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

SURFACE VEHICLE STANDARD

SAE J997 REV. SEP90

Issued 1967-08
Revised 1990-09-10

Superseding J997 OCT88

Submitted for recognition as an American National Standard

(R) SPARK ARRESTER TEST CARBON

1. SCOPE:

This SAE Standard establishes physical properties required of SAE Coarse Test Carbon and SAE Fine Test Carbon, and establishes test methods to ensure that these requirements are met.

1.1 Purpose:

The purpose of this document is to establish specifications for test carbon to be used when performing the tests described in SAE J335, J342, and J350.

2. REFERENCES:

2.1 Applicable Documents:

SAE J335 Multiposition Small Engine Exhaust System Fire Ignition Suppression

SAE J342 Spark Arrester Test Procedure for Large Size Engines

SAE J350 Spark Arrester Test Procedure for Medium Size Engines

ASTM E 11

3. TEST CARBON REQUIREMENTS:

3.1 Type:

The test carbon shall be petroleum coke.

3.2 Form:

The test carbon shall be granular in form.

3.3 Size:

The size distribution of particles of test carbon shall be as follows:

3.3.1 Fine Carbon:

a. Pass through U.S. Standard No. 16 Sieve: 100% by mass
b. Retained on U.S. Standard No. 20 Sieve: 70% by mass
c. Retained on U.S. Standard No. 30 Sieve: 30% by mass

3.3.2 Coarse Carbon:

a. Pass through U.S. Standard No. 8 Sieve: 100% by mass
b. Retained on U.S. Standard No. 12 Sieve: 60% by mass
c. Retained on U.S. Standard No. 16 Sieve: 40% by mass

3.3.3 Mixing: Before use, mix screened fractions by pouring from one container to another at least five times.

3.4 Activity:

The test carbon shall conform to the commercial definition of "activated carbon."

3.5 Apparent Density:

0.5 to 0.6 g/cm^3 when vibrated to minimum volume (see 4.1.)

3.6 Strength:

75 to 90% (see 4.2.)

4. TEST METHODS:

4.1 Apparent Density:

4.1.1 Principle: The apparent density is the mass of a unit volume of the sample, including the pores and voids between the particles. It is obtained by measuring the volume of a weighed sample in a graduate.

4.1.2 Apparatus:

4.1.2.1 A balance of 100 g capacity, accurate to 0.01 g.

4.1.2.2 A 100 cm^3 graduated cylinder, accurate to 0.01 cm^3.

4.1.2.3 A vibrating table, such as shown in Figure 1. The table shown in Figure 1 is a 3/4 in (19 mm) air vibrator fastened to the vibrating table which is supported on rubber belting. Any shaker that provides adequate packing of the sample may be used.

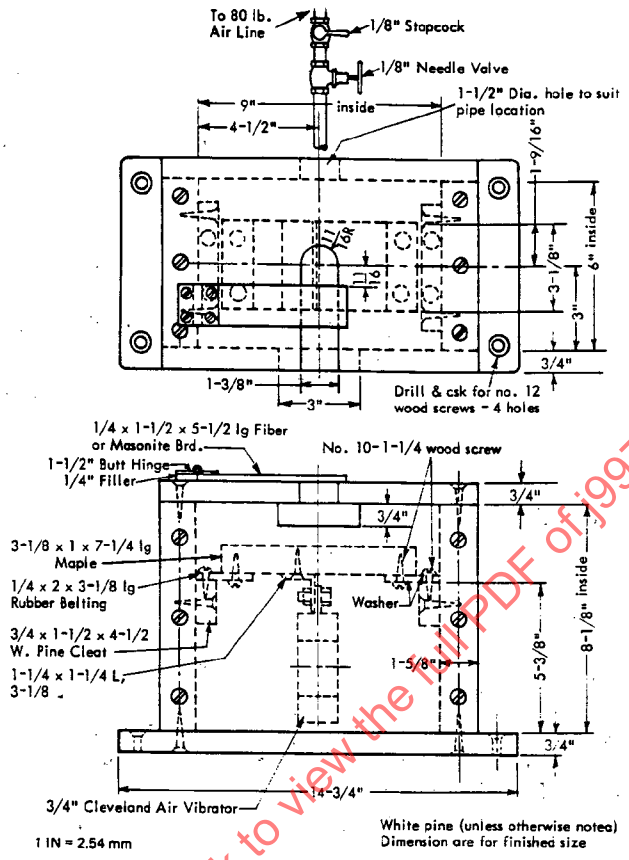

FIGURE 1 - Apparent Density of Activated Carbon

4.1.3 Procedure:

4.1.3.1 Dry 50 g of the sample for at least 6 h at 150°F. Either rough screened or final screened carbon may be used. See A.1 and A.2.

4.1.3.2 Loosely support the graduated cylinder on the vibrating table and start the vibrator.

4.1.3.3 Weigh out a 39.5 to 40.5 g portion of the dried sample.

4.1.3.4 Pour the sample slowly into the graduated cylinder. The vibrator shall be in motion all during the time the sample is being poured into the graduate, and shall not be turned off until 60 s after the last of the sample enters the graduated cylinder.

4.1.4 Calculation: (See Eq. 1)

$$\text{Apparent Density} = \frac{\text{mass of dried sample, g}}{\text{volume of sample, cm}} \qquad \text{(Eq.1)}$$

4.2 Strength:

4.2.1 Principle: The average particle size of a sample is determined. The sample is then shaken for a definite time interval with steel balls and the final average particle size again determined. The strength, or resistance to abrasion, is the ratio of the final average particle size to the original.

An alternative strength measurement method may be used, provided that the accuracy of the alternative method is established by at least three replicate tests using the alternative method and the method described in 4.2 of this document. No alternative method shall be used if it does not provide the same strength values for all three replicate samples, within 2% of the strength value obtained using the method described in 4.2.

4.2.2 Apparatus:

4.2.2.1 A W.S. Tyler Company Ro-Tap sieve shaking machine with sieves and special strength pan, or equivalent.

4.2.2.2 Six U.S. Standard Sieves, No. 4, 6, 8, 12, 16, and 20.

4.2.2.3 A special strength pan with a concave bottom. The pan may be constructed from a standard 8 in (203 mm) diameter Tyler pan (or equivalent) by replacing the bottom of the pan with a brass plate which has been turned 5/16 in (7.9 mm) thick at the circumference and tapers to 1/8 in (3.17 mm) thick in the center. The taper should be cut on a 43 in (1.09 m) radius and should extend from the center to the edge of the pan.

4.2.2.4 Twenty 1/2 in (12.7 mm) steel balls and ten 3/4 in (19 mm) steel balls.

4.2.2.5 A balance of 100 g capacity, accurate to 0.01 g.

4.2.3 Procedure:

4.2.3.1 Dry a 100 to 110 g sample for at least 6 h at 150°F. Either rough screened or final screened carbon may be used. See A.1 and A.2.

4.2.3.2 Place 100 g of the sample on the top sieve of the six sieves. Shake the sieves for 10 min on the sieve shaker. Weigh the material remaining on each sieve. Compute the average particle size of the sample from the weighted average of each sieve fraction as described in Table 1:

TABLE 1[1]

Retained On	Mass, g	Mean Sieve Opening	Weighted Average
No. 6 Sieve	22.8	4.01 mm	91.4
No. 8 Sieve	36.5	2.84 mm	103.7
No. 12 Sieve	24.1	2.00 mm	48.2
No. 16 Sieve	15.1	1.41 mm	21.3
No. 20 Sieve	0.9	1.00 mm	0.9
Pan	0.6	0.00 mm	0.0

[1]Mass x Mean Sieve Opening = Weight Average

4.2.3.3 After the original particle size of the sample has been determined, combine the screen fractions and shake the whole sample on the shaker for 20 min in the special strength pan with the 30 steel balls. At the end of the 20 min shaking interval, pour the sample on the top nested sieve, remove the balls, and shake the sieves for 10 min as before to separate the screen fractions.

4.2.3.4 Weigh the carbon on each sieve and determine the average particle size as in 4.2.3.2.

4.2.4 Calculation: (See Eq. 2)

$$\text{Strength} = \frac{\text{Final Average Particle Size}}{\text{Initial Average Particle Size}} \times 100 \qquad \text{(Eq.2)}$$

The (R) is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

APPENDIX A

A.1 CARBON SIZE:

Experience has shown that commercial suppliers cannot consistently supply carbon that meets this document. For this reason, it is suggested that the user perform the final sieving of the carbon to obtain samples for test use. The following commercially available "rough screened" carbon sieve analyses have proven to be satisfactory for final crushing and screening:

A.1.1 For Coarse Carbon:

TABLE A1 - Suppliers Coarse Carbon Rough Screen Analysis Specification

Retained on U.S. Standard Sieve No.	Mass %
8	0-10
12	40-60
16	30-40
20	0-10
Pan	0-1

A.1.2 For Fine Carbon:

TABLE A2 - Suppliers Fine Carbon Rough Screen Analysis Specification

Retained on U.S. Standard Sieve No.	Mass %
14	0-0.5
16	10-30
20	50-70
30	0-25
Pan	0-5

A.2 CARBON FINAL SCREENING:

A.2.1 Coarse Carbon:

A quantity of rough screened material may be sieved through a system of U.S. Standard Sieves 8, 12, and 16 (or their equivalent). Material retained on the No. 12 and No. 16 sieves is combined in the proportions specified under 3.3.2.

A.2.2 Fine Carbon:

A quantity of rough screened material may be sieved through a system of U.S. Standard Sieves 16, 20, and 30 (or their equivalent). Material retained on the No. 30 and No. 20 sieve is combined in the proportions specified under 3.3.1.

A.2.3 Shaking:

If a motorized vibrator shaker is used, material should be shaken in small quantities for approximately 10 min. If hand shaken, a longer shake period should be observed to assure that size segregation is complete.

A.3. ALTERNATE STRENGTH DETERMINATION METHOD:

One alternate method, which has been used to determine strength, utilizes a cyclonic separator. This is acceptable if it provides equivalent strength, ±2%, to the method described in 4.2.

A.4. USED CARBON:

Current practice forbids the use of carbon more than once, though this requirement is not contained in this document. Used carbon may be reused provided it is rescreened and meets all the requirements of this document, and in addition, at least three replicate tests are made using new and used carbon with spark arresters with the same flow rating, ±10%. The results of these replicate tests shall yield spark arrester efficiencies that are identical, ±5%, or the used carbon shall be rejected. Used carbon may be mixed with new carbon in a proportion up to one-third, without replicate testing, provided that the mixture meets all of the requirements of this document.

A.5. REFERENCE MATERIALS:

Refer to SAE J335, J342, and J350 for spark arrester test techniques. The standard screens used are described in ASTM E-11.