

### 1. Purpose and Scope

This criterion is applicable to the evaluation and testing on shading effect of solar ultraviolet (UV) rays of textile related products both before and after washing.

### 2. Terminology

UVA: Ultraviolet radiation (UVR) ranges in wavelength from 315~400nm

UVB: Ultraviolet radiation (UVR) ranges in wavelength from 290~315nm

Ultraviolet Protective Factor (UPF): The ratio of the average effective ultraviolet radiation irradiance calculated for unprotected skin to the average effective UVR irradiance calculated for skin protected by the test fabric.

### 3. Classification

UPF values of the textiles both as received state and after launderings are determined. The laundering procedures are based on AATCC 135(1)(III)(A) iii and in accordance with the guide in 4.1.

Table 1. UPF classification.

UPF	Grade	Classification
40-50、50+	A	Excellent
25-39	B	Very Good
15-24	C	Good

### 4. Test method

4.1 Durability : Wash the sample according to AATCC 135(1)(III)(A)iii. The washable samples submitted to apply for type I label should be laundered for 20 cycles. By applicant's request, the washing cycles could be over 20 (the number must be a multiple of 5, such as 25, 30, 35, 40 etc). For samples submitted to apply for type II label, washing is not necessary. The number of washing cycles should be noted on the mark label.

4.2 Ultraviolet Protection Factor (UPF) : refer to AS/NZS 4399

#### 4.2.1 Apparatus

Ultraviolet Transmittance Analyzer (A spectrophotometer or spectroradiometer).

#### 4.2.2 Sample Preparation

Two specimens should be taken from the machine direction ( or wrapwise direction) and another two from the across machine direction( or fillingwise direction) . The specimen size should be sufficient to cover the sample aperture of the analyzer. If the sample has areas of different color or struture and these areas are sufficient to cover the sample aperture of the analyzer, each color or texture should be tested.

#### 4.2.3 Procedure

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Select the solar spectral irradiance which was measured at noon on 17 January, 1990 in Melbourne, Australia and set the desired UV radiation range for measurement. Calibrate and check the ultraviolet transmittance analyzer according to the manufacturer's instruction. Then place the specimen at the transmission port of the integrating sphere and measure the UV transmission. Two measurements should be made for each specimen. Make one UV transmission measurement with the specimen oriented in one direction, a second measurement at 45° to the first one. Record all eight UV transmittance measurements of the 4 specimens individually.

#### 4.2.4 Test results

(1) The UPF of the specimen is calculated as follows:

$$\text{UPF} = \frac{\sum_{290}^{400} E_{\lambda} \times S_{\lambda} \times \Delta\lambda}{\sum_{290}^{400} E_{\lambda} \times S_{\lambda} \times T_{\lambda} \times \Delta\lambda}$$

where  $E_{\lambda}$  : Relative Erythermal Spectral Effectiveness

$S_{\lambda}$  : Solar Spectral Irradiance ( $\text{W.m}^{-2}.\text{nm}^{-1}$ )

$T_{\lambda}$  : Spectral Transmittance of the Item

$\Delta\lambda$  : Wavelength Step (nm)

$\lambda$  : Wavelength (nm)

(2) Calculate the mean UPF of the sample and the standard deviation of the mean UPF.

(3) The Rated UPF of the sample is determined by using the mean UPF of the sample to subtract the standard error calculated for 99% confidence level. If the Rated UPF determined as above is less than the lowest individual UPF measurement of the sample, the Rated UPF should be expressed as the lowest individual UPF measurement. (Since 8 measurements are obtained in this test, the standard error equal to the standard deviation multiplies 1.24). If the sample has areas of different color or struture, the lowest UPF measured should be used as the UPF result of the sample.

#### 5. Mark

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Table 2. Mark of UPF classification.

Type	UPF	Grade	Classification
I (Washing required)	40-50 、 50+	AAAAA	Excellent
	25-39	AAA	Good
	15-24	A	Fair
II (Washing not required)	40-50 、 50+	AAAAA	Excellent
	25-39	AAA	Good
	15-24	A	Fair

**6. Reference**

AATCC 135 Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics  
AS/NZS 4399 Sun Protective Clothing -- Evaluation and Classification

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