SLOVENSKI STANDARD
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Osebna varovalna oprema - Reġevalni jopiļ i in plavalni pripomoļ ki - Navodilo za izbiro in uporabo

Personal protective equipment - Lifejackets and buoyancy aids - Guide for selection and use

Persönliche Schutzausrüstungen - Rettungswesten und Schwimmhilfen - Leitfaden für Auswahl und Gebrauch

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Equipements de protection individuelle - Gilets de sauvetage et équipement individuel d'aide a la flottaison - Guide pour choix et utilisation

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This technical report was prepared by the Technical Committee CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets", of which the Secretariat is held by DIN.

The Technical Committee decided to publish this technical report.

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SIST CR 13033:1998

Introduction

This paper provides guidelines for the choice and application of the European Standards for lifejackets and buoyancy aids related to the Council Directive 89/656 EEC.

This paper should be of value to those responsible for specifying the carriage or use of lifejackets and to those who are contemplating the purchase of such garments. The primary aim of the paper is to increase awareness of those factors which should inform a purchaser or user on the choice of a lifejacket or a buoyancy aid. There is much that can be done at the point of sale to provide information by the packing, swing tags, or labelling to bring important information to the attention of the consumer or end user. However, the most important factor in the application of PPE such as lifejackets is to ensure that they are sufficiently comfortable in wear and attractive to the user, so that they are not just purchased but are actually used.

Lifejackets and buoyancy aids are remarkably recent innovations. In spite of various well-intentioned attempts to design personal flotation gear during the 18th and 19th centuries, it was not until 1852, that Alexander Carte introduced a cork lifejacket, and the First World War before that apparatus was issued to sailors in an attempt to protect them. However the basic requirements of personal flotation devices were not properly investigated until the Second World War, and most National Standards were evolved in the 1960s and later.

To date there have been three main groups who have specified requirements for lifejackets and buoyancy aids.

The "International Maritime Organisation's Safety of Life at Sea" (IMO SOLAS) for those lifejackets to be used internationally in larger surface vessels operating in the open sea.

The "US Federal Aviation Authority", "UK Civil Aviation Authority", and other associated national bodies for those lifejackets to be carried and used in Civil aviation settings.

Various national Standards Bodies (such as AFNOR, DIN, and BSI) have produced specific national Standards which have then been applied to certain national circumstances for lifejackets and buoyancy aids required by national law or by the rules of the governing bodies of sports.

Preparations for the implementation of a single market within the EU have led to the requirement that such National Standards be superseded by European ones. This in turn led to the EU-Council Directive on Personal Protective Equipment (PPE) in December 1989. The work to produce harmonised European Standards was started in June 1989 by experts from nearly all nations of EN and EFTA, representing all the different interests from researchers, Standard Setting Bodies, test houses, manufacturers, suppliers, users, consumer-organisations and sporting associations.

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SIST CR 13033:1998
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It should be noted however, that it was not the intention that the European Standards would replace the IMO SOLAS or FAA/CAA or ISO Standards. However these European Standards achieved what is required, the specification of lifejackets and buoyancy aids which are practical, economical and effective in use.

The European Standards for lifejackets and buoyancy aids

– **The 50 N Standard** buoyancy aid is intended for use by those who are competent swimmers and who are near to bank or shore, or who have help and rescue close at hand. These garments have minimal bulk and cost, but they are of limited use in disturbed water, and cannot be expected to keep the wearer in safety for a long period of time. They do not have sufficient buoyancy to protect people who are unable to help themselves. They require active participation by the wearer.

– **The 100 N Standard lifejacket** is intended for those who may still have to wait for rescue, but are likely to do so in sheltered and calm water. Whilst these lifejackets are less bulky than other types of lifejackets, they should not be used in rough conditions, or when there is wave splash.

– **The 150 N Standard lifejacket** is intended for general offshore and rough weather use where a high standard of performance is required. It will turn an unconscious person into a safe position and requires no subsequent action by the wearer to maintain this position.

– **The 275 N Standard lifejacket** is intended primarily for offshore use, by people who are carrying significant weights (thus requiring additional buoyancy) or those who are wearing clothing which traps air and which may adversely affect the self-righting capacity of a lifejacket and its ability to ensure that the wearer is floating in the correct position with his mouth and nose clear of the surface.

These Standards set four main levels of buoyancy, but also encourage and allow intermediate steps within the defined performance criteria which may enhance the performance of a device and make it suitable for special conditions or applications.

SIST CR 13033:1998

Before purchasing a lifejacket or buoyancy aid the user shall evaluate the risks to which he or she is likely to be exposed. Trained and experienced users may consider the use of devices with less buoyancy. Examples include experienced canoeists, dinghy and wind surfing sailors, who may be able to use garments of less than 100 N buoyancy, if help or other buoyant devices is to hand.

In principle, national bodies, in particular those responsible for making recommendations, should be left to determine what is appropriate for the user's activities under their jurisdiction. The advice of these bodies should be sought by groups, clubs or authorities, to select a suitable device out of this set of Standards.

A further Standard EN 394 specifies the requirements for a number of additional items.

- **Emergency lights,**
  to the Standard EN 394, are an important location aid during the hours of darkness, when they are much more effective than retroreflective tape alone.

  Lights not necessarily to this Standard are also useful aids particularly when legislation does not demand the fitting of a compliant light.

- **Whistles**
  to the Standard for additional items are a useful location aid at all times.

- **Multi-chamber buoyancy systems**
  to EN 394, may ensure that even damaged or punctured lifejackets can still save the life of the wearer, and may thus be of value in some occupational uses. Multi-chamber construction adds considerably to the cost and complexity of a lifejacket. Nevertheless for special application or in extreme conditions combined with the risk of wear and tear, such as offshore work, coastal fishing or pilot-transfer, the responsible authorities should consider making the use of such jackets mandatory. Alternatively inherent buoyancy is unlikely to be damaged but it is extremely bulky to be worn with comfort.

- **Safety harnesses and lines,**
  to prEN 1095, currently in draft, are useful tools to reduce the risk of immersion. If they are to be used they must not compromise the performance of the lifejacket or hazard survival.

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- **Buddy-lines,**
  to EN 394 are of value if a number of survivors are likely to be in the water together but unlikely to be able to enter a life raft. Buddy–lines can however pose a snag and trip hazard.

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- **Spray hoods,**
  to EN 394 are of great value in protecting the airways, in rough water, but add significantly to the cost and complexity of the lifejacket. They should not restrict the vision and must be easy to don and to remove.

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- **Protective covers,**
  to EN 394 are suitable for preventing damage to less robust lifejacket components, such as inflatable chambers and gas inflation heads. They reduce snag hazard, but add to the cost and complexity of lifejackets.

Protective covers must be used in addition against certain risks such as chemical fluids, heat impact, molten metal splash due to welding or the risks of fire-fighting. Protective covers can be used to provide tailor-made solutions for special applications. It is essential, however, that the correct functioning of the lifejackets used in hazardous working environments is not in any way compromised by the use of such a cover. The materials out of which protective covers are made may make them less popular with certain potential wearers.

Problematic matters for consideration by legislators and purchasers

There are specific areas which remain a problem. The interaction between protective clothing, particularly immersion suits and lifejackets is likely to be difficult. Furthermore attempting to specify buoyancy protection in isolation is always likely to be a problem when integrated assemblies are used until it is possible for the entire assembly can be specified.

One of the most significant factors in making a lifejacket or buoyancy aid an effective piece of PPE is in keeping costs low and in ensuring maximum comfort during use.

Another overriding consideration is that of any occupational use, such as welding. There is no protective value in a lifejacket if it has become damaged in normal use so that it no longer functions as required. Those workers whose lifejackets may be subject to increased abrasion, molten metal splash etc. should have specified for them those items described in the additional items Standards, as well as protective covers, and possibly also multi-chamber buoyancy. Almost all workers can come into contact with some corrosive or noxious chemicals and it may be necessary to use the additional requirements of appropriate European Standards for chemical resistance. Specifying such industrial PPE can be a very elaborate process, in which no two applications are quite the same; however the additional items provided for in the Standards are designed to cover most common hazards. PPE manufacturers have to be advised on specialist industrial items when specifying such equipment.

SIST CR 13033:1998

Another fundamental decision which must influence all requirements for lifejackets and buoyancy aids is whether the item will be worn all of the time that immersion is a possibility. The aim is to ensure that no one enters the water without having donned a lifejacket or buoyancy aid. Once more, however, some element of compromise may be necessary. If a device is to be worn for prolonged periods, then it should not hinder the mobility of the wearer and certainly must not endanger his safety in other respects. Persons working in confined spaces, or where there is rigging or other material which could entrap them, should also have a cover specified as an additional item to reduce snagging hazards. They will also not be able to use inherently buoyant devices and automatically inflatable lifejackets shall be required. Considerations shall be given first to use safety harnesses or other technical means to prevent accidental immersion altogether.

Flotation devices must be simple to don and to doff. Although the Standards each include timed tests for donning, it may be necessary in certain circumstances to consider additional requirements beyond those required by the Standards; for example to ensure rapid and reliable donning in complete darkness or in confined spaces or wearing gloves or mittens. Donning is also effected by the compatibility of the lifejacket with other equipment.

The physical circumstances of intended use are also of importance in determining the specification required of a lifejacket or buoyancy aid. If inflatable lifejackets are stored or worn in temperature below 0 °C, carbon dioxide, the traditional inflation gas, may be adversely affected and result in only partial inflation. Other components such as nylon poppers may become rigid and difficult to open. The Standards are intended to provide a reasonable performance for all lifejackets and buoyancy aids from the tropics to cold temperate climates, but do not require all devices to meet the more severe cold conditions likely to be encountered in polar regions. Temperatures have a considerable influence on the performance of the inflation mechanism. This occurs not just by slowing of carbon-dioxide inflation but also by the increasing activation times of the firing heads. It is very important to specify the lowest performance temperature for firing-tests, if the lifejacket is to be exposed to temperatures much below 0 °C. Another feature of the environment of higher latitudes in winter is short day length, and all those who are at all likely to use their lifejackets during the hours of darkness should also use lights which comply with the additional items Standard.

The EU-Directive for Occupational Health and Safety requires a risk-analysis that evaluates all surrounding conditions and influences. The outcome has to be a system of management activities and at least a proposal for the choice of adequate personal protection equipment.

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It has become a popular belief that most immersion deaths result from hypothermia after some time in water, but in fact recent research has demonstrated that it is often the first few minutes which are most critical. Effective lifejackets and buoyancy aids must therefore be fully functional immediately on entry into the water.

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The most obvious factor which needs careful consideration is the mode of inflation, as it is this which determines how rapidly and effectively the lifejacket can perform. In foreseeable conditions of use in which the wearer can enter cold water suddenly, or in a disabled or unconscious condition, then the lifejacket must be of an automatically operated type. Thus once it has been donned, it requires no further action by the wearer.

Once it has brought the user to the surface, an effective lifejacket must then maintain the wearer in a safe position so that he or she can continue to breathe. The water has two main ways in which to test that ability:

- by waves and water-splash entering the air-ways and
- by waves inverting the wearer.

The wave height above which a sprayhood becomes necessary, varies according to many factors. In the first instance, higher wind speeds and steeper waves increase the likelihood, so that even waves of only 30 cm height may constantly threaten the unprotected airway.

The design of the lifejacket and the orientation of the wearer with respect to waves are also very important.

A lifejacket with a widely split front or keyholes through which the head is inserted may funnel water onto the face in certain circumstances. However, it is generally accepted that conditions in which a sprayhood is required are very seldom encountered in inland waters unless they are very large; but such conditions are relatively common in the sea. No matter how high the freeboard between mouth and waves, if the conditions are right the face may be continually splashed. This results in inhalation of water and drowning if the victim is unconscious, or if breathing is rapid and uncontrollable – as occurs on first being immersed in water below about 20 °C without good immersion protective garments. This process has the additional effect of accelerating body cooling.

SIST CR 13033:1998

The self-righting ability of lifejackets is a key in most standards. Self-righting is of importance if an unconscious or disabled person is capsized by a wave. An unconscious person with the buoyancy of a lifejacket may surface inverted following initial entry into the water if air has been trapped in their clothing. The reason for self-righting tests being included in the European Standards is thus to try to provide for this event and because experience has shown that if an otherwise well-designed lifejacket performs well in this test, it is generally good in its overall performance in water in the sense of having good stability. The Standards call for such tests to be undertaken on subjects wearing bathing costumes in order to ensure a degree of test replicability although it is recognised that self-righting is usually a much greater problem when wearing clothing.

There is a commendable recent trend towards the wearing of garments which slow the cooling of the body.

There are of two types:

- constant wear suits (prEN 1913-1);
- abandonment suits (prEN 1913-2).

All pose problems however because such garments frequently trap air within them with the result that the wearer may in reality have effective buoyancy which may negate the righting properties of the lifejacket. The net result may be an assembly of immersion suit and lifejacket which is actually stable in the inverted position.

The 275 N Standard lifejacket is intended to give reasonable assurance that righting will be achieved with any well designed immersion protective clothing.

Finally, to repeat the vital principle:

- the aim of all recommendations and rules must be to ensure that lifejackets and buoyancy aids are comfortable to wear and attractive in use.

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SIST CR 13033:1998
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