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SURFACE VEHICLE STANDARD

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Drag Force Test Procedure for Construction, Forestry, and Industrial Machines

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE MTC1, Loaders, Crawlers, Scrapers and Mounted Attachments Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. ***Scope***—This SAE Standard establishes a test method to measure drag force of self-propelled, as well as towed, construction, forestry, and industrial machines, with or without payload, as listed in SAE J/ISO 6165 and J1116.

   Drag force is measured as a function of travel speed.

1.1 **Rationale**—The rationale for moving SAE J873 to a Noncurrent status is that we are not aware that this standard is being used in industry today and no experts exist to maintain this document.

2. ***References***

2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1057—Identification Terminology of Earthmoving Machines
SAE J1116—Categories of Off-Road Self-Propelled Work Machines

3. ***Definitions***—For the purpose of this document, the following definitions apply:

3.1 **Travel Speed**—The actual machine velocity expressed in kilometers per hour (km/h).

3.2 **Test Time**—The time taken to cover the test distance, or duration of the test run, expressed in seconds (s).

3.3 **Test Distance**—The distance traveled by the test machine during the test time, expressed in meters (m).

3.4 **Machine Mass**—The mass of the machine as tested. It shall include the operator, a full tank of fuel, and all fluid compartments at their specified level; expressed in kilograms (kg).

3.5 **Tire Pressure**—Air pressure in the machine tires, as tested, expressed in kilopascals (kPa).

3.6 Atmospheric Humidity—Measured as the difference between the wet bulb temperature and dry bulb temperature expressed in degrees Celsius (°C). The measurement is to be taken at a point in time of the test to be reasonably representative of the conditions during all test runs.

3.7 Drag Force—The combined rolling resistance and internal frictions that resist movement of a machine. It is determined by measuring the towing force required to maintain a specified travel speed. It is reported in kilonewtons (kN).

3.8 Towing Force—The horizontal force measured with a load cell between the towing machine and the test machine.

3.9 Tow Hitch—The part of the machine used for attaching the towing machine. For some machines not so equipped, this may have to be added for test purposes.

3.10 Towing Machine—A machine capable of towing the test machine for a sustained distance maintaining constant test speeds.

4. Test Track

4.1 Layout—The test track shall be a straight, flat surface prepared:

a. To minimize rolling resistance of the test machine without loss of traction of the towing machine.
b. With a recommended testing length of 100 m with approaches of such length that speed and load are stabilized before entering the test section. Sufficient turning areas shall be provided at both ends.
c. With a recommended grade of less than 0.5%. Where the grade exceeds 0.5%, runs shall be taken in both directions and the results averaged.
d. With a crown slope from centerline to shoulder of less than 3%.

4.2 Surface Conditions

4.2.1 RUBBER-TIRED MACHINES—For machines equipped with rubber tires, the surface shall be, in the order of preference, clean, dry:

a. Concrete—The surface shall have a uniform rough texture. Sealing material in any expansion joint shall be maintained flush or below the surface.
b. Bituminous—Asphalt or asphaltic concrete.

4.2.2 CRAWLERS AND STEEL-WHEELED MACHINES—For crawlers or steel-wheeled machines, test courses of compacted earth shall be used. Such surfaces shall be maintained to be adequately drained, free of ruts, and substantially free of loose material.

4.2.3 ALTERNATIVE SURFACES—The test may be conducted on any other type of surface if required for specific test purposes. The nature of the surface shall be reported.

5. *Apparatus*

5.1 Towing Machine

5.2 Means to measure and record the following Table 1:

TABLE 1—ACCURACY OF MEASUREMENTS

	Accuracy
Time	±0.2 s
Distance	±0.5%
Towing Force	±1.0%
Machine Mass	±1.5%
Tire Pressure	±3.0%
Temperature	±1 °C
Wind Velocity	±2.5 km/h

6. *Preparation for Test*

6.1 Inspect test machine to verify:

a. All mechanical adjustments (brakes, clutches, track tensions, etc.) meet manufacturer's operating specifications.
b. Fluids and lubricants are as specified by the manufacturer.
c. Fuel tank is filled to capacity.

6.2 Add payload, ballast, and/or attachments as required.

6.3 Adjust tire pressure as specified by the manufacturer.

6.4 Weigh the machine with operator in the operating position to obtain the total mass and the load distribution per axle or track.

6.5 Connect the test machine to the towing machine by means of tow hitch and tensile load cell.

6.6 If the test machine has a steerable front axle, a bridle hitch or other means may be necessary to maintain directional control.

6.7 Record data as shown in Figure 1.

7. *Procedure*

7.1 Prior to recording test data, the machine shall be operated until temperatures of fluids in all fluid compartments are in the operating range.

7.2 For self-propelled machines, the engine shall be functionally disconnected from the drivetrain by such means as disengaging master clutch, placing transmission in neutral, etc. The disengagement shall be accomplished by means of operator controls. If possible, drivetrain components which contribute to normal machine drag force shall remain engaged. Condition of various drivetrain components shall be recorded.