The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J379

REAF. MAR96

Issued 1969-01
Reaffirmed 1996-03

Superseding J379a

GOGAN HARDNESS OF BRAKE LINING

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

1. ***Scope*—**Gogan hardness, a nondestructive (a penetrator causes shallow surface deformation) method of measuring compressibility, is used as a quality control check of the consistency of formulation and processing of brake lining. Gogan hardness alone shows nothing about a lining's ability to develop friction or to resist fade when used as a friction element in brakes. Gogan hardness varies with formulation, contour, and thickness of the lining.

The Gogan hardness and the range of Gogan hardness are peculiar to each formulation, thickness, and contour and, therefore, the acceptable values or range must be established for each formulation and part configuration by the manufacturer.

1.1 The hardness of sintered powder metal lining is usually determined with Rockwell Superficial hardness equipment. Reference ASTM B 347.

1.2 **Purpose—**To establish a uniform procedure for determining the Gogan hardness of brake lining.

2. ***References***

2.1 **Applicable Publication—**The following publication forms a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 347—Standard Method of Test for Hardness of Sintered Metal Friction Materials

3. ***Equipment*—**A commercially available Gogan Model 911 (or equivalent) direct reading hardness testing machine is required. In this machine the flat end of a cylindrical penetrator is forced against the lining supported by a matching anvil. The Gogan hardness number is the distance, in units of 0.0064 mm (0.00025 in) that the penetrator advances into the lining, while the force on the penetrator increases from the initial or minor load to the final or major load. Two systems are used: 14.71 or 29.42 kN (1500 or 3000 kg) major loads with nominal 4.90 and 14.71 kN (500 and 1500 kg) minor loads, respectively.

QUESTIONS REGARDING THIS DOCUMENT: (412) 772-8512 FAX: (412) 776-0243
TO PLACE A DOCUMENT ORDER; (412) 776-4970 FAX: (412) 776-0790
http:\\www.sae.org

3.1 The test cycle is initiated by closing an electric switch, causing the penetrator to approach and contact the lining sample and start to apply the test load. When the minor load is reached, the hardness indicator is engaged to the penetrator and the two timers that control the actual test cycle are activated. At 0.75 s (ET_1), the hardness indicator is disengaged and arrested. The major load is reached prior to the ET_1 setting, the time depending upon the hardness of the lining penetrator travel, and the force buildup in the hydraulic system. At 1.75 s (ET_2), the cycle is terminated and the machine returns to its idle position and is reset for the next test. The 1 s interval between ET_1 and ET_2 provides sufficient dwell for the operator to read the Gogan hardness dial indicator. Four test combinations are possible utilizing 25.39 or 19.05 mm (1 or 0.75 in) diameter penetrators with either 14.71 or 29.43 kN (1500 or 3000 kg) major loads. This requires that Gogan hardness numbers be prefixed with a scale symbol representing the load and penetrator as listed in Table 1. The combination of the load and penetrator is selected to provide the greatest sensitivity with the least damage to the lining. Usually, this is accomplished when the Gogan readings fall within the ranges shown, although the desirable range will differ with formulation and the configuration of the lining, particularly its thickness and curvature.

TABLE 1—GOGAN HARDNESS SCALES

Scale Symbol	Major Load kN	Major Load kg	Nominal Minor Load kN	Nominal Minor Load kg	Penetrator Diameter mm	Penetrator Diameter in	Recommended Range of Gogan (G) Numbers
A	14.71	1500	4.90	500	25.39	1	GA10-GA80
B	29.42	3000	14.71	1500	25.39	1	GB10-GB80
C	14.71	1500	4.90	500	19.05	3/4	GC10-GC80
D	29.42	3000	14.71	1500	19.05	3/4	GD10-GD80

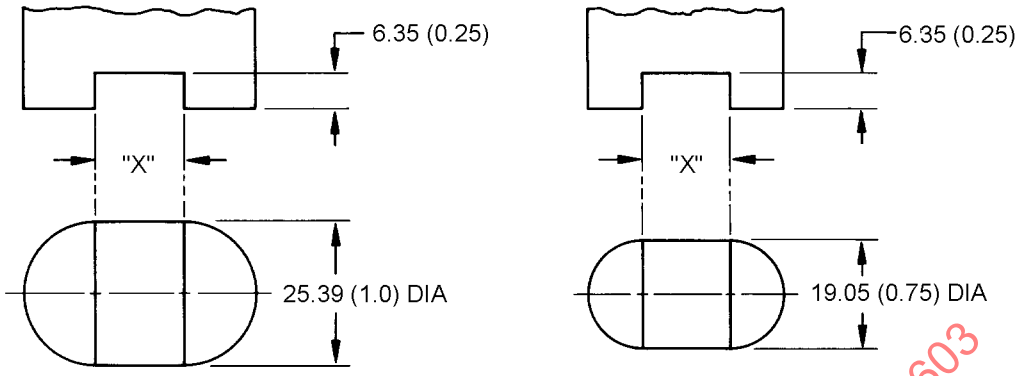
4. Test Machine Specifications

4.1 **Minor Load—**Nominal 4.90 or 14.71 kN (500 or 1500 kg).

4.2 **Major Load—**14.71 or 29.42 kN (1500 or 3000 kg).

4.3 **Penetrator Diameter—**25.39 or 19.05 mm (1 or 0.75 in).

4.4 **Split Penetrator—**For grooved lining, has a flat end face consisting of two semicircles, either 25.39 or 19.05 mm (1 or 0.75 in) in diameter, spaced apart a minimum of the groove width plus 6.4 mm (0.25 in) as shown in Figure 1.



"X" = (LINING GROOVE WIDTH PLUS
6.35 (0.25) MINIMUM)

DIMENSIONS ARE mm (in)

FIGURE 1—SPLIT PENETRATOR END

4.5 **Timers—**Reference Gogan Machine Co., Wiring Diagram XE-1473. ET_1—0.75 s, ET_2—1.75 s.

4.6 **Anvil for Curved Lining—**Curved to minimum inside radius specified for lining. Chord length, 50.8 mm (2 in); minimum width, 50.8 mm (2 in).

Anvil for Flat Lining—Minimum 44.4 mm (1-3/4 in) diameter flat.

4.7 **Penetrator Travel to Upper Surface of Lining—**13 mm ± 3 mm (1/2 in ± 1/8 in).

5. Operating Procedure

5.1 Position anvil in socket of anvil, adjusting screw after making sure seating surfaces are clean.

5.2 Position brake lining on anvil. Adjust backstop so that penetrator is no closer than 3 mm (1/8 in) to edge of lining.

NOTE—The penetrator must be completely supported by brake lining with a minimum of 3 mm (1/8 in) to any edge of the lining or groove for a valid Gogan hardness test.

A split penetrator will be used when the dimensions of the lining grooves on either side of the braking or shoe surface make it impossible to provide 3 mm (1/8 in) clearance between the OD of the penetrator and the edge of the lining or groove.

In positioning grooved brake lining on the anvil, adjust the backstop so the groove in the lining is centered with the penetrator and rotate the anvil so the groove in the lining and the groove in the penetrator are parallel. Gogan hardness numbers taken on grooved lining with a split penetrator are prefixed with an additional symbol, "S," as in Table 1; thus, GAS, GBS, GCS, and GDS.

5.3 With square bar gage, adjust space between penetrator and top of lining to 13 mm ± 3 mm (1/2 in ± 1/8 in). Tighten adjusting screw clamping nut.

5.4 Start machine pump. Allow 2 min minimum warmup. Operate machine a few times to seat anvil and eliminate backlash of anvil screw.

5.5 Test the lining at the desired locations and note the Gogan hardness from the dial indicator.

6. Calibration Procedure

6.1 Calibrate the Gogan hardness tester in accordance with the following:

a. Timers set as follows—ET_1—0.75s, ET_2—1.75s.
b. Penetrator size—10 mm ball. Anvil size—203.2 mm (8 in) spherical radius.
c. Check hardness tester with standard Brinell test block.

1. 14.71 kN (1500 kg) load:

   2.50–2.55[1] test block 25.1–25.5 hardness reading
   2.55–2.60[1] test block 25.5–26.2 hardness reading

2. 29.42 kN (3000 kg) load:

   3.20–3.25[1] test block 32.0–32.5 hardness reading

6.2 Major Calibration and Resetting of Gogan Hardness Tester

a. If machine is out of calibration, check the major load with either a load cell or proving ring, or by Brinelling a polished steel block of known hardness and reading the impression diameter with an accurate glass. Adjust major load pressure regulating valve to obtain correct load.
b. If major load is correct and calibration is off, adjust minor load pressure switch until indicator shows correct Gogan reading for standard Brinell test block.

PREPARED BY THE SAE BRAKE FORUM COMMITTEE

1. Brinell indentation diameter.