SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2654 APR2012

Issued 2004-08
Reaffirmed 2012-04

Superseding J2654 AUG2004

Hardness of Brake Lining

RATIONALE

J2654 has been reaffirmed to comply with the SAE five-year review policy.

1. Scope

Hardness measurements are used as a quality control check of the consistency of formulation and processing of brake linings. This hardness method is nondestructive.

NOTE—This method is not a measure of friction level.

The hardness and the range of hardness are characteristic of each formulation; therefore, the acceptable values and ranges must be established for each formulation and may be affected by processing.

NOTE—The hardness of sintered powder metal lining is usually determined with Rockwell superficial hardness equipment. (See ASTM B 347)

1.1 Purpose

To measure the Rockwell hardness of brake linings.

a. Rockwell hardness measures the depth of penetration.
b. Gogan hardness measures the compression of the materials under load. (See SAE J379)

2. References

2.1 Applicable Publications

2.1.1 JAPANESE INDUSTRIAL STANDARD

Available from JSA, 1-24, Akasaka 4, Minatoku, Tokyo 107-8440, JAPAN, www.jsa.or.jp

JIS D4421—Method of Hardness Test for Brake Linings, Pads, and Clutch Facings of Automobiles

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http://www.sae.org/technical/standards/J2654_201204

2.1.2 ASTM PUBLICATIONS

Available from ASTM International, 100 Barr Harbor Dr., West Conshohocken, PA 19428, USA (www.astm.org)

ASTM B 347—Standard Method of Test for Hardness of Sintered Metal Friction Materials
ASTM D 785—Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
ASTM E 18—Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

2.1.3 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J379—Gogan Hardness of Brake Lining

3. Definitions

3.1 Rockwell Hardness

The value of hardness is obtained from the following formula:

$$HR = 130 - 500h \qquad \text{(Eq. 1)}$$

Where h (mm) is the difference between the depths of penetration of the indenter under the first and second applications of the minor load. The minor load is first applied to the specimen using the indenter, then the major load is applied and then the load is returned to the minor load.

3.2 Scale

The Symbol which denotes the combination of the type of indenter and loads.

4. Temperature And Humidity For Testing

It is recommended the test be run with a consistent temperature and humidity, which should be recorded in the report. ASTM recommends the test be carried out in a room at a temperature 23 ± 2 °C, and a relative humidity of 50 ± 5%.

5. Equipment and Apparatus

5.1 Testing Machine

The Rockwell hardness testing machine shall be as follows:

a. The testing machine shall comply with ASTM E 18 and be calibrated per ASTM D 785
b. If the indenter is changed or removed and reinstalled, at least two tests should be performed to seat the indenter. Data from these tests should be discarded. Manually seating the indenter is insufficient to provide accurate measurements.

5.2 Sample Support

The sample shall be supported so that it does not shift nor flex during the test. For disc pad assemblies direct testing of the ground surface is possible if sufficient flat space to support the pad is available on the back of the steel. For drum linings, a fixture should be made to support the lining during the test. For curved samples the fixture shall be of the same radius as the test sample and shall be of sufficient length to support the lining so it does not move.

6. Sample

The sample shall be as follows:

a. The sample may be an assembly, lining, pad, or section thereof. The sample shall be thick enough so that no change appears on the back face due to generation of indentation. For friction material samples less than 5mm thick, the results may be affected by the thickness.
b. If preconditioning is required, the sample shall be allowed to stand in a desiccator for 24 hours or more, or shall be dried in a hot air circulating dryer maintained at 150 °C for 1 hour and then cooled to test temperature in a desiccator. The hardness may be affected by humidity.

7. Test Procedures

TABLE 1—ROCKWELL HARDNESS SCALES

Scale	Symbol for hardness	Indenter Diameter (Steel Ball)		Minor load	Major load
		mm	in.		
M	HRM	6.350±0.0025	0.2500±0.0001	98.07N 10kg	980.7N 100kg
R	HRR	12.700±0.0025	0.5000±0.0001	98.07N 10kg	588.4N 60kg
S	HRS	12.700±0.0025	0.5000±0.0001	98.07N 10kg	980.7N 100kg
V	HRV	12.700±0.0025	0.5000±0.0001	98.07N 10kg	1471.0N 150kg

7.1 Preparation Before Test

The following preparation shall be carried out before Rockwell hardness testing:

a. In general, scale R or S shown in Table 1 is recommended as the hardness scale. If the value of hardness obtained based on scale S does not fall within range of about 50 to 115, another scale should be selected from Table 1 so that the value falls within a range of 50 to 115.
b. It shall be verified that the steel ball is clean and free from flaws.
c. The support and mounting surfaces shall be clean.