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The Engineering Society For Advancing Mobility Land Sea Air and Space®

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SAE J661 AUG87

Brake Linings Quality Control Test Procedure

SAE Recommended Practice
Revised August 1987

Submitted for Recognition as an American National Standard

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space ®
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HIGHWAY VEHICLE PRACTICE

Submitted for recognition as an American National Standard

SAE J661

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Ø BRAKE LINING QUALITY CONTROL TEST PROCEDURE

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:

   - Measuring the drum temperature.
   - Heating the drum.
   - Controlling the drum heating rate.
   - Cooling the drum from the back side only.
   - Controlling the drum cooling rate.
   - Measuring friction force.
   - Measuring drum rotational speed.

   Means shall be provided for measuring specimen thickness and mass.

   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 adjusted as follows and remain so during the test: with the drum rotating at 411 rpm, cool from 300 F (149) to 200 F (93) with cooling air on. Then cool to 180 F (82) with cooling air off. Turn on heaters at 180 F and start timing. Heat for 10 minutes. Drum temperature shall be 430 F ± 25 (221 ± 14) at 10 minutes.

2. (Continued):

The drum cooling means shall be adjusted as follows: with the drum rotating at 411 rpm, and after having heated the drum with the heater elements to 700 F (371), turn off heaters and turn on cooling air. Cool to 650 F (343) and start timing. Cool for 10 minutes. Drum temperature shall be 200 F ± 25 (93 ± 14) at 10 minutes.

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 shall be used only between the inside diameter limits of 277.0 - 280.0 mm and have three thermocouple locations, one each at depths of 2.55 (stamped number 1), 3.05 (stamped number 2) and 3.55 mm (stamped number 3) from the new drum surface diameter of 277.0 mm.

The thermocouple should be mounted in the position indicated:

Drum Inside Diameter	Location Stamp on Drum
277 - 278	1
278 - 279	2
279 - 280	3

3. TEST CONDITIONS: Actual tests for performance shall be started when preparations have been completed in accordance with paragraph 4.

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

3.2 Drum Speeds: All drum speeds (rpm) are based on a nominal 278.5 mm 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 test specimen shall be 25.7/25.6 mm square (660 mm^2), flat on the bottom, and the radius of the working surface shall conform to the radius of the test drum. On pre-ground linings, remove at least 0.3 mm, but not more than 0.5 mm from the working surface of the specimen. For un-ground linings (directly from molds), remove 1.0/1.2 mm to be certain that the resin impregnated surface is totally removed. Specimen thickness (or specimen plus shim) should be approximately 6 mm measured in the center of specimen. Excess of material must be removed from the side opposite the working surface of the specimen. In cases where nominal lining thickness is less than 5 mm, remove minimum amount of material from the side opposite the working surface 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 cheese-cloth, white paper toweling or equivalent. Complete the surface preparation by running a reference specimen continuously at 440 N, 411 rpm and not over 200 F (93) until the friction coefficient 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 cheesecloth, white paper toweling or equivalent.

4.3 Conditioning of Test Specimen: The specimen is burnished at 308 rpm, 440 N and a maximum temperature of 200 F (93), for a minimum of 20 minutes, to obtain at least 95% contact.

4.4 Initial Thickness and Mass 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, to nearest milligram, and record. Reseat specimen by running continuously for 5 minutes at 220 N and 205 rpm. Initial clearance between specimen and drum should be 0.3 - 0.4 mm in the "OFF" position.

4.5 Initial Wear Measurement: With drum stationary and its temperature between 190 (88) and 210 F (99) with 660 N on specimen, obtain indicator reading of height of specimen holder and record.

5. TEST RUNS:

5.1 Baseline Run: Run 10 s "ON" (load applied) and 20 s "OFF" (load removed) at 660 N and 411 rpm for 20 applications.

Start run at a drum temperature of 180 (82) - 200 F (93) and maintain the maximum and minimum temperature during each successive application between 180 (82) - 220 F (104) with the use of cooling air. Turn cooling air off on 20th load application.

5.2 First Fade Run: Allow drum to cool with drum rotating and heating and cooling means off. At 180 F (82) apply specimen and energize heating elements. Run continuous drag at 660 N and 411 rpm. Run for either 10 minutes or until 550 F (288) is attained, whichever occurs first. Take readings of friction force at intervals of 50 F (28), starting at 200 F (93). Record time required to reach 550 F (288).

5.3 First Recovery Run: Immediately following completion of First Fade Run (Item 5.2), turn off heater and turn on cooling means and make a 10 s application at 660 N and 411 rpm at 500 (260), 400 (204), 300 (149) and 200 F (93) during cooling.

5.4 Second Wear Measurement: Repeat Initial Wear Measurement (Item 4.5).

5.5 Wear Run: Run 20 s "ON", 10 s "OFF", at 660 N and 411 rpm for 100 applications. Start run at a drum temperature of 380 (193) - 400 F (204) and maintain maximum and minimum temperature during each application between 380 (193) and 420 F (216) with use of cooling air.

5.6 Third Wear Measurement: Immediately upon completion of Wear Run (Item 5.5), cool to 190 (88) - 210 F (99) and repeat Initial Wear Measurement (Item 4.5).

5.7 Second Fade Run: Upon completion of Third Wear Measurement, allow drum to cool with drum rotating and heating and cooling means off. At 180 F (82) apply specimen and energize heating elements. Run continuous drag at 660 N and 411 rpm. Run for either 10 min or until 650 F (343) is attained, whichever occurs first. Take readings of friction force at intervals of 50 F (28), starting at 200 F (93). Record time required to reach 650 F (343).

5.8 Second Recovery Run: Immediately upon completion of Second Fade Run (Item 5.7), turn off heater and turn on cooling means and make a 10 s application at 660 N and 411 rpm at 600 (316), 500 (260), 400 (204), 300 (149) and 200 F (93) during cooling.

5.9 Baseline Rerun: Repeat Baseline Run (Item 5.1).

5.10 Final Wear Measurement: Repeat Initial Wear Measurement (Item 4.5).

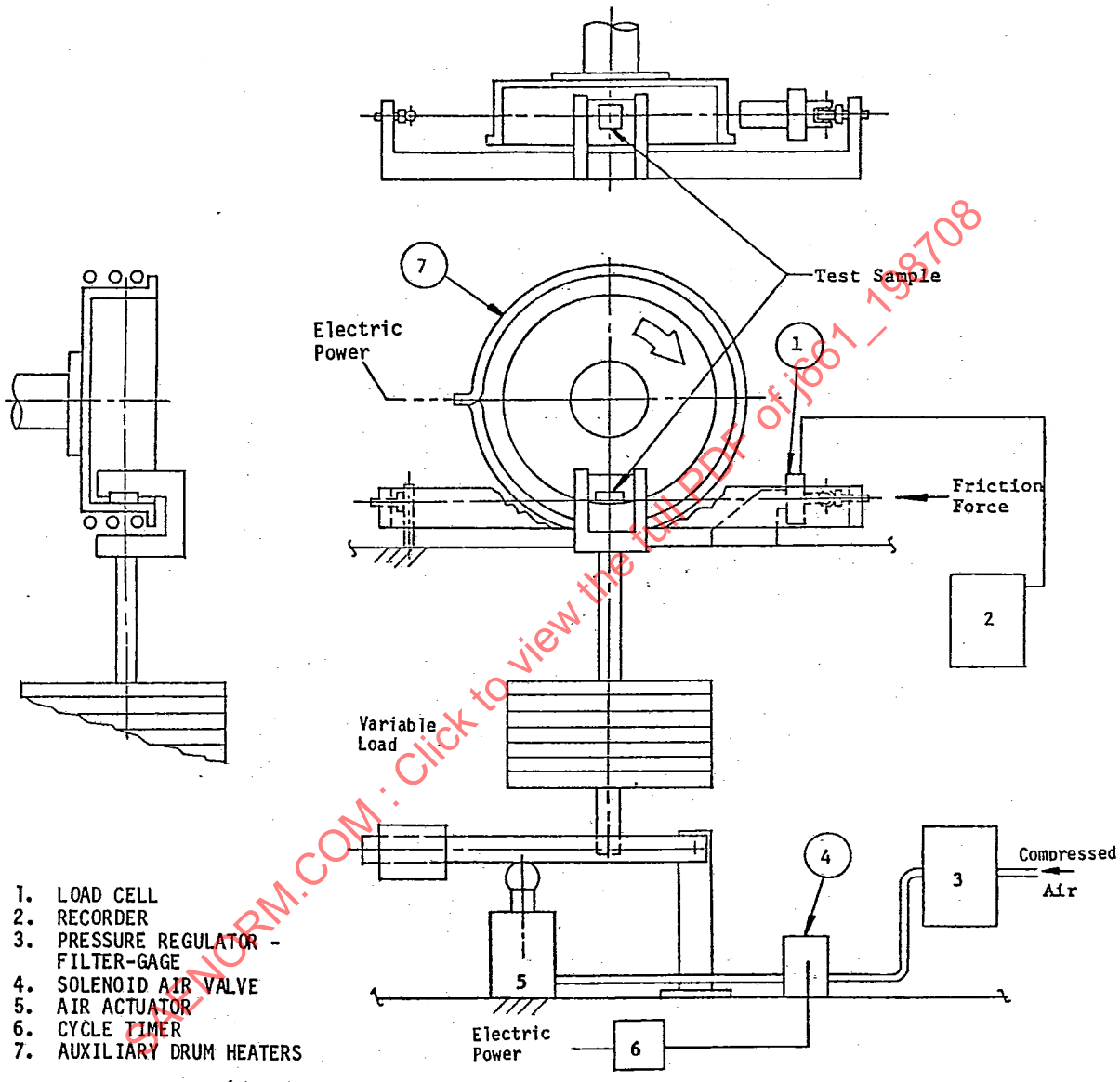
5.11 Final Thickness and Mass Measurements: Measure and weigh as described in Initial Thickness and Mass Measurements (Item 4.4).

6. SELECTION OF PLOT POINT FOR FRICTION COEFFICIENT VALUE: During intermittent application runs, the friction coefficient values are taken at the end of the application.

7. PRESENTATION OF TEST DATA:

7.1 Data should be presented on Master Form Log Sheet.

7.2 Data should be plotted on Master Form Plot Sheet.



1. LOAD CELL
2. RECORDER
3. PRESSURE REGULATOR - FILTER-GAGE
4. SOLENOID AIR VALVE
5. AIR ACTUATOR
6. CYCLE TIMER
7. AUXILIARY DRUM HEATERS

FIG. 1 - SCHEMATIC DIAGRAM OF FRICTION MATERIALS TEST MACHINE

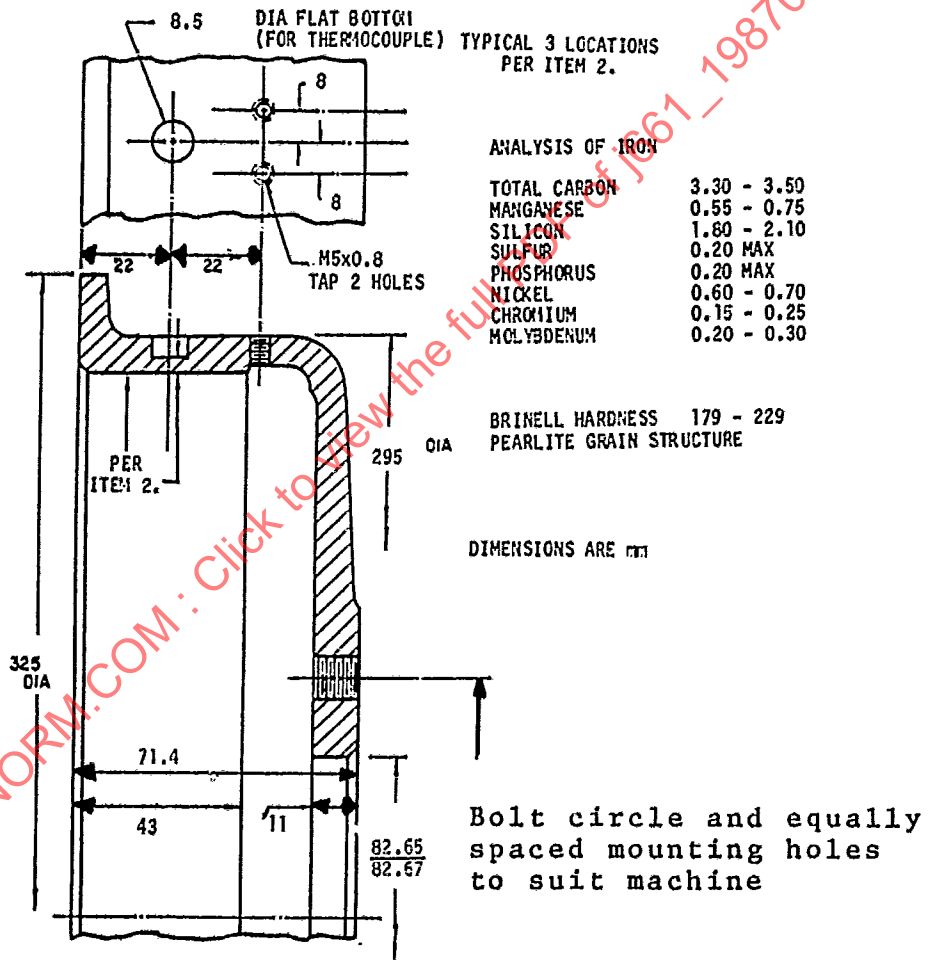


FIG. 2 - FRICTION MATERIALS TEST MACHINE DRUM

MATERIAL _____

LOT _____

REFERENCE _____

JOB NO. _____
TEST NO. _____
DATE _____
OPERATOR _____

	MASS	THICKNESS	INDICATOR READING
INITIAL			
FINAL			
LOSS			

FIRST BASELINE

APPL NO	FRICTION FORCE N	FC*
1		
5		
10		
15		
20		

FIRST FADE

TEMP F	FRICTION FORCE N	FC
200		
250		
300		
350		
400		
450		
500		
550		

MIN. AT 550F
____ F AT 10 MINUTES

FIRST RECOVERY

TEMP F	FRICTION FORCE N	FC
500		
400		
300		
200		

INDICATOR READING

WEAR TEST

APPL NO	FRICTION FORCE N	FC
1		
10		
20		
30		
40		
50		
60		
70		
80		
90		
100		

INDICATOR READING

SECOND FADE

TEMP F	FRICTION FORCE N	FC
200		
250		
300		
350		
400		
450		
500		
550		
600		
650		

MIN. AT 650F
____ F AT 10 MINUTES

SECOND RECOVERY

TEMP F	FRICTION FORCE N	FC
600		
500		
400		
300		
200		

SECOND BASELINE

APPL	FRICTION FORCE N	FC
1		
5		
10		
15		
20		

REMARKS: _____

*FC - FRICTION COEFFICIENT

FIG. 3 - MASTER FORM LOG SHEET