SURFACE VEHICLE STANDARD

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Superseded by J3078/5

Performance Test for Windshield Defrosting Systems for Off-Road, Self-Propelled Work Machines

RATIONALE

SAE J1535 is being cancelled and superseded by SAE J3078/5.

CANCELLATION NOTICE

This Technical Report has been declared “CANCELLED” as of August 2021 and has been superseded by SAE J3078/5. By this action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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FOREWORD

This document is the basis for ISO 10263 Part 5 and ISO 14269 Part 6. SAE J1535 covers additional work machines not covered by ISO documents

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, and forestry machinery as referenced in table one of this document. 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 Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 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 J381 Windshield Defrosting Systems Test Procedure and Performance Requirements - 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

2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 5353 Earth-moving machinery - Seat index point

ISO 10263-5 Earth-Moving Machinery - Operator Enclosure Environment - Part 5: Windscreen Defrosting System Test Method

2.2 Related Publication

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ISO Publication

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 10263-5 Earth-Moving Machinery - Operator Enclosure Environment - Part 5: Windscreen Defrosting System Test Method

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 windscreen and any adjacent glazing surfaces that are determined to be within the zones identified in Table 1..

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.

NOTE: Fretting is considered an obstruction and is not included as part of the DLO.

3.4 DEFROSTED AREA

That area of the windshield consisting of dry cleared surface and melted or partially melted (wet) test coating, and excluding that area of the windscreen covered with dry test coating of ice. For further explanation on defrosted areas see Figure 1.

3.5 HEAT TRANSFER MEDIUM (HTM)

The means through which defroster system heating is achieved.

3.6 SEAT INDEX POINT (SIP)

The point in the central, vertical, and longitudinal plane of the SIP Measuring Device per SAE J1163 , Figure 1, when installed in the operator seat as designated in 5.2 of SAE J1163.

4. DEFROSTING TEST

4.1 Test Equipment

4.1.1 Environmental chamber sufficiently large to contain the base machine or machine operator enclosure with provision for circulating 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 Device to measure the rotational frequency (RPM) with a measuring accuracy of 2% of observed value.

4.1.5 Stopwatch or other timing device.

4.1.6 Thermometers or other temperature measuring devices with an accuracy of ±0.5 °C.

4.1.7 Throttle control device (if desired).

4.1.8 A spray device 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 ± 20 kPa

d. Pattern at 200 mm from surface - 300 mm ± 50 mm wide

4.1.9 Device for measuring quantity of water provided for spray device ± 2.5%.

4.1.10 Auxiliary power supply for heater blower motor when bench testing operator enclosure only.

4.1.11 Anemometer to measure wind speed With a measuring accuracy within 0.5 m/s.

4.2 Test Conditions

4.2.1 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 test results.

4.2.2 The heat transfer medium (HTM) flow shall come from engine operation or from an independent (HTM) flow.

4.2.3 Ambient Air Temperature

The maximum ambient temperature for the heating system test shall be -15 °C.

4.2.4 Air Velocity

The maximum ambient wind speed for the heating test shall be 5 m/s.

4.2.5 Machine Load and Speed

The machine shall be started and operated in accordance with manufacturer's recommended warm-up procedure, and then at a rated speed. with no additional load other than the parasitic load required to operate the vehicle. The warm up procedure and rated speed shall be documented in the report.

4.2.6 Heater-Defroster System HTM Flow

That flow resulting from engine operation as prescribed in 4.2.5. . The independent HTM flow and temperature shall be the same as that resulting from operation of the machine engine, in accordance with the requirement of 4.2.5.

4.2.7 Heater-Defroster System HTM

The HTM temperature shall be measured as close as possible to the inlet

pipe of the heating unit. For those systems using more than one heater, it shall be measured at the inlet pipe of the heating unit receiving the first coolant.

Following are three typical examples of HTM .

Liquid engine coolant

Hydraulic oil

Air/Liquid obtained from an auxiliary heat source, i.e., gas fired

Heater or oil fired heater

4.2.8 Soak Time

Thermally soak the machine for 10 hours. A shorter soak time may be used if instrumentation can confirm that the HTM, windscreen, HVAC system with ductwork, and enclosure temperatures are stabilized at the ambient temperature.

4.2.9 An operator may be in the enclosure throughout the duration of the test.

4.2.10 Windscreen Wipers

Wiper blades and arms are to be off the windscreen glazing surface during ice application. Windshield wipers may be used during the test. If windscreen wipers are used the number of swipes and times are to be listed in the report.

4.2.11 Defroster and Heater System Air

Defroster and heating system are set to maximum air flow.

4.2.12 Test Voltage

The voltage at the terminals of the blower motor shall be within ± 5% of the nominal voltage on a production intended vehicle. If nominal voltage is unknown, the voltage at the terminals of the blower motor shall not exceed 15% above the nominal rating of the system. (Example - 13.8 V on 12 V system, 27.6 V for a 24 V system.)

4.2.13 Temperature Control

Maximum warm position.

4.2.14 All engine, heater, and defroster units shall be standard production parts or equivalent, adjusted to specified limits.

4.2.15 Engine hood, doors, and windows shall be closed.

4.2.16 If an auxiliary heater (or heaters) is part of the standard heater and defroster system, it may be operated.

4.2.17 Auxiliary means for preheating the engine, etc., are permissible providing they do not heat the HTM. At the start of the test, the HTM shall be at ambient temperature.

4.2.18 Under all test conditions, do not allow any simulated or actual solar heat load to strike the windscreen.

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 mL ± 0.005 mL of water per square centimeter of glass area applied by means of a spray gun with 345 kPa ± 20 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. If digital imagery is utilized, images can be used to calculate percent of area defrosted. Images shall be taken at 5 minute intervals.

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

5. A FORM SIMILAR TO THAT ILLUSTRATED IN FIGURE 4, MAY BE USED FOR RECORDING DATA.DEFROSTING PERFORMANCE REQUIREMENTS

5.1 Procedure to Determine Defrost Areas General Performance Requirements

The windscreen 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 . 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.

Any glazing surfaces that are intersected by the planes defined above should be included in the required defrosted area.

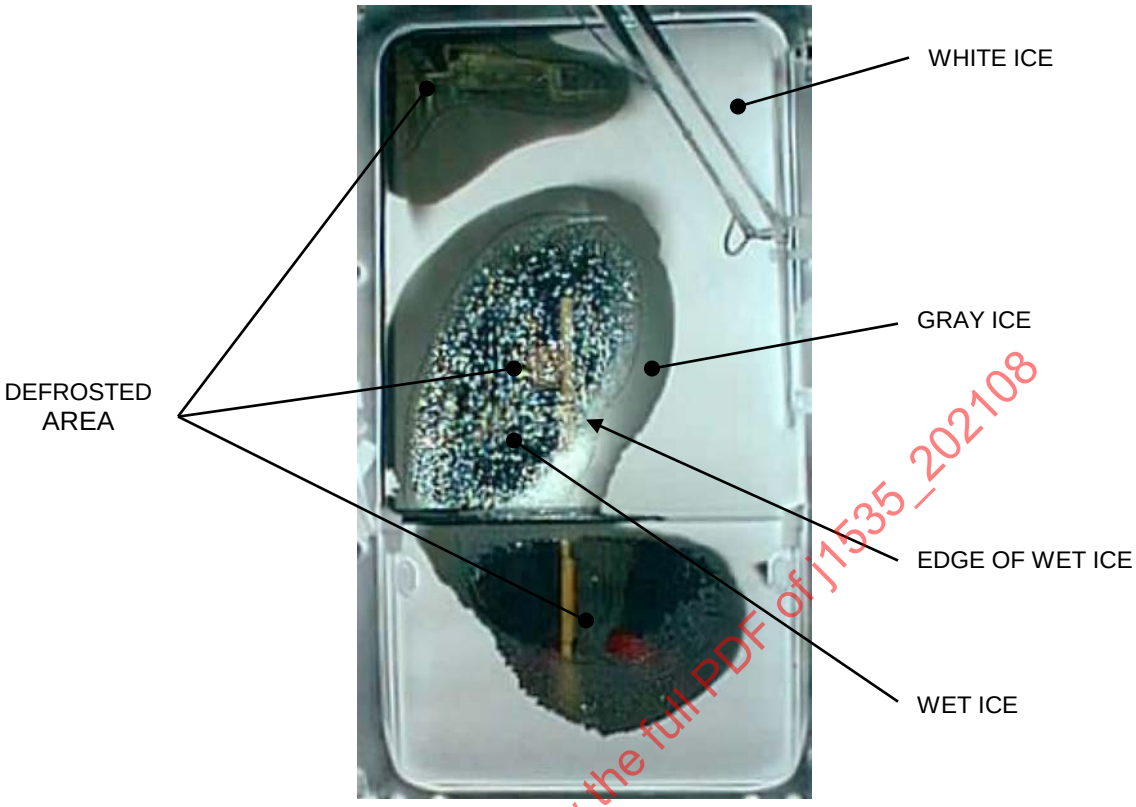

FIGURE 1 - DIGITAL PICTURE OF DEFROSTING WINDOW

TABLE 1 - ANGLES EMANATING FROM EYE POINT

Machine Type	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 Crawler Dozer	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
Compact Excavators	A	0	25	10	20
	B	5	35	17	25
	C	10	45	23	30
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

TABLE 1 (CONTINUED) - ANGLES EMANATING FROM EYE POINT

Machine Type	Area	Angle Up, Deg.	Angle, Down, Deg.	Angle Left, Deg.	Angle Right, Deg.
Skidders	A	12	18	10	20
	B	14	24	175	22
	C	20	30	25	25
Harvesters	A	12	18	10	20
	B	14	24	17	22
	C	20	30	25	25
Feller-Bunchers	A	12	18	10	20
	B	14	24	17	22
	C	20	30	25	25
Skid Steers Compact Tractor Loaders	A	10	20	17	17
	B	15	30	22	22
	C	20	40	30	30

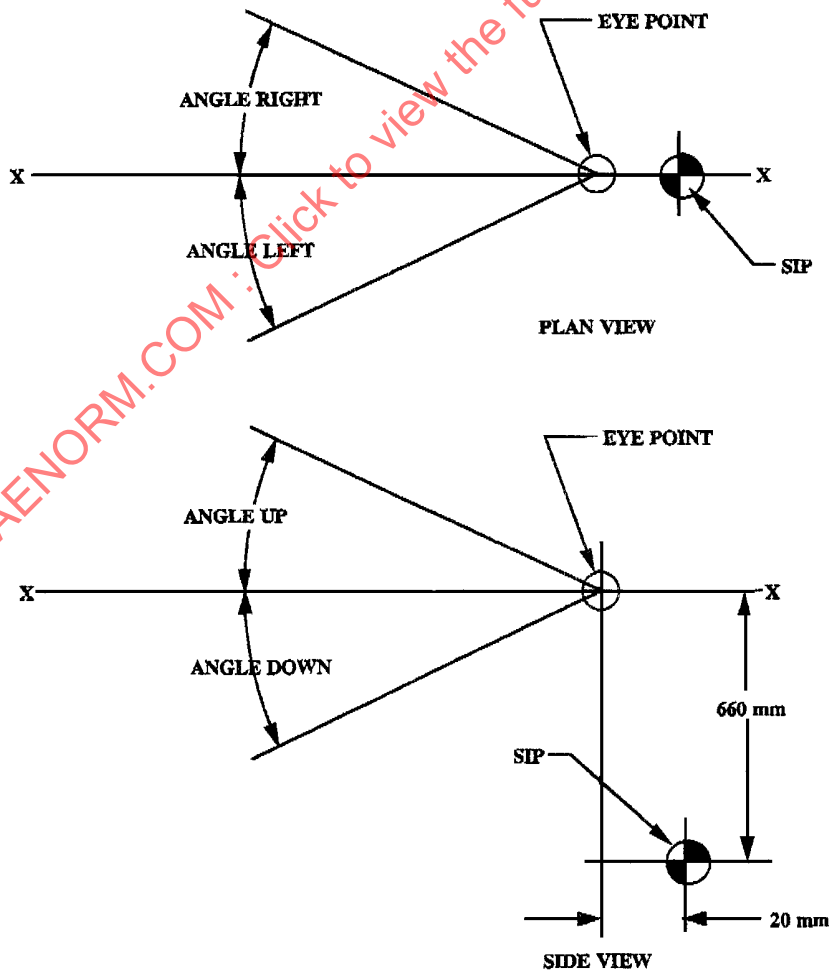

FIGURE 2 - ANGLES EMANATING FROM EYE POINT