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**Immersion suits —**

Part 1:  
**Constant wear suits, requirements  
including safety**

*Combinaisons de protection thermique en cas d'immersion —*

*Partie 1: Combinaisons de port permanent, exigences y compris la sécurité*



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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 3.

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 member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15027 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15027-1 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 188, *Small craft*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

ISO 15027 consists of the following parts, under the general title *Immersion suits*:

- *Part 1: Constant wear suits, requirements including safety*
- *Part 2: Abandonment suits, requirements including safety*
- *Part 3: Test methods*

Annex A of this part of ISO 15027 is for information only.

Annex ZZ provides a list of corresponding International and European Standards for which equivalents are not given in the text.

For the purposes of this part of ISO 15027, the CEN annex regarding the fulfilment of European Council Directives has been removed.

<b>Contents</b>	<b>Page</b>
Foreword.....	v
Introduction .....	vi
1 <b>Scope</b> .....	1
2 <b>Normative references</b> .....	1
3 <b>Terms and definitions</b> .....	2
4 <b>Requirements</b> .....	3
5 <b>Marking</b> .....	8
<b>Annex A</b> (informative) <b>Guidelines for manufacturers, users, regulators and industrial inspectors about immersion suits with respect to the application of immersed clo values and thermal protection times relevant to EN ISO Standards</b> .....	12
<b>Annex ZZ</b> (normative) <b>Corresponding International and European Standards for which equivalents are not given in the text</b> .....	16

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## Foreword

This document (EN ISO 15027-1:2002) has been prepared by Technical Committee CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 188 "Small craft".

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 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.

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(s).

The annex A is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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## Introduction

This European Standard has been prepared to meet the needs of persons engaged in certain activities on or near water.

The justification for using a constant wear suit would be to provide protection from the elements whilst working and, in the event of an accidental immersion, to prolong life and aid rescue. An individual's estimated thermal protection time when wearing this type of equipment will depend upon the water temperature, weather conditions, the cold tolerance of the person and the person's behaviour. The standard specifies the minimum levels of insulation provided by the different ranges of suit in particular water temperatures.

The standard allows for the thermal protection to be provided by a variety of methods and materials, some of which may require action when the suit enters the water (e.g. inflation of chambers by gas from a cylinder). The compliance of a constant wear suit with this standard does not imply that it is suitable for all circumstances. This standard cannot make detailed provision for all the special uses to which a constant wear suit may be put, such as special working conditions i. e. slip resistance or fire resistance or special leisure applications.

This standard is intended to serve as a minimum performance requirement for manufacturers, purchasers and users of constant wear suits by ensuring that they provided an effective standard of performance in use. Designers should encourage the wearing of this equipment by making them comfortable and functional for continuous wear on or near water.

The primary aims in wearing a constant wear suit are:

- a) to reduce the risk of cold shock and to delay the onset of hypothermia;
- b) to enable the wearer to propel himself in the water and extricate himself from the water without it becoming an encumbrance;
- c) to make the wearer sufficiently conspicuous in the water so as to aid his recovery.

The performance of the suit may be altered by a number of factors including wave action, or the wearing of additional equipment. Users, owners and employers should ensure that equipment is correctly maintained to manufacturer's instructions.

A suit system may be comprised of one or more pieces provided that in all cases it meets the requirements of this standard as a complete system.

The use of a lifejacket/constant wear suit combination during testing does not confer approval status for that combination. A constant wear suit may often be worn with a lifejacket as it will provide extra flotation and will help to bring a person to a face-up position.

## 1 Scope

This standard specifies the requirements for the construction, performance, safety and test methods for immersion suits.

This part of the standard is applicable to the requirements of constant wear suits.

For the requirements of abandonment suits see EN ISO 15027-2, for test methods for immersion suits see EN ISO 15027-3.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited 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 (including amendments).

EN 340, *Protective clothing — General requirements.*

EN 1095, *Deck safety harness and safety line for use on recreational craft — Safety requirements and test methods.*

EN ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1 : 1999).*

EN ISO 13934-2, *Textiles — Tensile properties of fabrics — Part 2: Determination of maximum force using the grab method (ISO 13934-2 : 1999)*

ISO 105-B04, *Textiles — Tests for colour fastness — Part B04: Colour fastness to artificial weathering: Xenon arc fading lamp test.*

ISO 188, *Rubber, vulcanised or thermoplastic — Accelerated ageing and heat-resistance tests.*

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

ISO 2411:1991, *Rubber- or plastics-coated fabrics — Determination of coating adhesion.*

ISO 3801, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area.*

ISO 4674, *Fabrics coated with rubber or plastics — Determination of tear resistance.*

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

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests.*

prEN ISO 12402-2:2000, *Personal flotation devices — Part 2: Class B (offshore lifejackets, extreme conditions — 275 N), safety requirements (ISO/DIS 12402-2:2000).*

prEN ISO 12402-3:2000, *Personal flotation devices — Part 3: Class C (offshore lifejackets — 150 N), safety requirements (ISO/DIS 12402-3:2000).*

prEN ISO 12402-4:2000, *Personal flotation devices — Part 4: Class D (inland/close to shore lifejackets — 100 N), safety requirements (ISO/DIS 12402-4:2000).*

prEN ISO 12402-5:2000, *Personal flotation devices — Part 5: Class E (buoyancy aids — 50 N), safety requirement (ISO/DIS 12402-5:2000).*

## ISO 15027-1:2002(E)

prEN ISO 12402-8:2000, *Personal flotation devices — Part 8: Additional items, safety requirements and test methods* (ISO/DIS 12402-8:2000).

EN ISO 15027-2, *Immersion suits - Part 2: Abandonment suits, requirements including safety* (ISO 15027-2:2002).

EN ISO 15027-3:2002, *Immersion suits — Part 3: Test methods* (ISO 15027-3:2002).

AATCC Method 30:1981, *Fungicides, evaluation on textiles: mildew and rot-resistance of textiles* <sup>1)</sup>.

*International Convention for the Safety of Life at Sea (IMO), 1974, amendment 1983* <sup>2)</sup>.

### 3 Terms and definitions

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

#### 3.1

##### **immersion suit**

suit designed to protect the wearer from the cooling effects of unintended immersion in water

#### 3.2

##### **constant wear suit**

an immersion suit, designed to be routinely worn for activities on or near water in anticipation of accidental immersion in water, but permitting physical activity by the wearer to such an extent that actions may be undertaken without undue encumbrance

#### 3.3

##### **abandonment suit**

an immersion suit, designed to permit rapid donning in the event of an imminent unintended immersion in water

#### 3.4

##### **dry suit**

a garment designed to preclude the entry of water upon immersion

#### 3.5

##### **wet suit**

a garment designed to permit the entry and exit of water upon immersion

#### 3.6

##### **primary suit closure**

any closure used in the donning of the suit

#### 3.7

##### **secondary suit closure**

any additional closure which may be operated by the wearer in the water

#### 3.8

##### **inherent buoyant material**

buoyancy provided by a material, forming a permanent part of the suit, with a density less than that of water

#### 3.9

##### **exterior fabric**

the outer fabric of a suit, either in the form of a single or composite fabric

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1) Available from American Association of Textile Chemists and Colorists (AATCC) one Davis Drive, PO Box 12215, Research Triangle Park, NC 27709-2215 US

2) IMO is an institution with domicile in London issuing regulations which are then published as laws by the member states

**3.10****retro-reflective material**

a material that reflects light beams back to their point of origin

**3.11****sprayhood**

a cover brought or placed in front of the face of the wearer in order to reduce or eliminate the splashing of water onto the airways, and thereby promoting the survival of the wearer in rough water conditions

**3.12****buddy line**

a length of cord which can be tied or otherwise fixed to another person's suit, or lifejacket, or to a life raft or other objects, so as to keep the wearer in the vicinity of that person or object with a view to making location and thus rescue easier

**3.13****clo value**

a unit to express the relative thermal insulation values of various clothing assemblies. One clo is equal to  $0,155 \text{ Km}^2 \text{ W}^{-1}$

**3.14****immersed clo value**

clo value measured when a clothing assembly is immersed and subjected to the effect of hydrostatic compression

**3.15****hypothermia**

a condition where body core temperature is below  $35 \text{ }^\circ\text{C}$

**3.16****working environment**

the environment in which the wearer of a suit system would engage in normal work

**3.17****helicopter transit suit**

a constant wear suit worn by helicopter occupants

**3.18****offshore installation**

any structure or vessel that is permanently or temporarily sited at sea or away from the shore in a fresh water lake or river and which is not covered under other international regulations

**3.19****suit system**

a combination of a suit and any other products which are used in conjunction with it

**3.20****heat strain**

increase of body temperature induced by sustained heat stress which cannot be fully compensated by temperature regulation, or activation of thermoeffector activities in response to heat stress which cause sustained changes in the state of other, nonthermal, regulatory systems

**4 Requirements****4.1 General**

**4.1.1** The suit system declared to be a constant wear suit shall meet all requirements of this standard nor shall be damaged or fail in its determined function when tested in accordance with clause 3 of EN ISO 15027-3:2002, nor materials, fabrics or components when tested in accordance with 4.14.

**4.1.2** A suit system declared to be a helicopter transit suit shall meet all requirements of this standard.

**4.1.3** The constant wear suit may incorporate additional items compliant with prEN ISO 12402-8:2000, none of which shall impair its performance with respect to the requirements of this standard, either by their presence or

## ISO 15027-1:2002(E)

their use. If a safety harness forms an integral part of the suit designed to comply with a European standard, then the complete assembly shall comply with EN 1095 or with the standards of harnesses for commercial use.

**4.1.4** The suit system shall be constructed in such a way as to reduce the risk of heat strain during physical activities (for relevant testing see 4.13.1 to 4.13.4, 4.13.6 and 4.13.7 or other relevant test methods to be developed).

**4.1.5** The insulation material shall be prevented from migrating and tested in accordance with 3.6 of EN ISO 15027-3:2002.

**4.1.6** The suit system shall not restrict the donning of a reference personal flotation device (PFD) in accordance with prEN ISO 12402:2000, unless the suit system meets or exceeds the performance requirements of a PFD.

**4.1.7** The performance requirements shall be tested after cleaning cycles in accordance with 3.7.1 of EN ISO 15027-3:2002. The performance requirements shall not be influenced by cleaning procedures as specified by the manufacturer.

**4.1.8** The suit system shall be designed in such a way as to minimise the risk of snagging. Testing in accordance with 3.1 of EN ISO 15027-3:2002.

**4.1.9** The suit system shall not contain or be accompanied by any component likely to injure or impede the user within the context of normal use. Testing in accordance with 3.1 of EN ISO 15027-3:2002.

### 4.2 Additional items

If the suit is provided with additional items, such as sprayhood, safety harnesses or safety lines, whistles, light and buddy lines, then they shall comply with EN 1095 and prEN ISO 12402-8:2000 and the relevant clauses of this standard.

### 4.3 Gas or air inflation

If any part of the suit relies upon air or gas inflation in order to achieve the performance levels set out within this standard then each part of the assembly namely: oral inflation tubes, inflation operating head, the gas cylinder, and the inflatable buoyancy chamber shall meet the relevant requirements of prEN ISO 12402-2:2000.

### 4.4 Buddy lines

Buddy lines in accordance with prEN ISO 12402-8:2000 shall have an attachment point, withstanding a vertical load not less than 750 N and shall not affect the performance of the suit when attached. Testing in accordance with 3.1 of EN ISO 15027-3:2002.

### 4.5 Colour

If the suit is intended for detection by marine search and rescue purposes the exposed portions of the suit shall have easily visible colours within the tolerances defined by the following ranges:

0070 —  
1070 — in tones  
0080 — Y 30R to Y 80R  
1080 —  
0090 —

and

0070 —  
0080 — in tones  
0090 — Y to Y 20R

or the corresponding fluorescent colours.

The coloured portions of the suit exposed above the water surface when in use should predominantly be in the colour range from yellow to red, excluding such components as webbing zips and other fittings. The colour shall be checked against colour samples from the NCS colour atlas, and comparisons shall be made in daylight.

#### 4.6 Expanded polymeric material

Any expanded polymeric material used to assist the buoyant performance of the suit system, shall be compression resistant without sustaining significant loss of buoyancy. Testing in accordance with 3.12 of EN ISO 15027-3:2002.

Any expanded polymeric material used to assist the buoyant performance of the suit system shall be shown to have thermal stability under the conditions of the test described in 3.13 of EN ISO 15027-3:2002, in which the maximum loss of buoyancy in any sample shall not exceed 5 %.

#### 4.7 Flammability

When tested in accordance with 3.5 of EN ISO 15027-3:2002, a constant wear suit shall not sustain burning or continue melting 6 s after being removed from the flames.

#### 4.8 Fuel resistance

A constant wear suit shall withstand the tests in accordance with 3.4 of EN ISO 15027-3:2002.

#### 4.9 Temperature cycling

The suit system shall be resistant to changes in ambient temperature. When tested in accordance with 3.9 of EN ISO 15027-3:2002, the weight of water which has leaked into a dry suit shall not exceed the results of the test of 3.7 of EN ISO 15027-3:2002.

#### 4.10 Leakage

The leakage of a dry suit system shall be measured in accordance with 3.7 of EN ISO 15027-3:2002 and the amount of measured water shall be used as threshold value to thermal testing in 3.8 of EN ISO 15027-3:2002.

#### 4.11 Thermal protection

The suit system shall provide the wearer (including the head) with thermal protection in a hydrostatical compressed state as defined by its flotation position, when worn with the test clothing. This standard recognises the need for different levels of thermal protection depending upon the water temperature in which the suit will be used. The levels of thermal protection are shown in Table 1. Testing in accordance with 3.8 of EN ISO 15027-3:2002.

**Table 1 — Thermal protection classes**

Class of suit	A	B	C	D
Immersed Clo	0,75	0,50	0,33	0,20

There are two options for measuring the thermal protection provided by a suit:

- a) using a thermal manikin: tested in accordance with 3.8.1 of EN ISO 15027-3:2002;
- b) using human subjects: tested in accordance with 3.8.2 of EN ISO 15027-3:2002.

NOTE It has to be stated, that for the time being no manikin is available giving sound test results. Therefore the performance of a suit system has to be proved by tests with human subjects. As soon as a manikin showing a sound performance the testing laboratories have the option to go forward and choose one of both methods. This will be accompanied also by an intensive exchange of experience between the testing laboratories, round robin testing and the correlation of results between the tests with human subject and manikin.

#### 4.12 Conspicuity

To assist search and rescue operations, a passive light system of retroreflective material shall be provided. This shall conform to the specification detailed in IMO 83, Chapter III, Resolution A.658(16), Annex 2. If it is the only light system, then a total area of not less than 400 cm<sup>2</sup> shall be provided. At least 100 cm<sup>2</sup> of which shall be affixed to the hood and at least 250 cm<sup>2</sup> shall be clear of the water and visible in the suit's normal in-water position as

## ISO 15027-1:2002(E)

tested in 3.11.6.4 of EN ISO 15027-3:2002. At least one piece of 50 cm<sup>2</sup> shall be affixed to the back of the suit so as to be visible when the wearer is floating in the face down position.

The performance of the retroreflective material shall not be degraded by its application. Testing e. g. in accordance with 3.11.6.4.2 of EN ISO 15027-3:2002.

An active light system may also be provided. This shall conform to the standard for emergency lights in prEN ISO 12402-8:2000. When an active light system is provided, the area covered by the passive light system may be reduced by an equivalent amount but a minimum of 300 cm<sup>2</sup> of passive light system should always be provided. At least 100 cm<sup>2</sup> of which should be affixed to the hood and 150 cm<sup>2</sup> clear of the water and visible in the suits normal in-water position as tested in 3.11.6.4 of EN ISO 15027-3:2002. At least one piece of 50 cm<sup>2</sup> shall be affixed to the back of the suit so as to be visible when the wearer is floating in the face down position.

Alternative systems to provide conspicuity to assist search and rescue operations, such as combinations of active light systems (emergency lights) and passive light systems (retroreflective material) will be acceptable if they meet the specifications for both emergency lights and retroreflective material as defined above.

### 4.13 Performance requirements

#### 4.13.1 Walking

A person wearing the suit system correctly donned shall be able to walk easily as tested to 3.11.3 of EN ISO 15027-3:2002.

#### 4.13.2 Climbing

A person wearing the suit system correctly donned shall be able to climb freely as tested to 3.11.4 of EN ISO 15027-3:2002.

#### 4.13.3 Donning

The suit system shall be able to be donned with all primary closures secured within 2 min, including any associated lifejacket (if required), at (20 ± 2) °C and another donning shall be able at a temperature of (– 30 ± 2) °C when tested in accordance with the methods described in 3.11.2 of EN ISO 15027-3:2002 without any damage to endanger the performance of the suit.

#### 4.13.4 Dexterity

The suit system, when correctly donned and adjusted, shall not hinder the wearer's mobility, to be tested in accordance with 3.11.5 of EN ISO 15027-3:2002.

#### 4.13.5 Hand protection

When hand protection is part of the system, a person wearing a suit system correctly donned shall be able to remove it from storage and don the hand protection when tested in accordance with 3.11.6.5 of EN ISO 15027-3:2002.

#### 4.13.6 Jumping

A person wearing a suit system correctly donned shall be able to jump vertically into water from a height of (4,5<sup>+0,5</sup><sub>0</sub>) m without any damage to the suit or injury to the wearer. The wearer shall be able to secure any secondary suit closures (if fitted) within 2 min of entering the water. This shall be tested in accordance with 3.11.6.1 of EN ISO 15027-3:2002.

#### 4.13.7 Boarding a platform

A person wearing the suit system correctly donned, with both primary and secondary (if fitted) closure systems activated, shall be able to swim and to board a platform. This shall be tested in accordance with 3.11.6.2 of EN ISO 15027-3:2002.

#### 4.13.8 Flotation and righting

A person wearing the suit system correctly donned, with both the primary and secondary closure systems activated (if fitted), shall be able to adopt a face up position in water in accordance with 3.11.6.3 of EN ISO 15027-3:2002.

Where the suit system is claimed to provide flotation, the freeboard shall meet the requirements specified in prEN ISO 12402-2:2000, prEN ISO 12402-3:2000, prEN ISO 12402-4:2000 or prEN ISO 12402-5:2000.

The buoyancy of a helicopter-transit-suit system shall be measured in accordance with 3.11.7.2 of EN ISO 15027-3:2002 and be no more than 150 N to be achieved within 15 s of submersion with the suit fully vented.

#### 4.13.9 Field of vision

The suit, when correctly donned and adjusted, shall not prevent the wearer from having an acceptable field of vision, as tested in 3.11.6.6 of EN ISO 15027-3:2002.

### 4.14 Requirements on materials, fabrics and components

#### 4.14.1 General

Materials, fabrics and components shall not be damaged by storage at temperatures of  $(-30 \pm 2)$  °C and  $(65 \pm 2)$  °C when tested in accordance with 3.9 of EN ISO 15027-3:2002 nor shall they be damaged by salt water when tested in accordance with ISO 9227 for a period of 96 h nor by fuel when tested in accordance with 3.4 of EN ISO 15027-3:2002.

#### 4.14.2 Resistance to rot

Resistance to rot shall be tested in accordance with the methods of AATCC Method 30 : 1981.

#### 4.14.3 Resistance to illumination

Resistance to illumination shall be tested in accordance with ISO 105-B04. Illumination shall take place to class 5-6 with ½ unit tolerance. Materials which are screened by some form of cover when in normal use shall not undergo illumination testing.

#### 4.14.4 Tensile strength

The tensile strength shall be of at least 300 N per 25 mm. Following exposure to rot or illumination, the tensile strength shall be measured using the grab method given in EN ISO 13934-2, using specimens of at least 60 mm width and with at least 100 mm of material on each side of the test point, with 4 similar seams for each type of seam, cloth and fastening devices (including zip fasteners).

#### 4.14.5 Coated fabrics

Coated fabrics shall comply with the following requirements:

- a) coating adhesion shall be tested in accordance with ISO 2411 : 1991, using the method described in 5.2.2.1 at 100 mm/min, and shall be not less than 50 N per 50 mm width;
- b) coating adhesion shall also be tested when wet following ageing in accordance with ISO 188, with an exposure of  $(336,0 \pm 0,5)$  h in fresh water at  $(70,0 \pm 1,0)$  °C, following which the method in 5.2.2.1 of ISO 2411 : 1991 shall be applied at 100 mm/min, and shall not be less than 40 N per 50 mm width;
- c) tear strength shall be tested in accordance with ISO 4674 using method A 1, and shall not be less than 35 N;
- d) resistance to flex cracking shall be tested in accordance with ISO 7854 method A using 9 000 flex cycles, following which there shall be no visible cracking or deterioration;
- e) breaking strength shall be tested in accordance with ISO 1421 using the CRE or CRT methods following conditioning of  $(24,0 \pm 0,5)$  h at room temperature, and shall be not less than 200 N per 50 mm width when tested;

## ISO 15027-1:2002(E)

- f) breaking strength shall be tested in accordance with ISO 1421 using the CRE or CRT methods following conditioning of  $(24,0 \pm 0,5)$  h immersion in fresh water at room temperature, and shall be not less than 200 N per 50 mm width when tested;
- g) elongation at break shall be tested in accordance with ISO 1421 using the CRE or CRT methods following conditioning of  $(24,0 \pm 0,5)$  h at room temperature, and shall be not more than 60 %;
- h) elongation at break shall be tested in accordance with ISO 1421 using the CRE or CRT methods following conditioning of  $(24,0 \pm 0,5)$  h immersion in fresh water at room temperature, and shall be not more than 60 %.

### 4.14.6 Other fabrics

Other fabrics used in the construction of the component the failure of which would render the entire item non-conformant with this standard, shall comply with the following requirements:

- a) breaking strength shall be tested in accordance with EN ISO 13934-1 using the CRE or CRT methods, following  $(24,0 \pm 0,5)$  h conditioning at room temperature, and shall be not less than 10 N/mm;
- b) elongation at break shall be tested in accordance with EN ISO 13934-1 using the CRE or CRT methods, following  $(24,0 \pm 0,5)$  h conditioning at room temperature, and shall be not more than 60 %;
- c) tear resistance shall be tested in accordance with ISO 4674 (method A2, tensile speed  $(100 \pm 10)$  mm/min, with a pretension of 2 N for materials of up to  $200 \text{ g/m}^2$ , 5 N for materials of over  $200 \text{ g/m}^2$  and up to  $500 \text{ g/m}^2$ , and 10 N for materials of over  $500 \text{ g/m}^2$ ), and shall be not less than 10 N.

### 4.14.7 Mass

Where the mass per unit area of a fabric is required to be measured, then it shall be measured in accordance with method 5 of ISO 3801.

### 4.14.8 Metal components

**4.14.8.1** When tested in accordance with ISO 9227 for a period of 96 h metal components shall not be significantly affected by corrosion. This shall be tested by a functional test.

**4.14.8.2** No component shall affect a magnetic compass of a type commonly used in small boats by more than 1 degree, when placed at a distance of 500 mm from it. Testing in accordance with 3.1 of EN ISO 15027-3:2002.

## 5 Marking

### 5.1 Marking on the suit

Each detachable part of the constant wear suit system shall be permanently and legibly marked with the following (which shall be given at least in the official language(s) of the member state of destination). Information shall be given as pictograms or as text combined with pictograms, or, if defined pictograms do not exist, as text alone.

Any label bearing this information shall be permanently affixed to the suit system, be resistant to salt water and withstand at least 10 washes carried out in accordance with the manufacturer's recommendations. Neither shall the label shrink so as to affect the performance of the constant wear suit or its own performance or legibility.

- a) identification of the manufacturer;
- b) the temperature (performance) range in which it is designed to operate;
- c) a statement
  - 1) that the suit system has to be worn with a PFD according to the relevant part of prEN ISO 12402:2000;
  - 2) that the suit system itself meets the performance requirements of the lifejacket standard in addition to the suit standard or;

- 3) a warning statement that this suit does not perform as a PFD and that it will not turn an unconscious wearer to the face up position as appropriate;
- d) type of suit, being a dry or wet type suit system;
- e) the recommended size range, height and chest measurements in line with the recommendations laid down in EN 340;
- f) storage, care, cleaning and maintenance instructions (in brief);
- g) simple donning and use instructions;
- h) the manufacturer's model designation, and quarter (or month) and year of manufacture and an individual serial number for the suit or batch of suits. Months are to be given as arabic numbers (1..12), and quarters as Roman numbers (I..IV) in order starting from 1st January;
- i) the numbers of the European Standards to which it conforms;
- j) pictograms or words indicating other risks catered for;
- k) the compatibility with safety harnesses and other equipment as relevant;
- l) the required underwear to establish the performance of the suit.

## 5.2 Consumer information about suit

Each constant wear suit system shall be supplied with an explanatory leaflet, and written in at least the official language(s) of the member state of destination. The leaflet shall contain at least the following items:

- a) items given in 5.1a) and 5.1e) in full;
- b) full donning and use instructions including the required underwear to establish the performance level;
- c) details of recommended limitations to use including the temperature range the constant wear suit system was designed; any limitations shall be spelled out explicitly as warning labels;
- d) description of any spare parts and their replacement, and instructions for servicing and maintenance, and packing (if applicable);
- e) the names and addresses of manufacturer's agents within at least the member state of destination;
- f) compatibility with safety harnesses and other equipment as relevant;
- g) such other general advice on the care and use of constant wear suits as the manufacturers see fit.

For consumer choice the information label as shown in Figure 1 shall be presented at the point of sale.

## 5.3 Consumer information at point of sale

### 5.3.1 Data list

The following information in Figure 1 shall be given via a consumer information label:

- |  |          |
|--|----------|
| — designation of relevant standard   | (1)      |
| — type of suit   | (2a — c) |
| — standard application as written on the sample label                      | (3)      |
| — performance classes A ... D and their allocated thermal protection times | (4a — d) |
| — required under garment to achieve or improve the thermal protection      | (5)      |

## ISO 15027-1:2002(E)

- size of suit (6a or 6b)
- special features i. e. that the suit has to be used with a PFD of type xxx, that the suit performs itself as a PFD of type xxx, the use of additional items etc. (7)
- the WARNING as given in the sample label (8)

Any information not listed in above data list as well as the layout of the label is voluntary.

### 5.3.2 Consumer information label

In order to satisfy the requirement under 5.3.1 for consumer information a uniform informative label is recommended. It shall be clearly visible when the suit is presented ready for sale, either by ensuring the visibility of the required marking on the suit itself or by labelling on the packaging. The label layout shown in Figure 1 constitutes an example for the layout of the label. It shall be presented at point of sale. The minimum dimensions of the label shall not be less than 150 mm × 120 mm. Colours may vary, but shall always be contrasting to the background. If the recommended label as shown in Figure 1 is applied, data as specified under 5.3.1 shall be clearly marked in the box adjacent to the relevant feature to indicate its presence or quantity. The marking shall be made by a hook-symbol.

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IMMERSION SUITS ACCORDING TO EN ISO 15027-1										(1)
TYPE OF		dry suit		CONSTANT WEAR SUIT						(2a)
		wet suit		HELICOPTER SUIT						(2b)
										(2c)
STANDARD APPLICATION		PROTECTION AGAINST COLD WATER DEPENDS ON THE INSULATION OF THE SUIT IN CORRELATION WITH WATER TEMPERATURE ESTIMATED THERMAL PROTECTION TIME PROVIDED BY THIS SUIT CAN BE IDENTIFIED FROM THE TABLE BELOW:								(3)
WATER TEMPERATURE	below 5 °C	6,0 h		2,5 h		1,5 h		1,0 h		(4a)
	5 °C to 10 °C	9,0 h		4,5 h		2,5 h		1,5 h		(4b)
	10 °C to 15 °C	15,0 h		7,0 h		4,0 h		2,0 h		(4c)
	over 15 °C	24,0 h		15,0 h		6,0 h		3,0 h		(4d)
Performance class		A		B		C		D		(4)
Required under garments		See system components								(5)
Size of suit		small		medium		large		X large		(6a)
height/waist										(6b)
Special features										(8)
<p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;">ESTIMATED THERMAL PROTECTION TIME ACCORDING TO PERFORMANCE CLASSES A...D ARE BASED ON STANDARD TESTING CONDITIONS AS SPECIFIED BY EN ISO 15027-3 REAL ENVIRONMENTAL CONDITIONS AND PERSONAL CHARACTERISTICS WILL CHANGE THERMAL PROTECTION TIME</p>										

Figure 1 — Example of a consumer information label

## Annex A (informative)

### **Guidelines for manufacturers, users, regulators and industrial inspectors about immersion suits with respect to the application of immersed clo values and thermal protection times relevant to EN ISO Standards**

Immersion of a person in water, accidentally or otherwise, carries the risk of harmful physiological effects which include cold shock, gasp reflex, hypothermia, unconsciousness and cardiac arrest, in addition to the obvious drowning hazard.

Immersion suits, as defined by the EN ISO standards, are intended to be worn by persons in circumstances where there is exposure to a risk of accidental immersion in water. Immersion suits are intended to provide thermal protection which will reduce or delay the harmful physiological effects and therefore extend the survival time of the wearer, thus providing emergency services with a greater opportunity to effect a rescue.

Unless the immersion suit has been additionally tested and certified as a lifejacket, protection against drowning may not be present and a suitable lifejacket will be required to be used in conjunction with the immersion suit. However, it should be noted that the air trapped in a suit will affect the performance of any lifejacket worn with the suit. Care should therefore be taken to ensure that the lifejacket and suit combination are compatible and that the lifejacket will turn the wearer to the face up position.

The EN ISO standards are general in nature and do not specify any particular type or design of immersion suit for any particular application. To attempt to do so would be impractical. There are extremely diverse considerations which will effect the selection of an immersion suit depending upon the application. The standards limit themselves to differentiating suits only in terms of whether they are intended for constant wear (wearing the suit during normal activities under occupational or leisure applications) or abandonment (suitable for emergency donning when being forced to abandon i. e. the boat, ship or offshore installation) and the degree of hypothermia protection provided.

The EN ISO standards are mainly intended to protect against hypothermia as a central risk, whereas others like cold shock or gasp reflex are highly influenced by personal conditions and fitness. Those conditions can neither be reproducible nor can be part of a test sequence for a type approval. But it can be assumed that an improvement of the actual thermal protection by an immersion suit also minimising those risks.

Hypothermia protection is normally provided in immersion suits by thermal insulation. The thermal protection performance of a suit is tested by using human subjects for the time being but giving the option to use a manikin so far available and reliable by its test results.

The development of suitable manikins is highly emphasised and will be taken under consideration by these standards if proofed in practise of testing. Meanwhile those standards rely on testing with human subjects, whereas these tests are specified in part 3 of these standards taking care of the safety of the subjects by medical check-up, monitoring, reporting and supervising these tests by a physician.

The test result is expressed in units "immersed Clo". Higher values of insulation indicate greater protection leading to longer survival times in water at any given temperature.

The prediction of "survival" potential for a person wearing an immersion suit is very complex and depends on a number of highly variable factors. These include water temperature and sea state; the type, design and performance level of the immersion suit; and the size, weight, general fitness and physiological of the individual.

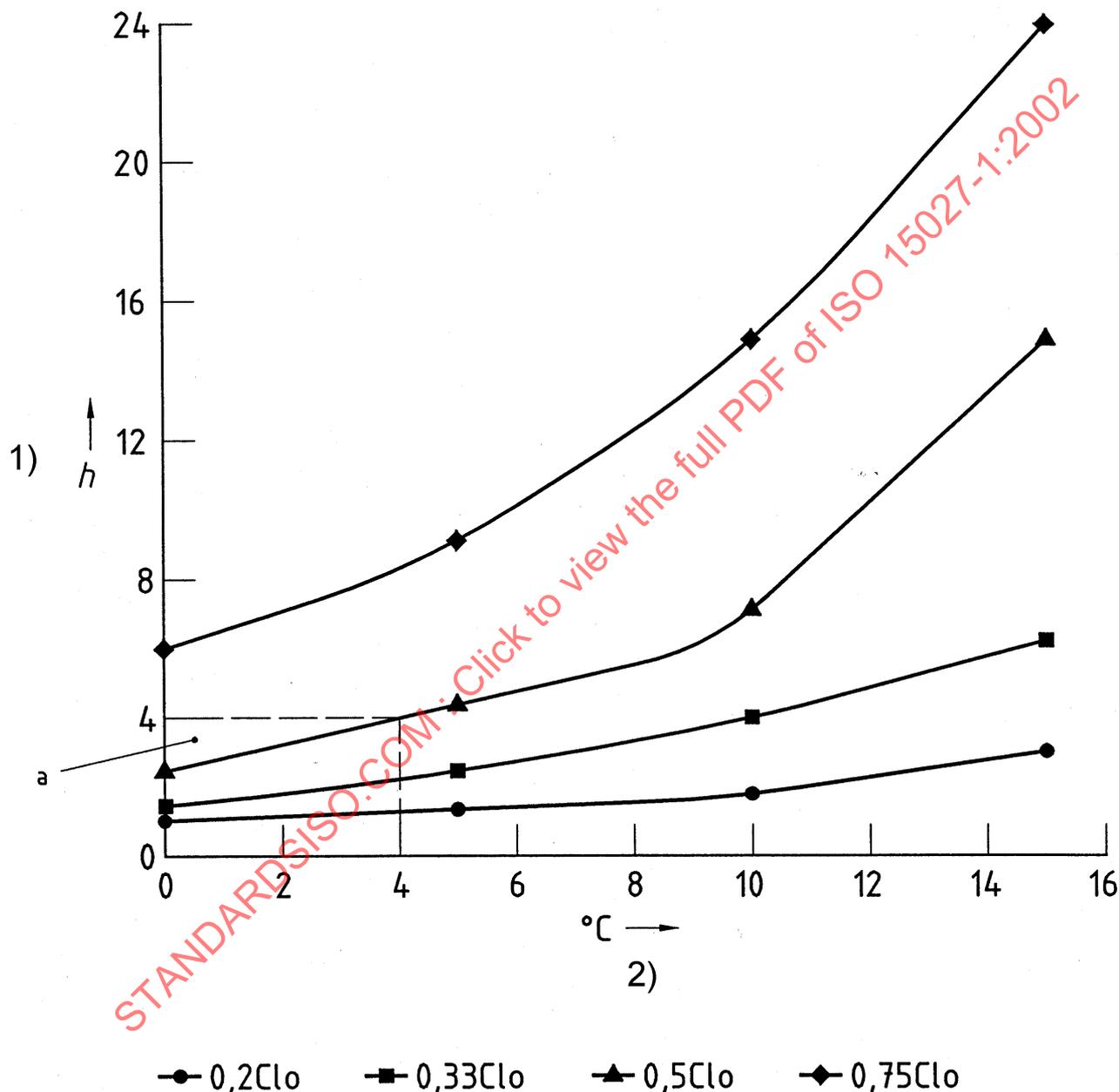
For practical purposes a mathematical thermal protection time prediction model has been developed by Wissler<sup>3)</sup>. The model can be presented in graphical form — a graduated vertical axis representing thermal protection time and a graduated horizontal axis representing water temperature. Upon this grid are super-imposed standard curves which are identified by different levels of insulation, or immersed Clo values. The EN ISO 15027-1

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3) Wissler EH & Nunneley SA (1983) Human thermal Responses to Accidental Immersion in Cold Water; A Theoretical Study. Paper presented at the 1983 Annual Scientific meeting of the Aerospace Medical Association, Houston, USA.

and EN ISO 15027-2 identify four levels of immersed Clo for standard purposes. These are 0,20, 0,33, 0,50 and 0,75 Clo. Figure A.1 shows curves for each level of insulation. The other variable factors are considered by the model to be constant and are treated conservatively to yield pessimistic values, thereby ensuring an under estimation rather than an over estimation of "survival" time.

The thermal protection time is the time that is predicted it will take for deep body temperature to fall to 34 °C. Generally a body temperature of 34 °C is considered to be survivable, although mental and physical performance will be impaired. With the development of hypothermia, the victim becomes increasingly incapacitated. As body temperature falls below 34 °C, consciousness may be lost, leading to drowning.



**Key**

- 1) Time (h)
- 2) Water temperature in °C

<sup>a</sup> Example shown by dotted line: suit system according to 0,5 clo used at a water temperature of 4 °C shall establish a thermal protection time of approximately 4 h.

**Figure A.1 — Predication of calm water thermal protection times for immersion suits used in a range of water temperatures**