

094 – NORWEGIAN OIL AND GAS RECOMMENDED GUIDELINES

RELATING TO

REQUIREMENT SPECIFICATIONS FOR SURVIVAL SUITS FOR USE ON THE NORWEGIAN CONTINENTAL SHELF



Translated version

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I INTRODUCTION

I. Purpose

- These requirement specifications stipulate the minimum requirements for the design and efficiency of integrated survival suits for the offshore activities on the Norwegian continental shelf. The requirement specifications comprise:
- A) Suit used by passengers during transportation by helicopter. This suit is handed out at the heliport and accompanies the user during the helicopter flight to the platform. It is kept during the offshore stay and used on the return flight to the heliport. On arrival offshore the suit is equipped with extra buoyancy so as to meet the requirements in Regulations 2003-04-11 no. 492: Regulations relating to life-saving appliances and evacuation on mobile installations (Folder 6 published in 2003 with entry into force on 2003-07-01). The extra buoyancy is removed prior to the return flight to the heliport.
- B) Suit placed on the platform which is not to be used during helicopter flights.
- An integrated survival suit is defined as a survival suit that incorporates a life jacket function. A dedicated life jacket is therefore not required.
- For Suit A the requirements in *NS-EN ISO 15027-1:2002 Immersion suits; Part 1 Constant wear suits, requirements including safety (thermal protection requirements for Suit class A)* apply.
- *For suit B the requirements in NS-EN ISO 15027-2:2002 Immersion suits; Part 2 Abandonment suits, requirements including safety (thermal protection requirements for Suit class A)* apply. Both suits shall meet the requirements in the *LSA Code, paragraph 2.3. Immersion suits* with the exception of 2.3.2.1, where special Norwegian requirements apply. Norsk olje og gass (Norwegian Oil and Gas Association) has defined certain additional special survival suit requirements for the Norwegian shelf. These requirements are specified in the REQUIREMENT section of this document.
- These specifications have followed and taken into account the ongoing work of the JAR JTSO-2C502 Helicopter crew and passenger integrated immersion suits for operations to or from helidecks located in hostile areas (2002). The requirements of this standard form the basis of the minimum requirements of the Norwegian Oil Industry Association's requirement specifications.

These minimum requirements cover the integrated survival suit requirements for use on helicopters operating to and from helicopter stations in areas of hostile weather conditions (as defined in JAR-OPS 3.480(a)(12)(8ii)(a))¹).

- The requirement specifications build on existing international standards for survival suits (see paragraph III References) and emphasise:
 - That the design of the survival suit shall be adapted to the ergonomical needs during normal activity before, during and after transportation by helicopter, during evacuation of the platform, when in the water and during rescue.
 - The need for thermal protection against thermal stress may be relevant during flights, when passengers are in the helicopter cabin, and protection against thermal loss is necessary when in the water after an accident.
 - Emergency situations that require underwater evacuation from the helicopter and the need for breathing systems which help prolong the time available for evacuation.
 - Integration of equipment that contributes to facilitating the search for missing persons at sea.
 - The relevant climatic conditions pertaining to helicopter flights and the work offshore on the Norwegian shelf.

2 Areas of application

The requirement specifications apply to integrated survival suits used in the offshore activities on the Norwegian shelf.

³ **Thermal comfort** The test shall be performed in a test chamber where the temperature is regulated to $27 \pm 0.5^\circ\text{C}$ and the humidity to $50 \pm 5\%$ RH and the wind velocity $\leq 1.5 \text{ m}\cdot\text{s}^{-1}$. The test shall last for two hours and shall include six test subjects (the height and weight category corresponding to EN ISO 15027-3, Section **3.3 Test subjects**). **3.3.1 Instruction and selection**.) All test persons shall be familiar with the test equipment. They shall be informed and instructed on the problematic of the tests. The subjects shall have a medical check-up to prove their qualification for the tests. The tests and a reasonable pre-treatment and follow-up shall be witnessed by a physician. All essential body functions shall be monitored and reported during the tests. The principles of the Declaration of Helsinki, 1976 shall be considered so far applicable. Furthermore national rules and regulations shall apply such as that the tests shall be supervised by a national ethic commission. **3.3.2 Subject sizes**.) Where tests call for the use of human subjects at least 6 people shall be used, each wearing a suit of a size category suitable for their build. Their body sizes shall be within the following heights and weights shown: Height person 1.40 m to 1.60 m, 1 person under 60 kg, Height person over 1.60 m to 1.80 m, 1 person under 70 kg, 1 person over 70 kg, Height person over 80 kg, 1 person under 80 kg, 1 person over 80 kg. **3.3.3 Sex of subjects**.) Not more than 67 % of the test subjects shall be of any one sex. **3.3.4 Fitness of subjects**.) The persons complying with the criteria of 3.3.1 should be capable of relaxing when in water out of their depth, be able to swim for 20 min and cover a distance of 350 m with the aid of a lifejacket approved to a relevant EN and, after sufficient rest, board the platform specified in 3.15. The test subjects shall have a normal night's sleep, not consume any alcohol during the last 12 hours and not eat the last 3 hours prior to the test. The test subjects shall be dressed in the integrated survival suit, and the clothes under the suit shall be as described in EN ISO 15027-3,

¹ (ii) In any case, the following areas shall be considered hostile: A) For overwater operations, the open sea areas North of 45°N and South of 45°S designated by the Authority of the State concerned.

Section 3.8.1.2. Prior to dressing and undergoing the test in the climate chamber the test subjects are fitted with the equipment for measuring the physiological parameters. After dressing the test subjects enter the climate chamber, and they shall perform the test sitting in a position of rest. The seat and back of the chair shall have fabric covering. During the test the following physiological parameters shall be measured: Metabolic heat production (oxygen intake and discharged carbon dioxide shall be measured for 5 minutes every 20 minutes and be used to calculate the metabolic heat production). Heart rate, rectal temperature (rectal thermistor with an accuracy of ± 0.2 °C placed 15 cm passed the anal sphincter); Skin temperature on the chest, upper arm, small of the back, shin and the tip of the left middle finger (skin thermistors with an accuracy of ± 0.2 °C. The thermistors shall be connected to a data log and the temperature shall be recorded every 5 minutes. The thermistor leads shall be assembled and exit the clothing in the neck region). Total perspiration production (the test subjects shall be weighed without clothes before and immediately after the test, the weight loss shall be used together with the calculated metabolic heat production to calculate the total perspiration production).

The integrated survival suit consists of the following:

- a) A dry suit
 - b) Protection of the head (hood), hands (gloves) and feet (fixed boots)
 - c) Buoyancy means
 - d) Breathing aid
 - e) Spray protection
 - f) Detection equipment
 - g) Rescue equipment.
- All accessories that form part of the suit's approval shall be regarded as an integrated part of the survival suit for the purpose of these requirement specifications.
 - In the REQUIREMENT section of this document the integrated suit is referred to as the "suit".

3. References

The requirement specifications refer to the following documents:

- IMO Resolution A.689(17) (International Maritime Organization)
- IMO Resolution MSC 81(70) (IMO's Maritime Safety Committee)
- SOLAS: The International Convention of 1974 of Safety of Life at Sea, 3rd issue, 2001,
- LSA Code: International Life-Saving Appliance Code (SOLAS Chapter III International Life-Saving Appliance Code (LSA Code) par. 2.2 and 2.3

- EN ISO 15027-1 Immersion suits; Part 1 Constant wear suits, requirements including safety (ISO 15027-1:2002)
- EN ISO 15027-3 Immersion suits; Part 2 Abandonment suits, requirements including safety (ISO 15027-3:2002)
- EN ISO 15027-3 Immersion suits; Part 3 Test methods (ISO 15027-3:2002)
- prEN ISO 12402-8:2002 Personal flotation devices-Part 8: Accessories-Safety requirements and test methods (ISO/DIS 12402-8:2002)

- JAR-OPS Subpart F, 3.480
- JAR JTSO-2C502 (2002) (Joint Aviation Requirements Joint Technical Standard Order 2C502: Helicopter Crew and passenger integrated immersion suits) for operations to or from helidecks located in a hostile sea area

- EN 394 Lifejackets and personal buoyancy aids - Additional items (1994)
- EN 396 Lifejackets and personal buoyancy aids - Lifejackets 150 N (1994, 1998)
- EN 399 Lifejackets and personal buoyancy aids - Lifejackets 275 N (1994, 1998)

- Shell U.K. Exploration and production (1992) Personal protective equipment for helicopter passengers; Specifications and testing criteria. Shell Standard, 12/10/92
- Shell Health, Safety and Environment Committee (1996) Personal protection of helicopter passengers in the event of ditching. SIPM, The Hague, The Netherlands
- Gagge AP, Stoljwijk JA og Hardy JD (1967) Comfort and thermal sensations and associated physiological responses at various ambient temperatures. *Environmental Research* 1: 1-20
- Hancock PA (1986) Sustained attention under thermal stress. *Psychological Bulletin*, 99:263-281
- Reinertsen RE, Volla TT, Sandsund M, Eid T, Bakkevig MK (1993) Comparison of thermal responses between rest and exercise during cold water immersion. In: Life in the cold; ecological, physiological and molecular mechanism (ed. Carey et al.). Westview Press, Oxford, 1993, pp15-24.
- Færevik H, Reinertsen RE (2003) Effect of wearing aircrew protective clothing on physiological and cognitive responses under various ambient conditions. *Ergonomics*, 46 : 780-799

- Tipton MJ og Vincent MJ (1989) Protection provided against the initial responses to cold immersion by a partial coverage wet suit. *Aerospace Medical Association*, 60: 769-73
- Tipton MJ, Balmi PJ, Bramham E, Maddern TA, Elliott DH (1995) A simple emergency underwater breathing aid for helicopter escape. *Aerospace Medical Association*, 66: 206-11.

II REQUIREMENTS

Suit A: A suit used by passengers during helicopter flights. This suit is handed out at the heliport and accompanies the user during the helicopter flight out to the platform. It is kept during the offshore stay and used on the return flight to the heliport.

Suit B: A suit kept on the platform.

The following special requirements apply as a supplement or extra requirements to the requirements in NS-EN ISO 15027-1:2002 *Immersion suits; Part 1 Constant wear suits, requirements including safety (thermal protection requirements for Suit class A)* and NS-EN ISO 15027-2:2002 *Immersion suits; Part 2 Abandonment suits, requirements including safety (thermal protection requirements for Suit class A)*:

1. Design, sizes and materials

- 1.1 The suit shall either be adapted to each individual user or designed in a range of sizes that satisfies all users with anthropometrical measurements which includes from 5 % of the female users (smallest size) to 95 % of the male users (biggest size). The suit design shall take into account the difference in the body shapes of females and males (e.g. size of hands, hips and chest).
- 1.2 The design and materials used in the chosen design of the suit shall not contain any elements that can be expected to have a detrimental effect on the operation of helicopters or equipment. This applies in particular to protruding suit parts that can get caught or represent a danger during flying, emergency evacuation from helicopters or platforms or restitution. Such parts shall be properly covered, protected or fastened.
- 1.3 It shall be possible to automatically or manually ventilate air accumulated on the inside of the suit after it has been put on and which may be detrimental in connection with evacuation of the helicopter or platform, movements or floating position.
- 1.4 People suited up (when the buoyancy aid has not been activated) shall be able to evacuate the helicopter through all the relevant emergency exits or windows that can be pushed out down to the least acceptable size of 405 mm x 465 mm. Such evacuation shall be possible both in the air and under water. The above shall be verified by performing tests as stipulated in Alternative: EN ISO 15027-3, Section 3.11.7.1. On the platform all relevant types of evacuation shall be possible when wearing the suit.

- 1.5 The material in the soles of the suit shoes must provide a good grip on the surface during all conditions that are relevant to the use of the suit.
- 1.6 The material used in the sealing around the head and wrists shall be elastic and have a design that does not cause the user discomfort or inhibits the flow of blood to tissue on both sides of the seal.
- 1.7 It is desirable that the material used in elbows and knees shall have a coefficient of friction that facilitates being rescued into a raft and/or vessel.
- 1.8 When the integrated suit has been put on, whether in an inflated or not inflated state, it shall not prevent the person wearing it to help others in the water or help them get from the water and into a life raft and/or vessel.

2. Water penetration

- 2.1.1 The suit shall be designed to prevent more than 200 g of water from penetrating into it, when it has been donned properly. This shall be verified by performing tests as stipulated in Section 3.7 of EN ISO 15027-3 and IMO Resolution MSC 81 (70). This shall not however prevent a solution based on the wet-suit principle.

3. Comfort and thermal protection

- 3.1 The suit design shall not cause a reduction in the comfort so that the suit represents a safety risk. This also applies to thermal comfort during long flights with strong irradiance. The suit, together with the clothes worn underneath, shall not reduce the comfort level by more than 2 units according to the definition of “comfortable” on Gagge’s scale for subjective evaluation of thermal comfort (evaluation range: comfortable, a little uncomfortable, uncomfortable, very uncomfortable) (Gagge, 1967). The body’s core temperature (measured in the rectum) must furthermore not rise by more than 1°C in the course of the test which lasts two hours. This shall be verified by tests done in a climate chamber according to a modified test protocol based on Shell Report EP 93-1660, N 3 Comfort, pp. 13-143.
- 3.2 The suits shall provide the user with thermal protection in the water that satisfies the test requirements of EN ISO 15027-3:2002 (Suit class A integrated) with the following tightening of the requirements contained in Section 3.8.2.2: there is to be a minimum of 5 ms⁻¹ of wind and the front of the body shall be overflowed with water (<2°C) every 10 minutes during the entire test. The suit insulation shall ensure that the temperature in all parts of the body is sufficiently high to maintain the necessary physical, physiological and mental functions. The temperature in the neck and small of the back must not fall below 25°C, and the temperature of the hands and feet must not fall below 15°C during the test. The insulating layer must not prevent the necessary movement of fingers and feet.

4. Breathing system

- 4.1 The suit shall have an integrated breathing system that provides more time for underwater evacuation than what is possible when that time is limited to each individual's capacity to hold his/her breath. The breathing system must be compatible with the survival suit and must not reduce the suit's efficiency. The breathing system shall be automatically activated when submerged.
- 4.2 The breathing system shall provide sufficient air supply for 60 seconds of breathing time at a depth of ≤ 2 m and at an activity level corresponding to 40 % of maximum aerobic capacity of a person weighing 90 kg.
- 4.3 It is mandatory that all suit users undergo training in how to use the breathing system. It is a further requirement that none of the breathing systems that become used requires training beyond the standard training for breathing systems.
- 4.4 It shall be possible to activate the breathing system by one single operation using one hand.
- 4.5 The breathing system shall be checked by performing the tests mentioned below⁴.

5. Spray protection/hood

- 5.1 The suit shall have a spray hood.

6. Personal locator beacon

- 6.1 The suit is to be fitted with a pocket for a personal locator beacon, which is fitted on the suit when handed out at the heliport. The pocket shall be on the suit's chest area so that the user can get hold of and operate the personal locator beacon with both the left and right hand. The pocket design shall allow it being opened and closed with one hand. The outer measurements of the pocket shall not exceed these measurements: WxHxD127x74x41 mm. This is to ensure that a possible evacuation is not made difficult by a big beacon, and that the suit can be used together with a life jacket without any problems. The pocket shall be shaped to allow easy influx of water, and the pocket's lower edge shall have a hole to allow easy draining of any water. The pocket shall furthermore be shaped to provide safe and suitable room for the personal locator beacon, also when the suit is held in an upside down position.

7. Lifting strap

- 7.1 The suit shall be equipped with a lifting strap that meets the requirements in Section 4.15 in EN 396:1993.

⁴ **Breathing system** The test method is described by the manufacturer in cooperation with a third party with the necessary competence.

7.2 The lifting strap shall allow lifting in a foetal position or a near horizontal position. This will reduce the risk of sudden blood-pressure drop and shock in people who have been in cold water for a long time.

7.3 Regardless of whether the suit is inflated or not, it shall not impede being rescued by a rescue strap with a circumference of 180 cm.

8. Buddy line

8.1 The suit shall have a buddy line.

9. Inflation system

9.1 All parts of the suit that requires air or gas inflation to meet the efficiency requirements must satisfy the relevant requirements in prEN ISO 12402-2:2002. This includes a tube for inflating the suit by mouth, valves, gas cylinders and inflatable chambers.

10. Buoyancy and floating position

10.1 The helicopter suit and the platform suit have different requirements relating to buoyancy and righting, §§ 4.1 and 4.4

10.2 Transportation by helicopter: When the suit has been ventilated, the buoyancy of the suit and the recommended clothing worn under the suit shall not exceed 150 N. This shall be verified by performing tests as per Section 3.11.7.2 in EN ISO 15027-3.

10.3 The buoyancy of the inflated suit shall be sufficient to ensure that a person wearing the recommended clothes and suit shall have a floating position where the angle between the person's body and the horizontal plane does not exceed 60°. This shall be verified by performing tests as stipulated in prEN ISO 12402-9:2002.

10.4 The mouth freeboard is defined as the lowest part of the mouth where water can enter. The freeboard shall be a minimum of 120 mm above the water line in calm seas. The nose freeboard shall not be less than the freeboard relating to the mouth. This shall be verified by performing tests as stipulated in prEN ISO 12402-9:2002.

10.5 Transportation by helicopter (suit A): The inflated suit shall enable the user to turn from a position with the face down to a stable floating position with the face up in 5 seconds. This shall be verified by performing tests as stipulated in Section 3.11.6.3 in EN ISO 15027-3.

10.5.1 Onboard the platform (suit B): Suits kept onboard shall have sufficient buoyancy and stability to enable righting an unconscious person, who is in calm fresh water, from any position to a position where the mouth out of the water in the course of 5 seconds. This shall be verified by performing tests as stipulated in prEN ISO 12402-9:2002.

- 10.6 The suit shall protect against drowning in rough seas and wind. The suit is to give the test subjects a stable floating position lying on the back and when they are placed crosswise in relation to the waves. This shall be tested under controlled conditions in a pool with waves measuring a minimum of 80 cm².
- 10.7 The inflated suit shall place the user in a floating position, which provides support for the head and neck region and which is perceived as comfortable by all the test participants.
- 10.8 It shall be possible to correct the floating position by regulating the volume of buoyancy in the suit, when a suited person is lying in the water.

11. Maintenance

- 11.1 The suit shall be delivered by the Manufacturer with instructions for storing, cleaning and maintenance and for looking after the suit, including information on repairing tears, to ensure the suit's functioning and a good hygienic standard.
 - 11.2 Routines to maintain the hygiene of the breathing system shall be stipulated by the Manufacturer.
 - 11.3 Routines for replacing the breathing system shall accompany the system from the Manufacturer.
 - 11.4 The Manufacturer shall prepare maintenance instructions describing the necessary maintenance procedures for the personal locator beacon. The instructions shall differentiate between work done by an authorised workshop and work carried out by the Owner. The Manufacturer shall prepare a description of the maintenance procedure for the Owner.
 - 11.5 The Manufacturer shall be able to supply tools and equipment for maintenance of the personal locator beacon, as required.
 - 11.6 The maintenance instructions shall contain intervals for the maintenance of individual components in the personal locator beacon. Components with a limited life shall have an expiry date: year-month-day.
 - 11.7 The Manufacturer shall stipulate routines for maintenance of the spray protection.
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