MEAM 150

Fundamentals of Mechanical Prototyping

Introduction
Drawings
Tolerances

Introduction

OBJECTIVES

LEARN TO SAFELY USE STANDARD MANUFACTURING TOOLS

BAND SAW

HAND TOOLS

DRILL PRESS

LATHE

MILL

CNC

GAIN INTUITION FOR THE PROTOTYPING PROCESS

METROLOGY

DRAWINGS

MATERIAL SELECTION

FASTENERS

TOLERANCES

OPERATIONAL SEQUENCES

20 INDIVIDUAL PARTS = 1 BIG PROJECT

GRADING IS BASED UPON:

DIMENSIONS AND TOLERANCES

FINISH QUALITY

PUNCTUALITY

OTHER CONSIDERATIONS:

SHOP SAFETY

PARTICIPATION

HELPING OTHERS

The Shop

NEVER WORK ALONE

SAFETY GLASSES AND CLOSED-TOED SHOES MUST BE WORN AT ALL TIMES

NO JEWELRY, BAGGY CLOTHES, OR LOOSE LONG HAIR

UPON ARRIVAL, YOU NEED TO SIGN IN WITH THE ON-DUTY TA

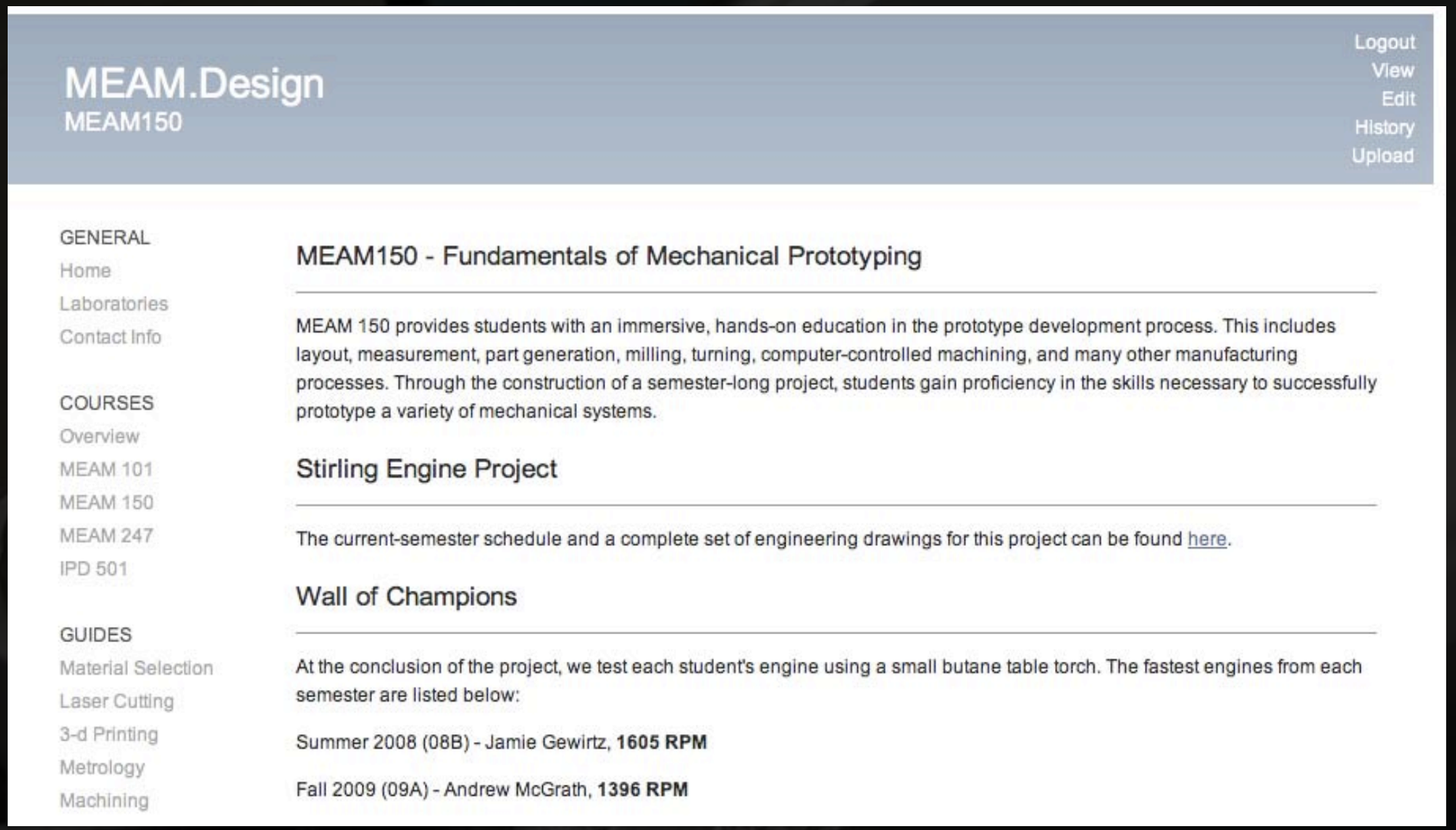
IF YOU ARE UNSURE ABOUT SOMETHING, ASK FOR HELP

IF SOMETHING (A TOOL, MACHINE, ETC.) BREAKS, LET US KNOW

YOU MUST CLEAN UP AFTER YOURSELF

BEFORE LEAVING, GET YOUR MACHINE(S) CHECKED OFF AND DO A “SHOP JOB”

The Wiki



http://alliance.seas.upenn.edu/~medesign/wiki

Drawings

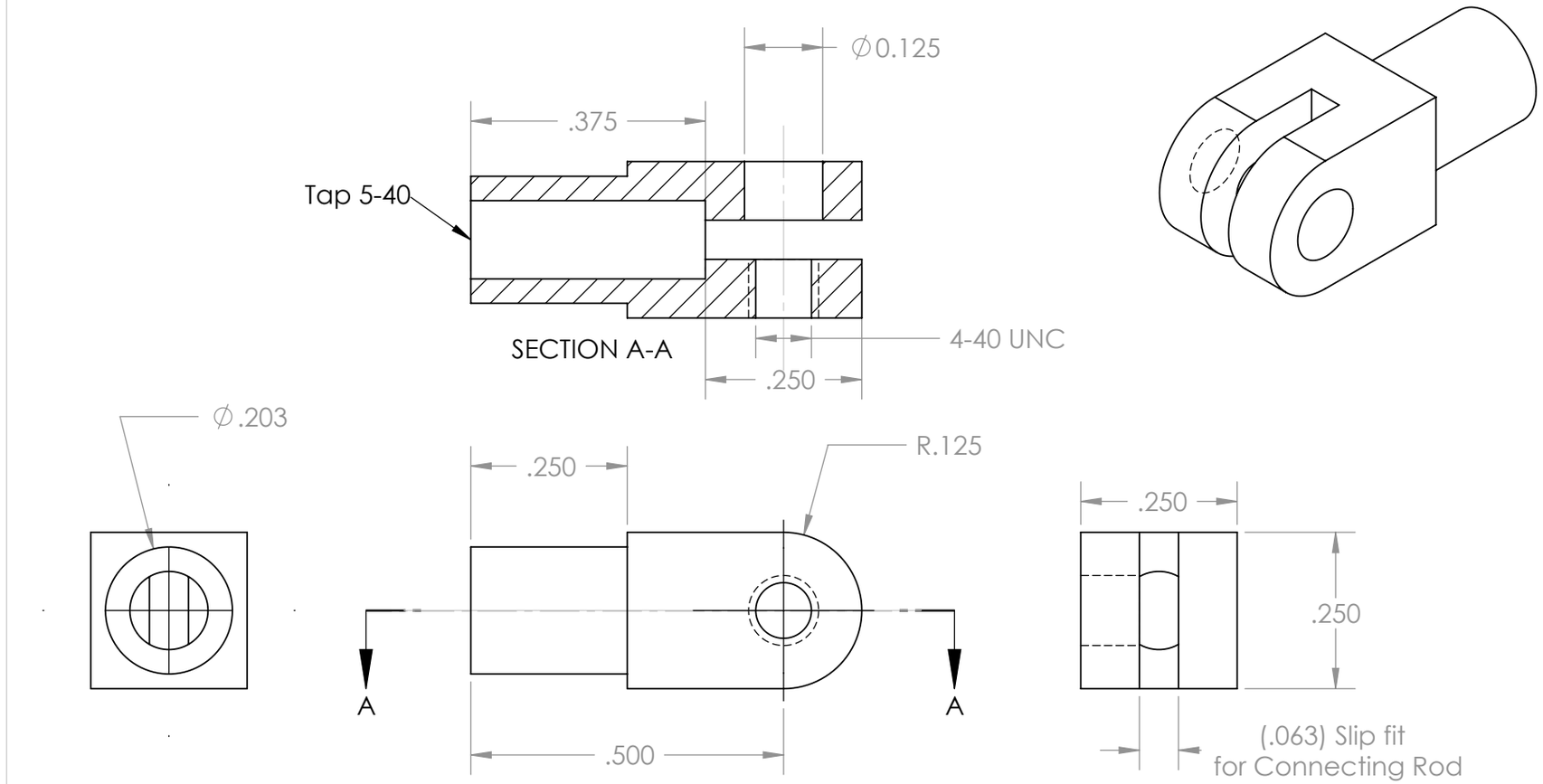
Fundamentals

Geometry
- show the shape of the object

Dimensions
- provide relative lengths of features

Tolerances
- give allowable variations for each of the dimensions

Notes
- scale, material, finish, post processing



		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: MACH ± 1 BEND ± TWO PLACE DECIMAL ±.01 THREE PLACE DECIMAL ±.005 FOUR PLACE DECIMAL ± .0005 FRACTIONAL ±1/64	DRAWN	AT	3/17
			REVISED	mk	5/23
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4" Sq C360 Brass	COMMENTS:		
NEXT ASSY	USED ON	FINISH Lathe/Mill			
APPLICATION		DO NOT SCALE DRAWING			

PROPRIETARY AND CONFIDENTIAL

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TITLE:

Displacer rod fork

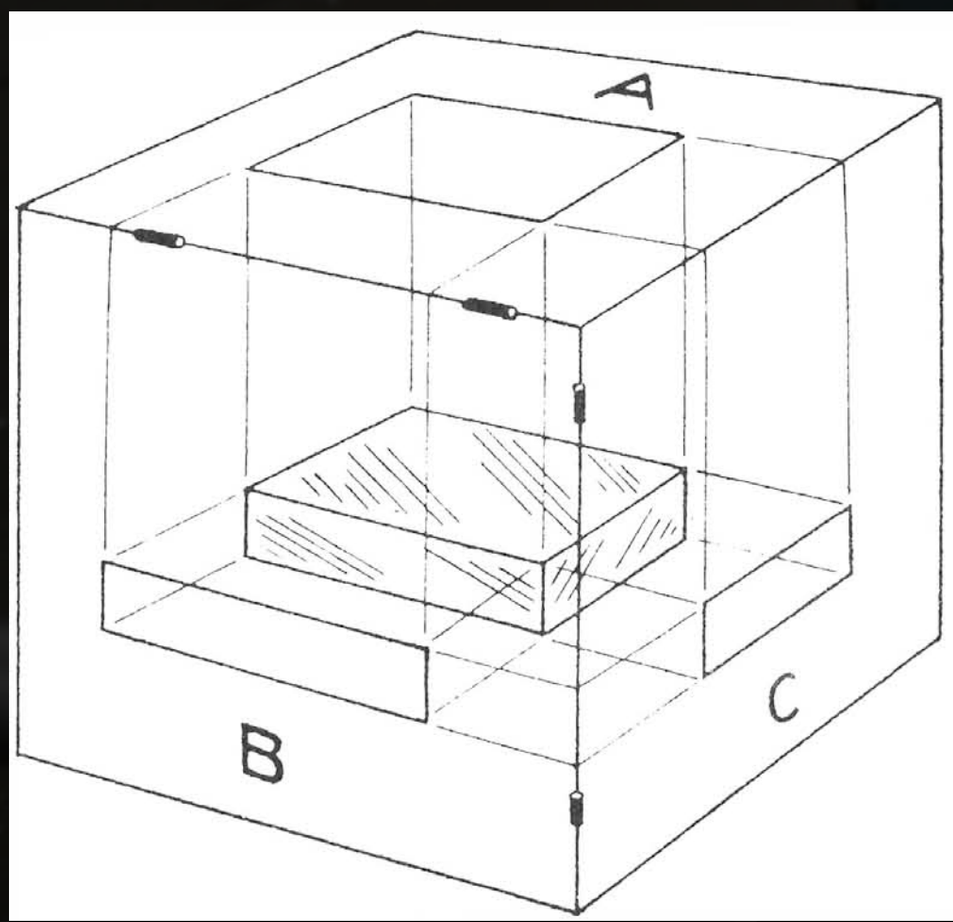
SIZE	DWG. NO.	REV
A	13	D

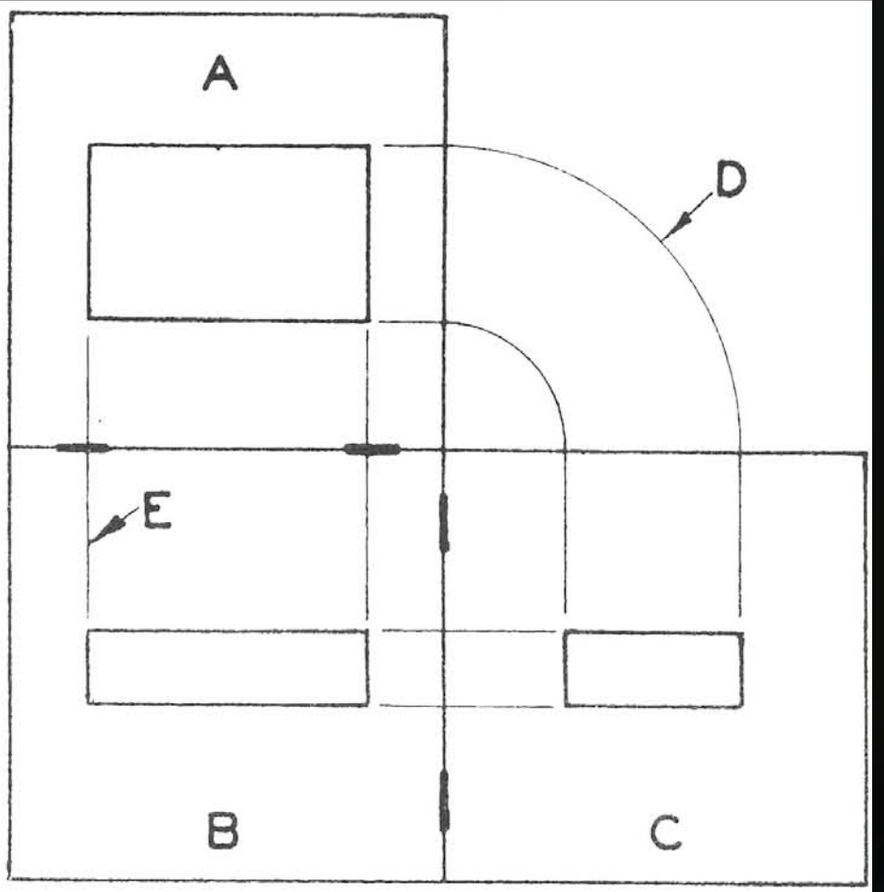
SCALE: 4:1 SHEET 1 OF 1

5 4 3 2 1

Geometry

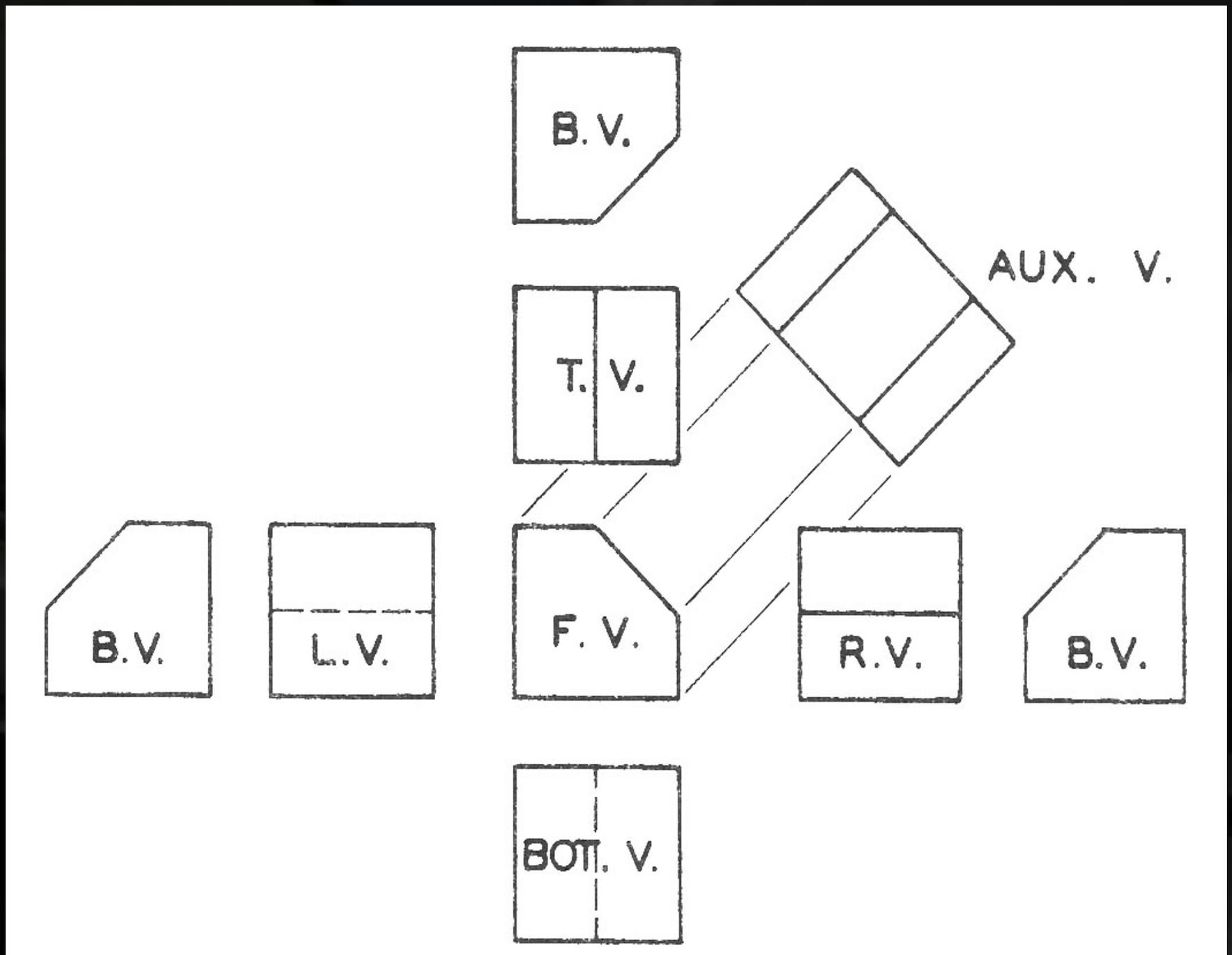
Show all relevant sides of the part





Standard Projections

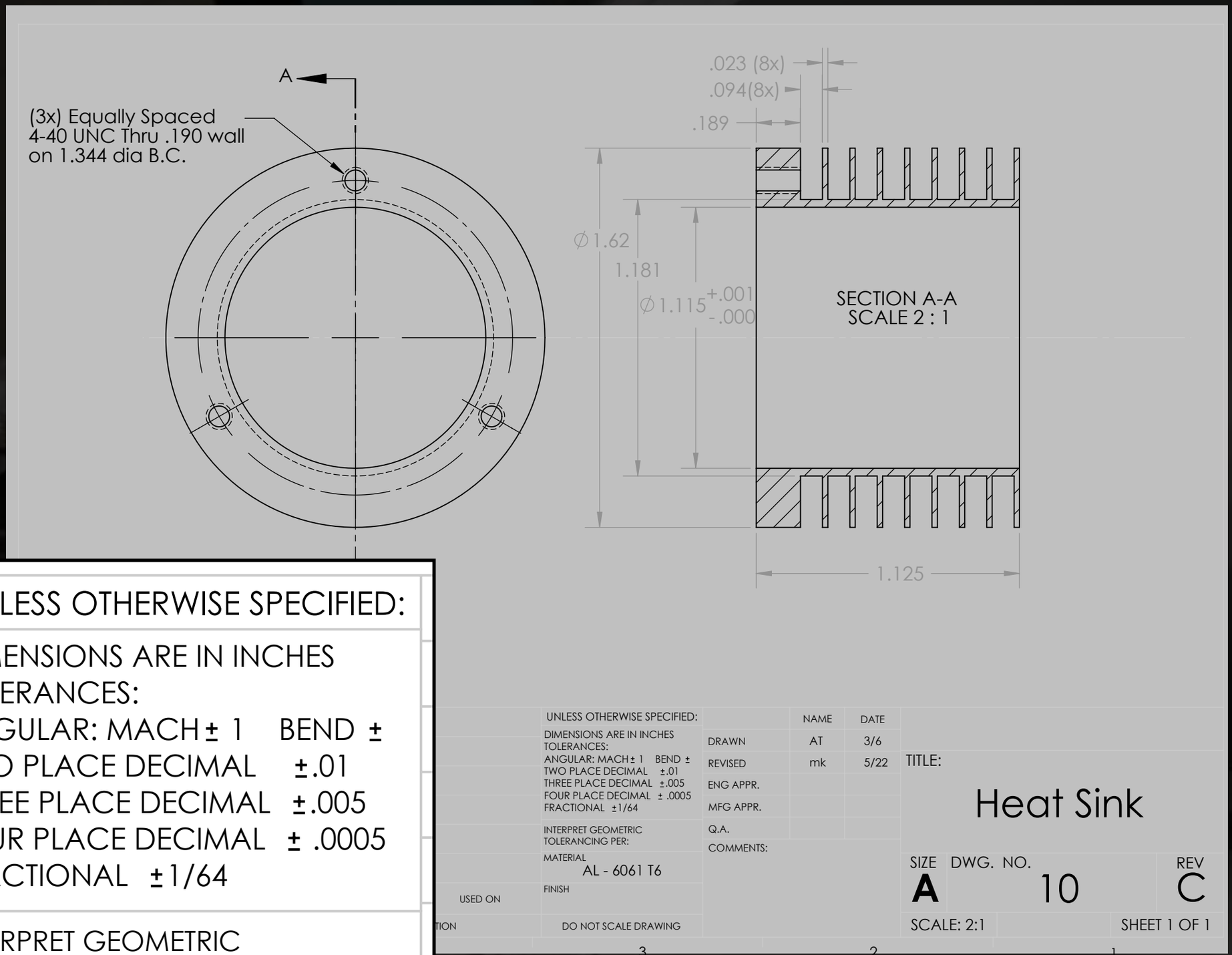
U.S. custom - "third angle projection"
(object rolling in a bowl)



Dimensions & Tolerances

Tolerances

Real parts are never exactly like the drawing...

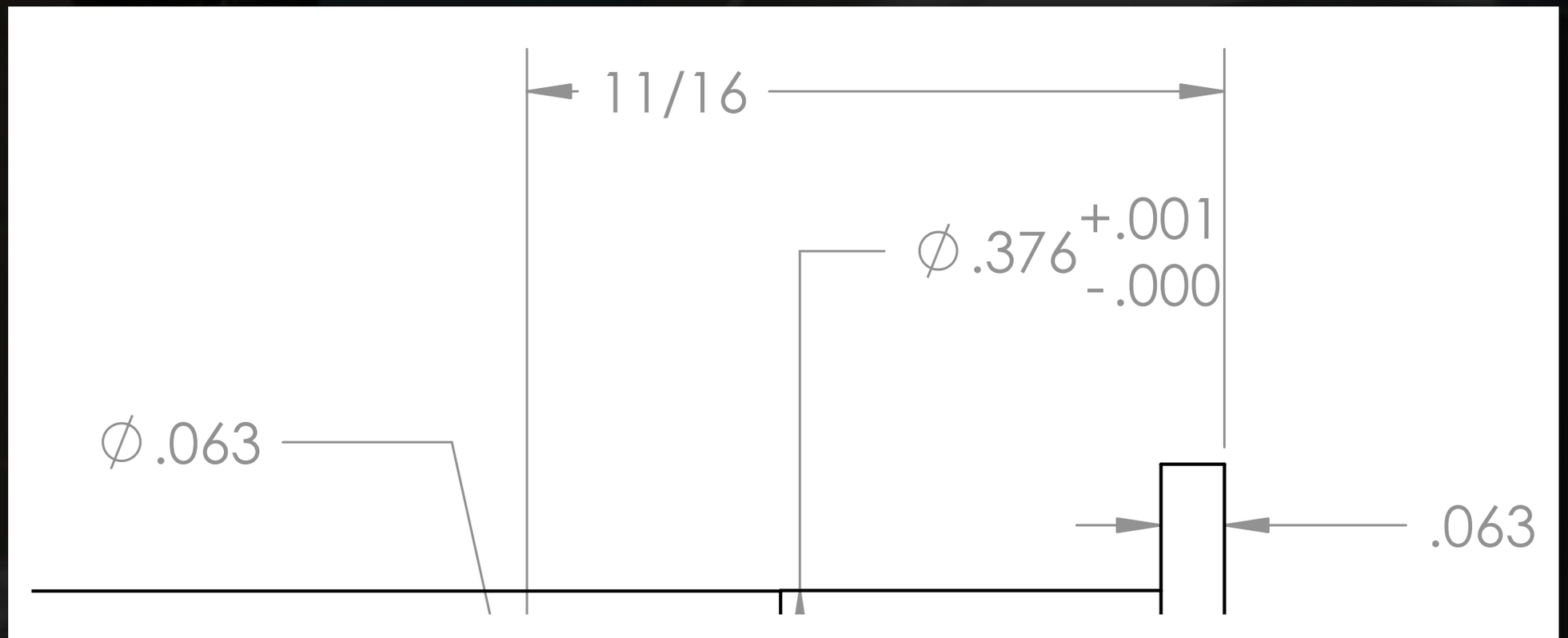


UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGULAR: MACH ± 1 BEND ±
TWO PLACE DECIMAL ±.01
THREE PLACE DECIMAL ±.005
FOUR PLACE DECIMAL ± .0005
FRACTIONAL ±1/64

INTERPRET GEOMETRIC TOLERANCING PER:

DIMENSIONS & TOLERANCES



UNLESS OTHERWISE SPECIFIED:

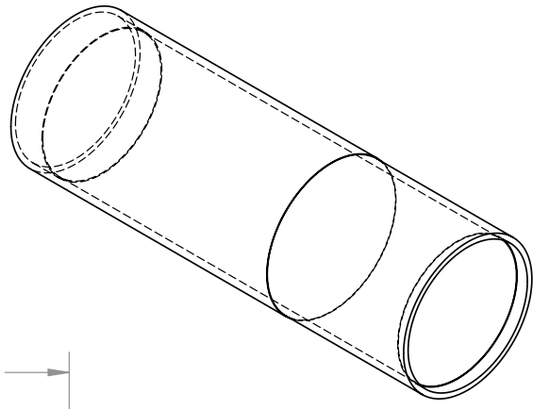
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ± .01
THREE PLACE DECIMAL ± .005
FOUR PLACE DECIMAL ± .0005

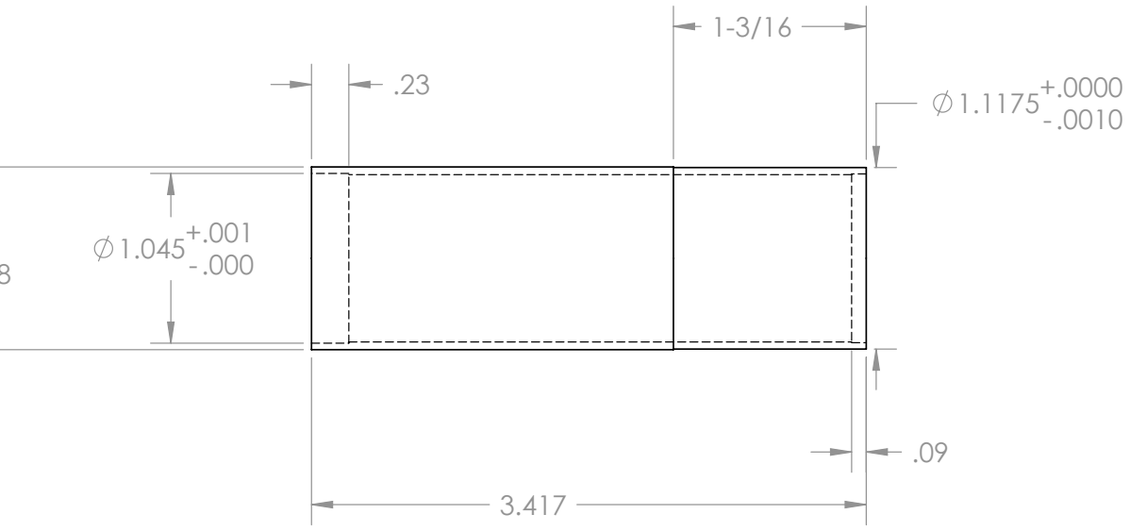
BILATERAL

$0.376^{+0.001}_{-0.000}$

UNILATERAL

0.376 +0.001





		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± 1/64 ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± .01 THREE PLACE DECIMAL ± .005 FOUR PLACE DECIMAL ± .0005	DRAWN	MK	2/24
			Revised	MK	5/22
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 304 Stainless Steel	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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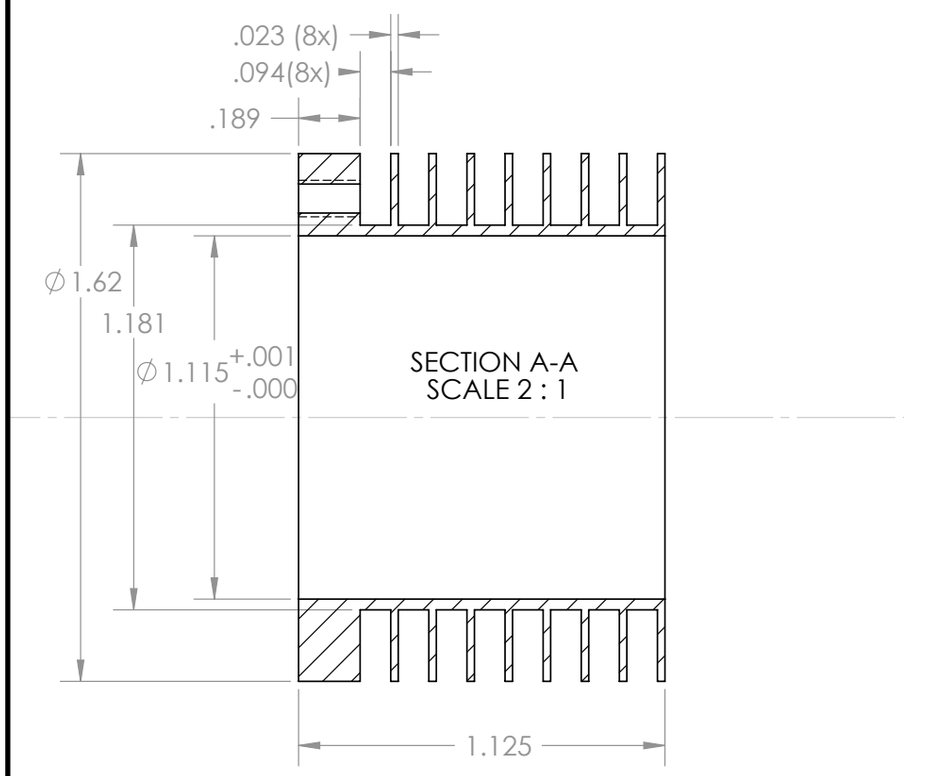
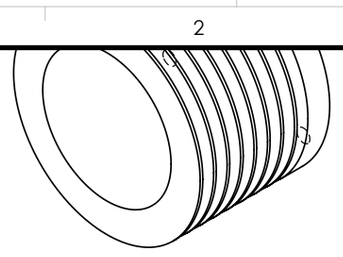
TITLE: **Air Chamber**

SIZE	DWG. NO.	REV
A	6	C
SCALE: 2:1	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1





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		DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: MACH ± 1 BEND ± TWO PLACE DECIMAL ±.01 THREE PLACE DECIMAL ±.005 FOUR PLACE DECIMAL ± .0005 FRACTIONAL ±1/64	DRAWN	AT	3/6
			REVISED	mk	5/22
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL AL - 6061 T6	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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TITLE: **Heat Sink**

SIZE	DWG. NO.	REV
A	10	C
SCALE: 2:1		SHEET 1 OF 1

5 4 3 2 1