

Submitted for recognition as an American National Standard

**PERFORMANCE TEST FOR WINDSHIELD DEFROSTING SYSTEMS FOR OFF-ROAD,  
SELF-PROPELLED WORK MACHINES**

This document is technically equivalent to ISO 10263 Part 5.

1. **Scope**—This SAE Standard establishes uniform test procedures for the defrosting systems of off-road, self-propelled work machines used in construction, general purpose industrial, agricultural, forestry, and specialized mining machinery categories as identified in SAE J1116, JUN86. It includes tests that can be conducted with uniform test equipment in commercially available laboratory facilities, as well as in an appropriate outdoor environment.

2. **References**

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

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J381—Windshield Defrosting System Test Procedure—Trucks, Buses, and Multipurpose Vehicles

SAE J899—Operator's Seat Dimensions for Off-Road Self-Propelled Work Machines

SAE J1116—Categories of Off-Road Self-Propelled Work Machines

SAE J1163—Determining Seat Index Point

SAE J1349—Engine Power Test Code—Spark Ignition and Compression Ignition—Net Power Rating

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

ISO 5353:1989—Earth-moving machinery—Seat index point

ISO 5721:1989—Tractors for agriculture—Operator's field of vision

ISO 9249:1989—Earth-moving machinery—Engine test code—Net power

2.2 **Related Publication**—The following publication is provided for information purposes only and is not a required part of this document.

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

ISO 10263:1994—Earth-moving machinery—Operator environment

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

**QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8512 FAX: (724) 776-0243  
TO PLACE A DOCUMENT ORDER; (724) 776-4970 FAX: (724) 776-0790  
SAE WEB ADDRESS <http://www.sae.org>**

3. Definitions

3.1 Defrost—To free from ice on the outside surfaces of the glazing with the defroster system.

3.2 Windshield Defroster System—Means intended to defrost the windshield.

3.3 Daylight Opening (DLO)—The maximum unobstructed opening through any glazed aperture, with trim moldings and mounting seals adjoining the glazing surface installed normal to the glass surface.

3.4 Defrosted Area—That area of the windshield composed of dry cleaned surface and melted or partially melted (wet) test coating, and excluding that area of the windshield covered with a test coating of ice.

3.5 Heat Transfer Medium (HTM)—The means through which defroster system heating is achieved. Following are three typical examples of HTM.

- a. Liquid engine coolant
- b. Hydraulic oil
- c. Air obtained from an auxiliary heat source, i.e., gas-fired heater or oil-fired heater

3.6 Seat Index Point (SIP)—The point in the central, vertical, and longitudinal plane of the SIP Measuring Device per SAE J1163 (JAN80), Figure 1, when installed in the operator seat as designated in 5.2 of SAE J1163.

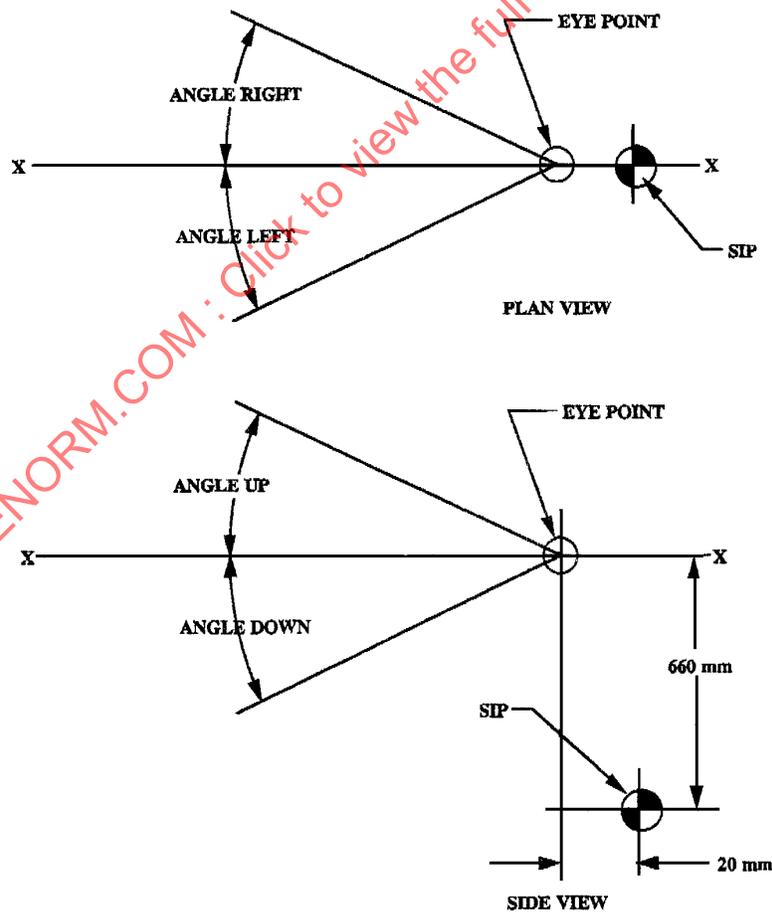


FIGURE 1—ANGLES EMANATING FROM EYE POINT

#### 4. Defrosting Test

##### 4.1 Test Equipment

- 4.1.1 Cold chamber sufficiently large to contain the base machine or machine operator enclosure with provision for circulating cold air.
- 4.1.2 In lieu of a cold chamber, the test may be conducted outdoors under test conditions similar to those in a cold chamber. (See 4.2.1.)
- 4.1.3 Means for recording the boundaries of the windshield areas defrosted. (A wax pencil can be used to outline defrosted areas.)
- 4.1.4 ENGINE TACHOMETER—Measuring accuracy of 2% of observed values.
- 4.1.5 Stopwatch or other timing device.
- 4.1.6 Thermometers or other temperature measuring devices with an accuracy of  $\pm 0.5$  °C.
- 4.1.7 Throttle control device (if desired).
- 4.1.8 A spray gun for applying mist to the windshield with the following characteristics:
  - a. Fluid—Water (distilled)
  - b. Liquid nozzle size diameter—1.7 mm
  - c. Operating gun gage pressure—345 kPa  $\pm$  20 kPa
  - d. Pattern at 200 mm from surface—300 mm  $\pm$  50 mm wide
- 4.1.9 Device for measuring quantity of water applied to windshield.
- 4.1.10 Auxiliary power supply for heater blower motor when bench testing operator enclosure only.
- 4.1.11 Anemometer to measure air velocity. Measuring accuracy of 10% of observed values.
- 4.1.12 If it is not practical to test the base machine due to physical size limitations, the operator's enclosure may be bench tested, simulating the heat loads imposed by the base machine on the enclosure. If this laboratory procedure is used, supplemental field testing should be used to confirm the procedure.

##### 4.2 Test Conditions

- 4.2.1 Either the test machine engine or an independent heat transfer medium supply may be used to provide coolant flow to the heater-defroster system under test.
- 4.2.2 AMBIENT AIR TEMPERATURE—  $-15$  °C maximum
- 4.2.3 AIR VELOCITY—The wind velocity should not exceed 5 m/s.
- 4.2.4 MACHINE LOAD AND SPEED—The machine shall be operated in accordance with manufacturer's recommended warm-up procedure, then rated speed under a maximum load of no more than 20% of the maximum rated net engine power. Net engine power shall be determined in accordance with SAE J1349.
- 4.2.5 HEATER-DEFROSTER SYSTEM HTM FLOW—That flow resulting from engine operation as prescribed in 4.2.4. Independent HTM supply must have the same coolant flow and temperature as the machine engine.

## SAE J1535 Issued AUG96

- 4.2.6 HEATER-DEFROSTER SYSTEM HTM—Temperatures to be ambient at start of test.
- 4.2.7 SOAK TIME—10 h—A shorter soak time may be used if instrumentation can confirm that the HTM, windshield, and enclosure temperatures are stabilized.
- 4.2.8 An operator may be in the enclosure throughout the duration of the test.
- 4.2.9 WINDSHIELD WIPERS—Wiper blades and arms are to be off the windshield glazing surface during ice application. Windshield wipers may be used during the test.
- 4.2.10 DEFROSTER AND/OR HEATER SYSTEM AIR—On full, blower(s) on maximum speed.
- 4.2.11 TEST VOLTAGE—When measured at the terminals of the blower, motor shall be no more than 20% above the nominal rating of the system. (Example—14.4 V on 12 V system, 28.8 V for a 24 V system.)
- 4.2.12 TEMPERATURE CONTROL—Maximum warm position.
- 4.2.13 All engine, heater, and defroster units shall be standard production parts or equivalent, adjusted to specified limits.
- 4.2.14 Engine hood, doors, and windows shall be closed.
- 4.2.15 If an auxiliary heater (or heaters) is part of the standard heater and defroster system, it may be operated.
- 4.2.16 Auxiliary means for preheating the engine, etc., are permissible providing they do not heat the HTM.
- 4.2.17 Under all test conditions, do not allow any simulated or actual solar heat load to strike the windshield.

### 4.3 Measurement Locations

- 4.3.1 The temperature of the engine coolant or the independent supplied coolant shall be measured as near to the inlet pipe of the heater unit as possible. For those systems using more than one heater, it shall be measured at the inlet pipe of the heater unit getting the first coolant flow. The coolant flow may be measured at any convenient point in the independent coolant supply system.
- 4.3.2 The ambient air temperature and air velocity shall be measured at a point that is outside the influence of the machine, but no farther than 10 m.

### 4.4 Test Procedure

- 4.4.1 The cold chamber shall have been maintained at or below the specified test temperature for not less than 10 h preceding the machine soak period.

NOTE—If instrumentation is available to assure the cold chamber air and wall temperatures are stabilized, a shorter time may be used. If tested outdoors, the outdoor temperature need only be stabilized at the specified test temperature for a period long enough to soak the windshield and operator enclosure for the required period.

4.4.2 ICE APPLICATION—Following the machine soak period, a coating of ice shall be formed on the windshield(s) as follows: The windshield(s) shall be sprayed with  $0.050 \text{ mL} \pm 0.005 \text{ mL}$  of water per square centimeter of glass area applied by means of a spray gun with  $345 \text{ kPa} \pm 20 \text{ kPa}$  air pressure at the gun, measured while spraying to form an even coating of ice over the entire glass surface. The spray nozzle (adjusted to full fan pattern and maximum flow) is held perpendicular to and 200 to 250 mm from the glass, and stroked back and forth evenly in horizontal overlapping layers until the specified quantity of liquid is applied. Upon completion of the icing process, an additional soak period of not less than 30 min, and not more than 40 min, shall have elapsed before start of the test. Alternate methods of applying the water may be used to achieve the same results.

4.4.3 The test period begins when:

- a. 4.4.2 is complete
- b. The engine or heat source is started.

Test conditions described in 4.2 are to be maintained throughout the duration of the test period.

4.4.4 The observer(s) shall outline the defrosted areas on the inner surface of the windshield at intervals of 5 min as the test proceeds.

4.4.5 At the completion of the test, the defrosted pattern shall be recorded. It is suggested that the pattern be transferred to a transparent material by tracing. This record shall be marked to identify the driver's side, if other than centered in the windshield.

4.4.6 RECORDING OF TEST DATA—A form similar to that illustrated in SAE J381 JUN84, Figure 2, may be used, with entry lines changed as appropriate to agree with this document.

## **5. Defrosting Performance Upon Stabilization Under the Test Conditions as Outlined Previously**

**5.1 General Performance Requirements**—The windshield area to be defrosted is determined using an operator's eye point 660 mm above, and 20 mm forward of the SIP. Seat Index Point shall be determined in accordance with SAE J1163 JUN91. To accommodate the wide variety of conditions encountered in these machines, the area is modified accordingly.

5.1.1 AREA TO BE DEFROSTED—The windshield areas that shall be defrosted are defined in Table 1 for various classifications of earthmoving machines. Each area is established using the angles of Table 1 emanating from the eye point location described in 5.1 and Figure 1.

In the side view, the upper and lower boundary of the areas are established by the intersection of two planes and the windshield glazing surface, the two planes being seen as lines converging at the eye point. The planes are fixed by angles above and below the X-X line.

In the plane (top) view, the left and right boundary of the areas are established by the intersection of two vertical planes and the windshield glazing surface; the two planes being seen as lines converging at the eye point. The planes are fixed by angles to the left and right of the X-X line.

If any of the four (4) planes, or portions thereof, established by the angles in Table 1 do not intersect the windshield glazing surface, but fall outside of the windshield DLO, then relocate that part of the plane to just intersect the windshield glazing surface along a line which lies entirely on the windshield DLO and touches the molding or frame.

TABLE 1—ANGLES EMANATING FROM EYE POINT

Classification (According to SAE J1116)	Area	Angle Up, Deg.	Angle, Down, Deg.	Angle Left, Deg.	Angle Right, Deg.
Loaders	A	10	5	15	15
	B	15	15	25	25
	C	30	25	35	35
Tractors	A	5	7	15	15
	B	8	20	25	25
	C	12	35	40	40
Dumpers	A	5	7	15	15
	B	8	15	20	20
	C	17	16	30	39
Tractor Scrapers	A	5	7	15	15
	B	8	15	20	20
	C	12	20	30	30
Excavators	A	12	18	10	20
	B	14	24	17	22
	C	20	30	25	25
Motor Graders	A	10	5	15	15
	B	15	15	25	25
	C	20	50	35	35
Backhoe Loaders	A	5	7	15	15
	B	8	20	25	25
	C	12	35	40	40
Agricultural Tractors	A	5	7	15	15
	B	8	20	25	25
	C	12	35	40	40

The areas used in determining the percentage of defrosted area are those areas on the exterior glazing surface which are not within 25 mm of the edge of the daylight opening (pillars, division bar, header, etc.) The percentage is the ratio of defrosted area within the defined area to the defined area. Figure 2 illustrates all of the area on a typical windshield.