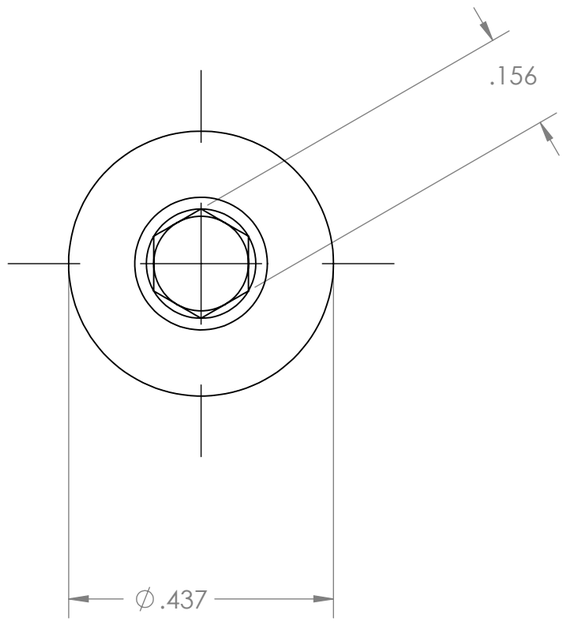
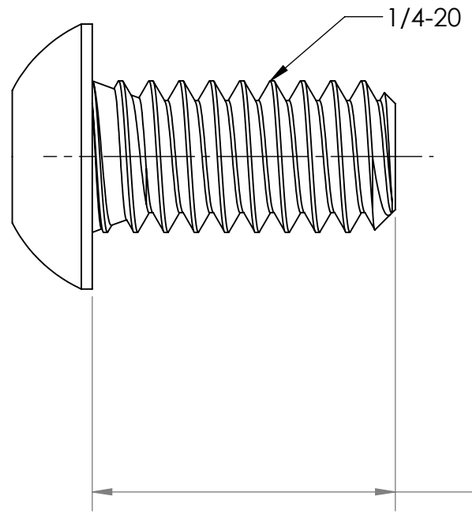
Aditya Patwardhan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 90322A660
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: Threaded Axle
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: threaded axle rear left
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-024 REV #: A
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 2:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Button Head Hex Drive Screw 1/4, 1/2
Manufacturer purchased item	





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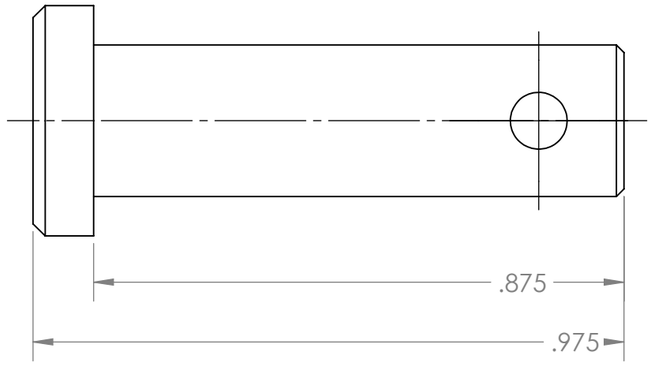
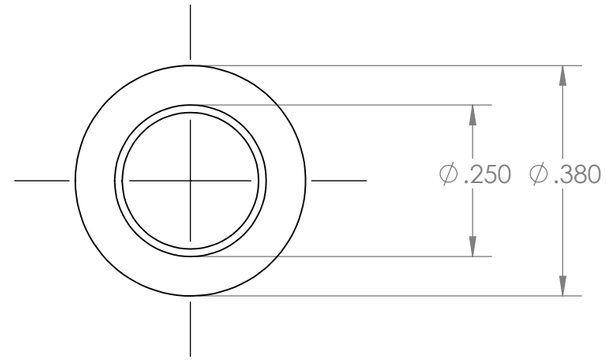
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI Type 316L stainless steel
3rd Angle Projection	TITLE/DESC: Button Head Hex Drive Screw 1/4, 1/2
TOLERANCES:	FILE NAME: Button Head Hex Drive Screw
ANGULAR ± 1°	DWG. #: P-025 REV #:
FRACTIONAL ±1/8"	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Clevis Pin
Manufacturer purchased item	





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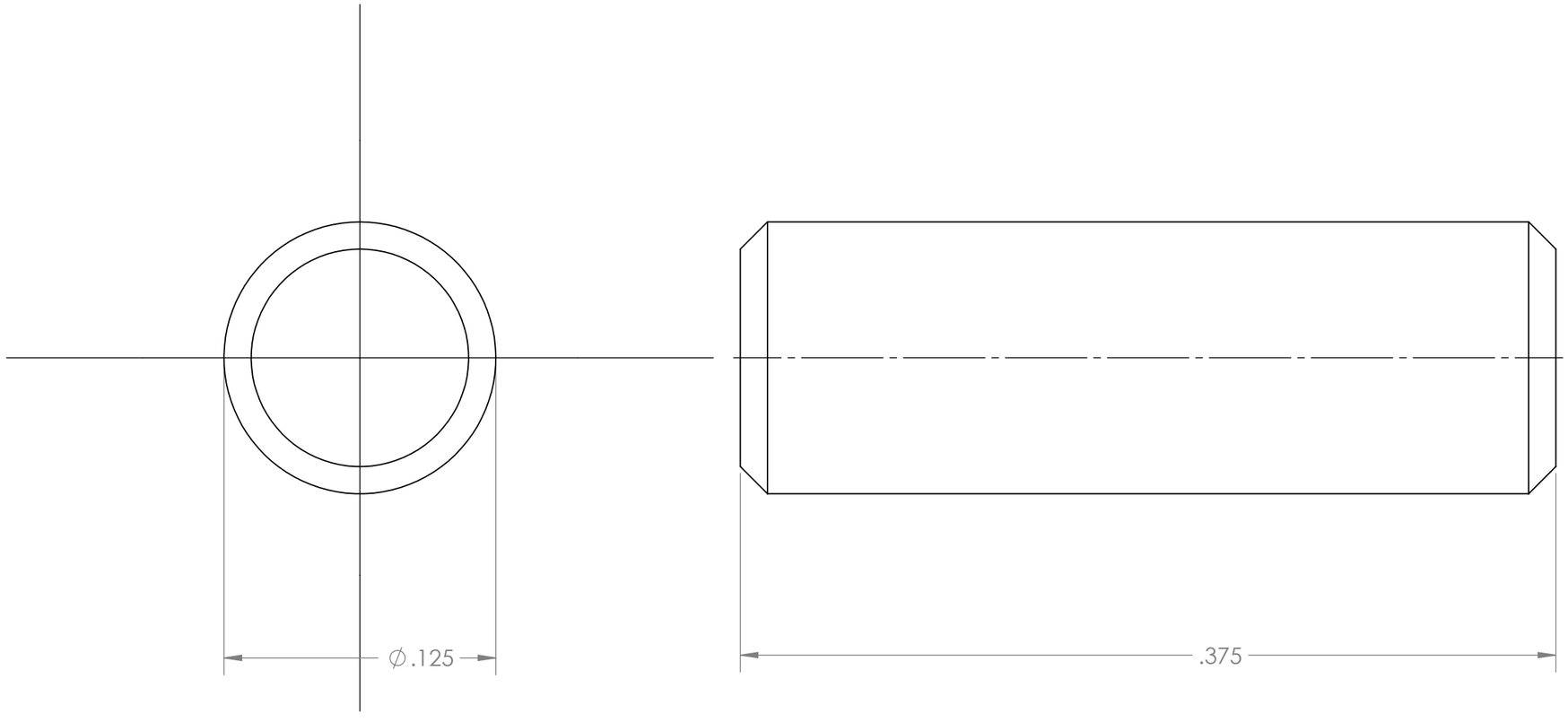
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 98306A158		
UNLESS OTHERWISE SPECIFIED:	Careless Broncos		
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL:	AISI 1020	
	TITLE/DESC:	Clecis Pin	
TOLERANCES:	FILE NAME:	Clevis Pin	
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	DWG. #: P-026	REV #:	
	SCALE: 4:1	SIZE **B**	SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Dowel Pin



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Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: Dowel Pin
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: Dovel Pin
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-027 REV #:
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 16:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances

DRAWN BY: Giampietro Nigro	DATE: 12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

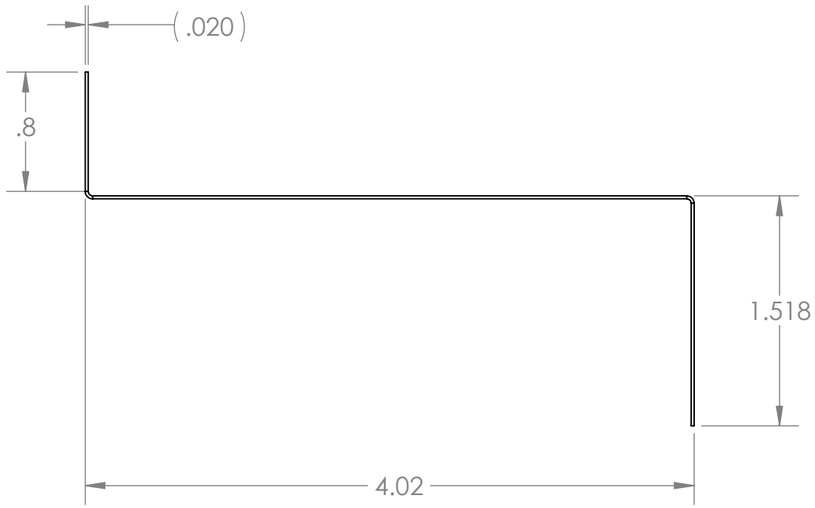
STOCK VENDOR INFO:	Home Depot Model # 56030
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; ANGLES ARE IN DEGREES; 3rd Angle Projection	Careless Broncos
	MATERIAL: Leathergrain Aluminum Sheet in Silver
	TITLE/DESC: Split frame 1 Front
	FILE NAME: Frame1_Unfolded Front
	DWG. #: P-028 REV #: D
	SCALE: 2:1 SIZE B SHEET 1 OF 2

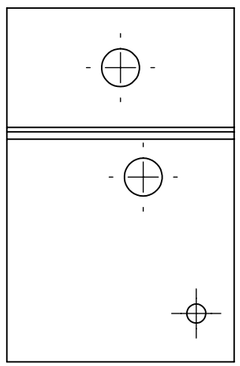
TOLERANCES:

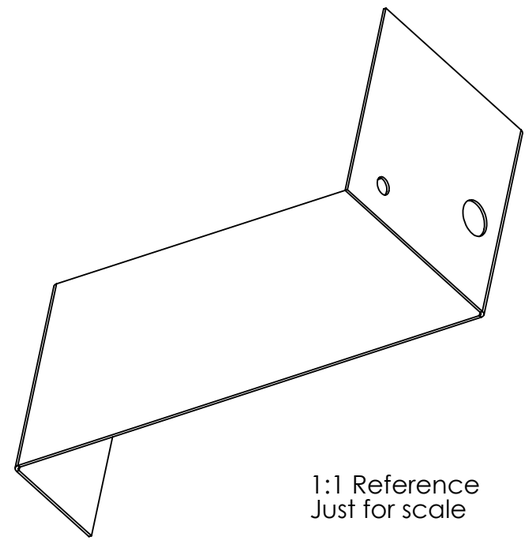
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances







1:1 Reference
Just for scale

DRAWN BY	DATE
Giampietro Nigro	12/6/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO: Home Depot Model # 56030

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

Careless Broncos

MATERIAL: Leathergrain Aluminum Sheet in Silver

TITLE/DESC: Split frame 1 Front

FILE NAME: Frame1 Front

DWG. #: P-028 REV #: D

SCALE: 1:1 SIZE **B** SHEET 2 OF 2

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

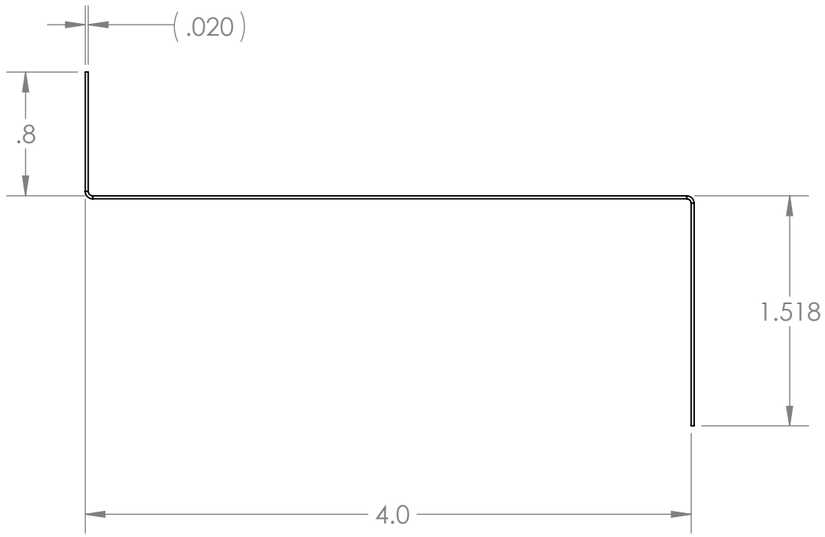
1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances

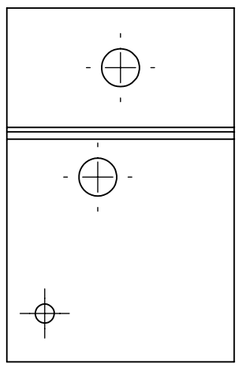
DRAWN BY	DATE
Giampietro Nigro	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

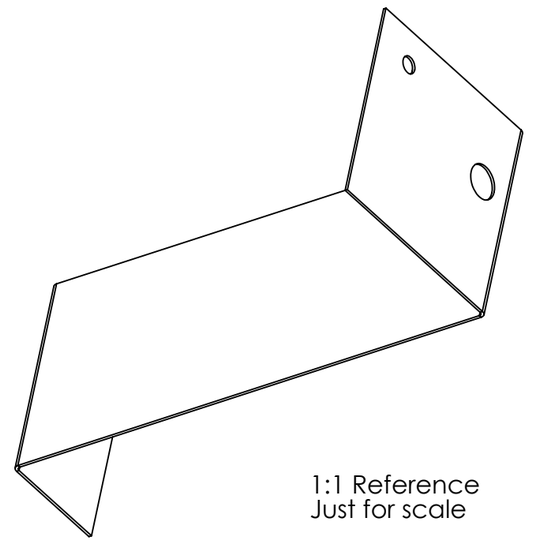
STOCK VENDOR INFO:	Home Depot Model # 56030
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: Leathergrain Aluminum Sheet in Silver
	TITLE/DESC: Split frame 1 Rear
TOLERANCES:	FILE NAME: Frame1_Unfolded Rear
ANGULAR ± 1°	DWG. #: P-029 REV #: D
FRACTIONAL ±1/8"	SCALE: 2:1 SIZE **B** SHEET 1 OF 2
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances







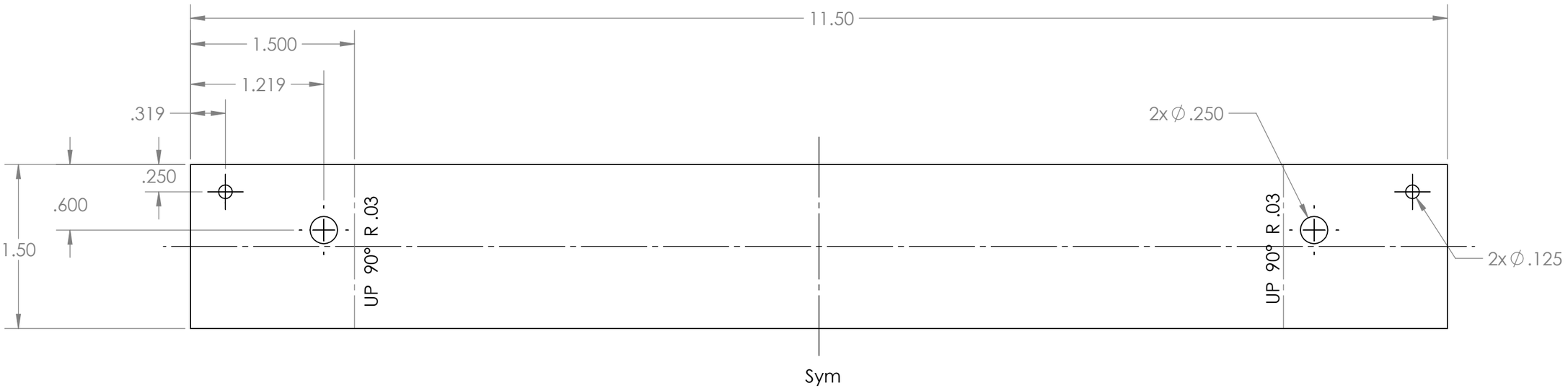
1:1 Reference
Just for scale

DRAWN BY	DATE
Giampietro Nigro	12/6/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Home Depot Model # 56030
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: Leathergrain Aluminum Sheet in Silver
	TITLE/DESC: Split frame 1 Rear
TOLERANCES:	FILE NAME: Frame1 Rear
ANGULAR ± 1°	DWG. #: P-029 REV #: D
FRACTIONAL ±1/8"	SCALE: 1:1 SIZE **B** SHEET 2 OF 2
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances



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Giampietro Nigro	12/6/2019
APPROVALS:	
AU EMAIL	SINGNATURE

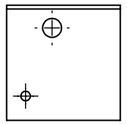
STOCK VENDOR INFO:	Home Depot Model # 56030
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: Leathergrain Aluminum Sheet in Silver
	TITLE/DESC: Split frame 2
	FILE NAME: Frame2_Unfolded
	DWG. #: P-001 REV #: A
	SCALE: 1:1 SIZE B SHEET 1 OF 2

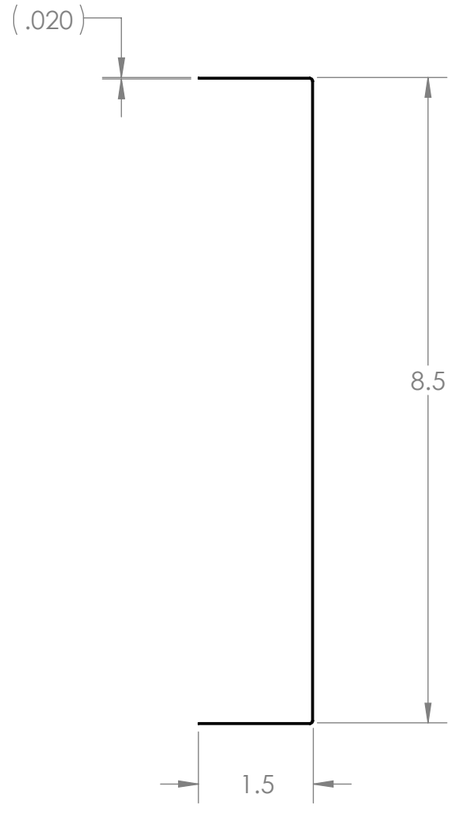
TOLERANCES:

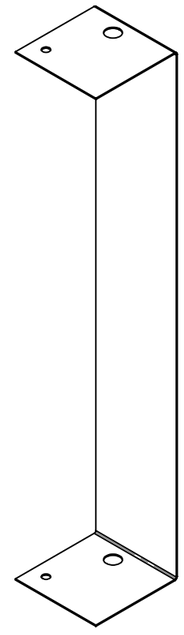
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver

1. Cut a strip of material from the sheet of proper dimensions with a band saw
2. Drill the holes using a power drill
3. Sand the edges using silicon carbide sandpaper
4. Bend the strip, by using the procedure of heat bending, according to the given tollerances







1:2 Refence
Just for scale

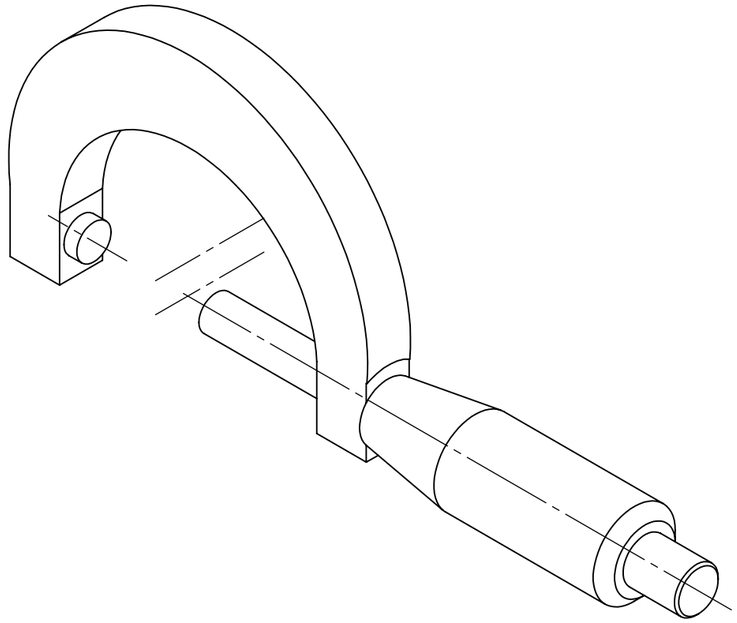
DRAWN BY	DATE
Giampietro Nigro	12/6/2019
APPROVALS:	
AU EMAIL	SINGNATURE

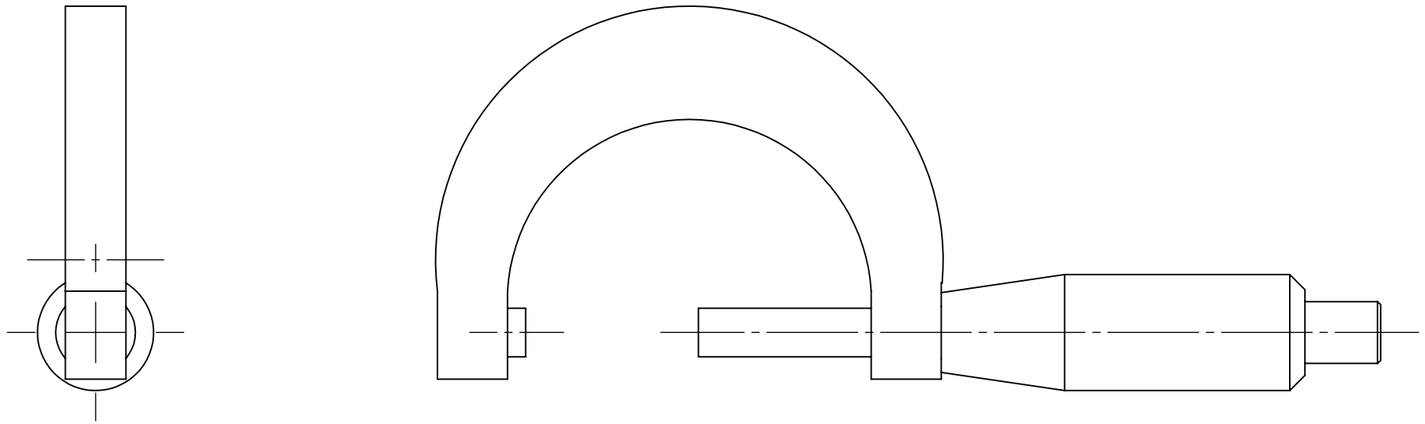
STOCK VENDOR INFO:	Home Depot Model # 56030
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: Leathergrain Aluminum Sheet in Silver
ANGLES ARE IN DEGREES	TITLE/DESC: Split frame 2
3rd Angle Projection	FILE NAME: Frame2
DWG. #: P-030	REV #: A
SCALE: 1:2	SIZE B / SHEET 2 OF 2

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	micrometer
Purchaed manufactured item	

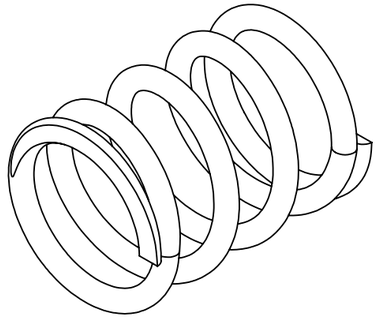


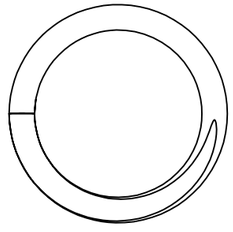


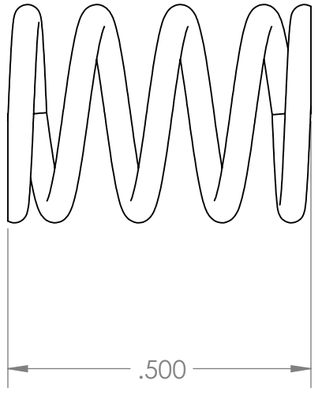
DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 85205A61
UNLESS OTHERWISE SPECIFIED:	GROUP NAME
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: AISI 1020
3rd Angle Projection	TITLE/DESC: micrometer
TOLERANCES:	FILE NAME: micrometer
ANGULAR ± 1°	DWG. #: P-031 REV #:
FRACTIONAL ±1/8"	SCALE: 2:1 SIZE **B** SHEET 1 OF 1
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Compression Spring
Purchased manufacturer Item	





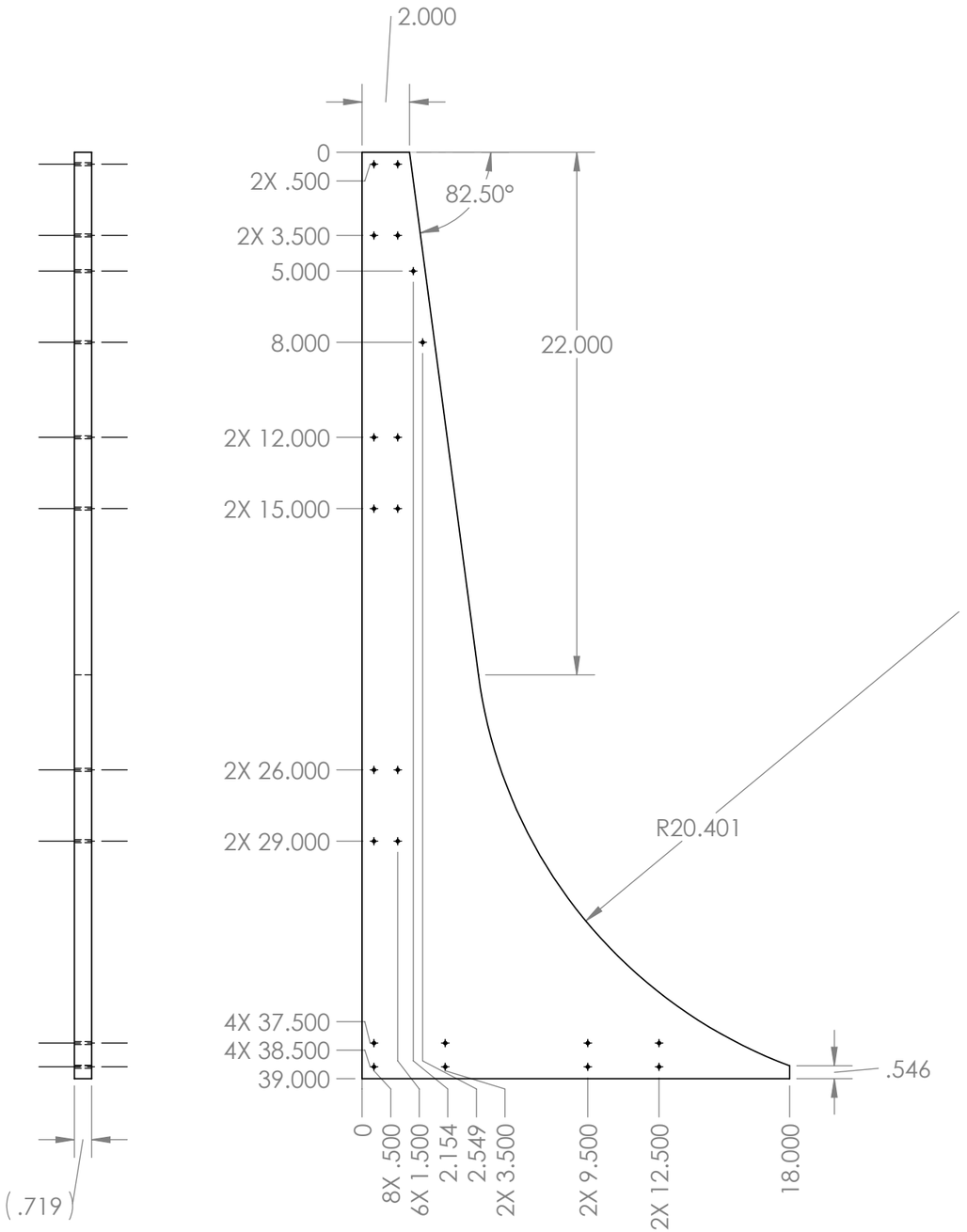


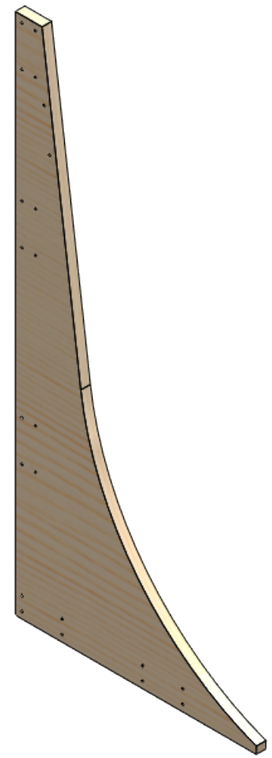
DRAWN BY	DATE
Felix Lasch	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	McMaster-Carr 2022N161		
UNLESS OTHERWISE SPECIFIED:	Careless Broncos		
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL:	AISI 1020	
	TITLE/DESC:	Compression Spring	
TOLERANCES:	FILE NAME:	Compression Spring	
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	DWG. #: P-032	REV #:	
	SCALE: 4:1	SIZE **B**	SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	BC SANDED PINE PLYWOOD 23/32 in. x 4 ft. x 8ft.

1. USE CIRCULAR SAW TO CUT OUT A RECTANGLE WITH CORRECT LENGTH AND HEIGHT SPECIFIED. WIDTH WILL COME FROM THE PURCHASED PRODUCT.
2. USE BAND SAW TO CUT OUT BASIC CURVE SHAPE OF PART.
3. SAND EDGES TO MATCH DIMENSIONING WITHIN GIVEN TOLERANCES
4. USE DRILL WITH 1/8 IN. BIT SIZE TO CREATE HOLES WITHIN GIVEN TOLERANCES





ISOMETRIC VIEW

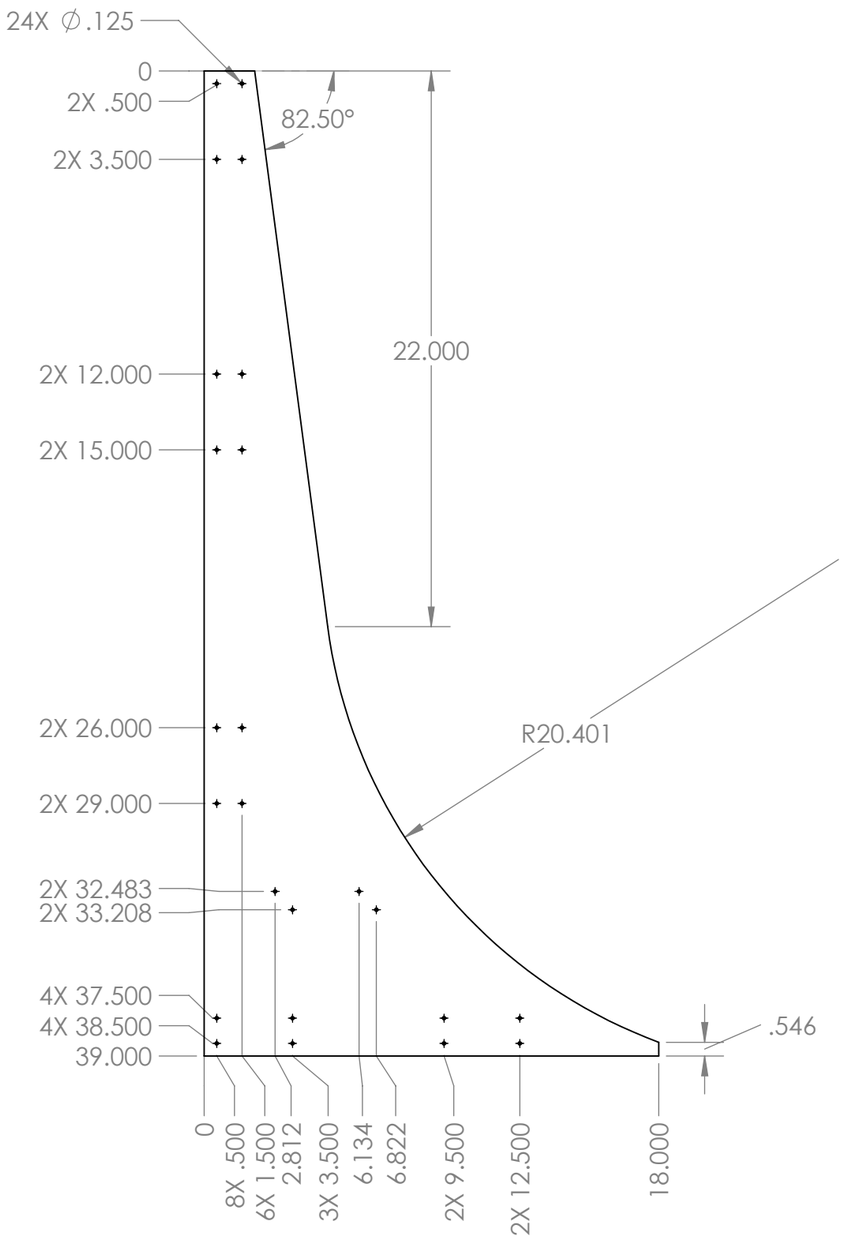
FOR REFERNCE ONLY
SCALE 1:8

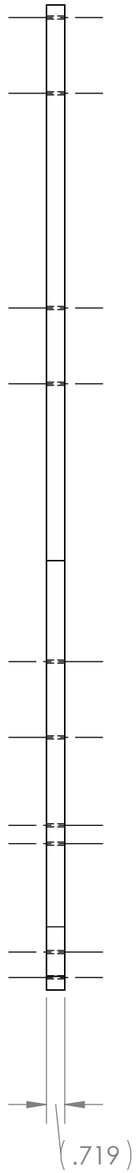
DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

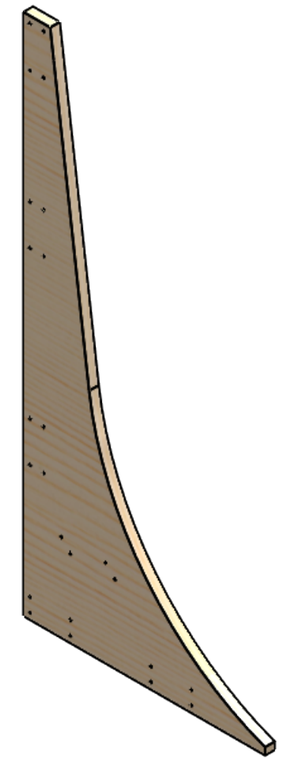
STOCK VENDOR INFO:	Home Depot Model# 201428
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	GROUP NAME
	MATERIAL: Pine
	TITLE/DESC: Ramp Right Side
TOLERANCES:	FILE NAME: Left Ramp Side
ANGULAR ± 1°	DWG. #: P-033 REV #: A
FRACTIONAL ±1/8"	SCALE: 1:6 SIZE B SHEET 1 OF 1
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	BC SANDED PINE PLYWOOD 23/32 in. x 4 ft. x 8ft.

1. USE CIRCULAR SAW TO CUT OUT A RECTANGLE WITH CORRECT LENGTH AND HEIGHT SPECIFIED. WIDTH WILL COME FROM THE PURCHASED PRODUCT.
2. USE BAND SAW TO CUT OUT BASIC CURVE SHAPE OF PART.
3. SAND EDGES TO MATCH DIMENSIONING WITHIN GIVEN TOLERANCES
4. USE DRILL WITH 1/8 IN. BIT SIZE TO CREATE HOLES WITHIN GIVEN TOLERANCES







ISOMETRIC VIEW

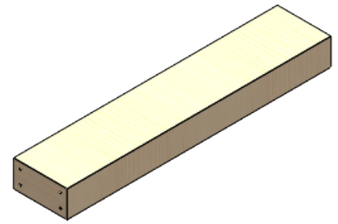
FOR REFERENCE ONLY
SCALE 1:8

DRAWN BY	DATE
Andrew Weir	11/22/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Home Depot Model# 201428
UNLESS OTHERWISE SPECIFIED:	TEAM CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Pine
ANGLES ARE IN DEGREES	TITLE/DESC: Ramp Right Side
3rd Angle Projection	FILE NAME: Ramp Right Side
TOLERANCES:	DWG. #: P-034 REV #: D
ANGULAR ± 1°	SCALE: 1:6 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

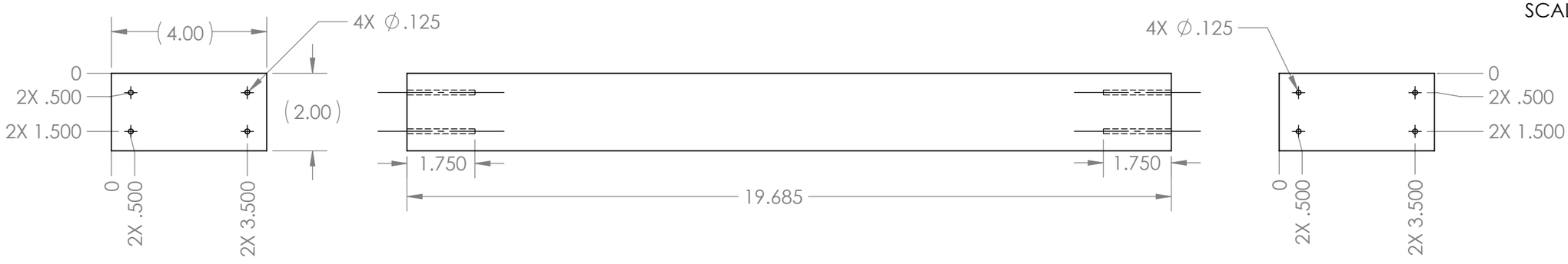
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	2 IN. X 4 IN. X 16 FT. SPRUCE PINE FIR LUMBER

1. USE A CIRCULAR SAW TO CUT THE A BLOCK WITH LENGTH APPROXIMATELY EQUAL TO DIMENSIONS GIVEN. DIMENSIONS FOR WIDTH AND HEIGHT ARE EQUAL TO PURCHASED DIMENSIONS.
2. USE A DRILL WITH 1/8 IN. TO DRILL THE SMALL HOLES ON BOTH SIDES OF THE BLOCK. THE LOCATION OF THE HOLES SHOULD FALL WITHIN TOLERANCES GIVEN. THE DEPTH OF THE HOLES ONLY HAVE TO FALL WITHIN 1 IN. OF TOLERANCE.
3. SAND THE SIDES OF THE BLOCK UNTIL ALL TOLERANCES FALL WITHIN GIVEN TOLERANCES.



ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:8



DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

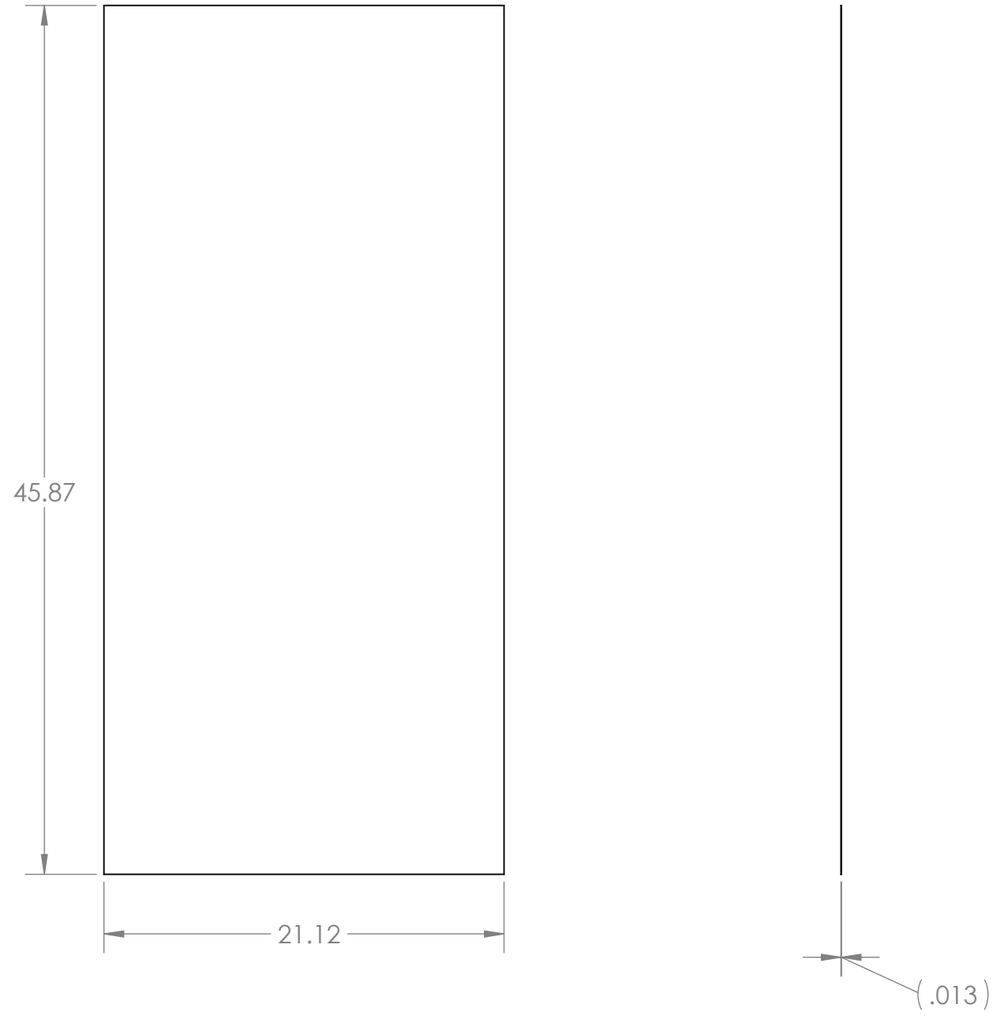
STOCK VENDOR INFO:	HOME DEPOT MODEL # 0133166
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: Pine
	TITLE/DESC: RAMP CONNECTING SUPPORT
	FILE NAME: base support
	DWG. #: P-035 REV #: A
	SCALE: 1:3 SIZE B SHEET 1 OF 1

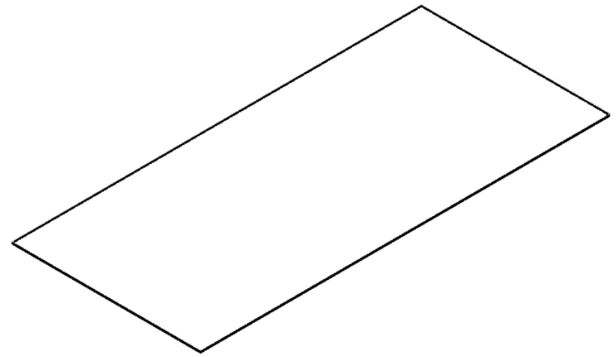
TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.13"
THREE PLACE DECIMAL	±0.125"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	24 IN. W x 3 FT. L Galvanized Steel Sheet Metal

1. USE A PAIR OF TIN SNIPS TO CUT THE SHEET METAL WITH APPROXIMATE LENGTH AND HEIGHT GIVEN.
2. USE SAND PAPER TO SAND THE EDGES OF THE SHEET OF METAL UNTIL ALL DIMENSIONS ARE WITHIN TOLERANCE.





ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:12

DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

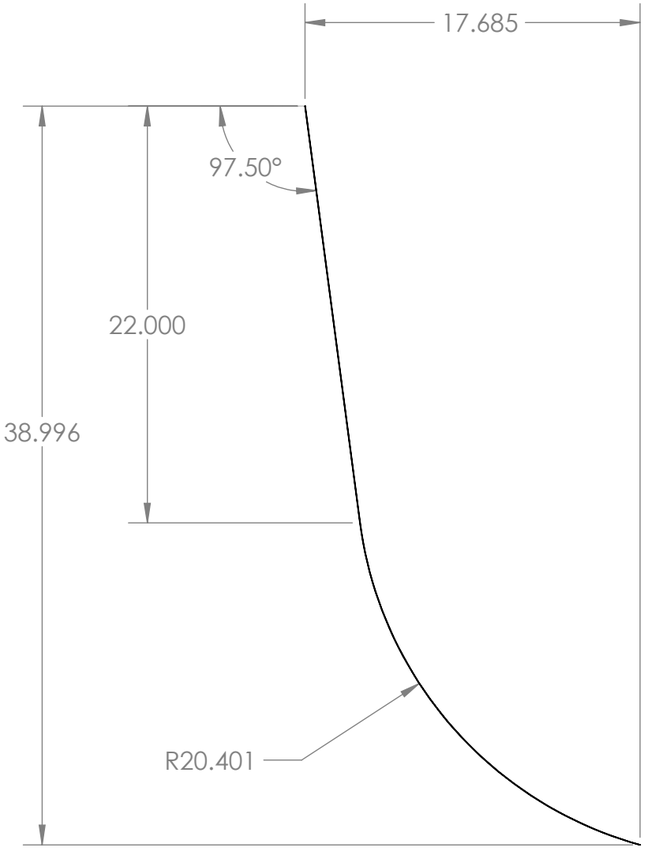
STOCK VENDOR INFO:	LOWE'S MODEL # GVL0108
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	CARELESS BRONCOS
	MATERIAL: Galvanized Steel
	TITLE/DESC: Ramp Top
	FILE NAME: ramp top
	DWG. #: P-036 REV #: A
	SCALE: 1:8 SIZE B SHEET 1 OF 2

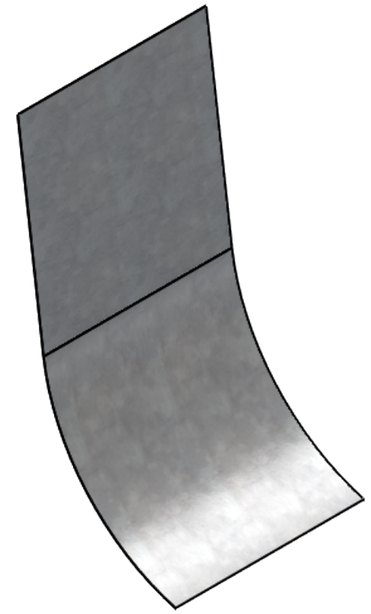
TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.13"
THREE PLACE DECIMAL	±0.125"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	24 IN. W x 3 FT. L Galvanized Steel Sheet Metal

1. USE HANDS TO BEND SHEET METAL UNTIL IT IS IN APPROXIMATE POSITION SHOWN.
2. LINE THE SHEET METAL UP TO THE TOP OF THE RAMP, THEN USE PHYSICAL FORCE TO BEND THE METAL UNTIL IT IS FLUSH WITH THE TOP SURFACE OF THE RAMP.





ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:12

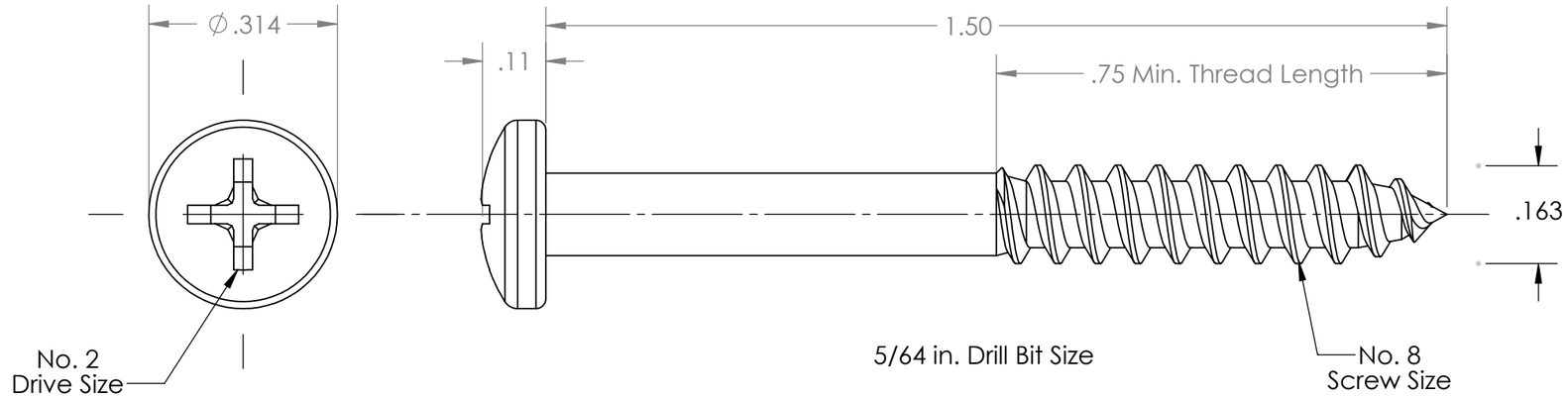
DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

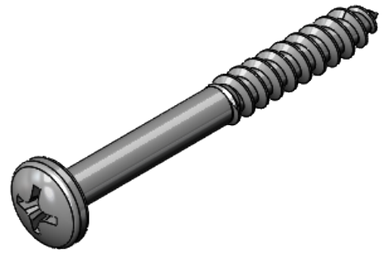
STOCK VENDOR INFO:	LOWE'S MODEL # GVL0108
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Galvanized Steel
ANGLES ARE IN DEGREES	TITLE/DESC: Ramp Top
3rd Angle Projection	FILE NAME: ramp top
	DWG. #: P-036 REV #: A
	SCALE: 1:8 SIZE B SHEET 2 OF 2

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.13"
THREE PLACE DECIMAL	±0.125"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Screw Rounded Head,No. 8 Size,1-1/2" Long
1. PURCHASE FROM MANUFACTURER	





ISOMETRIC VIEW

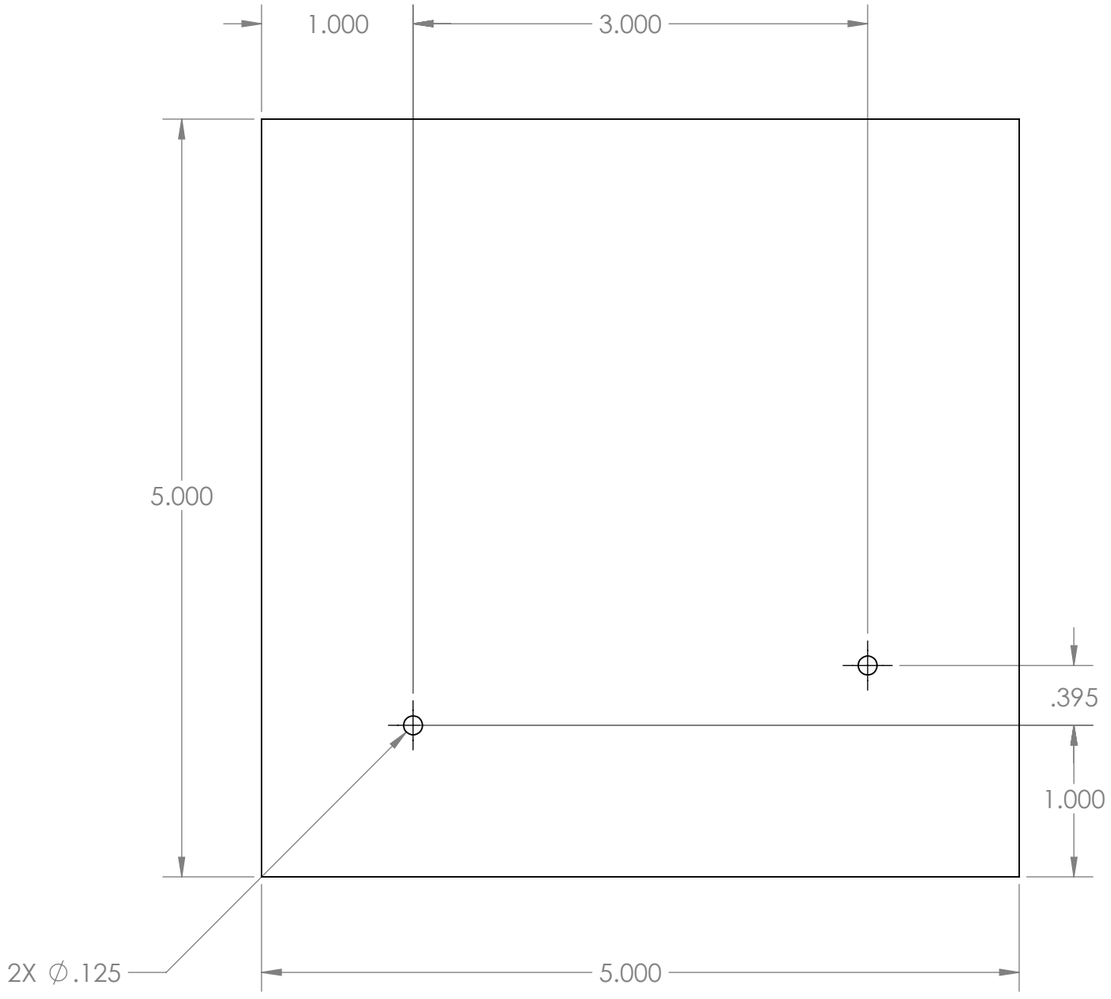
FOR REFERENCE ONLY
SCALE 2:1

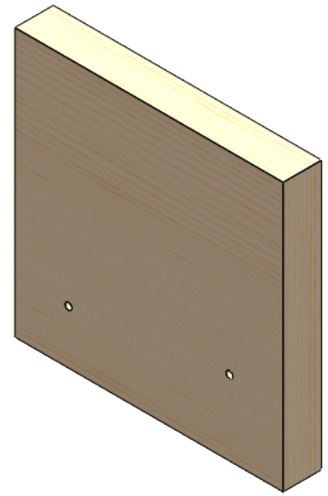
DRAWN BY	DATE
Andrew Weir	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	MCMASTER-CARR ITEM NO. 93360A255
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Stainless Steel
ANGLES ARE IN DEGREES	TITLE/DESC: Wood Screw No. 8 Size, 1-1/2" Long
3rd Angle Projection	FILE NAME: Smaller Wood Screw
TOLERANCES:	DWG. #: P-037 REV #: A
ANGULAR ± 1°	SCALE: 4:1 SIZE B SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	BC SANDED PINE PLYWOOD 23/32 IN. X 4 FT. X 8 FT.

1. USE CIRCULAR SAW TO CUT A BLOCK WITH APPROXIMATE HEIGHT AND WEIGHT SHOWN. WIDTH OF BLOCK WILL COME FROM PURCHASED PRODUCT.
2. USE A DRILL WITH 1/8 IN. BIT SIZE TO DRILL HOLES IN APPROPRIATE LOCATIONS. LOCATIONS SHOULD FALL WITHIN TOLERANCES.
3. USE SAND PAPER TO SAND EDGES OF BLOCK UNTIL ALL DIMENSIONS ARE WITHIN TOLERANCE.





ISOMETRIC VIEW

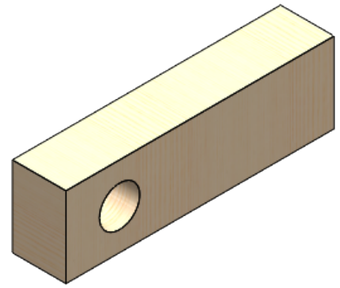
FOR REFERENCE ONLY
SCALE 1:2

DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

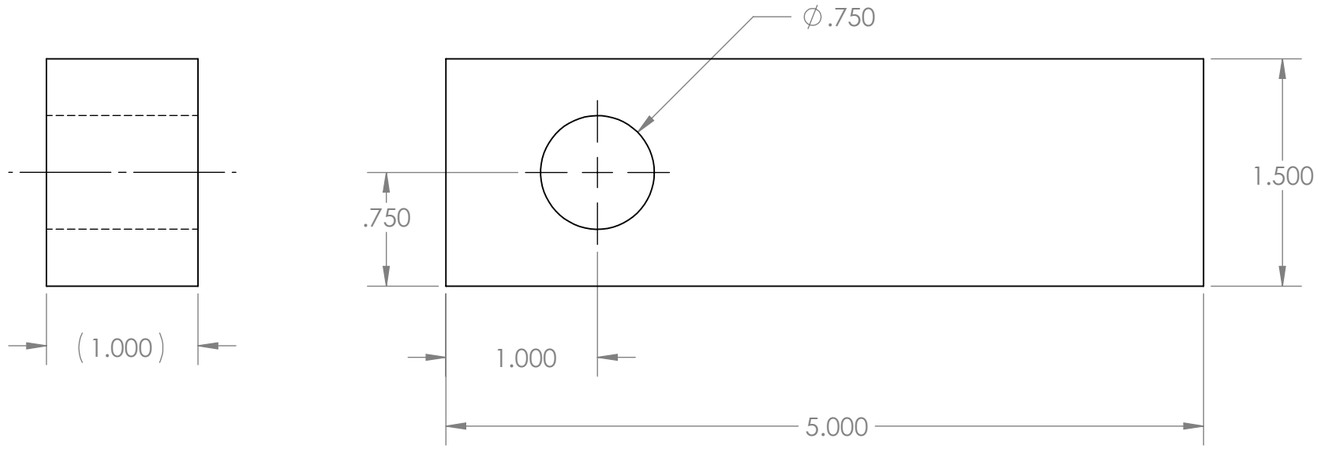
STOCK VENDOR INFO:	HOME DEPOT # 201428
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Pine
ANGLES ARE IN DEGREES	TITLE/DESC: Position Marker
3rd Angle Projection	FILE NAME: Position Marker
TOLERANCES:	DWG. #: P-038 REV #: A
ANGULAR ± 1°	SCALE: 1:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SELECT PINE BOARD 1in. X 6in. X 6ft.

1. USE A CIRCULAR SAW TO CUT A BLOCK WITH LENGTH AND HEIGHT APPROXIMATELY EQUAL TO DIMENSIONS GIVEN. THE WIDTH SHOULD CORRESPOND TO PURCHASED MATERIAL.
2. USE A DRILL WITH A BIT SIZE OF .75 IN TO CUT OUT A HOLE IN APPROXIMATE LOCATION GIVEN. THE LOCATION OF THE HOLE SHOULD FIT WITHIN TOLERANCES.
3. USE SAND PAPER TO SAND THE EDGES OF THE BLOCK AND HOLE UNTIL IT FITS WITHING GIVEN TOLERANCES.



ISOMETRIC VIEW
FOR REFERENCE ONLY
SCALE 1:2

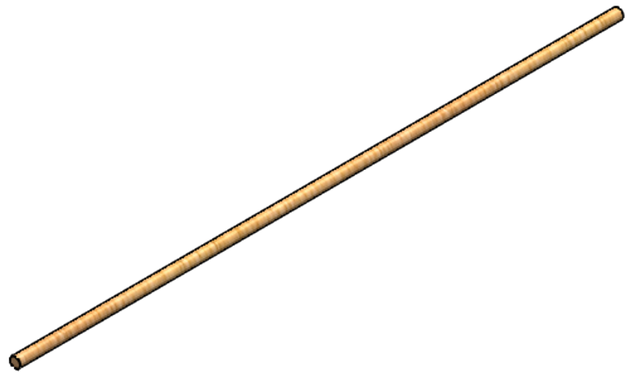


DRAWN BY	DATE
Andrew Weir	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	HOME DEPOT MODEL #928787
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: Pine
	TITLE/DESC: RELEASE LEVER
TOLERANCES:	FILE NAME: Release Lever
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.13" THREE PLACE DECIMAL ±0.125"	DWG. #: P-039 REV #: A
	SCALE: 1:1 SIZE **B** SHEET 1 OF 1

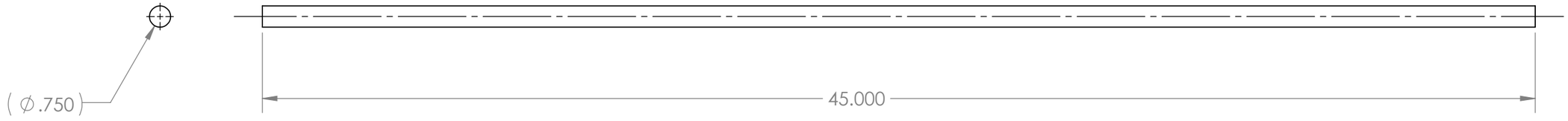
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	3/4 IN. X 36 IN. OAK ROUND DOWEL

1. USE A CIRCULAR SAW TO CUT A DOWEL WITH APPROXIMATE LOCATION SPECIFIED. THE DIAMETER OF THE DOWEL SHOULD CORRESPOND TO THAT OF PURCHASED MATERIAL.
2. USE SAND PAPER TO SAND THE BASE OF THE DOWEL UNTIL IT IS WITHIN GIVEN TOLERANCES.



ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:8

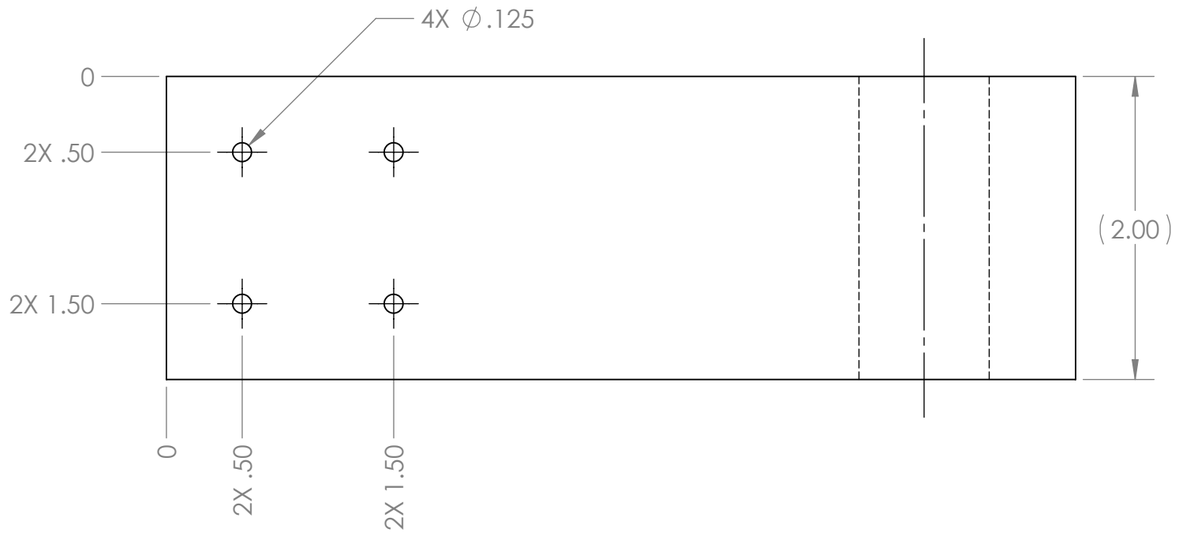


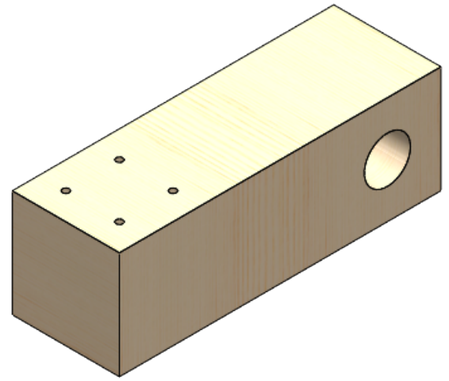
DRAWN BY	DATE
Joe Ragan	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	HOME DEPOT MODEL #HDDO3436
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Oak
ANGLES ARE IN DEGREES	TITLE/DESC: RELEASE DOWEL
3rd Angle Projection	FILE NAME: Release Dowel
TOLERANCES:	DWG. #: P-040 REV #: A
ANGULAR ± 1°	SCALE: 1:4 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

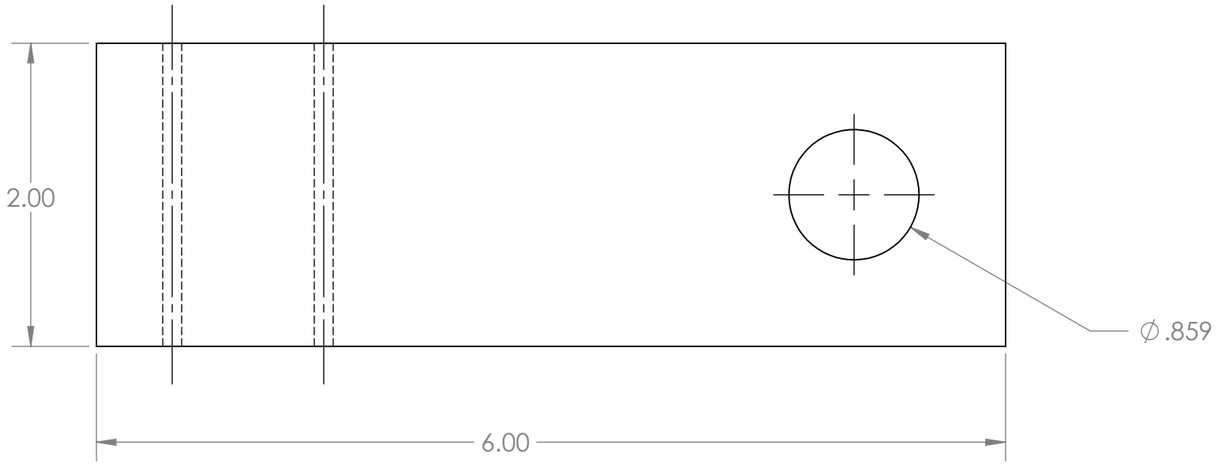
SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	2 IN. X 4 IN. X 16 FT. SPRUCE PINE FIR LUMBER

1. USE A CIRCULAR SAW TO CUT A WOOD BLOCK WITH HEIGHT AND LENGTH APPROXIMATELY EQUAL TO DIMENSIONS GIVEN.
2. USE A DRILL WITH A 1/8 IN. DRILL BIT TO DRILL THE SMALL PILOT HOLES. THE LOATION OF THE HOLES SHOULD FALL WITHIN TOLERANCES.
3. USE A DRILL WITH A 55/64 IN. DRILL BIT TO DRILL THE LARGER HOLE. THE LOCATION OF HOLE SHOULD CORRESPOND TO THE GIVEN DIMENSIONS WITHIN TOLERANCE.
4. SAND THE SIDES OF THE BLOCK UNTIL ALL DIMENSIONS ARE WITHIN TOLERANCE.





ISOMETRIC VIEW
FOR REFERENCE ONLY
SCALE 1:2

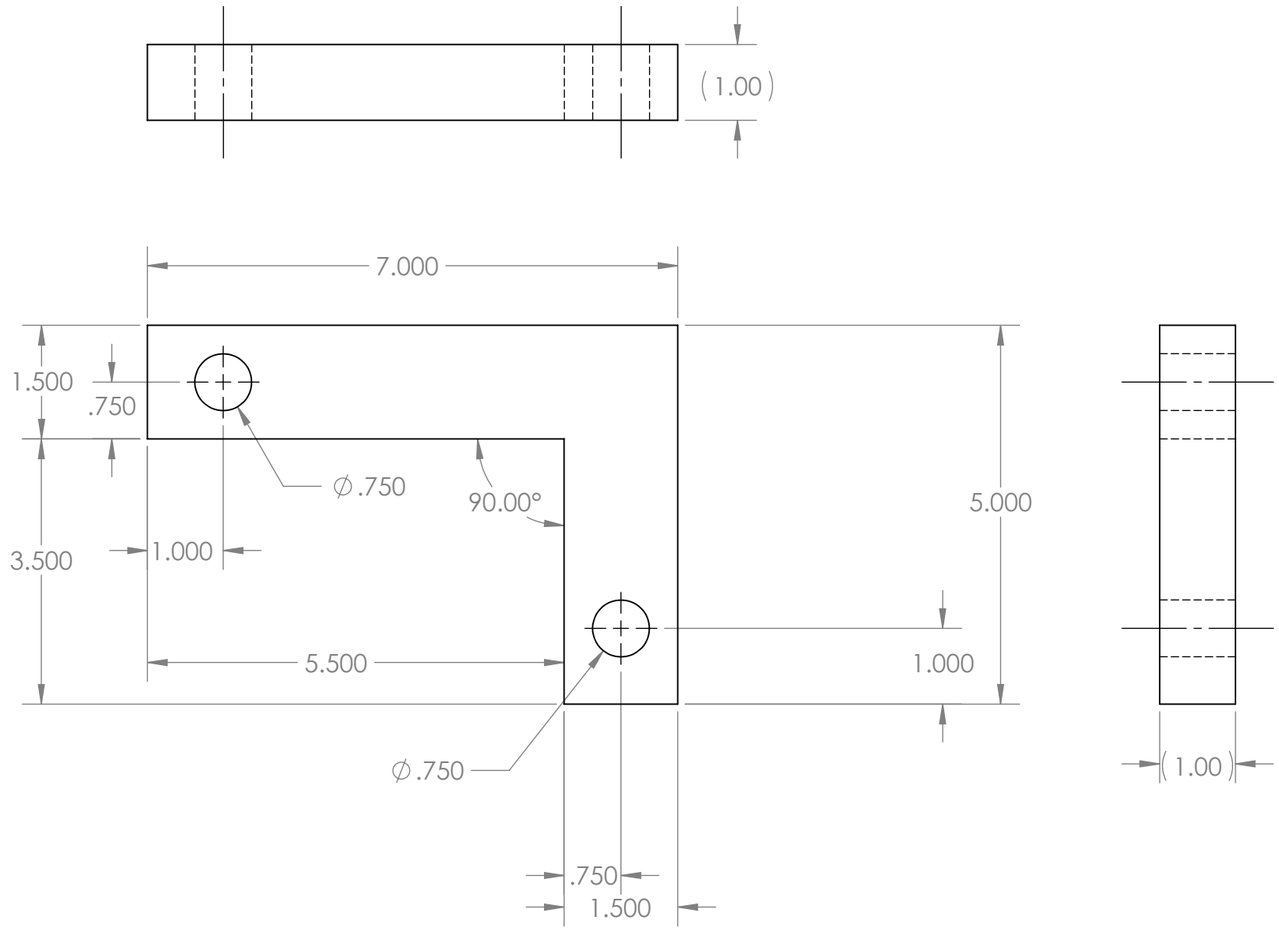


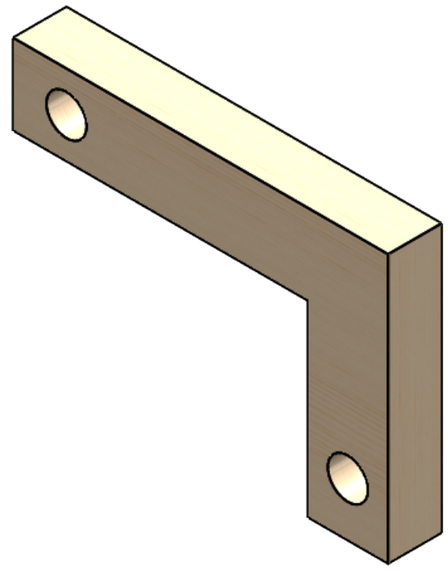
DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	HOME DEPOT MODEL # 0133166
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Pine
ANGLES ARE IN DEGREES	TITLE/DESC: RELEASE CONNECTING SUPPORT
3rd Angle Projection	FILE NAME: Release support
TOLERANCES:	DWG. #: P-041 REV #: A
ANGULAR ± 1°	SCALE: 1:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	SELECT PINE BOARD 1in. X 6in. X 6ft.

1. USE A CIRCULAR SAW TO CUT OUT A BOARD WITH LENGTH AND HEIGHT APPROXIMATELY EQUAL TO DIMENSIONS GIVEN.
2. USE A BAND SAW TO CUT OUT THE INNER RECTANGLE TO CREATE THE HOOK SHAPE. THE CUT SHOULD BE DONE TO APPROXIMATE DIMENSIONS GIVEN.
3. USE A DRILL WITH APPROXRIATE BIT SIZE TO CREATE HOLES IN THE LOCATIONS GIVEN. BIT SIZE OF .75 IN SHOULD CORRESPOND TO APPROXIMATE DIMENSION GIVEN. LOCATION OF HOLE SHOULD FALL WITHING GIVEN TOLERANCES.
4. USE SAND PAPER TO SAND THE EDGES OF THE CREATED PART UNTIL EACH DIMENSION IS WITHIN TOLERANCE.





ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:2

DRAWN BY	DATE
ANDREW WEIR	11/21/2019
APPROVALS:	
AU EMAIL	SINGNATURE

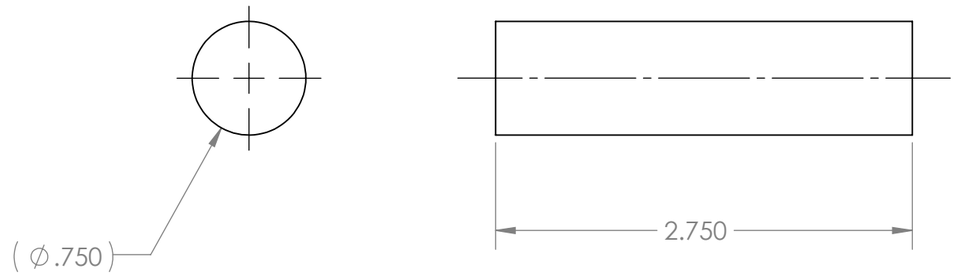
STOCK VENDOR INFO:	HOME DEPOT MODEL #928787
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES	MATERIAL: Pine
ANGLES ARE IN DEGREES	TITLE/DESC: RELEASE HOOK
3rd Angle Projection	FILE NAME: RELEASE HOOK
TOLERANCES:	DWG. #: P-042 REV #: C
ANGULAR ± 1°	SCALE: 1:2 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.13"	
THREE PLACE DECIMAL ±0.125"	

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	3/4 IN. X 36 IN. OAK ROUND DOWEL

1. USE A CIRCULA SAW TO CUT A DOWEL WITH APPROXIMATE LENGTH SHOWN. THE DIAMETER OF THE DOWEL SHOULD CORRESPOND TO THAT OF THE PURCHASED MATERIAL.
2. USE SAND PAPER TO SAND THE BASE OF THE DOWEL UNTIL THE LENGTH IS WITHIN THE GIVEN TOLERANCE.

ISOMETRIC VIEW

FOR REFERENCE ONLY
SCALE 1:2



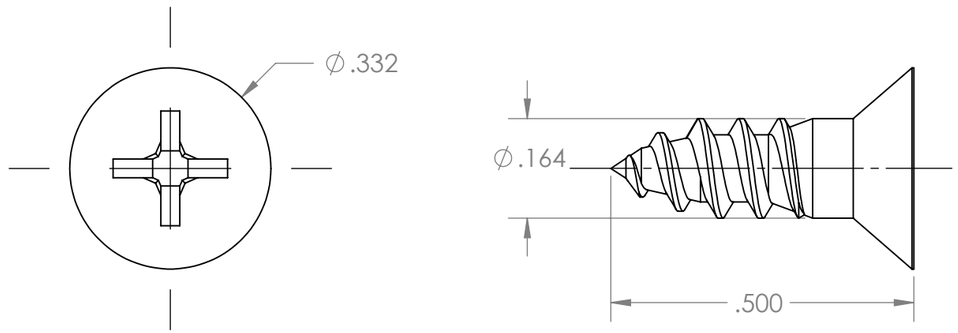
DRAWN BY	DATE
ANDREW WEIR	11/22/2019
APPROVALS:	
AU EMAIL	SINGNATURE

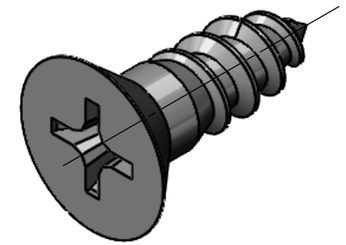
STOCK VENDOR INFO:	HOME DEPOT MODEL # HDDO3436		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	CARELESS BRONCOS		
	MATERIAL:	Oak	
	TITLE/DESC:	HOOK DOWEL	
	FILE NAME:	Hook Dowel	
	DWG. #: P-043	REV #: A	
	SCALE: 1:1	SIZE B	SHEET 1 OF 1

TOLERANCES:

ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.13"
THREE PLACE DECIMAL	±0.125"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Phillips Flat Head Screw Number 8 Size, 1/2" Long
1. Bought Part	

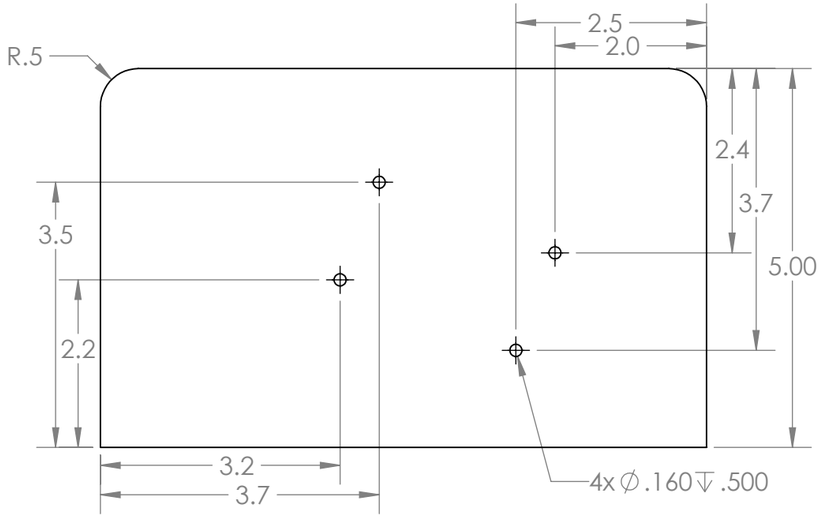


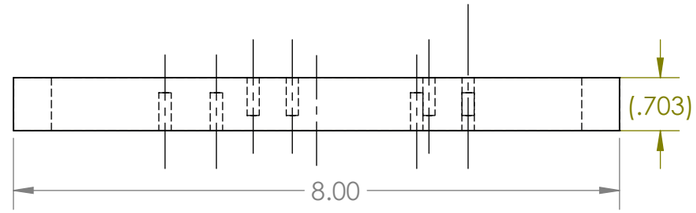


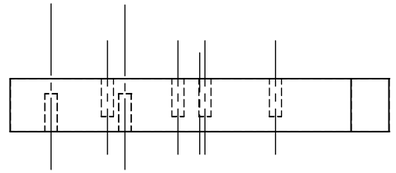
DRAWN BY	DATE
Joe Ragan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

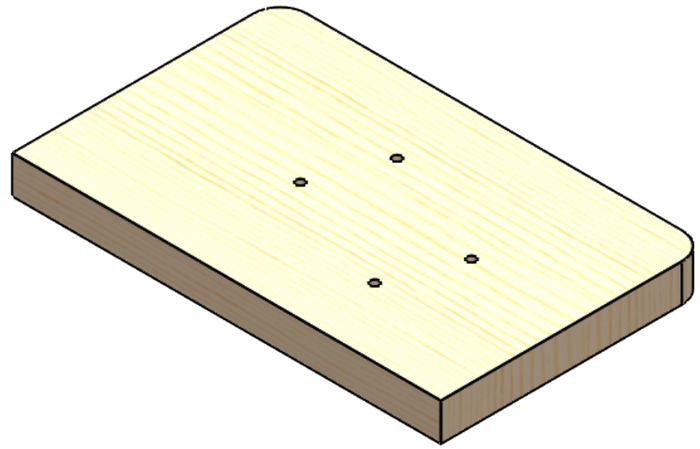
STOCK VENDOR INFO:	McMaster Carr 90031A194
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: Zinc-Plated Steel
ANGLES ARE IN DEGREES	TITLE/DESC: Sight Screw
3rd Angle Projection	FILE NAME: sightscrew
TOLERANCES:	DWG. #: P-0044 REV #: A
ANGULAR ± 1°	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

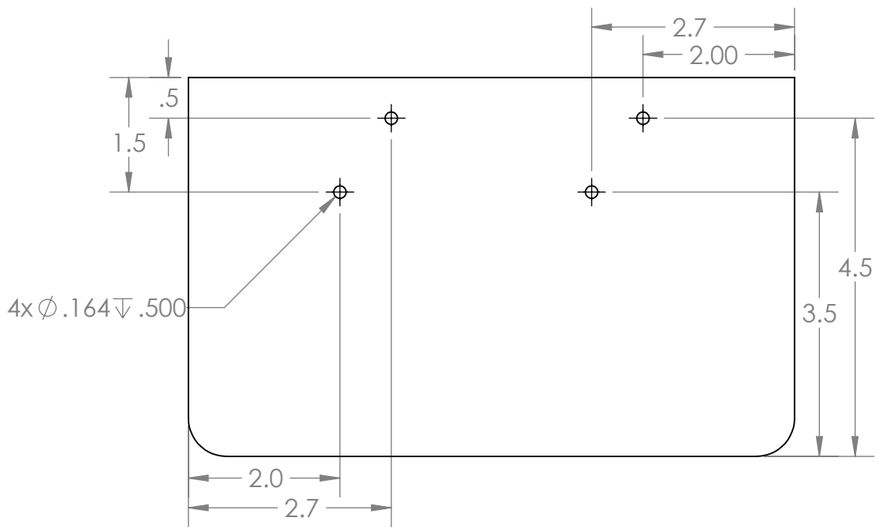
B











A

SAMPLE FABRICATION/ASSEMBLY PROCESS

STOCK DESC/DIMS	Sanded Pine Plywood 23/32in.x 2 ft.x4 ft.

1. USE TABLE SAW TO CUT RECTANGLE WITH DIMENSIONS SPECIFIED IN DRAWING
2. USE BAND SAW TO ACQUIRE BASIC CURVATURE ON EDGES
3. SAND SURFACE AND EDGES DOWN TO SIZES SHOWN AND WITHIN TOLERANCES GIVEN
4. USE DRILL PRESS TO CREATE HOLES WITH SHOWN DIMENSIONS AND WITHIN GIVEN TOLERANCES

DRAWN BY	DATE
David Chandler	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

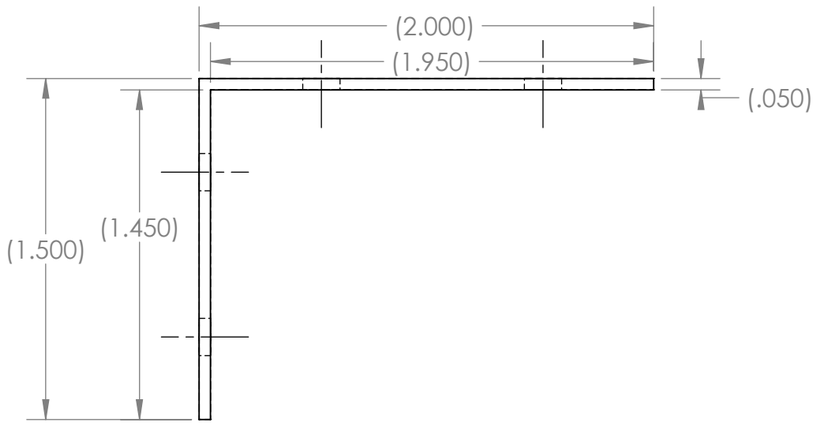
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ANGLES ARE IN DEGREES
3rd Angle Projection

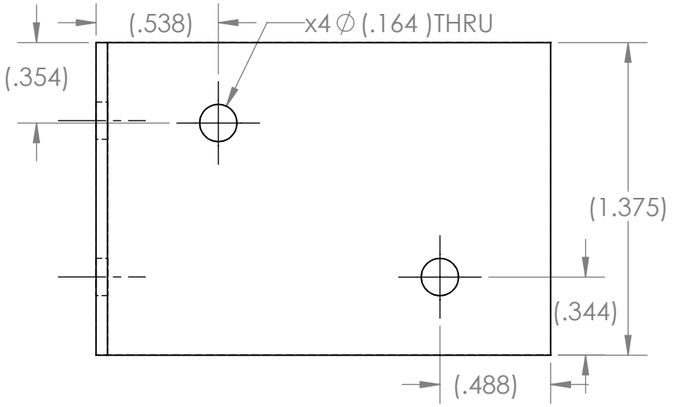
TOLERANCES:

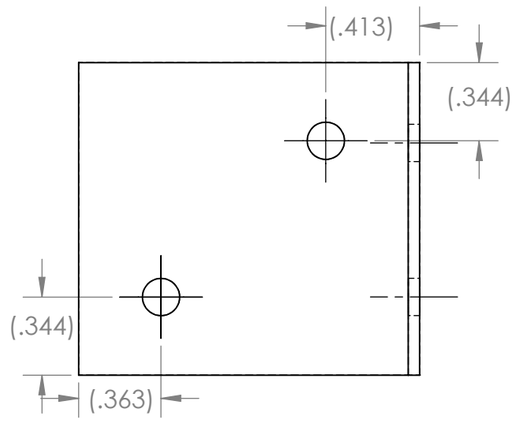
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.13"
THREE PLACE DECIMAL	±0.125"

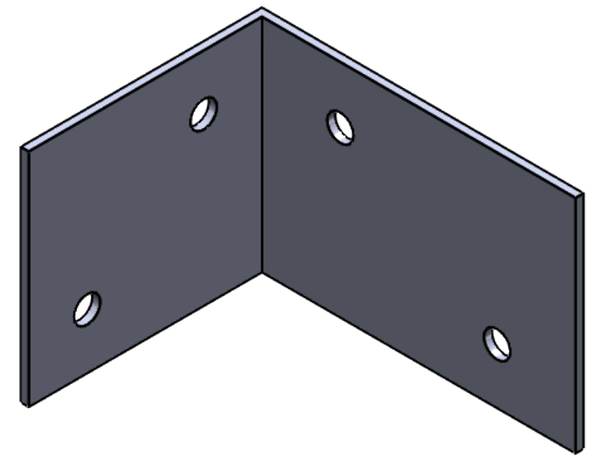
STOCK VENDOR INFO:	Home Depot Model # 1502108
	Team Careless Broncos
MATERIAL:	Pine
TITLE/DESC:	Sight Rest
FILE NAME:	RampSightdwg
DWG. #: P-0045	REV #: D
SCALE: 1:2	SIZE B / SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	ZMAX 18-Gauge Galvanized Steel Angle
1. Bought Part	





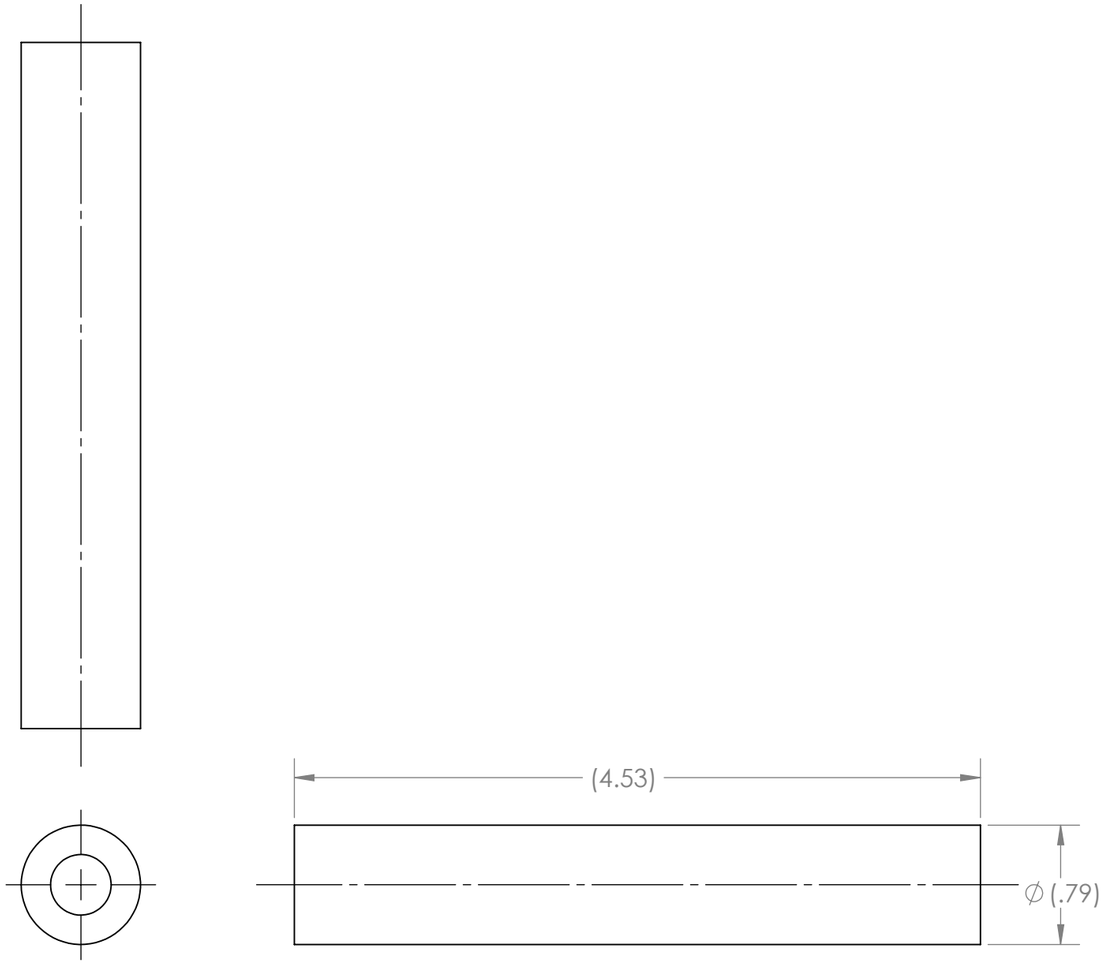


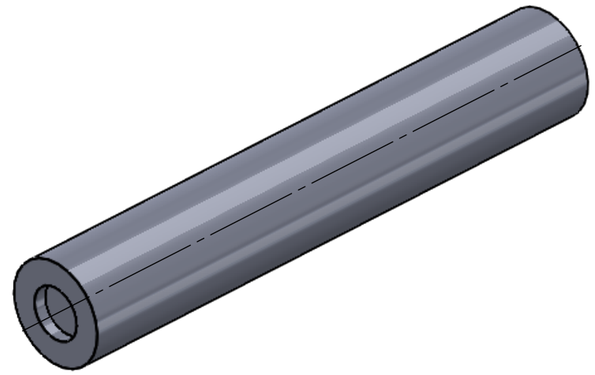


DRAWN BY	DATE
Joe Ragan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Home Depot Model # A21Z
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	
ANGLES ARE IN DEGREES	MATERIAL: G185 Galvanized Steel
3rd Angle Projection	TITLE/DESC: Srew Angle
TOLERANCES:	
ANGULAR ± 1°	FILE NAME: screwangle
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	DWG. #: P-0046 REV #: A
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	SCALE: 2:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Green Laser Pointer JD-851
1. Bought Part	





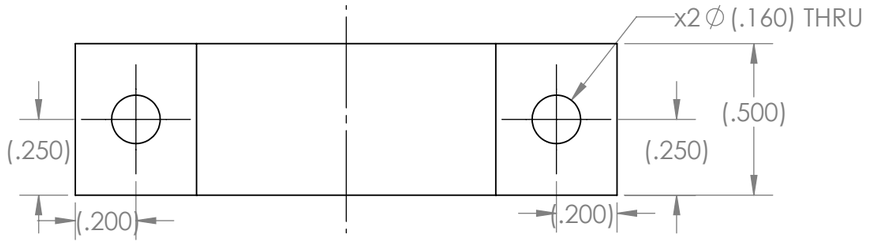
DRAWN BY	DATE
Joe Ragan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

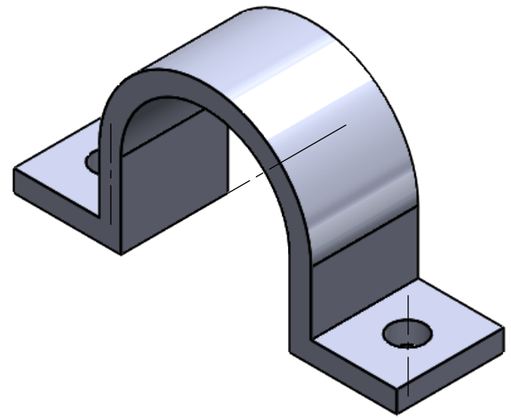
STOCK VENDOR INFO:	Walmart JD-851
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: Aerometal
ANGLES ARE IN DEGREES	TITLE/DESC: Sight Laser
3rd Angle Projection	FILE NAME: laserpointereal
DWG. #: P-0047	REV #: A
SCALE: 1:1	SIZE B / SHEET 1 OF 1

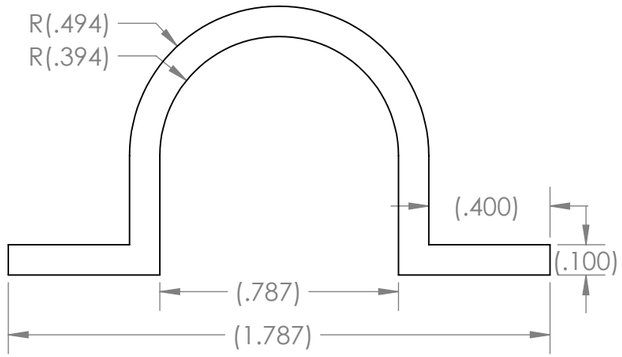
TOLERANCES:

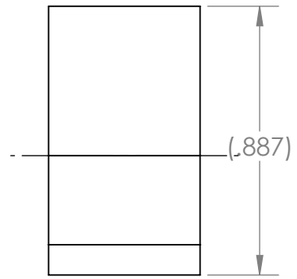
ANGULAR	± 1°
FRACTIONAL	±1/8"
ONE PLACE DECIMAL	±0.1"
TWO PLACE DECIMAL	±0.05"
THREE PLACE DECIMAL	±0.005"

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	1/2 in. PVC Conduit Clamp
1. Bought Part	









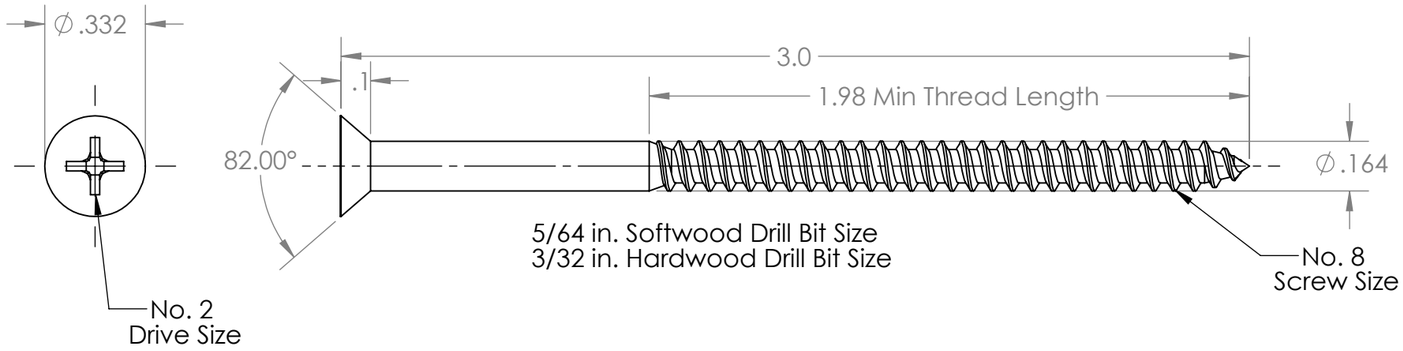
DRAWN BY	DATE
Joe Ragan	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Home Depot Model # E977DC-CTN		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	Careless Broncos		
	MATERIAL: PVC		
	TITLE/DESC: Conduit Clamp		
TOLERANCES: ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	FILE NAME: LaserStrap		
	DWG. #: P-0048	REV #: A	
	SCALE: 4:1	SIZE B	SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Phillips Flat Head Screws No. 8 Size, 3" Long
1.	PURCHASED FROM MANUFACTURER

ISOMETRIC VIEW

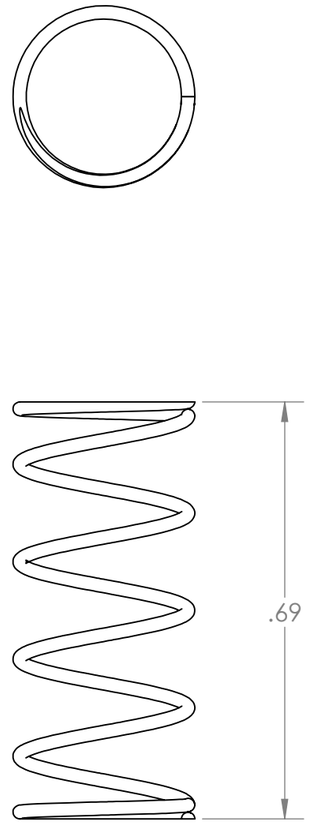
FOR REFERNECE ONLY
SCALE 1:1



DRAWN BY	DATE
Andrew Weir	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Homedepot PTN3S1
UNLESS OTHERWISE SPECIFIED:	CARELESS BRONCOS
DIMENSIONS ARE IN INCHES ANGLES ARE IN DEGREES 3rd Angle Projection	MATERIAL: ZINC-PLATED STEEL
	TITLE/DESC: Wood Screw Number 8 Size, 3" Long
TOLERANCES:	FILE NAME: Biggest Wood Screw
ANGULAR ± 1° FRACTIONAL ±1/8" ONE PLACE DECIMAL ±0.1" TWO PLACE DECIMAL ±0.05" THREE PLACE DECIMAL ±0.005"	DWG. #: P-049 REV #: A
	SCALE: 2:1 SIZE **B** SHEET 1 OF 1

SAMPLE FABRICATION/ASSEMBLY PROCESS	
STOCK DESC/DIMS	Compression Spring Break
1.	Purchased manufactued Item



DRAWN BY	DATE
Felix Lasch	12/5/2019
APPROVALS:	
AU EMAIL	SINGNATURE

STOCK VENDOR INFO:	Centuryspring NN-24
UNLESS OTHERWISE SPECIFIED:	Careless Broncos
DIMENSIONS ARE IN INCHES	MATERIAL: Spring Steel - SPR
ANGLES ARE IN DEGREES	TITLE/DESC: Compression Spring Break
3rd Angle Projection	FILE NAME: Compression Spring Break
TOLERANCES:	DWG. #: P-050 REV #: A
ANGULAR ± 1°	SCALE: 4:1 SIZE **B** SHEET 1 OF 1
FRACTIONAL ±1/8"	
ONE PLACE DECIMAL ±0.1"	
TWO PLACE DECIMAL ±0.05"	
THREE PLACE DECIMAL ±0.005"	

Purchase List-

List Number	Description	Serial Number	Quantity	Unit Cost	Cost	Vendor	
1	1/2"x1" Aluminum Flat bar, 6061 Plate, 12" length	89755K11	1	$ 8.90	$ 8.90	McMaster Carr($24.39), bought on ebay	
2	Low-Carbon Steel Rod, 1" Diameter	8920K231	1	$ 12.81	$ 12.81	McMaster Carr	
3	High-Strength Steel Threaded Rod, 1/4"-28 Thread Size, 1" Long	90322A660	4	$ 3.76	$ 15.04	McMaster Carr	
4	Easy-to-Form 1075 Spring Steel Sheet, 8" x 12" x 0.0350"	9071K73	1	$ 18.50	$ 18.50	McMaster Carr	
5	Polypropylene Wheel with Roller Bearing, 4" Diameter x 1-1/2" Wide, for 1/2" Axle	2781T585	4	$ 9.03	$ 36.12	McMaster Carr	
6	Brass Wing Nut, 1/4"-28 Thread Size	92771A529	1	$ 6.06	$ 6.06	McMaster Carr	
7	18-8 Stainless Steel Button Head Hex Drive Screw, 1/4"-20 Thread Size, 3/4" Long	92949A540		$ 7.39	$ -	McMaster Carr	
8	18-8 Stainless Steel Thin Hex Nut, 1/4"-28 Thread Size 100 pack	91847A429	1	$ 4.84	$ 4.84	McMaster Carr	
9	18-8 Stainless Steel Button Head Hex Drive Screw, 1-64 Thread Size, 1/4" Long 100 pack	92949A316	1	$ 7.34	$ 7.34	McMaster Carr	
10	316 Stainless Steel Washer for 1/4" Screw Size, 0.281" ID, 0.625" OD, 100 pack	90107A029	1	$ 8.25	$ 8.25	McMaster Carr	
11	Ball Bearing, Open, Trade Number 608, for 8 mm Shaft Diameter	5972K91	1	$ 4.70	$ 4.70	McMaster Carr	
12	1/4 in. x 48 in. Hardwood Round Dowel	203360194	1	$ 0.86	$ 0.86	Home Depot	
13	Low-Carbon Steel Rod, 1" Diameter, 1' Length	8920K231	1	$ 12.81	$ 12.81	McMaster Carr	
14	1004-1045 Carbon Steel Clevis Pin, 1/4" Diameter, 11/16" Usable Length, 25 pack	98306A158	1	$ 5.82	$ 5.82	McMaster Carr	
15	12 in. x 24 in. Leathergrain Aluminum Sheet in Silver	56030	1	$ 11.53	$ 11.53	HomeDepot	
16	New 0-1mm 0.001" Metric Outside Micrometer Carbide Tipped USA		1	$ 12.99	$ 12.99	Ebay	Ebay
17	Mil. Spec. Compression Springs, 0.5" Long, 0.36" OD, 0.276" ID, MS 24585-1257	2022N161	1	$ 17.32	$ 17.32	McMaster Carr	
18	15/32 in. x 4 ft. x 8 ft. 3-Ply RTD Sheathing	132411	1	$ 16.55	$ 16.55	Home Depot	
19	2 in. X 4 in. X 16 ft. Spruce-Pine-Fir Lumber	133166	1	$ 9.08	$ 9.08	Home Depot	
20	24 in. W X 3 ft. L Galvanized Steel Sheet Metal	GVL0108	1	$ 11.48	$ 11.48	Lowe's	
21	Screw Rounded Head, No 8, Size 1-1/2" Long	93360A255	1	$ 9.90	$ 9.90	McMaster Carr	
22	Gorilla Glue 9oz Heavy Duty Construction Adhesive	8010003	1	$ 7.97	$ 7.97	Home Depot	
23	Grip-Rite #8 x 3 in. Philips Bugle-Head Coarse Thread Sharp Point Polymer Coated Exterior Screw (1 lb. - Pack)	PTN351	1	$ 3.98	$ 3.98	McMaster Carr	
24	Select Pine Board 1 in. X 6 in. X 6 ft.	928787	1	$ 12.00	$ 12.00	Home Depot	
25	3/4 in. X 36 in. Oak Round Dowel	HDDO3436	1	$ 4.98	$ 4.98	Home Depot	
26	Gorilla 4 fl. oz Wood Glue	62020	1	$ 2.97	$ 2.97	Home Depot	
27	Phillips Flat Head Screws for Wood, Zinc-Plated Steel, Number 8 Size, 1/2" Long, 100 pack	90031A194	1	$ 4.82	$ 4.82	McMaster Carr	
28	Simpson Strong-Tie ZMAX 18-Gauge Galvanized Steel Angle	A21Z	2	$ 0.65	$ 1.30	Home Depot	
29	1/2 Pipe, PVC, Pipe or Conduit Strap, 2 mounting holes	54090345	2	0.37	$ 0.74	MSC	https://www.mscdirect.com/product/details/54090345
30	JD-851 5mW High Power 532nm Green Light Adjustable Starry Sky Star Cap Pointer Pen Flashlight	jd-851	1	$ 6.72	$ 6.72	Walmart	https://www.walmart.com/ip/JD-851-5mW-High-Power-532nm-Green-Light-Adjustable-Starry-Sky-Star-Cap-Pointer-Pen-Flashlight/780331241
31	Compression Springs	NN-24	1	$ 5.73	$ 5.73	Century spring	https://www.centuryspring.com/catalog/?page=product&cid=compression-regular&id=NN-24CS&cdskeys=NN-24
				Total =	$ 282.11		