Technical Report Preprint

This report is scheduled to appear in the 1968 SAE Handbook

SOCIETY OF AUTOMOTIVE ENGINEERS, INC.,
485 Lexington Avenue, New York, New York 10017

J661a

BRAKE LINING QUALITY CONTROL TEST PROCEDURE—SAE J661a

SAE Recommended Practice

Report of Brake Committee approved May 1958 and last revised April 1967.

1. Purpose—The purpose of this SAE Recommended Practice is to establish a uniform laboratory procedure for securing and reporting the friction and wear characteristics of brake linings. The performance data obtained can be used for in-plant quality control by brake lining manufacturers and for the quality assessment of incoming shipments by the purchasers of brake linings.

2. Equipment—A typical, commercially available, machine as used in the preparation of this test procedure and known as a Friction Materials Test Machine is shown in Figs. 1 and 2. The Friction Materials Test Machine shall be equipped with suitable means for:

1. Measuring the drum temperature.
2. Heating the drum.
3. Controlling the drum heating rate.
4. Cooling the drum.
5. Controlling the drum cooling rate.
6. Measuring friction force.
7. Measuring drum rotational speed.

Means shall be provided for measuring specimen thickness and weight.

The temperature measuring means shall incorporate a welded thermocouple, coin silver slip rings, silver-graphite brushes, and an indicator and/or recorder having a high input impedance.

The drum heating means shall be capable of insuring that the "free-running" temperature rise of the drum follows the heating curve of Fig. 3 within ±25 F.

The drum cooling means shall be capable of insuring that the maximum drum temperature of 200 F specified in paragraph 4.3 is not exceeded, and that the "free-running" cooling curve of the drum follows the cooling curve of Fig. 4 within ±25 F.

The temperature measuring system shall have ±2% full scale accuracy.

The friction force measuring system shall have ±2% full scale accuracy.

The drum speed measuring system shall have ±2% full scale accuracy.

The drum diameter shall be between the limits of 10.920-11.020 in.

3. Test Conditions—Actual tests for performance shall be started when preliminary preparations and lining "break-in" have been completed as given in paragraph 4.

3.1 Conduct of Test—All testing shall proceed without interruption.

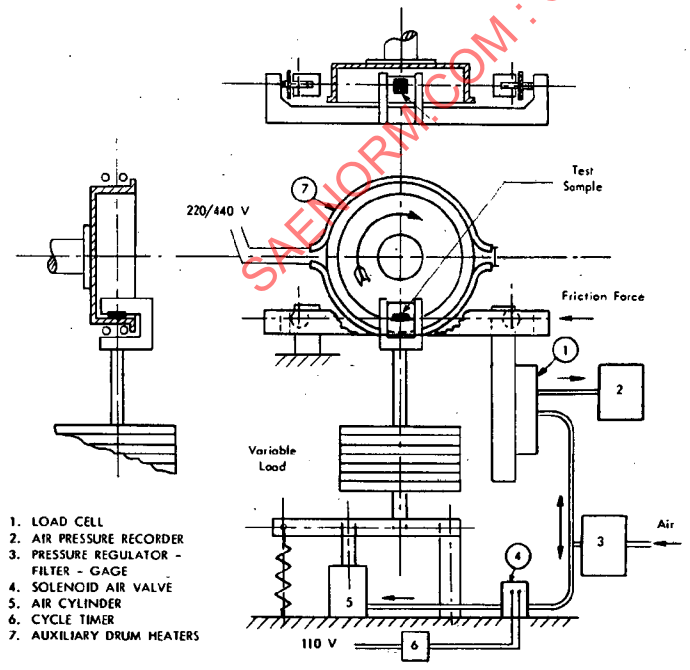
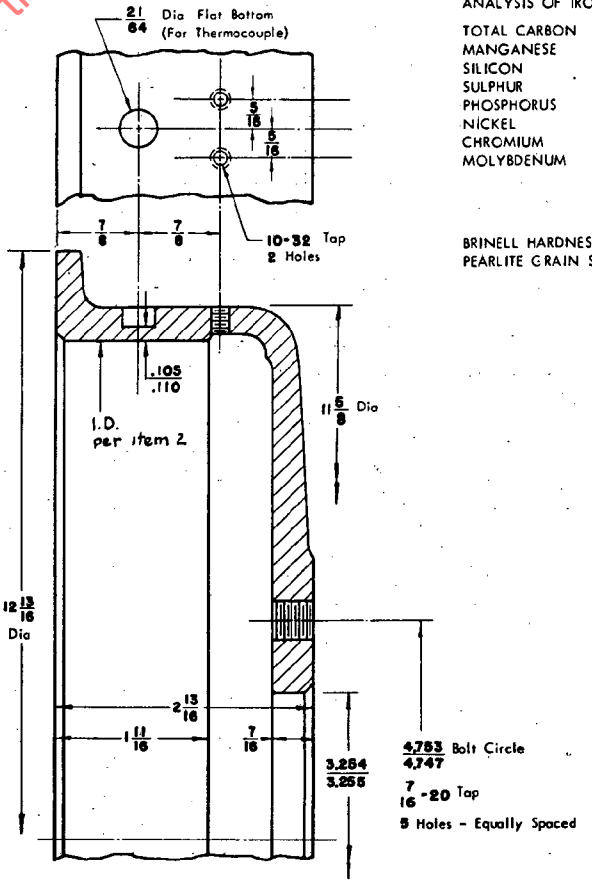


FIG. 1—SCHEMATIC DIAGRAM OF FRICTION MATERIALS TEST MACHINE



ANALYSIS OF IRON

TOTAL CARBON	3.30 - 3.50
MANGANESE	.55 - .75
SILICON	1.80 - 2.10
SULPHUR	.20 MAX
PHOSPHORUS	.20 MAX
NICKEL	.60 - .70
CHROMIUM	.15 - .25
MOLYBDENUM	.20 - .30

BRINELL HARDNESS 179 - 229
PEARLITE GRAIN STRUCTURE

FIG. 2—FRICTION MATERIALS TEST MACHINE DRUM

3.2 **Drum Speeds**—All drum speeds (rpm) are based on a nominal 11 in. diameter drum with load applied to the specimen.

4. Procedure

4.1 **Preparation of Test Specimen**—The test specimen shall be taken from the center of the friction material approximately equidistant from each end.

The specimen shall be 1 in. square, flat on the bottom, and the radius of the working surface shall conform to the radius of the test drum. Remove a minimum of material (but not less than 0.010 in.) from the working surface of the specimen. Specimen thickness (or specimen plus shim) must be approximately 0.240 in. measured in the center of specimen. Excess of material must be removed from the bottom side of the specimen cut from 0.250 in. or greater nominal thickness linings. In cases where nominal lining thickness is less than 0.210 in., remove minimum amount of material from the bottom to produce flatness.

The working surface of the specimen shall not be handled and shall be kept free from foreign material.

4.2 **Preparation of Test Drum Surface**

4.2.1 NEW OR RESURFACED DRUM—After grinding the drum surface on the test machine, remove all grinder marks by polishing with abrasive paper or cloth. Final polishing shall be with 320 grit. Remove dust from drum with clean dry air and/or with clean cheesecloth or equivalent. Complete the surface preparation by running a reference specimen continuously at 100 psi, 417 rpm (20 fps), and not over 200 F until coefficient of friction has stabilized.

4.2.2 PRIOR TO EACH TEST—Polish the drum surface with abrasive paper or cloth. Final polishing shall be with 320 grit. Remove dust from the drum with clean dry air and/or with clean cheesecloth or equivalent.

4.3 **Conditioning of Test Specimen**—The specimen is run-in at 312 rpm (15 fps), 100 psi, and a maximum drum temperature of 200 F, for a minimum of 20 minutes, to obtain at least 95% contact.

4.4 **Initial Thickness and Weight Measurements**—Specimen thickness measurement is taken in three places along the axis parallel to the drum axis (open, center, and closed edges) and recorded. Weigh (in grams) to third decimal place and record. Reseat specimen by running continuously for 5 minutes at 50 psi and 208 rpm (10 fps). Initial clearance between specimen and drum should be 0.010-0.015 in. in the "OFF" position.

4.5 **Initial Wear Measurement**—With drum stationary and at 200 F, with 150 psi on specimen, obtain indicator reading of height of specimen holder and record.

5. Test Runs

5.1 **Base Line Run**—Run 10 sec "ON" (load applied) and 20 sec "OFF" (load removed) at 150 psi and 417 rpm for 20 applications.

Start run at a drum temperature of 200 ± 20 F and maintain the temperature within these limits throughout this portion of the test.

5.2 **First Fade Run**—With the heater voltage adjusted so that the "free-running" temperature rise curve of the drum follows the heating curve of Fig. 3 within ±25 F, run continuous drag at 150 psi and 417 rpm with the heater "ON" and cooling means "OFF." Start run at 200 F and run for either 10 minutes or until 550 F is attained, whichever occurs first. Take simultaneous readings of friction force and drum temperature at 30 sec intervals. Record time required to reach 550 F.

5.3 **First Recovery Run**—Immediately following completion of First Fade Run (paragraph 5.2), turn off heater and turn on cooling means (adjusted so that the "free-running" cooling curve of the drum follows the cooling curve of Fig. 4 within ±25 F), and make a 10 sec application at each 100 F interval during cooling from 500 to 200 F.

5.4 **Second Wear Measurement**—Repeat Initial Wear Measurement (paragraph 4.5).

5.5 **Wear Run**—Run 20 sec "ON", 10 sec "OFF", at 150 psi and 417 rpm for 100 applications. Start run at a drum temperature of 400 ± 20 F and maintain the average of the maximum and minimum temperature for each application at 400 ± 20 F.

FIG. 3—STANDARD DRUM HEATING CURVE, FRICTION MATERIALS TEST MACHINE

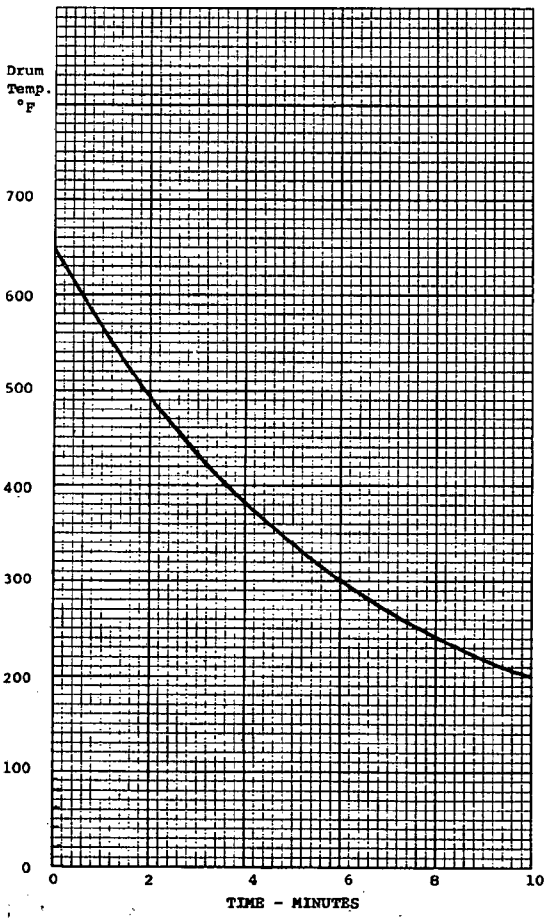


FIG. 4—STANDARD DRUM COOLING CURVE, FRICTION MATERIALS TEST MACHINE