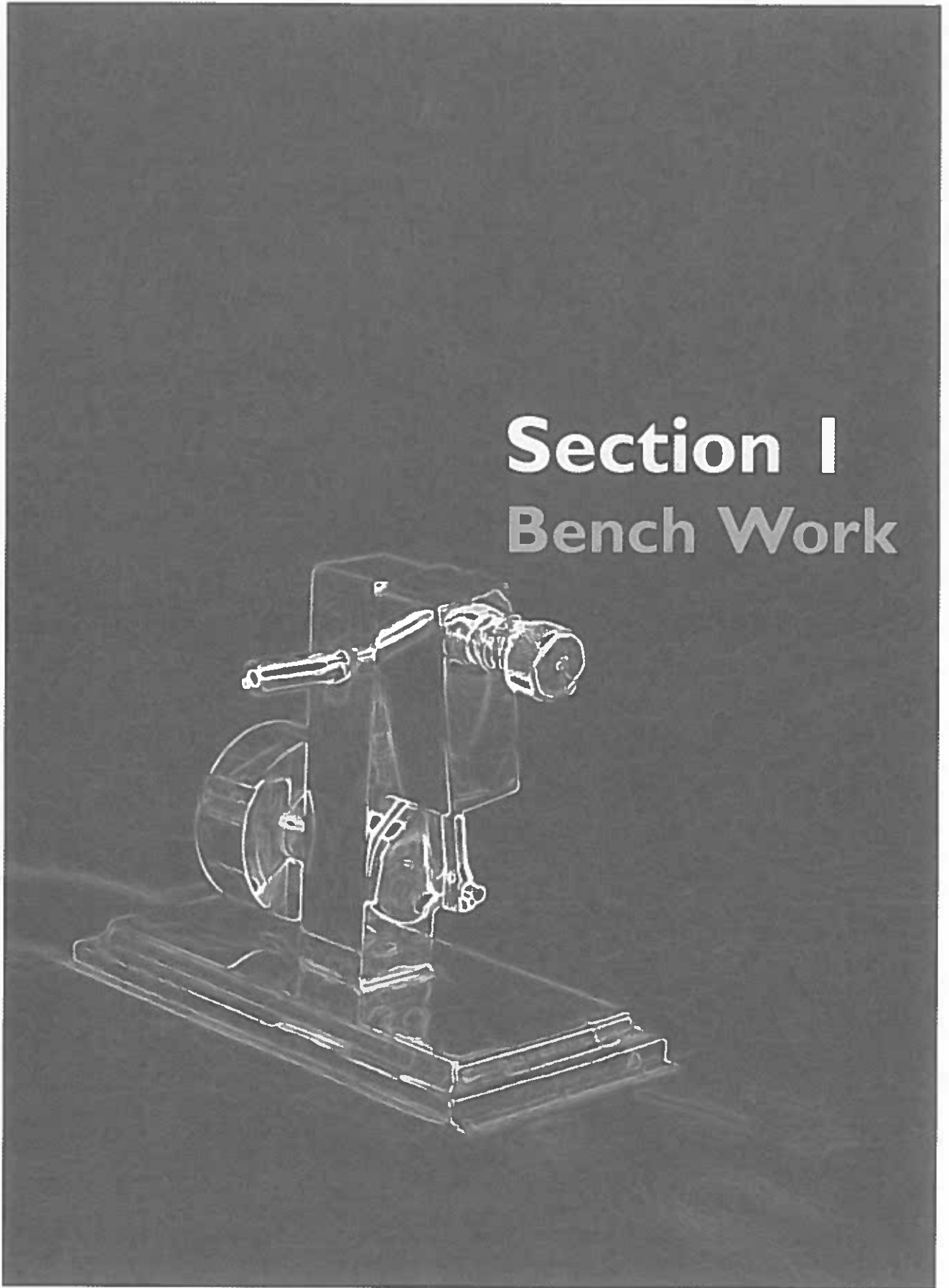


Section I

Bench Work



Project 4.18

Air Engine

Name _____ Date _____

Instructor _____ Period _____

Order of Operations

Base

- 1. Measure and cut stock plus facing allowance.
- 2. Check the alignment and trim of the vertical mill with a dial indicator.
- 3. Calculate the correct cutting speed and feed for the size and type end mill to be used and the size and type material to be cut.
- 4. Lock the workpiece in the mill vise, set with a deadblow hammer, and face to the specified dimension.
- 5. Mount a 1/2" diameter end mill in the spindle and cut the 1/4" radius on all four edges.
- 6. Locate the center of the base and drill, countersink, and ream the 3/8" hole.
- 7. Deburr all edges.

Engine Block

- 1. Measure and cut stock plus facing allowance.
- 2. Face workpiece to the specified length in vertical mill.
- 3. Locate and drill the .375" diameter hole.
- 4. Locate, drill, and tap the 3/8-24UNF hole .750" deep.
- 5. Locate and drill the .156" diameter hole .375" deep.
- 6. Locate and drill the .156" diameter through hole.
- 7. Rotate the workpiece 90° in the vise, then locate, drill, and tap the 5/16-18UNC hole .375" deep.
- 8. Place the workpiece in the mill vise in a vertical position. Use a precision square to aid in positioning and be sure the bottom of the block is up.
- 9. Locate, drill, and tap the 3/8-16UNC hole .625" deep.

Crankshaft

- 1. Measure and cut stock plus facing allowance.
- 2. Face to the specified length.
- 3. Turn down one end to .368" diameter × 2.081" length.
- 4. Place workpiece in a 4-jaw chuck, offset it .500", and cut to .180" diameter for the length indicated.
- 5. Deburr all edges.

Flywheel

- 1. Measure and cut stock plus facing allowance.
- 2. Face to the specified length.
- 3. Turn one end to .870" diameter \times .353" long.
- 4. Drill through using a U drill.
- 5. Place in mill, then locate, drill, and tap the 1/4-20 hole.
- 6. Deburr all edges.

Piston

- 1. Measure and cut stock plus facing allowance.
- 2. Face to length.
- 3. Turn to the dimensions shown.
- 4. Drill #14 drill through as indicated.
- 5. Deburr all edges.

Cylinder Block

- 1. Measure and cut stock plus facing allowance.
- 2. Face to length in vertical mill.
- 3. Drill with V drill through where shown.
- 4. Drill with #19 drill through as indicated.
- 5. Drill 19/32" and then ream 5/8" in end as pictured.
- 6. Deburr all edges.

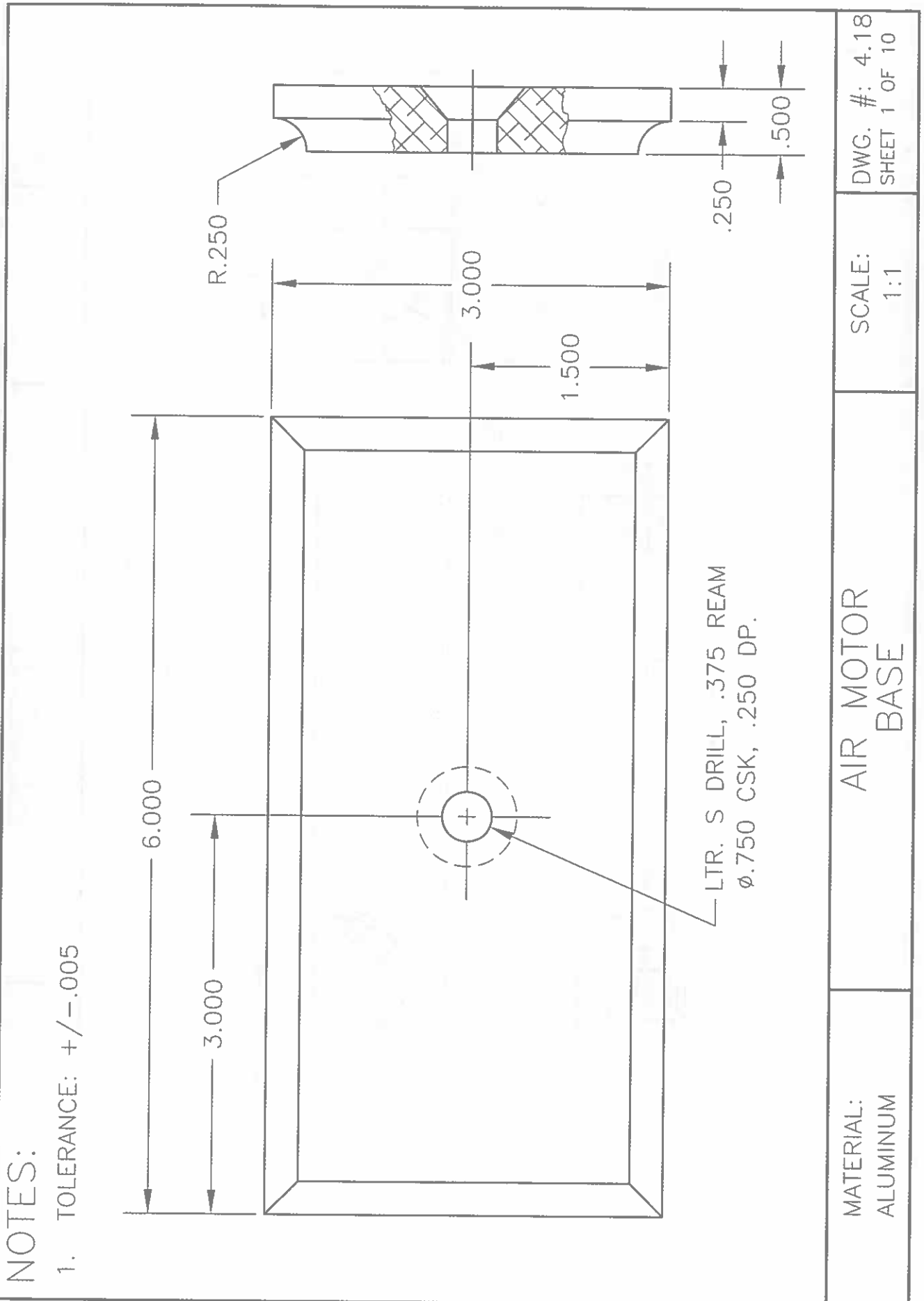
Spring

Note A simple mandrel must be made to facilitate the fabrication of the air motor spring. Cut a piece of 5/16" diameter cold rolled steel 5" long. Face one end and center drill with a #2 center drill. Approximately 1" from the other end, drill a 3/64" diameter hole through the center of the rod.

- 1. Place mandrel in lathe chuck with 3/64" diameter hole approximately 1/2" from the face of the chuck jaws.
- 2. Engage the point of the live center in the other end and lock the tailstock and tailstock spindle.
- 3. Place the lathe in neutral.
- 4. Insert approximately 1/2" of the end of a piece of .045" diameter music wire in the 3/64" hole in the mandrel.
- 5. Grasp the music wire 8"-10" for the mandrel and begin turning the spindle by hand.
- 6. Wrap one full revolution of wire and then begin leading the wire toward the tailstock at a rate that will result in five turns over the space of 1".
- 7. When the correct number of turns is achieved, stop movement and complete one full wrap to terminate the spring.
- 8. Clip the spring material at each end and remove from mandrel.

Bolt

- 1. Measure and cut stock plus facing allowance.
- 2. Face to correct overall length.
- 3. Turn section indicated to .375" and thread 3/8-24 for the length shown.
- 4. Deburr all ends and edges.



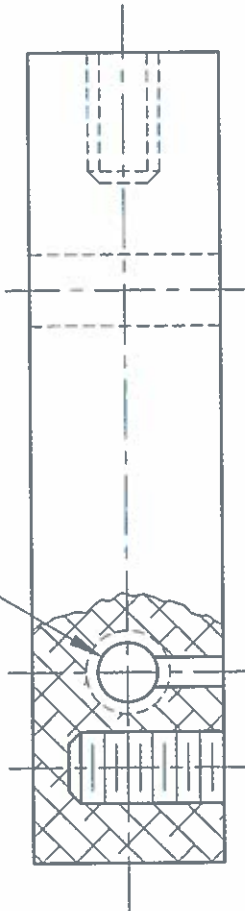
NOTES:

- 1. TOLERANCE: $\pm .005$

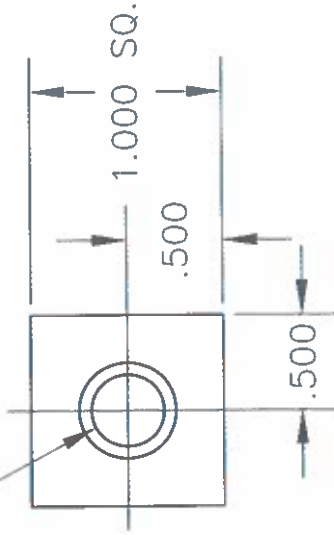
NOTES:

1. TOLERANCE: $\pm .005$
2. ALL HOLES: $\pm .003, - .000$

5/16-18UNC-2B
.375 DP.

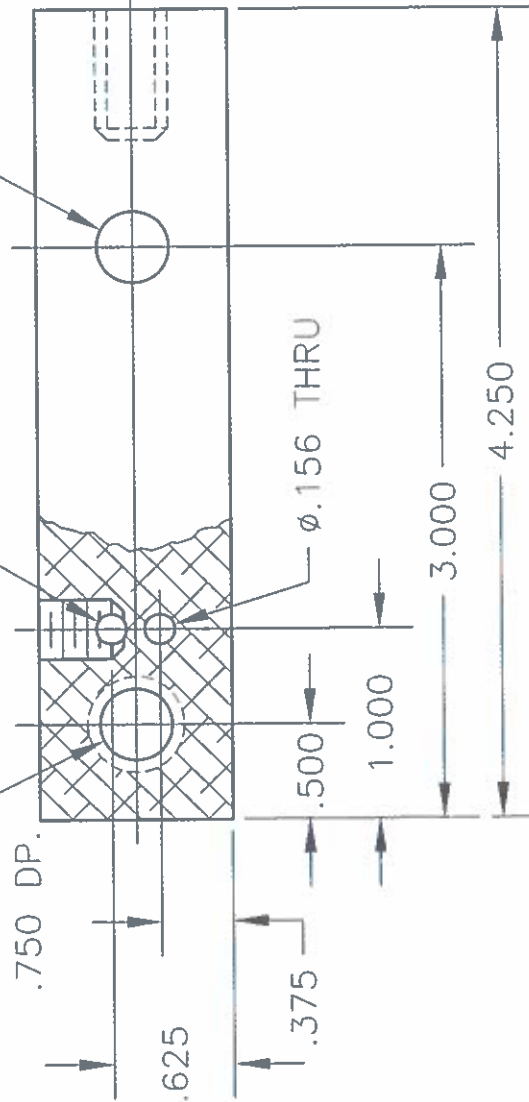


3/8-16UNC-2B
.625 DP.



3/8-24UNF-2B
.750 DP.

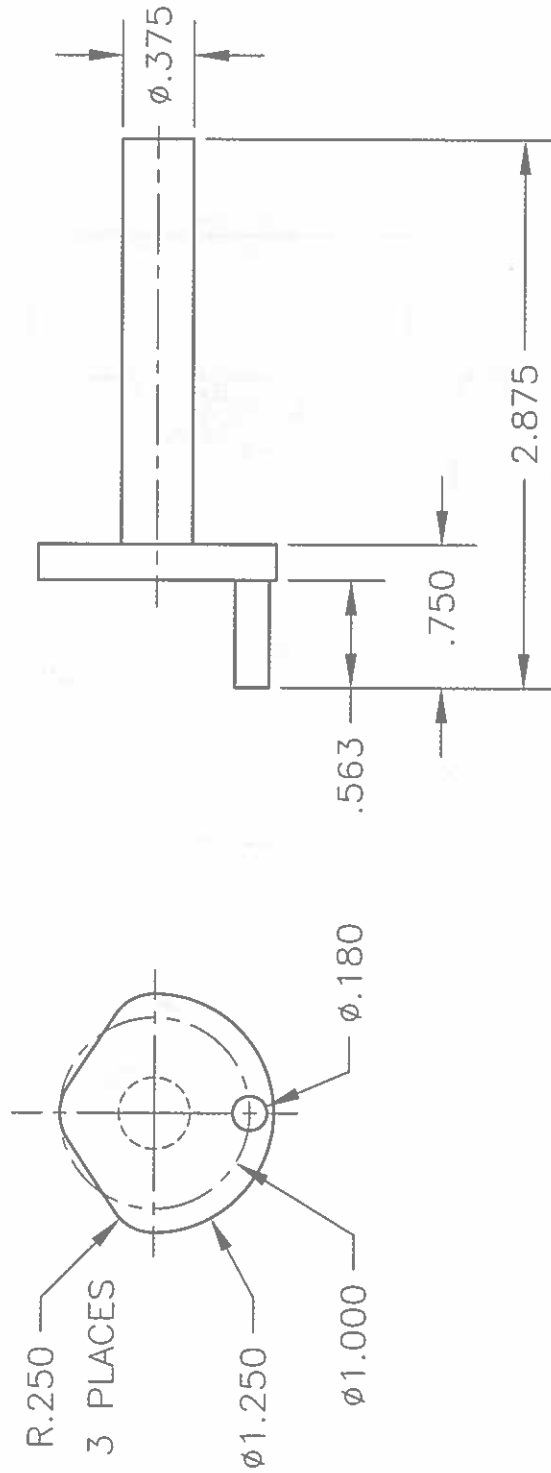
φ.156, .375 THRU



MATERIAL: ALUMINUM	AIR MOTOR ENGINE BLOCK	SCALE: 1:1	DWG. #: 4.18 SHEET 2 OF 10
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NOTES:

1. TOLERANCE: +.000 / -.003



MATERIAL:
ALUMINUM

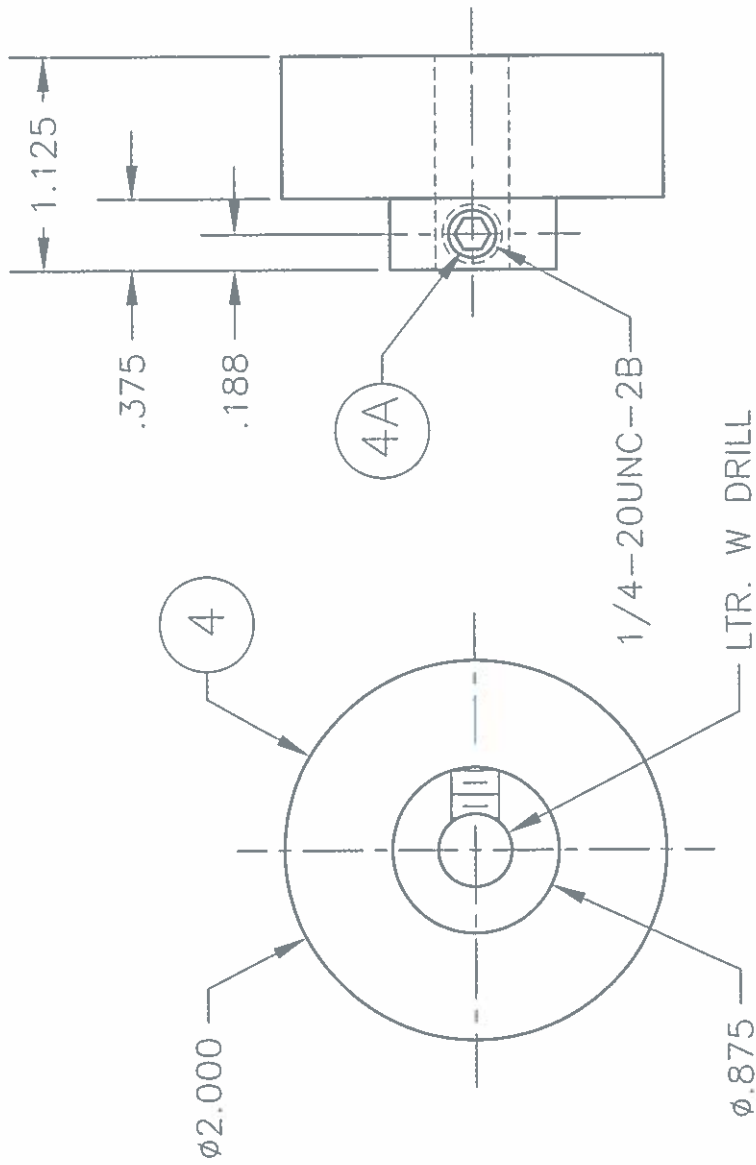
AIR MOTOR
CRANKSHAFT

SCALE:
1:1

DWG. #: 4.18
SHEET 3 OF 10

NOTES:

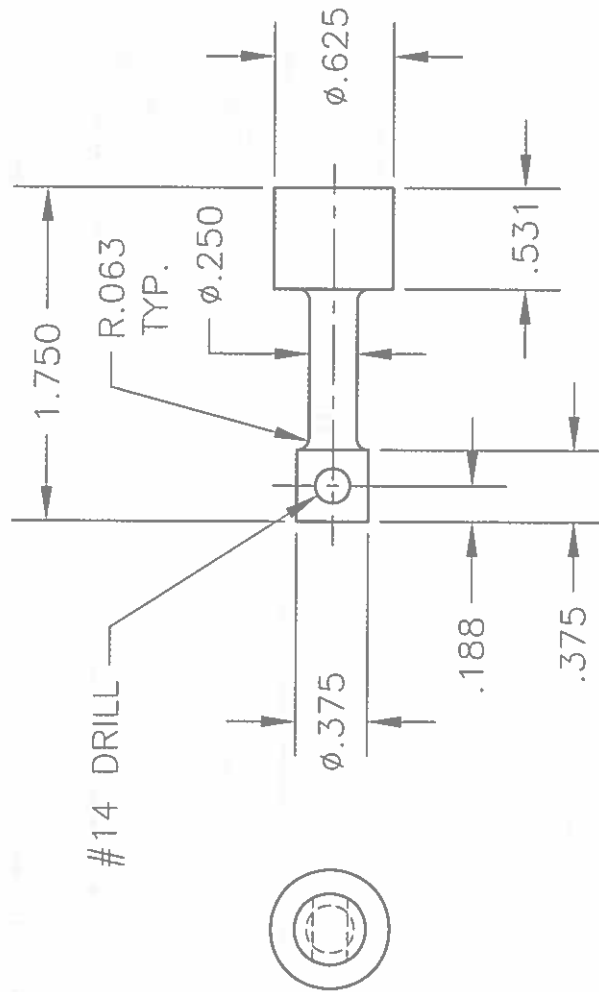
1. TOLERANCE: $+/- .005$



4A	4.19, SH4	1/4-20 UNC-2A X .250 HEX SETSCREW	STEEL	1
4	4.19, SH4	CAE, FLYWHEEL	ALUMINUM	1
PART #.	DWG. #.	DESCRIPTION	MATERIAL	QTY. REQD.
MATERIAL: ALUMINUM		AIR MOTOR FLYWHEEL	SCALE: 1:1	DWG. #: 4.18 SHEET 4 OF 10

NOTES:

1. TOLERANCE: $\pm .003$
2. ALL HOLES: $+.003, -.000$



MATERIAL:
ALUMINUM

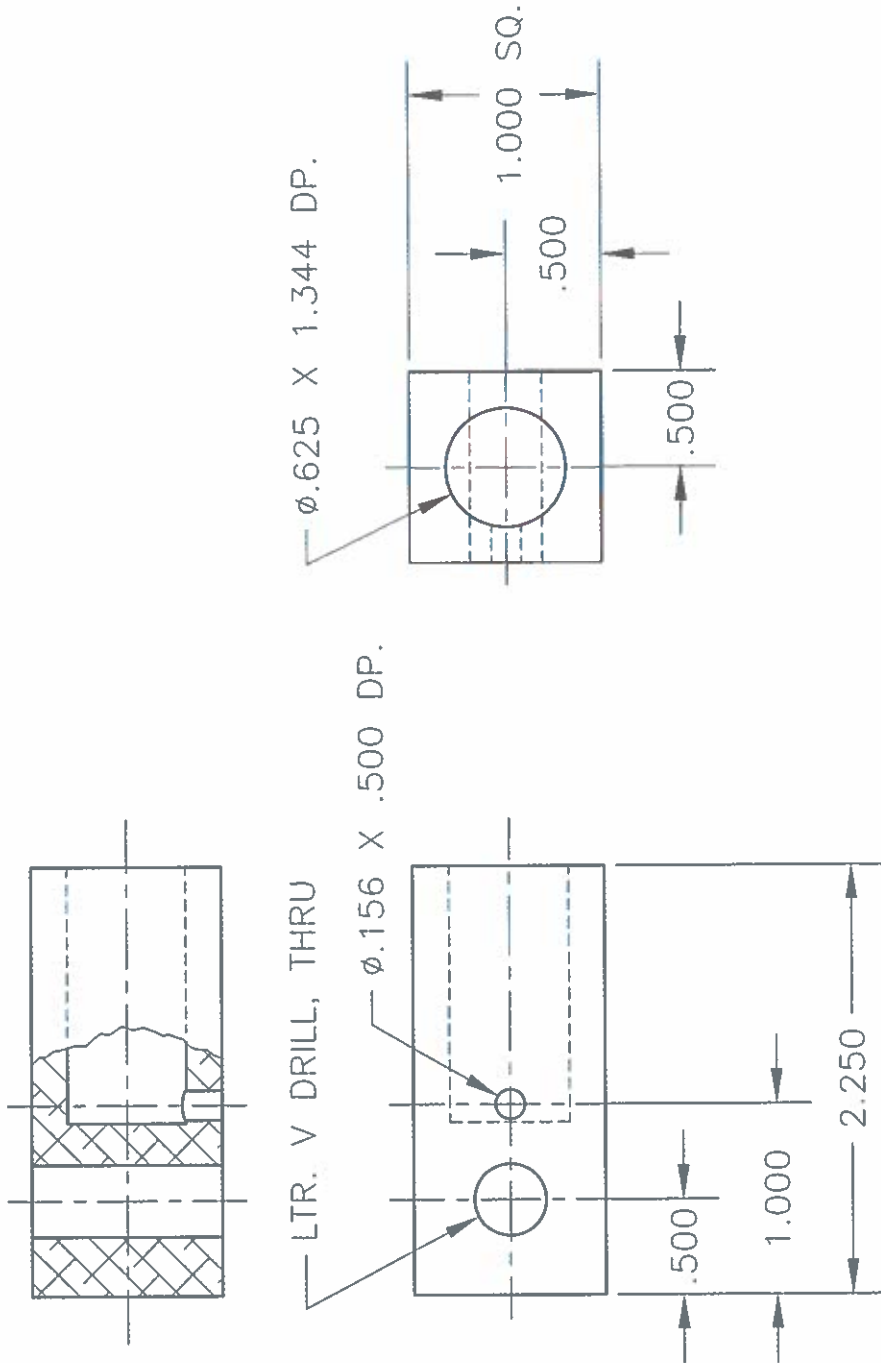
AIR MOTOR
PISTON AND ROD

SCALE:
1:1

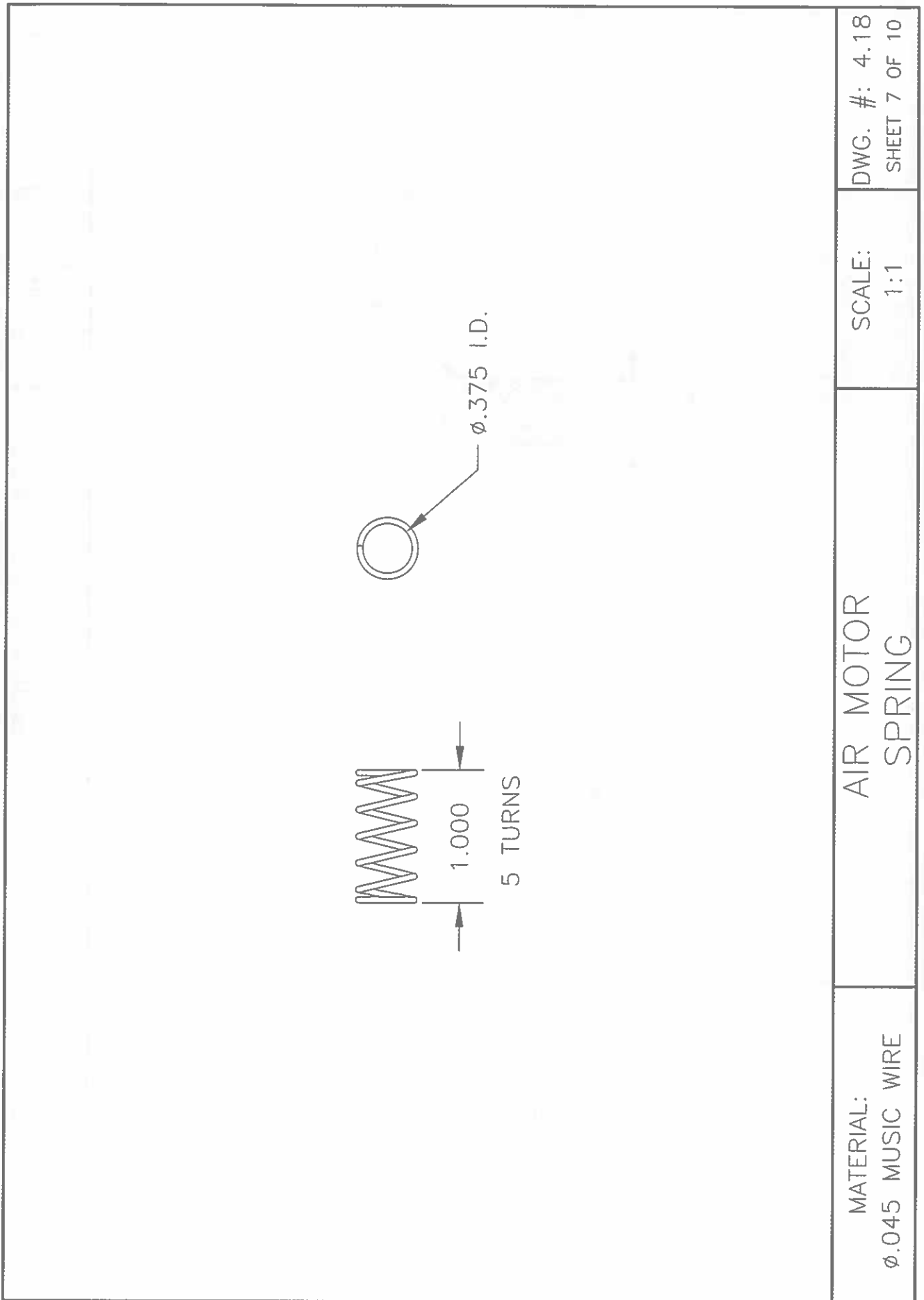
DWG. #: 4.18
SHEET 5 OF 10

NOTES:

1. TOLERANCE: $\pm / - .005$
2. ALL HOLES: $\pm .003, - .000$



DWG. #: 4.18 SHEET 6 OF 10	SCALE: 1:1	AIR MOTOR CYLINDER BLOCK	MATERIAL: ALUMINUM
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DWG. #: 4.18
SHEET 7 OF 10

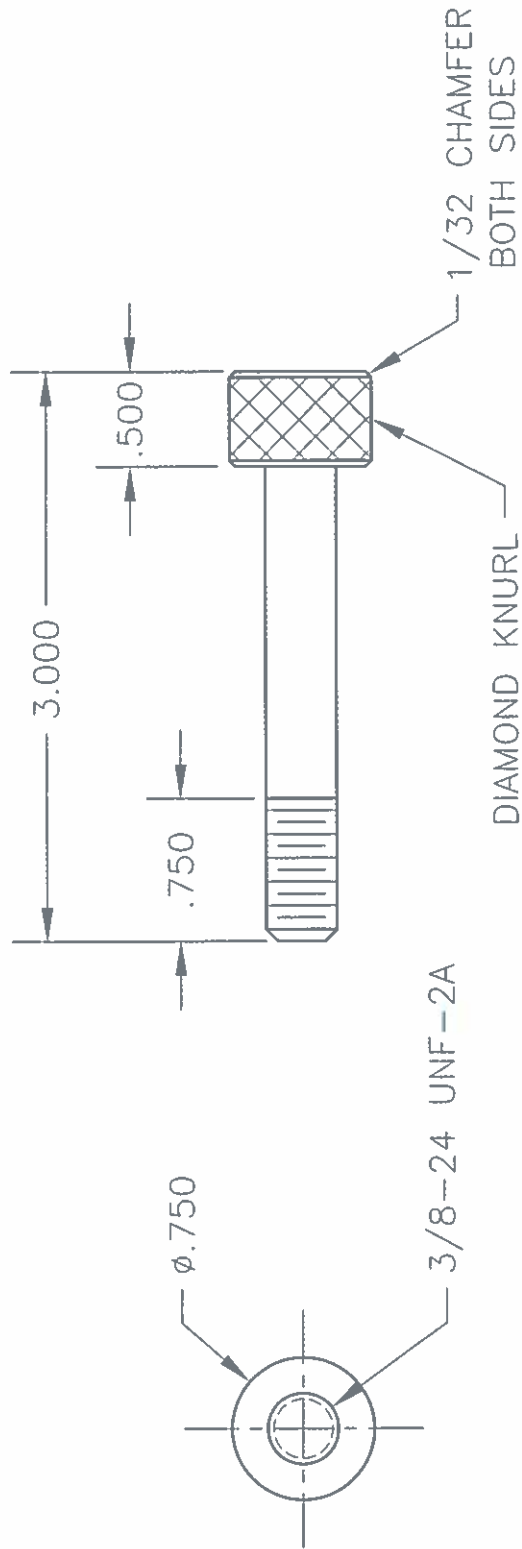
SCALE:
1:1

AIR MOTOR
SPRING

MATERIAL:
 $\phi.045$ MUSIC WIRE

NOTES:

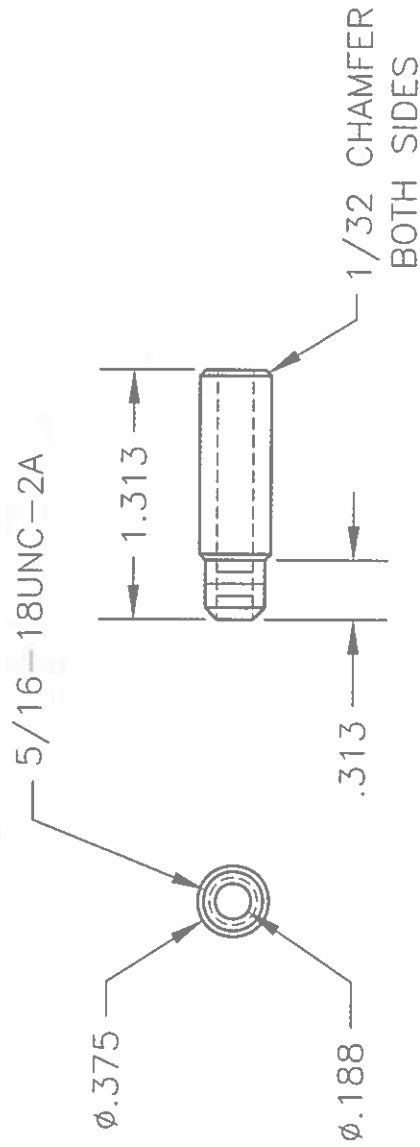
- 1. TOLERANCE: $\pm .005$



MATERIAL: ALUMINUM	AIR MOTOR BOLT	SCALE: 1:1	DWG. #: 4.18 SHEET 8 OF 10
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NOTES:

1. TOLERANCE: $\pm .005$

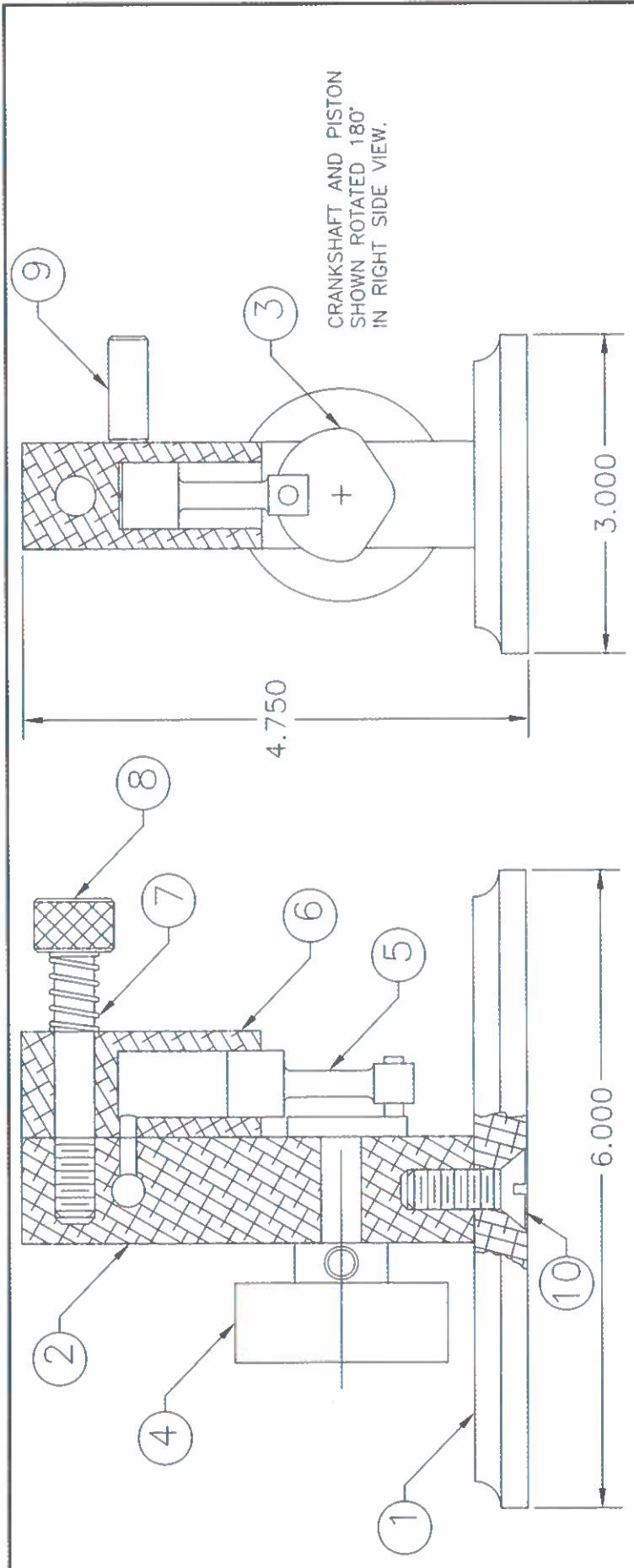


MATERIAL:
ALUMINUM

AIR MOTOR
INLET PIPE

SCALE:
1:1

DWG. #: 4.18
SHEET 9 OF 10



PART #.	DWG. #.	DESCRIPTION	QTY.	REOD.
10	4.18, SH10	.375-16UNC-2A X 1.00 FLAT HEAD SCREW	1	ALUMINUM
9	4.18, SH9	CAE, INLET PIPE	1	ALUMINUM
8	4.18, SH8	CAE, BOLT	1	ALUMINUM
7	4.18, SH7	CAE, SPRING	1	MUSIC WIRE
6	4.18, SH6	CAE, CYLINDER BLOCK	1	ALUMINUM
5	4.18, SH5	CAE, PISTON & ROD	1	ALUMINUM
4	4.18, SH4	CAE, FLYWHEEL	1	ALUMINUM
3	4.18, SH3	CAE, CRANKSHAFT	1	ALUMINUM
2	4.18, SH2	CAE, ENGINE BLOCK	1	ALUMINUM
1	4.18, SH1	CAE, BASE	1	ALUMINUM
				MATERIAL

PARTS LIST	
MATERIAL: AS NOTED	AIR MOTOR ASSEMBLY
SCALE: N.T.S.	DWG. #: 4.18 SHEET 10 OF 10