Multiposition Small Engine Exhaust System Fire Ignition Suppression—SAE J335b

SAE Recommended Practice
Completely Revised September 1976

THIS IS A PREPRINT AND WILL
APPEAR IN THE NEXT EDITION
OF THE SAE HANDBOOK

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MULTIPOSITION SMALL ENGINE EXHAUST SYSTEM FIRE IGNITION SUPPRESSION—SAE J335b

SAE Recommended Practice

Report of Engine Committee approved April 1968 and completely revised September 1976

1. Purpose—The purpose of this SAE recommended practice is to provide a uniform method of testing to evaluate the fire ignition potential of exhaust systems of small multiposition engines such as used on chain saws.

2. Scope

2.1 This practice establishes equipment and test procedures for determining the performance of exhaust systems of multiposition engines used on chain saws and other hand held portable applications.

2.2 This practice also provides a uniform method of testing which can be used by engine and equipment manufacturers, governmental bodies, and equipment users.

2.3 Recommended performance criteria are given in Appendix A which are considered adequate for the severe fire hazard posed by the heavy vegetative fuels common to the Pacific Northwest. These levels are also believed suitable for other sections of the country where such fire hazards exist. However, it is recognized that during periods of extreme fire danger, exhaust systems meeting this standard may not give absolute protection against fires. Additional control of operations may be necessary during such periods.

3. Spark Arrester Effectiveness Test

3.1 Test Method for Carbon Particle Retention Efficiency—By definition an arrester is 100% efficient for carbon particles equal to or larger than the actual openings of its screens or baffles. No test is required for carbon particle retention of the sizes larger than the actual openings. Spark arresters shall be tested in the position judged to be the least efficient (see 3.8).

3.2 Apparatus—An apparatus as shown in Fig. 1 shall consist of a suitable blower with air directed through the testing apparatus, a flow valve, a back pressure manometer, a screened exhaust vent, a carbon injector, and a trap for collecting the particles.

3.3 Test Runs—Separate test runs shall be made using SAE fine test carbon (see 3.4.1) and SAE coarse test carbon (see 3.4.2).

3.4 Test Carbon—Spark arrester test carbon shall meet specifications of SAE J997.

3.4.1 SAE fine test carbon shall be prepared in accordance with paragraph 2.2.6 of SAE J997.

3.4.2 SAE coarse test carbon shall be prepared in accordance with paragraph 2.2.6 of SAE J997.

3.4.3 Weight of Test Sample—The amount of carbon used for each test run shall be 5 g. See 3.5.4 for exception.

3.4.4 Test carbon should not be reused.

3.5 Back Pressure and Flow

3.5.1 Provision shall be made for measuring flow rate through the arrester and differential pressure from intake to discharge of the arrester.

3.5.2 Unless 3.5.3 applies, the spark arrester shall be tested for two conditions:

(a) at a constant flow rate at which the initial back pressure (prior to test carbon injection) from intake to discharge is 2 in Hg (6.8 kPa)

(b) at a constant flow rate at which the initial back pressure (prior to test carbon injection) from intake to discharge is 1 in Hg (3.4 kPa).

3.5.3 With arresters using a small mesh screen, clogging of the screen may occur before the entire 5 g sample of carbon is injected into the arrester. In these instances, use the following test procedure:

(a) Condition 1—Initially establish an airflow to cause a pressure differential drop of 2 in Hg (6.8 kPa). Then allow the back pressure differential to build up to 2 1/2 in Hg (8.5 kPa). Once the 2 1/2 in Hg (8.5 kPa) is reached, maintain this pressure for the balance of the test.

(b) Condition 2—Initially establish an airflow to cause a pressure differential drop of 1 in Hg (3.4 kPa). Then allow the back pressure differential to build up to 1 1/2 in Hg (5.1 kPa). Once the 1 1/2 in (5.1 kPa) is reached, maintain this pressure for the balance of the test.

3.5.4 Establishment of Maximum Flow Capacity—to establish maximum flow capacity, measure the flow rate which occurs when a new arrester is subjected to a pressure differential from intake to discharge of 2 in Hg (6.8 kPa). No test carbon shall be injected for this part of the test. The assigned flow rate shall be one half the flow rate obtained for the conditions described above.

3.5.5 The flowmeter shall be an accepted design, such as a calibrated orifice. The indicated flow shall be within 5% of actual at the specified flow rate at 2 in Hg (6.8 kPa).

3.6 Injecting Mechanism—The test carbon shall be injected by a feeder mechanism that shall not crush or grind the material nor shall it unduly affect the normal flow of air through the apparatus. It shall be located approximately as shown in Fig. 1. Test carbon shall be injected into the air stream at uniform rate over a period of 15 ± 5 min.

3.7 Carbon Particle Collection—All carbon inside the testing apparatus which has escaped through the spark arrester during each run is to be carefully brushed into the trap and then hand sieved lightly on a U.S.

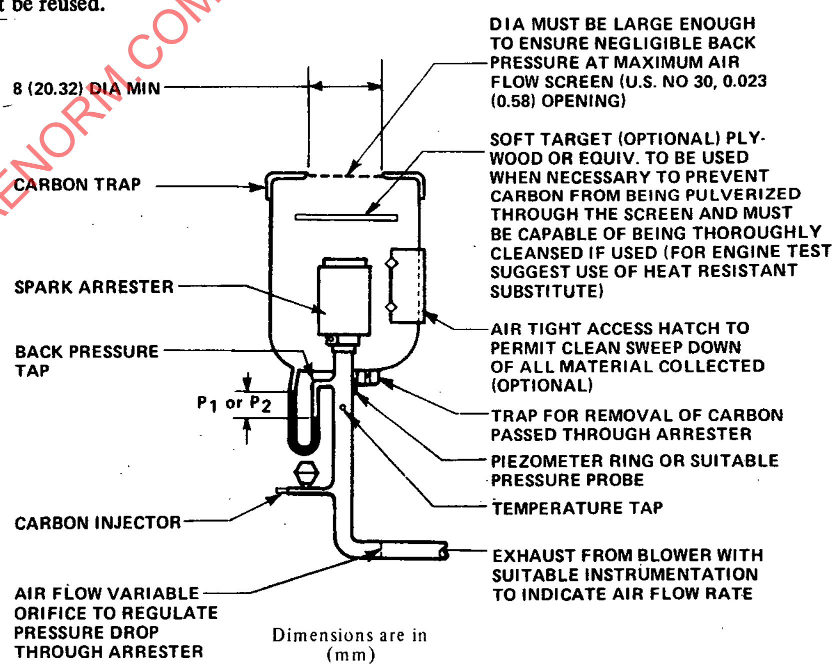

FIG. 1—TEST APPARATUS FOR MEASURING SPARK ARRESTER EFFICIENCY

Standard No. 30 (0.023 in (0.584 mm) opening) screen. Weigh the carbon particles retained for determining the arrester's particle retention efficiency.

3.7.1 Determination of Arresting Efficiency—Use the following formula for determining arresting efficiency for either SAE fine or SAE coarse carbon:

$$\%\ \text{efficiency} = \frac{\text{Grams of Carbon retained} \atop \text{Grams used - on No. 30 U.S. screen (see 3.7)}}{\text{Grams used}} \times 100$$

3.7.2 For combined average effectiveness of SAE fine and SAE coarse particles:

$$\%\ \text{efficiency} = \frac{\%\ \text{efficiency of SAE fine} + \%\ \text{efficiency of SAE coarse}}{2}$$

3.8 Test Position of Spark Arrester—The spark arrester shall be tested in the position where it is judged to be the least efficient. This may be determined by preliminary checks of arresting efficiency in various operating positions.

4. Exposed Surfaces Temperature Test

4.1 Exposed Surfaces Test Defined—Exhaust system temperatures will be measured at the points where the engine exhaust system can contact plane surfaces established by the extremities of the power unit or power head. In the case of a chain saw, the plane surfaces will be established by the extremities of the saw with bar removed and a line passing through the lowest points in the spaces between the bumper spikes (dogs). See Fig. 2. To determine points of measurement, place the power unit in a sufficient number of positions on a flat surface to determine where the exhaust system components can contact the surface.

4.2 Apparatus—Use a calibrated loading device as shown in Fig. 3 with temperature sensitive coatings for exhaust system surfaces (such as Detectotemp or Tempilaq paints, or Tempilstik or Thermochron crayons,

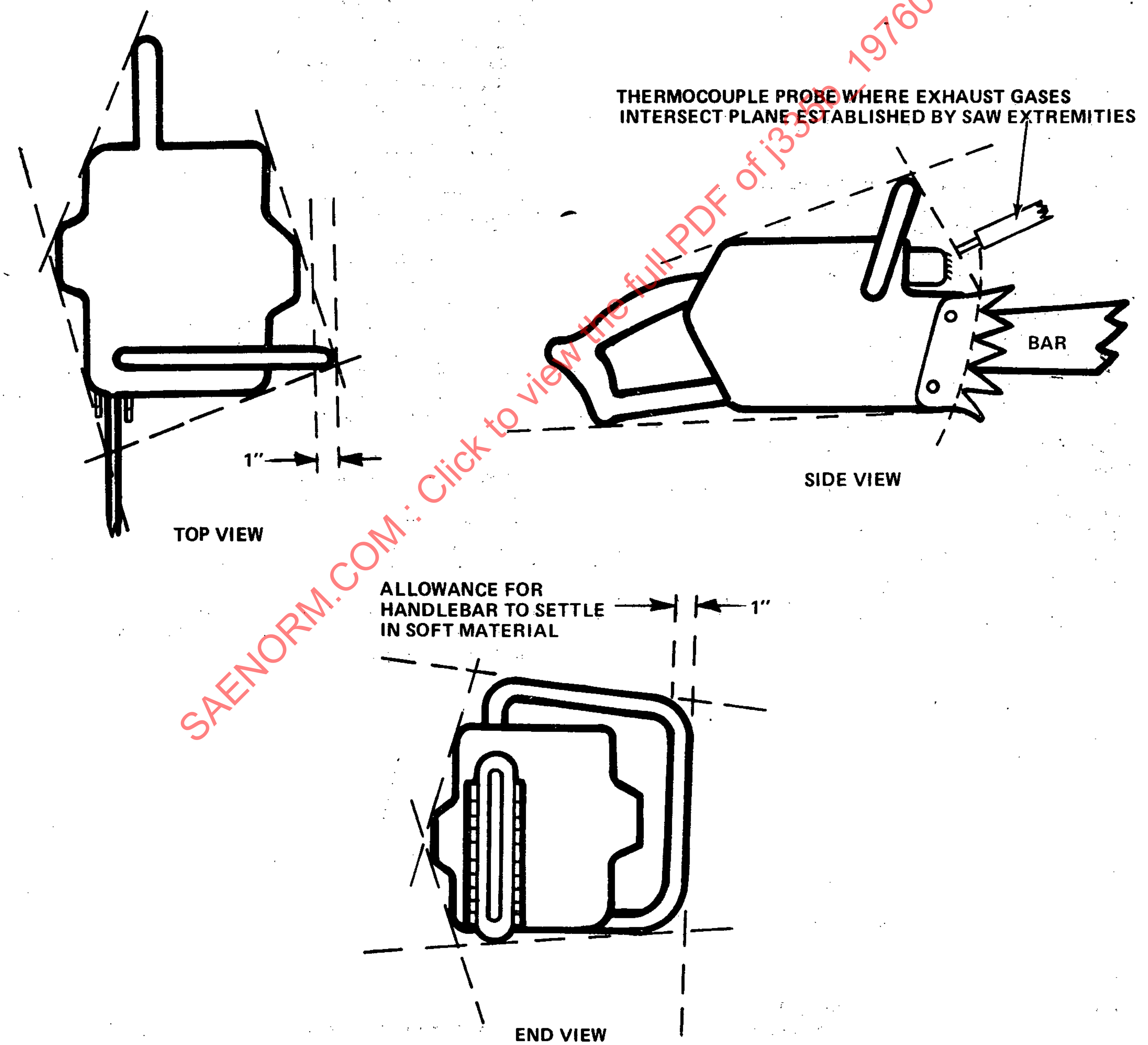

FIG. 2—DETERMINATION OF LOCATIONS FOR MEASURING EXHAUST SYSTEM SURFACE AND EXHAUST GAS DISCHARGE TEMPERATURES