

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021**

Procedure Title: Rotating Beam Fatigue Testing Machine

Minimum Review Requirements: Every 3 years

Creation Date: 2017, August 31

Date of Next Review: 2020, August

Creator of Procedure: Nanfang Zhao

Authorized by: Akindele Odeshi, Ike Oguocha, Jerzy Szpunar
Qiaoqin Yang, Duncan Cree

Table of Contents

Title Page and Table of Contents

| | | |
|-----------|--|----------|
| 1. | Version History | 2 |
| 2. | Introduction..... | 3 |
| 3. | Definition | 3 |
| 4. | Personnel..... | 3 |
| 5. | Safety | 5 |
| 6. | Procedure..... | 5 |
| 7. | Equipment or Materials Required..... | 9 |
| 8. | Highlights / Critical Control Points..... | 9 |
| 9. | References..... | 9 |

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021**

2. Introduction

The Rotating Beam Fatigue Tester Machine is designed to apply reversed bending loads to straight bars. In general, such machine includes a motor, cycle counter, adjustable speed spindle, a calibrated beam, poise system, and cutoff switch.

There are two rotating beam fatigue testing machines in our lab. One is called Krouse Rotating Fatigue Testing Machine, and another one is called RBF-200 Rotating Fatigue Testing Machine. The operation procedures for both of them are very similar.

This SOP provides general instructions for the following:

1. Safety practice for using the machine and required PPEs;
2. Introduction of both fatigue machines;
3. Procedures for operating the fatigue machines;

3. Definition

SOP: Standard Operating Procedure
RBF: Rotating Beam Fatigue
WHMIS: Workplace Hazardous Materials Information System
PPE: Personal Protective Equipment
WSEP: Workplace Safety and Environmental Protection

4. Personnel

Persons authorized to perform this SOP:

By signing this form I acknowledge that I have read and understand this SOP, as well as the applicable user manuals and that I will conduct myself in accordance with this SOP and the general laboratory rules.

NOTE: ALL SIGNATURES MUST BE PRESENT ON THE SOP LOCATED IN THE YELLOW BINDER IN ROOM 2C26 – Mechanical Engineering Materials Lab, digital copies of SOP's are made available for reference and convenience only. Printed SOP's are valid for 24 hours only, after that time their accuracy must be verified with the **OFFICIAL HARDCOPY VERSION.**

| Name (Print) | NSID | Dep't | Signature | Date |
|--------------|------|-------|-----------|------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021**

5. Safety

SERIOUS INJURY CAN BE RESULTED IF ANY PART OF YOUR BODY OR CLOTHING IS CAUGHT BY HIGH SPEED RUNNING PARTS.

Before proceeding you must have read this SOP and applicable user manuals.

Make sure the PowerStat wheel is at Zero speed before specimen set-up or removal.

When using the tester, the following PPEs are required:

1. Safety glasses
2. Closed-toe shoes with socks
3. Long pants
4. No loose pieces of clothing, long sleeve shirts need to have the arms rolled up
5. No jewelry
6. Long hair should be tied back

6. Procedure

Familiarizing Yourself with the Machines

Both fatigue testing machines in our lab are very similar. They use the same principle and have the same kind of structures and components.

Main components and specifications:

Motor: ½ HP, 115 Volt, variable speed from 500 to 10,000 RPM.

Drive Spindle: consisting of the shaft, bearing, and oil filled housing.

Calibrated Beam: the bending moment loading beam is numbered from 0 to 200 inch-pound at successive 10 inch-pound increments. A locking screw is provided in the poise weight to secure it at the desired bending moment setting.

Cutoff Switch: A snap action reset switch is furnished to automatically shut off the machine at specimen failure. When the beam drops at specimen failure, the bottom of the adjustable screw actuates the switch. The switch must be reset with the tab before testing can be resumed.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021**

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

See Figure 1 and 2 for all components and the name of each component.

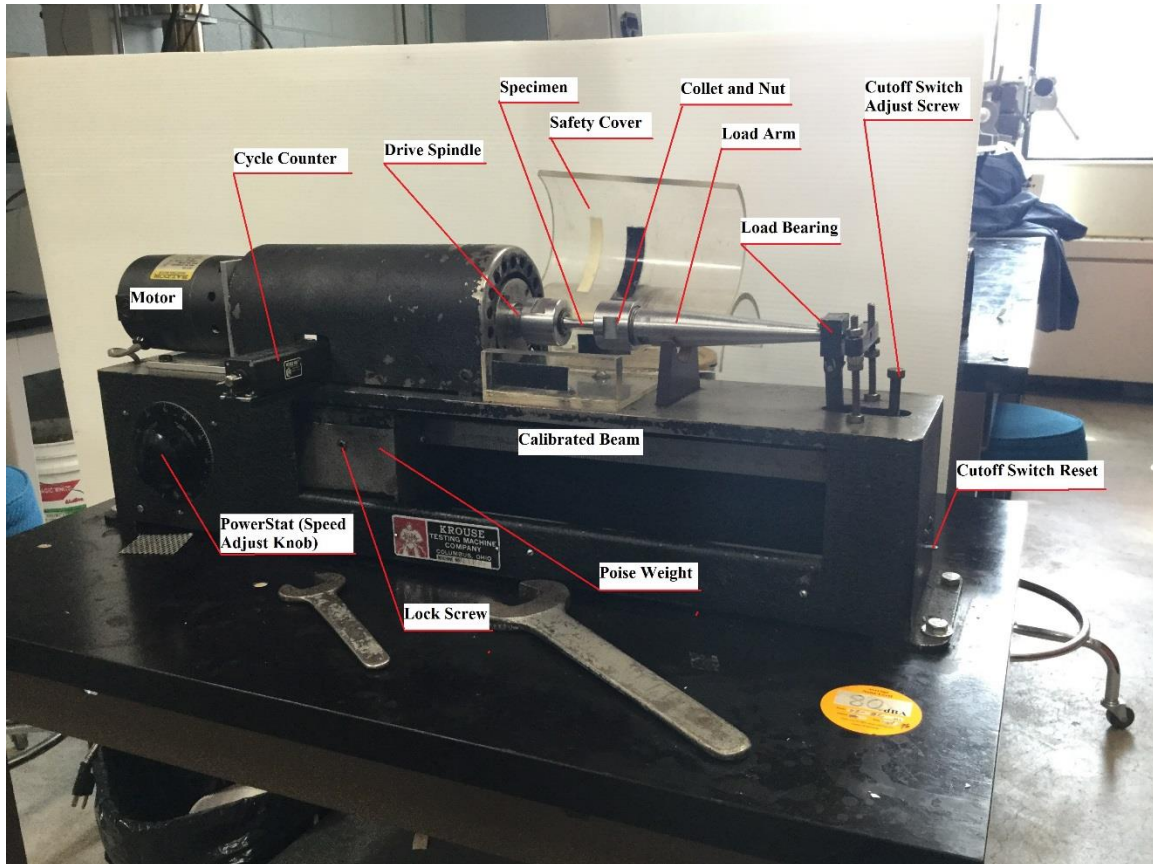


Figure 1. Krouse Rotating Fatigue Testing Machine

University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021

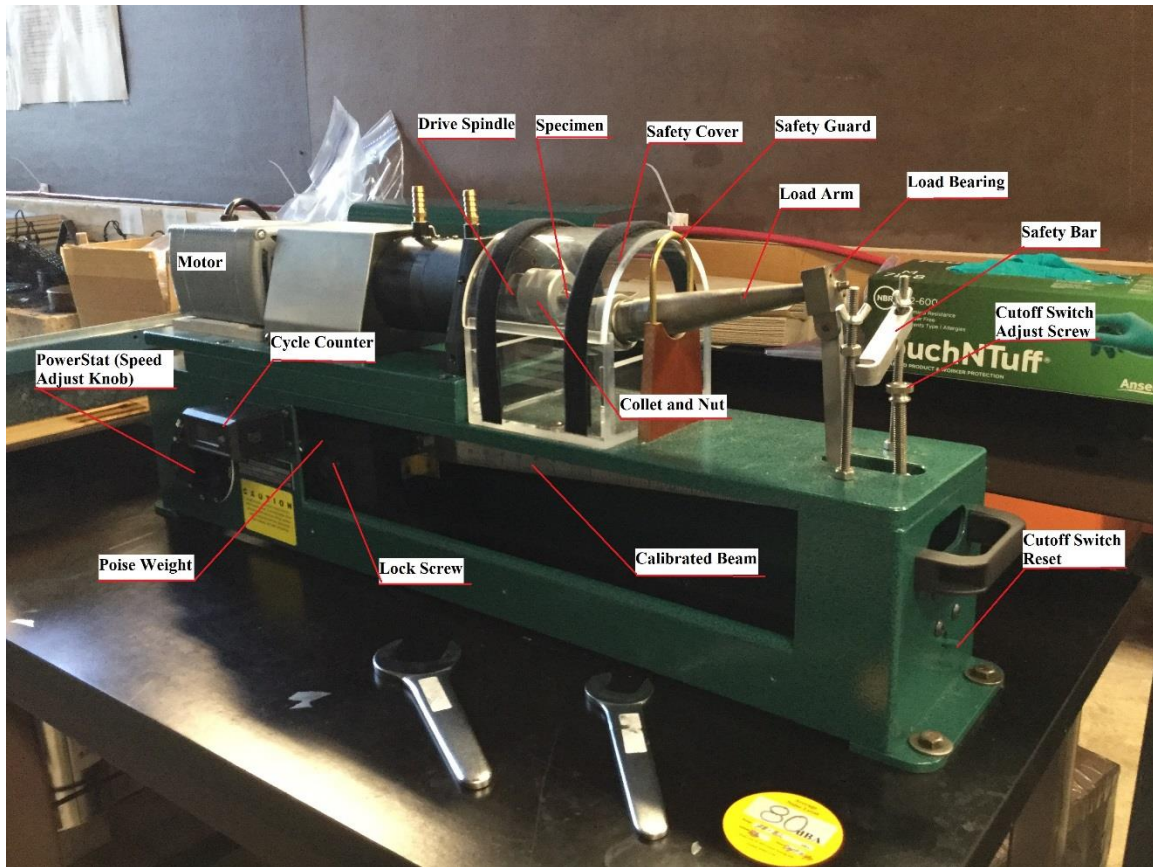


Figure 2: RBF-200 Rotating Fatigue Testing Machine

Operating Procedure

A. Specimen set-up

1. Turn the speed control knob (PowerStat) counter clockwise to the zero position if it is not set to zero.
2. If the poise weight is not at the extreme left end of the calibrated beam, loosen the lock screw on the poise weight and move the weight to the zero position.
3. Loose the nuts holding the safety bar at the end of the load arm and swing the bar free of the load arm (for RBF-200 machine only).
4. Pull the safety guard straight upward free from the phenolic block base (for RBF-200 machine only).
5. Swing the load arm up and to the right so that a specimen bar may be inserted into the drive spindle collet.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # Mat 0021**

6. Insert the specimen into the drive spindle collet and tighten it
 - a) Krouse Fatigue machine
 - i. Slip the specimen into the collet.
 - ii. Screw the specimen into the hold-in screw on the driving spindle end to **finger tight**.
 - iii. Tighten the chuck nut firmly (The collet must be tightened sufficiently to prevent any relative movement between the collet and specimen).
 - b) RBF-200 Fatigue machine
 - i. Push the specimen bar into the collet until either the specimen bottoms or the front face of the collet lines up with the end of the tangent on the specimen.
 - ii. Tighten the chuck nut firmly (The collet must be tightened sufficiently to prevent any relative movement between the collet and specimen).
7. Insert the free end of the specimen into the load arm collet by following the same procedures and precautions noted in step 6 for the drive spindle.

NOTE: when using wrench to tight the load arm collet, particular care should be taken to insure that pure torsional wrenching is used and the **no bending forces are imparted to the specimen**.
8. Rotate the assembly and check the run-out on the right hand of the load arm. The run-out should not exceed 0.006 inch.

B. Start the machine

1. **Put the safety cover on**, and secure it with sticky fastener belts.
2. Set the cycle counter to “zero”.
3. Push down the cutoff switch reset tab and slowly rotate the speed control knob clockwise to bring the machine up to the desired speed (around 5000 RPM). Two zeros must be added to the indicated reading of the counter for the actual spindle count.
4. After the spindle speed has been roughly adjusted to its desired rate, slowly move the position weight along the calibrated beam to the required bending moment setting.
5. Fix the weight to the beam by tightening the lock screw and quickly reset the counter to zero without stopping the machine.
6. Monitor the machine for bearing heating and abnormal noise and other problems during the run.

C. Specimen removal

1. Start to remove the specimen when the specimen has failed (the adjustable screw mounted on the right end of the calibrated beam will actuate the cut-off switch when the specimen has broken down, and the machine will be shut down automatically).
2. Turn the speed control knob counter clockwise to the zero position.
3. Loosen the lock screw on the poise weight and move the weight to the zero position.
4. Loosen the chuck nut on load arm end and on the drive spindle end;
5. Remove the failed specimen from the collet.

7. Equipment or Materials Required

- Fatigue testing machine
- Test specimen
- Wrenches

8. Highlights / Critical Control Points

Whenever abnormal situation (e.g: big vibration, big noise) is observed, stop the machine **IMMEDIATELY** by turning the speed control knob counter clockwise to the zero position.

9. References

- RBF-200 HT Owner's Manual