



Designation: G75 – 15 (Reapproved 2021)

Standard Test Method for Determination of Slurry Abrasivity (Miller Number) and Slurry Abrasion Response of Materials (SAR Number)¹

This standard is issued under the fixed designation G75; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a single laboratory procedure that can be used to develop data from which either the relative abrasivity of any slurry (Miller Number) or the response of different materials to the abrasivity of different slurries (SAR Number), can be determined.

1.2 The test data obtained by this procedure is used to calculate either a number related to the rate of mass loss of duplicate standard-shaped 27 % chromium iron wear blocks when run for a period of time in the slurry of interest (Miller Number), or to calculate a number related to the rate of mass loss (converted to volume loss) of duplicate standard-shaped wear specimens of any material of interest when run for a period of time in any slurry of interest (SAR Number).

1.3 The requirement for a finished flat wearing surface on the test specimen for a SAR Number test may preclude application of the procedure where thin (0.051 mm to 0.127 mm), hard, wear-resistant coatings will not allow for surface finishing. The 6 h total duration of the SAR Number Test may not allow establishment of a consistent rate-of-mass-loss of the unfinished surface.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee G02 on Wear and Erosion and is the direct responsibility of Subcommittee G02.30 on Abrasive Wear.

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2. Referenced Documents

2.1 *ASTM Standard*:²

G40 Terminology Relating to Wear and Erosion

2.2 *Military Standard*:

MIL-R-6855C Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes³

3. Terminology

3.1 *Definitions*:

3.1.1 Definitions used in this test method are in accordance with Terminology G40 as follows:

3.1.2 *abrasive wear*—wear due to hard particles or hard protuberances forced against and moving along a solid surface.

3.1.3 *corrosive wear*—wear in which chemical or electrochemical reaction with the environment is significant.

3.1.4 *abrasion-corrosion*—a synergistic process involving both abrasive wear and corrosion in which each of these processes is affected by the simultaneous action of the other and, in many cases is thereby accelerated.

3.1.5 *cumulative erosion-time curve*—a plot of cumulative erosion versus cumulative exposure duration, usually determined by periodic interruption of the test and weighing of the specimen. This is the primary record of an erosion test. Most other characteristics, such as the incubation period, maximum erosion rate, terminal erosion rate, and erosion rate-time curve, are derived from it.

3.1.6 *erosion*—progressive loss of original material from a solid surface due to mechanical interaction between that surface and a fluid, a multi-component fluid, or impinging liquid or solid particles.

3.1.7 *erosion-corrosion*—a conjoint action involving corrosion and erosion in the presence of a corrosive substance.

3.1.8 *instantaneous erosion rate*—the slope of a tangent to the cumulative erosion-time curve at a specified point on that curve.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *mass concentration*—the mass of solid particles per unit mass of mixture, expressed in percent.

3.2.2 *Miller Number*—a measure of slurry abrasivity as related to the instantaneous rate of mass loss of a standard metal wear block at a specific time on the cumulative abrasion-corrosion time curve.

3.2.3 *SAR Number*—a measure of the relative abrasion response of any material in any slurry, as related to the instantaneous rate of mass-loss of a specimen at a specific time on the cumulative abrasion-corrosion time curve, converted to volume or thickness loss rate.

3.2.4 *slurry*—a mixture of solid particles in liquid, of such a consistency as to be capable of being pumped like a liquid.

3.2.5 *slurry abrasivity*—the relative tendency of a particular moving slurry to produce abrasive and corrosive wear compared with other slurries.

4. Summary of Test Method

4.1 The relative effect of slurry abrasivity in both the Miller Number and the SAR Number is determined by using the measured mass loss of a standard-shaped 27 % chrome iron metal wear block (Miller Number); or a metal, ceramic, composite, plastic, or elastomer wear specimen (SAR Number), driven in a reciprocating motion by a rotating crank, riding in the bottom of a trough containing the slurry. A direct load is applied to the wear block or wear specimen. For each test, the bottom of the trough is equipped with a new piece of a sheet of Neoprene⁴ to act as a lap. The interior of the trough has a flat-bottomed or truncated “V” shape trough that confines the slurry particles to the path taken by the wear block or wear specimen. At one end of each stroke, the wear block wear specimen is lifted off the lap by a cam action for sufficient time to allow fresh slurry material to flow under the wear block or wear specimen. The wear block/wear specimen holder is made of plastic, as are the troughs, so that electrolysis inherent in certain slurries is minimized.

4.2 The test consists of measuring the mass loss of a part that is referred to either a wear block or wear specimen to be consistent with Section G34 of Form and Style for ASTM Standards. Standard wear blocks of 27 % chrome iron are used for the Miller Number test where the slurry is the specimen and the results are the relative abrasivity of the slurry. Wear specimens are used in the SAR Number test where the test results are the relative wear rate of different wear specimens in a given slurry.

4.3 This test method was originally developed as a 16 h test to be run in 4 h increments. However, experience has shown that the extended test length is unnecessary and it has been established that a 6 h test, run in 2 h increments, gives essentially equivalent results. The current revision is based on the shorter test procedure.

⁴ Neoprene is a registered trademark of E. I. du Pont de Nemours and Co., Wilmington, DE 19898.

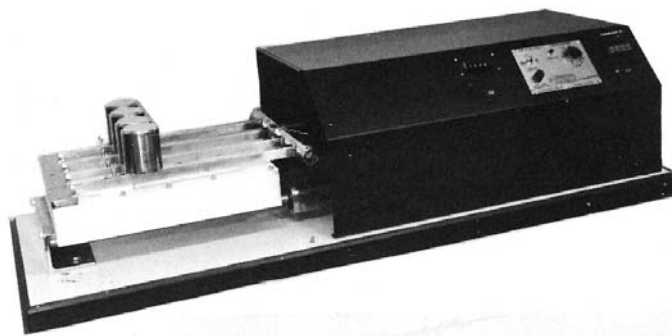


FIG. 1 Miller Number Machine

5. Significance and Use

5.1 The Miller Number⁵ is an index of the relative abrasivity of slurries. Its primary purpose is to rank the abrasivity of slurries in terms of the wear of a standard reference material. The wear damage on the standard wear block is worse as the Miller Number gets higher.

5.2 The SAR Number is an index of the relative abrasion response of materials as tested in any particular slurry of interest. The SAR Number is a generalized form of the Miller Number applicable to materials other than the reference material used for the Miller Number determination. A major purpose is to rank construction materials for use in a system for pumping and fluid handling equipment for a particular slurry. It can also be used to rank the abrasivity of various slurries against any selected construction material other than the reference material specified for a Miller Number determination. The slurry damage on the specimen of material being tested is worse as the SAR Number gets higher.

5.3 Experience has shown that slurries with a Miller Number or a SAR Number of approximately 50 or lower can be pumped with minor abrasive damage to the system. Above a number of 50, precautions must be observed and greater damage from abrasion is to be expected. Accordingly, the Miller Number and the SAR Number provide information about the slurry or the material that may be useful in the selection of pumps and other equipment and to predict the life expectancy of liquid-end parts of the pumps involved.

5.4 The SAR Number can be used to determine the most suitable materials for certain slurry systems.

6. Apparatus

6.1 Figs. 1 and 2 show the arrangement of a typical test machine.⁶

⁵ “The Miller Number—A New Slurry Rating Index,” AIME Paper 73-B-300, SME Meeting, Pittsburgh, PA, 1973.

⁶ The sole source of supply of the machine and parts, including laps and wear blocks, known to the committee at this time is Falex Friction and Wear Test Machines, 1020 Airport Dr., Sugar Grove, IL 60554. If you are aware of alternate suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful attention at a meeting of the responsible technical committee,¹ which you may attend.