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# High visibility clothing - Test methods and requirements (ISO 20471:2013, Corrected version 2013-06-01)

EVS EESTI STANDARDIMIS- JA AKREDITEERIMISKESKUS
ESTONIAN CENTRE FOR STANDARDISATION AND ACCREDITATION

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

| | |
|---|---|
| See Eesti standard EVS-EN ISO 20471:2013 sisaldab Euroopa standardi EN ISO 20471:2013 ingliskeelset teksti. | This Estonian standard EVS-EN ISO 20471:2013 consists of the English text of the European standard EN ISO 20471:2013. |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. |
| Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 20.03.2013. | Date of Availability of the European standard is 20.03.2013. |
| Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest. | The standard is available from the Estonian Centre for Standardisation and Accreditation. |

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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# High visibility clothing - Test methods and requirements (ISO 20471:2013, Corrected version 2013-06-01)

Vêtements à haute visibilité - Méthodes d'essai et exigences (ISO 20471:2013, Version corrigée 2013-06-01)

Hochsichtbare Warnkleidung - Prüfverfahren und Anforderungen (ISO 20471:2013, korrigierte Fassung 2013-06-01)

This European Standard was approved by CEN on 1 March 2013.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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# Foreword

This document (EN ISO 20471:2013) has been prepared by Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment" in collaboration with Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by September 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 471:2003+A1:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**Endorsement notice**

The text of ISO 20471:2013, Corrected version 2013-06-01 has been approved by CEN as EN ISO 20471:2013 without any modification.

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20471 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

This corrected version of ISO 20471:2013 incorporates the following correction:

— in the fourth paragraph of subclause 4.1 the requirement concerning the sleeves of a class 3 garment has been corrected.



 

# Introduction

The performance of the conspicuity-enhancing materials to be used for high risk-related visibility clothing is specified photometrically together with minimum areas and placement (design) requirements.

Conspicuity is the property that makes an object readily attract visual attention. This is a particularly important feature in complex environments which have visually competing objects. Conspicuity is determined by an object's luminance contrast, colour contrast, pattern and design, and motion characteristics relative to the ambient background against which it is seen.

Three classes of garment are defined based on three different minimum areas of retroreflective, fluorescent and/or combined performance materials. Each of these classes will provide a different level of conspicuity, class 3 being the class that provides the highest degree of conspicuity against most backgrounds found in urban and rural situations in daylight and in night time. Users should select the required class of performance based on a risk assessment of the location/situation in which the protection afforded by clothing to this International Standard is required.

This International Standard contains requirements relating to risk assessment and risk analysis of high visibility garments. Possible designs illustrating the placement of retroreflective materials are included within the standard. Ergonomic factors such as fit/sizing, comfort, and range of motion of the wearer should be considered when selecting the most appropriate configuration of retroreflective and fluorescent materials within the garment.

Selection and use of high visibility clothing can vary among user countries and may be subject to local regulations. This International Standard contains requirements relating to risk assessment of the condition in which the high visibility clothing is to be used. This will involve consideration of the factors which may affect an observer's ability to detect that a person is present. The observer needs both to perceive and to recognize the wearer and then needs to be able to take appropriate avoidance action. The wearing of a conspicuity-enhancing high visibility garment does not guarantee that the wearer will be visible under all conditions.

The minimum requirements given within this International Standard are determined by the specific test methods and their assigned measuring values. The tests are partly performed on new materials and partly on preconditioned materials. By preconditioning (e.g. folding of retroreflective material) a load of the materials is simulated. However, it should be noted that laboratory testing may not represent real life conditions. The conspicuity performance of a garment will depend on usage (e.g. dirt, solar irradiation), care (e.g. cleaning agent, repair), storage (e.g. dust-free, lightproof), etc.

# High visibility clothing — Test methods and requirements

## 1 Scope

This International Standard specifies requirements for high visibility clothing which is capable of visually signalling the user's presence. The high visibility clothing is intended to provide conspicuity of the wearer in any light condition when viewed by operators of vehicles or other mechanized equipment during daylight conditions and under illumination of headlights in the dark. For further information concerning risk situations, see Annex A.

This International Standard is not applicable to medium-risk and low-risk situations.

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.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 105-A03, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining*

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

ISO 105-C06, *Textiles — Tests for colour fastness — Part C06: Colour fastness to domestic and commercial laundering*

ISO 105-D01, *Textiles — Tests for colour fastness — Part D01: Colour fastness to drycleaning using perchloroethylene solvent*

ISO 105-E04, *Textiles — Tests for colour fastness — Part E04: Colour fastness to perspiration — Part E04: Colour fastness to perspiration*

ISO 105-N01, *Textiles — Tests for colour fastness — Part N01: Colour fastness to bleaching: Hypochlorite — Tests for colour fastness — Part N01: Colour fastness to bleaching: Hypochlorite*

ISO 105-X11, *Textiles — Tests for colour fastness — Part X11: Colour fastness to hot pressing — Tests for colour fastness — Part X11: Colour fastness to hot pressing*

ISO 105-X12, *Textiles — Tests for colour fastness — Part X12: Colour fastness to rubbing*

ISO 1421:1998, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break*

ISO 4674-1:2003, *Rubber- or plastics-coated fabrics — Determination of tear resistance — Part 1: Constant rate of tear methods*

ISO 4675, *Rubber- or plastics-coated fabrics — Low-temperature bend test*

ISO 7854:1995, *Rubber- or plastics-coated fabrics — Determination of resistance to damage by flexing*

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



 

ISO 12947-2, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown*

ISO 13688:1998, *Protective clothing — General requirements*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 13938 (all parts), *Textiles — Bursting properties of fabrics*

EN 343, *Protective clothing — Protection against rain*

CIE 15, *Colorimetry*

CIE 54.2, *Retroreflection — Definition and measurement*

## 3 Terms and definitions

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

**3.1**
**high visibility clothing**
warning clothing intended to provide improved conspicuity in situations where the risk of not being seen is high

**3.2**
**fluorescent material**
material that emits electromagnetic radiation at visible wavelengths longer than those absorbed

**3.3**
**background material**
coloured fluorescent material intended to be highly conspicuous, but not intended to comply with the requirements of this International Standard for retroreflective material

**3.4**
**retroreflective material**
material which is a retroreflector but which is not intended to comply with the requirements of this International Standard for background material

**3.5**
**separate-performance material**
material intended to exhibit either background or retroreflective properties but not both

**3.6**
**combined-performance material**
material intended to exhibit both background and retroreflective properties

**3.7**
**orientation-sensitive material**
material having coefficients of retroreflection that differ by more than 15 % when measured at the two rotation angles $\varepsilon_1 = 0°$ and $\varepsilon_2 = 90°$

**3.8**
**torso**
thorax and abdomen or section of the body to which the limbs, head and neck are attached

**3.9**
**long sleeve**
**(1/1 arm)**
part of a garment that is completely covering the arm