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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*

ICS: 13.340.10

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 188, *Small craft*, Subcommittee SC 1, *Personal safety equipment*.

This third edition cancels and replaces the second edition (ISO 15027-1:2012) which has been technically revised.

The main changes are as follows:

- Terms and conditions have been revised;
- In [subclause 4.3](#), requirements for Other optional accessories have been added;
- In [table 3](#), new thermal performance level E, equivalent to SOLAS uninsulated immersion suit has been added;
- In [table 3](#), minimum immersed CLO values to Suit Performance levels have been added;
- In [subclause 4.12](#), the Performance Requirements have been re-ordered to improve the order of testing;
- In [subclause 4.12.5](#), missing donning time for hand protection has been added;
- In [clause 5](#), Warnings in Marking have been revised;
- In [clause 7](#), Consumer information has been revised;
- [Annex A](#) has been revised;

A list of all parts in the ISO 15027 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This part of ISO 15027 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 in the event of accidental immersion, to prolong life and to aid rescue. An individual's estimated thermal protection time when wearing this type of equipment will depend upon the water temperature, weather conditions, clothing, the cold tolerance of the person and the person's behaviour. This part of ISO 15027 specifies the minimum levels of insulation provided by the different ranges of suit in particular water temperatures.

This part of ISO 15027 allows for 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 part of ISO 15027 does not imply that it is suitable for all circumstances. This part of ISO 15027 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 part of ISO 15027 is intended to serve as a minimum performance requirement for manufacturers, purchasers and users of constant wear suits by ensuring that they provide an effective standard of performance in use. Designers should encourage the wearing of this equipment by making it 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 user to propel himself in the water and extricate himself from the water without it becoming an encumbrance;
- c) to make the user 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 according to manufacturer's instructions.

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

A constant wear suit may often be worn with a lifejacket as it will provide extra flotation and may help to bring a person to a face-up position.

# Immersion suits —

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

### 1 Scope

This document specifies performance and safety requirements for constant wear immersion suits and suit systems for professional and leisure activities to protect the user against the effects of cold water immersion, such as reducing cold shock and delaying the onset of hypothermia.

It is applicable for dry and wet constant wear immersion suits and suit systems.

Abandonment suits are not covered by this document. Requirements for abandonment suits are given in ISO 15027-2:202x. Test methods for immersion suits are given in ISO 15027-3:202x.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

CIE 15:2004, *Colorimetry*<sup>1)</sup>

ISO 13688, *Protective clothing - General requirements (ISO 13688:2013)*

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

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

ISO 105-E02, *Textiles — Tests for colour fastness — Part E02: Colour fastness to sea water*

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

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

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

ISO 2411:2017, *Rubber- or plastics-coated fabrics — Determination of coating adhesion*

ISO 3801:1977, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area*

ISO 4674-1:2016, *Rubber- or plastics-coated fabrics — Determination of tear resistance — Part 1: Constant rate of tear methods*

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

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

ISO 12401:2009, *Small craft — Deck safety harness and safety line — Safety requirements and test methods*

ISO 12402-2:2020, *Personal flotation devices — Part 2: Lifejackets, performance level 275 — Safety requirements*

1) Available from <https://www.cie.co.at/main/publist.html>.

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ISO 12402-3:2020, *Personal flotation devices — Part 3: Lifejackets, performance level 150 — Safety requirements*

ISO 12402-4:2020, *Personal flotation devices — Part 4: Lifejackets, performance level 100 — Safety requirements*

ISO 12402-5:2020, *Personal flotation devices — Part 5: Buoyancy aids (level 50) — Safety requirements*

ISO 12402-6:2020, *Personal flotation devices — Part 6: Special purpose lifejackets and buoyancy aids — Safety requirements and additional test methods*

ISO 12402-7:2020, *Personal flotation devices — Part 7: Materials and components — Safety requirements and test methods*

ISO 12402-8:2020, *Personal flotation devices — Part 8: Accessories — Safety requirements and test methods*

ISO 12402-9:2020, *Personal flotation devices — Part 9: Evaluation*

ISO 13688:2013, *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 13935-2, *Textiles — Seam tensile properties of fabrics and made-up textile articles — Part 2: Determination of maximum force to seam rupture using the grab method*

ISO 13937-4, *Textiles — Tear properties of fabrics — Part 4: Determination of tear force of tongue-shaped test specimens (Double tear test)*

ISO 15027-3:20xx, *Immersion suits — Part 3: Test methods*

RESOLUTION A. 658(16)<sup>2)</sup> adopted by the IMO<sup>3)</sup> Assembly to amend the International Convention for the Safety of Life at Sea (SOLAS), 1974, *Use and fitting of retro-reflective materials on life-saving appliances*

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### 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **immersion suit**

suit designed to protect the user's body from the cooling effects of immersion in water

Note 1 to entry: Cooling effects include cold shock (3.21) and hypothermia (3.14).

#### 3.2

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

immersion suit, designed to be routinely worn for activities on or near water in anticipation of immersion in water, but permitting physical activity to such an extent that actions can be undertaken without undue encumbrance and thus, head, hands and feet need not be covered

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2) Accessible at [https://www.imo.org/KnowledgeCentre/HowAndWhereToFindIMOInformation/In dexofIMOResolutions/Pages/Assembly-\(A\).aspx](https://www.imo.org/KnowledgeCentre/HowAndWhereToFindIMOInformation/In dexofIMOResolutions/Pages/Assembly-(A).aspx).

3) IMO is the abbreviation for International Maritime Organization, based in London, UK. IMO issues regulations which are then published as laws by the member states.



**3.3****abandonment suit**

immersion suit including head, hand and feet protection designed to permit rapid donning in the event of an imminent immersion in water

**3.4****dry suit**

immersion suit which covers all or particular regions of the body and which is designed to prevent the ingress of water upon immersion

**3.5****wet suit**

immersion suit which covers all or particular regions of the body and which is designed to limit the flow of water in and out of the suit

**3.6****secondary suit closure**

additional closure which can be operated by the user to enhance the fit of the suit

**3.7****exterior fabric**

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

**3.8****retro-reflective material**

material that reflects light beams back to their point of origin

**3.9****buddy line**

length of cord which can be tied or otherwise fixed to another person, or to that person's personal flotation device or other objects, so as to keep a user in the vicinity of that person or object with a view to making location and thus rescue easier

**3.10****clo value**

unit to express the relative thermal insulation values of various clothing assemblies

Note 1 to entry: One clo is equal to  $0,155 \text{ Km}^2 \text{ W}^{-1}$ .

**3.11****hypothermia**

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

**3.12****helicopter transit suit**

constant wear suit worn by helicopter occupants

**3.13****offshore installation**

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 by other international regulations

**3.14****suit system**

immersion suit including its components and accessories, and any auxiliary buoyancy, or personal flotation device (PFD)

Note 1 to entry: The storage bag is not part of the suit system.

### 3.15

#### **underclothing**

clothes worn under the suit system

Note 1 to entry: The underclothing to be worn with the suit system shall be specified by the manufacturer. If not specified by the manufacturer, it shall be according to ISO 15027-3:20xx, 3.8.1.3.

### 3.16

#### **heat strain**

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

### 3.17

#### **cold shock**

short transitory phase lasting about 2 min to 3 min upon sudden immersion in cold water and characterized by an uncontrollable hyperventilation accompanied by other cardio-respiratory distress

## 4 Requirements

### 4.1 General

**4.1.1** A constant wear suit system (dry or wet suit) shall meet the requirements of this document. The suit shall not be damaged or fail in its determined function when tested in accordance with ISO 15027-3:20xx, Clause 3.

When a PFD or auxiliary buoyancy is part of the suit system, it shall be tested and included as part of the suit system.

**4.1.2** The suit system shall be designed so as not to impede the user during normal use when tested in accordance with ISO 15027-3, 3.15.

**4.1.3** All suit samples shall undergo temperature cycling in accordance with ISO 15027-3:20xx 3.3, followed by the rotating shock bin test in accordance with ISO 15027-3:2020 3.4, and cleaning shall be done according to the specification of the manufacturer in accordance with ISO 15027-3:20xx 3.11, prior to all remaining tests.

**4.1.4** The manufacturer shall specify the components of the suit system including underclothing and additional items. The constant wear suit may incorporate additional items compliant with ISO 12402-8, none of which shall impair its performance with respect to the requirements of this part of ISO 15027, either by their presence or their use. If a safety harness forms an integral part of the suit designed to comply with this part of ISO 15027, then the complete assembly shall comply both with ISO 12401 and with this part of ISO 15027.

**4.1.5** The risk of heat stress and discomfort shall be taken into account in the design and use of the suit system with underclothing. This should be accompanied in the information supplied by the manufacturer by specific advice or warnings according to [Clause 6](#).

**NOTE** In general, the higher the protection against cold shock and hypothermia, the higher the possibility of heat strain is. The user of a constant wear suit needs to balance those two effects when choosing a device.

**4.1.6** The rotating shock bin test according to ISO 15027-3:20xx, 3.4 shall be performed on each sample. There shall be no visible migration of insulation material and no visible wear-and-tear damage after the rotating shock bin test.