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Foreword

This Japanese Industrial Standard has been revised by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Safety Appliances Association (JSAA)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied *mutatis mutandis* pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS T 8127:2015**), which has been technically revised.

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High visibility safety clothing

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 20471:2013**, Edition 1, and its Amendment 1:2016 with some modifications of the technical contents to increase the usability of this Standard. The amendment to the said International Standard has been incorporated into this Standard.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JB. Annex JA is unique to **JIS** and not given in the corresponding International Standard.

1 Scope

This Standard specifies requirements for high visibility safety clothing which is capable of visually signalling the user's presence. The high visibility safety clothing is intended to provide conspicuity of the wearer in any light condition when viewed by operators of moving bodies such as vehicles or construction machines (hereafter referred to as moving bodies) during daylight conditions and under illumination of headlights in the dark.

This Standard is not applicable to medium-risk and low-risk situations (see Annex A). Performance requirements are included for colour and retroreflection as well as for the minimum areas and for the placement of the materials in protective clothing.

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 20471:2013 *High visibility clothing—Test methods and requirements* and Amendment 1:2016 (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and the revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent editions (including amendments) shall be applied.

JIS K 6404-2 *Testing methods for rubber- or plastics-coated fabrics—Part 2: Determination of basic physical properties*

NOTE Corresponding International Standard: ISO 1421 *Rubber- or plastics-coated fabrics—Determination of tensile strength and elongation at break* and ISO 4674-1 *Rubber- or plastics-coated fabrics—Determination of tear resistance—Part 1: Constant rate of tear methods*

JIS K 6404-3 *Testing methods for rubber- or plastics-coated fabrics—Part 3: Determination of physical properties (Application)*

NOTE Corresponding International Standard: ISO 4675 *Rubber- or plastics-coated fabrics—Low-temperature bend test*

JIS L 0001 *Textiles—Care labelling code using symbols*

NOTE Corresponding International Standard: ISO 3758 *Textiles—Care labelling code using symbols*

JIS L 0804 *Grey scale for assessing change in colour*

JIS L 0805 *Grey scale for assessing staining*

NOTE Corresponding International Standard: ISO 105-A03 *Textiles—Tests for colour fastness—Part A03: Grey scale for assessing staining*

JIS L 0843 *Test methods for colour fastness to xenon arc lamp light*

JIS L 0844 *Test methods for colour fastness to washing and laundering*

NOTE Corresponding International Standard: ISO 105-C06 *Textiles—Tests for colour fastness—Part C06: Colour fastness to domestic and commercial laundering*

JIS L 0848 *Test method for colour fastness to perspiration*

NOTE Corresponding International Standard: ISO 105-E04 *Textiles—Tests for colour fastness—Part E04: Colour fastness to perspiration*

JIS L 0849 *Test methods for colour fastness to rubbing*

NOTE Corresponding International Standard: ISO 105-X12 *Textiles—Tests for colour fastness—Part X12: Colour fastness to rubbing*

JIS L 0850 *Test method for colour fastness to hot pressing*

NOTE Corresponding International Standard: ISO 105-X11 *Textiles—Tests for colour fastness—Part X11: Colour fastness to hot pressing*

JIS L 0856 *Test methods for colour fastness to bleaching with hypochlorite*

NOTE Corresponding International Standard: ISO 105-N01 *Textiles—Tests for colour fastness—Part N01: Colour fastness to bleaching: Hypochlorite*

JIS L 0860 *Test methods for colour fastness to dry cleaning*

NOTE Corresponding International Standard: ISO 105-D01 *Textiles—Tests for colour fastness—Part D01: Colour fastness to drycleaning using perchloroethylene solvent*

JIS L 1096 *Testing methods for woven and knitted fabrics*

NOTE Corresponding International Standard: ISO 13934-1 *Textiles—Tensile properties of fabrics—Part 1: Determination of maximum force and elongation at maximum force using the strip method* and ISO 13938-1 *Textiles—Bursting properties of fabrics—Part 1: Hydraulic method for determination of bursting strength and bursting distension*

JIS L 1099 *Testing methods for water vapour permeability of textiles*

NOTE Corresponding International Standard: ISO 11092 *Textiles—Physiological effects—Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

JIS T 8005 *Protective clothing—General requirements*

NOTE Corresponding International Standard: ISO 13688 *Protective clothing—General requirements*

JIS Z 8717 *Methods of measurement for colour of fluorescent objects*

JIS Z 8720 *Standard illuminants and sources for colorimetry*

ISO 105-A02 *Textiles—Tests for colour fastness—Part A02: Grey scale for assessing change in colour*

ISO 105-B02:1994 *Textiles—Tests for colour fastness—Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

ISO 7000 *Graphical symbols for use on equipment—Registered symbols*

ISO 7854 *Rubber-or plastics-coated fabrics—Determination of resistance to damage by flexing*

ISO 8559-2 *Size designation of clothes—Part 2: Primary and secondary dimension indicators*

ISO 13938-2 *Textiles—Bursting properties of fabrics—Part 2: Pneumatic method for determination of bursting strength and bursting distension*

ISO 30023 *Textiles—Qualification symbols for labelling workwear to be industrially laundered*

CIE 15 *Colorimetry*

CIE 54.2 *Retroreflection—Definition and measurement*

CIE 1931 *Standard colourimetric observer*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

high visibility safety clothing

clothing intended to enhance safety of the wearer by improving the conspicuity in situations where the risk of not being seen is high

3.2

tabard

vest both sides of which are open but closed by such means as strings and hook-and-loop fasteners

3.3

seam

permanent joint between materials of high visibility safety clothing, made by such means as stitching up and adhesion

3.4

fluorescence

electromagnetic radiation at visible wavelengths longer than those absorbed

NOTE Fluorescence reacts to lights other than visible light, making colours appear more vivid than if they were without fluorescence.

3.5

background material

coloured fluorescent material

3.6

retroreflection

reflection where light is reflected back to the light source selectively along the path of the incident light over a wide range of illuminating angle

3.7

retroreflective material

material which is a retroreflector

3.8

combined-performance material

material intended to exhibit both background and retroreflective properties, e.g. fluorescent retroreflective material

3.9

orientation-sensitive material

material having coefficients of retroreflection that differ by more than 15 % when measured at the two rotation angles ($\varepsilon_1 = 0^\circ$, $\varepsilon_2 = 90^\circ$)

3.10

torso

thorax and abdomen

3.11

long sleeve

part of a high visibility safety garment that is completely covering the entire arm

NOTE “Covering the entire arm” means that the sleeve length is capable of covering the arm all the way up to the wrist.

3.12

road etc.

traffic-related area with moving vehicles, light vehicles and mechanised equipment

It includes indoor passages such as those in a factory as well as outdoor passages such as general roads.

Example General road, expressway, cycling path, harbour, airport, railway track, car park, factory passage, etc.

3.13

active road user

person using the road etc. for transportation purposes, participating in the traffic and with the attention on the traffic

Example Cyclist using the road and pedestrian using the road.

3.14

passive road user

person using the road etc. for other purposes than transportation, not participating in traffic of moving bodies and with attention focused on something other than traffic

Example Road worker, person in emergency situation.

3.15

risk

combination of the degree of the hazard to be confronted and the probability of occurrence

3.16

hazard

factor or situation which has a probability of injuring a human body or damaging human health

4 Design

4.1 Types and classes

High visibility safety clothing is grouped into three classes related to risk assessment. Each class shall have minimum areas of high visibility materials incorporated in the garment in accordance with Table 1. Garments shall comprise the required areas of background material and retroreflective material or alternatively shall comprise the required area of combined-performance material. The area shall be measured on the smallest garment size available with all fasteners adjusted to the smallest configuration possible. Measurement shall be made on the garment laid flat on the table.

The garment shall be made up of high visibility material on all sides. To ensure visibility from all sides (360° visibility), horizontal retroreflective bands and fluorescent materials shall encircle torso, trouser legs and sleeves.

The performance class can be obtained using a single garment and/or a clothing ensemble, e.g. jacket and trousers. An assembly, e.g. a classified trouser and a classified jacket, can be classified as a higher class if the assembly meets the minimum requirement achieved by the actually visible area when wearing the garment. This higher class shall be additionally specified as required in both the information for use and on the labels of both garments (see Clause 8).

The area calculation of a clothing ensemble shall be performed using the smallest garment size available (of jacket, trousers, etc.) with all fasteners adjusted to the smallest configuration possible. The clothing ensemble shall be measured flat on the table, with the top edge of the trousers etc. (hereafter referred to as a lower garment) at a

position 380 mm from the back neck point¹⁾ of the jacket etc. (hereafter referred to as an upper garment), 380 mm being a distance corresponding to a posterior waist length from the back neck point to the waist line²⁾, and with the upper and lower garments partially overlapped (see Annex JA).

Notes ¹⁾ The top of the apophysis of the seventh cervical vertebra, also called cervical spine point (see 106 of **JIS L 0111**).

²⁾ The position between the lowest end of the ribs and ilium where a waist belt settles down. It is not necessarily horizontal (see 133 of **JIS L 0111**).

Regardless of the area of materials used, a class 3 garment shall cover the torso and shall have as a minimum either sleeves with retroreflective bands or full length trouser legs with retroreflective bands, if not both.

NOTE Class 3 garments include the following: upper garment singly conforming to class 3, clothing ensemble consisting of an upper garment classified as class 1, class 2 or class 3 and a lower garment classified as class 1, class 2 or class 3 that, as an assembly, conform to class 3, or coverall conforming to class 3 and satisfying the requirements in **4.2.5**.

Table 1 Minimum required areas of visible material

Unit: m²

Material	Class 3	Class 2	Class 1
Background material	0.80	0.50	0.14
Retroreflective material	0.20	0.13	0.10
Combined-performance material	—	—	0.20
The clothing class is determined by the lowest area of visible material.			

The minimum required area of visible material for class 3 and class 2 garments is determined by the combined area of background material and retroreflective material; that of class 1 garments is determined by the combined area of background material and retroreflective material, or the area of combined-performance material.

The minimum visible area requirements to achieve a garment classification in Table 1 are not to be reduced or compromised due to the presence of any logos, lettering, labels etc.

At least (50 ± 10) % of the minimum area of visible background material shall be on the front part of the garment. When using two or more background materials, the total area usable regardless of colour shall be measured. The garment shall be measured flat on the table.

NOTE 1 For factors related to the risk level, the situation and environment of the user, such as the road etc., and examples of intended wearers, see Annex A.

NOTE 2 For additional information on high visibility safety garment design, see Annex D.

NOTE 3 For additional information on area measurement of background and retroreflective materials of high visibility safety garments, see Annex JA.

4.2 Minimum design requirements

4.2.1 Garments covering only the torso

The background material shall encircle the torso and shall maintain a minimum width (height) of 50 mm. Interruptions of background material by retroreflective stripes are not counted. Bands of retroreflective material shall be at least 50 mm wide.

Garments only covering the torso shall have one or more bands of retroreflective material encircling the torso with a maximum inclination of $\pm 20^\circ$ to the horizontal and bands of retroreflective material joining the torso band from the front to the back over each shoulder. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge. If more than one horizontal band is applied the horizontal bands shall be at least 50 mm apart.

Alternatively, garments covering only the torso shall have two bands of retroreflective material at least 50 mm apart and encircling the torso with a maximum inclination of $\pm 20^\circ$ to the horizontal. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge.

Tabards shall be constructed so that a person of the size for which they are designed can wear the tabard so that any gaps at the sides shall not be greater than 50 mm horizontally.

In horizontal bands of retroreflective or background material encircling the torso, any gap (for fastening systems and seams) in the lengthwise continuity of each band of retroreflective or background material shall not be greater than 50 mm, measured parallel to the direction of the band, and the total of such gaps shall not be greater than 100 mm in any one band around the torso.

The size of the gaps at the sides and the size of any gap in the lengthwise continuity of each band of retroreflective material and background material shall be measured with the fasteners, including a hook-and-loop fastener for closing the said gap, being adjusted to the longest position at which the garment can maintain its performance.

Examples of garments covering only the torso are given in Figure 1.

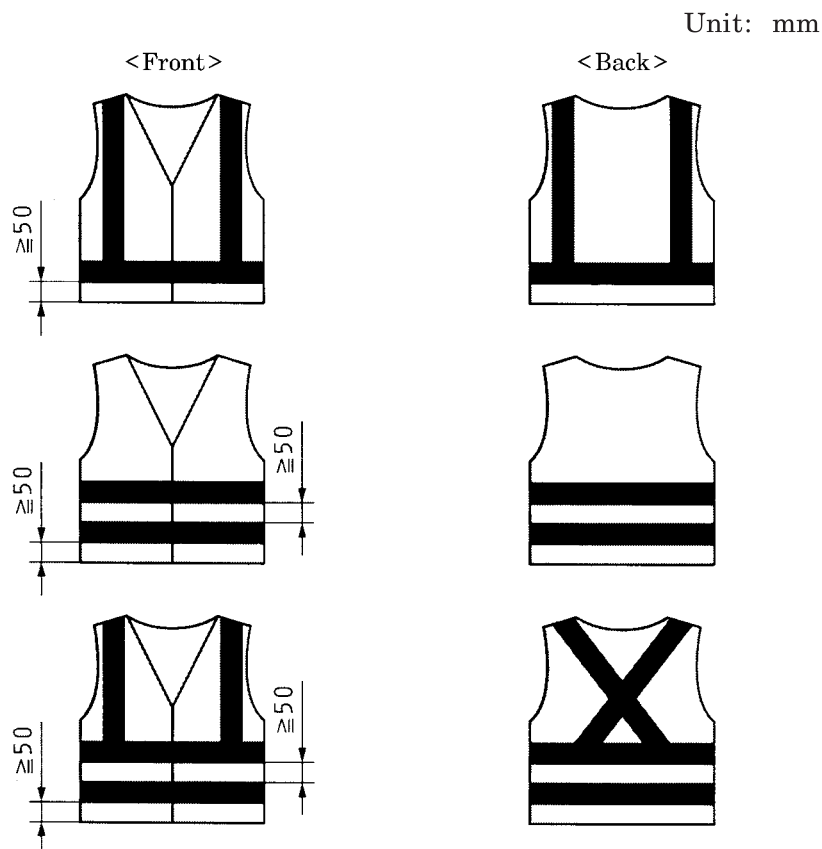


Figure 1 Examples of garments covering only the torso

NOTE Examples of garments covering only the torso are vests encircling the torso and tabards with the front and back material separated.

4.2.2 Garments covering torso and arms

The background material shall encircle the torso and the sleeves and shall maintain a minimum width (height) of 50 mm. Interruptions of background material by retroreflective stripes are not counted. Bands of retroreflective material shall be at least 50 mm wide.

Garments covering the torso and arms shall have one or more bands of retroreflective material encircling the torso with a maximum inclination of $\pm 20^\circ$ to the horizontal and bands of retroreflective material joining the torso band from the front to the back over each shoulder. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge. If more than one horizontal band is applied the horizontal bands shall be at least 50 mm apart.

Alternatively, garments covering torso and arms shall have two or more bands of retroreflective material at least 50 mm apart and encircling the torso with a maximum inclination of $\pm 20^\circ$ to the horizontal. The bottom of the lowest torso band shall be at least 50 mm above the bottom edge.

If a sleeve blocks a clear view of a horizontal torso band, then the sleeve shall be encircled by a retroreflective band. If it is a garment with a long sleeve (including when it is a detachable sleeve), the sleeve shall be encircled by two bands of retroreflective material at least 50 mm apart.

If a sleeve blocks a clear view of two horizontal torso bands, then the sleeve shall be encircled with two retroreflective bands at least 50 mm apart with the lower band at least 50 mm above the sleeve edge. Testing regarding the clear view shall be done by visual inspection while moving the arm in all positions.

In horizontal bands of retroreflective or background material encircling the torso and arms, any gap (for fastening systems and seams) in the lengthwise continuity of each band of retroreflective or background material shall not be greater than 50 mm, measured parallel to the direction of the band, and the total of such gaps shall not be greater than 100 mm in any one band around the torso and 50 mm around the sleeves.

The size of any gap in the lengthwise continuity of each band of retroreflective material and background material shall be measured with the fasteners, including a hook-and-loop fastener for closing the said gap, being adjusted to the longest position at which the garment can maintain its performance.

Examples of garments covering the torso and arms are given in Figure 2.

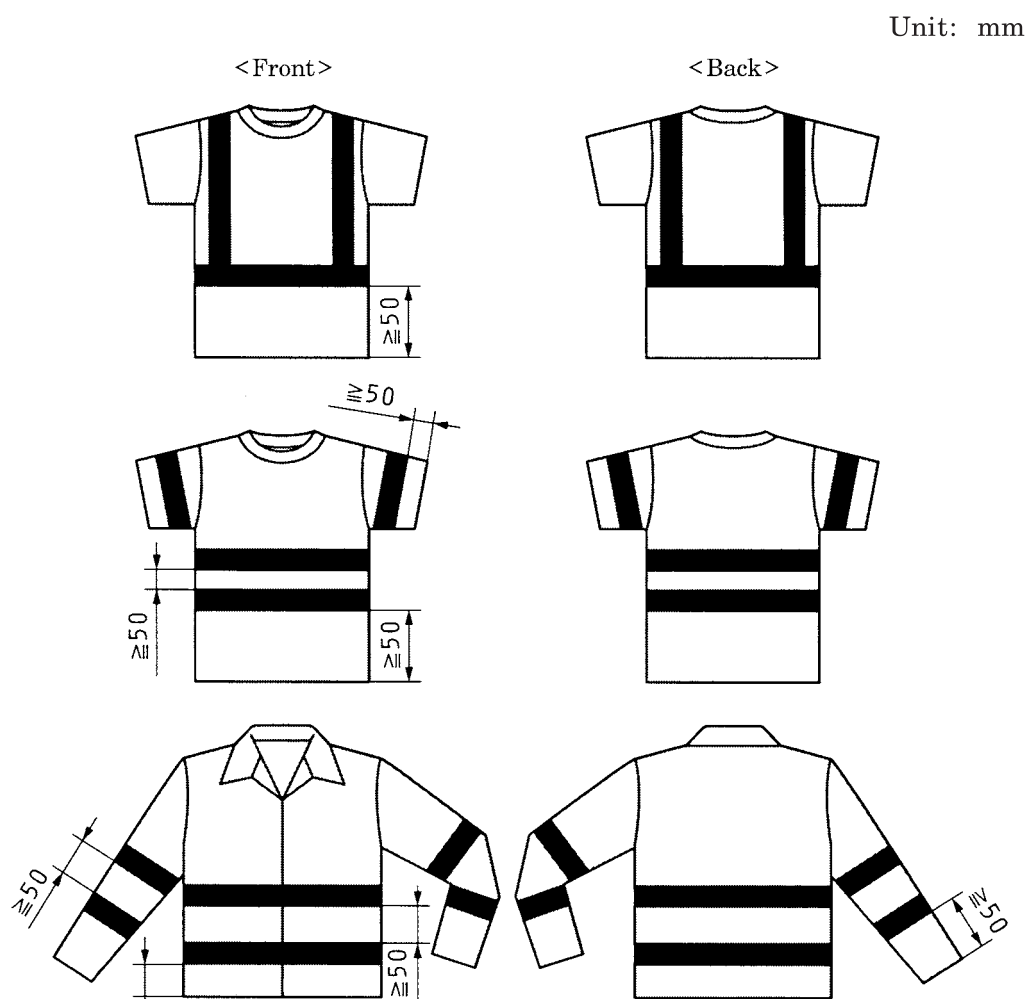


Figure 2 Examples of garments covering torso and arms

NOTE Examples of garments covering torso and arms are jackets, shirts, coats and t-shirts.

4.2.3 Garments covering legs

The background material shall encircle the trouser legs and shall maintain a minimum width (height) of 50 mm. Interruptions of background material by retroreflective stripes are not counted. Bands of retroreflective material shall be at least 50 mm wide.

Garments covering legs shall have two or more bands of retroreflective material at least 50 mm apart and encircling each leg with a maximum inclination of $\pm 20^\circ$ to the horizontal. The bottom of the lower band shall be at least 50 mm above the bottom of the trouser leg.

In horizontal bands of retroreflective or background material encircling the legs, any gap (for fastening systems and seams) in the lengthwise continuity of each band of retroreflective or background material shall not be greater than 50 mm, measured parallel to the direction of the band.

The size of any gap in the lengthwise continuity of each band of retroreflective material and background material shall be measured with the fasteners, including a hook-and-loop fastener for closing the said gap, being adjusted to the longest position at which the garment can maintain its performance.

Examples of garments covering legs are given in Figure 3.

Unit: mm

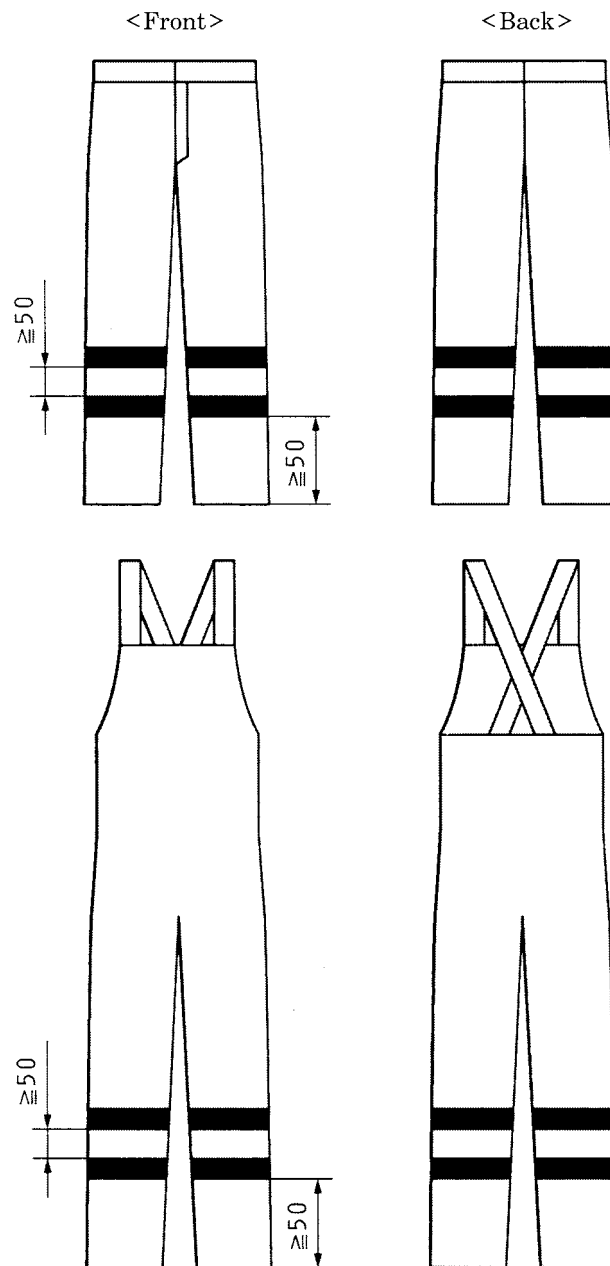


Figure 3 Examples of garments covering legs

NOTE Examples of garments covering legs are trousers, shorts, bermudas, waist-band trousers and bib and brace.

4.2.4 Garments covering torso and legs

The background material shall encircle the torso and trouser legs and shall maintain a minimum width (height) of 50 mm. Interruptions of background material by retroreflective stripes are not counted. Bands of retroreflective material shall be at least 50 mm wide.

The requirements of 4.2.1 and 4.2.3 shall be applied.

An example of a garment covering the torso and legs is given in Figure 4.