



**SLOVENSKI STANDARD**  
**SIST EN 14225-3:2005**

**01-julij-2005**

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**Potapljaške obleke – 3. del: Aktivno segrevane ali hlajene obleke (sistemi) –  
Zahteve in preskusne metode**

Diving suits - Part 3: Actively heated or cooled suits (systems) - Requirements and test methods

Tauchanzüge - Teil 3: Aktiv beheizte oder gekühlte Anzüge (Systeme) - Anforderungen und Prüfverfahren

Vêtements de plongée - Partie 3: Vêtements avec système de chauffage ou de refroidissement actif (ensembles) - Prescriptions et méthodes d'essai

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**ICS:**

97.220.40	Oprema za športe na prostem in vodne športe	Outdoor and water sports equipment
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ICS 97.220.40

English version

## Diving suits - Part 3: Actively heated or cooled suits (systems) - Requirements and test methods

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de chauffage ou de refroidissement actif (ensembles) -  
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(Systeme) - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 14 February 2005.

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## Foreword

This document (EN 14225-3:2005) 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.

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of an identical text or by endorsement, at the latest by September 2005, and conflicting national standards shall be withdrawn at the latest by September 2005.

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 89/686/EEC.

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This standard for actively heated suits or actively cooled diving suits (Systems) is Part 3 of 4. The other parts are:

- Diving Suits – Part 1: Wet suits – Requirements and test methods.
- Diving Suits – Part 2: Dry suits – Requirements and test methods.
- Diving Suits – Part 4: One atmosphere suits (ADS) – Human factors requirements and test methods.

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This document includes a Bibliography.

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

## Introduction

This document for actively heated or cooled diving suits (systems) has been prepared to meet the needs of persons engaged in underwater activities where the user is breathing underwater, and where the water temperature and exposure duration are such that the person's thermal status only can be maintained at a safe level by means of active heating or cooling.

Actively heated suits and actively cooled suits are designed to reduce the risk of the diver suffering hypothermia and hyperthermia, respectively.

The performance of the suit can be altered by a number of factors including any additional equipment carried by the diver.

A suit may be comprised of one or more pieces.

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## 1 Scope

This document specifies the construction and performance of actively heated suits and actively cooled suits for wear by divers for underwater activities where the user is breathing underwater. Marking, labelling, information to be provided at the point of sale, and instructions for use are also specified.

The document applies to the actively heated or cooled suits (systems) of the two types, dry and wet. It is only required that the suit should fulfil this Part 3, not the Parts 1 or 2 unless specified.

Laboratory and practical performance tests are specified.

## 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.

EN 250:2000, *Respiratory equipment — Open circuit self-contained compressed air diving apparatus — Requirements, testing marking*

EN 340:2003, *Protective clothing — General requirements*

EN 1809:1997, *Diving accessories — Buoyancy compensators — Functional and safety requirements, test methods*

EN 14126:2003, *Protective clothing — Performance requirements and test methods for protective clothing against infective agents*

EN 14225-2:2005, *Diving suits — Part 2: Dry suits — Requirements and test methods*

EN 23758:1993, *Textiles — Care labelling code using symbols (ISO 3758:1991)*

EN ISO 105-E02:1996, *Textiles — Tests for colour fastness — Part E02: Colour fastness to sea water (ISO 105-E02:1994)*

EN ISO 105-X12:2002, *Textiles — Tests for colour fastness — Part X12: Color fastness to rubbing (ISO 105-X12:2001)*

EN ISO 4674-2:1998, *Rubber- or plastic-coated fabrics — Determination of tear resistance — Part 2: Ballistic pendulum method (ISO 4674-2:1998)*

EN ISO 6529:2001, *Protective clothing — Protection against chemicals — Determination of resistance of protective clothing materials to permeation by liquids and gases (ISO 6529:2001)*

EN ISO 13935-2:1999, *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 13935-2:1999)*

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

ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

AODC:1985, *Code of practice for safe use of electricity under water*  
(<http://www.imca-int.com/publications/IMCA-Publications.pdf> )

SOLAS:1974, as amended, *Chapter III as amended by IMO Resolution MSC 47(66) and LSA Code. Recommendation on retroreflective tapes on life-saving appliances adopted by Res. A.658(16), Annex 2*

### 3 Terms and definitions

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

- 3.1 actively heated suit**  
suit designated to provide heat to the layer of gas or water between the suit and the diver's body
- 3.2 actively cooled suit**  
suit designated to remove heat from the layer of gas or water between the suit and the diver's body
- 3.3 connector**  
connecting device between the suit's internal distribution system and the umbilical delivering electricity and/or heating/cooling gas/liquid from an external source
- 3.4 diving environment**  
environment in which the wearer of a diving suit engages in diving activities
- 3.5 diving suit**  
suit designed for intended underwater activities, in which the user is breathing underwater
- 3.6 dry suit**  
diving suit, which covers all or particular regions of the body and which is designed to prevent the ingress of water upon immersion
- 3.7 heat stress**  
physiological stress produced by the heat load on the body
- NOTE The total heat load is made up of the metabolic heat load and environmental heat loads including that due to clothing.
- 3.8 hypothermia**  
condition of the human body in which the core temperature is below 35 °C
- 3.9 hyperthermia**  
condition of the human body in which the core temperature is above 39 °C
- 3.10 suit system**  
combination of diving suit components, undergarments and attachments
- 3.11 wet suit**  
diving suit, made of thermal insulating material, which covers all or part of the body and that is designed to reduce the flow of the water around the diver's body
- 3.12 umbilical**  
hose or cable system for transferring energy and other services to or from an actively heated or actively cooled suit

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**3.13****undergarment**

garment worn under the diving suit to provide one or more of insulation mechanical protection or thermal control

**3.14****single action release mechanism**

mechanism, which can be released with one hand

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

Actively heated and cooled suits (systems) shall conform to the requirements listed in Table 1, as applicable. Actively heated and cooled suits (systems) incorporating optional features shall also conform to the requirements listed in Table 2, as applicable.

The requirements are for both types of suits (wet and dry) unless otherwise specified.

**4.2 Mechanical performance of the whole suit****4.2.1 Resistance to cold and hot storage and inflation**

Applicable only for dry suits.

After the leakage test (5.4) a suit, complete with all attachments including valves and hose, shall be subjected to hot and cold storage followed by an inflation resistance test, in accordance with 5.5. After each hot and cold storage cycle and after the inflation resistance test the suit shall be visually inspected in accordance with 5.3. There shall be no visible signs of damage.

Applicable only for wet suits.

A suit and samples of each suit material and each suit material combination shall be subjected to a high temperature resistance test followed by a low temperature resistance test as given in 5.5 and repeated four cycles. The suit and the samples shall then be inspected in accordance with 5.3. There shall be no visible signs of damage.

**4.2.2 Sea water resistance**

After the test for resistance to hot and cold storage (5.5), the suit, complete with all attachments including valves and hose, and the samples of suit materials shall be subjected to the seawater resistance test in accordance with 5.6 and then visually inspected after each cycle in accordance with 5.3. There shall be no visible signs of damage.

#### 4.2.3 Resistance to cleaning, disinfection and decontamination

The suits, complete with all attachments and the samples of suit materials and of each material combination shall be subjected to cleaning and disinfection and, where applicable, to decontamination in accordance with 5.7 and shall then be visually inspected in accordance with 5.3. There shall be no visible signs of damage or degradation.

### 4.3 Mechanical performance of the material, seams and attachments

#### 4.3.1 Resistance of material to puncture and dynamic tearing

Following preliminary tests of resistance to cold and hot storage (5.5), seawater resistance (5.6) and resistance to cleaning, disinfection and decontamination (5.7) the suit material samples shall be tested in accordance with EN 14225-2:2005, 5.4.3.1 the mean tear length shall be less than 40 mm.

#### 4.3.2 Strength of suit seams

When the suit material samples (with seams) that has been subjected to the tests specified in 5.5, 5.6 and 5.7 are tested in accordance with EN ISO 13935-2:1999 the seam joining each combination of materials used to manufacture the suit, but excluding wrist, ankle, neck and face seals, shall withstand a tensile load of > 100 N for 10 s applied perpendicular to the seam, without visible evidence of permanent deformation or tearing, when visually inspected according to 5.3.

#### 4.3.3 Joint strength of attachments

When the suit material samples (with attachments) that has been subjected to the tests specified in 5.5, 5.6 and 5.7 are tested in accordance with EN ISO 13935-2:1999 (if joints include seams) and EN 14225-2:2005, 5.4.3.2, the joints between the basic suit material and the hood, gloves, neck seal, wrist seals, boots and socks, where these are attached to the suit, shall each withstand a tensile load of  $100 \binom{+10}{0}$  N without visible evidence of permanent deformation or tearing, when visually inspected according to 5.3.

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Table 1 — Actively heated or cooled suit (systems) – Overall requirements

Requirement	Requirement specified in clause	Test method
<b>Whole suit</b>		
Sizing	4.5.1	5.10.7.3 b)
Leakage resistance of dry suits	4.5.6	5.4
Resistance to hot and cold storage and inflation resistance	4.2.1	5.5
Sea water resistance	4.2.2	5.6
Resistance to cleaning, disinfection and decontamination	4.2.3	5.7
Thermal requirements	4.6	5.10
Safety requirements	4.7	AODC Electrical code:1985
Practical performance	4.8	5.10
Control systems	4.5.2	5.10
Provision for urination	4.5.5	5.10 and 5.3
Internal volume control system	4.5.3	5.10 EN 14225-2:2005, 5.5.1
Connectors	4.5.4	5.10, 5.9 and 5.3
<b>Suit materials</b>		
Resistance to puncture and dynamic tearing	4.3.1	EN 14225-2:2005, 5.4.3.1
Seam strength	4.3.2	EN ISO 13935-2:1999
Joint strength of attachments	4.3.3	EN 14225-2:2005
Compactness of slide fasteners	4.3.4	EN 14225-2: 2005, 5.5.2
Mechanical performance of underwear material	4.4	EN ISO 4674-2:1998
<b>Marking and Information</b>		
Marking	Clause 6	5.3 and 5.9
Information to be supplied by manufacturer	Clause 7	5.3 and 5.9

**Table 2 — Actively heated or cooled Suit (Systems) with Special Protection and other optional features**

Feature	Requirement specified in clause	Test method	Symbol
Protection against chemicals	4.9.1.1	5.11.1.2	HZ
Protection against micro-organisms	4.9.1.2	EN 14126:2003, 4.1.4.1 and 4.1.4.2	BIO
Suits to aid visibility	4.9.2.1 4.9.2.2	EN ISO 105-E02:1996 EN ISO 105-X12:2002 EN ISO 15027-3:2002	VIS

**4.3.4 Compactness of slide fasteners**

Any slide fasteners used in dry suits shall not leak when the suit is tested in accordance with EN 14225-2:2005, 5.5.2.

**4.4 Mechanical performance of underwear material**

When tested in accordance with EN ISO 4674-2:1998 the material of an underwear being a specified part of the suit system shall withstand a tensile force of 25 N applied in the direction of the warp and in the direction of the weft of the material, without signs of tearing, when visually inspected according to 5.3.

**4.5 Construction**

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**4.5.1 Sizing**

The manufacturer shall use the sizing system specified in EN 340:2003 or another sizing system. If the manufacturer uses a sizing system other than that specified in EN 340:2003, the manufacturer shall state at least two body dimensions including at least the height and chest girth of the intended user.

When the suit is donned by a test diver in accordance with 5.10.7.3 b) the size of the suit shall correspond to the size marked on it by the manufacturer.

**4.5.2 Control systems for heating or cooling**

When tested in accordance with 5.10, the system shall provide a mechanism to enable the diver to override the active heating or cooling system.

**4.5.3 Internal volume control system**

If devices for control of the internal volume of the suit are fitted they shall demonstrate appropriate function when tested in accordance with 5.10 and EN 14225-2:2005, 5.5.1.

**4.5.4 Connectors**

External suit connectors shall have a single action release mechanism.

When tested in accordance with 5.10 external suit connectors shall be capable of being readily connected and disconnected with gloved hands, when the diver is wearing three finger gloves, (6<sup>+2</sup><sub>0</sub>) mm thickness, double lined, or the gloves permanently attached to the suit.