SAE J661 Brake Lining Quality Test Procedure / Testing Equipment

Description

3 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 Figures 1 and 2. The Friction Materials Test Machine shall be equipped with suitable means for:
a. Measuring the drum temperature
b. Heating the drum
c. Controlling the drum heating rate
d. Cooling the drum from the back side only
e. Controlling the drum cooling rate
f. Measuring friction force
g. 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, silvergraphite 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 417 r/min, cool from 149 °C (300 °F) to 93 °C (200 °C) with cooling air on. Then cool to 82 °C (180 °F) with cooling air off. Turn on heaters at 82 °C (180 °F) and start timing. Heat for 10 min. Drum temperature shall be 221 °C ± 14 °C (430 °F ± 25 °F) at 10 min.
The drum cooling means shall be adjusted as follows with the drum rotating at 417 r/min, and after having heated the drum with the heater elements to 371 °C (700 °F), turn off the heaters and turn on cooling air. Cool to 343 °C (650 °F) and start timing. Cool for 10 min. Drum temperature shall be 93 °C ± 14 °C (200 °F ± 25 °F) at 10 min.
The temperature measuring system shall have ±2% full-scale accuracy.

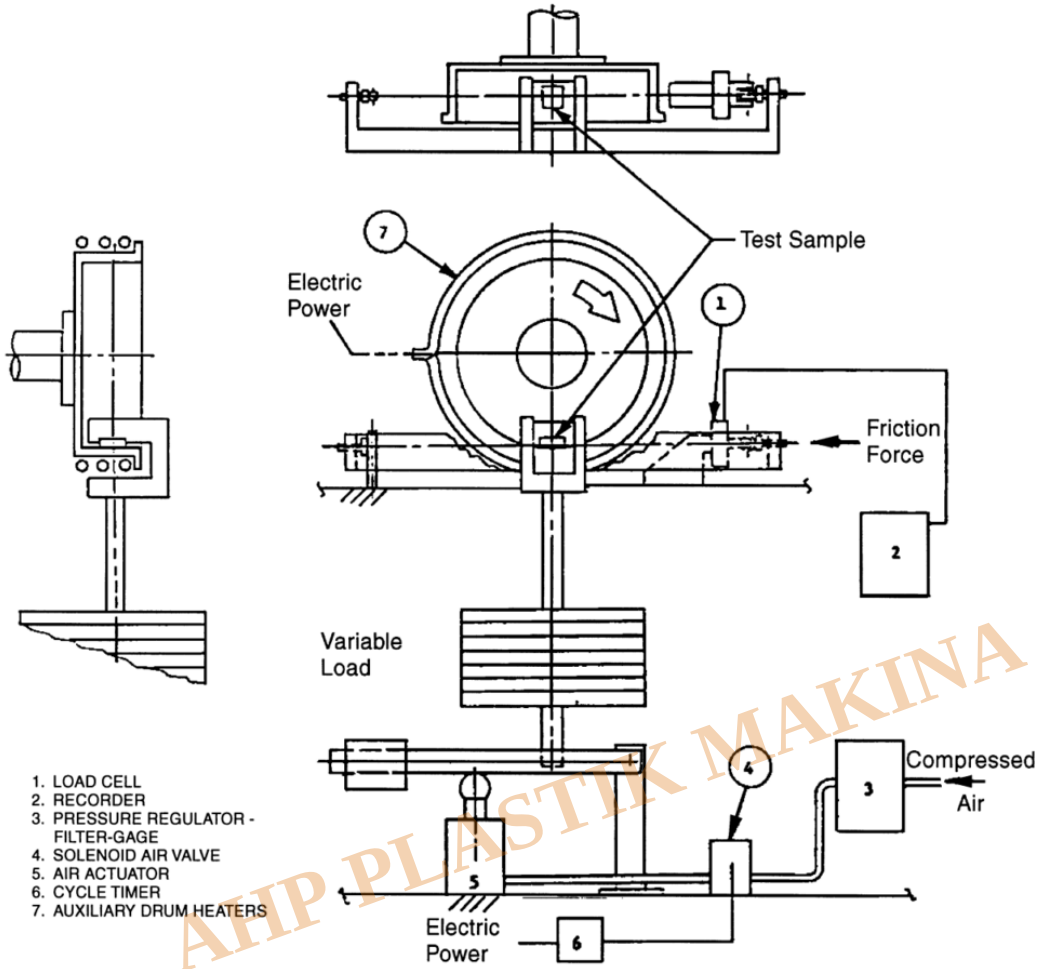

FIGURE 1—SCHEMATIC DIAGRAM OF FRICTION MATERIALS FOR TEST MACHINE

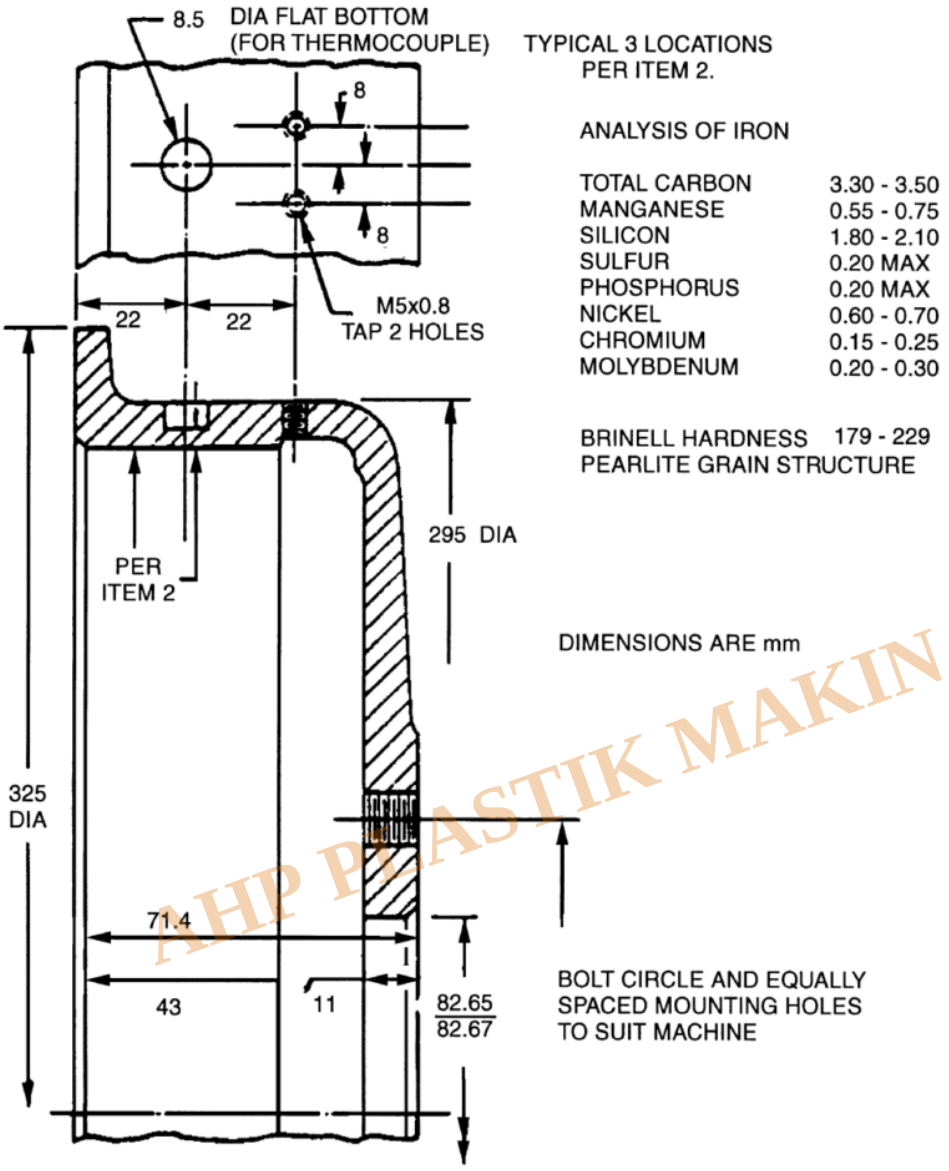

FIGURE 2—FRICTION MATERIALS TEST MACHINE DRUM

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 277.4 to 279.9 mm (10.920 to 11.020 in) 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 277.4 mm (10.920 in).
The thermocouple should be mounted in the position indicated in Table 1:

TABLE 1—THERMOCOUPLE POSITIONS

Drum Inside Diameter	Location in Drum
277 - 278 mm	1
278 - 279 mm	2
279 - 280 mm	3

4 Test Conditions—Actual tests for performance shall be started when preparations have been completed in
accordance with Section 5.
4.1 Conduct of Test—All testing shall proceed without interruption.
4.2 Drum Speeds—All drum speeds (r/min) are based on a nominal 279.4 mm (11.0 in) diameter drum with load applied to the specimen.

5 Procedure
5.1 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 have dimensions of 25.4 mm x 25.4 mm (1.0 in x 1.0 in), 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 (0.01 in), but not more than 0.5 mm (0.02 in) from the working surface of the specimen. For unground linings (directly from molds), remove 1.0/1.2 mm (0.04/0.05 in) to be certain that the resin impregnated surface is totally removed. Specimen thickness (or specimen plus shim) should be approximately 6 mm (0.24 in) 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 (0.20 in), remove a 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.

5.2 Preparation of Test Drum Surface
5.2.1 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 cheesecloth, white paper toweling, or equivalent. Complete the surface preparation by running a reference specimen continuously at 440 N (100 lb), 417 r/min and not over 93 °C (200 °F) until the friction coefficient has stabilized.
5.2.2 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.
5.3 Conditioning of Test Specimen—The specimen is burnished at 312 r/min, 440 N (100 lb), and a maximum temperature of 93 °C (200 °F), for a minimum of 20 min, to obtain at least 95% contact.
5.4 Initial Thickness and Mass Measurement—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 min at 222 N (50 lb) and 208 r/min. Initial clearance between specimen and drum should be 0.3 to 0.4 mm in the “OFF”

position.

5.5 Initial Wear Measurement—With drum stationary and its temperature between 88 °C (190 °F) and 99 °C (210 °F) with 667 N (150 lb) on specimen, obtain indicator reading of height of specimen holder and record. Test Runs
6.1 Baseline Run—Run 10 s “ON” (load applied) and 20 s “OFF” (load removed) at 667 N (150 lb) and 417 r/min for 20 applications.
Start run at a drum temperature of 82 to 93 °C (180 to 200 °F) and maintain the maximum and minimum
temperature during each successive application between 82 to 104 °C (180 to 220 °F) with the use of cooling air. Turn cooling air off on 20th load application.
6.2 First Fade Run—Allow drum to cool with drum rotating and heating and cooling means off. At 82 °C (180 °F) apply specimen and energize heating elements. Run continuous drag at 667 N (150 lb) and 417 r/min. Run for either 10 min or until 288 °C (550 °F) is attained, whichever occurs first. Take readings of friction force at intervals of 28 °C (50 °F), starting at 93 °C (200 °F). Record time required to reach 288 °C (550 °F).
6.3 First Recovery Run—Immediately following completion of First Fade Run (6.2), turn off heater and turn on cooling means and make a 10 s application at 667 N (150 lb) and 417 r/min at 260 °C (500 °F), 204 °C
(400 °F), 149 °C (300 °F), and 93 °C (200 °F) during cooling.
6.4 Second Wear Measurement—Repeat Initial Wear Measurement (5.5).
6.5 Wear Run—Run 20 s “ON,” 10 s “OFF,” at 667 N (150 lb) and 417 r/min for 100 applications. Start run at a drum temperature of 193 to 204 °C (380 to 400 °F) and maintain maximum and minimum temperature during each application between 193 to 216 °C (380 to 420 °F) with use of cooling air.
6.6 Third Wear Measurement—Immediately upon completion of Wear Run (6.5), cool to 88 to 99 °C (190 to 210 °F) and repeat Initial Wear Measurement (5.5).

6.7 Second Fade Run—Upon completion of Third Wear Measurement, allow drum to cool with drum rotating and heating and cooling means off. At 82 °C (180 °F) apply specimen and energize heating elements. Run continuous drag at 667 N (150 lb) and 417 r/min. Run for either 10 min or until 343 °C (650 °F) is attained, whichever occurs first. Take readings of friction force at intervals of 28 °C (50 °F), starting at 93 °C (200 °F). Record time required to reach 343 °C (650 °F).
6.8 Second Recovery Run—Immediately upon completion of Second Fade Run (6.7), turn off heater and turn on cooling means and make a 10 s application at 667 N (150 lb) and 417 r/min at 316 °C (600 °F), 260 °C (500 °F), 204 °C (400 °F), 149 °C (300 °F), and 93 °C (200 °F) during cooling.
6.9 Baseline Rerun—Repeat Baseline Run (6.1).
6.10 Final Wear Measurement—Repeat Initial Wear Measurement (5.5).
6.11 Final Thickness and Mass Measurements—Measure and weigh as described in Initial Thickness and Mass Measurements (5.4).

Selection of Plot Point for Friction Coefficient Value—During intermittent application runs, the friction coefficient values are taken at the end of the application.

8 Presentation of Test Data
8.1 Data should be presented on Master Form Log Sheet (Figure 3).

Material _____ Job No. _____
Test No. _____

Lot _____ Date _____
Operator _____

Reference _____

	Mass	Thickness	Indicator Reading
INITIAL			
FINAL			
LOSS			

APPL NO.	FIRST BASELINE FRICTION FORCE lb	μ*
1		
5		
10		
15		
20		

TEMP °F	FIRST RECOVERY FRICTION FORCE lb	μ
200		
250		
300		
350		
400		
450		
500		
550		

MIN AT 550 °F _____ F AT 10 MINUTES

WEAR TEST

INDICATOR READING _____

APPL. NO	FRICTION FORCE lb	μ
1		
10		
20		
30		
40		
50		
60		
70		
80		
90		
100		

INDICATOR READING _____

TEMP °F	SECOND BASELINE FRICTION FORCE lb	
200		
250		
300		
350		
400		
450		
500		
550		
600		
650		

MIN. AT 650 °F _____ F AT 10 MINUTES

TEMP °F	SECOND RECOVERY FRICTION FORCE lb	
600		
500		
400		
300		
200		

TEMP °F	FIRST RECOVERY FRICTION FORCE lb	μ
500		
400		
300		
200		

APPL. NO.	SECOND BASELINE FRICTION FORCE lb	
1		
10		
15		
20		

REMARKS: _____

FIGURE 3—MASTER FORM LOG SHEET

8.2 Data should be plotted on master Form Plot Sheet (Figure 4).

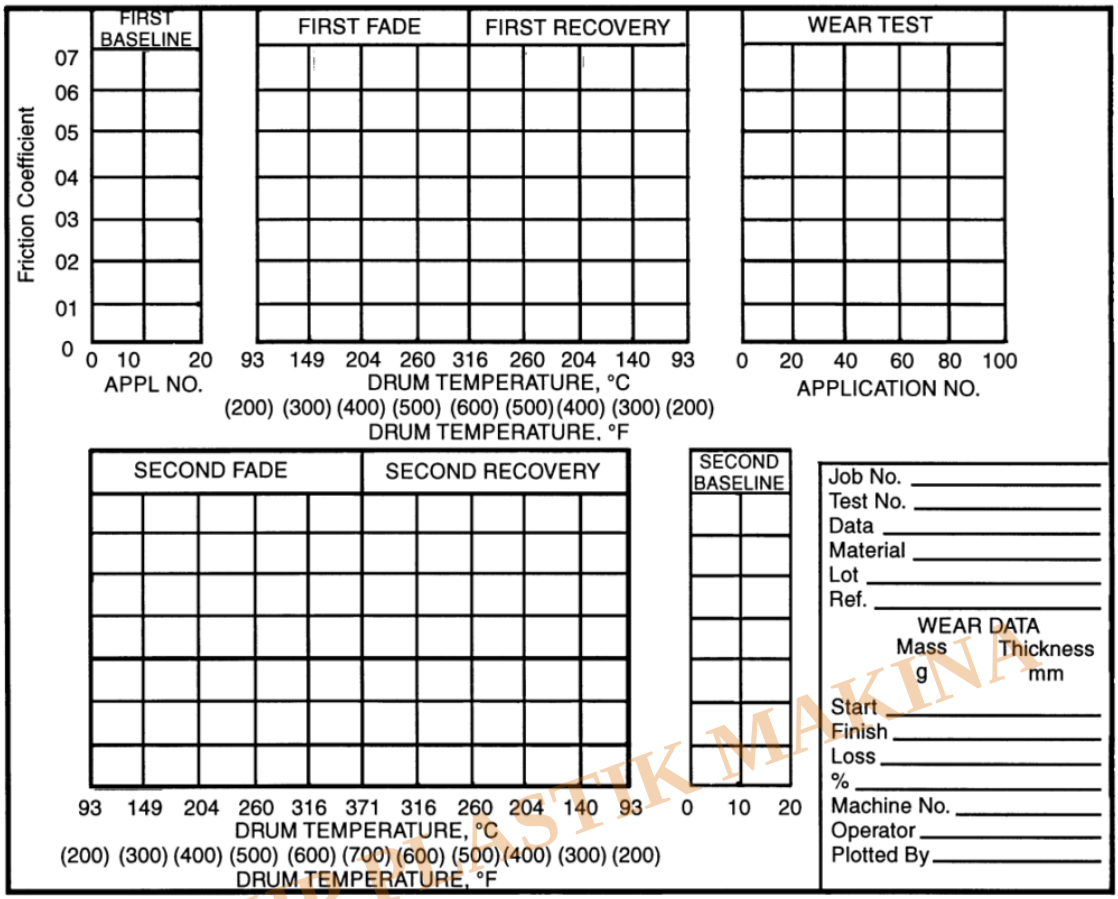

FIGURE 4—MASTER FORM PLOT SHEET

Brake Lining Friction Tester

- According to SAE J661
- Sample size 1*1 inch
- computer controlled
- Software is included
- PLC electric panel
- 6 KW heating
- 1.5 KW air cooling

- Temperature control up to 600 C
- Main rotor up to 1000 rpm
- Normal load up to 2000 N servo controlled
- Automatic calculation of standard parameters

Category

1. Equipment for Standards
2. Standards