

AS/NZS 1906.4:2023



Australian/New Zealand Standard™

Retroreflective materials and devices for road traffic control purposes

Part 4: High-visibility materials for safety garments



AS/NZS 1906.4:2023

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Australian/New Zealand Standard™

Retroreflective materials and devices for road traffic control purposes

Part 4: High-visibility materials for safety garments

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Preface

This document was prepared by the Joint Standards Australia/Standards New Zealand Committee MS-049, Retroreflective Devices, to supersede AS/NZS 1906.4:2010.

The objective of this document is to provide requirements for materials to be used in the manufacture of, or for incorporation into, garments designed to be worn in situations where the wearer needs to be highly visible.

A list of all parts in the AS/(NZS) 1906 series can be found in the Standards Australia online catalogue.

The major changes in this edition are as follows:

- (a) The introduction of two new high visibility background colours; Pink and Green. This includes chromaticity coordinates, which have been inserted into [Figure 2.1](#), and luminance values, which have been added to [Table 2.2](#) and [Table 2.3](#).
- (b) The introduction of two new material classifications, Class NF (W) for high visibility background material and Class SP for retroreflective material.
- (c) The introduction of an optional extended wash testing specification for high visibility background materials (see [Clause 2.7](#)).
- (d) The addition of a specification for the testing of chequered pattern and heat applied retroreflective tapes (see [Clause 3.3](#)).
- (e) The introduction of an optional extended wash testing specification for retroreflective material (see [Clause 3.9](#)).

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Australian/New Zealand Standard

Retroreflective materials and devices for road traffic control purposes

Part 4: High-visibility materials for safety garments

1 Scope and general

1.1 Scope

This document provides requirements for materials to be used in the manufacture of, or for incorporation into, garments designed to be worn in situations where the wearer needs to be highly visible. These materials include the following:

- (a) High visibility materials for daytime and low light conditions.

Daytime and low light high visibility for safety garments is normally achieved through the use of fluorescent materials. An allowance is made for non-fluorescent colours for use in those situations where, for safety reasons in addition to conspicuity in a particular industry, fibres that will not adequately retain fluorescent colour are used in safety garments.

- (b) Retroreflective materials for use in night-time and low light conditions.

Night-time and low light high visibility for safety garments is normally achieved through the use of retroreflective materials. Retroreflected colour is not specified for retroreflective materials. The essential night-visibility requirement for high-visibility garment material is an absolute retroreflective performance regardless of colour.

This document applies only to high-visibility materials to be used in the manufacture of safety garments. It does not apply to the garments themselves. Immersible water safety materials such as those used on personal flotation devices are excluded.

NOTE This document does not include requirements for the integrity or performance of materials under extremes of temperature, extreme atmospheric conditions, abrasive conditions or any other abnormal use of the material.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents for informative purposes are listed in the Bibliography.

AS 1441.14, *Methods of test for coated fabrics, Method 14: Determination of resistance to cold cracking*

AS 1906.1, *Retroreflective materials and devices for road traffic control purposes, Part 1: Retroreflective sheeting*

AS 2001.2.25.1, *Methods of test for textiles, Method 2.25.1: Physical tests—Determination of the abrasion resistance of fabrics by the Martindale method—Martindale abrasion testing apparatus*

AS 2001.4.A01, *Methods of test for textiles, Method 4.1: Colourfastness tests—Definitions and general requirements*

AS 2001.4.B02, *Methods of test for textiles, Method 4.B02: Colourfastness tests—Colourfastness to artificial light: Xenon arc fading lamp test (ISO 105-B02:1994, MOD)*

AS 2001.4.E04, *Methods of test for textiles, Method 4.E04: Colourfastness tests—Determination of colourfastness to perspiration*

AS 2001.4.15, *Methods of test for textiles, Method 4.15: Colourfastness tests—Determination of colourfastness to washing*

AS 4004, *Lighting booths for visual assessment of colour and colour matching*

AS 4878.9, *Methods of test for coated fabrics, Method 9: Determination of resistance to damage by flexing*

AS/NZS 1957, *Textiles—Care labelling*

AS ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing*

CIE 051.2, *A method for assessing the quality of daylight simulators for colorimetry*

1.3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.3.1

viewing geometry

Note 1 to entry: The following [definitions \(1.3.1.1 to 1.3.1.3\)](#) are condensed versions of the corresponding definitions given in CIE 054.2. Reference should be made to the CIE document if a full set of parameters and their definitions is required.

Note 2 to entry: An illustration showing the parameters of these definitions can be found in AS 1906.1.

1.3.1.1

entrance angle

β (Beta)

angle between the axis normal to the retroreflector through its point of reference and the axis joining the point of reference and illumination source

Note 1 to entry: The angle β has two components, β_1 and β_2 , as follows:

- (a) β_1 is the component projected onto the plane containing the observation angle.
- (b) β_2 is the component projected onto the plane containing the axis normal to the retroreflector and which is at right angles to the plane containing the observation angle.

Note 2 to entry: Since this document specifies that all CIL/m² measurements are to be taken with the plane containing the entrance angle in the same plane as the observation angle, the CIL/m² tabulations in [Section 3](#) will show $\beta_2 = 0$.

1.3.1.2

observation angle

α (Alpha)

angle between the axis joining the point of reference on the retroreflector and the observer or receptor, and the axis joining the point of reference on the retroreflector and the illumination source

Note 1 to entry: The retroreflector is either a device or a material sample. The point of reference on the retroreflector is usually the centre.

1.3.1.3

rotation angle

ϵ (Epsilon)

angle measured from an arbitrary starting point through which the retroreflective material is rotated during the photometric testing, about an axis normal to, and passing through the centre of, the piece

Note 1 to entry: The rotation angle ϵ has two components, ϵ_1 and ϵ_2 , as follows:

- (a) ϵ_1 is either taken from a datum mark on the material or from clear instruction from the manufacturer. If no datum or instruction exists, it may be selected at random.

(b) ε_2 is a point of rotation set at 90° to ε_1 .

1.3.2

light technical parameters

1.3.2.1

coefficient of luminous intensity

CIL

quotient expressed in candela per lux (cd.lx^{-1}), obtained by dividing the luminous intensity, in the direction considered, by the illuminance at the retroreflective surface, for given observation, entrance and rotation angles

Note 1 to entry: This coefficient is applicable to devices that are effectively point sources of light at normal viewing distances.

1.3.2.2

coefficient of luminous intensity per unit area

CIL/ m^2

value expressed in candela per lux per square metre ($\text{cd.lx}^{-1}.\text{m}^{-2}$), obtained by dividing the coefficient of luminous intensity of a test piece by the area in square metres of that test piece measured parallel to its surface

1.3.2.3

luminance factor

ratio of the luminance of a surface to that of an ideal white diffusing surface when illuminated and viewed under the same conditions and viewing geometry

Note 1 to entry: The luminance factor is usually expressed as a decimal in the range 0 to 1, but values greater than 1 are possible for some fluorescent materials. It may also be expressed as a percentage.

1.3.3

material performance parameters

1.3.3.1

orientation sensitive material

retroreflective material that exhibits CIL/ m^2 values that differ by more than 15 % when measured at any two rotation angles 90° apart and at entrance angle $\beta_1 = 20^\circ$ and observation angle $\alpha = 0.2^\circ$

1.3.3.2

fluorescent material

material that emits optical radiation at wavelengths longer than absorbed

1.3.4

may

indicates the existence of an option

1.3.5

shall

indicates that a statement is mandatory

1.3.6

should

indicates a recommendation

1.4 Classification of materials

High-visibility materials shall be classified according to their day or night-time application, as follows:

(a) *Class F* — Daytime high visibility fluorescent material.

- (b) *Class F (W)* — Daytime high visibility fluorescent material that has met both the requirements for Class F material and passed an optional wet weather test (see [Clause 2.6](#)).
- (c) *Class R* — Retroreflective material for use on garments used in night-time and low light conditions.
- (d) *Class RF* — Combined performance retroreflective/fluorescent material meeting all of the requirements of Class R and the daytime colour requirements of Class F.
- (e) *Class NF* — Daytime high visibility non-fluorescent material.
- (f) *Class NF (W)* — Daytime high visibility non-fluorescent material that has met both the requirements for Class NF material and passed an optional wet weather test (see [Clause 2.6](#)).
- (g) *Class SP* — Separate performance material where one section of the material meets the requirements of Class R and the other meets the requirements of Class F.

2 Daytime high visibility materials (Classes F, RF, SP, and NF)

2.1 Application of section

The requirements of this section shall apply to Class F, Class RF, Class SP and Class NF materials in respect of their daytime visibility only.

2.2 General description and summary of test requirements

2.2.1 Class F and Class NF materials

Class F and NF materials typically comprise, but are not limited to, one of the following:

- (a) A robust fabric to which a fluorescent or other highly coloured plastic coating has been applied.
- (b) A robust fabric which contains either a fluorescent colour or, if indicated in [Clause 2.4](#), another high-visibility colour.

Class F and Class NF materials shall be subjected to the following tests:

- (i) Daylight colour and luminance factor test (see [Clauses 2.3](#) and [2.4](#)).
- (ii) Colourfastness after UV exposure test (see [Clause 2.5.1](#)).
- (iii) Colourfastness to washing test (see [Clause 2.5.2](#)).
- (iv) Colourfastness to perspiration test (see [Clause 2.5.3](#)).

A fresh sample of material shall be used for each test.

A Class F or Class NF material which has passed the optional wet weather test in [Clause 2.6](#) may be designated Class F (W) or Class NF (W), respectively.

NOTE This document specifies only those requirements related to the visibility, and possible degradation of visibility, of materials. These tests do not address the durability or fitness for purpose of the materials in other respects.

2.2.2 Class RF materials

Class RF is a combined performance material that shall meet the fluorescent colour requirements of [Clause 2.3](#) and, because the fluorescent colour is also acting as background material, meet the