
Potapljaške obleke – 2. del: Suhe obleke – Zahteve in preskusne metode

Diving suits - Part 2: Dry suits - Requirements and test methods

Tauchanzüge - Teil 2: Trockentauchanzüge - Anforderungen und Prüfverfahren

Vêtements de plongée - Partie 2: Combinaisons étanches - Prescriptions et méthodes d'essai

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English version

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

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14225-2:2005) 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of an identical text or by endorsement, at the latest by September 2005, and conflicting national standards shall be withdrawn at the latest by September 2005.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 dry suits is Part 2 of 4. The other parts are:

- Diving Suits – Part 1: Wet suits – Requirements and test methods.
- Diving Suits – Part 3: Actively heated or cooled suits (systems) – Requirements and test methods.
- Diving Suits – Part 4: One atmosphere suits (ADS) – Human factors requirements and test methods.

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 dry diving suits has been prepared to meet the needs of persons engaged in underwater activities where the user is breathing underwater, and where thermal comfort and required thermal protection is higher than that provided by a wet suit. A dry suit is also designed to enable the wearers to maintain their buoyancy and to adjust the gas volume in the suit according to their requirements.

A dry suit may be comprised of one or more pieces. Dry suits may be used in conjunction with a range of accessories including passive and active undergarments, gloves, a hood and other head protection equipment.

The conformity of a dry suit to this document does not imply that it is suitable for all circumstances, nor does the standard make detailed provisions for all the special uses for which dry suits may be utilised.

A dry suit manufactured for special purposes may also:

- a) provide or enable thermal insulation;
- b) provide special protection.

The level of protection and performance offered by a dry suit may be altered by a number of factors, including the water temperature, the depth of the dive, the diver's work rate and behaviour, and the manner in which the suit has been maintained. The adequacy of the protection provided by a dry suit also depends upon the individual diver's level of cold tolerance. The degree of thermal protection offered by a dry suit is especially problematic. Appropriate material and manikin tests are being developed and refined, but at best they will only be able to provide broad indications of the likely protection provided by a particular suit to an individual diver.

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1 Scope

This document specifies the construction and performance, of dry 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.

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 14225-1:2005, *Diving suits — Requirements and test methods*

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

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: Colour fastness to rubbing (ISO 105-X12:2001)*

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 13995:2000, *Protective clothing — Mechanical properties — Test method for the determination of the resistance to puncture and dynamic tearing of materials (ISO 13995:2000)*

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*

ISO 1817:1999, *Rubber, vulcanized — Determination of the effects of liquids*

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, issued by the International Maritime Organisation (IMO)*

3 Terms and definitions

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

- 3.1 diving suit**
suit designed for intended underwater activities, in which the user is breathing underwater
 - 3.2 suit system**
combination of diving suit components, undergarments and attachments
 - 3.3 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
 - 3.4 closure**
device to close openings provided for the donning and use of a diving suit
- NOTE Closures include slide fasteners (3.22).
- 3.5 attachment**
item attached to the diving suit
 - 3.6 neck seal**
closure used to make a water and gas tight seal around the neck
 - 3.7 wrist seal**
closure used to make a water and gas tight seal around the wrist
 - 3.8 ankle seal**
closure used to make a water and gas tight seal around the ankle
 - 3.9 face seal**
closure used to make a water and gas tight seal around the face
 - 3.10 medium pressure**
pressure between a pressure reducer and a gas control system
- NOTE This is sometimes referred to as intermediate pressure.
- 3.11 inflation device**
device that allows gas to be added to the internal volume of a dry suit
 - 3.12 deflation device**
device that allows gas to be released from the internal gas volume of a dry suit

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3.13**manually operated deflation device**

deflation device activated by the diver

3.14**inflation hose**

hose used to supply pressurised gas to the inflation device

3.15**safety pull disconnection device**

device enabling quick disconnection of a gas connector from the suit

3.16**single action release mechanism**

mechanism which can be released with one hand

3.17**undergarment**

garment worn under a dry suit to provide insulation or thermal control

3.18**hypothermia**

condition of the human body in which the core temperature is below 35 °C

3.19**hyperthermia**

condition of the human body in which the core temperature is above 39 °C

3.20**hazard**

source of possible injury or damage to health

3.21**label**

item permanently attached to a product that carries information related to parts or special features of the product

3.22**slide fastener**

closure with a fastening device consisting of two flexible interlocking strips and a slider

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4 Requirements

4.1 General

Dry suits shall conform to the requirements listed in Table 1, as applicable. Dry suits incorporating optional features shall also conform to the requirements listed in Table 2, as applicable.

4.2 Mechanical performance of the whole suit

4.2.1 Resistance to cold and hot storage and inflation

After the leakage test (5.5.2) 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 5.4.2.1. 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.

4.2.2 Sea water resistance

After the tests for resistance to hot and cold storage and inflation resistance, the suit, complete with all attachments including valves and hose, and the material samples shall be subjected to the seawater resistance test in accordance with 5.4.2.2. After each cycle the suit shall be visually inspected in accordance with 5.3. There shall be no visible signs of damage.

4.2.3 Resistance to cleaning, disinfection and decontamination

The suit, complete with all attachments and samples of suit materials and of each material combination shall be subjected to cleaning, disinfection and, where applicable, to decontamination, in accordance with 5.4.2.3 and shall then be visually inspected in accordance with 5.3. There shall be no visible signs of damage or degradation.

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4.3 Mechanical performance of the material, seams and attachments

4.3.1 Resistance of material to puncture and dynamic tearing

Following preliminary tests (5.4.2) the samples of the suit material shall be tested in accordance with 5.4.3.1. The mean tear length shall be less than 40 mm.

4.3.2 Strength of suit seams

When the material samples (with seams) that has been subjected to the tests specified in 5.4.2 is 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 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 material samples (with attachments) that has been subjected to the tests specified in 5.4.2 is tested in accordance with 5.4.3.2, the joints between the basic suit material and the hood, gloves, neck seal (if applicable), wrist seals, boots and socks, where these are attached to the suit, shall each withstand a tensile load of $(100 \begin{smallmatrix} +10 \\ 0 \end{smallmatrix})$ N without visible evidence of permanent deformation or tearing, when visually inspected according to 5.3.

4.3.4 Compactness of slide fasteners

Any slide fasteners shall not leak when the suit is tested in accordance with 5.5.2.

4.4 Construction

4.4.1 Sizing

The manufacturer shall use the sizing system specified in EN 340:2003 or another sizing system. If the manufacturer uses as 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 5.6.7.3 a) the size of the suit shall correspond to the size marked on it by the manufacturer.

4.4.2 Internal volume control system

4.4.2.1 General

If devices for control of the internal volume of the suit are fitted, they shall be positioned in such a manner that they are able to maintain buoyancy control and can be easily manipulated with a single hand when the suit is inspected and tested in accordance with 5.5.1 and 5.6.

4.4.2.2 Inflation hose

When the inflation hose is tested unpressurized in accordance with 5.5.1.1, the tensile load and the flexibility of the hose shall conform to EN 250:2000.

When tested in accordance with 5.5.1.1 the restriction of the airflow shall not exceed any value stated by the manufacturer.

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If the inflation hose is provided with a restrictor in order to limit the airflow, means to identify it as such shall be provided. This shall be stated in the information supplied by the manufacturer (see 7.1).

When any medium pressure hose assembly is tested in accordance with EN 250:2000 the burst pressure and leakage shall conform to EN 250:2000.

Table 1 — Dry suits – Overall requirements

Requirement	Requirement specified in clause	Test method
Whole Suit		
Sizing	4.4.1	5.6.7.3 a)
Leakage resistance	4.4.4	5.5.2
Resistance to hot and cold storage and inflation resistance	4.2.1	5.4.2.1
Sea water resistance	4.2.2	5.4.2.2
Resistance to cleaning, disinfection and decontamination	4.2.3	5.4.2.3
Practical performance	4.5	5.6
Suit Materials		
Resistance to puncture and dynamic tearing	4.3.1	5.4.3.1
Seam strength	4.3.2	ISO 13935-2:1999
Joint strength of attachments	4.3.3	5.4.3.2
Compactness of slide fasteners	4.3.4	5.5.2
Inflation hose		
Tensile load resistance	4.4.2.2	5.5.1.1
Flexibility	4.4.2.2	5.5.1.1
Leakage resistance	4.4.2.2	EN 250
Inflation device(s)		
Strength of bond to suit	4.4.2.3	5.5.1.2 a)
Reliability	4.4.2.3	5.5.1.2 e)
Air flow rate	4.4.2.3	5.5.1.2 b)
Leakage resistance	4.4.2.3	5.5.1.2 f) and 5.5.2
Connector strength	4.4.3	5.5.3
Deflation Devices		
Strength of bond to suit	4.4.2.4	5.5.1.3 a)
Leakage resistance	4.4.2.4	5.5.1.3 b) and 5.5.2
Connector strength	4.4.3	5.5.3
Marking and Information		
Marking	Clause 6	5.3 and 5.6
Information to be supplied by manufacturer	Clause 7	5.3 and 5.6

4.4.2.3 Inflation device(s)

When each inflation device is tested in accordance with 5.5.1.2 f) and 5.5.2 the inflation device shall not leak.

When a suit incorporating a manually operated inflation device is tested in accordance with 5.6, it shall be possible to activate the device with a single gloved hand, when the diver is wearing three finger gloves, (6⁺²₀) mm thickness, double lined, or the gloves permanently or separately attached to the suit.

When the joint between each suit inflation device and the suit is tested in accordance with 5.5.1.2 a) the bond shall not show visible signs of damage and the suit shall not leak. When tested in accordance with 5.5.1.2 b), the inflation device shall provide an airflow rate of >100 l·min⁻¹ when corrected to a standard temperature and pressure of 273,15 K and 1,013 bar.