JOINT CANADA-UNITED STATES
NATIONAL STANDARD

# ANSI/CAN/UL 1191:2024

# STANDARD FOR SAFETY

## Components for Personal Flotation Devices



ANSI/UL 1191-2024

## SCC FOREWORD

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UL Standard for Safety for Components for Personal Flotation Devices, ANSI/CAN/UL 1191

Fifth Edition, Dated May 28, 2019

***Summary of Topics***

***This revision of ANSI/CAN/UL 1191 dated April 3, 2024 includes the following:***

***– Correction of Table 19.2 Webbing Closures and Adjusters***

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated September 15, 2023 and February 23, 2024.

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**ANSI/CAN/UL 1191:2024**

# Standard for Components for Personal Flotation Devices

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**Fifth Edition**

**May 28, 2019**

This ANSI/CAN/UL Safety Standard consists of the Fifth Edition including revisions through April 3, 2024.

The most recent designation of ANSI/UL 1191 as an American National Standard (ANSI) occurred on April 3, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on April 3, 2024.

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# Preface

This is the Fifth Edition of the ANSI/CAN/UL 1191, Standard for Components for Personal Flotation Devices.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 1191 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in ULSE's Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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This Edition of the Standard has been formally approved by the Technical Committee (TC) on Personal Flotation Devices, TC 1123.

This list represents the TC 1123 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

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# INTRODUCTION

## 1 Scope

1.1 These requirements cover components intended for use in the manufacturer of personal flotation devices and immersion suits. Compliance with these requirements does not indicate that the product is intended for use as a component of an end product without further investigation. The requirements shall be applied to other components if found to be appropriate.

1.2 The components addressed in this Standard are intended for use in personal flotation devices and immersion suits which comply with the requirements of Underwriters Laboratories Inc., the United States Coast Guard Subparts of Chapter I, Title 46, Code of Federal Regulations, and Transport Canada. These include:

a) USCG Subparts 160.002, 160.047, 160.048, 160.049, 160.050, 160.052, 160.053, 160.055, 160.060, 160.064, 160.076, 160.077, 160.150, 160.155, 160.171, and 160.176.

b) The requirements for:

1) Marine Buoyant Devices, UL 1123;

2) Buoyant Cushions, UL 1175;

3) Buoyant Vests, UL 1177;

4) Hybrid Personal Flotation Devices, UL 1517; and

5) Fully Inflatable Recreational Personal Flotation Devices, UL 1180.

6) Immersion Suits, UL 1197.

7) Personal Flotation Devices – Part 5: Buoyancy Aids (Level 50) – Safety Requirements, UL 12402-5.

1.3 These requirements also cover personal flotation device components intended to meet the requirements of the United States Coast Guard Subparts of Chapter I, Title 46, Code of Federal Regulations. These include USCG Subparts 164.019 and 164.023.

1.4 The components addressed in this Standard are not prohibited from being used on devices that comply with other regulations and requirements (other than those tabulated in 1.2) when the component meets the intent of the requirements of Underwriters Laboratories Inc., the United States Coast Guard, and Transport Canada.

## 2 General

### 2.1 Units of measurement

2.1.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

### 2.2 Use codes/product classifications

2.2.1 One or more use codes shall be assigned to each device component to show the classification of PFD or immersion suit for which it is intended. See Table 2.1.

**Table 2.1**
**Use codes**

| Use code | Product Classification | Description of device |
|---|---|---|
| 1 | Level 150 and 100 Lifejacket | Inherently Buoyant Adult or Child sizes |
| 1F | | Fully Inflatables |
| 2 | Level 100 Lifejacket | Recreational Buoyant Adult or Child sizes |
| 2A | | Recreational Buoyant Adult sizes only |
| 2C | | Recreational Buoyant Child sizes only |
| 2F | | Recreational Fully Inflatables |
| 3F | | Recreational Fully Inflatables |
| 3 | Level 50 and 70 Buoyancy Aid | Inherently Buoyant Adult or Child sizes |
| 3A | | Inherently Buoyant Adult sizes only |
| 3C | | Inherently Buoyant Child sizes only |
| 3F | | Inflatables |
| 4 | Throwable | Any Styles |
| 4B | | Any ring or horseshoe buoy |
| 4BC | | Buoyant Cushions |
| 4H | | Horseshoe buoys |
| 4RB | | Recreational ring buoys |
| 5 | Special Use Level 150 and 100 Lifejacket or Special Use Level 50 and 70 Buoyancy Aid | Any styles except Hybrids or work vests |
| 5H | | Hybrids |
| 5SB | | Recreational sailboard devices |
| 5R | | Any recreational style Type V; except Hybrids |
| 5WV | | Workvest |
| 6F | Special Use Inflation systems | Unique, limited or restricted categories for devices not covered in this Table. When used, the intended application for this Use Code/Product Classification shall be specifically described, such as convertible inflation systems. |
| 6I | Immersion Suit | Abandonment Suit or Constant Wear Suit |



## 2.3 Material

2.3.1 Polymeric material shall comply with the regrind requirements specified in the Standard for Polymeric Materials – Fabricated Parts, UL 746D, and is to be determined the same when it is of the same generic type, the same kind and amount of resin, filler, stabilizers or reinforcement as demonstrated by the applicable identification tests.

## 2.4 Color – sample conditioning

2.4.1 When a textile or polymeric product is furnished in a range of colors, samples of each are to be provided for evaluation. Where various colors are evaluated by representative sample(s) of a range of colors, only the representative sample(s) are required to be evaluated.

**Table 2.2**
**Sample conditioning**

| Exposure | Method |
|---|---|
| Standard Conditioning<br>SC | Except for textile products (i.e., fabric, webbing, thread, tie tape), the applicable number of samples specified in each section are to be conditioned at 23 ±2°C (73 ±4°F) and 50 ±5 percent relative humidity for not less than 24 h prior to the tests. For textile products, the samples are to be conditioned at 21 ±2°C (70 ±4°F) and 65 ±5 percent relative humidity for not less than 24 h. A different temperature and relative humidity that provides equivalent conditioning is not prohibited from being used. |
| Natural Accelerated Weathering<br>$Nt_{75}$<br>$Nt_{138}$ | Where $Nt_{75}$ or $Nt_{138}$ exposure is specified, samples are to be exposed to natural weathering of 75 or 138 MJ/$m^2$ of UV radiation below 385 nm, respectively in South Florida (approximately 3 or 6 months) beginning between May 21 and July 21. Unless otherwise specified specimens are to be mounted with the face side (the side normally exposed to sunlight in service) toward the light, open backing, 45° angle, facing south. Condition samples to Standard Conditioning after exposure. |
| Xenon Accelerated Weathering<br>$Xe_{500}$<br>$Xe_{750}$<br>$Xe_{1380}$ | Unless otherwise specified, specimens are to be mounted with the face side (the side normally exposed to sunlight in service) toward the light so that the exposed area of each specimen is perpendicular to the light source rays. Condition samples to Standard Conditions after exposure. Where $Xe_{500}$ or $Xe_{750}$ or $Xe_{1380}$ exposure is specified, samples are to be exposed to 500 or 750 or 1380 KJ/ ($m^2$ · nm)[a,b,c]@ 340 nm of Xenon accelerated weathering conditions, respectively in accordance with the following specifications:<br>Irradiance: 0.55 W/$m^2$ at 340 nm<br>Filters: Daylight filters per ISO 4892-2 (if published, or substitute applicable ASTM)<br>Black Panel Temp.: 63 ±2°C (145 ±4°F)<br>Dry Bulb Temp.: 42 ±2°C (108 ±4°F)<br>Relative Humidity (light only): 50%<br>Initial Water Temp.[d]: 20 ±5°C (68 ±10°F)<br>Test Cycle: 102 min of light / 18 min of light and water spray / 24 min dark and water spray |

[a] 500 KJ/ ($m^2$ · nm) is approximately [0.55 W/($m^2$ · nm)] · [3600 sec/hr · KJ/ 1000J] · [300 hr machine cycling · 83.3 percent light cycle]. Equivalent to 100 h of sunshine carbon arc accelerated weathering.

[b] 750 KJ/ ($m^2$ · nm) is approximately [0.55 W/($m^2$ · nm)] · [3600 sec/hr · KJ/ 1000J] · [450 hr machine cycling · 83.3 percent light cycle]. Equivalent to 300 h of sunshine carbon arc accelerated weathering.

[c] 1380 KJ/ ($m^2$ · nm) is approximately [0.55 W/($m^2$ · nm)] · [3600 sec/hr · KJ/ 1000J] · [835 hr machine cycling · 83.3 percent light cycle].

[d] Temperature of source water measured at inlet of test chamber.

## 2.5 Color – conspicuity

2.5.1 The color of the exposed portions of outer materials used on lifejackets, immersion suits, and their inflatable compartment materials, if applicable, (excluding components such as webbing, zips and other fittings) shall be in the color range from yellow to red; the chromaticity coordinates for non-fluorescent colors shall lie within one of the areas defined in Table 2.3 and the luminance factor shall exceed the corresponding minimum in Table 2.3. The chromaticity coordinates and the minimum luminance factor for fluorescent colors shall comply with Table 2.4.

**Table 2.3**
**Chromaticity coordinates *x* and *y* and luminance factor *β* for yellow, orange and red non-fluorescent colors of lifejacket and immersion suit material**

| Color | Chromaticity coordinates | | Luminance factor |
|---|---|---|---|
| | *x* | *y* | *β* |
| Yellow | 0.389 | 0.610 | > 0.35 |
| | 0.320 | 0.490 | |
| | 0.405 | 0.400 | |
| | 0.500 | 0.500 | |
| Orange | 0.500 | 0.500 | > 0.25 |
| | 0.405 | 0.400 | |
| | 0.470 | 0.330 | |
| | 0.600 | 0.400 | |
| Red | 0.600 | 0.400 | > 0.15 |
| | 0.470 | 0.330 | |
| | 0.525 | 0.270 | |
| | 0.700 | 0.300 | |

**Table 2.4**
**Chromaticity coordinates *x* and *y* and luminance factor *β* for yellow, yellow-orange, orange and orange-red fluorescent colors of lifejacket and immersion suit material**

| Color | Chromaticity coordinates | | Luminance factor |
|---|---|---|---|
| | *x* | *y* | *β* |
| Fluorescent yellow | 0.380 | 0.610 | > 0.60 |
| | 0.320 | 0.490 | |
| | 0.370 | 0.440 | |
| | 0.440 | 0.550 | |
| Fluorescent yellow-orange | 0.440 | 0.550 | > 0.50 |
| | 0.370 | 0.440 | |
| | 0.420 | 0.390 | |
| | 0.505 | 0.490 | |
| Fluorescent orange | 0.505 | 0.490 | > 0.40 |
| | 0.420 | 0.390 | |
| | 0.460 | 0.350 | |
| | 0.575 | 0.425 | |
| Fluorescent orange–red | 0.575 | 0.425 | > 0.30 |
| | 0.460 | 0.350 | |
| | 0.488 | 0.320 | |
| | 0.630 | 0.360 | |
| Fluorescent red | 0.630 | 0.360 | > 0.20 |
| | 0.488 | 0.320 | |
| | 0.525 | 0.280 | |
| | 0.695 | 0.300 | |

2.5.2 The color of the material samples shall be measured with the procedures defined in CIE publication No. 15.2 with polychromatic illumination D65, 45/0 geometry and 2° standard observer. The specimen shall have a black underlay with reflectance of less than 0.,04. The specimens shall be conditioned for at least 24 h at (20 ±2)°C and (65 ±5)% relative humidity. If the CIE procedures are carried out in other than standard conditions described above, the test shall be conducted within 5 min after withdrawal from the conditioning atmosphere.

## 3 Definitions

3.1 For the purpose of this standard, the following definitions apply.

3.2 COURSE – In knitted fabrics, the series of successive loops lying crosswise in the fabric, that is, lying at right angles to a line passing through the open throat to the closed end of the loops.

3.2.1 CRACK PRESSURE – Pressure at which the over pressure relief valves opens within an oral inflator.

3.3 CYLINDER SEAL INDICATOR – A visual display on an inflation system which provides information regarding the status of the seal on an installed cylinder.

3.4 DESIGN INFLATION RANGE – The range of buoyancy and pressure, as specified by the manufacturer, to which a compartment is capable of being inflated to provide the intended in-water performance.

3.5 FILLING (also referred to as Weft) – In woven fabrics, yarn running from selvage to selvage at right angles to the warp (for knitted fabric see Wale).

3.6 FILL RATIO – For inflation medium containers, the weight of the gas charge (in grams) divided by the volume of the inflation medium container (in milliliters).

3.7 FULL INFLATION – A chamber or chambers inflated to any value within the design inflation range.

3.8 INFLATABLE COMPARTMENT – A container that is inflated by a gas or other medium through an automatic, manual-auto, manual, or oral inflation system.

3.9 INFLATION SYSTEM – A means of inflating one or more compartments to make the device buoyant or more buoyant on demand, either actively or passively of the wearer's action, based on its type as follows:

a) AUTOMATIC INFLATION SYSTEM – A system that activates to inflate one or more compartments upon immersion in water without any action by the user (a passive system), and which has no provision for manually actuated inflation.

b) MANUAL-AUTO INFLATION SYSTEM – A system that activates to inflate one or more compartments upon immersion in water without any action by the user (a passive system), and which also has provision for being activated by a single deliberate user action, such as by the pulling of a lanyard.

c) MANUAL INFLATION SYSTEM – A system that inflates one or more compartments when activated by a single deliberate user action, such as by the pulling of a lanyard, and which has no provision for automatically actuated inflation.

d) ORAL INFLATION SYSTEM – A means for a user to blow air into a compartment by mouth.

e) MULTI-USE INFLATION SYSTEM – Either an automatic inflation system or manual-auto inflation system designed so that the inflation system can be used multiple times by means of rearming.

f) ONE-TIME USE INFLATION SYSTEM – Either an automatic inflation system or manual-auto inflation system, however designed so that the inflation system can be used only one time and must be completely replaced during rearming.

3.10 INITIAL JAW SEPARATION – The distance between the bottom of the top clamp and the top of the bottom clamp of a tensile test machine prior to testing.

3.11 LOT NUMBER – A marking assigned to each group of materials or component produced which incorporates a means of identifying the year and quarter of manufacture (unless provided elsewhere), and provides a means of identifying the production of a particular factory, when a manufacturer produces at more than one factory.

3.11.1 LOW-VOLTAGE LIMITED ENERGY – A control circuit involving a peak open-circuit potential of not more than 24 volts (dc or peak) supplied by a primary battery or by an isolated secondary circuit, and where the current capacity is limited such that the allowable energy is not more than 100VA.

3.12 MULTI-POINT STATUS INDICATOR – A status indicator which utilizes two or more independent visual display points to communicate inflation system readiness.

3.13 SELVAGE – The uncut edge portion of a fabric.

3.14 SERVICEABILITY – The ease with which the inflation system mechanism is properly rearmed. Use Code 1F inflation systems have the most stringent serviceability requirements, with Use Code 2F and 3F systems having correspondingly less stringent requirements.

3.15 SERVICEABLE – Capable of continued use (i.e. exhibits no signs of functional deterioration, deformation of hardware, indicators not functional, oral inflation tube blocked or detached, and manual inflator trigger detached).

3.16 SINGLE-POINT STATUS INDICATOR – A status indicator which combines all system checks into a single visual display point to communicate inflation system readiness.

3.17 STATUS INDICATOR – The part or parts of an inflation system which provide user feedback to assist in keeping an inflatable PFD in an armed and ready condition. Use Code 1F inflation systems have the most stringent status indicator user recognition requirements, with Use Code 2F and 3F systems having correspondingly less stringent requirements.

3.18 WALE – In knitted fabrics, a column of loops in successive courses. The column is parallel to the loop axes.

3.19 WARP – In a woven fabric, the yarn running lengthwise, parallel to the selvage (for knitted fabrics see Course).

**THREAD**

## 4 Construction

4.1 Thread shall not contain cotton or be monofilament.

## 5 Performance

5.1 Thread shall comply with the requirements specified in Table 5.1 and United States Coast Guard Subpart 164.023 of Chapter 1, Title 46, Code of Federal Regulations – Thread for Personal Flotation Devices.

**Table 5.1**
**Thread**

| Tests | Exposure[a] | Test methods | Number of samples[b] | Sample size[c] inch (mm) | Use Codes[d] | Compliance criteria pounds-force (N) |
|---|---|---|---|---|---|---|
| Single Strand Breaking Strength | **1.** SC<br>**2a.** $Xe_{500}$<br>**2b.** $Xe_{750}$ or $Nt_{750}$ | ASTM D204-93 | 5 for each separate exposure | 36 (914) | 1, 1F, 2, 2F, 3, 3F, 4, 4BC, 4RB, 5, 5H, 5SB, 5R and 5WV | **Exposure 1**<br>Average ≥ 5.7 (25) |
| | | | | | 4B and 4H | **Exposure 1**<br>Average ≥ 36 (160) |
| | | | | | 4B and 4H | **Exposure 2a**<br>Average ≥ 22 (96)<br>or<br>**Exposure 2b**<br>Average ≥ 14 (64) |
| | | | | | 1, 1F, 2, 2F, 3, 3F, 4, 4BC, 4RB, 5, 5H, 5SB, 5R and 5WV | **Exposure 2a or 2b**<br>Average ≥ 5.1 (23) |

[a] See Table 2.2 for conditioning details.

[b] Colors - lightest and darkest.

[c] *Deleted*

[d] See Table 2.1 for an explanation of Use Code designations.

5.2 For the loop breaking strength test, the test machine described in the Standard Test Methods for Sewing Threads, ASTM D204 is to be used. Both ends of one piece are to be secured in one clamp of the testing machine so that the length of the loop equals one-half the total length between the jaws. One end of the second piece is to be passed through the loop formed by the first, and both ends of the second piece are to be secured in the other clamp of the machine. The clamps are to be separated at a rate of 12 ±0.5 inches per min (305 ±12.7 mm per min).

## 6 Marking

6.1 Each spool of thread and each shipping label shall be permanently and clearly marked with the following information in a color which contrasts with the color of the surface on which the marking is to be applied:

a) The manufacturer's name, tradename, or symbol;

b) The style (model) number of the thread;

c) The size of the thread, unless a unique style (model) number is provided for each size;

d) The lot number of the thread; and

e) Use Code(s).

## FABRIC

### 7 Construction

7.1 Fabric used as drainage material in a structural application (for example, when removed, the device does not function as intended) shall comply with all of the applicable fabric requirements for the specific PFD for which it is intended.

### 8 Performance

#### 8.1 General

8.1.1 Fabric shall comply with the acceptance criteria specified in Table 8.1 when subjected to the tests in this Section.

8.1.2 Separate samples are to be used for each different conditioning exposure.

#### 8.2 Yarn slippage – woven fabric only

8.2.1 The warp samples specified in Table 8.1 are to be cut with the long dimension parallel to the warp yarns and filling samples are to be cut with the long dimension parallel to the filling yarns. No two warp samples are to contain the same warp yarns and no two filling samples are to contain the same filling yarns. No sample is to include selvage.

8.2.2 The narrow end of the sample is to be inserted approximately 1/4 inch (6.35 mm) into the nine-hole chuck illustrated in Figure 8.1 and centered. A nine-needle bit is to be aligned with the holes in the chuck so that the smooth side of the needles faces the 1/4 inch (6.35 mm) edge of the sample. The needles are to be forced through the fabric past the scarf joint so that the fabric lays against the blade of the needles.

8.2.3 The tensile machine is to be a Constant-Rate-of-Traverse (CRT) or Constant-Rate-of-Extension (CRE). The tensile machine is to be equipped with clamps having front jaws 1 x 1 inches (25.4 mm x 25.4 mm) and back jaws 1 x 1.5 inches (25.4 mm x 38.1 mm) or wider. The nine-hole chuck is to be centered and clamped in the upper jaws of the machine so the sample hangs lengthwise. The holes in the chuck are be perpendicular to the direction of pull. The fabric is to be clamped to the lower jaws of the machine. Separation between the holes in the chuck and the top of the jaws is to be 2.5 inches (63.5 mm). The yarns are to be parallel to the direction of pull. The jaws are then to be separated at a rate of 12 ±0.5 inches (305 ±12.7 mm) per min. The maximum force required to cause rupture is to be recorded.

#### 8.3 Openness of weave

8.3.1 The openness of weave, see Table 8.1, is to be determined using a full width sample at least 1 yard (0.9 m) long. Five separate measurements are to be taken across the width of the roll. For each measurement a 1 inch square (645 $mm^2$) is to be marked on the fabric. No measurement is to be within 1 inch (25.4 mm) of the selvage edge.

8.3.2 In the area of the marked fabric material, the size of each opening is to be measured using an optical comparator with a magnification sufficient to determine the size of each opening (i.e. 5X). Openings on the edge of a 1 inch square are to be counted as one whole opening only when more than 1/2 of the opening is inside the marked square. The openness of the weave is to be calculated as follows:

$$O_W = 100 \sum_{i=1}^{N} \frac{T_A}{N \times 1\ inch^2}$$