

Australian/New Zealand Standard™

Sun protective clothing—Evaluation and classification



AS/NZS 4399:2017

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Australian Fire and Emergency Services Authorities Council
Australian Radiation Protection and Nuclear Safety Agency
Cancer Council Australia
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Consumers Federation of Australia
Measurements Standards Laboratory of New Zealand
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TX-021 Sun Protective Clothing, to supersede AS/NZS 4399:1996.

This Standard is intended to provide information to the consumer about the relative sun protection capabilities of materials and items of clothing. This information is provided to the consumer in the form of a labelling scheme based on an objective, reproducible in vitro test method. This Standard is applicable to all materials and clothing claiming a UPF rating. Sun protection offered by synthetic shade cloth, sunscreens, sunglasses and eye protectors is the subject of other Standards.

The major changes in this edition are as follows:

- (a) Introduction of a minimum level of body coverage required for clothing to display or claim a UPF rating.
- (b) A revised UPF classification scheme.
- (c) Introduction of minimum requirements for specified items of clothing including hats and gloves.

The term ‘normative’ has been used in this Standard to define the application of the appendices to which it applies. A ‘normative’ appendix is an integral part of a Standard.

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FOREWORD

Australia and New Zealand experience the highest rates of skin cancer in the world. As a result, substantial effort has been invested in ensuring sun protective measures are readily available for and easily adopted by the Australian and New Zealand public.

There is scientific evidence to indicate that skin cancer risk can be meaningfully reduced by ensuring that a greater proportion of the body surface is routinely covered by clothing, particularly during childhood (Harrison et al, 2005, 2010 and Smith et al 2013).

Therefore, this revision adds a new requirement by specifying the amount of body surface that an item of clothing needs to cover in order to be allowed to make a UPF claim. It explicitly excludes the manufacturers of brief clothing items, such as bikini swimwear, from making any sun protection claims regardless of the UPF rating of the material that the bikini is made from.

The Standard does not seek to prescribe the ideal level of body coverage to ensure 100% coverage or sun protection. Furthermore, it does not address the issue of UVR exposure that achieves an ideal balance between skin cancer prevention and vitamin D production, as this issue is considered outside the scope of this Standard.

It is not the intention of this Standard to inhibit innovation. However, clothing which does not cover significant areas of exposed skin, should not be considered as sun protective clothing in the general sense, although the material itself may block UVR.

To designate clothing which provides inadequate skin coverage as sun protective is misleading. Clothing of such design is therefore excluded from the scope of this Standard.

In determining the test method, and thus the rating system given in this Standard, the Committee considered the relative merits of *in vivo* (direct testing in humans) and *in vitro* (laboratory-based) test methods, and the relationship between sunglasses and sun protective materials (which are inert products) and sunscreens (where there may be an interaction such as bioactivation, or a variability in the sunscreen film thickness because of the uneven application onto the skin surface). Many consumers will be familiar with the term ‘sun protection factor’ (SPF) which is used to rate sunscreens. The test method used to determine an SPF value is an *in vivo* one, using the start of a sunburn on human skin as an endpoint, and the procedure is given in AS/NZS 2604, *Sunscreen products—Evaluation and classification*. However, the term ‘ultraviolet protection factor’ (UPF) is used in this Standard to rate sun protective materials and clothing, and it is based on an *in vitro* test method (Gies et al, Health Phys., 1994). The UPF measurement is a relative ranking of the sun protective capabilities of a material. The UPF is not related to the development of redness in human skin due to excessive sun exposure.

The test method given in this Standard is intended for determining the UPF of an unstretched, dry material. It is expected that some materials will have a lower UPF rating when wet, and that the amount of protection offered by knitted materials is likely to vary according to how much they are stretched. Research to identify these variables is currently underway, but the relevant variables for a wet test procedure and a stretched test procedure are not yet known.

It is also noted that loose clothing provides better protection from solar UVR than tight fitting clothing (tight enough to stretch material) and that dark colours generally offer better sun protection than light colours. The sun protection afforded by clothing is also influenced by the weave and knit of the material, with denser construction blocking more UVR. It is recommended that a high SPF sunscreen product be applied to any exposed areas of the skin not protected by clothing.

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1 SCOPE

This Standard sets out procedures for determining the performance of materials and items of clothing that are worn in close proximity to the skin to provide protection against solar ultraviolet radiation (UVR). The sun protective capability of materials and clothing is described in terms of their UPF, which is based on an objective, reproducible test conducted on the material. This information is provided to the consumer in the form of a labelling scheme.

This Standard applies to all materials and items of clothing seeking to claim a UPF rating. All such clothing needs to be designed in a manner that supports the concept of minimal skin exposure. Thus, this Standard specifies the amount of body surface that an item of clothing needs to cover in order to be allowed to make a UPF claim.

This Standard excludes sunglasses, sunscreen products for topical application to human skin, materials for architectural or horticultural use such as shade cloth, and items which offer protection at a distance from the skin such as shade structures. It also does not cover protection from UVR from sources other than the sun. Thus, any reference made to UVR in this Standard refers exclusively to solar UVR.

NOTES:

- 1 Requirements for sunscreens are specified in AS/NZS 2604.
- 2 Requirements for sunglasses are given in AS 1067 (series).
- 3 Requirements for shade cloth are given in AS 4174.
- 4 Products such as umbrellas and shade structures which are not in close proximity to the skin will provide a lesser degree of protection than would be indicated by the rating of the material from which the product is made, because of the amount of scattered radiation that could enter from around the edges of the product. The amount of this radiation will vary with the area of the product, and the distance of the product from the body. This Standard is therefore not appropriate for evaluating such items.

2 OBJECTIVE

This Standard is intended to provide guidance regarding the information communicated to the consumer on UPF labels and/or swing tags about the relative sun protective capability of material and items of clothing. This information is intended to assist the consumer in the selection of those items which best suit their need for sun protection. This Standard also specifies the minimum level of body coverage that an item of clothing needs to achieve in order to legitimately display or claim an UPF rating.

3 DEFINITIONS AND ABBREVIATIONS

For the purpose of this Standard, the definitions below apply.

3.1 Elbow

The joint situated between the upper arm (humerus) and the forearm (primarily connected to the ulna) as shown in Figure 1.

3.2 Erythema

The start of a sunburn for people with the most sun-sensitive skin type.

3.3 Hip line

A line formed by measuring the hips at the fullest part (i.e. where the girth of the body is greatest between the abdomen and the crotch. (See Figure 1.)

3.4 Knee

Corresponds with a horizontal line drawn through the uppermost point of the knee cap (patella) just below where it meets the femur. (See Figure 1.)

3.5 Lower body

Incorporates the buttocks and legs, from the hip line to the ankle.

3.6 Meagre

Deficient in quantity. For the purpose of this Standard meagre is used to describe clothing which only covers a small percentage of the total body surface area, for example, bikini swimwear.

3.7 Shall

Indicates that a statement is mandatory.

3.8 Should

Indicates a recommendation.

3.9 Shoulder point

Corresponds with the outermost extent of the shoulder joint and generally aligns with the seam joining a 'fit-in' sleeve to the body of a garment. It can be defined anatomically as the outermost extent of the acromio-clavicular joint (commonly known as the A-C joint), which is derived from the junction of the collar bone (clavicle) and the shoulder blade (scapula). The exact point of measurement (see Figure 1) coincides with the hollow between the shoulder (acromion) and above the long bone of the upper arm (the humerus).

3.10 Sun protective clothing

An item of clothing (including personal clothing, garments and clothing accessories such as hats, gloves, sleeves, leggings, wrist protectors, body wraps and blankets, brim and neck protectors such as gaiters or balaclavas for use with helmets or hats) that is designed or made to be used in a way that reduces or minimizes skin exposure and, is manufactured from material which meets the requirements for the minimum UPF rating under this Standard.

3.11 Ultraviolet protection factor (UPF)

The ratio of the average effective UVR irradiance (see Appendix B, Tables B1 and B2) calculated for unprotected skin to the average effective UVR irradiance calculated for skin protected by the test material.

3.12 Ultraviolet radiation (UVA)

Solar ultraviolet radiation in the range 315 nm to 400 nm.

3.13 Ultraviolet radiation (UVB)

Solar ultraviolet radiation in the range 280 nm to 315 nm.

NOTE: This classification is based on the ranges given in the International Commission on Non-Ionizing Radiation Protection (2004) and apply to all of UVA, UVB and UVR.

3.14 Ultraviolet radiation (UVR)

Ultraviolet radiation (UVR) is UVR in the range 280 nm to 400 nm (see Appendix B, Tables B3 and B4) while solar UVR at the earth's surface only covers the range 290 to 400 nm as 280 to 290 nm is absorbed by the atmosphere and is not present.

3.15 Upper body

Incorporates the torso, from the base of the neck to the hip line and across the shoulders to the wrist.

4 BODY COVERAGE

4.1 General

The design of clothing for sun protection is an important component in lowering exposure of the body to UVR. Minimal skin coverage afforded by scant clothing design is not recommended. Correct sizing of clothing or loose fitting clothing is also necessary to avoid stretching and afford maximum protection.

The following specifications are required for clothing to carry a sun protection UPF rating.

4.2 Clothing

4.2.1 General

Maximum coverage of the skin is recommended when exposed to solar UVR and the more skin covered by material, the better the protection offered. Clothing designs incorporating full length sleeves, collars, crew necklines, long skirt or long trouser legs cover more body surface area, thereby providing a more extensive physical barrier to solar UVR than sleeveless dresses and vests, low necklines, mini-skirts, shorts, bikini tops and briefs.

The design for clothing which offers optimal protection from solar UVR includes full coverage of both the upper and lower body (see Figure 1), but particularly—

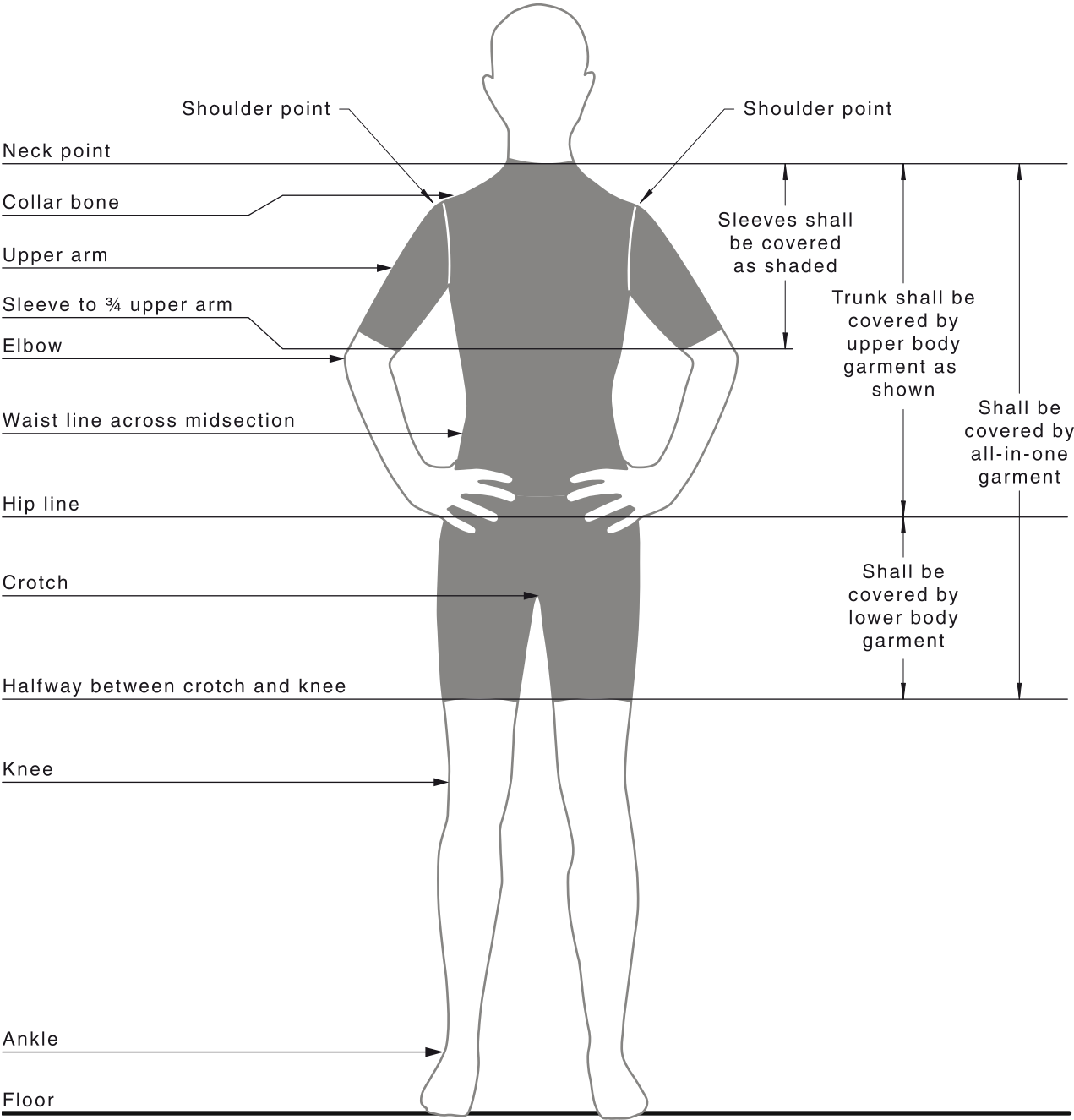
- (a) the torso;
- (b) the neck and collarbones;
- (c) the shoulders and upper arms; and
- (d) the thighs.

Upper body and lower body garments may be worn in combination to achieve the body coverage required to claim a UPF rating.

NOTE: There is no intention to allow 'all in one' suits to be the only design permissible to make a sun protection claim.

There are circumstances where a range of materials are used in combination to make up a garment. This Standard allows for such combinations (e.g. use of mesh in underarm of outdoor work shirts). However, parts of the garment covering body parts usually exposed to the sun while outdoors need to meet testing requirements to claim a UPF rating. The lowest UPF rating achieved in testing of multi-component garments, excluding those areas not exposed to sunlight (i.e. armpits), is the rating that shall be used for the garment.

NOTE: Headwear not shown



NOTE: There is no intention to allow 'all in one' suits to be the only design permissible to make a sun protection claim.

FIGURE 1 MINIMUM BODY COVERAGE REQUIRED
IN ORDER TO MAKE A SUN PROTECTION CLAIM

4.2.2 Upper body

To claim a UPF rating, the garment shall fully cover the shoulders and extend down to the hip line. It shall also have sleeves that extend to at least as far as the three-quarter measurement between the shoulder point and the elbow as illustrated in Figure 1.