SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

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Superseding J1944 SEP2000

Truck and Bus Multipurpose Vehicle Windshield Washer System

RATIONALE

Revised to include minor corrections, added references.

1. SCOPE

This SAE Recommended Practice provides the following for the windshield washer system for trucks, buses, and multipurpose vehicles with GVW of 4500 kg (10 000 lb) or greater:

a. Minimum performance requirement

b. Uniform test procedures. The test procedures are limited to those tests that can be conducted with uniform test equipment by commercially available laboratory facilities.

c. Uniform terminology of windshield washer system characteristics and phenomena.

The minimum performance requirements and test procedures, outlined in this document, are based on currently available engineering data.

It is intended that all portions of the document will be periodically reviewed and revised as additional data on windshield washer system performance are developed.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

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 J198 Windshield Wiper Systems—Trucks, Buses, and Multipurpose Vehicles

SAE J680 Location and Operation of Instruments and Controls in Motor Truck Cabs

SAE J726 Air Cleaner Test Code

SAE J942 Passenger Car Windshield Washer Systems

SAE J1037 Windshield Washer Tubing

2.1.2 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM D 1149 Test for Accelerated Ozone Cracking of Vulcanized Rubber

2.1.3 TMC Publications

Available from Technology & Maintenance Council – American Trucking Associations, 950 N. Gllebe Road, Arlington, VA 22203, Tel. 703-838-1763, http://tmc.truckline.com

RP 405B (T) Windshield Washer System Performance recommendations

RP 406C (T) Windshield Wiper System Performance recommendations

3. DEFINITIONS

3.1 WINDSHIELD WASHER SYSTEM

An apparatus for storing, filtering, and applying fluid to the exterior of the windshield glazing surface together with the necessary controls to actuate and arrest operations.

3.2 CONTROL

A means for actuating and arresting the operation of the windshield washer system. The actuation and arresting may be coordinated or semi-coordinated with components of the windshield wiper system or may be fully independent.

3.3 ACTUATION AND ARREST

A use of the controls which causes the windshield washer system to begin and cease operation.

3.4 FUNCTION (FUNCTIONAL)

Ability of the windshield washer system to both store and apply fluid to the windshield glazing surface.

3.5 PUMP

A device for transferring the washer solution from the reservoir through the washer system to windshield glazing surface.

3.6 RESERVOIR

A container capable of storing the washer solution.

3.7 WASHER SOLUTION

The fluid used in the washer system consisting of water or water with appropriate commercial additives.

3.8 COMMERCIAL ADDITIVES

Materials which are compatible with the system and which may be added to depress the fluid freezing point, assist in cleansing, and/or increase the wetting capacity of the washer solution.

3.9 LOW TEMPERATURE WASHER SOLUTION

A 50% solution of methyl or isopropyl alcohol and water for use with low temperature tests.

3.10 NOZZLE

A device for directing washer solution to the windshield glazing surface.

3.11 TARGET AREA

A design area on the windshield glazing surface to which the washer solution is directed by the nozzle, with the vehicle at rest.

3.12 DAYLIGHT OPENING (DLO)

The term “daylight opening” (DLO) refers to the maximum opening of any glass aperture which is unobstructed by moldings, masking, or framing.

3.13 WASH AREA

That portion of the windshield glazing surface within the DLO which is wiped when the wiper blade travels through a wiper cycle.

3.14 WIPER CYCLE

The movement of the wiper arm and blade from one extreme to the other and the return.

3.15 DURABILITY TEST CYCLE

The system actuation(s) required to deliver a minimum of 15 ml of washer solution within 30 s.

3.16 CLEANSER

Nonabrasive type that leaves no coating or residue on the glass.

4. REQUIREMENTS

4.1 Washer System Capability

When tested in accordance with test procedures described in 5.1, the windshield washer system in conjunction with the wiper system shall be capable of clearing, within seven wiper cycles, 90% of the total wash area and 99% of the wash areas included in area C as defined by SAE J198 for trucks, buses, and multipurpose vehicles. System capability shall be demonstrated with vehicle parked and dynamically operated at 72 km/h (45 mph). Pump run time is at the discretion of the manufacturer.

4.2 System Strength

The windshield washer system shall be capable of withstanding the loads induced when either all nozzles are blocked or the system is frozen and tested in accordance with the test procedures established in 5.2. At the completion of the test, the system shall function.

4.3 Temperature Performance and Exposure

4.3.1 Low Temperature Exposure

The windshield washer system must remain functional after being subjected to the freeze-thaw cycle described in 5.3.2.1.

4.3.2 High Temperature Exposure

The windshield washer system must remain functional after exposure to a temperature of 90 °C ± 3 °C (194 °F ± 5 °F) as described in 5.3.2.2.

4.3.3 Operating Range

The windshield washer system shall function within temperature range of –18 to +80 °C ± 3 °C (0 to 176 °F ± 5 °F) as described in 5.3.2.3.

4.4 Durability

The washer system must remain functional after operating 8000 durability test cycles as specified in 3.1 and shall deliver at least 75% of fluid compared to that delivered at the beginning of the test.

4.5 Windshield Washer Tubing

Per SAE J1037, although it is recognized that other flexible materials may be used. The following requirements cover only rubber and synthetic rubber tubing consistent with SAE J1037.

4.5.1 Ozone Resistance

After testing in accordance with the test procedure established in 5.5.1, the tubing shall show no visual evidence of splitting or cracking.

4.5.2 Temperature Aging

After testing in accordance with the test procedures established in 5.5.2, the tubing shall show no visual evidence of splitting or cracking. The reduction in elongation shall not be greater than 50% in the unexpanded portion of the specimen. There shall be no visual evidence of wax or other contaminants exuding from the tubing.

4.5.3 Stress Relaxation

After testing in accordance with the test procedure established in 5.5.3, the tubing ID shall be no larger than 1.65 times the tubing's original nominal ID.

4.6 Chemical Resistance

The windshield washer system shall not be adversely affected when operated with a 50% solution or a 100% concentration of methyl alcohol.

4.7 Accessibility

The control shall be positioned so that it is readily accessible. The control when situated on the panel/console shall be located similar to that specified per SAE J680. Control may also be on the steering column or overhead, readily accessible to the operator.

4.8 Sealing

For truck applications which involve the tilting of the cab for service purposes, the washer container and extension tubes should be adequately contained/checked so as to prevent fluid spillage from the reservoir and/or the draining of fluid from the washer lines.

4.9 Positioning of the Reservoir

The reservoir should be positioned or supported so that the bracket and/or frame member is capable of withstanding the weight of the reservoir in its filled condition. The support should also be sufficient to allow the reservoir to remain secure during typical test/road vibrations.

The reservoir filler opening shall be positioned to be readily accessible and to permit filling of the reservoir without obstruction.

4.10 Reservoir Capacity

Minimum of 1 L; preferably 4 L.

4.11 Nozzles on Wiper Arms

Security of the nozzle, tubing or fastening components for the tubing should be such as to prevent disengagement during adverse operating conditions, such as snowpack, etc.

5. TEST PROCEDURE

5.1 Washer System Capability

5.1.1 Test Equipment

5.1.1.1 Test Fixture

A test fixture shall consist of a structure used to mount the components of the windshield wiper/washer system in a manner which represents a vehicle installation or use a test vehicle.

5.1.1.2 Test Mixture

By volume, 92.5% tap water (water not to exceed 205 ppm hardness), 5.0% saturated salt (sodium chloride) water, and 2.5% coarse grade test dust (as described in SAE J726, or equivalent).

5.1.2 Test Procedure

a. Using the nominal power input specified by the manufacturer, adjust washer nozzle(s) if adjustable under static conditions to the target area of the windshield glazing surface.

b. Clean the windshield glazing surface with a cleanser, rinse, and allow to dry.

c. Apply, by pouring (or any other method which provides an equivalent uniform coating), a freshly shaken quantity of the test mixture uniformly to the entire windshield glazing surface without coating the windshield wiper blades. If the test mixture does not uniformly adhere to the entire windshield glazing surface, the glazing surface is not sufficiently clean.

5.1.2.1 Static Test

After the mixture has completely dried on the windshield glazing surface, the washer system using the water as the washer solution or the low temperature solution must meet the requirements of 4.1.

5.1.2.2 Dynamic Test Procedure

Repeat 5.1.2.1 by driving a test vehicle 72 km/h ± 2 km/h (45 mph ± 1 mph) and testing in two opposite directions with the ambient wind velocity not exceeding 24 km/h (14 mph); or as an alternate, repeat 5.1.2.1 while directing a 72 km/h (45 mph) wind against the windshield and front of the test vehicle or equivalent in a longitudinal direction. The equivalent test vehicle must include all exterior surfaces which affect air flow over the windshield surface.

For the dynamic test, an area sufficient to insure vision for safely operating the vehicle shall be cleared in the center of the driver side wipe area.

5.2 System Strength

5.2.1 Test Equipment

5.2.1.1 Test Fixture

See 5.1.1.1 or, as an alternate, a structure may be used to mount the washer system parts in proper vehicle attitude, with hoses coiled to reduce the overall size of the fixture for convenient utilization of small laboratory environmental chambers.

5.2.1.2 Temperature Measuring Device

Thermometer or equivalent.

5.2.2 Test Procedure

This test shall be conducted after the system capability test described in 5.1 is completed. The test shall be conducted in the following manner using the power input level specified in Table 1 unless specified otherwise by the vehicle manufacturer.

5.2.2.1 Fill and fully prime the washer system with water. At an ambient temperature of 26 °C ± 5 °C (79 °F ± 10 °F), all nozzles shall be plugged and the system shall be actuated six times within a period of 1 min.

TABLE 1 - POWER INPUT LEVEL

TYPE OF PUMP	POWER INPUT (applied for a minimum of 3 s)
Hand operated	110–135 Pa (25–30 lbf)
Foot operated	400–445 Pa (90–100 lbf)
Power operated	
Electric	13 V ± 2% (for 12 V rated system)
	26 V ± 2% (for 24 V rated system)
Pneumatic	620–900 kPa (90–130 psi) (available to the washer control valve)

5.2.2.2 Fill and fully prime the washer system with water and freeze for a minimum of 4 h at a temperature of –29 °C ± 3 °C (–20 °F ± 5 °F). Following this period and in the same temperature environment, actuate the washer system six times within a period of 1 min.

5.2.2.3 Gradually increase the ambient temperature to 26 °C ± 5 °C (79 °F ± 10 °F) until the ice is completely thawed. Test the function of the system.

5.3 Temperature Performance and Exposure

5.3.1 Test Equipment

5.3.1.1 Test Fixture

See 5.2.1.1.

5.3.1.2 Environmental chamber(s) capable of maintaining the test temperatures.

5.3.2 Test Procedures

These tests shall be conducted after the system strength test described in 5.2 is completed. Fill and prime the washer system with washer solution and perform the following tests:

5.3.2.1 Low Temperature Exposure

Using water as a washer solution, reduce the ambient temperature to –30 °C ± 3 °C (–22 °F ± 5 °F) and maintain for sufficient time to insure that the total mass of the water in the reservoir is frozen, including the core which freezes last. Following this period, gradually increase the ambient temperature to 26 °C ± 5 °C (79 °F ± 10 °F) until the ice is completely thawed. Repeat this freeze-thaw cycle until a total of six cycles have occurred. After the last cycle, test the function of the system.

5.3.2.2 High Temperature Exposure

Using water as the washer solution, increase the ambient temperature to 90 °C ± 3 °C (194 °F ± 5 °F) and maintain for a minimum of 8 h. Following this period, reduce the ambient temperature to 26 °C ± 5 °C (79 °F ± 0 °F) until the system stabilizes. Test the function of the system.

5.3.2.3 Operating Range

Using a low temperature washer solution, reduce the ambient temperature to –18 °C ± 3 °C (0 °F ± 5 °F) until the washer system has stabilized at this temperature. Following this period and in the same environment, test the function of the washer system, using the nominal power input specified by the manufacturer. Repeat with an ambient temperature of 80 °C ± 3 °C (176 °F ± 5 °F) using water as the washer solution and again test the function of the washer system.

5.4 Durability

5.4.1 Test Equipment

5.4.1.1 Environmental chamber(s) capable of maintaining test temperatures.

5.4.1.2 Counter

A device for determining the number of washer cycles.

5.4.1.3 Temperature Measuring Device

Thermometer or equivalent.

5.4.1.4 Low temperature washer solution.

5.4.1.5 Pressure measuring gage.

5.4.1.6 Stopwatch.

5.4.1.7 Graduated cylinder.

5.4.2 Test Procedure:

5.4.2.1 This test shall be conducted after the Temperature Performance Test described in 5.3 is completed.

5.4.2.2 Using the nominal power input specified by the manufacturer, measure washer system fluid flow rate, or volume per actuation, and fluid delivery pressure.

5.4.2.3 Actuate system for 8000 durability test cycles in the sequence indicated in Table 2, using the low temperature washer solution when required.

TABLE 2 - TEST SEQUENCE

Test	Durability Test Cycles Total	Durability Test Cycles No./Min.	Ambient Temperatures °C ± 3	Ambient Temperatures °F ± 5
1	2000	2	24	75
2	2000	2	66	150
3	2000	2	–12	10
4	2000	2	24	75

5.4.2.4 Repeat 5.4.2.2.

5.5 Windshield Washer Tubing

When rubber and/or synthetic tubing is used, the following tests apply.

5.5.1 Ozone Resistance

5.5.1.1 Test Equipment

Commercial ozone test cabinet as described in ASTM D 1149.

5.5.1.2 Preparation of Tubing

A 200 mm (8 in) specimen of new tubing is to be wrapped around a mandrel whose OD is eight times the nominal OD of the tubing and held in position by using a piece of enamel-covered copper wiring. The mounted specimens are then to be exposed for 48 h in an ozone-free atmosphere.

5.5.1.3 Procedure

Test specimens are to be placed in the ozone test cabinet for a period of 72 h. The test cabinet is to be operated at a temperature of 38 °C ± 3 °C (100 °F ± 5 °F), and an ozone concentration of 0.5 ppm by volume.

5.5.1.4 Rating

Upon removal from the ozone cabinet and while still on the mandrel, visually examine the test specimen for evidence of splitting or cracking under 2X magnification.

5.5.2 Temperature Aging

5.5.2.1 Test Equipment

Environmental chamber.

5.5.2.2 Preparation of Tubing

A specimen of new tubing shall be fitted with a metal tube inserted 13 mm (0.5 in) into both ends. The OD of the metal tube shall be 50% larger than the nominal ID of the tubing on the test.

5.5.2.3 Procedure

Test specimen shall be placed in an environmental chamber at 100 °C ± 3 °C (212 °F ± 5 °F) for 70 h.

5.5.2.4 Rating

Upon removal from the environmental chamber, visually inspect the test specimen for evidence of splitting or cracking while still on the metal tube. Determine the elongation of the unexpanded portion of the specimen and compare to the elongation of a portion of the original specimen before temperature aging. Examine for visual evidence of wax or other contaminants exuding from the tubing.

5.5.3 Stress Relaxation

5.5.3.1 Test Equipment

Environmental chamber.

5.5.3.2 Preparation of Tubing

A mandrel whose diameter is two times the nominal ID of the tubing shall be inserted for a length of 13 mm (0.5 in) into a specimen of new tubing.

5.5.3.3 Procedure

The test specimen shall be placed in an environmental chamber at 100 °C ± 3 °C (212 °F ± 6 °F) for 70 h.

5.5.3.4 Upon removal from the environmental chamber, remove the specimen from the mandrel and allow it to cool to room temperature. Measure the tubing ID in the section which was expanded.

6. NOTES

6.1 Marginal Indicia

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PREPARED BY THE SAE TRUCK AND BUS WINDSHIELD WIPER AND CLIMATE CONTROL COMMITTEE
OF THE SAE TRUCK AND BUS BODY AND OCCUPANT ENVIRONMENT STEERING COMMITTEE