INSTRUCTION MANUAL

MODEL RBF-200

ROTATING BEAM
FATIGUE TESTING MACHINE

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8/85

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1.0 DESCRIPTION

1.1 General

The RBF-200 is a compact, bench mounted machine designed to apply reversed bending loads to unthreaded, straight shank specimen bars. Included is a cycle counter (99,999,900 maximum count), adjustable speed spindle (500 to 10,000 cpm), and a calibrated beam amd poise system which can apply an infinitely adjustable moment of up to 200 inch-pounds to the cantilevered end of the specimen bar. Collet sizes available include 1/4, 3/8, and 1/2 inch diameters. Unless specified otherwise, a 1/2 inch pair of collets is furnished with the machine. Other collet sizes are available on special order within the range of 1/4 to 1/2 inch diameter.

1.2 Detail

1.2.1 Motor and Spindle

The motor is a 1/2 HP, 115 volt, universal type which is powered by a variable transformer to control the speed from 500 to 10,000 RPM. The motor drives a spindle assembly through a flexible coupling.

> CAUTION: The motor must not be operated at a speed over 10,000 RPM!

The spindle assembly consists of the shaft, bearings, and oil filled housing. A sight gage is provided on the back of the machine for maintaining the proper oil level in the spindle.

1.2.2 Moment Beam

The bending moment loading beam is numbered from 0 to 200 inch-pounds at successive 10 inch-pound increments. The interval between each 10 inch-pound increment is marked with successive one inch-pound divisions. A locking screw is provided in the poise weight to secure it at the desired bending moment setting.

1.2.3 Cutoff Switch

A snap action reset switch is furnished to automatically shut off the machine at specimen failure. It is located under the end of the calibrated beam in such a manner that when the beam drops at specimen failure, the bottom of the adjustable screw actuates the switch. The nuts on the screw are adjusted to stop the beam from damaging the switch after actuation. The switch must be reset with the tab at the outside end of the machine before testing can be resumed.

1.2.4 Cycle counter

The six digit resettable counter (99,999,900 maximum count) is actuated by a switch which is directly driven by the spindle through a 100 : 1 ratio.

2.0 INSTALLATION

2.1 Dimensions

The machine has the following approximate overall dimensions:

Length - 33 in.
Depth - 11 in.
Height - 11 in.

2.2 Weight

The machine weighs approximately 125 pounds.

2.3 Mounting

The four corners of the machine should be shimmed as required to level it in both directions. It is suggested that the corners be secured with 3/8 inch diameter bolts to a mounting surface with adequate flatness to prevent distorting the frame.

If the machine causes an objectionable noise level during testing, vibration absorbtion media can be placed under the machine while maintaining a level position.

2.4 Wiring

Unless otherwise tagged, the machine must be plugged into a 115 VAC, 60 Hz grounded outlet with a 5 amp minimum capacity.

2.5 Lubrication

Fill the spindle assembly through the sight gage with a light spindle oil such as Standard Sohio Spin #60 or equivalent. Fill to approximately mid way on the sight glass until a very slight amount of oil leaks out the spindle end cap during initial run-up.

3.0 OPERATION

3.1 Specimen Set-up

The specimen should be set up in the machine in accordance with the following step-by-step sequence refering to Fig 1.

a. Loosen the lock screw fixing the poise weight to the calibrated beam and move the weight to the zero position at the extreme left end of the beam.

b. Loosen the nuts holding the safety bar at the end of the load arm and swing the bar free of the load arm.

c. Pull the safety guard straight upward free from the phenolic block base. The guard is retained only by a friction fit.

d. Swing the load arm up and to the right so that a specimen bar may be inserted into the drive spindle collet. Position the load arm to prevent contact with the free end of the specimen.

Before inserting the specimen into the drive spindle collet, wipe the specimen clean and carefully check for any burrs, flats, or ridges. Stone away any discontinuities that might interfere with the even distribution of the collets gripping action. Also wipe clean the specimen bores in both collets.

Specimen bars should be pushed into the collets until either the specimen bottoms or the front face of the collet lines up with the end of the tangent on the specimen.

e. Tighten the drive spindle collet onto the specimen. The collet must be tightened sufficiently to prevent any relative movement between the collet and specimen which could cause fretting corrosion.

f. Manually rotate the assembly and check for run-out. The run-out should not exceed .001 inch at the drive spindle collet and .003 inch at the free end of the specimen.

If excessive run-out is present, loosen the collet sufficiently to allow rotating the specimen and/or the collet slightly. Tighten the collet and recheck the run-out.

g. Insert the free end of the specimen into the load arm collet observing the same procedures and precautions noted above for the drive spindle.

In wrenching tight the load arm collet, particular care should be taken to insure that pure torsional wrenching is used and that no bending forces are imparted to the specimen.

h. Again rotate the assembly and check the final run-out on the right hand end of the load arm which should not exceed .006 inch. If excessive run-out is present, repeat the procedure described in step f. It may be necessary tap the specimen free from the collet. Tighten the collet and recheck the run-out.

i. Set the counter to "zero".

j. Turn the speed control knob counter-clockwise to the zero position. Back off the cutoff switch adjusting screw on the beam as required to prevent the switch from tripping by the movement of the load arm as it comes up to speed.

Push down the cutoff switch reset tab extending through the right hand end of the machine base.

With the fingers of the right hand, grasp the load arm bearing *housing* to damp out any resonances and slowly rotate the speed control knob clockwise to bring the machine up to the desired speed.

The speed may be readily determined from a counter/timer relationship. Two zeroes must be added to the indicated reading of the counter for the actual spindle count.

k. After the spindle speed has been roughly adjusted to its desired rate, slowly move the poise weight along the calibrated beam to the required bending moment setting.

While adjusting the position of the poise weight, watch for interference between the cutoff switch adjusting screw and the switch guard.

Fix the weight to the beam by tightening the lock screw and quickly reset the counter to zero without stopping the machine.

The machine speed should be rechecked to determine if loading the specimen caused it to slow down.

1. Finally, adjust the cutoff switch actuation by slowly turning the adjusting screw clockwise until the switch actuates and the power is shut off. Immediately, and in the following sequence, back off the adjusting screw 1/2 turn, and push down the cutoff switch reset tab. This should be done as quickly as possible to minimize the loss of spindle speed.

The intent in this procedure as well as moving the weight to the desired moment setting *after* the machine has been brought up to speed is to minimize any overload condition on the specimen if the machine passes through a critical (resonant) speed. In addition, it is important to select a non-resonant test speed and to hold the load bearing housing with the fingers during any speed changes to dampen vibration when passing through critical speeds.

4.0 SPECIMEN DESIGN

The applicable inch-pound moment setting for the poise weight is generally determined on the basis of some desired bending stress level in the specimen. This moment may be determined from the equation:

$$M = 3.1416\ SD^3/32 = .0982\ SD^3$$

where:

M = Setting for poise weight in inch-pounds

S = Desired bending stress level in specimen at minimum cross section in pounds per sqare inch

D = Diameter of specimen at minimum cross section in inches

Suggested configurations and design information intended to insure reliability and reproducible data between specimen bars are shown in Fig 2.

F = weight $\quad M = \frac{\pi S D^3}{32}$ $\quad M = .0982(60{,}000)(.25)^3$

$S = \frac{32F}{\pi D^3}$ $\quad m = \frac{\pi S D^3}{32}$

$\frac{(32)m}{\pi D^3} = S$

~~B = 4~~ = l

$M \cdot 2 = \frac{\pi S D^3}{32}$

$S = 2M$

5.0 MAINTENANCE

5.1 Motor

At periodic intervals, such as every 6 months, the motor brush wear should be checked. Spare brushes are avaiable from Fatigue Dynamics, Inc. Brush inspection and replacement are explained in the attached Dayton instruction sheet. The motor bearings are sealed and permanently lubricated.

5.2 Spindle Bearings

The oil level must be maintained in the middle of the sight gage on the spindle assembly. Add oil to the sight gage by removing the screw cap. As the gage is filled, it may be necessary to blow gently onto the housing to allow the oil to flow into the spindle housing. Repeat this process until oil flows back into the gage to assure that an air lock is not giving a false indication of the oil level. Use a light spindle oil of approximately 60/100 SSU seconds. Suggested brands are:

Standard Oil of Ohio - Sohio Spin #60
Mobil Oil Co. - Velocite 10

The load arm bearing is sealed and permanently lubricated and requires no attention. The operating temperature of the bearing at high speed may be too hot to touch. This temperature rise is caused by the bearing seal and will decrease with usage. No harm will occur unless the temperature rises far enough to cause it to smoke.

Under reasonably clean environmental operating conditions, these bearings will perform satisfactorily for several years. When they become noisy or exhibit roughness or looseness, they should be replaced. A log of individual bearing operating time and replacement is recommended to insure uninterrupted testing.

5.3 Calibrated Beam and Load Arm Pivots

The pivot pins in the calibrated beam and load arm bearing housing should be cleaned and lubricated with a light machine oil at regular intervals not exceeding one month.

5.4 Spindle Axis

The drive spindle, load arm, collets, and bearings are components of the high speed spindle axis assembly. Because of the extremely adverse effect of vibration on this assemoly, due care should be excercised at all times in the handling and use of these components to prevent their being bumped, dented, bent, or otherwise abused.

Wear and tear on the collets and/or the bearings is generally evidenced by increasing difficulties with specimen run-out. This situation is best handled by replacing the components at fault.

6.0 ACCESSORIES

6.1 Collets

Collets are avaiable in the following sizes expressed as specimen shank diameter: 1/4, 3/8, and 1/2 inch.

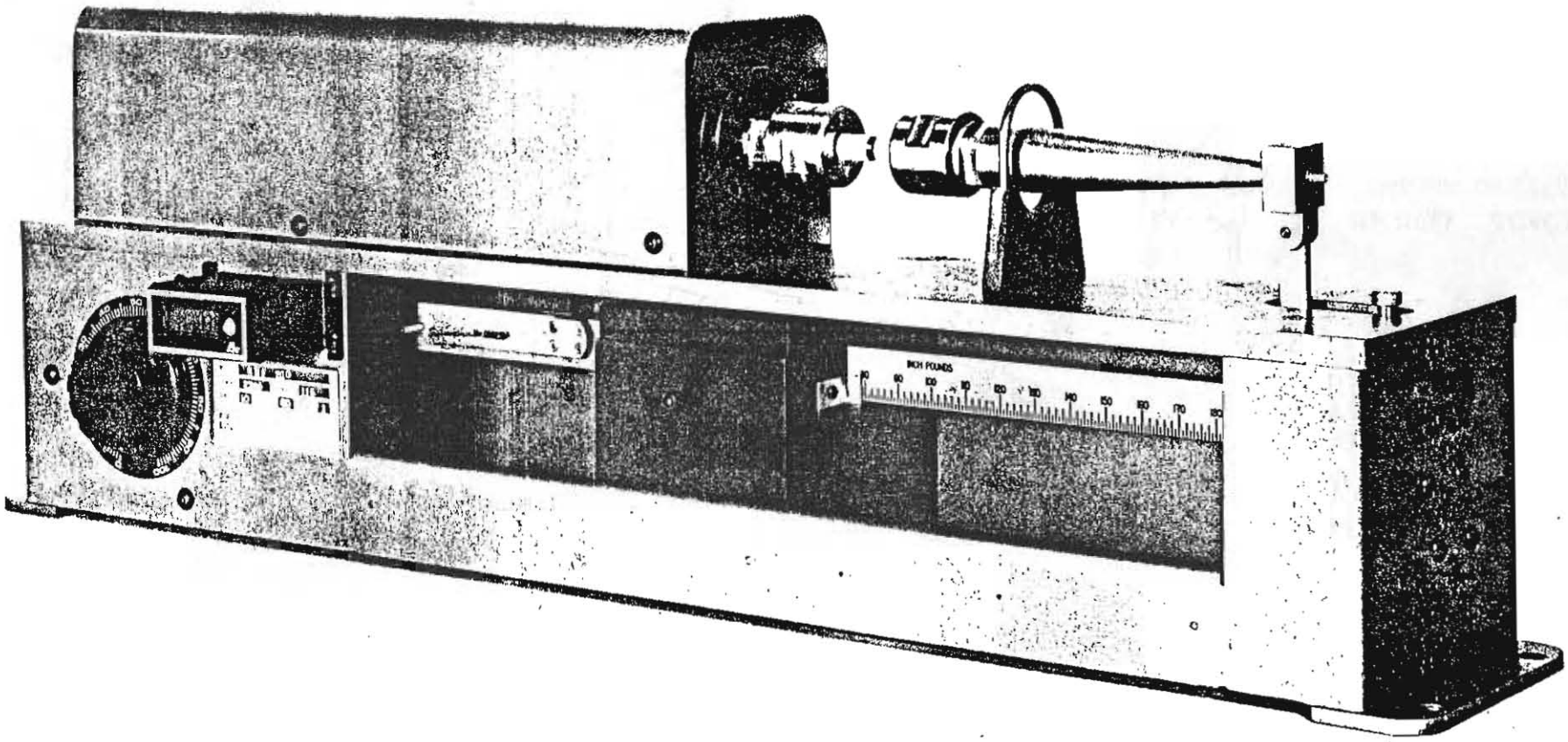
6.2 Corrosion Attachment and Pump

6.3 Wire and Tube Testing Attachment

7.0 APPLICABLE DRAWINGS

The following drawings apply to this machine:

Drawing No.	Title
300-044607	General Arrangement - 200 IN-LB Rotating Beam Testing Machine
C-40789 & PL-C-40789	Spindle Assembly
A-23773	Wiring Schematic


INCH POUNDS

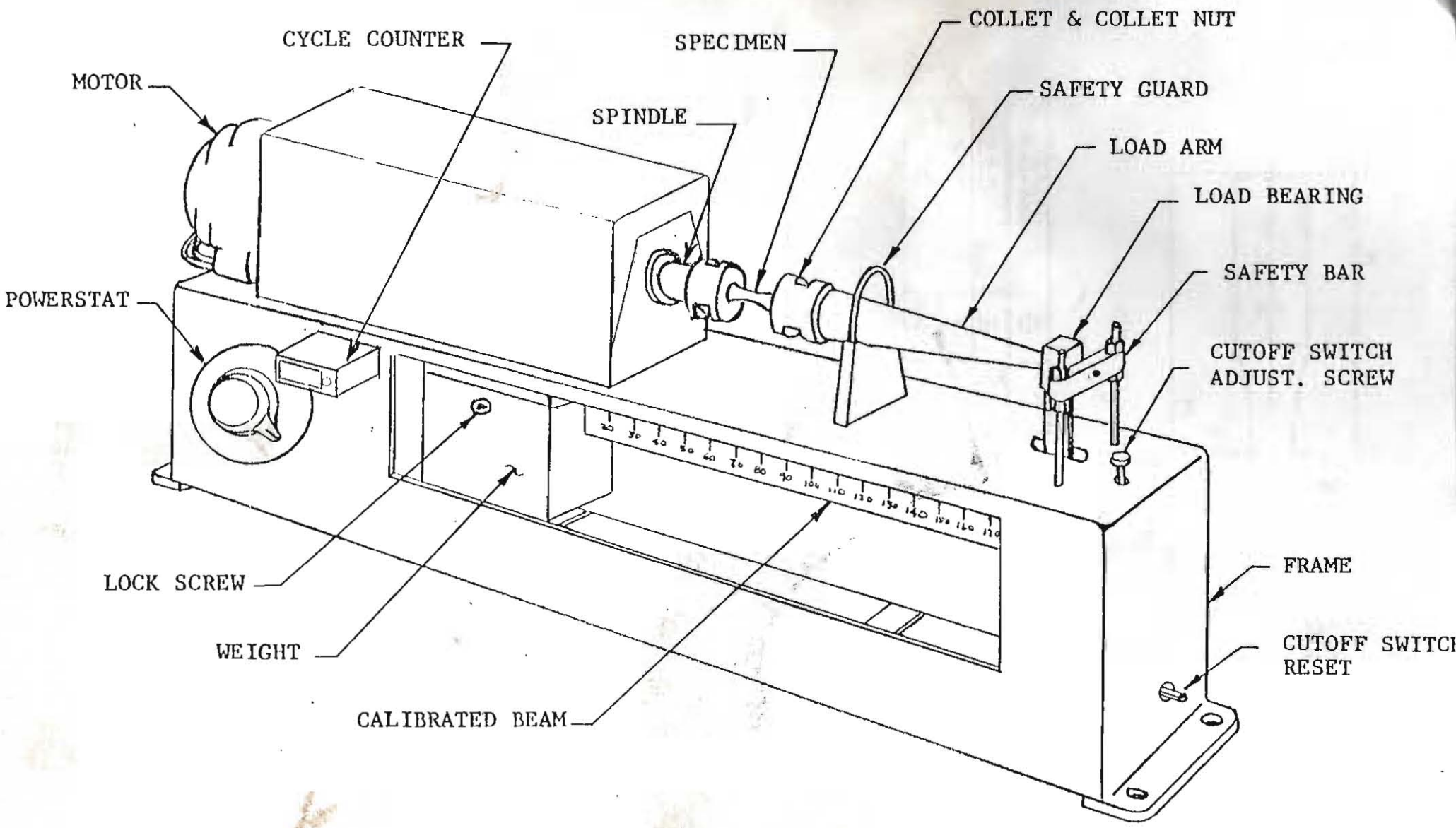
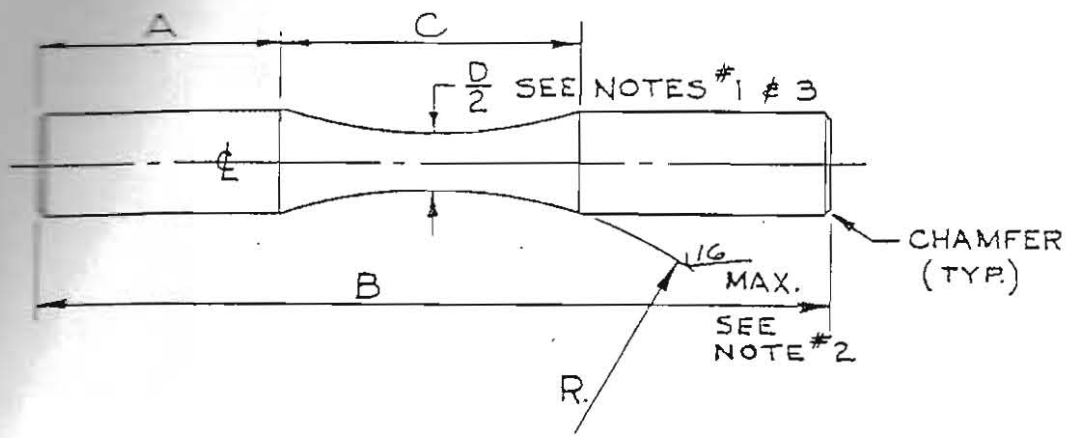
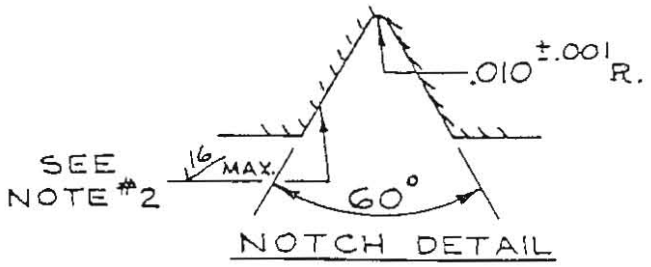
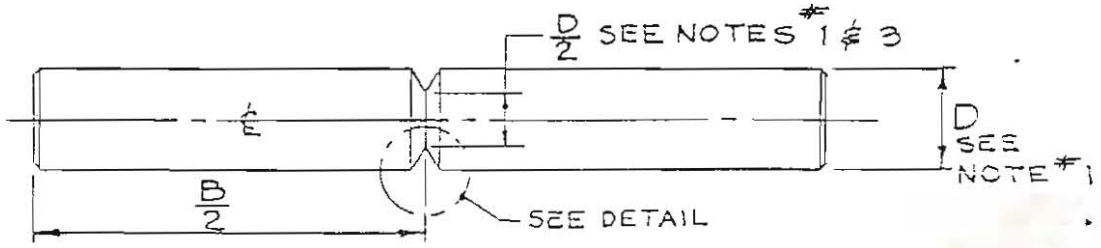

CYCLE COUNTER
SPECIMEN
COLLET & COLLET NUT
MOTOR
SAFETY GUARD
SPINDLE
LOAD ARM
LOAD BEARING
POWERSTAT
SAFETY BAR
CUTOFF SWITCH
ADJUST. SCREW
FRAME
LOCK SCREW
WEIGHT
CUTOFF SWITCH
RESET
CALIBRATED BEAM

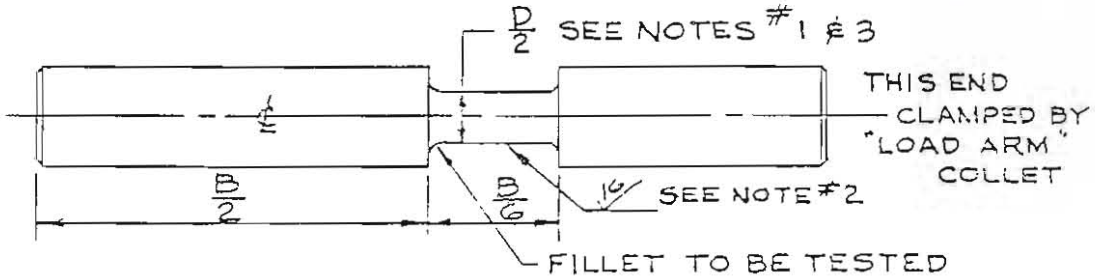
FIGURE 1



DIA. D $^{+.001}_{-.000}$	A	B	C
.250	5/8	2	3/4
.375	1	3	1
.500	1 1/4	4	1 1/2







NOTES:

1. Diameters "D" and "D/2" to be concentric within 0.001.
2. Test section finish to be free of nicks, dents, scratches, and circumferential tool marks. Polish longitudinally, progressing through 0,00 and 000 emery paper. Do not buff.
3. Adjust dimensions D/2 to identity through all specimens ±.0002

FIGURE 2: Suggested Test Specimen Configurations