SLOVENSKI STANDARD
SIST EN 421:1996

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Varovalne rokavice za zaščito pred ionizirnim sevanjem in radioaktivno kontaminacijo

Protective gloves against ionizing radiation and radioactive contamination

Schutzhandschuhe gegen ionisierende Strahlen und radioaktive Kontamination

Gants de protection contre les rayonnements ionisants et la contamination radioactive

Ta slovenski standard je istoveten z: **EN 421:1994**

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13.280	Varstvo pred sevanjem	Radiation protection
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English version

Protective gloves against ionizing radiation and radioactive contamination

Gants de protection contre les rayonnements ionisants et la contamination radioactive

Schutzhandschuhe gegen ionisierende Strahlen und radioaktiveKontamination

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

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Foreword

This European Standard was prepared by CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets" of which the secretariat is held by DIN.

This European Standard has been prepared under a mandate given to CEN by the Commission of the European Communities and the European Free Trade Association, and supports essential requirements of EC Directive(s).

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of an identical text or by endorsement, at the latest by October 1994, and conflicting national standards shall be withdrawn at the latest by October 1994.

In accordance with the CEN/CENELEC Internal Regulations, following countries are bound to implement this European Standard: Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden and United Kingdom.

1 Scope

This standard specifies requirements and test methods for gloves to protect against ionizing radiation and radioactive contamination. The standard is applicable to gloves offering protection to the hand and various parts of the arm and shoulder. It also applies to gloves to be mounted in permanent containment enclosures.

2 Normative references

This European Standard incorporates by dated and undated references, provisions for other publications. These normative references are sighted at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 374-1	Protective gloves against chemicals and micro organisms - Part1: Terminology and performance requirements
EN 374-2	Protective gloves against chemincals and micro organisms - Part2: Determination of resistance to penetration
EN 374-3	Protective gloves against chemicals and micro organisms - Part 3: Determination of resistance to permeation by chemicals
EN 388	Protective gloves against mechanical risks
EN 420	General requirements for gloves

ISO 1431-1:1989	Rubber, vulcanised or thermoplastic - Resistance to ozone cracking - Part 1: Static strain test
ISO 4648	Rubber, vulcanised or thermoplastic - Determination of dimensions of test pieces and products for test purposes

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 Irradiation

Exposure of a living being or matter to ionizing radiation by external sources (X, Alpha, Beta, Gamma or Neutron radiations).

3.2 Radioactive contamination

Presence of radioactive substances in or on a material or in a place where they are undesirable or could be harmful.

3.3 Water vapour permeability

Weight of water vapour in grammes transmitted though a material per square metre per 24 h time, per millimetre thickness under specified conditions of temperature and humidity ($g \cdot m^{-2} \cdot d^{-1} \cdot mm^{-1}$).

4 Design principles

4.1 General principles

The general principles given in EN 420 apply in this case with the following specific additions.

4.2 Protective glove material

Any material or combination of materials used in a glove for the purpose of isolating the user from direct contact with the irradiation or radioactive contamination.

Note: For choice of material see references contained in the bibliography Annex C.

4.3 Construction of glove

The glove may be constructed from a single or multiple material layers. The choice of material is defined by the end use requirements.

In the case of protection against external ionizing radiation the glove may contain lead (PbO, Pb_3O_4) or other heavy metallic elements to act as attenuation medium in one or more of the layers. Metallic element distribution may be uniform or designed in agreement by manufacturer and user. Normally the metallic element used is lead.

In the case of protection against radioactive contamination, depending on the nature or condition of the contaminates (dust, gasses, liquids or mixtures the necessary protection can be provided by the impermeability of the glove.

4.4 Glove sizing

Gloves shall be sized by overall length and the circumference of the palm. In the case of gloves to be mounted in containment enclosures, the diameter of the cuff end and the bead diameter (if applicable) shall be in the accordance with the standardized dimensions of the opening in the containment enclosure.*)

5 General requirements

5.1 Attenuation efficiency and uniformity of distribution of protective material

The efficiency of the glove material to absorb radiation is normally quoted as equivalent lead thickness. For gloves covered by this standard, the following range of lead equivalences (in millimetres) is specified 0, 0,05, 0,1, 0,15, 0,2, 0,25, 0,3, 0,35, 0,4, 0,45, 0,5. The equivalent lead thickness shall be measured by one of the methods described in 6.1. Other equivalent lead thicknesses may be manufactured by special agreement between the manufacturer and the user.

Unless otherwise agreed (see 4.3) the uniformity shall be such that no single measurement shall be below the specified value of the stated equivalent lead thickness. A minimum of three measurements shall be taken (see 6.1 and 6.2).

5.2 Glove integrity

The purpose of the glove to protect against ionizing radiation or radioactive contamination is to isolate the user from the potential hazard. This is only possible if the integrity of the glove is proven. The integrity shall be tested by the method given in EN 374-2 or by either of the test methods described in 6.2. These methods shall be assumed to be interchangeable.

5.3 Water vapour permeability

Gloves used in containment enclosures are often required to offer an impermeable barrier to water and water vapour when the enclosures are required to work under anhydrous conditions. Measurement of water vapour permeability can therefore be an important factor in glove selection.

The performance level for water vapour permeability shall be determined by the method described in 6.3, and reported as the performance level, as shown in table 1.

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*) A standard for containment enclosures and their components is under preparation.

Table 1 Performance level (water vapour permeability)

Performance level	Maximum Permeability $g \cdot m^{-2} \cdot d^{-1} \cdot mm^{-1}$
1	3,0
2	1,5
3	0,75
4	0,375
5	0,125

The method given in 6.3 is applicable to impermeable materials offering a degree of resistance to the passage of water vapour, and should not be confused with the method given in EN 420 which is designed to measure the permeability of leather.

5.4 Resistance to ozone cracking (static strain)

Damage to elastomeric materials under conditions of ionizing radiation may be modelled by their behaviour under attack by ozone. Resistance to ozone cracking may therefore be used as an aid to selection of gloves which require resistance to ionizing radiation. There are however certain circumstances where actual behaviour against radiation may need to be measured, as allowed under special radiation tests (see annex B).

The performance level shall be determined by the method described in 6.4, and reported as the performance level, as shown in table 2.

Table 2 Performance level: Resistance to ozone cracking

Performance level	State of the material
1	cracks apparent at 10 % elongation
2	no cracks apparent at 10 % elongation
3	no cracks apparent at 20 % elongation
4	no cracks apparent at 100 % elongation

5.5 Mechanical requirements

Where mechanical characteristics are required, they shall be defined by the user. These requirements shall be measured using the test methods and performance levels defined in EN 388.

5.6 Chemical requirements

Where chemical characteristics are required, they shall be defined by the user. These requirements shall be measured using the test methods and performance levels defined in EN 374-3.

5.7 Special requirements

Special tests may be defined by agreement between the manufacturer and user as referred to in Annexes A and B.

6 Test methods

6.1 Determination of equivalent lead thickness and uniformity of distribution

This standard specifies two methods by which equivalent lead thickness may be measured. Either method may be used for determination as agreed by the manufacturer and user. The determination of equivalent lead thickness does not lead to an absolute answer but will depend upon the source and energy spectrum of the radiation and hence should always be used as a relative measure. If the glove is loaded with another heavy metallic element, the principle of the test method is the same except for the calibrated wedge which is fabricated with the considered heavy metallic element.

6.1.1 Method 1: X ray tube source

Principle

Millimetres lead equivalence shall be determined by a standard X ray tube source. The gloves shall be compared with a calibrated lead step wedge.

The method consists of placing an X ray film inside the glove and placing another film with a calibrated lead step wedge beside the glove for reference. The whole system is then exposed to a standard X ray tube source.

Procedure

The glove may be tested as a whole or in part. The section of material is placed such that it is between a standard X ray film and the X ray source. Beside the glove is placed another film protected by a calibrated lead step wedge. Care should be taken that both glove and calibrated lead step wedge are exposed to the same intensity of radiation. The system is then exposed to the radiation from a standard X ray source, the films are developed and the images are evaluated on a densometer. Exposure times will be dependant on both the intensity of the X ray source and the attenuation efficiency of the glove. Exposure conditions are energy 50 kV to 70 with current, time, and distance such that a readable density is obtained. A measurement of lead equivalence shall be taken at a minimum of three points on the centre line of the palm side of the glove, at the centre of the palm at a distance of 10 cm from the cuff, and at the mid point between these two readings. The minimum value taken as the lead equivalence. For gloves that are to be used in containment enclosures it is usual that the lead equivalence will not be measured in the last 10 cm of the cuff.

Expression of results

The results shall be expressed in equivalent lead thickness in millimetres. This shall be the minimum value obtained from the point results taken. The test report shall also state the X ray tube energy and any other special test conditions.