CAPP
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EXHIBIT/P-00054

Index

Topic 1: HUEBA

Documents

1.1 February 25, 2000 C-NLOPB letter
1.2 May 15, 2000 CAPP letter
1.3 June 19, 2001 CAPP letter + attached five page Research Summary
1.4 February 12, 2003 C-NLOPB letter
1.5 March 20, 2003 CAPP letter + attached 17 page EBS Discussion Paper
1.6 April 8, 2003 C-NLOPB letter
1.7 Helicopter EBS Risk Assessment 2005
1.8 Helicopter Underwater Escape Breathing Systems Workshop Summary Report; March 1, 2006
1.9 March 13, 2007 C-NLOPB letter
1.10 May 22, 2007 CAPP letter
1.11 February 02, 2009 CAPP HUEBA Task Force Meeting Notes
1.12 May 2009 HUEBA Implementation Plan

Topic 2: Survival Suits

Documents

2.1 CAN/CGSB – 65.16 – 2005 Immersion Suit Systems
2.2 CAN/CGSB-65.17-99 Helicopter Passenger Transportation Suit Systems
2.3 February 24, 2009 CGSB letter
2.4 March 20, 2009 C-NLOPB letter
2.5 May 21, 2009 CAPP letter
2.6 May 28, 2009 CGSB letter to CAPP; May 26, 2009 letter + attached Project Agreement
2.7 August 2009 CAPP comments to CGSB

Topic 3: BST/BST-R Course Quality Review

Documents

3.1 Standard Practice for the Training and Qualifications of Personnel
3.2 Summary of Survey Results
3.3 July 16, 2009 CAPP letter + BST and BST-R Course Reviews at the Marine Institute (MI); report revised to October 2009
3.4 July 16, 2009 CAPP letter + BST and BST-R Course Reviews at Survival Systems report

Topic 4: Escape, Evacuation and Rescue Guide (EER)

Document

4.1 August 28, 2009 CAPP letter + final draft EER Guide

Topic 5: U.K. Helicopter Task Group

Document

5.1 Emergency Response – Lessons Learned

Topic 2: Survival Suits

2.1

Government of Canada | Gouvernement du Canada
Canadian General Standards Board | Office des normes générales du Canada

CAN/CGSB-65.16-2005

Supersedes CAN/CGSB-65.16-99

(Final version)

Immersion Suit Systems

ICS 13.340.10

National Standard of Canada

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Experience and excellence
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NATIONAL STANDARD OF CANADA

CAN/CGSB-65.16-2005

Supersedes CAN/CGSB-65.16-99

IMMERSION SUIT SYSTEMS

Prepared by the
Canadian General Standards Board CGSB

Approved by the
Standards Council of Canada

Published November 2005 by the
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Acknowledgment is made for the translation of this National Standard of Canada by the Translation Bureau of Public Works and Government Services Canada.

FOREWORD

This standard has been incorporated by reference in the *Life Saving Equipment Regulations* made pursuant to the *Canada Shipping Act*. Where there are differences between the requirements of the *Life Saving Equipment Regulations* and this standard, the *Life Saving Equipment Regulations* shall prevail.

For approval requirements, the reader must refer to the approval authority, Transport Canada, Marine Safety.

CAN/CGSB-65.16-2005

Supersedes CAN/CGSB-65.16-99

CANADIAN GENERAL STANDARDS BOARD

IMMERSION SUIT SYSTEMS

1. SCOPE

1.1 This standard applies to immersion suit systems for marine abandonment and constant wear. This standard applies to suit systems that reduce thermal shock upon entry into cold water; delay the onset of hypothermia during immersion in cold water; provide acceptable flotation and minimize the risk of drowning; do not impair the wearer's ability to perform fundamental survival actions; and, in the case of constant wear immersion suits, do not impair the wearer's ability to perform normal working duties.

1.2 The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

2. REFERENCED PUBLICATIONS

2.1 The following publications are referenced in this standard:

2.1.1 Canadian General Standards Board (CGSB)

3-GP-11d (2002) — Naval Distillate Fuel

3-GP-691c (1995) — General Purpose Grease

CAN/CGSB-4.2 — Textile Test Methods:

No. 9.2-M90 — Breaking Strength of Fabrics — Grab Method — Constant time-to-break Principle

No. 26.1-M88 — Water Resistance — Static Head Penetration Test

No. 32.2-M89 — Breaking Strength of Seams in Woven Fabrics.

CAN/CGSB-54.1-M90, Part 1/ISO 4915:1981 — Stitches and Seams — Part I: Textiles — Stitch Types — Classification and Terminology

CAN/CGSB-65.18-M86 — Closed-Cell Foamed Polymeric Materials

CAN/CGSB-65.19-2004 — Textile Components of Life Jackets and Personal Flotation Devices.

2.1.2 ASTM International

B 21/B 21M-01e1 — Standard Specification for Naval Brass Rod, Bar, and Shapes

B 117-03 — Standard Practice for Operating Salt Spray (Fog) Apparatus

C 177-04 — Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate-Apparatus

C 518-04 — Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

D 2062-87(1997) e1 — Standard Test Methods for Operability of Zippers

D 3886-99 — Standard Test Method for Abrasion Resistance of Textile Fabrics (Inflated Diaphragm Method).

2.1.3 European Committee for Standards (CEN)

EN 1095:1998 — Deck safety harness and safety line for use on recreational craft — Safety requirements and test methods.

2.1.4 International Maritime Organization (IMO)

Resolution A.658(16) — Use and fitting of retroreflective materials on life-saving appliances

Resolution A.760(18) — Symbols related to life-saving appliances and arrangements

Resolution MSC.48(66) — International Life-Saving Appliances Code, 2003

Resolution MSC.81(70) — Testing and Evaluation of Life-Saving Appliances.

2.1.5 Underwriters Laboratories Inc. (UL)

UL 1123-1996 — Marine Buoyant Devices

UL 1180-2004 — Fully Inflatable Recreational Personal Flotation Devices

UL 1191-1997 — Components for Personal Flotation Devices

UL 1197-1996 — Immersion Suits.

2.2 A dated reference in this standard is to the issue specified. An undated reference in this standard is to the latest issue, unless otherwise specified by the authority applying this standard. The sources are given in the Notes section.

3. DEFINITIONS

3.1 The following definitions apply in this standard:

Abandonment Suit (Combinaison en cas de naufrage)

An immersion suit, designed to permit rapid donning in the event of an imminent unintended immersion in water.

Auxiliary Buoyancy Element (Élément de flottaison auxiliaire)

A source of buoyancy additional to the suit system's inherent buoyancy.

Buddy Line (Corde d'assurance)

A length of cord which can be tied or otherwise fixed to another person's suit, or lifejacket, or to a life raft or other objects, so as to keep the wearer in the vicinity of that person or object with a view of making location and thus rescue easier.

Clo Value (Valeur clo)

An index of clothing insulation. One clo equals $0.155°C \cdot m^2 \cdot W^{-1}$.

Constant Wear Suit (Combinaison de bord)

An immersion suit, designed to be routinely worn for activities on or near water in anticipation of accidental immersion in water, but permitting physical activity by the wearer to such an extent that actions may be undertaken without undue encumbrance.

Design Buoyancy (Flottabilité nominale)

The actual buoyancy of the device, including compression loss factors and manufacturing tolerance allowance.

Exterior Fabric (Tissu extérieur)

The outer fabric of the suit system, either in the form of a single or composite fabric.

Face–Plane Angle (Angle du plan facial)

The angle relative to the surface of the water, of the plane formed by the most forward part of the forehead and the chin.

Freeboard (Franc bord d'émersion)

The perpendicular distances from the surface of the water to the corner of the mouth.

Immersed Clo Value (Clo en état d'immersion)

The insulation measurement taken when a suit system is subjected to the effect of hydrostatic compression.

Inflatable Buoyancy Element (Élément de flottaison gonflable)

An auxiliary buoyancy element that requires gas inflation as a means of buoyancy.

Minimum Buoyancy (Flottabilité minimum)

The minimum amount of buoyancy that must be provided by inherently buoyant materials.

Primary Suit System Closures (Principaux dispositifs de fermeture de la combinaison)

Any closures utilized in the donning of the suit system for normal work purposes.

Retroreflective Material (Matériau rétroréfléchissant)

A material that reflects light beams back to their point of origin.

Secondary Suit System Closures (Dispositifs complémentaires de fermeture de la combinaison)

Additional closures that may be operated by the wearer in the water.

Sprayhood (Dispositif anti-éclaboussures)

A cover brought or placed in front of the face of the wearer in order to reduce or eliminate the splashing of water onto the airways, and thereby promoting the survival of the wearer in rough water conditions.

Structural Seam (Couture structurale)

A seam that the structural integrity of the suit system relies upon.

Total Buoyancy (Flottabilité totale)

The total buoyancy available to the wearer from all elements of the suit system, excluding accidentally entrapped air. This includes the minimum inherent buoyancy and the auxiliary buoyancy.

V-factor (Facteur V)

An expression of the buoyancy retention of polymeric materials intended for use in suit systems, life jackets and personal flotation devices.

4. CLASSIFICATION

4.1 The immersion suit systems shall be supplied in the following categories and sizes:

4.1.1 *Categories*

Category 1 — Marine Abandonment

Category 2 — Constant Wear

4.1.2 *Sizes*

4.1.2.1 *Marine Abandonment* — Marine Abandonment Immersion Suit Systems shall be supplied in adult and child sizes as listed in the body heights and mass ranges, as specified in Table 1.

TABLE 1

Marine Abandonment Immersion Suit Sizes

Size	Body Height cm	Body Mass kg
Adult:		
Small	120 to 170	40 to 100
Universal	150 to 200	50 to 150
Jumbo	170 to 220	100 to 150 or greater
Custom	Any height	Any mass
Child	100 to 150	18 to 40

4.1.2.2 *Constant Wear* — Constant Wear Immersion Suit Systems shall be supplied in multiple adult and child sizes covering the body mass ranges, as specified in Table 2.

TABLE 2

Constant Wear Immersion Suit Sizes

Size	Body Mass kg
Adult	Over 40
Child	18 to 40

4.1.2.3 *Sizes* — There are important distinctions between "Universal" sized suits and suits that have a specific size range (Small, Jumbo, Custom and Child Marine Abandonment Suits and all Constant Wear Suits. "Universal" suits are for general and unspecified users and are designed with a "One size fits most" approach. Such suits are suitable for uncontrolled distribution in emergency situations. Suits with a reduced size range are designated for a specific segment of the population and are required to be clearly identified to prevent inadvertent selection in emergency situations. The marking section (par. 8.5) of this standard incorporates requirements that reflect the distinction between "Universal" size suits and suits that have a specific size range.

5. GENERAL REQUIREMENTS

5.1 As suit systems will be used by uninitiated persons, often in adverse conditions, it is essential that risk of incorrect donning be minimized. Ties and fastenings necessary for proper performance should be few and simple. Marine Abandonment Immersion Suit Systems should readily fit various sizes of adults and children, both lightly and heavily clad.

5.2 The suit system may be composed of one or more pieces, provided that in all cases it meets the requirements of this standard as a complete system. The suit system shall be constructed so that it is suitable for use in a working industrial environment when properly worn and secured.

5.3 **Hand and Arm Construction** — Gloves or mittens may be either integral with the suit system or removable and attached to the suit system. In either case, the wearer shall retain sufficient dexterity to pass the dexterity tests, and the wearer's escape or survival ability shall not be hindered or reduced. If the hand can be exposed, the watertight integrity of the suit system (dry suit system only) shall be maintained. (Test procedures: par. 6.11, 6.12 and 6.14.)

5.4 **Leg Construction** — Each suit system leg shall be fitted with a foot in which there is a hard sole or enough room for a work shoe to be worn inside. The sole shall prevent the wearer from slipping. (Test procedure: par. 6.15.)

5.5 **Closures and Seals** — Each closure, seal and zipper shall be durable and constructed to be donned with ease and secured while fulfilling all other requirements specified in this standard. If the suit system (dry suit system only) contains elements that may be detached by the wearer, the general water integrity of the suit system shall be maintained when any such element is detached. All seals (i.e. face, neck, wrist and foot) shall be comfortable. (Test procedures: par. 6.8, 6.9 and 6.10.)

5.6 **Sprayhood** — The fitting of a sprayhood is optional but if fitted must comply with par. 6.21.

5.7 **Workmanship** — The suit system shall be free from defects in workmanship and materials that might affect its strength, serviceability, or appearance.

5.8 **Operational Temperature** — The suit system shall operate throughout the seawater temperature range of -1 to +30°C. The suit system shall withstand stowage throughout an air temperature range of -30 to +65°C. (Test procedures: par. 6.2, 6.9 and 6.22.)

5.9 **Materials** — The suit system shall be rot-proof, corrosion-resistant, and shall not be unduly affected by seawater, oil or fungal attack. The exterior fabric shall be resistant to puncture, tearing and abrasion. The suit system shall be capable of being readily cleaned. The suit system, where exposed to sunlight, shall be resistant to deterioration. (Test procedure: par. 6.3.)

5.10 **Colour** — To assist detection, the exterior fabric of the suit system shall be a red, orange, or yellow colour.

5.11 **Buoyancy** — The suit system shall provide buoyancy for flotation. (Test procedures: par. 6.4 and 6.5.)

5.12 **Donning Time** — The suit system shall be unpacked and donned without assistance within 2 min. (Test procedures: par. 6.8 and 6.9.)

5.13 **Flame Resistance** — The performance of the suit system shall not be affected after being enveloped in a fire for a period of 2 s. (Test procedure: par. 6.6.)

5.14 **Radio Pocket** — A pocket shall be attached to the front of the suit system that can house a portable radio. It shall be easily accessible and securable by either hand to stow or withdraw the radio.

5.15 **Field of Vision** — The suit system, when worn in or out of the water, shall have minimal affect on the wearer's visual fields. (Test procedure: par. 6.18.)

5.16 **Free Ends** — Drawstrings, hook and pile fasteners, belts, buckles, or other primary or secondary closure devices used on the suit system shall be designed to minimize the risk of snagging. (Test procedure: par. 6.23.)

5.17 **Personal Locator Light** — Each suit system shall be fitted with a personal locator light meeting the requirements of the IMO Resolution MSC.81(70). The light location shall be above the water level when the wearer is in the water.

5.18 **Personal Whistle** — Each suit system shall be fitted with a whistle firmly secured by a cord. It shall be easily accessible by either hand when the suit system is worn on land or in the water.

5.19 **Storage** — Each Marine Abandonment Immersion Suit System shall be supplied with a storage container that provides protection for the suit system. Constant Wear Immersion Suit Systems do not require a storage container.

5.20 **Repairs** — In case of damage that might affect the buoyancy or thermal properties of the suit system, repairs shall

a. be performed by the manufacturer of the suit system or any repair facility authorized by the manufacturer; and
b. meet the construction and performance requirements of this standard.

6. DETAILED REQUIREMENTS

6.1 Construction Detail

6.1.1 *Body Strength* — When a force of not less than 1350 N is applied to the part of the suit system that secures it to the body of the wearer, the suit system shall not be damaged, tear or break, or its performance degraded as a result.

6.1.1.1 *Body Strength Test* — The body strength of the suit system shall be tested under the following conditions and procedures:

6.1.1.1.1 Body Strength Test Equipment — The test apparatus shown in Figure 1 shall be used in this test. It consists of

a. two rigid cylinders, each 125 mm in diameter, with an eye or ring at each end;
b. a mass of 138 kg; and
c. ropes or cables of sufficient length to allow the suit system to be suspended.

6.1.1.1.2. Body Strength Test Procedure — Cut the suit system at the waist and wrists or cut holes into it as necessary to accommodate the test apparatus. Immerse the suit system in water for at least 2 min. Next, remove the suit system from the water and immediately arrange it on the test apparatus, using each closure as it would be used by a person wearing the suit system. Apply the 1350 N load for 5 min.

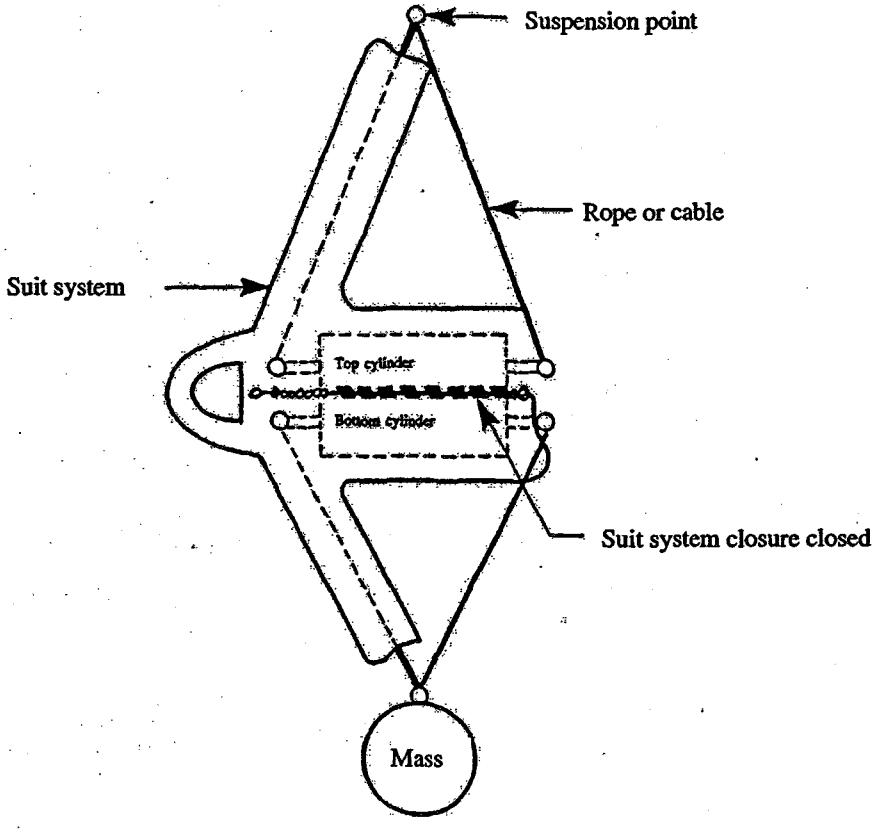

FIGURE 1
Body Strength Apparatus

6.1.2 *Fittings* — The size and design of additional fittings and their attachment to the suit system shall allow for ease of use of the fittings. The fittings shall be attached in such a way that they are visually and physically accessible and operable. They shall not attain a position that either degrades the function of the fittings or reduces the wearer's ability to escape or survive.

6.1.3 *Attachment Strength of Closure Systems* — Where the design of the closure involves the attachment of parts or components (e.g. straps, cords, etc.), it shall have a strength of 222 N.

6.1.3.1 *Attachment Strength of Closure Systems Test* — Apply a static load of 222 N to the closure system attachment parts or components for 1 min. There shall be no evidence of damage or failure upon visual examination subsequent to this test.

6.1.4 *Seams*

6.1.4.1 *Seam Slippage* — All structural seams shall be stitched with 7 to 10 lock stitches per 25 mm, stitch type 301 for fabric materials or stitch type 101 for neoprene materials (see CAN/CGSB-54.1-M90, Part 1/ISO 4915:1981). Other construction methods may be used if they can be demonstrated to meet the seam strength requirements outlined in this standard.

6.1.4.2 *Strength of Seams* — The minimum strength of seams shall be 360 N for exterior seams and 285 N for lining seams when tested in accordance with CAN/CGSB-4.2 No. 32.2-M89. Seams shall be deliberately positioned to assist in developing the full strength of the exterior shell. Seams shall be of a type that does not expose any raw edges.

6.1.4.2.1 Strength of Seams Test — Obtain ten samples, each 100 mm wide and at least 150 mm long, with the seam to be tested at right angles to the length and approximately equidistant from the ends of the sample. Five samples shall have the seams on the warp, and five samples shall have the seams on the weft. Immerse each sample in water at 20 ± 3°C to which not more than 0.5 g/L of a neutral wetting agent has been added. Test each sample in accordance with CAN/CGSB-4.2 No. 32.2-M89.

6.1.5 ***Ankle, Wrist and Other Strap Attachment Strength*** — The attachment strength of ankle and wrist straps shall not be less that 222 N.

6.1.5.1 *Attachment Strength Test* — Prepare 10 samples of the strap and fabric combination. Five samples shall have the strap secured to the fabric parallel to the fabric warp yarns and five samples, parallel to the weft yarns. The intended securing means (e.g. Box X stitch) shall be used. The samples shall be clamped between the jaws of a tensile testing machine with the strap in the direction of jaw travel. The jaws are to be separated at a rate of 300 mm/min.

6.2 **Temperature Cycling** — The suit system shall show no signs of damage such as shrinking, cracking, swelling, dissolution, or change of mechanical qualities when donned and secured subsequent to the Temperature Cycling Test (par. 6.2.1).

6.2.1 ***Temperature Cycling Test*** — Expose each suit system alternately to temperatures of -30 and 65°C. Hang the suit system and repeat the following procedure for a total of five cycles:

a. Expose the suit system at 65°C for 8 h.
b. Remove the suit system from the warm chamber and expose it for a period of not less than 8 h at room temperature.
c. Expose the suit system at -30°C for 8 h.
d. Remove the suit system from the cold chamber and expose it for a period of not less than 8 h at room temperature.

6.3 **Materials**

6.3.1 ***Oil Resistance*** — After contact with oil or grease, the suit system shall show no signs of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities. The seams shall have a breaking strength of not less than 150 N.

6.3.1.1 *Oil Resistance Test* — At least two samples of each type of exterior fabric and each seam type are required for this test. Immerse or coat at least two samples of each type of exterior fabric and seam-type combination and allow them to stand for a period of not less than 6 h in

a. marine diesel oil, in accordance with CGSB standard 3-GP-11d (2002) (soak);
b. cod liver oil (soak); and

c. multipurpose bearing grease, in accordance with CGSB standard 3-GP-691c (1995) (coat).

Note: Each fabric and seam-type sample is only exposed to one contaminant.

6.3.1.1.1 Upon completion of the 6 h period, wipe off each sample and test one sample of each type of fabric and seam as described in CAN/CGSB-4.2 No. 9.2-M90 (fabrics) and No. 32.2-M89 (seams).

6.3.1.1.2 Test one sample of each type of exterior fabric and seam-type combination in accordance with CAN/CGSB-4.2 No. 26.1-M88, under a 1 m head of water for a period of not less than 1 h.

6.3.2 ***Corrosion Resistance of Metal Parts*** — Each metal part of the suit system shall be

a. fabricated from one of the following:
   i. naval brass in accordance with ASTM B 21/B 21M-01e1; or
   ii. metal for which there is published evidence of salt-spray corrosion resistance; or
   iii. metal with corrosion resistance equal to or greater than naval brass when tested in accordance with par. 6.3.2.1; and
b. compatible galvanically with any other metals with which it may be in contact, as determined by meeting the requirements of the corrosion resistance test (par. 6.3.2.1).

6.3.2.1 *Corrosion Resistance Test* — Test a sample of each metal and metal combination under test and a sample of naval brass for 720 h in accordance with ASTM B 117-03. At the conclusion of the test, each sample of test metal and metal combination shall show corrosion resistance equal to or better than the sample of naval brass.

6.3.3 ***Fabric*** — The exterior fabrics shall meet the requirements of CAN/CGSB-65.19-2004 for Type I or Type IV fabric. The lining shall meet the requirements of CAN/CGSB-65.19-2004 for any fabric type except that the accelerated weathering test is not required.

6.3.3.1 Suit system components, such as boots, cuffs, fasteners, gloves, hood seal, hood seal trim, tapes, threads, or webbing, may be of any colour.

6.3.3.2 *Fabric Abrasion Resistance* — When tested in accordance with ASTM D 3886-99, the number of cycles to hole formation on the outer surface of the exterior fabric shall exceed 500.

6.3.4 ***Thread*** — The thread shall comply with the requirements of CAN/CGSB-65.19-2004.

6.3.5 ***Hardware and Fasteners*** — All hardware and fasteners shall be of a size and design consistent with the webbing, tape or fabric with which they are engaged. They shall be located to enhance the wearability of the device.

6.3.5.1 Hardware shall comply with the requirements of 19.1 to 19.4 of UL 1191-1997.

6.3.6 ***Zippers*** — Zippers shall comply with the following:

6.3.6.1 *Opening and Closing Force Test*

6.3.6.1.1 Conduct opening and closing force tests on four samples of 750 mm long zippers (two open ended and two closed ended) after conditioning in the half-way-open position as follows:

a. Test one sample in the as-received condition.
b. Test one sample after conditioning for 720 h in a salt spray of 5% sodium chloride in accordance with ASTM B 117-03.
c. Test one sample after conditioning for 24 h under a 100 mm head of No. 2 marine diesel oil at a temperature of 18 to 20°C.
d. Test one sample after being folded in half lengthwise to form a radius of not more than 25 mm and subjected to the Temperature Cycling Test (par. 6.2.1).

6.3.6.1.2 Conduct the opening and closing force tests on completion of the final cold exposure with the samples maintained at -30°C. Conduct the opening test described in ASTM D 2062-87(1997)e1, 16, on the samples conditioned in the closed position. Conduct the closing test described in ASTM D 2062-87(1997)e1, 16, on samples conditioned in the open position.

6.3.6.1.3 The test results shall not exceed

a. 40 N opening and closing force after conditioning as described in par. 6.3.6.1.1 a., except docking at the top stop shall be 50 N;
b. 60 N opening and closing force after conditioning as described in par. 6.3.6.1.1 d.; and
c. 175 N opening and closing force after conditioning as described in par. 6.3.6.1.1 b. and c.

6.3.6.2 *Point Breaking Strength Test* — On completion of the opening and closing tests, subject all samples to this test at the top, bottom end, and centre (at the point of folding as described in par. 6.3.6.1.1 d.). Test the point breaking strength as described in UL 1191-1997. The point breaking strength (averaged results) shall not be less than 440 N.

6.3.6.3 *Diagonal Pull Test*

6.3.6.3.1 Prepare three 750 mm long zipper samples as follows:

a. one sample in the as-received condition;
b. one sample after conditioning as described under par. 6.3.6.1.1 b.; and
c. one sample after conditioning as described under par. 6.3.6.1.1 c.

6.3.6.3.2 Open and mount the samples securely onto a hard flat surface such as a wood board, as follows:

a. one of each sample as in par. 6.3.6.3.1, secured with the left side of the zipper secured.
b. one of each sample as in par. 6.3.6.3.1, secured with the right side of the zipper secured.

6.3.6.3.3 Close zippers secured on the left side by pulling the slider at an angle of approximately 25° to the right of the line of the zipper (Figure 2a.). Close zippers secured on their right side by pulling the slider at an angle of approximately 25° to the left of the line of the zipper (Figure 2 b.). Pull the unsecured part of the closed zipper at an angle of 90° to the line of the zipper, away from the secured part with a force of not less than 45 N (Figure 3). The zipper points shall not pull free.

Note: The procedures described in par. 6.3.6.3.2 and 6.3.6.3.3 apply to asymmetrical zippers only. Symmetrical zippers shall be tested on either the left or the right side.

6.3.6.4 *Leak Resistance Test*

6.3.6.4.1 Prepare two 305 mm long zippers by gluing and securing to a 356 mm long piece of 5 mm thick nylon-both-sides neoprene to form a 127 mm diameter cylinder. Seal the bottom end of the cylinder with another piece of 5 mm nylon-both-sides neoprene.

Note: It is recommended that the insides of the glued seams be checked for their tightness as these samples will be used for the leak test, and the adhesive used shall be resistant to diesel oil, as these samples will be tested for their resistance to diesel oil.

6.3.6.4.2 Place a wire mesh fixture 300 mm in length and 125 mm in diameter inside the sample, and close the zipper fully. Place the sample in a water tank with the closed end of the sample down to a depth sufficient to submerge 90% of the zipper's effective length (the portion measured from the top of the bottom stop to the bottom of the slide when the slide is in the fully closed position). Then remove the sample from the water and blot the inside with pre-weighed blotting paper to absorb any water that ingressed. The mass of the ingressed water shall not exceed 20 g.

Note: The acceptable value will be established based on the volume of the sample compared to the volume of a typical adult "Universal" size suit system.

6.3.6.4.3 Next, allow the sample to dry and then place it in No. 2 marine diesel oil at a depth as prescribed in par. 6.3.6.4.2 for a period of 24 h. Remove the sample, blot it dry, and repeat the test described in par. 6.3.6.4.2. The zipper will be considered acceptable if the amount of water that ingressed is minimal, and there is no sign of degradation resulting from its exposure to the diesel oil.

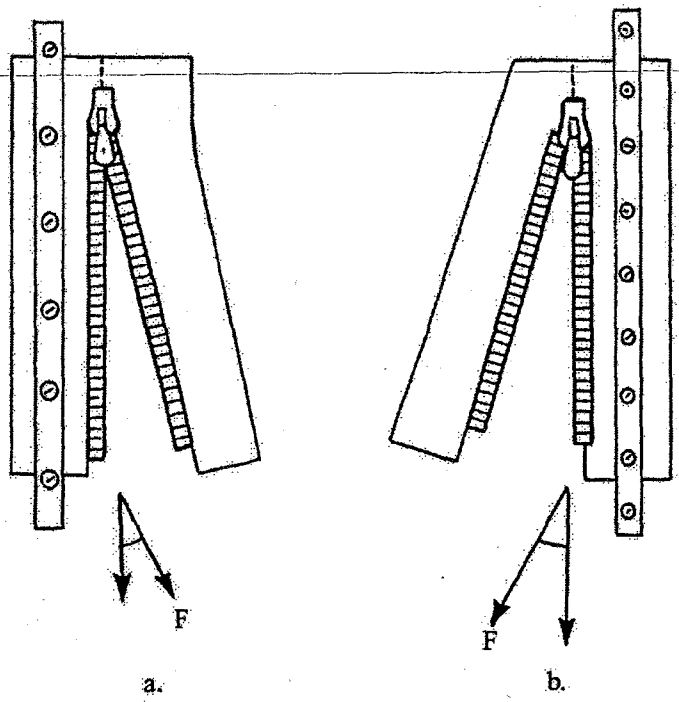

FIGURE 2
Asymetrical Zipper Closure

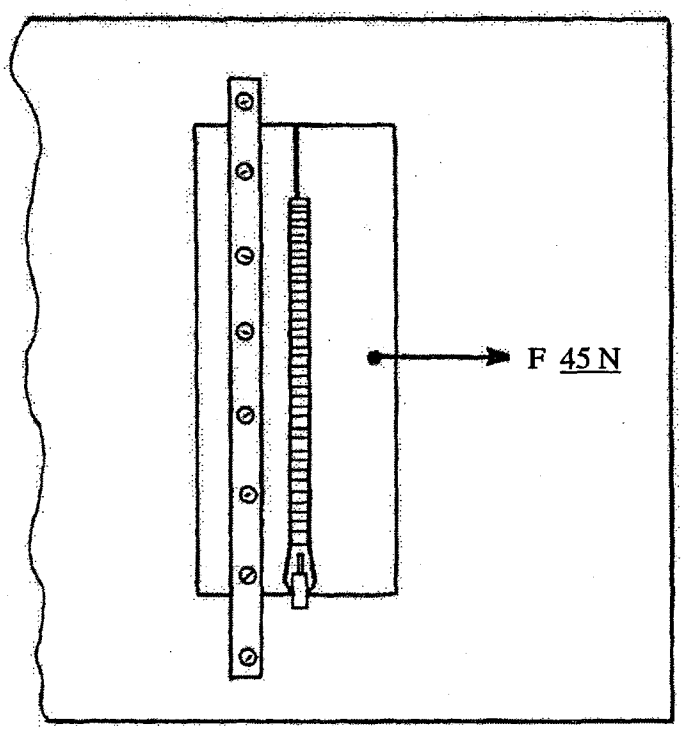

FIGURE 3
Closed Zipper Assembly

6.3.7 ***Retroreflective Material*** — The retroreflective material shall conform to the specification detailed in Resolution A.658(16) with an area of at least 300 cm² on the front and with at least 100 cm² on the back. Retroreflective material shall be placed on the suit system to cover a minimum surface area of 200 cm² above the water level when tested with the subject in a relaxed, floating position.

6.4 **Inherent Buoyancy (Static)**

6.4.1 The suit system shall provide a minimum inherent buoyancy of not less than 70 N.

6.4.2 ***Inherently Buoyant Materials*** — Inherently buoyant materials shall be unicellular foam conforming to CAN/CGSB-65.18-M86. Kapok or other natural fibre shall not be used as a buoyancy medium.

6.5 **Buoyancy** — The original buoyancy, the buoyancy after 24 h immersion, the buoyancy retention, and the corrected buoyancy of the suit system shall be measured as follows:

6.5.1 ***Test Equipment*** — The following equipment is required for this test:

a. A mesh basket that is large enough to hold a folded suit system and that is weighted sufficiently to overcome the buoyancy of the suit system when placed in the basket.
b. A tank of fresh water that is large enough to contain the basket submerged with its top edge 50 mm below the surface of the water.
c. A scale or load cell with an accuracy of ±1 g and that is arranged to support and determine the mass of the basket in the tank.
d. One complete, unassembled suit system.

6.5.2 ***Determination of Original Measured Buoyancy*** — Submerge the basket so that its top edge is 50 mm below the surface of the water. Determine the mass of the submerged basket. Thereafter, submerge the suit system in the water, ensuring it is filled with water and any inflation elements are fully deflated; then place it in the submerged basket. Tilt the basket 45° from the vertical for 5 min in each of four different directions to allow entrapped air to escape. Suspend the basket with the suit system in the water with the top edge of the basket 50 mm below the surface of the water. Determine the mass of the submerged basket and the suit system immediately. Determine the original measured buoyancy of the suit system by subtracting the mass of the basket plus the suit system from the mass of the basket. Calculate the buoyancy in Newtons (N). The suit system can be a fully assembled suit or all the unassembled components.

6.5.3 ***Determination of Buoyancy After 24 h Immersion*** — Submerge the suit system in the tank of fresh water for 24 h. Determine the buoyancy as described in par. 6.5.2.

6.5.4 ***Buoyancy Retention*** — Calculate the buoyancy of the suit system after 24 h immersion (par. 6.5.3) and express it as a percentage of the original measured buoyancy (par. 6.5.2).

6.5.5 ***Corrected Inherent Buoyancy*** — The corrected buoyancy of the suit system is its measured buoyancy reduced by the buoyant correction factor of the buoyant suit system material. The correction is made for barometric pressure and water temperature and is determined in accordance with UL 1191-1997 except that the minimum number of samples required to determine each property shall be 10 instead of 75.

6.5.5.1 Calculate the corrected inherent buoyancy as follows:

$$Bc = B_M \times (P/760) \times (527.69/T_M)$$

where:

B_C = Corrected buoyancy, in newtons
B_M = Measured buoyancy, in newtons
P = Atmospheric pressure, in millimetres of mercury
T_M = Temperature, in degrees Rankine

6.5.6 ***Determination of Corrected Buoyancy After 24 h Immersion*** — Determine the buoyancy of the suit system after 24 h immersion in accordance with par. 6.5.2, and correct this buoyancy value in accordance with par. 6.5.5.

6.5.7 *Buoyancy Loss*

6.5.7.1 The minimum design buoyancy of the suit system shall be calculated in accordance with the following formulae depending on the buoyant material so that the predicted minimum buoyancy is not less than the total buoyancy requirement (par. 6.4.1).

a. Buoyant neoprene materials — Shall be calculated in accordance with the formula outlined in UL 1197-1996, 23.7.
b. Other buoyant polymeric materials — Shall be calculated in accordance with the following formula[1]:

$$Bi = Bt \times \sum_{i=1}^{n} (Pi \times 100)/Vi$$

where:

Bi = Minimum production buoyancy for the suit system, in newtons
Bt = Minimum total buoyancy required for the suit system, in newtons
Pi = Percentage of buoyancy provided by the i th material to the total buoyancy of the suit system
n = *Number of materials used in the suit system*
Vi = V-factor of the *i* th buoyant material

6.5.7.2 The V-Factor for any buoyant material necessary to meet these requirements shall not be less than 85 when tested in accordance with CAN/CGSB-65.18-M86 or UL1123-1996, 24.4.

6.5.7.3 *Exception In The Equation Including Subscripts* — Foam that is used may have a V-factor not less than 80 provided that at least 85% of the total minimum buoyancy is supplied by foam with a V-factor of 85 or more. Foam that is not relied upon to meet the requirements for total minimum buoyancy shall be excluded from this V-factor requirement provided the suit system complies with the flotation stability requirements (par. 6.20) with such buoyant materials in place.

For non-polymeric materials, the buoyancy after 24 h submersion in water shall be determined in accordance with par. 6.5.2.

Note: Additional buoyancy elements are excluded from this requirement.

6.5.8 ***Total Buoyancy*** — Auxiliary buoyancy may be added to the minimum inherent buoyancy (par. 6.4.1). After 45 s upon water entry, the total buoyancy shall not be less than 150 N. Determine the total buoyancy in accordance with par. 6.5.

6.5.9 ***Auxiliary Buoyancy in the Equation Including Subscripts*** — If an auxiliary buoyancy element is required, it shall be attached to the suit system in a manner that prevents removal by the wearer.

6.5.9.1 Inflation chambers, required to meet the minimum total buoyancy, shall meet the following requirements of UL 1180-2004:

a. 7.9 — Strength of Attachment Tests
b. 7.10 — Temperature Resistance/Stability Test
c. 7.11 — Solvent Resistance Test
d. 7.12 — Flame Resistance Test
e. 7.14 — Puncture Resistance Test
f. 7.15 — Over-Pressure Tests, and
g. 7.16 — Air Retention Test.

6.5.9.2 If the inflatable buoyancy element is totally enclosed within the shell of the suit system, then the tests shown in par. 6.5.9.1 a. and d. shall be performed on the complete assembly.

[1] *This formula establishes the absolute minimum production buoyancy and does not address manufacturing tolerances.*

6.5.9.3 If inflation is achieved entirely by oral inflation, then the test shown in par. 6.5.9.1 f. is not required.

6.6 **Flame Resistance** — The suit system and the storage container (if required) shall be designed to be functional after a 2 s contact with a gasoline fire.

6.6.1 ***Flame Resistance Test*** — The suit system and storage container shall be tested for resistance to flame as follows:

6.6.1.1 *Test Equipment* — The following equipment is required for this test:

a. A metal pan at least 300 mm wide, 450 mm long, and 65 mm deep. The pan shall have at least 12 mm of water on the bottom with approximately 40 mm of gasoline floating on top of the water.
b. An arrangement to hold the suit system and storage container over the pan.

6.6.1.2 *Flame Exposure Test Procedure* — The suit system is held from the top by the holding arrangement. Ignite the gasoline and allow it to burn for approximately 30 s in a draft-free location. The suit system is then held with the lowest part of each foot 240 mm above the surface of the burning gasoline. After 2 s, measured from the moment the flame first contacts the suit system, remove the suit system from the fire. If the suit system is burning, allow it to continue to burn for 6 s before extinguishing the flames. If the suit system sustains any visible damage other than scorching, subject it to the flotation stability requirement (par. 6.20) using one subject and to the Buoyancy Test (par. 6.5) except the immersion time shall be for 2 h instead of 24 h.

6.6.1.3 *Storage Container Flame Exposure Test Procedure* — Test the storage container using the test equipment. Place the suit system inside the storage container for the test. The storage container is held from the top by the holding arrangement. Ignite the gasoline and allow it to burn freely for approximately 30 s in a draft-free location. The storage container is then held with its lowest point 240 mm above the surface of the burning gasoline. After 2 s, measured from the moment the flames first contact the container, remove the container from the fire. If the container is burning, allow it to continue to burn for 6 s before extinguishing the flames. The storage container material shall not burn through at any point in this test, and the suit system shall not sustain any visible damage.

6.7 **Human Testing**

6.7.1 ***General*** — Each adult and child size suit system shall be tested. CAUTION: During each in-water test, a person ready to render assistance when needed should be near each subject in the water.

6.7.2 ***Test Anomalies*** — Throughout the testing program, certain results may vary significantly from the collected data set. Such results must be recognized and validated by the testing agency. Where this variation is determined to be a suit system design or performance factor, the results shall remain as part of the data set. Where this variation is determined to be an anomaly caused by subject activities, which are outside the scope of the specific test objective, the test may be repeated or the results deleted from the data set.

6.7.3 ***Testing For Child Size Suit Systems*** — Child-size suit systems shall pass the following tests:

a. The flotation stability requirement (par. 6.20) except that six children of either sex shall be used as subjects. The subjects shall be within the size prescribed in Table 1 (par. 4.1.2.1), and have a mass spread of at least 4 kg between subjects.
b. The Buoyancy Test (par. 6.5)
c. Body Strength (par. 6.1.1) except that the cylinders shall be 50 mm in diameter and the test mass shall be 55 kg.

6.7.4 ***Test Clothing*** — Clothing to be worn for each test procedure shall consist of

a. underwear (short sleeved, short legged),
b. shirt (long sleeved),
c. trousers (not woollen), and
d. wool socks.

6.8 **Donning Time** — Following a demonstration, each subject shall be able to unpack, don and secure the suit system over his or her test clothing unassisted and within 2 min. Where the suit system is intended to be used for helicopter transit flights and is designed to be worn unsealed in flight, it shall be capable of being correctly sealed by the wearer within 10 s. This action shall be possible when seated at the wearer's normal position in a helicopter with harness fastened and wearing an uninflated life jacket, if required.

6.8.1 ***Donning Time Test*** — Test the donning, mobility and flotation capabilities of each suit system as follows. The depth of water shall be at least 3 m.

6.8.1.1 *Test Subjects* — Each test shall be performed using as many samples of the suit system as are needed to make efficient use of the subjects and test equipment. If the exterior fabric is a composite fabric, it shall be tested as a composite fabric unless otherwise stated. There shall be seven male and four female subjects. The subjects shall be comfortable in the water and shall be selected to represent the body height and mass ranges, as specified in Table 3.

TABLE 3

Test Subject Sizes

Body Height cm	Body Mass kg
140 to 160	Under 60
140 to 160	Over 60
160 to 180	Under 70
160 to 180	Over 70
Over 180	Under 80
Over 180	Over 80

6.8.1.1.1 At least two of the eleven subjects shall have a chest size of 760 ± 25 mm. At least two of the eleven subjects shall have a chest range of 1320 ± 25 mm.

6.8.1.1.2 In the event that a size of suit system is not accommodated by the above selection of subjects, an additional subject shall be used to ensure all sizes are tested.

6.8.1.2 *Donning Time Test Procedure* — If the suit system under test is designed to be worn with rubber boots, then standard fishermen's rubber boots shall be worn for the test. Each subject shall be removed from the view of the other subjects and allowed 10 min to examine the suit system and the manufacturer's instructions for donning and using the suit system. The subject shall then attempt to don the suit system as rapidly as possible without the aid of a chair or any support on which to lean. The subject, however, may sit on the floor. Each subject shall don the suit system completely, in a single attempt and within 2 min.

6.9 **Cold Donning Time** — The suit system, immediately after exposure in the packed condition for 24 h at -30°C, shall be capable of being donned in less than 5 min.

6.9.1 ***Cold Donning Time Test Procedure*** — Repeat the Donning Time Test procedure (par. 6.8.1.2) except the time period is 5 min and the ambient room temperature is -30°C.

6.10 **Donning Durability** —The suit system shall be donned and doffed ten times without sustaining damage.

6.11 **Mobility** — The suit system shall permit the wearer to climb, bend, move arms, and walk without restriction.

6.11.1 ***Mobility Tests*** — Mobility shall be tested according to the following tests:

6.11.1.1 *Mobility Out of the Water Test* — The suit system shall be completely donned and any zippers or ties that would normally be closed under working conditions shall be fastened. The following tests shall then be conducted to test the mobility of the suit system:

a. Each subject shall assume the squatting position with no difficulty or discomfort.
b. Each subject shall assume the sitting position with no difficulty or discomfort.
c. With the arms by the side fully extended, each hand grasping a 1 kg dumbbell, and the knuckles facing the sides of the thighs, each subject, with no difficulty or discomfort, shall be able to raise the arms through a full arc above the head until the arms are fully extended and the flexed fingers touching above the head.
d. Starting from the same position as in par. 6.11.1.1 c., each subject with arms fully extended shall be able to raise the arms laterally to 90° without difficulty or discomfort. Then, with the arms fully extended and parallel to the ground, each subject shall be able to rotate them in front until the flexed fingers of the hands holding the dumbbells touch.
e. A vertical ladder extending at least 5 m above a level floor shall be used for the last part of the test. Each subject while not wearing the suit system is timed twice climbing the ladder so that feet are at a height of 3 m above the floor. The subject shall then don the suit system and is again timed twice climbing to the same height. The average time for each subject wearing the suit system to climb the ladder shall not exceed the average time for each subject not wearing the suit system to climb the ladder by more than 10%.

6.11.1.2 *Mobility in the Water Test* — Mobility in the water shall be tested as follows:

a. The life raft used for this test shall be a nonreversible, dual chamber, 10-man capacity life raft with a boarding ladder. The raft shall be free-floating in water at a temperature of not less than 18°C. A brief demonstration on how to right an inverted life raft shall be given to the subjects. Each subject, wearing only test clothing, shall enter the water, and swim or tread water for approximately 2 min. The subject shall then be able to right the life raft and climb into it via the boarding ladder with no other boarding aids in a maximum of 3 min. Only subjects that can perform this task shall be used in the subsequent test. A minimum of eight subjects, of which two shall be female, must qualify.
b. The test is then carried out with the qualifying subjects as follows:
   i. Each subject shall don the suit system over their test clothing, enter the water, and deploy the auxiliary buoyancy element. The subject is allowed to adjust any buckles, fittings, etc. The subject shall then swim 25 m. The time required to swim 25 m with the suit system and test clothing on shall not exceed the time required to swim 25 m with only the test clothing on by more than 25%.
   ii. The subject is then required to right an inverted life raft and climb into the life raft via the boarding ladder, with no other boarding aids, in a maximum of 6 min. All qualifying subjects shall pass the test.

6.12 **Hand Dexterity** — While wearing the suit system, each test subject shall be capable of performing all of the following hand tests.

6.12.1 ***Hand Dexterity Test*** — If gloves are fitted to or provided with the suit system, then each subject shall pass the following tests while wearing the gloves:

a. At any time, pick up a pencil of 10 mm in diameter and write.
b. Cut a painter using a standard raft knife[2] within 1 min.
c. Unroll five turns of 2 cm black plastic insulating tape from a 4 cm dowel to simulate preparing a hand flare for use. (The first 2 cm of tape shall be folded back on itself to form a 1 cm starter tab simulating a tab on a flare.)

6.13 **Swimming** — The suit system, fully deployed, shall permit the subject to swim through the water at least 25 m and board a survival craft in accordance with par. 6.11.1.2 b.

6.14 **Leakage** — The ingress of water into the suit system shall be measured in accordance with par. 6.22.1.1.

6.15 **Skid Resistance** — Each subject, wearing only the test clothing (par. 6.7.4) and rubber-soled shoes, shall walk a distance of 30 m on a smooth, wet surface such as tile or painted concrete. The smooth, wet surface shall be 23 ± 5°C. There shall be at least one turn of at least 90° in the 30 m course. The course shall be walked twice,

[2] *The painter and standard raft knife are provided with the life raft described in par. 6.11.1.2 a.*

and the times recorded. The walk is repeated and timed with the suit system fully donned. The average time while wearing the fully donned suit system shall not exceed by more than 25% the average time recorded when not wearing the suit system.

6.16 **Jump** — The suit system shall permit the wearer to jump from a height of not less than 4.5 m into the water with feet first, without damaging or dislodging the suit system or being injured.

6.16.1 ***Jump Test*** — The subject shall jump into the water feet first from a height of 4.5 m. After water entry, the subject may make initial in-water adjustments to the suit system to improve his or her field of vision and breathing. However, if this cannot be accomplished within 1 min of water entry, the suit system shall fail this test. After the initial in-water adjustments, the subject shall assume a relaxed, floating position in the water for 10 min with the arms at the sides, making no conscious effort to prevent the suit system from riding up. After removal from the water, measure the ingress of water into the suit system in accordance with par. 6.22.1.1.

6.17 **Head-First Entry** — The subject, while wearing the suit system, shall enter the water head first from a height of 1 m above the water surface and shall attain a head-up floating position within 5 s of water entry.

6.18 **Field of Vision** — The suit system shall comply with the following field of vision requirements on land and in water.

6.18.1 ***Field of Vision on Land*** — With the subject in a seated position, head perpendicular to the shoulder plane, suit system fully secured and the inflatable buoyancy element, if any, uninflated, the average single field of lateral vision must be at least 120°. With the subject's head rotated 30° to the left of the perpendicular of the shoulder plane and then 30° to the right, the average single field of lateral vision must also be at least 120°.

6.18.2 ***Field of Vision in the Water*** — With the subject floating in a relaxed position in the water with the suit system fully secured and the inflatable buoyancy element, if any, fully inflated, the subject's field of vision shall be

a. lateral, unrestricted 120° arc of vision from left to right, water level to water level;
b. vertical, forward through an arc of 60° and backward through an arc of 15°; and
c. horizontal, an arc of 30° starting at right angles to the body and sweeping down towards the feet, parallel to the water surface.

6.18.3 ***Field of Vision Tests*** — The suit system's field of vision shall be tested as follows:

6.18.3.1 *Field of Vision on Land Test* — Each subject, not wearing a suit system, shall be seated with the chin resting firmly on a support and shall look straight ahead. A person carrying a lighted flashlight pointed at the subject's head shall stand behind the seated subject and walk clockwise and then counter clockwise around the circumference of a circle with a 5 m radius, of which the seated subject's head is at the centre. It shall be established from the results of carrying out this test that the seated subject, moving the eyes if necessary, can observe the lighted flashlight on each side at an angle of at least 60° from the perpendicular of the shoulder plane. The test shall then be repeated with each subject having fully donned the suit system with the auxiliary buoyancy element, if any, uninflated for each of the following positions:

a. head perpendicular to the shoulder plane;
b. head rotated 30° to the left of the perpendicular of the shoulder plane; and
c. head rotated 30° to the right of the perpendicular of the shoulder plane.

6.18.3.2 *Field of Vision in Water Test* — The field of vision shall be measured in the lateral, vertical and horizontal planes with the suit system fully donned and auxiliary buoyancy element, if any, fully inflated. The Bohemier Perimeter Scope[3] (Figure 4) or equivalent shall be used to measure field of vision. Measure the field of vision of each subject in the relaxed flotation position with the head fixed and eyes allowed to move, in the lateral (Figure 5a), horizontal (Figure 5b) and vertical (Figure 5c) planes.

[3] *This device has studs to stabilize the subject's head and a* 2 cm *plastic pipe bent into a semicircle measuring* 2 m *in diameter. Marks are placed on the ring at* 15 cm *intervals using a selection of coloured tapes.*

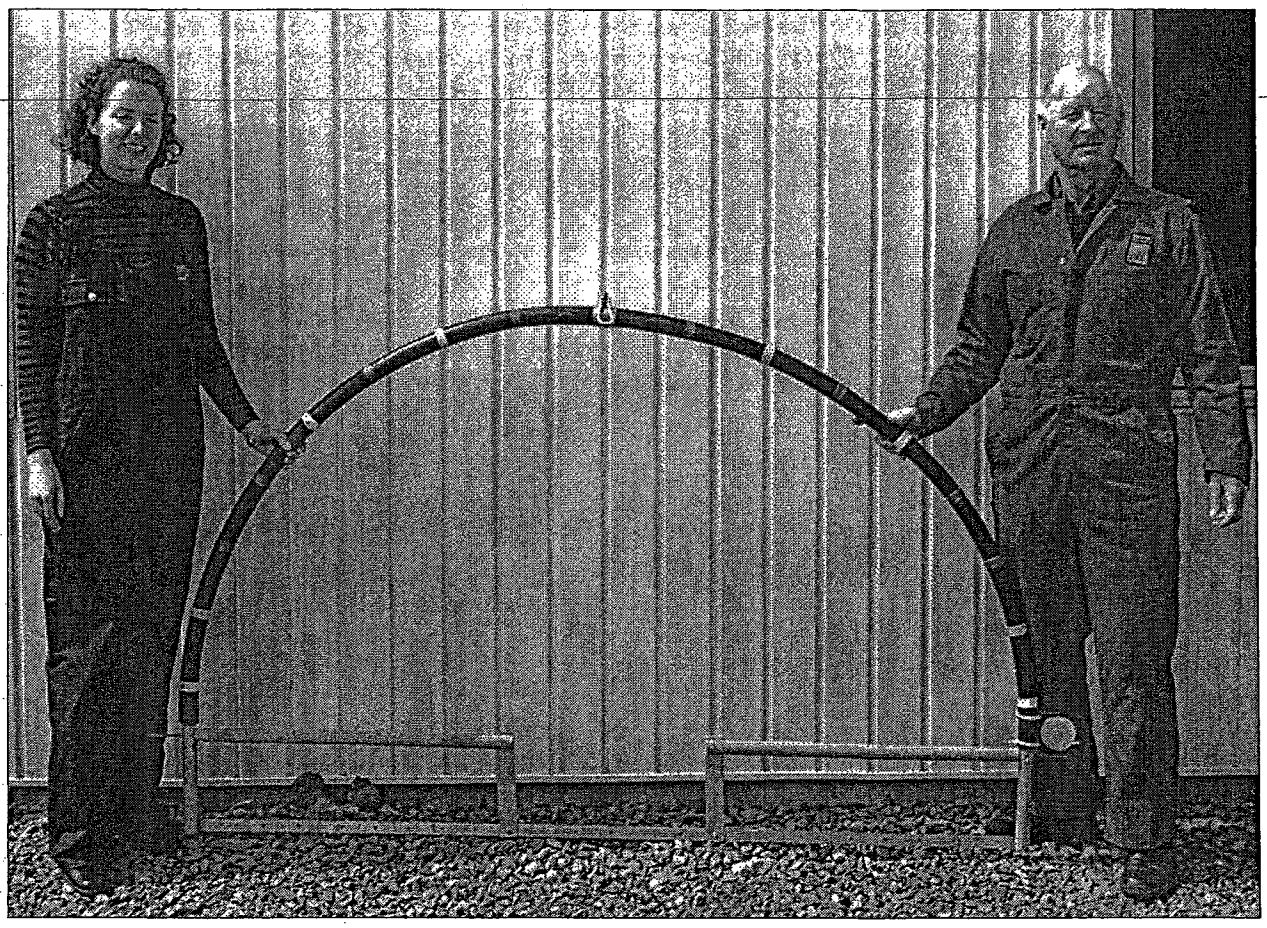

FIGURE 4

Bohemier Perimeter Scope

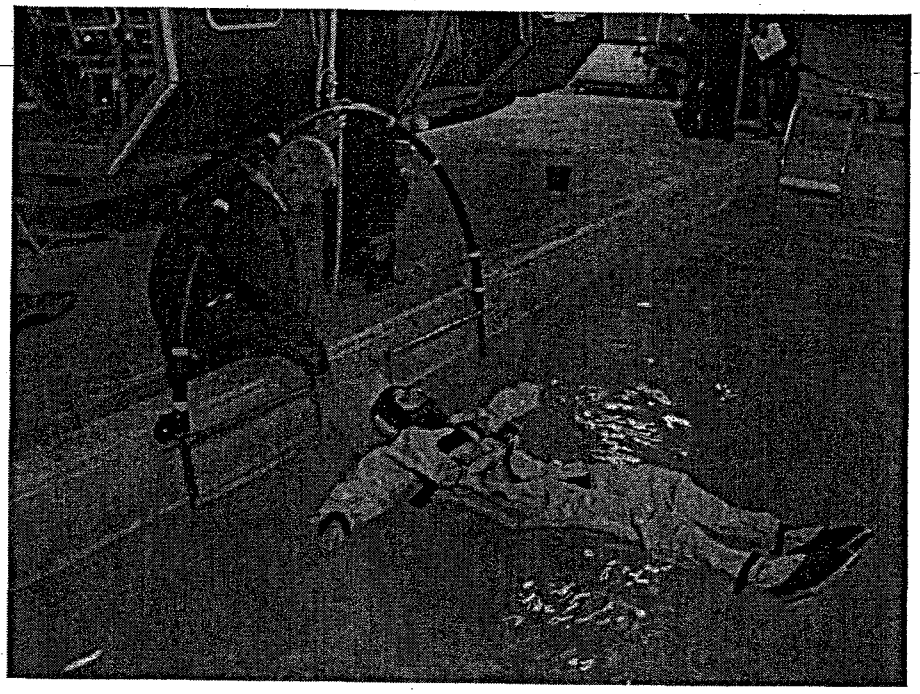

FIGURE 5a

Field of Vision in the Water — Lateral Plane

FIGURE 5b

Field of Vision in the Water — Horizontal Plane

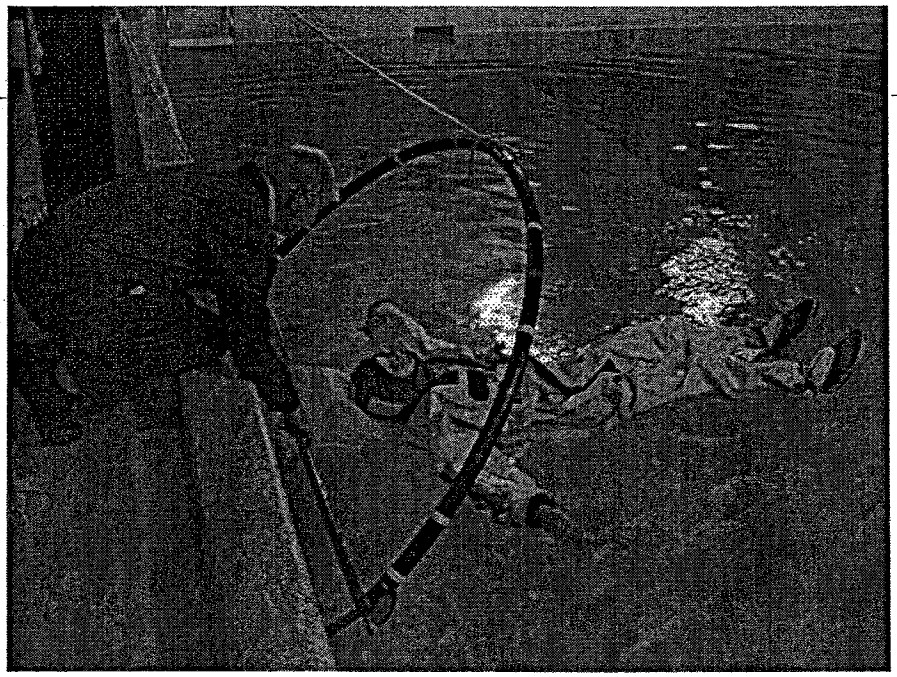

FIGURE 5c (i)

Field of Vision in the Water — Vertical Plane Forward

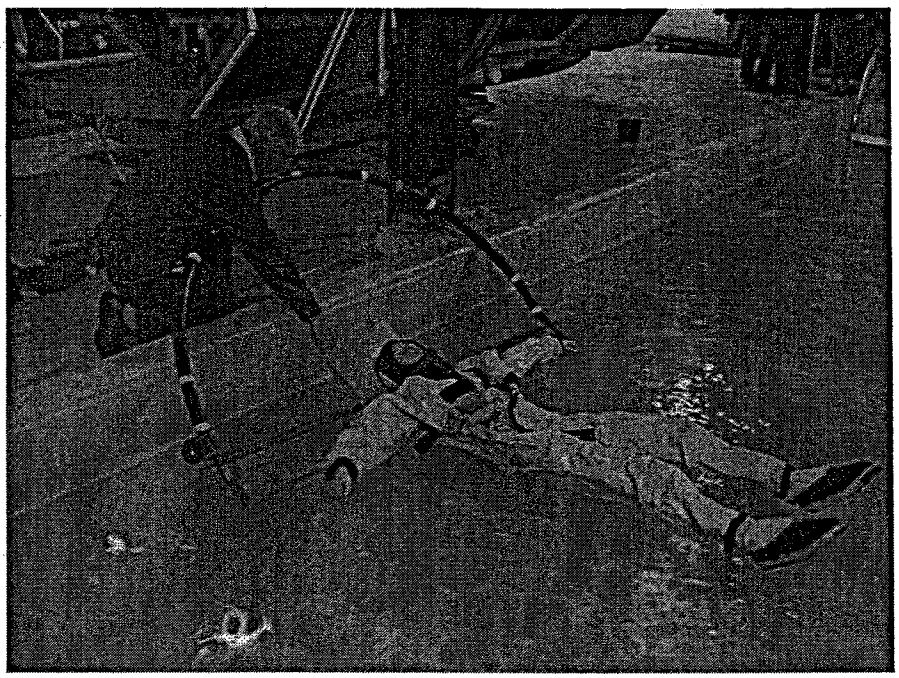

FIGURE 5c (ii)

Field of Vision in the Water — Vertical Plane Backwards

6.19 **Retroreflective Tape** — Each subject, wearing the suit system fully deployed, shall adopt a relaxed, floating position in the water. The surface area of the retroreflective tape above the water level is then measured. Measurements on at least 9 out of 11 subjects shall meet the requirement, and no measurement shall be below 75% of the requirement.

6.20 **Flotation Stability**

6.20.1 ***Righting*** — While wearing the suit system in the water fully secured with any inflatable buoyancy element inflated, each subject shall take a deep breath, assume a facedown position, allow the body to become limp, and slowly expel air. The suit system shall cause the subject to turn face-up within 5 s. If the suit system does not turn the subject within 5 s, the subject shall be able to turn face-up under his or her own power within 5 s. The suit system shall not have the tendency to turn a subject facedown from a face-up position.

6.20.2 ***Freeboard***

6.20.2.1 Each subject, in turn, while wearing the suit system correctly secured and adjusted, shall step from a platform located not less than 4.5 m above the water.

6.20.2.2 The suit system shall position the wearer's mouth above the water surface within 5 s of water entry.

6.20.2.3 The suit system shall allow the subject to attain a near vertical position with a minimum freeboard of 120 mm within 15 s of water entry.

6.20.2.4 The subject shall be permitted to make any adjustments and deploy any auxiliary buoyancy element within 45 s of water entry. At this point in time, the suit system shall provide a minimum buoyancy of 150 N and a minimum relaxed freeboard of 120 mm. On completion of the relaxed freeboard measurements, the suit system is removed from three of the subjects (one large, one medium, and one small), and the total buoyancy of each is measured immediately (par. 6.20.4).

6.20.2.5 *Face-plane* — The suit system shall support each subject in a relaxed, stable, face-up position with a face-plane angle of 30 to 80° above the horizontal.

6.20.2.6 *Stability in the Water* — With the suit system deployed, each subject shall be able to maintain a vertical position for 2 min without assistance or undue effort.

6.20.3 ***Inherent Buoyancy Freeboard Test*** — The subject shall don the suit system, and secure and adjust any fasteners. The auxiliary buoyancy element, if any, shall not be deployed. The subject shall adopt a squatting position and place two fingers under the neck or face seal for 5 s to allow entrapped air to escape. The subject is then to enter the water and adopt a relaxed position. Measure the freeboard at the lowest point of the breathing cycle. Freeboard shall not be less than 50 mm. Measurements on nine out of eleven subjects shall meet the requirement, and no individual measurement shall be below 41 mm.

6.20.4 ***Total Buoyancy Test*** — Forty-five seconds after water entry, three of the subjects shall remove the suit system while in the water. The suit system shall support a weight assembly having an in-water mass of 15.3 kg.

6.21 **Sprayhood** — If any form of hood or sprayhood is fitted to cover the face in whole or in part (to protect mouth and nose from water splash), the carbon dioxide level within the hood shall not exceed 5% at any time and does not average more than 2.5% in any one minute.

The sprayhood shall be stowed in a position that keeps it clear of the user's face. It shall not interfere with the operation of a lifejacket (if fitted as part of the immersion suit system) or create a hazard, for example through snagging.

The sprayhood shall be able to be un-stowed and deployed to protect the airway whilst the user is in the water. If a lifejacket is deployed as part of the immersion suit system, the sprayhood shall not impair the performance of the suit system and render it no longer in conformity with the relevant standards.

The sprayhood shall be fitted with a clear area to enable the user to see sufficient of the surroundings in order to aid rescue operations. If, when deployed, the sprayhood reduces the effectiveness of any retroreflective material on the immersion suit system, the sprayhood shall itself provide additional retroreflective area at least equal to that obscured. The sprayhood shall be easily removable from its protective position, and shall be capable of being restored so that it does not fall back to its deployed position.

6.21.1 *Apparatus* — A fast-response carbon dioxide analyser, capable of indicating continuous measurements of the percentage of carbon dioxide gas within a continuously flowing sample, with a time constant short enough to give accurate measures of end-tidal carbon dioxide level.

6.21.2 *Procedure* — Demonstrate, by analysing samples of gas using a fast-response carbon dioxide analyser, that in calm air and calm water, using a minimum of six subjects over test periods of at least 5 min each, that the carbon dioxide level within the hood does not exceed 5% at any place at any time and does not average more than 2.5% in any 1 min.

Take the samples at a distance between 50 mm and 100 mm from the nostrils, when the subject is holding breath. The longest averaging period shall not exceed 60 s.

6.22 **Thermal Performance** — Thermal performance parameters are established and measured as follows for thermal manikins and human subjects.

6.22.1 *Using Thermal Manikin* — The mean level of thermal insulation over the body as provided by the suit system, including test clothing, shall not be less than $0.116°C \cdot m^2 \cdot W^{-1}$ (0.75 immersed Clo). The hands shall have a minimum thermal protection value of $0.6\ K \cdot m^2 \cdot W^{-1}$ (0.5 immersed Clo).

6.22.1.1 *Determination of Water Ingress* — The amount of water ingress is required so that it may be introduced into the suit system (dry suit systems only) prior to testing using a thermal manikin and human subjects. The subjects shall be as described in Table 3 (par. 6.8.1.1). Prior to testing, determine the saturation time of the suit system material by conducting a series of tests using two subjects, following the test procedures described in par. 6.22.1.1.1 and 6.22.1.1.2, increasing the saturation time by 2 min for each test until the saturation mass does not show a significant increase. That time shall be the established saturation time for this test.

6.22.1.1.1 Water Ingress During Jump Into Water — Each subject, with the suit system fully donned and detachable components, if any, removed (e.g. hood, gloves, buoyancy element) shall climb into the water and remain in the vertical position with the water at neck level for the established saturation time to pre-wet the suit system. Each subject shall then climb out, dunk his/her head in water up to the neck to soak the hair, stand for 1 min to permit excess water to run off the exterior of the suit system, and shall then be weighed. Means shall be provided so that any further run-off is included in the weighing. Observe and record the amounts and locations of any water leakage into the suit.

Each subject, with the suit system fully donned including detachable components, shall then jump into the water from a height of not less than 3 m to ensure total immersion. The jump shall be carried out in a feet first position and with feet together. Arms should be crossed over the chest using one hand to protect the nose and mouth. The subject shall then remain still in the water for at least 1 min before being manoeuvred into a position at the pool side where it is possible to climb out with a minimum of effort. Immediately after the subject has left the water, detachable components shall be removed. The subject shall stand for 1 min to permit excess water to run off the exterior of the suit system and then be weighed again in that any further run-off is included in the weighing. The weighing machine shall be capable of measuring 250 kg with an accuracy of ± 0.025 kg.

On completion of the test, each suit system shall be removed and a record made of the location of any leaks and damp patches observed as well as the total mass of water leaked into the suit system.

6.22.1.1.2 Water Ingress During Swimming — The test shall take place in a swimming pool with a water temperature of not less than 18°C. Each subject, with the suit system fully donned and all detachable components, if any, removed (e.g. hood, gloves, buoyancy element), shall climb into the water and remain in the vertical position with the water at neck level for the established saturation time to pre-wet the suit system. Each subject shall then climb out, stand for 1 min to permit excess water to run off the suit system and shall then be weighed again in order that any further run-off is included in the weighing.

A minimum of three subjects shall participate in the test together in order to achieve adequate wave motion in the pool. At the start of the test, each subject, with the suit system fully donned including detachable components, shall enter the water via a stepladder and proceed to swim on his/her back and abreast, with a maximum distance of 2 m between subjects and at an approximate speed of 18 m/min for 60 min. Subjects shall use their arms and legs for swimming throughout. The distance covered shall be recorded and must lie between 1000 and 1200 m. Each subject shall then leave the water and remove the detachable components immediately. Each subject shall stand for 1 min to permit excess water to run off the suit system. The suit system is then weighed.

6.22.1.1.3 Calculation of Water Ingress — Calculate the amount of water, W, to be introduced at the start of the insulation measurement using the formula

$$W = W_1 + 3\ L$$

where:

W = mass of water to be introduced, in grams
W_1 = water ingress, in grams, average for eleven subjects, measured at jump test
L = water ingress, in grams, average for eleven subjects, measured at 60 min swim test.

Note: W_1 and L should be taken as one standard deviation above the mean for the eleven subjects tested.

Where water ingress has been recorded specific to each detachable component, the greatest ingress value recorded from the tests described in par. 6.22.1.1.1 or 6.22.1.1.2 shall be introduced specific to the component it was recorded from.

6.22.1.2 *Using Thermal Manikin Test*

6.22.1.2.1 The thermal protection provided by the suit system shall be assessed by measuring the effective insulation of the whole suit system and test clothing placed on a thermal manikin and immersed in turbulent water with a wave height of 40 cm with the thermal manikin in a natural floating position as determined in par. 6.22.1.2.3.

6.22.1.2.2 Test Equipment — A thermal manikin is required, and it shall

a. have a surface area and shape similar to that of a fiftieth percentile man;
b. be capable of being dressed in the test clothing;
c. be capable of being heated to, and controlled at, uniform temperature;
d. control, measure, and record temperatures and power inputs; and
e. be capable of being immersed in water.

6.22.1.2.3 Flotation Position — A subject of approximately the same mass and height of the manikin and wearing test clothing shall don the suit system, inflate auxiliary buoyancy elements (if any) and enter the calm water. The subject shall assume a relaxed, floating position. The freeboard is measured to the mouth, abdomen and toes, perpendicularly from the surface of the water. This shall be the freeboard and body position used for the thermal manikin.

6.22.1.2.4 Test Procedure — Pre-weigh the test clothing and suit system lining, if any. Dress the thermal manikin in the test clothing and suit system. Inflate auxiliary buoyancy elements, if any. Before closing the suit system closures, introduce water into the test clothing (dry suit system only) in areas representative of those recorded during the water ingress tests and in amounts, W, calculated from the results of the water ingress tests in par. 6.22.1.1.

After closing the suit system closures, ensuring that all seals are closed and waterproof, lower the thermal manikin into the water until the freeboard to the mouth, abdomen and toes equals the amounts measured in par. 6.22.1.2.3. This position may be achieved by mounting the thermal manikin on a support frame.

The target temperature of the thermal manikin and the water temperature are set at levels appropriate to the particular thermal manikin in use. However, the minimum gradient shall not be less than 3°C between the thermal manikin and the water. Provision shall be made for inducing turbulence in the vicinity of the thermal manikin. The temperature(s) of the thermal manikin, the water and the power input(s) shall be measured continuously and recorded as means for each successive period not to exceed 15 min. Once the target temperature is achieved, the thermal manikin shall remain immersed for the time period determined by Defence Research and Development Canada[4] calibration acceptance testing. This ensures reliable data and consistent test results. Insulation is calculated, in the case of a single section thermal manikin, from the measured temperature gradient, the power input (i.e., heat loss) and the surface area of the thermal manikin. In the case of a thermal manikin consisting of multiple sections, the mean overall insulation is calculated by area, weighting the insulation found in each section. After the thermal manikin is removed from the water, the test clothing and lining shall be reweighed to determine if there was leakage during the test. If leakage has occurred, the measurement of insulation will be lower than it should be and the test may have to be repeated.

[4] *Defence Research and Development Canada (Toronto) can be contacted at 1133 Sheppard Avenue West, Downsview, Ontario, Canada M3M 3B9.*

6.22.2 *Using Human Subjects* — The suit system shall provide thermal protection such that the average body core (rectal) temperature of persons wearing the suit system for 6 h in calm circulating water that is between 0 and 2°C shall not drop more than 2°C, and the finger, toe or buttock temperature of the wearer shall never drop below 10°C for more than 15 min throughout the entire duration of immersion. Providing the suit system protecting the hands and feet (i.e., gloves and socks) meets a minimum requirement of 0.5 immersed Clo, it is permissible for the testing agency to provide additional insulation to the hands and feet, to prevent the occurrence of non-freezing cold injury in the subjects through hand and foot temperature reductions below these limits. The clo value of gloves can be measured according to the par. 6.22.3.

6.22.2.1 *Using Human Subjects Test* — The thermal protection capability of a suit system shall be tested as follows:

6.22.2.1.1 Test Subjects — At least four male and four female subjects shall be used for this test. Each subject shall be familiarized with the test procedure prior to the start of the test. Each subject must be between 160 and 185 cm tall and must not be more than 10% overweight or underweight for his or her height and physical type as determined by a physician or physiologist or from published physiological data. Each subject shall have had a normal night's sleep the night before the test, a well-balanced meal 1 to 5 h before the test, and no alcoholic beverages for 24 h prior to the test. Each subject shall wear the test clothing in addition to the suit system.

6.22.2.1.2 Test Equipment — The test shall be conducted in calm circulating water of a temperature between 0 and 2°C. The air temperature 300 mm above the water surface shall be between 10 and 20°C. Each subject shall be instrumented with an electrocardiograph, a thermistor or thermocouple in the rectum placed 150 mm beyond the anal margin, a thermistor or the thermocouple on the tip of the index finger, and a thermistor or thermocouple on the tip of the great toe. Each thermistor or thermocouple shall have an accuracy of 0.1°C.

6.22.2.1.3 Test Procedure — A physician shall be present during the test. Before donning the suit system, each subject shall rest quietly in a room of temperature between 10 and 25°C for 15 min. The rectal temperature is then recorded as the initial rectal temperature. If the suit system is a dry suit system, the quantity of water determined in par. 6.22.1.1 shall then be added to the suit system. The subject dons and fully deploys the suit system as rapidly as possible without damaging the instrumentation, and immediately enters the water. The subject assumes a relaxed, floating position. No auxiliary means of buoyancy that is not part of the suit system may be used. The subject remains in the water, engaging in activity that maintains the heart rate between 50 and 140 beats per minute for the first hour, and 50 to 120 beats per minute thereafter, except that no attempt is made to control heart rate if the subject is shivering. Each temperature is recorded every 10 min. The test continues for 6 h from the time the subject first enters the water, unless it is terminated sooner.

6.22.2.1.4 Termination of Test — The test shall be terminated if

a. the physician determines that the subject should not continue;
b. the subject requests termination due to discomfort or illness;
c. the subject's rectal temperature drops more than 2°C below the initial rectal temperature, unless the physician determines that the subject may continue without danger; or
d. the subject's finger, toe or buttock temperature drops below 8°C for more than 15 min and never below 5°C.

6.22.3 ***Suit System Exterior Fabric Insulation*** — The thermal conductivity of the exterior fabric of the suit system shall be less than or equal to that of a control sample of 4.75 mm thick, closed-cell neoprene foam when submerged at a depth of 1 m and tested as described in par. 6.22.3.1.1. The control samples of neoprene foam shall have a thermal conductivity of not more than 0.050 W/(m·K) as determined by ASTM C 177-04 or C 518-04.

6.22.3.1 *Insulation Test*

6.22.3.1.1 Insulation — The suit system material shall be tested as follows except that if the suit system exterior fabric meets the requirements for the control sample in par. 6.22.3.1.2 c., the test procedure in par. 6.22.3.1.3 is not required.

6.22.3.1.2 Test Equipment — The following equipment is required for the test:

a. A sealed copper or aluminum can that has at least two parallel flat surfaces and contains at least 2 L of water and no air (see Figure 6).
b. A thermistor or thermocouple with an accuracy of ±0.1°C arranged to measure the temperature of the water inside the can.

c. A control sample consisting of two flat pieces of 4.75 mm thick, closed-cell neoprene foam of sufficient size to enclose the can between them. The control sample shall have a thermal conductivity of not more than 0.050 W/(m·K). The thermal conductivity of the control sample shall be determined in accordance with ASTM C 177-04 or C 518-04.

d. Two flat pieces of the suit system material of sufficient size to enclose the can between them. The surface covering, surface treatment, and number of layers of the material tested shall be the same as those of the material used in the suit system. If the material used in the suit system varies in thickness or number of layers, the material tested shall be representative of the portion of the exterior fabric of the suit system having the least thickness or number of layers.

e. A clamping arrangement to form a watertight seal around the edges of the pieces of material when the can is enclosed inside. A sealing compound may be used (see Figure 7).

f. A tank of water deep enough to hold the assembly of the can, material, and clamp arrangement at least 1 m below the surface of the water.

g. A means to control the temperature of the tank of water between 0 and 1°C.

h. A thermistor or thermocouple with an accuracy of ±0.1°C arranged to measure the temperature of the water in the can.

6.22.3.1.3 Test Procedure — The temperature of the water in the tank shall be between 0 and 1°C. The temperature of the water in the can shall be at 45°C. Hold the can under the water and clamp it between the two pieces of the neoprene foam control sample so that the assembly formed conforms as closely as possible to the shape of the can, and water fills all voids in the assembly. Submerge the entire assembly with the water temperature in the can at 45°C in the tank of water to a depth of 1 m at the highest point of the assembly. No part of the assembly shall touch the bottom or sides of the tank. Every 2 min, shake the assembly and then invert it from its previous position. Record the time for the water inside the can to drop from 45 to 33°C. Repeat this procedure three times using the suit system material instead of the neoprene control sample. The shortest time for the drop in water temperature when the suit system material is used shall be greater than or equal to the shortest time when the neoprene control sample is used.

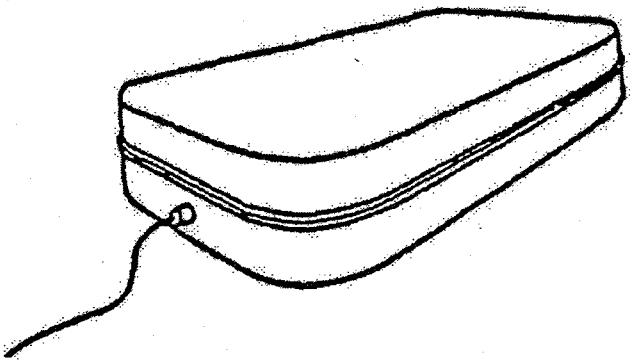

FIGURE 6

Water Can with Thermistor Lead

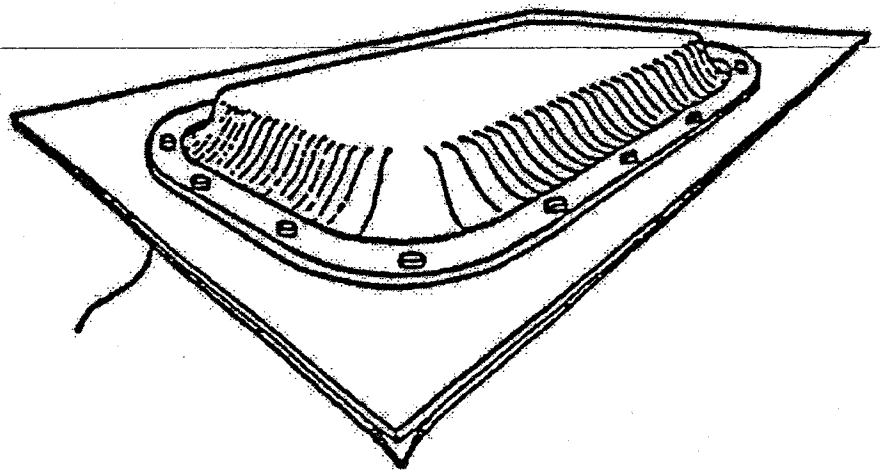

FIGURE 7

Insulation Test Assembly
(Assembly formed with water can, two pieces of material, and clamping device, with thermistor lead brought out of the assembly between the pieces of material.)

6.23 **Free Ends** — The excess length of any exterior belt or tie tape shall not exceed 100 mm when worn on a subject having a chest size at the lower limit of the indicated size range. Where the free end of an exterior belt or tie tape is sewn to form a loop, the loop shall not permit the passage of a rod 25 mm diameter.

6.24 **Buddy Line** — The suit system shall be equipped with a buddy line. It shall be stowed in such a way that it is easily visible and easily operable. The line shall not be less than 1 m and not more than 2 m in length when deployed. The line shall be attached to the suit system in such a way that if torn from the suit system, damage does not degrade the suit system's performance. The buddy line and attachments shall have a breaking strength greater than 400 N and less than 1340 N. The line shall have a snap hook attached at the free end to enable the wearer to connect to another wearer.

6.25 **Deck Safety Harness** — If a suit system incorporates a safety harness, it shall comply with the requirements of EN 1095:1998.

7. INSTRUCTIONS FOR USE

7.1 All instructions and marking shall be provided in English and French, primarily pictorial, with a minimum number of words. General information on the intended use of the suit system shall be readable at point of sale, including a description of the suit system, maintenance and cleaning instructions, instructions concerning the fitting and operation of a personal locator light, instructions of the operation of the inflatable element if any, and instruction on when and how to use it. The method of depicting proper donning procedures and other operational instructions on the use of the suit system shall be simple and obvious. The donning and wearing instructions shall be on the exterior of the storage container. These instructions shall also be available in a form suitable for mounting a bulkhead and insertion into the ship's training manual, where applicable.

7.2 The following information on the suit system shall be readable at point of sale:

a. The effectiveness of this suit system in preventing hypothermia and possibly death depends upon it fitting well enough to prevent the ingress of water;
b. Although the Universal size immersion suit system has been designed to fit the majority of individuals, the suit does not fit all body types equally well;
c. It is important that each person takes the initiative, where possible, to ensure the suit system they intend to wear in an emergency is of a proper size and watertight;

d. A description of the suit system;
e. Maintenance and cleaning instructions;
f. Instructions concerning the fitting and operation of a personal locator light; and
g. Instructions of the operation of the inflatable element if any and instructions on when and how to use it.

7.3 The method of depicting proper donning procedures and other operational instructions on the use of the suit system shall be simple and obvious. The donning and wearing instructions shall be on the exterior of the storage container. These instructions shall also be available in a form suitable for mounting a bulkhead and insertion into the ship's training manual, where applicable.

7.4 The manufacturer shall provide written instructions for the care and maintenance of the suit system. Any relevant information concerning the operation of the accessories specific to the suit system, and the operation of the personal locator light shall also be provided. Instructions on the operation of the inflatable buoyancy element, if any, shall be readable in the water in low-level illumination.

8. MARKING

8.1 Each suit system shall be marked or labelled legibly and permanently with the following information:

Name, logo, or trademark of the manufacturer
Category of immersion suit system
Model number
Date of manufacture
Size (for Marine Abandonment Immersion Suit Systems, mark in block letters not less than 25 mm high)
Size range (height and weight, or both)
Thermal protection as immersed clo value
Lot number
Serial number, if assigned
Statement of compliance: "This suit system complies with the requirements of CAN/CGSB-65.16-2005."

Note: Manufacturers should be aware that in Canada the Administration having jurisdiction, Department of Transport, requires that the approval number on immersion suit systems be clearly marked with approval information, including the Administration that approved it and any operational restrictions.

8.2 The size markings for the child size suit system and storage container, if any, shall include

a. the statement "CHILD (PERSON UNDER 40 kg)"; and
b. a child pictogram conforming to that of IMO Resolution A.760(18). The pictogram (see Figure 8) shall be a minimum of 38 mm high.

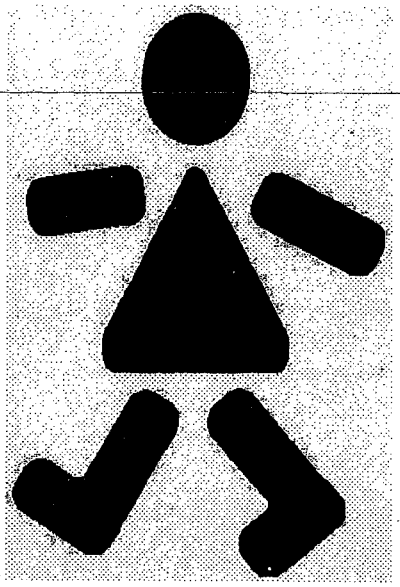

FIGURE 8

Child Pictogram

8.3 **Logos, Appliqués and Lettering** — Markings may be stitched, silk-screened, heat-sealed, or adhered to the exterior fabric such that they do not

a. affect the integrity of the device;
b. affect the visibility or readability of the required markings; and
c. provide any information contradicting the required markings.

8.4 Each storage container, where applicable, shall be marked with the following information:

a. The words "IMMERSION SUIT"
b. Size range
c. Donning instructions

8.5 Any suit, as well as its stowage bag or container, that is intended for constant wear only, or any marine abandonment suit that is sized other than "Universal," shall be conspicuous and permanently marked with the following words in characters at least 10 mm high.

WARNING

THIS SUIT HAS A LIMITED SIZE RANGE AND IS NOT SUITABLE FOR UNCONTROLLED EMERGENCY DISTRIBUTION

9. NOTES

9.1 **Sources of Referenced Publications**
The following addresses were valid at the date of publication.

9.1.1 The publications referred to in par. 2.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone (819) 956-0425 or 1-800-665-2472. Fax (819) 956-5644. E-mail ncr.cgsb-ongc@pwgsc.gc.ca. Web site www.ongc-cgsb.gc.ca.

9.1.2 The publications referred to in par. 2.1.2 may be obtained from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, U.S.A. or from IHS Canada, 1 Antares Drive, Suite 200, Ottawa, Ontario K2E 8C4, telephone (613) 237-4250 or 1-800-267-8220, fax (613) 237-4251, Web site www.global.ihs.com.

9.1.3 The publication referred to in par. 2.1.3 may be obtained from IHS Canada, 1 Antares Drive, Suite 200, Ottawa, Ontario K2E 8C4. Telephone (613) 237-4250 or 1-800-267-8220. Fax (613) 237-4251. Web site www.global.ihs.com.

9.1.4 The publications referred to in par. 2.1.4 may be obtained from the International Maritime Organization (IMO) Publications Section, 4 Albert Embankment, London SE1 7SR, United Kingdom. Web site www.imo.org.

9.1.5 The publications referred to in par. 2.1.5 may be obtained from Comm 2000, 1414 Brook Drive, Downers Grove, IL 60515, telephone (415) 352-2168, fax 1-888-853-3512, Web site www.comm-2000.com or from IHS Canada, 1 Antares Drive, Suite 200, Ottawa, Ontario K2E 8C4, telephone (613) 237-4250 or 1-800-267-8220, fax (613) 237-4251, Web site www.global.ihs.com.

Topic 2: Survival Suits

2.2

CGSB ONGC

Canadian
General
Standards
Board

CAN/CGSB-65.17-99

Supersedes CAN/CGSB-65.17-M88

Helicopter Passenger Transportation Suit Systems

National Standard of Canada

Canada

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NATIONAL STANDARD OF CANADA

CAN/CGSB-65.17-99

Supersedes CAN/CGSB-65.17-M88

HELICOPTER PASSENGER TRANSPORTATION SUIT SYSTEMS

Prepared by the
Canadian General Standards Board CGSB

Approved by the
Standards Council of Canada

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Higginbotham, P.		Mustang Survival Corp.
Ireland, R.		Helicopter Survival Rescue Services Inc.
Kent, D.		Protexion Products Inc.
Khouzam, M.		Transport Canada
Little, R.S.		Canadian Asssociation of Petroleum Producers
Lugar, J.		Seafood Producers Association of Nova Scotia
Marchand, L.		Canadian Coast Guard/Fisheries and Oceans
Mitton, M.T.		Consultant
Neaves, D.R.		Helly-Hansen (Canada) Ltd.
Noel, P.		Canada-Newfoundland Offshore Petroleum Board
Paquette, R.A.		Transport Canada
Potter, P.		The Cord Group Ltd.
Roberts, C.		Small Fishing Vessels Safety Committee
Schmidt, R.		Rubatex Corporation
Scratch, D.		Canada-Nova Scotia Offshore Petroleum Board
Sellers, Capt T.		Atlantic Pilotage Authority
Sickler, R.		Stearns Inc.
Sine, P.		Fitzwright Company Ltd.
Therrien, E.		Canada Safety Council
Trites, D.		Associated Marine Equipment Ltd.
Westley, C.		United Food and Commercial Workers Union Local 864
White, F.		Whites Manufacturing Ltd.
Wright, G.R.		Ergonomics Plus Inc.
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CANADIAN GENERAL STANDARDS BOARD

HELICOPTER PASSENGER TRANSPORTATION SUIT SYSTEMS

TABLE OF CONTENTS

		Page
FOREWORD		1
1.	SCOPE	1
2.	REFERENCED PUBLICATIONS	1
3.	DEFINITIONS	2
4.	CLASSIFICATION	2
5.	GENERAL REQUIREMENTS	2
6.	DETAILED REQUIREMENTS	3
6.1	**Construction Details**	3
6.1.1	*Body Strength*	3
6.1.2	*Seam Integrity*	3
6.1.3	*Water Penetration (Fabric)*	3
6.1.4	*Closures and Seals*	3
6.1.5	*Additional Fittings*	3
6.1.6	*Colour of Suit System Exterior*	3
6.1.7	*Hand and Arm Construction*	3
6.1.8	*Leg Construction*	4
6.1.9	*Wearer Vision and Mobility*	4
6.1.10	*Retroreflective Material*	4
6.1.11	*Breaking Strength*	4
6.1.12	*Tearing Strength*	4
6.1.13	*Abrasion Resistance*	4
6.1.14	*Vertical Positioning*	4
6.1.15	*Buddy Line*	5
6.1.16	*Personal Locator Light*	5
6.1.17	*Personal Whistle*	5
6.2	**Performance Requirements**	5
6.2.1	*Maximum Escape Buoyancy*	5
6.2.2	*Minimum Flotation Buoyancy*	5
6.2.3	*Floating Characteristics*	5
6.2.4	*Righting*	5
6.2.5	*Thermal Protection*	5
6.2.6	*Flame Resistance*	6
6.2.7	*Temperature Cycling (Storage)*	6
6.2.8	*Oil Resistance*	6
7.	INSTRUCTIONS FOR USE	6
8.	DESIGN APPROVAL — TESTING	6
8.1	**Approval Testing of Suit Systems**	6
8.1.1	*General*	6
8.1.2	*Test Samples*	6
8.1.3	*Wearer Vision, Mobility and Flotation Tests*	7
8.1.4	*Vertical Positioning*	11

TABLE OF CONTENTS — *(Continued)*

		Page
8.1.5	*Buoyancy*	12
8.1.6	*Thermal Protection Using a Thermal Manikin*	17
8.1.7	*Thermal Protection Using Human Subjects*	19
8.1.8	*Body Strength*	19
8.1.9	*Buddy Line*	20
8.1.10	*Corrosion Resistance*	20
8.1.11	*Flame Exposure*	20
8.1.12	*Temperature Cycling (Storage)*	21
8.1.13	*Water Penetration*	21
8.1.14	*Oil Resistance*	21
8.2	**Test Report**	21
9.	**MARKING**	21
10.	**NOTES**	22
10.1	**Related Publications**	22
10.2	**Sources of Referenced Publications**	22
APPENDIX A — SUIT SYSTEM EXTERIOR FABRIC GUIDELINES FOR INSULATION		A1
A1.	**REQUIREMENTS**	A1
A2.	**TEST METHOD**	A1
A2.1	**Insulation**	A1
A2.2	**Test Equipment**	A1
A2.3	**Test Procedure**	A1
APPENDIX B — WATERPROOF ZIPPER REQUIREMENTS AND TEST METHODS		B1
B1.	**SAMPLE REQUIREMENTS**	B1
B2.	**PREPARATION OF SAMPLES**	B1
B3.	**TEST METHODS AND REQUIREMENTS**	B1
B3.1	**Opening and Closing Force Tests**	B1
B3.2	**Point Breaking Strength Test**	B1
B3.3	**Diagonal Pull Test**	B2
B3.4	**Leakage Resistance Test**	B2

CANADIAN GENERAL STANDARDS BOARD

HELICOPTER PASSENGER TRANSPORTATION SUIT SYSTEMS

FOREWORD

CAN/CGSB-65.16 *Marine Abandonment Immersion Suit Systems* and CAN/CGSB-65.17 *Helicopter Passenger Transportation Suit Systems* provide the potential for dual-role approval of immersion suit systems in certain use situations.

1. SCOPE

1.1 This standard applies to immersion suit systems that:

— reduce thermal shock upon entry into cold water;

— delay the onset of hypothermia during immersion in cold water;

— provide acceptable flotation and minimize the risk of drowning;

and

— do not impair the wearer's ability to evacuate from a ditched helicopter.

1.2 The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements prior to its use.

1.3 Appendix A includes guidelines for insulation of the suit exterior fabric.

1.4 Appendix B includes the requirements and test procedures for waterproof zippers.

2. REFERENCED PUBLICATIONS

2.1 The following publications are referenced in this standard:

2.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2 — Textile Test Methods:

No. 9.2 — Breaking Strength of Fabrics — Grab Method (Constant time-to-break Principle)

No. 12.1 — Tearing Strength — Single-Rip Method

No. 26.1 — Water Resistance — Static Head Penetration Test

No. 32.2 — Breaking Strength of Seams in Woven Fabrics

62-GP-12 — Marking Material, Retroreflective, Enclosed Lens, Flexible Type.

2.1.2 American Society for Testing and Materials (ASTM)

B 21M — Standard Specification for Naval Brass Rod, Bar, and Shapes (Metric)

B 117 — Standard Practice for Operating Salt Spray (Fog) Apparatus

C 177 — Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate-Apparatus

C 518 — Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

D 2062 — Standard Test Methods for Operability of Zippers

279 D 3886 — Standard Test Method for Abrasion Resistance of Textile Fabrics (Inflated Diaphragm Method).

2.1.3 Shoe and Allied Trade Research Association (SATRA)

PM 34 — Resistance to Water Penetration — Maeser Test.

2.1.4 Underwriters Laboratories Inc. (UL)

UL 1191 — Components for Personal Flotation Devices.

2.1.5 U.S. Department of Transportation, Federal Aviation Administration

Technical Standard Order (TSO) C 13 Life Preservers

Technical Standard Order (TSO) C 85 Survivor Locator Lights.

2.2 A reference to a regulation is always to the latest issue. A dated reference is to the issue specified. An undated reference is to the latest issue unless otherwise specified by the authority applying this method. The sources are given in the Notes section.

3. DEFINITIONS

3.1 The following definitions apply in this standard:

Escape Buoyancy (Flottabilité (avant gonflement))
The total buoyancy of the system on the wearer, including the inherent buoyancy of the components and entrapped air, but without the inflatable buoyancy element deployed.

Exterior Fabric (Tissu extérieur)
For the purpose of this standard this refers to the principal outer fabric of the suit, either in the form of a single or composite fabric. Where relevant, i.e., abrasion, water penetration, tests refer to the outer surfaces of the fabric.

Flotation Buoyancy (Flottabilité (après gonflement))
The total buoyancy available to the wearer from all elements of the suit system, excluding entrapped air.

Helicopter Passenger Transportation Suit System (Combinaison pour passager d'hélicoptère)
A suit that is designed to reduce the loss of body heat of a person immersed in cold water and to provide buoyancy and flotation as specified by this standard.

Immersed Clo (Clo en état d'immersion)
The insulation measurement taken when a suit is subjected to the effect of hydrostatic compression is called an immersed clo value. One clo equals $0.155°C \cdot m^2 \cdot W^{-1}$.

Inflatable Buoyancy Element (Élément de flottaison gonflable)
An auxiliary buoyancy element that requires gas inflation as a means of buoyancy.

Test Clothing (Vêtement d'essai)
A long-sleeved cotton shirt, denim trousers, underwear (briefs) and medium-weight dress socks for wear by the subject and by the manikin during the testing procedures.

4. CLASSIFICATION

4.1 Suit system sizes shall be classified by the maximum girth and height of the intended wearer.

4.2 This standard also allows for suits to be sized to individual wearers.

5. GENERAL REQUIREMENTS

5.1 The buoyancy shall not be provided by loose or granular materials.

5.2 The suit system shall be designed so that when fully donned, it covers the entire body, except that the face may be exposed.

5.3 The exterior fabric shall be resistant to puncture, tearing and abrasion. All other fabrics shall be tested for durability.

5.4 The suit system shall not be adversely affected by sea water, perspiration and petroleum products.

5.5 The suit system shall be resistant to rot, corrosion and sunlight.

5.6 The suit system shall be designed to minimize snagging during emergency egress from a ditched helicopter or when boarding a life raft.

5.7 The suit system closures shall be capable of being easily secured.

6. DETAILED REQUIREMENTS

6.1 Construction Details

6.1.1 ***Body Strength*** — The suit system shall be designed and constructed so that it is not damaged when tested for impact (par. 8.1.3.9), durability (par. 8.1.3.10) and body strength (par. 8.1.8). When tested for impact and durability, the suit system must not tear, separate at any seam or sustain any damage that would render it unsafe to use. When tested for body strength no part of the suit may tear or break. The suit system shall not be damaged in any way that would allow water to enter (dry suit system only) or that would affect the performance of the suit.

6.1.2 ***Seam Integrity*** — If the suit system is not a dry suit concept, par. 6.1.2.2 does not apply.

6.1.2.1 *Seam Strength* — With the exception of the inflatable buoyancy element (par. 6.2.2.2), each different type of seam in the exterior fabric of the suit system shall have a minimum seam strength of 300 N when tested in accordance with CAN/CGSB-4.2 No. 32.2.

6.1.2.2 *Water Penetration (Seams)* — When tested in accordance with par. 8.1.13, each different type of seam in the exterior fabric of the suit system shall not exhibit leakage before 8000 cycles. Seams that are not crucial to the water integrity of the suit system shall be excluded.

6.1.3 ***Water Penetration (Fabric)*** — When tested in accordance with par. 8.1.13, the exterior fabric(dry suit system only) shall not exhibit leakage before 10 000 cycles.

6.1.4 ***Closures and Seals*** — Each closure, seal and zipper shall be durable and constructed to be donned with ease and secured while fulfilling all other requirements specified in this standard. If the suit system (dry suit system only) comprises elements that may be detached by the wearer, the general water integrity of the suit system shall be maintained when any such element is detached.

6.1.4.1 *Zippers* — The zippers shall be capable of being operated with gloved hands. The zippers for the dry suit system shall be tested in accordance with the test procedures in Appendix B and shall meet the requirements also specified in Appendix B.

6.1.5 ***Additional Fittings*** — The size and design of additional suit fittings and their attachment to the suit system shall allow easy use of the fittings. The fittings shall be attached in such a way that they are visually and physically accessible and operable. They shall not attain a position that either degrades the function of the fittings or reduces the wearer's ability to escape or survive.

6.1.5.1 *Corrosion Resistance of Metal Parts* — Each metal part of the suit system shall be:

a. fabricated from either naval brass in accordance with ASTM B 21M, or metal having equivalent or superior corrosion characteristics when tested for corrosion resistance as described in par. 8.1.10; and

b. compatible galvanically with any other metals with which it may be in contact.

6.1.6 ***Colour of Suit System Exterior*** — The primary colour of the exterior surface of the suit system shall be an international orange/yellow or an equivalent high visibility colour acceptable to the approval authority.

6.1.7 ***Hand and Arm Construction*** — Gloves or mittens may be either integral with the suit system or removable and attached to the suit system. Under both circumstances, the wearer shall retain sufficient dexterity to pass the tests described in par. 8.1.3.5 and the wearer's escape or survival ability shall not be hindered or reduced. If the hand is exposible, the watertight integrity of the suit system (dry suit system only) shall be maintained.

6.1.8 $_{281}$ ***Leg Construction*** — The suit system shall have the following leg construction:

a. A foot with a hard sole or enough room for a work shoe to be worn inside. The sole area of the foot shall be natural or synthetic rubber that is ribbed or embossed for skid resistance. The sole shall prevent the wearer from slipping when the suit system is tested as described in par. 8.1.3.4.

b. The suit system shall be designed so that when the subject enters the water head first, the suit system shall not prevent the subject from attaining a head-up floating position within a period of not more than 5 s when tested as described in par. 8.1.3.11. This may include the use of leg straps but will not allow the use of neoprene flap valves. All subjects must pass this test. The suit system shall be considered acceptable if all subjects are able to perform both tasks.

6.1.9 ***Wearer Vision and Mobility*** — The suit system shall be capable of being worn over test clothing and shall not restrict the wearer's vision or mobility as described below.

6.1.9.1 *Field of Vision* — Two requirements are necessary for establishing a field of vision. One requirement is to determine the field of vision on land with the subject wearing a suit system in a seated position with the inflatable buoyancy element uninflated. The other requirement is to determine the field of vision in the water with the suit system on, inflatable buoyancy element fully inflated and the subject in a relaxed floating position. The field of vision on land and in the water shall be tested as described in par. 8.1.3.3. All subjects must pass these tests. The suit system shall be considered acceptable if all subjects are able to perform both tasks.

a. Field of Vision on Land — With the subject in a seated position, head perpendicular to the shoulder plane, with the suit system fully secured and the inflatable buoyancy element uninflated, the average single field of lateral vision must be at least 120°. With the subject's head rotated 30° to the left of the perpendicular of the shoulder plane and then 30° to the right, the average single field of lateral vision must also be at least 120°.

b. Field of Vision in the Water — With the subject floating in a relaxed position in the water with suit system fully secured and the inflatable buoyancy element fully inflated, the subject's field of vision shall be:

i. lateral, unrestricted 120° arc of vision from left to right, water level to water level

ii. vertical, forward through an arc of 60° and backwards through an arc of 15°

iii. horizontal, an arc of 30° starting at right angles to the body and sweeping down towards the feet, parallel to the water surface.

6.1.9.2 *Mobility and Hand Dexterity* — The suit system size and design shall not unduly restrict the wearer's mobility and dexterity as judged by the tests in par. 8.1.3.5.

6.1.10 ***Retroreflective Material*** — Retroreflective material, meeting the requirements of CGSB standard 62-GP-12, shall be placed on the suit system so that at least 200 cm^2 is visible above the water level when tested as described in par. 8.1.3.6, of which at least 100 cm^2 shall be on the hood. In addition, a 5 cm wide band of retroreflective material shall be placed around each forearm of the suit system.

6.1.11 ***Breaking Strength*** — With the exception of the inflatable buoyancy element (par. 6.2.2.2), the principal exterior fabric shall have a minimum breaking strength of 300 N when tested in accordance with CAN/CGSB-4.2 No. 9.2.

6.1.12 ***Tearing Strength*** — With the exception of the inflatable buoyancy element (par. 6.2.2.2), the principal exterior fabric shall have a minimum tearing strength of 25 N when tested in accordance with CAN/CGSB-4.2 No. 12.1.

6.1.13 ***Abrasion Resistance*** — When tested in accordance with ASTM D 3886, the minimum number of cycles to hole formation on the outer surface of the principal exterior fabric (hole formation on the first layer of a composite fabric) shall be 500 cycles.

6.1.14 ***Vertical Positioning*** — Each subject shall be able to attain a vertical position while wearing the suit system when tested in accordance with par. 8.1.4.

6.1.15 ***Buddy Line*** — The suit system shall be equipped with a buddy line which shall be stowed in such a way that it is visually and physically accessible and operable. The line shall not be less than 1 m and not more than 2 m in length when deployed. The line shall be attached to the suit system in such a way that, if torn from the system, damage does not degrade the suit system's performance. When the buddy line system is attached to the system, it shall have a minimum breaking strength of 1350 N.

6.1.16 ***Personal Locator Light*** — Each suit system shall be fitted with a personal locator light meeting the minimum standard of TSO-C 85.

6.1.17 ***Personal Whistle*** — Each suit system shall be fitted with a whistle acceptable to the approval authority. The whistle shall be located in such a way that it is visually and physically accessible and operational by the wearer when in the water with the inflatable buoyancy element inflated.

6.2 **Performance Requirements**

6.2.1 ***Maximum Escape Buoyancy*** — The maximum escape buoyancy of the suit system as determined by testing procedures outlined in par. 8.1.5.1 shall not be more than 175 N.

6.2.2 ***Minimum Flotation Buoyancy***

6.2.2.1 The minimum flotation buoyancy of the suit system shall not be less than 156 N when tested in accordance with par. 8.1.5.2.

6.2.2.2 The inflatable buoyancy element shall be capable of inflation by mechanical means requiring a single deliberate action by the wearer to initiate inflation. It shall also be equipped with a means of oral inflation. The materials and components from which the inflatable buoyancy element is constructed shall meet the requirements of TSO-C 13 unless otherwise stated.

6.2.2.3 The design and construction of the inflatable buoyancy element shall be such that the following performance requirements are achieved:

a. Required for approval only:

Burst Pressure — The cell shall burst at a pressure not less than six times the design working pressure or a gauge pressure of 69 kPa when tested in accordance with par. 8.1.5.2 a.

b. Required for approval and for every produced item:

Proof Pressure — No damage to the unit shall be evident when tested in accordance with par. 8.1.5.2 b.

Leak Test — The pressure shall not be less than 75% of the initial test pressure when tested in accordance with par. 8.1.5.2 b.

6.2.3 ***Floating Characteristics*** — When tested as described in par. 8.1.3.7, the suit system shall provide a stable floating position, with a face plane angle between 30 and 80° to the horizontal, in which the subject is face-up with the mouth and nose at least 120 mm above the surface of the water. This shall be achieved for at least eight out of the eleven subjects.

6.2.4 ***Righting*** — The suit system shall turn the wearer from a face-down position to a face-up position within 5 s or allow the wearer without assistance to turn himself or herself from a face-down position to a face-up position within 5 s. If a suit system has auxiliary buoyancy, the suit system shall be designed to meet these requirements when the auxiliary means of buoyancy is used as well as when it is not used. The righting tests are carried out as described in par. 8.1.3.8.

6.2.5 ***Thermal Protection*** — Two options for measuring thermal protection are given. For dry suit systems, the leak tests as described in par. 8.1.6.1 shall be conducted to determine the amount of water that will be introduced into the suit system for the thermal tests.

6.2.5.1 *Using Thermal Manikin* — When tested in accordance with par. 8.1.6.2, the mean level of thermal insulation over the body as provided by the suit system which includes test clothing (described in Section 3) must not be less than 0.116°C·m²·W⁻¹ (0.75 immersed Clo). Using this test method, the hands shall have a minimum thermal protection value of 0.6 K·m²·W⁻¹ (0.5 immersed Clo).

6.2.5.2 *Using Human Subjects* — The suit system shall provide thermal protection such that the average body core (rectal) temperature of persons wearing the suit system for 6 h in calm circulating water that is between 0 and 2°C shall not drop more than 2°C and the finger, toe or buttock temperature of the wearers shall never drop below 5°C, and never below 8°C, for more than 15 min for an entire immersion. Providing the suit system protecting the hands and feet (i. e., gloves and sockets) meets a minimum requirements of 0.5 immersed Clo, it is permissible for the test house to provide additional insulation to the hands and feet, to prevent the occurrence of none-freezing cold injury in the test subjects through hand and foot temperature reductions below these limits. The clo value of gloves can be measured according to the test method in Appendix A.

6.2.6 ***Flame Resistance*** — The suit system shall be designed to be useable after 2 s contact with a gasoline fire, when tested as described in par. 8.1.11.

6.2.7 ***Temperature Cycling (Storage)*** — The suit system shall not be damaged by storage at any temperature between –40 and 65°C, when tested as described in par. 8.1.12.

6.2.8 ***Oil Resistance*** — When tested in accordance with par. 8.1.14, the samples shall not exhibit any damage such as cracking, swelling, dissolution, or change in mechanical properties, and the seams shall have a breaking strength of not less than 150 N. As well, the samples of the exterior material and seams of dry suit system shall not exhibit any leakage.

7. INSTRUCTIONS FOR USE

7.1 The suit system shall have written or pictorial instructions for its donning and use. However, instructions for the use of the inflatable buoyancy element shall be primarily pictorial with a minimum use of words. The proper donning procedure and other operational instructions on the use of the suit shall be simple and obvious. If written instructions are provided, they shall be in both official languages.

7.2 These instructions shall be readily available to the wearer in the helicopter.

7.3 Instructions on the operation of the inflatable buoyancy element shall be readable in the water in low level illumination.

7.4 The manufacturer shall provide written instructions for the care and maintenance of the suit system and any relevant information concerning the operation of accessories specific to the suit system.

8. DESIGN APPROVAL — TESTING

8.1 Approval Testing of Suit Systems

CAUTION: During each of the in-water tests prescribed in this section, a person ready to render assistance when needed should be near each subject in the water.

8.1.1 ***General*** — Each suit system shall be tested for design approval as described in this section.

8.1.1.1 *Test Anomalies* — Throughout the testing program, certain results may vary significantly from the collected data set. Such results must be recognized and validated by the testing agency. Where this variation is determined to be a suit system design/performance factor, the results shall remain as part of the data set. Where this variation is determined to be an anomaly caused by test subject activities which are outside the scope of the specific test objective, the test may be repeated or the results deleted from the data set. This decision must be made in consultation and agreement with a representative of the approval authority.

8.1.2 ***Test Samples*** — Each test prescribed in this section shall be performed using as many samples of the suit system as are needed to make an efficient use of the test subjects and test equipment, except that in the Impact Test in par. 8.1.3.9, an individual subject shall use the same suit system for the entire test. If the exterior fabric is a composite fabric, it shall be tested as a composite fabric unless otherwise stated.

8.1.3 ***Wearer Vision, Mobility and Flotation Tests*** — The wearer vision, mobility and flotation capabilities of each suit system shall be tested under the following conditions and procedures:

8.1.3.1 *Test Subjects* — The subjects used in the tests shall be seven males and four females selected to represent the approximate percentile range of heights for the ninety-fifth to the fifth percentiles for both males and females. The test subject selection criteria will be as follows:

Gender	Body height cm	Body mass kg	Number of subjects
Males	184 or greater	90 or greater	2
	170 to 176	68 to 78	3
	162 or less	55 or less	2
Females	170 or greater	65 or greater	2
	157 to 163	52 to 62	1
	150 or less	48 or less	1

8.1.3.2 *Donning Time* — Each subject is removed from the view of the other subjects and allowed time to examine the suit system and the manufacturer's instructions for donning and using the suit system. At the end of this period, the subject shall attempt to don the suit system as rapidly as possible without the aid of a chair or any support to lean on; however, the subject may sit on the floor. If the subject does not don the suit system completely, including gloves or mittens and any other accessories as necessary to achieve the thermal protection (par. 6.2.5), within 2 min, the subject removes the suit system, examines the instructions for 1 min and again attempts to don the suit system. At least ten of the eleven subjects shall be able to don the suit system completely within 2 min in at least one of the two attempts. Inflation of the buoyancy element is not required.

8.1.3.3 *Field of Vision* — The suit system's field of vision shall be tested as follows:

a. Field of Vision on Land — Each subject not wearing a suit system shall be seated with the chin resting firmly on a support and shall look straight ahead. A person carrying a lighted flashlight pointed at the subject's head, shall stand behind the seated subject and walk clockwise and then counterclockwise around the circumference of a circle of which the seated subject's head is at the centre and whose radius is 5 m. It shall be established from the results of carrying out this test that the seated subject, moving the eyes, if necessary, can observe the lighted flashlight on each side at an angle of at least 60° from the perpendicular of the shoulder plane.

   The test shall then be repeated with each subject having fully donned the suit system with the inflatable buoyancy element uninflated for each of the following positions:

   i. head perpendicular to the shoulder plane

   ii. head rotated 30° to the left of the perpendicular of the shoulder plane

   iii. head rotated 30° to the right of the perpendicular of the shoulder plane.

b. Field of Vision in the Water — The field of vision shall be measured in the lateral, vertical and horizontal planes with the suit system fully donned and inflatable buoyancy element fully inflated. The Bohemier Perimeter Scope (Figure 1) or equivalent shall be used to measure field of vision. This device has studs to stabilize the subject's head and a 2 cm plastic pipe bent into a semi-circle measuring 2 m in diameter. Marks are placed on the ring at 15 cm intervals using a selection of coloured tapes. Measure the field of vision of each person in the normal flotation angle with head fixed and eyes allowed to move, in the lateral (Figure 2a), horizontal (Figure 2b) and vertical (Figure 2c) planes.

285

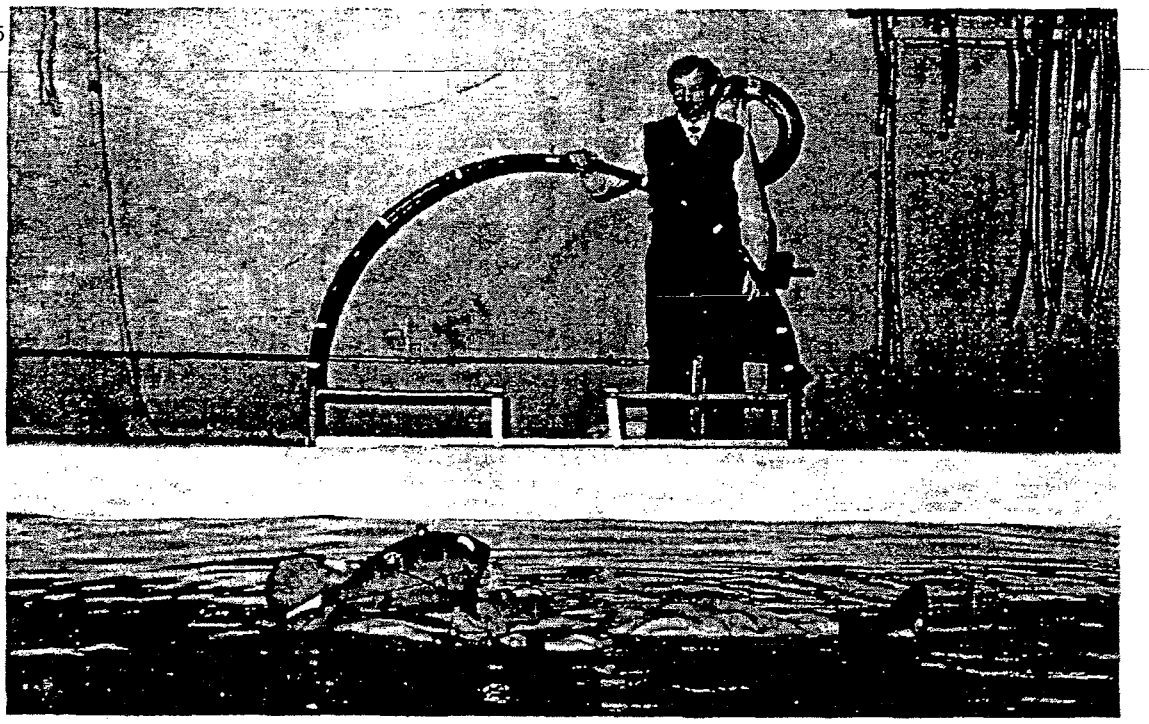


FIGURE 1
Bohemier Perimeter Scope

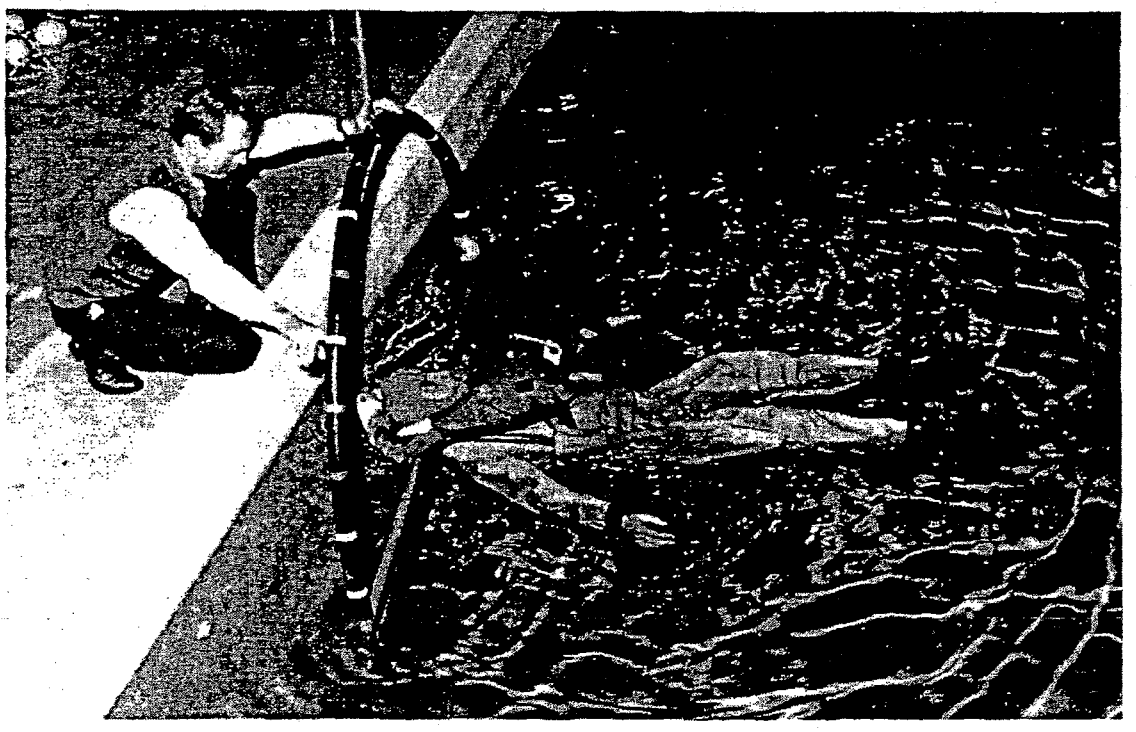


FIGURE 2a
Field of Vision in the Water — Lateral Plane

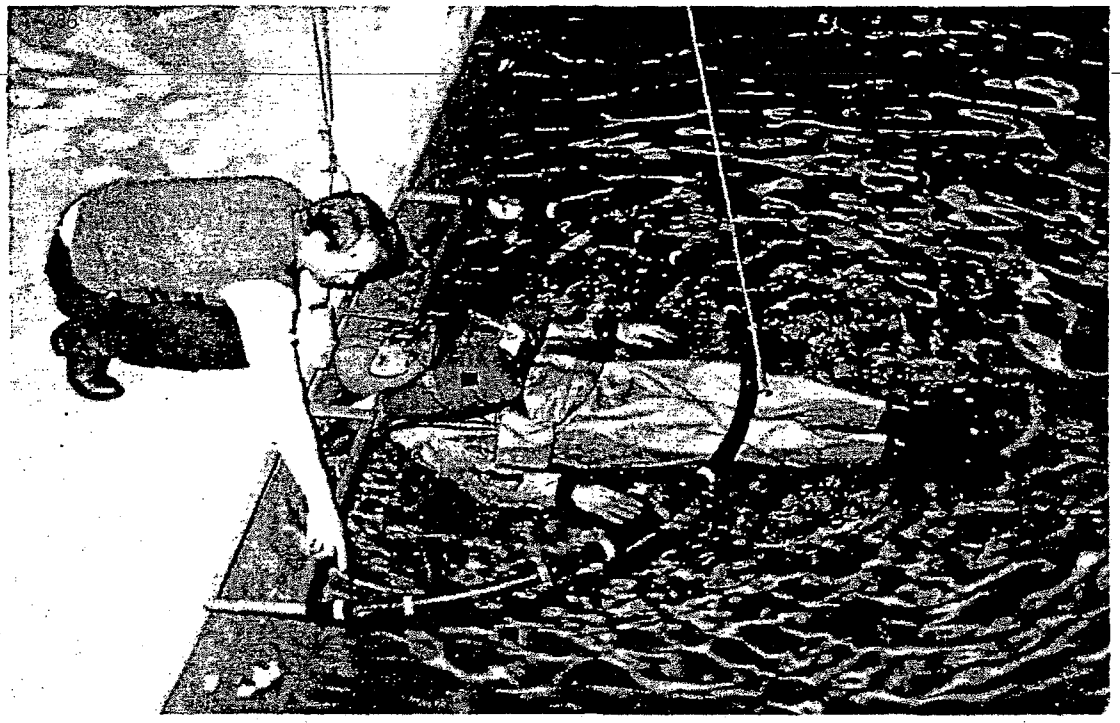
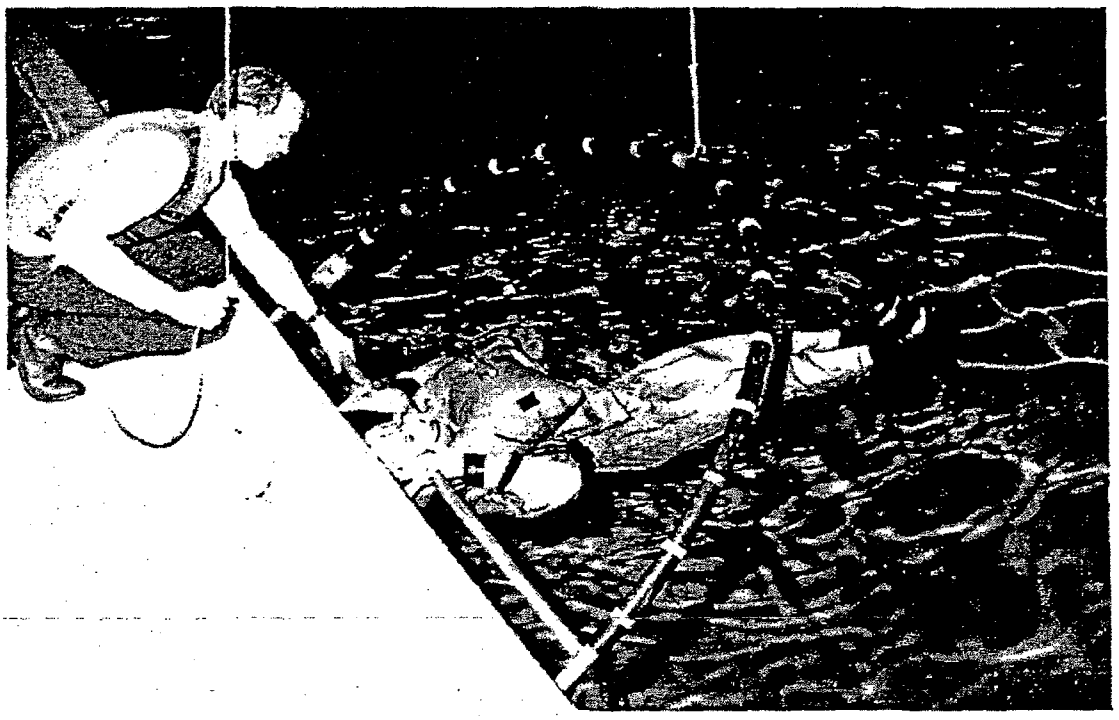


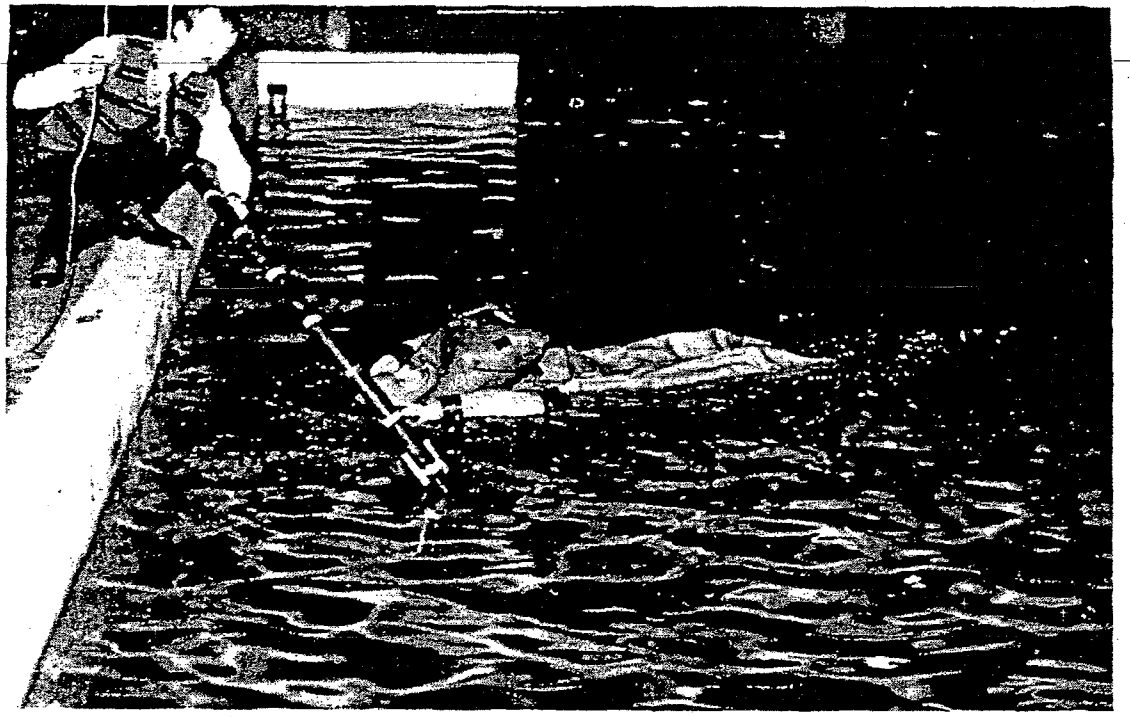
FIGURE 2b
Field of Vision in the Water — Horizontal Plane



(i) Forward

FIGURE 2c
Field of Vision in the Water — Vertical Plane

287



(ii) Backwards

FIGURE 2c
Field of Vision in the Water — Vertical Plane

8.1.3.4 *Skid Resistance* — Each subject, wearing only the test clothing and rubber-soled footwear, shall walk a distance of 30 m on a smooth wet surface such as tile or painted concrete. The smooth wet surface shall be 23 ± 5°C. There shall be at least one turn of at least 90° in the 30 m course. This distance shall be walked twice and the times recorded. The walk is repeated with the suit system fully donned. The average time while wearing the fully donned suit system must not exceed by more than 25% the average time when not wearing the suit system. Rest periods between each transit of the course are permitted.

8.1.3.5 *Mobility and Hand Dexterity* — This is assessed in four parts, (a. to d.) if the suit system has a detachable hood and/or gloves; and three parts, (a. to c.) if the suit system lacks one or both of these detachable components.

a. A vertical ladder, with rungs 300 mm apart, extending a suitable distance above a level floor shall be used for the first part of this test. Each subject while not wearing the suit system is timed twice climbing the ladder so the feet are at a height of 3 m above the floor. (The subject shall climb the ladder quickly but without jeopardising safety.) The subject shall then don the suit system and is again timed twice climbing to the same height. The subject is given adequate rest periods between trials to avoid fatigue. The average time for each subject to climb the ladder wearing the suit system must not exceed the subject's average time to climb the ladder without the suit by more than 25%.

b. The life raft used for this test shall be a non-reversible dual chamber, Department of Transport-approved ten to fourteen-person capacity life raft with a boarding ladder which is free-floating on the water. Following a brief, simple demonstration on how to right a life raft, the subjects shall be able to right and climb into the life raft. Each subject shall enter the water at a temperature of not less than 18°C, without the suit system, but with a SOLAS-approved life jacket donned, and swim or tread water for approximately 2 min. The subject shall then be able to right the life raft and climb into it via the boarding ladder with no other boarding aids in a maximum of 3 min. Only subjects that qualify from this task shall be used in the subsequent test. A minimum of eight subjects must qualify for this test.

The test is then repeated with the qualifying subjects as follows:

The subject shall enter the water with the suit system fully secured and deploy the inflatable buoyancy element. The subject may adjust the suit system. The subject is then required to right an inverted life raft and climb into

288 the life raft via the boarding ladder, with no other boarding aids. The suit system shall be considered acceptable if the task is performed by each subject in less than 6 min.

c. Once in the life raft, the subject, with the gloves on, is required to cut a painter using a standard raft knife. The subject shall unroll five turns of 2 cm black plastic insulating tape from a 4 cm wood dowel to simulate preparing a hand flare for use. The first 2 cm of tape shall be folded back on itself to form a 1 cm starter tab, simulating a tab on a hand flare.

d. Where a suit system has a detachable hood and/or gloves, the subject, while floating in the water, shall be able to don both in less than 3 min.

8.1.3.6 *Retroreflective Material* — The inflatable buoyancy element shall be fully inflated for this test. Measure the area of the exposed retroreflective material on the suit system prior to entering the water and above the water level during the flotation characteristics test described in par. 8.1.3.7.

8.1.3.7 *Stability and Floating Characteristics* — Each subject, while wearing a suit system, shall enter the water gently, activate the inflatable buoyancy element and adopt a face-up position with the legs together and the arms at the sides. After a period of 5 min it shall be established that the subject is stable in that position by depressing each shoulder in turn to ensure that the subject returns to the face-up position and does not invert.

With the subject in a relaxed position, measure the freeboard to the mouth and nose, perpendicularly from the surface of the water.

Measure the angle, relative to the surface of the water, of the plane formed by the most forward part of the forehead and chin of the subject floating in the attitude of static balance in which respiration is least likely to be impeded. For each subject determine the stable position and the face plane angle.

8.1.3.8 *Righting* — Each subject, while wearing the suit system in the water fully secured and the inflatable buoyancy element fully inflated, takes a deep breath, assumes a face-down position, allows the body to become limp, and slowly expels air. The suit system shall cause the subject to turn face up within 5 s; or if the suit system does not turn the subject within 5 s, the subject shall be able to turn face up under his/her own power within an additional 5 s. The procedure is repeated using the auxiliary means of buoyancy if one is provided.

8.1.3.9 *Impact* — While wearing the suit system with the inflatable buoyancy element uninflated, each subject shall jump feet first into the water three times from a minimum height of 3 m above the water surface. Then, with the inflatable buoyancy element inflated, each subject shall repeat the same jump three times from the same height while holding the buoyancy element in accordance with the manufacturers' instructions. Each subject shall be able to assume a face-up stable position without assistance after each jump.

8.1.3.10 *Durability* — One suit system shall be fully donned and doffed six times prior to testing in accordance with par. 8.1.6.

8.1.3.11 *Head First Entry* — The subject, while wearing the suit system, shall enter the water head first from a height of 1 m above the water surface and shall attain a head-up floating position within 5 s of entry into the water.

8.1.4 ***Vertical Positioning***

8.1.4.1 Each subject, while wearing the suit system with minimal buoyancy, shall enter the water and demonstrate the ability to maintain a vertical position in the water without assistance for 2 min.

8.1.4.2 If the subject's legs rise to the water surface, the subject must be able to immediately resume the vertical position without assistance and if the subject's legs rise to the water surface more than once, the subject shall be disqualified from the remainder of this test. Ten subjects must qualify for this test.

8.1.4.3 Those subjects who qualify from the above test shall be allowed adequate rest and will then don the suit system and enter the water. The subject will then attempt to assume and maintain a vertical position without assistance for 1 min. Again, if the legs rise to the water surface, the subject must be able to immediately resume the vertical position without assistance. If the subject's legs rise to the water surface more than once during the 1 min, this will constitute a failure. The suit system shall be considered acceptable if seven or more subjects are able to perform the task.

8.1.5 289***Buoyancy***

8.1.5.1 *Maximum Escape Buoyancy* — The measurements of the maximum escape buoyancy shall be determined as follows:

Test Subjects — The subjects used in this test shall be as described in par. 8.1.3.1.

Test Equipment — The following equipment is required for this test:

a. A suspended scale/load cell with a capacity of 250 kg and an accuracy of ±0.2 kg.

b. A digital readout that measures mass in kilograms to an accuracy of ±0.2 kg.

c. A pen recorder that will record both mass in kilograms and mass against time.

d. An 80 kg steel chair with suspension system and seat belt to be used to lower the subject into the water. The overall configuration and dimensions shall be as indicated in Figures 3a, 3b, 3c and 3d.

Test Procedure — The subject, while wearing only a bathing suit, shall be strapped into the buoyancy chair and on command be totally submerged. The subject shall remain still in an upright position for 10 s. After a reading of the subject's natural buoyancy is recorded, the subject is rapidly withdrawn from the water. The subject shall don the suit system with the detachable components in a stowed position. The subject shall then expel excess air by manually releasing any convenient seal, while assuming a crouch position for 10 s. Strap the subject in the seat with the lap belt just comfortably tight. Following the suspension over the water and call for ditching, the subject shall assume a crash position with the hands grasping the underneath of the thighs just behind the knees and the chest and head pulled down as close to the knees as possible. On total immersion the subject shall maintain this position for 5 s. (It is recommended the subject count out to themselves "one thousand and one," "one thousand and two", etc. to make this easier.) After 5 s, the subject shall sit right back in the chair to represent the post-crash situation of re-orientation prior to escape. This position shall be maintained for a further 10 s to complete the 15 s immersed buoyancy recording. Once the 15 s reading is recorded, the subject is rapidly withdrawn from the water. The natural body buoyancy of each subject shall be subtracted from the 15 s readings, and the average of three readings for each subject will be taken to allow for inconsistencies in seat position, lap strap tightness and whether the subject has taken a full inspiration or not. Record the buoyancy in newtons.

8.1.5.2 *Inflatable Buoyancy Element*

a. The following tests are required for type testing only:

Burst Pressure — Inflate the buoyancy element at a rate sufficient to increase the gauge pressure by approximately 7 kPa every 2 s to destruction. Record the pressure at burst.

Buoyancy — Inflate the buoyancy element at the design working pressure. Determine the buoyancy according to the following procedure.

Test Equipment — The following equipment is required for this test:

— A mesh basket that is large enough to hold an inflatable buoyancy element and that is weighted sufficiently to overcome the buoyancy of the buoyancy element when placed in the basket.

— A tank of fresh water that is large enough to contain the basket submerged with its top edge 50 mm below the surface of the water.

— A scale or load cell that has an accuracy of 0.15 N and that is arranged to support and determine the mass of the basket in the tank.

Test Procedure — Submerge the basket so that its top edge is 50 mm below the surface of the water. Determine the mass of the submerged basket. Submerge the inflatable buoyancy element in the submerged basket. Tilt the basket 45° from the vertical for 5 min in each of four different directions to allow all entrapped air to escape. Suspend the basket with the inflatable buoyancy element in the water with the top edge of the basket 50 mm below the surface of the water. Determine the mass of the submerged basket and inflatable buoyancy element immediately. Determine the original measured buoyancy of the buoyancy element by subtracting the mass of the basket plus buoyancy element from the mass of the basket. Correct the buoyancy to an atmospheric pressure of 760 mm mercury and water temperature of 20°C. Calculate the buoyancy in newtons.

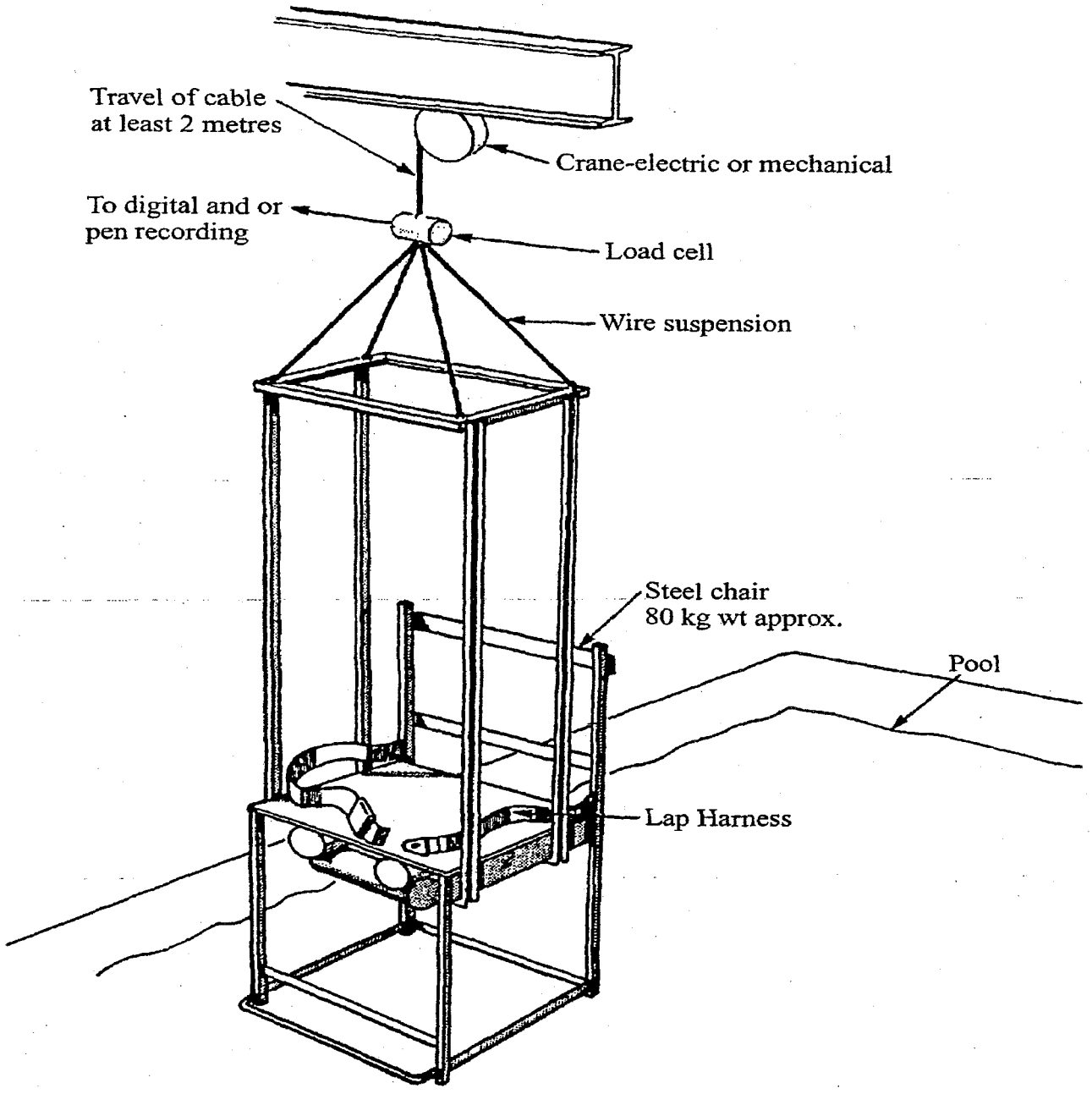


FIGURE 3a
Immersion Suit Buoyancy Measuring System

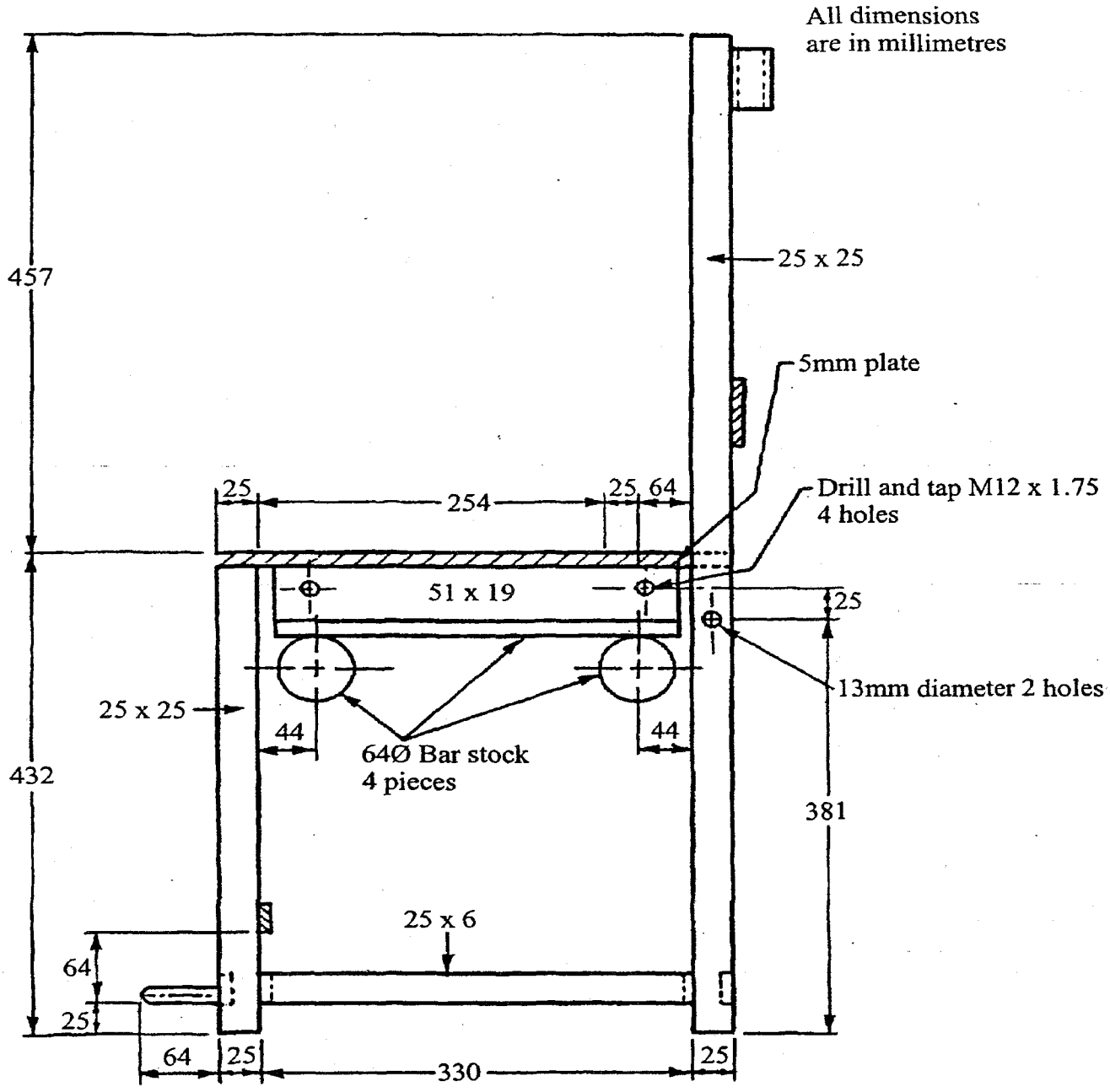


FIGURE 3b
Buoyancy Measuring Device — Side View

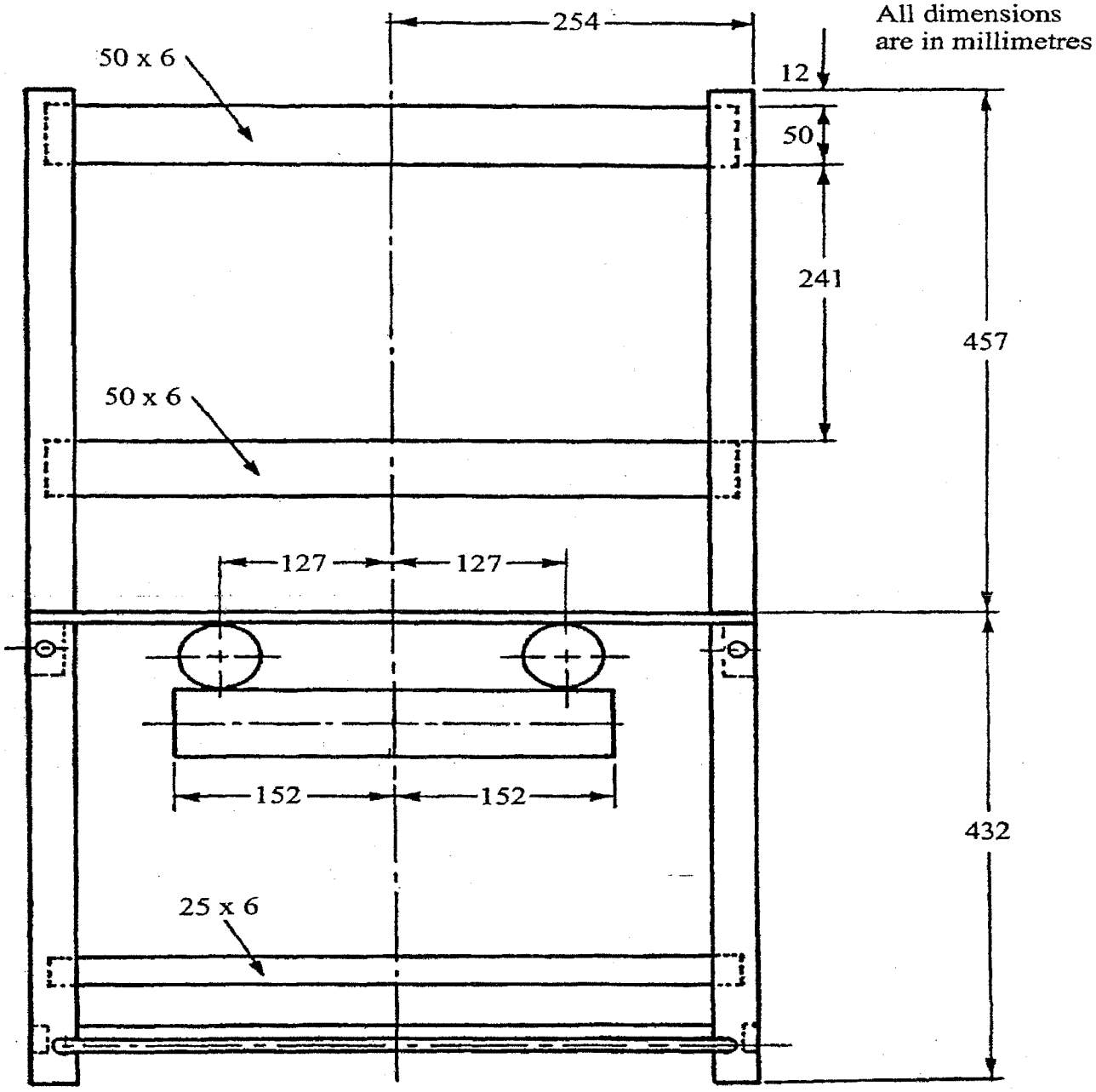


FIGURE 3c
Buoyancy Measuring Device — Front View

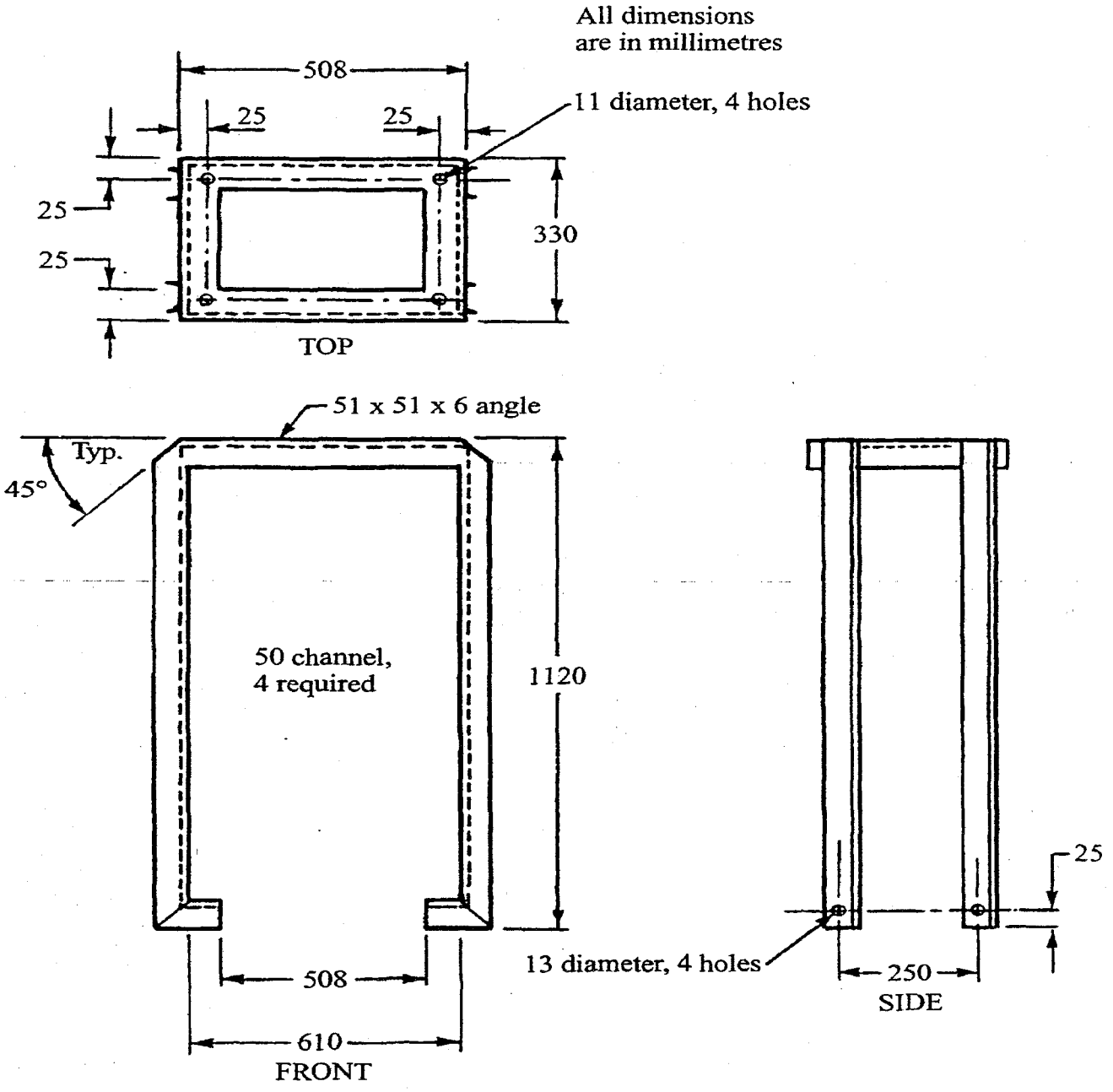


FIGURE 3d
Buoyancy Measuring Device — Top Assembly

b. The following tests are required for each produced item:

Proof Pressure — Inflate the buoyancy element to a pressure three times the design working pressure for 5 min.

Leak Test — Subsequent to proof pressure testing inflate the buoyancy element to a pressure 1.25 times its design working pressure and hang for 12 h.

8.1.6 ***Thermal Protection Using a Thermal Manikin*** — In order to determine compliance with the requirements in par. 6.2.5.1, the thermal protection capability of a suit system shall be tested under the following conditions and procedures:

8.1.6.1 *Water Ingress* — This section pertains to dry suit system concepts only. Test subjects shall be as described in par. 8.1.3.1. Prior to testing, determine the saturation time of the suit system material by conducting a series of tests using two subjects, following the procedures in a. and b., increasing the saturation time by 2 min for each test until the saturation mass does not show a significant increase. That time shall be the established saturation time for this test.

a. Water Ingress During Jump Into Water — Each subject, with the suit system fully donned, but all detachable components removed (e.g. hood, gloves, buoyancy element), shall climb into the water and remain in the vertical position with the water at neck level for the established saturation time to pre-wet the suit system. Each subject shall then climb out, dunk his/her head in water up to the neck to soak the hair, stand for 1 min to permit excess water to run off the exterior of the suit system and shall then be weighed. Means shall be provided so that any further run-off is included in the weighing. Observe and record any water leakage into the suit.

Each subject, with the suit system fully donned including detachable components, shall then jump into the water from a height of not less than 3 m, sufficient to permit total immersion. The jump shall be carried out in a feet first position and with feet together. Arms should be crossed over the chest using one hand to protect the nose and mouth and the other to hold down the suit and inflatable buoyancy element. The subject shall then remain still in the water for at least 1 min before being manoeuvred into a position at the pool side where it is possible to climb out with the minimum of effort. Immediately after the subject has left the water, detachable components shall be removed. The subject shall stand for 1 min to permit excess water to run off the exterior of the suit system, and then be weighed again in such a manner that any further run-off is included in the weighing. The weighing machine shall be capable of measuring 250 kg with an accuracy of ±0.025 kg.

On completion of the water ingress jump test each suit system shall be removed and a record made of the location of any observed leaks and damp patches and the total amount of water leakage into the suit system.

b. Water Ingress During Swimming (Leak Test) — The test shall take place in a swimming pool with a water temperature of not less than 18°C. Each subject, with the suit system fully donned, but all detachable components removed, shall climb into the water and remain in the vertical position with the water at neck level for the established saturation time to pre-wet the suit system. Each subject shall then climb out, stand for 1 min to permit excess water to run off the exterior of the suit system and shall then be weighed again in such a manner that any further run-off is included in the weighing.

A minimum of three subjects shall participate in the test together in order to achieve adequate wave motion in the pool. At the start of the test, each subject, with the suit system fully donned including detachable components, shall enter the water via a suitable step-ladder, inflate the additional buoyancy element and proceed to swim on his/her back, in line abreast with a maximum distance of 2 m between subjects and at an approximate speed of 18 m/min for 60 min. Subjects shall use their arms and legs for swimming throughout. At the end of the tests the distance covered shall be recorded and must lie between 1000 and 1200 m. On completion of the test each subject shall leave the water, and the detachable components shall be removed immediately. Each subject shall stand for 1 min to permit excess water to run off the exterior of the suit system and shall then be weighed.

c. Calculate the amount of water, W, to be introduced at the start of the insulation measurement from:

$W = W_1 + 3\ L$

295 *where:*

W = amount of water to be introduced, in grams

W_1 = water ingress, in grams, average for eleven subjects, measured at jump test

L = water ingress, in grams, average for eleven subjects, measured at 60 min swim test

Note: W_1 and L should be taken as one standard deviation above the mean for the eleven subjects tested.

Where water ingress has been recorded specific to each detachable component, the greatest ingress value recorded from the tests described in section a. or b. above shall be introduced, specific to the component it was recorded from.

8.1.6.2 *Thermal Protection*

a. The thermal protection provided by a suit system shall be assessed by measurement of the effective insulation of the whole suit system and associated test clothing (described in Section 3) placed on a thermal manikin and immersed in turbulent water with a wave height of 40 cm so that the thermal manikin is in a natural floating position as determined in par. 8.1.6.2 b.

A thermal manikin shall be constructed so that it:

i. has a surface area and shape similar to that of a fiftieth percentile man;

ii. can be dressed in representative test clothing;

iii is capable of being heated to and controlled at a programmable, uniform temperature;

iv. can control and measure temperatures and power inputs and calculate, record and present the parameters;

v. can be immersed to the neck in water without causing failure in the electrical system if water leaks inside the outer clothing.

b. Flotation Position — A subject (wearing the test clothing described in Section 3) of approximately the same mass and height of the manikin shall don the suit system, inflate all auxiliary buoyancy elements (if any) and enter the water. The subject shall assume a face-up, stable position in calm water. With the subject in a relaxed position, measure the freeboard to the mouth, abdomen and toes, perpendicularly from the surface of the water.

c. Test Procedure — Dress the thermal manikin in preweighed test clothing as described in Section 3 and then with the test suit system. Where a suit system is provided with an inflatable buoyancy element, this buoyancy element shall be inflated during the tests. Before placing the suit system on the thermal manikin, preweigh all items worn beneath the suit system including the suit system lining where provided. Immediately before closure of the main suit system zipper, introduce water into the test clothing (dry suit system only) in areas representative of those recorded during the water ingress tests and in amounts, W, calculated from the results of the water ingress tests in par. 8.1.6.1.

After closing the entry zipper and ensuring that all other seals are fully closed and waterproof, lower the thermal manikin into the water until the freeboard to the mouth, abdomen and toes equals the amounts measured in par. 8.1.6.2 b. This position may be achieved by using a frame on which the manikin is mounted.

The target temperature of the thermal manikin and the water temperature are set at levels appropriate to the particular thermal manikin in use. However, the minimum gradient shall not be less than 3°C between the thermal manikin and the water. Provision shall be made for inducing turbulence in the vicinity of the thermal manikin. The temperature(s) of the thermal manikin, the water and the power input(s) shall be measured continuously and recorded as means for each successive period not to exceed 15 min. Once the target temperature is achieved, the thermal manikin shall remained immersed for the time period determined by DCIEM[1] calibration acceptance testing. This ensures reliable data and consistent test results. Insulation is calculated, in the case of a single section thermal manikin, from the measured temperature gradient, the power input (i.e., heat loss) and the known surface area of the thermal manikin. In the case of a thermal manikin consisting of multiple sections, the mean overall insulation is calculated by area, weighting the insulation found in each section. After the thermal manikin is removed from the water, the clothes and lining shall be reweighed to check whether there has been leakage during the test. If leakage has occurred the measurement of insulation will be lower than it should be, and the test may have to be repeated.

[1] *The Defence and Civil Institute of Environmental Medicine (DCIEM) can be contacted at 1133 Sheppard Avenue West, Downsview, Ontario, Canada M3M 3B9.*

8.1.7 ***Thermal Protection Using Human Subjects*** — In order to determine compliance with the requirements of par. 6.2.5.2, the thermal protection capability of a suit system shall be tested under the following conditions and procedures:

8.1.7.1 *Test Subjects* — At least four male and four female subjects must be used for this test. Each subject shall be familiarized with the test procedure prior to the start of the test. Each subject must be between 160 and 185 cm tall and must not be more than 10% overweight or underweight for his height and physical type as determined by a physician or physiologist or from published physiological data. Each subject shall have had a normal night's sleep the night before the test, a well-balanced meal 1 to 5 h before the test, and no alcoholic beverages for 24 h prior to the test. In addition to the suit system, each subject shall wear the test clothing described in Section 3.

8.1.7.2 *Test Equipment* — The test shall be conducted in calm circulating water with a temperature between 0 and 2°C. The air temperature 300 mm above the water surface shall be between –10°C and –20°C. Each subject shall be instrumented with an electrocardiograph, a thermistor or thermocouple in the rectum placed 150 mm beyond the anus, a thermistor or the thermocouple on the tip of the index finger, and a thermistor or thermocouple on the tip of the great toe. Each thermistor or thermocouple shall have an accuracy of 0.1°C.

8.1.7.3 *Test Procedure* — A physician shall be present during this test. Before donning the suit system, each subject rests quietly in a room with a temperature between 10 and 25°C for 15 min. The rectal temperature is then recorded as the initial rectal temperature. If the suit system is a dry suit concept, the quantity of water determined in par. 8.1.6.1 shall then be added to the suit system. The subject dons the suit system as rapidly as possible without damaging the instrumentation, and immediately enters the water. The subject assumes a face-up, stable floating position. No auxiliary means of buoyancy may be used during this test. The subject remains in the water, engaging in activity that maintains the heart rate between 50 and 140 beats per minute for the first hour, and 50 to 120 beats per minute thereafter, except that no attempt is made to control heart rate if the subject is shivering. Each temperature is recorded at least every 10 min. The test continues for 6 h from the time the subject first enters the water, unless it is terminated sooner.

8.1.7.4 *Termination of Test* — If any of the following occurs, the test of the subject must be terminated:

a. The physician determines that the subject should not continue.

b. The subject requests termination due to discomfort or illness.

c. The subject's rectal temperature drops more than 2°C below the initial rectal temperature, unless the physician determines that the subject may continue without danger.

d. The subject's finger, toe or buttock temperature drops below 8°C for more than 15 min and never below 5°C.

8.1.8 ***Body Strength*** — The body strength of the suit system shall be tested under the following conditions and procedures:

8.1.8.1 *Test Equipment* — The test apparatus shown in Figure 4 shall be used in this test. This apparatus consists of:

a. Two rigid cylinders, each 125 mm in diameter, with an eye or ring at each end.

b. A weight that when combined with the mass of the lower cylinder, comprises a total applied mass of 135 kg.

c. Ropes or cables of sufficient length to allow the suit to be suspended as shown in Figure 4.

8.1.8.2 *Test Procedure* — A hole 25 mm in diameter is to be punched through each side of the suit, at the waist, to permit the passage of the slings. Immerse the suit system in water for at least 5 min, then remove the suit system from the water and immediately arrange it on the test apparatus, using each closure as it would be used by a person wearing the suit system. Apply the 135 kg mass for 5 min.

Note: Tearing at these locations during the test shall not be considered grounds for rejection of the suit.

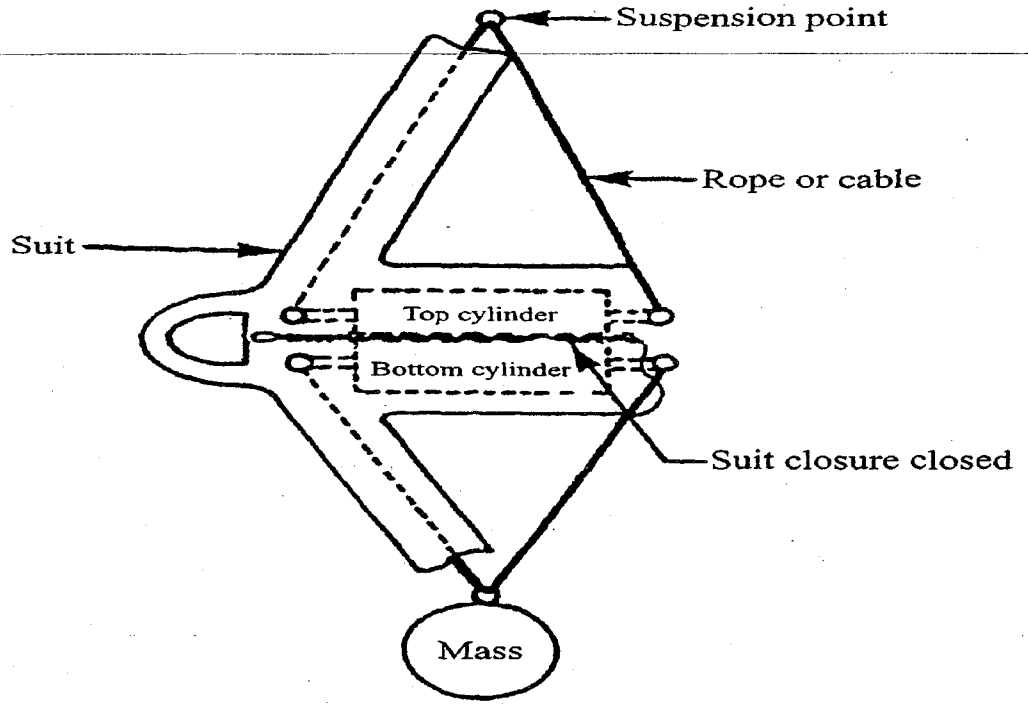


FIGURE 4

Body Strength Test

8.1.9 ***Buddy Line*** — The buddy line breaking strength shall be tested under the following conditions and procedures:

8.1.9.1 A rigid cylinder of approximately 125 mm, with an eye at each end is placed in the suit in such a way as to pass through the part where the buddy line is attached. The end of the buddy line is then secured overhead.

8.1.9.2 Two lines are attached to the eyes, and then a mass of 135 kg is attached to the lines and allowed to hang for 2 min.

8.1.10 ***Corrosion Resistance*** — Expose five samples of each metal part that is critical to the performance of the suit system in accordance with par. 5.5 of TSO C 13. At the conclusion of the exposure, each sample of the test metal and metal combination shall be tested to ensure it performs its intended function.

8.1.11 ***Flame Exposure*** — Test the suit system for resistance to flame under the following conditions and procedures:

8.1.11.1 *Test Equipment* — The following equipment is required for this test:

a. A metal pan at least 300 mm wide, 450 mm long and 60 mm deep. The pan shall have at least 12 mm of water on the bottom with approximately 40 mm of n-heptane floating on top of the water.

b. An arrangement to hold the suit system over the n-heptane.

8.1.11.2 *Flame Exposure Test Procedure* — The suit system is held from the top by the holding arrangement. The n-heptane is ignited and allowed to burn for approximately 30 s in a draft-free location. The suit system is then held with the lowest part of each foot 240 mm above the surface of the burning n-heptane. After 2 s, measured from the moment the flame first contacts the suit system, remove the suit system from the fire. If the suit system is burning, it is allowed to continue to burn for 6 s before extinguishing the flames. If the suit system sustains any visible damage other than scorching, subject it to the stability test (par. 8.1.3.7) using one subject, the impact test (par. 8.1.3.9) using one subject, the thermal protection test (par. 8.1.6 or 8.1.7) and the buoyancy test (par. 8.1.5) except that the immersion time shall be for 2 h instead of 24 h.

8.1.12 *Temperature Cycling (Storage)*

8.1.12.1 Each suit system in its storage container shall be alternately subjected to surrounding temperatures of –40°C and 65°C. These alternating exposures need not follow immediately after each other. The following procedure shall be repeated for a total of 10 cycles.

a. Expose the suit system at 65°C for 8 h.

b. Remove the suit system from the warm chamber and leave it exposed for a period of 8 h at room temperature.

c. Then expose the suit system at –40°C for 8 h.

d. Remove the suit system from the cold chamber and leave it exposed for a period of 8 h at room temperature.

8.1.12.2 On completion of the final cold exposure the suit system shall be removed from the chamber. The system should be opened up by three subjects, allowed to stand in the air at room temperature (21°C) for 10 minutes. Then it should be capable of being donned within 4 min.

8.1.12.3 Upon completion of the test, the suit system shall be examined and shall show no sign of cracking, swelling, dissolution or change in mechanical properties that would affect its performance.

8.1.13 ***Water Penetration*** — Test each different type of seam in the suit system (par. 6.1.2.2) and the exterior fabric (par. 6.1.3) in accordance with SATRA PM 34 "Maeser" procedure. Before performing the test, ensure that the fabric is not damaged.

8.1.14 ***Oil Resistance***

8.1.14.1 At least two samples of each type of exterior fabric and each type of seam are required for this test.

8.1.14.2 Immerse the samples of the suit system exterior fabric and each type of seam in No. 2 Marine diesel oil and allow them to soak for not less than 6 h.

8.1.14.3 Upon completion of the 6 h soak period remove the samples from the oil and wipe off each of them.

8.1.14.4 Test one sample of each type of exterior fabric and of each type of seam in accordance with CAN/CGSB-4.2 No. 9.2 and No. 32.2, respectively. As well, for dry suit systems, test one sample of each type of exterior fabric and of each type of seam in accordance with CAN/CGSB-4.2 No. 26.1, under a 1 m head of water, for a period of not less than 1 h.

8.2 **Test Report** — After the approval tests are completed, a test report shall be prepared by the independent laboratory. The test report shall contain:

a. The name and address of the applicant

b. The name and address of the independent laboratory

c. A detailed description of the test procedure and apparatus used

d. Detailed test results including all data recorded and a description of each test failure and each other discrepancy

e. The date and location of testing

f. The name of each participant and observer.

g. Photographs, where necessary, showing at least one overall view of the suit, enough views to show all major design details, test apparatus, and each failure occurring during testing.

9. MARKING

9.1 Each suit shall be clearly marked with the following information:

Manufacturer's name
Date of manufacture
Model size
Lot number
Serial number, if assigned
Department of Transport Approval Number.

10. [299]NOTES

10.1 Related Publications

10.1.1 Underwriters Laboratories Inc. (UL)

UL 1191 — Standard for Safety for Components for Personal Flotation Devices, First Edition dated January 2, 1976, revision pages to January 16, 1984.

UL 1197 — Standard for Safety for Exposure Suits, February 1977.

10.1.2 U.S. Federal Register, Vol. 49, No. 26, Tuesday February 7, 1984, Rules and Regulations, Part 160 Lifesaving Equipment, Subpart 160171 Immersion Suits.

10.2 Sources of Referenced Publications

10.2.1 The publications referred to in par. 2.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Ottawa, Canada K1A 1G6. Telephone (819) 956-0425 or 1-800-665-CGSB (Canada only). Fax (819) 956-5644.

10.2.2 The publications referred to in par. 2.1.2 may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, U.S.A, or from Global Info Centre Canada, 240 Catherine Street, Suite 305, Ottawa, Ontario K2P 2G8. Telephone (613) 237-4250 or 1-800-854-7179. Fax (613) 237-4251.

10.2.3 The publication referred to in par. 2.1.3 may be obtained from the Shoe and Allied Trade Research Association House (SATRA), Rockingham Road, Kettering, Northamptonshire NN16 9JH, England.

10.2.4 The publications referred to in par. 2.1.4 and 10.1.1 may be obtained from the Underwriters' Laboratories Inc., Publications Stock, 333 Pfingsten Road, Northbrook, IL 66062-2096, U.S.A. or from Global Info Centre Canada, 240 Catherine Street, Suite 305, Ottawa, Ontario K2P 2G8. Telephone (613) 237-4250 or 1-800-854-7179. Fax (613) 237-4251.

10.2.5 The publications referred to in par. 2.1.5 may be obtained from the Federal Aviation Administration, Office of Airworthiness, Aircraft Engineering Division (AIR-100), 800 Independence Avenue S.W., Washington, D.C. 20591, U.S.A.

10.2.6 The publication referred to in par. 10.1.2 may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, U.S.A.

APPENDIX A
(This appendix forms a mandatory part of the standard.)

SUIT SYSTEM EXTERIOR FABRIC GUIDELINES FOR INSULATION

A1. REQUIREMENTS

A1.1 The thermal conductivity of the exterior fabric of the suit system should be less than or equal to that of a control sample of 4.75 mm thick, closed-cell neoprene foam when they are submerged to a depth of 1 m in water and when tested as described in A2. The control samples of neoprene foam shall have a thermal conductivity of not more than 0.050 W/(m·K) as determined by ASTM C 518 or C 177.

A2. TEST METHOD

A2.1 **Insulation** — Test the suit system material under the following conditions and procedures except that if the suit system exterior fabric meets the requirements for the control sample in par. A2.2 c., the test procedure in par. A2.3 is not required.

A2.2 **Test Equipment** — The following equipment is required for the test:

a. A sealed copper or aluminum can that has at least two parallel flat surfaces and that contains at least 2 L of water and no air. One possible configuration of the can is shown in Figure A1.

b. A thermistor or thermocouple with an accuracy of ±0.1°C arranged to measure the temperature of the water inside the can.

c. A control sample of two flat pieces of 4.75 mm thick, closed-cell neoprene foam of sufficient size to enclose the can between them. The control sample shall have a thermal conductivity of not more than 0.050 W/m·K. The thermal conductivity of the control sample shall be determined in accordance with the procedures of ASTM C 177 or C 518.

d. Two flat pieces of the suit system material of sufficient size to enclose the can between them. The surface covering, surface treatment, and number of layers of the material tested shall be the same as those of the material used in the suit system. If the material used in the suit system varies in thickness or number of layers, the material tested shall be representative of the portion of the exterior fabric of the suit system having the least thickness or number of layers.

e. A clamping arrangement to form a watertight seal around the edges of the pieces of material when the can is enclosed inside. A sealing compound may be used. Figure A2 shows one possible configuration of the clamping arrangements.

f. A tank of water deep enough to hold the entire assembly of the can, material, and clamp at least 1 m below the surface of the water.

g. A means to control the temperature of the water between 0 and 1°C.

h. A thermistor or thermocouple with an accuracy of ±0.1°C arranged to measure the temperature of the water at the depth at which the can, material and clamp are held.

A2.3 **Test Procedure** — The temperature of the water in the tank shall be between 0 and 1°C. The temperature of the water in the can shall be at or above 45°C. Hold the can under the water and clamp it between the two pieces of the neoprene foam control sample, so that the assembly formed conforms as closely as possible to the shape of the can, and water fills all void spaces in the assembly. Submerge the entire assembly with the water temperature in the can at or above 45°C in the tank of water to a depth of 1 m at the highest point of the assembly. No part of the assembly may touch the bottom or sides of the tank. Every 2 min, shake the assembly and then invert it from its previous position. Record the time for the water inside the can to drop from 45 to 33°C. Repeat this procedure three more times using the suit system material instead of the neoprene control sample. The shortest time for the drop in water temperature when the suit system material is used shall be greater than or equal to the shortest time when the neoprene control sample is used.

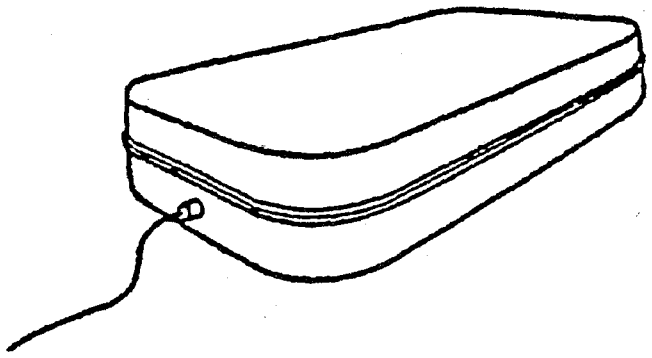
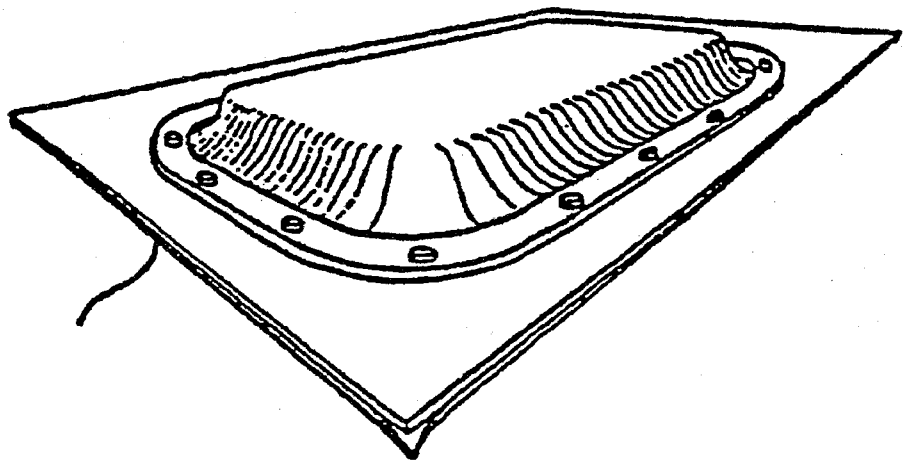


FIGURE A1
Water Can for Insulation Test Shown with Thermistor Lead



Assembly formed with water can, two pieces of material, and clamping device, with thermistor lead brought out of the assembly between the pieces of material.

FIGURE A2
Insulation Test Assembly

APPENDIX B

(This appendix forms a mandatory part of the standard.)

WATERPROOF ZIPPER REQUIREMENTS AND TEST METHODS

B1. SAMPLE REQUIREMENTS

B1.1 The following number of waterproof zippers are required:

a. 4 of 750 mm long samples (2 open end and 2 closed end)

b. 2 of 305 mm long samples.

B2. PREPARATION OF SAMPLES

B2.1 Prepare two 305 mm long zippers as follows:

a. Each shall be glued and secured to a 356 mm long piece of 5 mm thick N2S (nylon both sides) neoprene to form a 127 mm diameter cylinder.

b. The bottom end of the cylinder shall be sealed with another piece of 5 mm N2S neoprene.

Note: It is recommended that the insides of the glued seams be checked for their tightness as these samples will be used for the leak test, and the adhesive used be resistant to diesel oil as these samples will be tested for their resistance to diesel oil.

B3. TEST METHODS AND REQUIREMENTS

B3.1 Opening and Closing Force Tests

B3.1.1 Conduct opening and closing force tests on 4 samples of the 750 mm long zippers after conditioning in the half-way-open position as follows:

a. Test one sample in the as-received condition.

b. Test one sample after conditioning for 720 h in a salt spray of 5% natrium chloride in accordance with ASTM B 117.

c. Test one sample after conditioning for 24 h under a 100 mm head of No. 2 Marine diesel oil at 18 to 20°C.

d. Test one sample after being folded in half lengthwise to form a radius of not more than 10 mm and subjected to the temperature cycling test in par. 8.1.12.1.

B3.1.2 The opening and closing test are to be conducted on completion of the final cold exposure, while the samples are maintained at –30°C. The opening test described in ASTM D 2062, section 16, is to be conducted on the samples conditioned in the closed position. The closing test described in ASTM D 2062, section 16, is to be conducted on samples conditioned in the open position.

B3.1.3 The test results shall not exceed:

a. 40 N opening and closing force after conditioning as described in B3.1.1 a.;

b. 60 N opening and closing force after conditioning as described in B3.1.1 d.; and

c. 175 N opening and closing force after conditioning as described in B3.1.1 b. and c.

B3.2 Point Breaking Strength Test

B3.2.1 On completion of the opening and closing tests under B3.1.1 subject all samples to this test as follows:

a. at the top

b. at the bottom end

c. at the centre (at the point of folding as described in B3.1.1 d).

B3.2.2 Test the point breaking strength as described in UL 1191.

B3.2.3 The point breaking strength shall not be less than 440 N (averaged results).

B3.3 303 **Diagonal Pull Test**

B3.3.1 Three samples of the 750 mm long zippers are required for this test as follows:

a. one sample in the as-received condition

b. one sample after conditioning as described under B3.1.1 b. and

c. one sample after conditioning as described under B3.1.1 c.

B3.3.2 Open and mount the sample securely onto a hard flat surface such as a woodboard, as follows:

a. one of each sample as in B3.3.1 a., b. and c., secured with the left side of the zipper secured.

b. one of each sample as in B3.3.1 a., b. and c., secured with the right side of the zipper secured.

B3.3.3 Close the zippers as follows:

a. Close zippers secured on the left side by pulling the slider at an angle of approximately 25° to the right of the line of the zipper (Figure B1 a.)

b. Close zippers secured on their right side by pulling the slider angle of approximately 25° to the left to the line of the zipper (Figure B1 b.).

B3.3.4 When closed, the unsecured part of the zipper shall be pulled at an angle of 90° to the line of the zipper away from the secured part with a force of not less than 45 N (Figure B2).

B3.3.5 The zipper points shall not pull free.

Note: The procedures described in B3.3.2 a. and b. and B3.3.3 a. and b. apply to asymmetrical zippers only. Symmetrical zippers shall be tested on either the left or the right side.

B3.4 **Leakage Resistance Test**

B3.4.1 Test the cylindrical samples of zippers as prepared in B2.2 as follows:

a. Place a wire mesh fixture 300 mm in length and 125 mm in diameter inside the sample and close the zipper fully.

b. Place the sample in a water tank with the closed end of the sample down to a depth sufficient to submerge 90% of the zipper's effective length (the portion measured from the top of the bottom stop to the bottom of the slide when the slide is in the fully closed position).

c. Remove the sample from the water and blot the inside with the pre-weighed blotting paper to absorb any water which has ingressed in excess of 20 g.

Note: The acceptable value will be established based on the volume of the sample compared to the volume of a typical adult "Universal" size suit system.

B3.4.2 Following the water leak test, allow the sample to dry and then place it in No. 2 Marine diesel oil at a depth as prescribed in B3.4.1 b. for a period of 24 h.

B3.4.3 Remove the sample, blot it dry and resubject it to the water leak test as described in B3.4.1.

B3.4.4 The zipper will be considered acceptable if the amount of water which has ingressed is minimal, and there is no sign of degradation as a result of its exposure to the diesel oil.

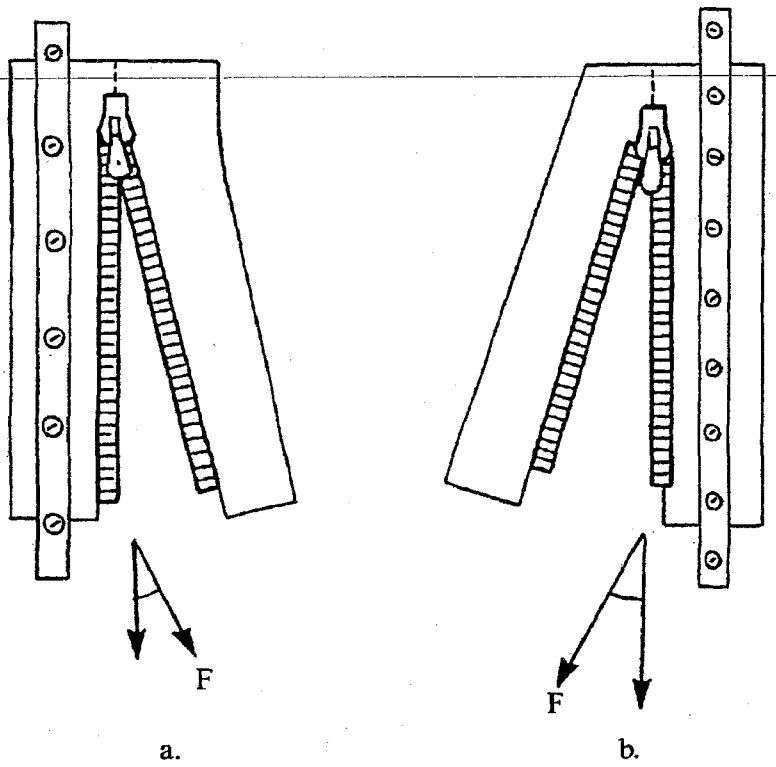


FIGURE B1

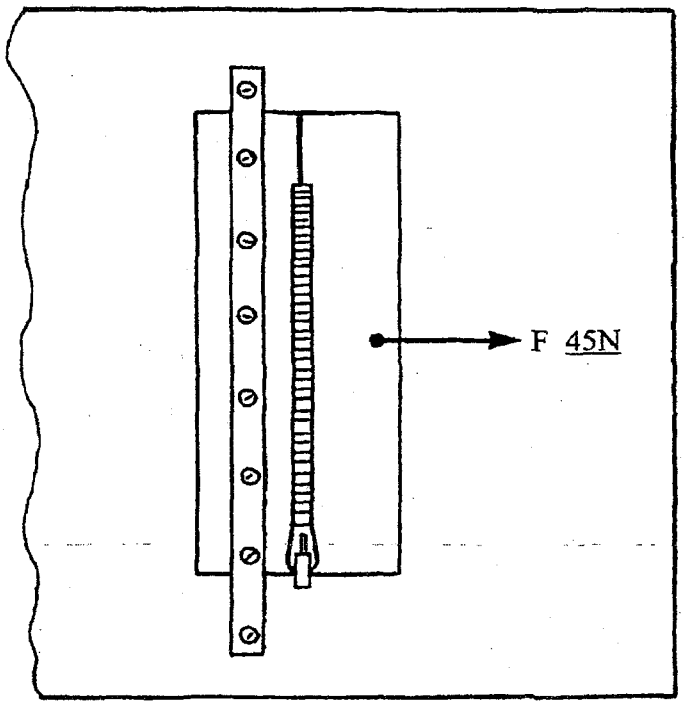


FIGURE B2

Topic 2: Survival Suits

2.3

Government of Canada
Gouvernement du Canada

Canadian General Standards Board
Office des normes générales du Canada

Place du Portage III - 6B1
Hull, Quebec
K1A 1G6

Place du Portage III - 6B1
Hull (Québec)
K1A 1G6

24 February 2009

ACG 6481-65/2-Ag

Mr. David Collyer
President
Canadian Association of Petroleum Producers
350 7th Avenue S.W., Suite 2100
Calgary, Alberta
T2P 3N9

Dear Mr. Collyer:

Subject: Project Agreement for CAN/CGSB-65.17-99 *Helicopter Passenger Transportation Suit Systems*

We would like to confirm whether the Canadian Association of Petroleum Producers is agreeable to fund the revision of the above National Standard of Canada. Mr. Paul Barnes, who sits on the CGSB Committee for Immersion Suits as a voting member representing Canadian Association of Petroleum Producers, recently voted against the withdrawal of the above standard. There is an immediate need to review and revise the standard not just because it is time dated (10 years old) but more importantly for technical deficiencies and concerns in the interest of public safety.

Given the continued interest of the Canadian Association of Petroleum Producers in retaining the standard a project agreement (two copies) identifying the work plan and estimated costs are presented for your review and acceptance, as CGSB services are cost recoverable. Should you agree to fund the revision of the standard, please forward us your signed copies of the agreement by no later than **March 24, 2009**.

This agreement has been provided to those organizations on the committee who have voted not to withdraw the above standard. Costs would be shared proportionately, should more than one organization agree to fund the revision of CAN/CGSB-65.17-99. In absence of a signed agreement by March 24, 2009 to fund the revision of CAN/CGSB-65.17-99, it will be necessary to proceed with the withdrawal of the standard.

If you wish to discuss the matter further or require further information, please do not hesitate to contact me.

Sincerely,

R. Charest

Bob Charest
Team Leader, Standards Division
Chef d'équipe/Division des normes

(819) 956-0886|télécopieur/facsimile (819) 956-5740
robert.j.charest@pwgsc.gc.ca

cc: Paul Barnes

Topic 2: Survival Suits

2.4

CANADA-NEWFOUNDLAND and LABRADOR
OFFSHORE PETROLEUM BOARD

March 20, 2009

R. Paul Barnes
Manager, Atlantic Canada
Canadian Association of Petroleum Producers
905, 235 Water Street
St. John's, Newfoundland
Canada A1C 1B6

Dear Mr. Barnes:

Subject: Helicopter Passenger Transportation Suit Systems

Pursuant to our meeting of March 18, 2009, concerning the Canadian General Standards Board (CGSB) *Helicopter Passenger Transportation Suit Systems* standard (CAN/CGSB 65.17-99. We are formalizing our request made during that meeting that CAPP address the technical concerns with regard to the standard that were tabled at the CGSB committee meeting as far as they relate to the helicopter suits system currently in use. We also requested CAPP to address concerns raised by users of the helicopter suit systems.

We look forward to a response.

Yours truly,

H. L. Pike, P.Eng.
Chief Safety Officer

Fifth Floor, TD Place, 140 Water Street, St. John's, NL., Canada A1C 6H6
Telephone (709) 778-1400 Fax (709) 778-1473

Topic 2: Survival Suits

2.5

CAPP
CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

May 21, 2009 *Letter sent electronically – to follow by regular mail*

Howard Pike
Chief Safety Officer
5th floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Dear Mr. Pike:

Re: Helicopter Passenger Transportation Suits

I am writing in response to your letter dated March 20, 2009 in which you request that CAPP consult with its members and provide the Board with an overview of Operator actions taken as a result any issues that have been raised by their workforce with respect to the current helicopter suit. In addition, you have requested that we comment on to the technical concerns tabled at the Canadian General Standards Board committee meeting in May 2008 related to the CAN/CGSB 65.17-1999 Helicopter Passenger Transportation Suit System standard. These technical concerns were presented as proposed opportunities for change in a standard revision.

To facilitate this response, we have consulted with Helly Hansen, the manufacturer of the Helly Hansen Survival Suit E-452 used by Newfoundland Operators. They have provided technical information in relation to the design and performance of the E452 suit. We have also consulted with the Operators to summarize any feedback from their respective OHS committees and any actions they have taken with respect to the current suit. This feedback is listed below for your review.

As you know, the current suit (Helly Hansen E452) was built to meet two standards: the CAN/CGSB 65.17-1999 Helicopter Passenger Transportation Suit System Standard (helicopter suit standard) and the CAN/CGSB 65.16-2005 Immersion Suit Standard (immersion suit standard).

1. **Suit Buoyancy**: Buoyancy of the suit may impede egress from a helicopter in water, especially for smaller individuals.
   Response:

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Calgary, Alberta
Canada T2P 3N9
Tel (403) 267-1100
Fax (403) 261-4622

403, 235 Water Street
St. John's, Newfoundland and Labrador
Canada A1C 1B6
Tel (709) 724-4200
Fax (709) 724-4225

www.capp.ca • communication@capp.ca

- The maximum escape buoyancy of the current suit standard was increased from 150 newtons to 175 newtons during the 1999 helicopter suit standard revision.
- All sizes of the Helly Hansen Survival Suit E-452 passed the escape buoyancy requirements of the standard. Extra small, small, medium, and large sizes in fact had escape buoyancies of less than the 150 newtons required by the previous standard. The extra large size was just over 150 newtons and the 2X and 3X suits are under the maximum escape buoyancy of 170 newtons allowed by the current standard.
- The test method used during the current standard development measures escape buoyancy after 15 seconds upright underwater. During the revision of the current standard this test method will be examined.
- While Helly Hansen have investigated suit and liner options to decrease the buoyancy in the suit they are constrained by the 70 newton minimum inherent buoyancy requirement of the immersion suit standard and thermal requirements of both the helicopter suit standard and the immersion suit standard.

2. **Bulk and Stiffness of the Suits:** Bulk and stiffness of the suits may impede egress from a helicopter in water.
   Response:
   - The current suit has met all of the mobility and dexterity requirements included in both suit standards.
   - The requirement to meet the immersion suit standard and the helicopter suit standard dictates a minimum of 70 newtons of inherent buoyancy and thermal insulation of 0.75clo in turbulent water. The more rigorous insulation requirement and the need for minimum inherent buoyancy require a layer of closed cell foam throughout. The marine approval also requires the use of specific liner fabrics and close cell foams that pre-determine the weight and stiffness of the suit system to a large degree.
   - While Helly Hansen has investigated suit and liner options to decrease the buoyancy in the suit, they are constrained by the 70 newton minimum inherent buoyancy requirement of the immersion suit standard and thermal requirements of both the helicopter suit standard and the immersion suit standard.

3. **Suit Zippers:** Zipper stiffness and difficult to close.
   Response:
   - The current standard is rigorous and limits options for zippers.
   - Helly Hansen has deployed staff to heliports in Newfoundland & Labrador and Nova Scotia to view this problem and to work with passengers to instruct them in procedures that make donning the hoods more efficient. Personnel at the heliports have been instructed to request that each passenger demonstrate an ability to fully close the zipper while seated before boarding at the heliport.

- Helly Hansen is continuing to apply products to the zippers to increase flexibility and report that flexibility is increasing as cycle time on the suits increases.
- In 2008, Helly Hansen conducted an investigation to determine whether a "toggle" could be added to increase ease of zipping, but found it did not enhance the ability to zip the suit and had potential to create an additional hazard.
- Currently Helly Hansen is investigating whether an additional "grab point" could be added to the suit to facilitate zipping.

4. **Leakage during training:** Suits used at the Marine Institute leak during training exercises.
   Response:
   - During the approval testing, water ingress into the suit was measured using the standards test method. The measured water was then added to the suit system during the thermal testing and the suit met the thermal protection requirements.
   - Additionally, it should be noted that feedback received from instructors at the Marine Institute has varied. The suits are used in multiple runs in underwater egress and various factors may have resulted in water ingress, including lack of proper suit sizing for students.
   - Helly Hansen is currently working with the Marine Institute to review fitting and donning procedures to ensure that individuals receive the proper sized suits and if individuals have difficulty fitting the suit that they are identified at that time.

5. **Suit Sizes:** Range of suit sizes available is insufficient for the offshore workforce.
   Response:
   - The current size range for the suits runs from XS to 3XL. A 2XS is currently being investigated and is expected to be produced.
   - Operators have investigated suit modifications for individuals who have a specific physical limitation or disability which impacts the ability to don and / or operate in the suit. These modifications are the subject of RQF's between Operator(s) and the respective Regulator.

6. **Boots:** Range of boot sizes is insufficient for the offshore workforce and the larger boot tread may be a potential tripping hazard.
   Response:
   - Where boot size is a concern for an individual the Operator and Helly Hansen assess the specifications of that instance and undertake appropriate suit modifications
   - Helly Hansen is currently undergoing tests to have the boot size range increased for each size of suit (within the aviation approval)

- On the *SeaRose* where the tripping hazard complaint originated, the helideck steps were modified and procedures changed to ensure helideck teams carry all but small baggage.
- A safety alert was issued to personnel on all facilities to reinforce the need for caution and promote the use of hand-rails.

7. **Wrist Seals:** Tightness of wrist seals.
   Response:
   - Some users have expressed discomfort related to wrist seals being uncomfortably tight
   - Operators have worked with Helly Hansen to ensure that the tightness issue is addressed (i.e. some products have been applied to the wrist seals) while ensuring that the integrity of the suits (ie. the ability to keep water out) is not compromised. It is noted that Helly Hansen has stated that the seals are easing as cycle time on the suits has increased.

During a survey conducted in Quarter 3 2008 designed specifically to obtain feedback from the workforce about the E452 suit, the most significant issue raised related to tightness of wrist seals. The survey was conducted by Helly Hansen in conjunction with the Newfoundland Operators for all inbound and outbound passengers over a six week period. Issues raised have been addressed as per the text above. Should any new or additional issues be raised by the workforce regarding the suit, Operators will address these with Helly Hansen and will keep the Board apprised of the process.

Further, CAPP and local operators are working with regulators and the CGSB to co-fund and participate in the review of the current helicopter suit standard. There have been items referenced in preparation for such a review that propose changes to this standard (refer to attached table). These proposed changes relate primarily to the standard's testing procedures, comparison/compatibility with the immersion suit standard and flexibility in materials. From our understanding many of these proposed changes resulted from the process of creating a suit (the E452 suit) to meet both the helicopter suit standard and the immersion suit standard. The items listed in the table require discussion that will occur through the review of the standard. The current suit has been certified, through rigorous review, by Transport Canada and meets the requirements that exist for its usage offshore. However, we recognize that review of the items in the table is important for a thorough review of the standard and possible improvements in the testing procedure and compatibility of the two standards. In anticipation of this we propose a meeting with you, and representatives of the CNSOPB, in the next few weeks to consider how best to proceed and ensure that all such areas of the standard are identified in preparation for the review.

The work to review the helicopter suit standard is expected to take some time to complete; in the meantime, we will continue to keep you apprised of any further issues identified with the current suit and the actions taken to address the issues. As outlined above, Operators have undertaken actions to address the issues raised by their workforce with the current suit. We are also committed to full participation in the upcoming review

of the standard. We are committed through these processes to ensuring that all issues identified are addressed and any improvements, to the standard or the current suit, are explored and undertaken where appropriate.

Please let me know if you require any further information.

Sincerely,

R. Paul Barnes
Manager, Atlantic Canada

Topic 2: Survival Suits

2.6

Government of Canada
Canadian General Standards Board
Place du Portage III - 6B1
Hull, Quebec
K1A 1G6

Gouvernement du Canada
Office des normes générales du Canada
Place du Portage III - 6B1
Hull (Québec)
K1A 1G6

28 May 2009

ACG 6481-213

Mr. Paul Barnes
Manager, Atlantic Canada
Canadian Petroleum Products Association
235 Water Street, Suite 905
St. John's, Newfoundland
A1C 1B6

Dear Mr. Barnes:

Subject: Agreement
Revision of Standard for Helicopter Passenger Transportation Suit Systems

Please find enclosed a copy of the signed Agreement. We look forward to working with you and the various stakeholder interests in revising the CGSB standard CAN/CGSB-65.17-99 *Helicopter Passenger Transportation Suit Systems.*

Should you have any questions in the future on the Agreement, please do not hesitate to contact me.

Sincerely,

Marian Gaucher
Manager, Standards Division
Canadian General Standards Board
Tel.: (819) 956-1594
Email: marian.l.gaucher@tpsgc-pwgsc.gc.ca

Encl.

c.c. Bob Charest, CGSB

CAPP

CANADIAN ASSOCIATION
OF PETROLEUM PRODUCERS

May 26, 2009

Marian L. Gaucher
Manager, Standards Division
Canadian General Standards Board
11 Laurier Street, Place du Portage, Phase III, 6B1
Gatineau, Quebec K1A 0S5 CANADA

Re: Project Agreement for: The Revision of a National Standard of Canada for Helicopter Passenger Transportation Suit Systems – CGSB and CAPP

Attached please find a copy of the agreement as signed by David Pryce of the Canadian Association of Petroleum Producers (CAPP). Please note Mr. Pryce's title should correctly read Vice President, Operations, not Western Canada Operations as noted.

If you have any questions or concerns please contact Paul Barnes (709) 724-4202.

Sincerely,

Shirley Lake

on behalf of David Pryce
Vice President, Operations

CAPP_EDMS-#152520-V1

2100, 350 – 7 Avenue S.W.
Calgary, Alberta
Canada T2P 3N9
Tel (403) 267-1100
Fax (403) 261-4622

403, 235 Water Street
St. John's, Newfoundland and Labrador
Canada A1C 1B6
Tel (709) 724-4200
Fax (709) 724-4225

www.capp.ca • communication@capp.ca

Project Agreement for:
The Revision of a National Standard of Canada for Helicopter Passenger Transportation Suit Systems

THIS AGREEMENT is made this ___st day of April 2009;

BETWEEN

HER MAJESTY THE QUEEN IN RIGHT OF CANADA
(hereinafter referred to as Her Majesty) as represented by the Minister of Public Works and Government Services, (The Minister) the Minister responsible for the Canadian General Standards Board (hereinafter referred to as "CGSB")
OF THE FIRST PART

AND

CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS
(hereinafter referred to CAPP), a body corporate incorporated under the laws of Alberta, having a place of business at 2100, 350 7th Avenue S.W., Calgary, Alberta T2P 3N9.
OF THE SECOND PART

WITNESSETH THAT:

WHEREAS:

1. CGSB and CAPP (hereinafter referred to as "the Parties") acknowledge undertaking the revision of a National Standard of Canada (NSC), CAN/CGSB-65.17-99 *Helicopter Passenger Transportation Suit Systems* in accordance with the Work Program attached hereto and the requirements of the Standards Council of Canada for a National Standard of Canada.

2. The Parties acknowledge that CGSB is a revenue dependent organization within PWGSC;

3. CAPP (hereinafter referred to as "the Sponsor") agrees to fund the costs incurred by the CGSB on behalf of Her Majesty for fiscal year 2009/2010 and 2010/2011 in the course of revising the Standard.

NOW, THEREFORE, the Parties, in consideration of the premises and mutual covenants herein contained, agree as follows:

Purpose

1. a) The Parties shall undertake the revision of the Standard in accordance with the WORK PROGRAM, attached hereto and the requirements of the Standards Council of Canada for a National Standard of Canada.

Funding

2. a) The Sponsor agrees to fund the total cost for the revision of the Standard. Initial estimates are provided in Tables 1- 4 of the WORK PROGRAM, attached hereto. The complete project spans the fiscal year 2009/2010 and 2010/2011. The Work Program for 2010/2011 will include any work not completed in 2009/2010.

b) The Parties agree that where total costs are to be shared amongst more than one Sponsor with whom CGSB has an agreement for the revision of the standard, CGSB shall invoice CAPP on the proportion agreed to among the Sponsors themselves.

c) CAPP agrees to inform CGSB of the proportion to be invoiced that has been agreed upon amongst the Sponsors with whom CGSB has a signed agreement.

d) CAPP agrees to fund the revision of the standard to an amount not to exceed $100,000 where costs are to be shared amongst more than one Sponsor with whom CGSB has an agreement.

e) The Parties agree that CGSB work on the revision of the standard is conditional on CGSB costs being fully recovered for the quarter being invoiced.

f) The Parties acknowledge that the funding estimate only takes into account CGSB fees, based on the current per diem for secretariat services, and editing, translation and publication expenses of the final standard.

g) The Parties acknowledge that funding estimates are estimates only and that final costs will be based on actual person-days utilized and the recovery of CGSB expenses. Charges to the Sponsor shall be based on the CGSB per diem ($1250 for FY 2009/2010) in effect during the time period in which the work is completed.

h) The Sponsor agrees that CGSB shall invoice the Sponsor on a quarterly basis in accordance with this agreement for project charges and costs to Her Majesty for any work performed and costs incurred by CGSB during the quarter.

i) The Sponsor agrees to pay within 30 days from the receipt of the invoice the total funding requirement due and owed to Her Majesty.

Term

3. a) The Agreement shall have a term beginning on the 1st day of April, 2009 and ending on March 31, 2011.

Changes To The Work Program and Funding Requirements

4. a) The Parties acknowledge that the nature of the consensus process and the requirements established by the Standards Council of Canada for a National Standard of Canada (NSC) may lead to additional work and unforeseen costs during the course of updating the standard. The Parties thus agree that the costs detailed in the Work Program, Tables 1- 4 are estimated costs only and that these costs are subject to change upon the written consent of the Parties.

b) The Parties agree that changes to the Work Program, additional work and/or any cost increases (or changes to funding requirements) must be incorporated into Tables 1- 4 by way of a written amendment.

c) The Parties agree that CGSB work on the revision of the standard is conditional on the availability of funds to meet work requirements.

Amendment

5. a) No amendment to the Agreement and the Work Program and Tables 1- 4 shall become effective unless it is authorized in writing by CGSB and approved by the Sponsor.

b) The Parties acknowledge that project activity shall be suspended until the Agreement can be amended should the total estimated funding requirements be exceeded.

b) This Agreement shall be terminated where the Sponsor is unable to approve any proposed amendment to this Agreement at the end of 30 days following the receipt of such a proposal from the CGSB.

Designated Representative

6. a) The "Sponsor's Representative" for all matters pertaining to this Agreement shall be the following Official:

Paul Barnes
Manager, Atlantic Canada
Canadian Petroleum Products Association
235 Water St., Suite 905
St. John's, NL
Canada, A1C 1B6
Tel: (709) 724-4202
E-mail: paul.barnes@capp.ca

b) The Minister's Representative for all matters pertaining to this Agreement shall be the following Official:
Marian L. Gaucher
Manager, Standards Division
Canadian General Standards Board
11 Laurier Street, Place du Portage, Phase III, 6B1
Gatineau, Quebec K1A 0S5 CANADA
Tel: (819) 956-0383

Fax: (819) 956-1634
E-mail Marian.L.Gaucher@pwgsc.gc.ca

c) The above designated authorities and addresses may be changed by written notice.

Intellectual Property

7. a) Any intellectual property, scientific or technical information, including technology, generated pursuant to the implementation of this Contract shall vest solely in Canada as represented by the Canadian General Standards Board; and

b) Intellectual Property is defined as "any proprietary right provided under (i) copyright law, (ii) patent law, (iii) trade-mark law, (iv) design patent or industrial design law, (v) any other statutory provision or common law principle applicable, which may provide a right in either (A) ideas, formulae, algorithms, concepts, methods, inventions, works or know-how generally including trade secret law, or (B) the expression of such ideas, formulae, algorithms, concepts, methods, inventions, works or know-how".

c) The Parties agree that the provisions of this Agreement relating to the protection of intellectual property rights and the use of confidential or proprietary information will survive termination of this Agreement.

Termination

8. a) Upon termination of this Agreement, the Sponsor will reimburse CGSB for all work done up to the effective date of the termination;

b) This Agreement shall be terminated on the occurrence of any of the following events:

i. If either party commits any material breach of this Agreement that is not remedied within thirty (30) days of notice specifying the breach.

ii. For an unexpected event preventing either of the Parties from performing its obligations under this Agreement by any cause beyond its reasonable control providing such cause does not arise from the party's fault or neglect and providing that the party unable to perform notifies the other party in writing of the projected termination, and

iii. By written mutual agreement of both Parties. Such written notification shall be delivered to the undersigned senior representative.

c) The Parties agree that any notice including notice of termination required to be given pursuant to the terms of this Agreement may be given by regular mail, registered mail, telex, facsimile or other telecommunication that provides a written record and shall be deemed to have been given on the date the notice was sent to the address shown below:

to <u>Her Majesty</u>	to <u>the Sponsor</u>
Director	Vice President of Western Canada Operations
Canadian General Standards Board	Canadian Association of Petroleum Producers
11 Laurier Street	2100, 350 7th Avenue S.W.

Gatineau, Quebec K1A 1G6	Calgary, Alberta T2P 3N9

No Bribe

9. The Sponsor warrants:

   a) that no bribe, gift or other inducement has been paid, given, promised or offered to any official or employee of Her Majesty, for or with a view to the execution of the Agreement by the Sponsor;

   b) that it has not employed any person to solicit or secure the Agreement upon any agreement for a commission, percentage, brokerage or contingent fee; and

   c) since the standard will be approved by consensus, the Sponsor will not receive any favoured treatment in the development of the standard.

Dispute Resolution

10. Dispute resolution will proceed as follows:

   a) In the event that a dispute arises between the Sponsor and CGSB regarding the activities governed by this Agreement, the designated Project Representatives will make reasonable efforts to resolve the dispute;

   a) In the event that the Project Representatives are not able to resolve the dispute, the supervisors of the Project Representatives from their respective organizations will attempt to mediate and resolve the dispute;

   c) In the event that the Project Representatives are not able to resolve the dispute, mediation will be elevated to the next level of management between the Sponsor and CGSB;

   d) In the event that all of the proceeding efforts do not resolve the dispute, the Parties will appoint a mutually agreed upon objective mediator for resolution;

   e) In the event that all dispute resolution efforts are not successful, either party on reasonable notice to the other may terminate the Agreement.

Miscellaneous

   a) This Agreement shall bind and inure to the benefit of the Parties hereto and their respective successors and assigns.

   b) This Agreement shall be governed by the laws of the Province Alberta and the laws of Canada applicable therein, without reference to conflict of laws principles.

   c) This document contains the entire Agreement between the Parties with respect to the subject matter hereof. There are no oral agreements between the Parties.

d) Any failure to enforce any provision of this Agreement shall not constitute a waiver thereof or of any other provision hereof.

e) In the event any term of the Agreement is found by any court to be void or otherwise unenforceable, the remainder of this Agreement shall remain valid and enforceable as though such terms were absent upon the date of its execution.

IN WITNESS WHEREOF, and in accordance with the Department of Public Works and Government Services Act, this Agreement has been executed on behalf of Her Majesty The Queen in the Right of Canada by the Canadian General Standards Board, and has been executed by the authorized representative of the Canadian Association of Petroleum Producers.

SIGNED, SEALED AND DELIVERED

MINISTER OF PUBLIC WORKS AND GOVERNMENT SERVICES

Terrence Davies
A/Director
Canadian General Standards Board

CANADIAN ASSOCIATON OF PETROLEUM PRODUCERS

Dave Pryce
Vice President of Western Canada Operations

Revision of the National Standard of Canada for Helicopter Passenger Transportation Suit Systems

WORK PROGRAM
(Attachment to the Agreement Between
the Canadian General Standards Board (CGSB) and
Canadian Petroleum Producers Association (CAPP))

1. INTRODUCTION

1.1 Scope of the Standard

This standard applies to immersion suit systems that:

- reduce thermal shock upon entry into cold water:
- delay the onset of hypothermia during immersion in cold water
- provide acceptable flotation and minimize the risk of drowning; and
- do not impair the wearer's ability to evacuate from a ditched helicopter.

1.2 Project References

- Minutes of the April 11-12, 2005 Meeting of the Committee on Immersion Suits (65/2)
- Minutes of the May 26-27, 2008 Joint Meeting of the Committee on Life Jackets (65/1) and the Committee on Immersion Suits (65/2).
- *Canada Oil and Gas Geophysical Operations Regulations*
- *Canadian Aviation Regulations*
- Letter December 8, 2008 Letter-ballot # 65-2-13 for Withdrawal
- CAN-P-2F *Requirements and Procedures for the Request for, Development, Approval, Preparattion, and Maintenance of National Standards of Canada*
- *CGSB Policy and Procedures Manuals for the Development and Review of Standards*

1.3 Background

A joint meeting of CGSB committees 65/1 and 65/2 was convened on May 26-27, 2008 to take immediate action on time-dated standards and to establish funding support available to undertake the revision of CAN/CGSB-65.17-99 for this standard as well as other standards. CAN/CGSB-65.17-99 is one of the time-dated standards that was discussed and identified for immediate action with regards to its maintenance.

At the joint committee meeting of CGSB committees 65/1 and 65/2, it was noted that CAN/CGSB-65.17-99 is in need of immediate updating for several reasons. The new edition of CAN/CGSB-65.16-2005 *Immersion Suits* has necessitated changes to CAN/CGSB-65.17-99. It is time-dated (10 years old). In addition, regulators for offshore oilrigs present at the meeting indicated that they have some concerns with the standard resulting from worker complaints raising safety and performance issues. The need from a technical and safety perspective to revise the standard was noted at the meeting. As a result, the Committee recognized the need to withdraw CAN/CGSB-65.17-99 if funding cannot be confirmed in the short term to update it. Comments subsequently received on the letter-ballot for the withdrawal of the standard from committee members further reinforced the need for a review of the standard.

As part of the CGSB review and maintenance process, and given the nature of the CGSB standard (see reference to scope above) and its 1999 publication date, CGSB proceeded with the public notification of the intent to withdraw CAN/CGSB-65.17-99 in accordance with the Standards Council of Canada (SCC) document CAN-P-2F *Requirements and Procedures For The Development and Maintenance of National Standards of Canada* and CGSB procedures for the development and review of standards.

CGSB had attempted to identify and confirm funding support to revise the standard between March 2008 and March 2009, but without success. The standard was issued for withdrawal to the Committee on Immersion Suits in December 2008. Members of the Committee who voted against withdrawal expressed support to review and revise the standard and suggested that additional consideration be given to funding and funding requirements. As a result a project agreement was distributed to their respective organizations to fund and revise the standard.

Discussions, which have since followed within the industry, the provincial and federal governments have resulted in the necessary funding support being established.

2. ROLES AND RESPONSIBILITIES WITHIN THE STANDARDS DEVELOPMENT PROCESS

2.1 The Canadian General Standards Board

As a standards writing organization accredited by the Standards Council of Canada (SCC), CGSB must fulfil the requirements of the SCC document CAN-P-1 *Accreditation of Standards-Development Organizations* (SDO), and respect the criteria for National Standards of Canada (NSC) as identified in the SCC document CAN-P-2 *Requirements and Procedures For The Development and Maintenance of National Standards of Canada.* CGSB operates in accordance with its latest policy and procedures manuals.

CGSB is responsible for managing the standards development process from the beginning of the process to the publication of the final document, including the maintenance of a standard in accordance with CAN-P-2. This includes the committee formation and maintenance, and the preparation and distribution of letter-ballot(s). The final authority on editorial modifications, layout and translation of the standard rests with CGSB.

2.2 CGSB Committee on Immersion Suits

The standards committee is responsible for the technical review, content, and approval of the standard. It is comprised of a balance of stakeholder interests representing the user, producer, general interest and regulatory interests.

Committee approval of the technical content of the National Standard of Canada is by consensus in accordance with CGSB policies and procedures, and the CAN-P-2 referenced herein.

2.3 Standards Council of Canada

The Standards Council of Canada is a Crown Corporation created by an Act of Parliament, the *Standards Council of Canada Act.* The Act defines the role and responsibilities of the SCC.

SCC has the responsibility of approving a document submitted as a proposed NSC by SDOs such as CGSB contingent upon the results of the Standards Development Organization's consensus process, specifically:

- committee review and approval process,
- compliance with CAN-P-2 and

- satisfactory resolution of any SCC comments resulting from its review.

3. WORK ACTIVITIES CONSTITUTING THE WORK PROGRAM

There are four tables (Tables 1 – 4) accompanying this proposal in the form of Excel spreadsheets. Note that this Agreement covers the fiscal year 2009/2010 and 2010/2011.

3.1 Work Program Estimates

The estimated work constituting the work program is detailed in *Table 1 – Work Activities Constituting Work Program for the Revision of CAN/CGSB-65.17-99*. The work program is based on the expectation that the development of the standard will be of a medium degree of difficulty.

CGSB cannot accurately predict how long committee decisions will take or what additional technical issues, work items or time requirements may arise during the course of the work. Committee decisions and/or unresolved technical issues may impact on the completion date FOR the standard and may increase overall work requirements. Consequently, the PD (person days) in Table 1 are based on an average of actual results for similar previous projects. Should additional work requirements be identified through the course of this project, additional funding will be needed.

Actual completion dates will depend on:

- the agreed work requirements
- the members of the Committee completing work items within expected timeframes
- the progress made at committee meetings and
- the rate at which the Committee as a whole works.

The following assumptions were used to estimate the level of effort (PDs) in the work program:

- The work is limited to the scope of the standard described. (Significant changes to the work program shall require formal agreement between the Parties, and the amending of this Project Agreement.)
- Work does not include a revision of CAN/CGSB-65.16 or the combining of CAN/CGSB-65.16 and CAN/CGSB-65.17.
- Work does not include CGSB convening more than two Working Group meetings and two Committee meetings.
- All meetings are scheduled for 3-4 days in duration as noted in the work program.
- All meetings will be held in the National Capital Region in government conference facilities.

4. ESTIMATED FUNDING REQUIREMENTS FOR THE WORK PROGRAM

4.1 Total Funding Estimate

Table 2 — Estimated Funding for the Work Program summarizes the estimated funding requirements for the work program detailed in Table 1.

Table 3 — Estimate of Costs for Translation of Committee Documents and Interpretation at Meetings gives estimates of the cost for providing translations services if required.

The following stipulations apply to Table 2:

- Funding requirements are estimates only. Final costs will be based on actual person-days and the recovery of CGSB expenses.

- Should additional work requirements be identified through the course of this project, additional funding will be needed. See *Possible additional costs for new work requirements* in Table 2 for costing of these services.

- Charges to the Sponsor will be based on the CGSB per diem ($1250/day for FY 2009/2010) in effect during the time period in which work is completed.

- This funding estimate only takes into account CGSB fees, based on the CGSB per diem for committee secretariat services in effect, and the editing, translation and publication expenses of the final standard. The estimated cost for editing, translation, composition and publication of the final document is based on the expected length of the standard being 11,800 words of English and 12,400 words of French, for a total of 40 pages.

- This funding estimate does not include funding to pay consultants or committee members to attend meetings. Participation in all standards development activities is voluntary and as such, members are required to cover their own expenses.

- This funding estimate does not include funding to pay for any technical research and development activities that may be required to address outstanding technical issues.

- Should services in the second official language need to be provided, such as the translation of committee documents and simultaneous interpretation at meetings, costs for these services are recoverable and would be additional costs over and above the estimated funding requirement for the work program. See Table 3 should these services be required.

- If it is necessary to expedite the project, more than one CGSB Standards Specialist can be assigned with commensurate funding requirements.

4.2 Adjustment of PDs as Work Progresses

Total PDs for the project will be adjusted as follows:

- When utilization of CGSB PDs for a specific step in the work plan exceeds the estimate for that step, the additional PDs (rounded to the nearest half PD) utilized and their associated cost will be added to the approved project total.
- When utilization of CGSB PDs for a specific step in the work plan does not exceed the estimate for that step, the actual PDs (rounded to the nearest half PD) and their associated cost will be subtracted from the approved project total.

4.3 Estimate of Expenditure For Fiscal Year 2009/2010

Table 4 — Estimate of Expenditure by Fiscal Year is self-explanatory.

4.4 Suspension of Work

Should the **Total Estimated Funding Requirements** of Table 2 be exceeded, CGSB will advise the Sponsor accordingly and suspend all project activity until the Agreement has been amended.

4. 5 Maintenance of the Standard

Following the publication of a new or revised standard, it is normally reviewed after five years, or earlier if warranted, to reaffirm, revise, or withdraw the standard. When the review period is due, the Sponsor will be contacted to determine if the Sponsor wishes to support the maintenance of the standard.

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
1	Review files, scope of the document and basic work requirements. Perform international standards search. Identify whether there are factors that could help or hinder the successful establishment or general application of the standard. Identify other factors that could impact on the development of an NSC, such as SCC requirements for NSCs. This is an on-going activity during the life of the project.	3.0			
2	Confirm the Working Group membership comprised of technical experts and other key stakeholders, including the champion. Establish Working Group terms of reference and work requirements.	1.0			
3	Confirm participation on the Committee, ensuring a balance of representation among interest groups in keeping with Standards Council of Canada requirements for the development of a National Standards of Canada. Membership update is an on-going activity during the life of the project.	4.0			
4	PUBLIC NOTIFICATION - Announce a draft available for 60-day public review period.				
5	LETTER BALLOT REAFFIRMATION OF STANDARD Distribute without change to members for acceptance without change.	3.0			
7	Follow-up with voting members to ensure the timely return of ballots by the closing date. (Closing date shall be one month from the date of distribution of the letter-ballot.)	2.0			
8	Review the comments received from members for clarity and additional information. Compile member comments into the comment template and distribute to the Committee along with a summary report of the ballot results.	3.0			
9	Follow-up with voting members to ensure the timely return of ballots by the closing date. (Closing date shall be one month from the date of distribution of the letter-ballot.)	2.0			

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
10	Review the comments received from members for clarity and additional information. Compile member comments into the comment template and distribute to the Committee along with a summary report of the ballot results.	3.0			
11	Confirm consensus by the 2/3 rule.				
12	DECISION POINT - If consensus has been reached, proceed to step 52 and continue with step 13.				
13	DEVELOP A WORKING DRAFT FOR A NEW EDITION -				
14	In developing the draft, CGSB will give consideration to the observations made in 2005 during the finalization of CAN/CGSB-65.16-2005 that impacted CAN.CGSB-65.17-99 AND any available information since that time identified through consultation with the champion for CAN/CGSB-65.17-99. Stakeholders on the Committee will also be contacted to identify specific issues with sections of the standard, make recommendations and asked to provide information on any known studies that can be forwarded to the members for consideration. The CGSB will develop the Working Draft in compliance with CGSB policies and procedures, good standards writing practices, and SCC requirements for a NSC.	15.0			
15	Prepare for a Working Group meeting as follows: – prepare the meeting agenda – compile additional materials for working group members – perform administrative tasks (arrangements for meeting room, hospitality, and equipment, etc.)	1.0			
	FIRST WORKING GROUP MEETING - Convene a four-day meeting in the National Capital Region to: - review the working draft in detail.				

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
16	- consider North American and International standards on the same subject to harmonize where possible - review the recommendations of the champion – establish major issues needing resolution by the Working Group/champion and timelines**Note: two staff members facilitating the process will be present, Team Leader (Acting Chair) and Secretary**	8.0			
17	Prepare and distribute minutes of the Working Group meeting along with relevant attachments to Working Group members.	7.0			
18	Revise Working Draft based on the resolutions and decisions made at the Working Group meeting.	5.0			
19	Follow-up on action items identified through the meeting that need to be completed by CGSB. (Excludes time spent on the Working Draft.)	2.0			
20	Coordinate work items delegated to others, specifically the work of the Working Group/champion .	2.0			
21	Further update the Working Draft based on final Working Group/champion recommendations. Update the comment template identifying the changes and justifications for change along with available supporting documentation. Deficiencies will be referred back to the Working Group/champion for resolution.	2.0			
22	WORKING DRAFT -Distribute the Working Draft and supporting documentation to the full Committee prior to the committee meeting for review and comment	1.0			
23	Coordinate the response of comments received from committee members on the Working Draft. Review the comments received, seek clarification and additional input where required. Roll-up the comments in the comment template and distribute to the members at large in preparation for the committee meeting	6.0			

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
24	Prepare for a Committee meeting as follows: – prepare the meeting agenda – compile additional materials for committee members – perform administrative tasks (arrangements for meeting room, hospitality, and equipment, etc.)	1.0			
25	FIRST COMMITTEE MEETING - Convene a four-day meeting in the National Capital Region to: – review roles and responsibilities of CGSB and Committee members – review committee membership – establish the work of the Committee and scope proposed for the standard – receive the report of the Working Group Chair and champion on the proposed changes – review existing standards used nationally and internationally specific to the subject at hand – review and resolve the comments received from members on the Working Draft – identify outstanding issues that can be resolved in the short term by the Working Group/champion ar timelines. **Note: two staff members facilitating the process will be present, acting Chair and Secretary.**	8.0			
26	Update the Working Draft based on resolutions reached at the committee meeting and the comment template recording changes.	3.0			
27	Prepare and distribute minutes of the committee meeting along with relevant attachments to members.	7.0			
28	Follow-up on action items identified through the meeting that need to be completed by CGSB. (Excludes time spent on the Working Draft.)	2.0			
29	Coordinate remaining work items delegated to others, specifically the work of the Working Group/champion .	2.0			

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
30	Update the Working Draft based on any final Working Group recommendations, creating the Committee Ballot Draft (CBD) for ballot to the Committee. This includes ensuring that good standards writing practices still apply and that the Working Group/champion have provided the comment template identifying the changes and justifications for additional change along with available supporting documentation. Deficiencies will be referred back to the Working Group/champion for resolution prior to distributing the Committee Ballot Draft to the full Committee under letter ballot.	2.0			
31	PUBLIC NOTIFICATION - Announce a draft available for 60-day public review period.				
32	LETTER BALLOT - Distribute the Committee Ballot Draft under letter-ballot with supporting documentation to the Committee for approval once membership commitment to return ballots and committee membership balance has been confirmed.	1.0			
33	Follow-up with voting members to ensure the timely return of ballots by the closing date. (Closing date shall be one month from the date of distribution of the letter-ballot.)	2.0			
34	Review the comments received from members for clarity and additional information. Compile member comments into the comment template and distribute to the Committee along with a summary report of the ballot results.	3.0			
35	SECOND WORKING GROUP MEETING - Convene a three-day meeting in the National Capital Region to: Review the comments received on the letter ballot and provide resolutions.	6.0			
36	Prepare and distribute minutes of the Working Group meeting along with relevant attachments.	7.0			
37	Follow-up on action items identified through the meeting that need to be completed by CGSB. (Excludes time spent on the Working Draft.)	2.0			
38	Coordinate work items delegated to others, specifically the work of the Working Group/champion .	2.0			
39	Revise comment template to reflect proposed recommendations. Distribute to full Committee.	2.0			

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
40	Make preparations for a three-day committee meeting.	1.0			
41	SECOND COMMITTEE MEETING - Convene a three-day meeting in the National Capital Region (quorum required) to: - resolve negative votes -seek resolutions to all comments **Note: two staff members facilitating the process will be present, acting Chair and Secretary**	6.0			
42	Prepare and distribute minutes of the meeting along with relevant attachments. (Excludes time spent on the Committee Ballot Draft)	5.0			
43	Update the Committee Ballot Draft based on resolutions reached at the committee meeting, creating the Final Committee Draft for advancement to Second Level Review if changes considered minor. Otherwise issue a second letter ballot if the changes are considered significant.	2.0			
44	Confirm withdrawal of negative votes and consensus by the 2/3 rule.	1.0			
45	SECOND LETTER BALLOT - Distribute the Committee Ballot Draft under letter-ballot with supporting documentation to the Committee for approval once membership commitment to return ballot and committee membership balance has been confirmed.	1.0			
46	Follow-up with voting members to ensure the timely return of ballots by the closing date. (Closing date shall be one month from the date of distribution of the letter-ballot.)	2.0			
47	Review the comments received from members for clarity and additional information. Compile member comments into the comment template and distribute to the Committee along with a summary report of the ballot results.	3.0			
48	Confirm consensus by the 2/3 rule.				
49	DECISION POINT - If consensus has been reached, proceed to step 52.				

Table 1 - Work Activities Constituting Work Program For the Revision of CAN/CGSB-65.17-99 for FY09/10

STEP	ACTIVITY	PDs (CGSB Standards Specialist person days employed on the project)		COMPLETION DATE	
		EST	ACTUAL	TARGET	ACTUAL
50	DECISION POINT - If consensus is not reached by the Committee at step 48, then all or portions of the above process will have to be repeated, requiring amendment of the project agreement. For example, the Committee may decide to defer specific items back to the Working Group to incorporate into a revised CD or to CGSB for a revised CBD for re-balloting. Such changes to the work plan requires the project agreement to be amended to take into account additional work requirements needed to reach consensus and the additional costs before work proceeds. Proceed to step 51.				
51	Amend the work plan and Project Agreement; obtain appropriate funding.	1.0			
52	SECOND LEVEL APPROVAL i) Prepare supporting documentation and submit Final Committee Draft to second-level review by the CGSB Panel on Process Assurance (PPA). ii) Advise the Committee upon PPA approval of the Final Committee Draft.	2.0			
53	STANDADS COUNCIL OF CANADA (SCC) – submit Final Committee Draft and supporting documentation – follow up with SCC and keep committee advised of progress – address SCC inquiries on submission	1.0			
53	PUBLICATION - Complete the editing, translation, and composition leading to the publication of the revised National Standard of Canada in both official languages in accordance with the CGSB Style Guide and CANP-2 requirements. *Note: The estimated expenses for editing, translation, composition and publication of the final document are based on the expected length of the standard. See Table 3 - Estimated Funding For The Work Program.*				
	Total maximum time (person days) based on estimated work:	**145.0**			

Table 2 — Estimated Funding for the Work Program

ITEM	ESTIMATED UNITS	ESTIMATED COST
Standards Administratio		
Steps 1 to 53 — PDs @ $1,250/day	145.0	$181,250
Edits/ Composition/Publication, estimated (based on 11,800 English words and 12,400 French words; 600 words/page, 4 days/10 pages) Editor PDs @ $900/day *(TO BE CONFIRMED)*	24,200	$14,520
Meeting Room Rentals @ est. $1000/meetin	3	$8,000
Translation of final document, est. words 11800 @ $0.43 per wor	11,800	$5,074
Travel of CGSB Secretariat to Committee Meetings (Ottawa	0	$0
Hospitality(Estimated at $8 per person per day of meeting) 35 persons per day*	14	$3,920
Ongoing Activities**	14	$17,500
Total Estimated Funding Requirements (based on Table 1)		**$230,264**

Possible additional costs for new work requirements

ITEM	ESTIMATED PDs @ $1,250	ESTIMATED COST
Each additional draft	3.0	$3,750
Each additional 1-day meeting, including preparation and minute	5.0	$6,250
Each additional 2-day meeting, including preparation and minute	10.0	$12,500
Each additional ballot, including follow-up, review of comments and compilation	6.0	$7,500
Translation of Committee Working Documents and Interpretation at Committee Meetings (if required), See Table 3 -*Estimate of Costs for Translation of Committee Documents and Interpretation at Two Committee Meetings*	—	$37,820

**Coffee, muffins at meetings*

***Items such as project management, miscellaneous correspondence, inquiries*

Table 3 — Estimate of Costs for Translation of Committee Documents and Interpretation at Committee Meetings

(i) Translation of Committee Documents			
Event	**Items Requiring Translation**	**Estimated Word Count**	**Estimated Cost @ $0.43/word**
First Meeting	Notices, agenda, minutes, draft standard (no French/English edit)	25,000	$10,750
For Additional Meetings	Notices, agenda, minutes, draft standard (no French/English edit)	25,000	$10,750
Items Which Require Translation, Regardless of Number of Meetings	Comments from members, letter ballots, miscellaneous correspondence from/to members	24,000	$10,320
	Subtotal (i)	**74,000**	**$31,820**

(ii) Simultaneous Interpretation at Meetings			
Event	**Item**	**Estimated Number**	**Estimated Cost @ $3,000/two-day meetings**
Committee Meetings	Equipment and set-up. Includes items such as microphones, booth for interpreters. Currently interpreters are provided by PWGSC at no cost in the Ottawa region.	2	$6,000
	Subtotal (ii)		**$6,000**
	Total (i) + (ii)		**$37,820**

Table 4 — Estimate of Expenditure by Fiscal Year

Item	2009/2010		2010/2011		2011/2012		Total
Steps - PDs @ $1,250/PD	Est. Qty.	Est. Cost	Est. Qty.	Est. Cost	Est. Qty.	Est. Cost	
Steps 1-53	125.0	$156,250	20.0	$25,000			$181,250
Edits(English to French)/Composition/Publication*				$7,080			$7,080
Edits French to English)/Composition/Publication*				$7,440			$7,440
Meeting rooms		$8,000					$8,000
Hospitality**		$3,920					$3,920
Ongoing Activities**	12.0	$15,000	2.0	$2,500			$17,500
Translation				$5,074			$5,074
Estimated Total Cost per FY (without translation and interpretation)	**137.0**	**$183,170**		**$47,094**			**$230,264**
Translation of Committee documents* **		$31,820					**$31,820**
Simultaneous Interpretation* **		$6,000					**$6,000**
Total Cost per FY (with translation and interpretation)		**$220,990**		**$47,094**		**$0**	**$268,084**

***If overtime is required by translators, translation costs would increase by 30%.**

****See Table 3**

*****If required. See Table 3**

Topic 2: Survival Suits

2.7

ISO COMMENT TEMPLATE

CGSB Committee on Immersion Suits (65/2)
Comments from Members on LB65-2-14

Closing Date:	Document Under Review:
2009-08-20	CAN/CGSB-65.17-99 Helicopter Passenger Transportation Suit Systems (reaffirmation)

1	2	(3)
M[1]	Comments	Secretariat observations
[redacted]	The following comments are being submitted to supplement the vote CAPP has made as a member of CGSB 65-2 Immersion Suits in the re-affirmation of CAN/CGSB 65.17-99. CAPP has voted 'no' in order to support the review of this standard. CAPP supports a review given the duration of time since the previous review and in order to incorporate any new research, technology or practices that may be pertinent to this standard. These comments are meant to outline areas CAPP has identified for discussion by the CGSB working group during a review of the standard. COMMENTS 1) Incorporation of any new research, literature, testing methodology, practices, etc. The testing protocols and formulas in the standard should be designed to ensure a product approved to the standard has been tested for performance based results. Improvements in the availability of facilities and safety measures to test products in a more realistic fashion have occurred since the previous revision of the standard. Further, any research, new literature, or other relevant information should be considered with respect to the basis of the standard and its goals. It is noted that the ISO immersion suit standard is currently under review; applicable research included in the review of the ISO standard should be considered during the review of this CGSB helicopter suit standard. **Review the testing protocols, survival criteria, formulas and requirements contained within the standard and revise if needed to ensure up-to-date performance based testing methods and associated formulas as per expected end-use**. Consider: leakage testing and formula escape and inherent buoyancy thermal testing/requirements	

1 M = Member Initials+

ISO COMMENT TEMPLATE

CGSB Committee on Immersion Suits (65/2)
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Closing Date:	Document Under Review:
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1	2	(3)
M[1]	Comments	Secretariat observations
	sample sizes to reflect end user population mobility and donning tests Survival/rescue expectations in Canadian offshore environment 2) Certification and suit product sizing Consider a mechanism to allow for suit components which are certified to the standard be interchangeable to provide better range of suit fit for end user populations (i.e. hoods, boots, wrist seals, etc. once certified should be interchangeable with suit body sizes without needing to be re-certified).	

1 M = Member Initials+