
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 15027-1:2012

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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 15027-1 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets*, in collaboration with Technical Committee ISO/TC 188, *Small craft*, Subcommittee SC 1, *Personal safety equipment*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15027-1:2002) which has been technically revised. The main technical changes are:

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- a) addition of “underclothing” under terms and definitions;
 - b) addition of “cold shock” under terms and definitions;
 - c) revision of requirements for buddy lines; [ISO 15027-1:2012](https://standards.iteh.ai/catalog/standards/sist/18887264-b26a-43f5-b88f-2bcd4/iso-15027-1-2012)
 - d) revision of requirements regarding conspicuity; <https://standards.iteh.ai/catalog/standards/sist/18887264-b26a-43f5-b88f-2bcd4/iso-15027-1-2012>
 - e) addition of Clause 6 “Information supplied by the manufacturer”;
 - f) revision of consumer information label;
 - g) reordering of subclauses;
 - h) revision of requirements regarding thermal protection in water.

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*

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 part of ISO 15027 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.

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Immersion suits —

Part 1: Constant wear suits, requirements including safety

1 Scope

This part of ISO 15027 specifies performance and safety requirements for constant wear immersion suits for work and leisure activities to protect the body of a user against the effects of cold water immersion, such as cold shock and hypothermia.

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

Abandonment suits are not covered by this part of ISO 15027. Requirements for abandonment suits are given in ISO 15027-2:2012. Test methods for immersion suits are given in ISO 15027-3:2012.

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.

CIE 15:2004, *Colorimetry*¹⁾

EN 340, *Protective clothing — General requirements*

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 2411:2000, *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 4674-1:2003, *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, *Small craft — Deck safety harness and safety line — Safety requirements and test methods*

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

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

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

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

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

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

ISO 12402-7:2006, *Personal flotation devices — Part 7: Materials and components — Safety requirements and test methods*

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

ISO 12402-9:2006, *Personal flotation devices — Part 9: Test methods*

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 15027-3:2012, *Immersion suits — Part 3: Test methods*

Resolution A.658(16)²⁾ adopted by the IMO³⁾ 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

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

3.1

immersion suit

suit designed to protect the user's body from the cooling effects of unintended 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 accidental 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

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 designed to protect the user against the effect of cold water immersion by precluding the entry of water upon immersion

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

3.5**wet suit**

immersion suit designed to protect the user against the effect of cold water immersion by providing insulation and limiting the entry and exit of water upon immersion

3.6**primary suit closure**

closure used in the donning of the suit

3.7**secondary suit closure**

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

3.8**inherent buoyant material**

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

3.9**exterior fabric**

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

3.10**retro-reflective material**

material that reflects light beams back to their point of origin

3.11**sprayhood**

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

3.12**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

3.13**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 Km² W⁻¹.

3.14**hypothermia**

condition where body core temperature is below 35 °C

3.15**working environment**

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

3.16**helicopter transit suit**

constant wear suit worn by helicopter occupants

3.17**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

3.18**suit system**

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

3.19
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 15027-3:2012, 3.8.1.3.

3.20
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

3.21
cold shock

short transitory phase lasting about 2 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 The suit system (dry or wet suit) declared to be a constant wear suit shall meet all requirements of this part of ISO 15027. The suit shall not be damaged or fail in its determined function when tested in accordance with ISO 15027-3:2012, Clause 3. The test sequence shall start with the temperature cycling in accordance with ISO 15027-3:2012, 3.9, followed by the rotating shock bin test in accordance with ISO 15027-3:2012, 3.6.

4.1.2 A suit system declared to be a helicopter transit suit shall meet all requirements of this part of ISO 15027.

4.1.3 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.

4.1.4 The risk of heat stress and discomfort shall be taken into account in the design and use of the suit system. 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.

4.1.5 The rotating shock bin test according to ISO 15027-3:2012, 3.6 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.

4.1.6 Unless the suit system has been designed to be used without a PFD, the suit system shall not prevent the donning of a personal flotation device (PFD) in accordance with ISO 12402-2 or ISO 12402-3 and the manufacturer of the suit system shall specify the type of PFD (inflatable and/or inherent) to be used.

4.1.7 The performance requirements shall be met after cleaning in accordance with ISO 15027-3:2012, 3.7.1.1. The cleaning shall be performed according to the specification of the manufacturer.

4.1.8 The suit system shall be designed in such a way as to minimize the risk of snagging. Test in accordance with ISO 15027-3:2012, 3.10.

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. Test in accordance with ISO 15027-3:2012, 3.10.

4.1.10 A dry suit requires a tight fit around neck or face, wrists and ankles. This is tested in the leakage test (see 4.9).

4.2 Basic health and ergonomic requirements

4.2.1 Innocuousness

The suit system shall not adversely affect the health or hygiene of the user. The materials shall not, in the foreseeable conditions of normal use, release substances generally known to be toxic, carcinogenic, mutagenic, allergenic, toxic to reproduction or otherwise harmful.

NOTE 1 More information can be found in ISO 13688.

NOTE 2 Materials should be selected to minimize the environmental impact of the production and disposal of protective clothing (see ISO 13688:—, Annex F).

The examination, in combination with the following requirements in 4.2, shall determine whether the claim that the materials are suitable for use in the protective clothing or protective equipment is justified. Particular attention has to be paid to the presence of plasticizers, unreacted components, heavy metals, impurities and the chemical identity of pigments and dyes.

4.2.2 Design

4.2.2.1 The design of the suit system shall facilitate its correct positioning on the user and shall ensure that it remains in place for the foreseeable period of use, taking into account ambient factors, together with the movements and postures that the wearer could adopt during the course of work or other activity. For this purpose, appropriate means, such as adequate adjustment systems or adequate size ranges shall be provided so as to enable protective clothing to be adapted to the morphology of the user.

4.2.2.2 The design shall ensure that no parts of the body get uncovered by expected movements by the user (e.g. a jacket should not rise above the waist when the arms are raised). When testing according to ISO 15027-3:2012, 3.10 it shall be proven that the suit system can be put on and taken off easily; that arm and knee and bending movements are possible; that unprotected body areas do not appear during movements; that there is an adequate overlap of jacket and trousers; that the manufacturer's information is adequate to explain the correct usage.

4.2.2.3 The design of the suit system shall take into account other additional items to be worn with it. The appropriate level of protection shall be provided at interface areas, for example sleeve to hand protection, trouser to footwear, hood and respirator combinations; there may be other combinations.

4.2.3 Comfort

4.2.3.1 The suit system shall provide users with a level of comfort consistent with the level of protection against hazards for which it is provided, the ambient conditions, the level of the user's activity, and the anticipated duration of use of the protective clothing.

The suit system shall not

- have rough, sharp or hard surfaces that irritate or injure the user;
- be so tight, loose and/or heavy that it restricts normal movement.

4.2.3.2 If applicable, the suit system shall be made of materials with low water-vapour resistance and/or high air permeability and/or shall be sufficiently ventilated to minimize discomfort and thermal stress.