The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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# SURFACE VEHICLE RECOMMENDED PRACTICE

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Submitted for recognition as an American National Standard

## (R) Motor Vehicle Glazing—Electrical Circuits

***1. Scope***—This SAE Recommended Practice establishes limits for electrical circuits on motor vehicle safety glazing materials.

***2. References***

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

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

SAE J100—Passenger Car Glazing Shade Bands
SAE J903c—Passenger Car Windshield Wiper Systems
SAE J1050—Describing and Measuring the Driver's Field of View

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

ANSI Z26.1—Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways, Safety Code

2.1.3 FEDERAL PUBLICATION—Available from the Superintendent of Documents, U. S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320.

FMVSS 49 CFR 571.205—Glazing Materials

***3. Definitions***

**3.1 Electrical Circuits**—Electrical conductors used to carry current for lighting, antennas to facilitate communication, special sensors, and heating to promote vision through the removal of moisture condensation, ice films, or snow.

**3.2 Safety Glazing Materials**—A product consisting of organic and/or inorganic materials so constructed or treated to reduce, in comparison with annealed sheet, plate, or float glass, the likelihood of injury to persons as a result of contact with these safety glazing materials when used in a vehicle, whether they may be broken or unbroken, and for which special requirements regarding visibility, strength, and abrasion are set-forth.





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**3.3 Windshield—**The principal forward-facing, safety glazing material provided for forward vision in operating a motor vehicle.

**3.4 Rear Window—**The principal rearward-facing, safety glazing material in a motor vehicle.

**3.5 Primary Rear Vision Area—**This is the 'Indirect Field of View' afforded by the inside rear view mirror. The mirror vision through the backlight should provide a minimum of an unobstructed 20 degree horizontal field of view and an unobstructed vertical field of view, which includes the horizon and the road 60.9 m (200 ft) rearward of the driver's SgRP. The procedures specified in SAE J1050 AUG94 should be used to measure the rear vision area.

**3.6 Side Window—**The safety glazing material to the right and left of the driver, including those adjacent and to the rear of the driver.

**3.7 Glazing Not Requisite for Driving Visibility—**The safety glazing materials, or areas thereof, that are in locations defined as not required for vision in operating a motor vehicle.

***4. General—***This document defines the limits of electrical circuits on motor vehicle safety glazing materials. The safety glazing materials used may be of any type that meets the requirements of FMVSS 205 and ANSI/SAE Z26.1, which define glazing types, permissible for use in the various body positions, dependent upon requisite vision areas applicable to the vehicle classification.

Presently there are two types of electrical circuits: opaque and transparent. Opaque types consist of either small conductive elements (e.g., wires) in or on the plastic interlayer of the laminated safety glazing material or conductors integral with the surface of a safety glazing material. Opaque conductors shall be of low reflectivity and of neutral or unobtrusive color.

Transparent types consist of very thin electrically conductive coatings, which when utilized, provide a safety glazing material that complies with the applicable luminous transmittance requirements described in FMVSS 205 and ANSI Z26.1.

The electrical circuits shall not interfere with or degrade the safety properties of a safety glazing material. To minimize the potential for electrical, thermal, or electromagnetic exposure to the occupants, glazing materials with electrical circuits should be jointly designed by the glazing and motor vehicle manufacturers.

As electric conductors may also reduce vision or cause optical distortion, a practical limitation of their use is desirable. Until substantial research data are obtained, which do not exist at the present, limitation in the use of electrical circuits must be based on present manufacturing processes, practices, and existing data on field of view. Consequently, this document will be reviewed periodically and revised as additional information becomes available.

***5. Safety Glazing Materials—Electrical Circuits***

**5.1 Areas Not Requisite for Driving Visibility—**There is no limitation on the use of electrical circuits with safety glazing materials in those areas defined by SAE J100, SAE J1050, ANSI Z26.1, and FMVSS 205 as not requisite for driving visibility.

### 5.2 Windshields

5.2.1 OPAQUE ELECTRICAL CIRCUITS—Opaque conductors shall not exceed 2.5% of the area defined in SAE J100 as requisite for driving visibility. Defrosting or demisting conductors up to 0.035 mm (0.0014 in) in diameter or width, in a "zig-zag" or sinusoidal form, with a density of up to 10 wires/cm if vertical and 7 wires/cm if horizontal, are acceptable but should not impair the vision areas requisite for driving visibility before, during, and after a power cycle. Opaque conductors not exceeding 0.8 mm (0.03 in) in diameter or width are allowed outside the "B" area as defined by SAE J903c and allowed within the "B" area restricted to 38.1 mm (1.5 in) wide vertical strip each side of the vertical centerline of the windshield.

5.2.2 TRANSPARENT ELECTRICAL CIRCUITS—Transparent electrical conductive coatings used in the windshield vision area shall not decrease the light transmittance below 70% as defined in ANSI Z26.1.

### 5.3 Rear Windows Requisite for Driving Visibility

5.3.1 OPAQUE ELECTRICAL CIRCUITS—Opaque electrical circuits shall not exceed 5% of the primary rear vision area of the safety glazing material defined in 3.5 and shall consist of conductors no greater than 1 mm (0.04 in) wide and no closer together than 25.4 mm (1.00 in). Defrosting or demisting wire conductors up to 0.035 mm (0.0014 in) in diameter or width, in a "zig-zag" sinusoidal or straight form, with a density of up to 10 wires/cm if vertical and 7 wires/cm if horizontal, are acceptable but should not impair the vision areas requisite for driving visibility before, during, or after a power cycle.

In other rear vision areas outside the primary rear vision area, opaque electrical conductors shall not exceed 6.5% of the area.

5.3.2 TRANSPARENT ELECTRICAL CIRCUITS—Transparent electrical conductive coatings used in the rear vision areas shall not decrease the light transmittance below 70% as defined in ANSI Z26.1.

### 5.4 Side Windows Requisite for Driving Visibility

5.4.1 OPAQUE ELECTRICAL CIRCUITS—Defrosting or demisting conductors up to 0.035 mm (0.0014 in) in diameter or width, in a "zig-zag" or sinusoidal form, with a density of up to 10 wires/cm if vertical and 7 wires/cm if horizontal, are acceptable but shall not impair the vision areas requisite for driving visibility before, during, or after a power cycle.

5.4.2 TRANSPARENT ELECTRICAL CIRCUITS—Transparent electrical conductive coatings used in the side vision areas shall not decrease the light transmittance below 70% as defined in ANSI Z26.1. Exposed coatings, either exterior or interior, shall pass the abrasion requirements of Test 5.18, Abrasion Resistance, in ANSI Z26.1.

## *6. Notes*

**6.1 Marginal Indicia—**The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.



PREPARED BY THE SAE GLAZING MATERIALS STANDARDS COMMITTEE