
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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ISO 15027-1:2002

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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*

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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.

Contents	Page
Foreword.....	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Requirements	3
5 Marking	8
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	12
Annex ZZ (normative) Corresponding International and European Standards for which equivalents are not given in the text	16

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[ISO 15027-1:2002](https://standards.iteh.ai/catalog/standards/sist/71876f65-4816-4937-8328-dcf3c609693/iso-15027-1-2002)
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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 15027-1:2002](https://standards.iteh.ai/catalog/standards/sist/71876f65-4816-4937-8328-302360402020/iso-15027-1:2002)

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* ¹⁾.

International Convention for the Safety of Life at Sea (IMO), 1974, amendment 1983 ²⁾.

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

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 °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

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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:

- using a thermal manikin: tested in accordance with 3.8.1 of EN ISO 15027-3:2002;
- 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 cm² shall be provided. At least 100 cm² of which shall be affixed to the hood and at least 250 cm² shall be clear of the water and visible in the suit's normal in-water position as