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SURFACE VEHICLE STANDARD

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(R) BRAKING SYSTEM TEST PROCEDURES AND BRAKING PERFORMANCE CRITERIA FOR AGRICULTURAL TRACTORS

Technically equivalent to ISO 5697-1982(E)

1. Scope—The test procedures and performance criteria are directed to operation and parking of agricultural tractors equipped with braking system(s) and having a maximum design speed exceeding 6 km/h. Combinations of agricultural towing machines equipped with braking systems and towed agricultural machines without braking systems are included in this SAE Standard.

1.1 Purpose—The purpose of this document is to establish test procedures for measurement of braking system performance and minimum performance criteria for braking systems on agricultural tractors.

2. References

2.1 Applicable Documents—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.

SAE J1150 JUN88—Terminology for Agricultural Equipment

2.1.2 ASAE PUBLICATIONS—Available from ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659.

ASAE S365.2—Braking System Test Procedures and Braking Performance Criteria for Agricultural Field Equipment

2.1.3 EEC PUBLICATIONS—Available from European Economic Commission, Palais Des Nations, CH-121 Geneva 10 Switzerland.

EEC 76/432—Braking for Agricultural Tractors

2.1.4 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 5697-1982(E)—Braking System Test Procedures and Braking Performance Criteria for Agricultural Tractors

3. Definitions

3.1 Agricultural Tractors—A traction machine designed and advertised primarily to supply power to agricultural implements and farmstead equipment (per SAE Standard J1150 JUN88).

3.2 Agricultural Trailers—A transport machine used in agriculture which, according to its design, is suitable and intended for coupling to an agricultural tractor.

3.3 Average Deceleration—The retardation rate of a machine defined by the formula:

$$a = \frac{V^2}{2S} \qquad \text{(Eq. 1)}$$

where:

a = average deceleration, m/s^2

V = initial speed, m/s

S = stopping distance, m

3.4 Braking Control Input Force—The sum of all forces applied by the operator to the braking system control(s), as measured at the point of force application, in a line from the point of application through the operator's hip joint for foot pedal controls, or through the arm to shoulder joint for hand-operated controls.

3.5 Cold Brakes—A brake is deemed to be cold if one of the following conditions is met:

3.5.1 The temperature measured at the periphery of the disc or on the outside of the drum is below 100 °C.

3.5.2 In the case of totally enclosed brakes including oil-immersed brakes, the temperature measured on the outside of the housing is below 50 °C or within the manufacturer's specifications.

3.5.3 The brake has not been actuated in the previous 1 h.

3.6 Combination—Trailed equipment with or without braking systems coupled to an agricultural tractor.

3.7 Maximum Gross Mass—The maximum permissible mass (weight) of the test machine in accordance with manufacturer's recommendations regardless of travel speed restrictions, and including maximum ballast, equipment, material load recommended or permitted.

3.8 Maximum Gross Mass for Stopping Tests—The maximum permissible mass (weight) of the test machine in accordance with the manufacturer's recommendations for maximum transport speed or 25 km/h whichever speed is less.

3.9 Parking Brake System—A means for holding a machine continuously in a parked position.

3.10 Secondary Braking System—A braking system used for stopping a machine in the event of a malfunction in the operation or control of the service braking system.

3.11 Service Braking System—The primary system(s) used for retarding and stopping a machine.

3.12 Single-Unit Machine—A self-propelled machine not coupled to trailed equipment.

3.13 Stopping Distance—The distance traveled between the point at which the braking control is first moved and the point at which the machine comes to a stop.

3.14 Stopping Time—The time elapsed between the first movement of the braking control and the instant at which the machine comes to a stop.

3.15 Test Machine—The term used in this document to identify the agricultural machinery on which braking performance is measured by test.

3.16 Towed Agricultural Machine—An implement that is designed to perform agricultural operations and is pulled by an agricultural tractor or self-propelled agricultural machine. It is usually equipped with wheels for transport.

3.17 Towing or Towed Force—The force required to move a machine in a specified manner by another machine which has the motive power.

3.18 Unladen Machine—A machine completely serviced with fuel, coolant, and lubricants, carrying a driver (if required) having a minimum weight of 75 kg but no optional accessories, weights, ballast, or material load.

4. Classifications

4.1 For the purpose of this document, agricultural field equipment is classified in the following categories:

Category I—Agricultural Tractors

Category IIa—Self Propelled Agricultural Machines (see ASAE S365.2)

Category IIb—Special Self Propelled Agricultural Machines (See ASAE S365.2)

Category III—Agricultural Trailers

Category IV—Towed Agricultural Machines

5. Facilities and Instrumentation

5.1 The following facilities and instrumentation capabilities are required

5.1.1 AMBIENT TEMPERATURE—A means of measuring ambient temperature within ±3 °C.

5.1.2 BRAKING SYSTEM INPUT FORCE—An instrument to measure the applied force to the braking control, with an accuracy of ±5%.

5.1.3 STOPPING DISTANCE—A means of measuring the stopping distance with an accuracy of ±1%.

5.1.4 TEST COURSE—The test course shall be straight and consist of a clean swept, level dry concrete or other hard clean surface with equivalent friction characteristics and of adequate length to conduct the test. The approach shall be of sufficient length, smoothness, and uniformity of grade to assure stabilized travel speed of the machine. The braking surface shall not have more than 1% grade in the direction of travel or more than 3% grade at right angles to the direction of travel.

5.1.5 TEST SPEED—A means of measuring the test speed with an accuracy of ±2%.

5.1.6 TEST MASS (WEIGHT)—A means for determining wheel loads with an accuracy of ±3%.

5.1.7 TIRE PRESSURE—A means of measuring tire inflation pressure with an accuracy of ±5%.

5.1.8 TOWING OR TOWED FORCE—An instrument to measure towing force (tension and compression) with an accuracy of ±3%, and with a towing force indicator visible to the test machine operator.

5.1.9 TOWING MACHINE—A towing machine with sufficient power and mass (weight) to pull the test machine. The device connecting the towing machine to the test machine shall be horizontal within ±4 degrees when the machine is on a level surface.

5.1.10 WIND VELOCITY—A means of measuring wind velocity with an accuracy of ±3 km/h.

5.2 Instrumentation to Measure the Following is Optional

5.2.1 BRAKE TEMPERATURE—A temperature measuring system shall have ±2% accuracy.

5.2.2 BRAKING SYSTEM FLUID PRESSURE (FOR CATEGORY III AND IV ONLY)—A means of measuring braking system fluid pressure with an accuracy of ±5%.

5.2.3 DECELERATION—An instrument to measure and record average deceleration with an accuracy of ±3%.

5.2.4 TIME TO STOP—A means of measuring the stopping time with an accuracy of ±1%.

5.3 Braking System Test Report—A typical braking system test report form is shown in Figure 1.