



WITHDRAWAL

October 2017

Selected standards in the series Protective Clothing

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CAN/CGSB-155.20-2000

Workwear for Protection Against Hydrocarbon Flash Fire (ICS 13.340.10)

CAN/CGSB-155.21-2000

Recommended Practices for the Provision and Use of Workwear for Protection Against Hydrocarbon Flash Fire (ICS 13.340.10)

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CAN/CGSB-155.20-2000

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CAN/CGSB-155.21-2000

Recommandations visant la fourniture et l'utilisation des vêtements de travail de protection contre les feux à inflammation instantanée causés par des hydrocarbures (ICS 13.340.10)



CAN/CGSB-155.21-2000

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Recommended Practices for the Provision and Use of Workwear for Protection Against Hydrocarbon Flash Fire

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**RECOMMENDED PRACTICES FOR THE PROVISION
AND USE OF WORKWEAR FOR PROTECTION
AGAINST HYDROCARBON FLASH FIRE**

Prepared by the
Canadian General Standards Board 

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**RECOMMENDED PRACTICES FOR THE PROVISION
AND USE OF WORKWEAR FOR PROTECTION
AGAINST HYDROCARBON FLASH FIRE**

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CANADIAN GENERAL STANDARDS BOARD

RECOMMENDED PRACTICES FOR THE PROVISION AND USE OF WORKWEAR FOR PROTECTION AGAINST HYDROCARBON FLASH FIRE

CAN/CGSB-155.21 (Recommended Practices for the Provision and Use of Workwear for Protection Against Hydrocarbon Flash Fire) is not a mandatory part of CAN/CGSB-155.20 (Workwear for Protection Against Hydrocarbon Flash Fire).

1. SCOPE

- 1.1 These recommended practices provide guidance for the selection, use, maintenance, retirement, and understanding of the limitations of workwear for the protection against unplanned exposure to hydrocarbon flash fire by wearers, employers, and others involved in programs requiring such protective clothing.
- 1.2 The use of workwear providing protection against hydrocarbon flash fires should be incorporated into a proper safety program that also utilizes appropriate administrative and engineering controls in addition to proper safe work procedures.
- 1.3 Minimum performance requirements and test methods for single layer and multi-layer garments are addressed in *CAN/CGSB-155.20 — Workwear for Protection Against Hydrocarbon Flash Fire* and are not included in this document; however, other considerations regarding selection of workwear when preparing a purchase agreement are included.
- 1.4 Workwear for protection against hydrocarbon flash fire is available from a variety of manufacturers, in a range of items (coveralls, pants, shirts, vests, parkas, rainwear, disposable garments, aprons, etc.). Workwear for protection against hydrocarbon flash fire is made out of a variety of either inherently flame-resistant fabrics or fabrics that have been treated with flame-resistant finishes.
- 1.5 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)
 - CAN/CGSB-4.157 — Generic Names for Man-Made Fibres
 - CAN/CGSB-4.175 Part 1/ISO 4880 — Burning Behaviour of Textiles and Textile Products — Vocabulary
 - CAN/CGSB-4.175 Part 3/ISO 3572 — Textiles — Weaves — Definitions of General Terms and Basic Weaves
 - CAN/CGSB-4.175 Part 4/ISO 8159 — Textiles — Morphology of Fibres and Yarns — Vocabulary
 - CAN/CGSB-4.175 Part 6/ISO 9092 — Textiles — Nonwovens — Definition
 - CAN/CGSB-155.20 — Workwear for Protection Against Hydrocarbon Flash Fire.
 - 2.1.2 Industry Canada
 - Textile Labelling Act and Regulations
 - Textile Labelling and Advertising Regulations.

2.1.3 American Society for Testing and Materials (ASTM)
D 123 — Standard Terminology Relating to Textiles.

2.1.4 U.S. General Services Administration
Federal Standard
No. 191A — Textile Test Methods
5931 — Determination of Electrostatic Decay of Fabrics.

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 (Section 9).

3. GLOSSARY OF TERMS

NOTE: The terms which appear in CAN/CGSB-155.20, for the most part, are technical in nature and are more easily understood by testing facility staff. The glossary of terms section of this document is intended to offer a non-technical explanation. A Supplementary Glossary is included as Appendix A. Technical definitions for many of the terms included here can be found in CAN/CGSB-4.175 (Parts 1, 3, 4, 6), CAN/CGSB-4.157, the Textile Labelling Act, as well as in specific test methods referenced in this standard.

The following definitions are applicable to this standard:

Char (Produit de carbonisation)

Carbonaceous residue resulting from pyrolysis or incomplete combustion. Charring is the same phenomenon that occurs when a material subjected to fire becomes embrittled as it dries out, shrinks in size, and may break apart when any force or pressure is applied.

Decontamination (Décontamination)

Removal of the contaminant from the protective clothing by laundering or dry cleaning, to the extent necessary to continue to meet the minimum performance requirements specified in CAN/CGSB-155.20.

Drip (Égoutter)

To run or fall in drops or blobs.

Ease (Aisance)

The size requirements and tolerance of a garment which allows good fit and does not inhibit the natural body movement or the performance of any task.

Fabric (Tissu)

Yarns used to manufacture fabrics are made of a single fibre type or multiple fibre blends. Fabrics can either be woven or knitted. Each type of fabric has specific mechanical and physical properties that can have a distinct impact on wear, durability and comfort.

Fabric Blend (Mélange de tissu)

A fabric in which two or more textile fibres are combined to produce fabrics with special performance qualities.

Fibre (Fibre)

The correct term is manufactured fibre: a class name for various genera of filament, tow, or staple produced from fibre forming substances which may be (1) polymers synthesized from chemical compounds, (2) modified or transformed natural polymers, or (3) glass. Fibre is the first step of textile development that will result in the making of yarn, which is then made into fabric. Fibre can be a natural fibre (vegetable or animal), e.g. cotton, wool, flax, or it can be a man-made or synthetic fibre, e.g., aramid, rayon. While certain fibres have inherent flame resistance, other fibres do not. However, many fibres that do not have inherent flame resistance can be treated with a flame retardant to give them flame resistance after the fibre has been processed into a yarn and the yarn is made into a fabric.

Fire (noun) (Feu)

A process of combustion characterized by the emission of heat accompanied by smoke and/or flame.

Flame (noun) (Flamme)

A zone of combustion in the gaseous phase with emission of light.

Flame (verb) (Flamber)

To undergo combustion in the gaseous phase with emission of light.

Flame Resistance (Résistance à la flamme)

The property of a material whereby flaming combustion is slowed, terminated or prevented. Flame resistance can be imparted by specific treatment or can be an inherent property of the basic material.

For this document, flame resistance implies that flaming combustion is slowed and the material self-extinguishes and does not continue to burn when removed from the flame.

Flame-retardant treatment (Ignifugation)

A chemical process or treatment whereby flame retardant is imparted to a fabric which if it was not treated, would burn and/or melt when exposed to a flame.

Inherently Flame-resistant Fibre (Fibre ininflammable)

Manufactured fibres whose generic material makes them naturally flame resistant without a chemical treatment. Such fibres have slower flaming combustion and self-extinguish when exposed to a flame of short duration during testing.

Generic Term (Terme générique)

A name given to a class of fibres with similar chemical makeup. Examples of generic terms and fibres are aramid, cellulose fibres, polybenzimidazole (PBI), protein fibres. (See Appendix A — Supplemental Glossary.)

Knitted Fabric (Tricot)

A structure produced by interlooping one or more ends of yarn or comparable material. Examples are jersey, interlock and rib.

Melt (Fondre)

The physical process of changing from solid to liquid by action of heat, as evidenced by flowing or dripping.

Protective Workwear (Vêtements de travail de protection)

Single to multi-layer protective workwear such as, but not limited to, coveralls, trousers, shirts, jackets, rainwear and parkas, designed to provide protection against hydrocarbon flash fire. Protective workwear covers the body from the neck to the wrists and feet and may or may not cover the neck, head, hands and feet.

Static Electricity (Électricité statique)

An accumulation of negative or positive charge on the surface of the garment due to inadequate dissipation of electricity. The accumulated static electricity may discharge to materials with a different potential, producing sparks that may have sufficient energy to ignite a flammable mixture of hydrocarbon.

Woven Fabric (Tissé)

Woven fabrics consist of interlaced yarns that are perpendicular to each other. Those yarns running lengthwise (parallel to the length of the fabric) are called warp direction yarns. Those yarns running widthwise (across the width of the fabric) are called filling or weft direction yarns. Woven fabrics have a number of textures and appearances based on variations of this perpendicular placement of yarns. Examples are plain weave, twill, satin, and corduroy.

4. CONSIDERATIONS FOR THE SELECTION OF PROTECTIVE WORKWEAR

4.1 In addition to the protection or safety factors covered in CAN/CGSB-155.20, the selection of protective workwear should be based on the evaluation of specific criteria applicable to the particular occupational situation. This evaluation should be determined by safe work procedures, industry standards and occupational health and safety regulations. The evaluation should include consideration of the following parameters:

- a. potential hazards the workers may be exposed to in the course of their duties;

- b. hazard classification of the work area (for example, the presence of other types of hazards, such as chemical);
- c. appearance, thermal comfort, sizing;
- d. durability or wear life (for example, seam strength, tearing strength, UV degradation);
- e. physical demands of the work;
- f. climate;
- g. access to service such as laundering/dry cleaning, repair establishments; and
- h. supplier services (for example, inventory of garments, fabric, and fibre, quality assurance level, technical assistance, industry experience).

The relative importance of each of the criteria should be determined before deciding on the optimum combination of fabric and garment properties and performance requirements for a specific job or a combination of duties.

4.2 Additional Selection Criteria

- 4.2.1 Additional selection criteria which are not covered in CAN/CGSB-155.20, but may be useful in evaluation of workwear could include tearing strength, breaking strength of fabric and seams, seam slippage, abrasion resistance, pilling, chemical stability, dimensional change, colourfastness to sunlight, colourfastness to laundering or dry cleaning, and moisture properties. (See Appendix A - Supplementary Glossary.)
- 4.2.2 The protective workwear should provide a good functional fit for maximum protection and comfort on the job. Users should be aware that the fit of the garment (that is, too tight or too loose) can have a direct influence on how much protection can be provided by a particular garment.

5. USE OF PROTECTIVE WORKWEAR

NOTE: It is recommended that the outermost garment in any protective ensemble be in compliance with CAN/CGSB-155.20. The use of a garment that burns, melts, or drips which is worn over a garment meeting CAN/CGSB-155.20 may contribute to the severity of a burn injury.

- 5.1 For maximum protection, the protective workwear should be worn properly. The collar should be worn closed, and sleeves and cuffs worn down, and secured.
- 5.2 Single layer protective garments are more effective when worn over an additional layer.
WARNING — Disposable garments shall only be worn over workwear meeting CAN/CGSB-155.20.
- 5.3 Protective neck, head, hand and foot coverings should be worn if the occupational hazard warrants their use.
- 5.4 Certain synthetics or synthetic blend garments worn as undergarments may not be appropriate for use under flame-resistant workwear, as the transferred heat from a flash fire may cause them to melt. Undergarments with melt-resistant properties are recommended (e.g. cotton, aramid, wool).

6. MAINTENANCE OF PROTECTIVE WORKWEAR

- 6.1 Protective workwear must be kept clean. Adequate decontamination of protective workwear, according to the manufacturer's recommendations, by laundering or dry cleaning is imperative in order to maintain flame resistance and thermal protection. Soiling may reduce the protective qualities and increase the risk of second- and third-degree burns. Garments that are contaminated with a significant amount of oily soil, contaminants or a flammable substance, should be decontaminated (or cleaned) to remove the substance.
- 6.2 When maintaining protective garments, launder or dry clean sufficiently to prevent buildup of hard to remove stains which could reduce flame resistance. Pre-treat oily stains by either rubbing liquid detergent or powdered detergent mixed with water into the stain or use a pre-wash product recommended for oily stains. Use a liquid or powdered detergent designed especially for removing oily soils. Follow the detergent suppliers' recommendations for wash formulas including product concentration, wash temperatures, machine load sizes, and number of cycles required to sufficiently remove all soils.

- 6.3 Note any laundry precautions on the garment label which will lessen the effectiveness of the flame resistance, in particular:
- whether the use of chlorine bleach is advised or should be avoided.
 - whether a heavy-duty soap can be used or laundering must be limited to a heavy-duty synthetic detergent.
- 6.4 Some soap and detergent for dry cleaning can rapidly affect the flammable properties of protective garments. Certain petroleum solvents should be avoided as they commonly leave flammable grease deposit and reduce protective properties.
- 6.5 Repairs should only be made with components which comply with the original garment's specifications and construction.

7. LIMITATIONS OF PROTECTIVE WORKWEAR

- 7.1 The protective garments addressed in CAN/CGSB-155.20 and in this document provide a measure of protection against unplanned exposure to hydrocarbon flash fire (approximately 84 kW/m²) for relatively short periods of time, typically three seconds or less. Protective garments may serve to reduce the severity of burn injury as a result of a hydrocarbon flash fire but may not completely prevent an injury. Garments that continue to burn after a flash fire incident are hazardous. CAN/CGSB-155.20 was developed to minimize this hazard.
- 7.2 Periodically, a selection of garments should be removed from use, inspected and tested to the performance requirements of CAN/CGSB-155.20, so the user can make a decision on continued use or disposal.

8. STATIC ELECTRICITY

- 8.1 The major static hazard is the body which can store a large static charge. It is imperative in situations where static electricity poses a significant hazard that the body be grounded regardless of the type of clothing worn. Friction between clothing layers or between clothing and other surfaces can generate static electricity of sufficient energy to ignite combustible atmospheres. It is important to minimize the buildup of static electricity on workwear in order to prevent the clothing from becoming a source of ignition if discharged.
- 8.2 Workers must be grounded before entering a high-risk area to minimize the possibility of static buildup and discharge.
- 8.2.1 Workers must also avoid removing garments while in the high-risk area.
- 8.3 At low humidity levels (less than 20%), garments made from either natural fibres (such as cotton or wool) or synthetic fibres (such as aramids and rayon) that rely on water content to dissipate static electricity are not antistatic. One approach to reduce the static on garments is to use an antistatic treatment during laundering. This treatment works by trapping water on the fabric to distribute the static charge through conductivity. The antistatic treatment must be added during each laundering according to the manufacturer's directions. Over drying in the dryer should be avoided to minimize static buildup.
- 8.3.1 An alternative approach is to use inherently antistatic garments made of aramid fibres which are blended with 2% of a proprietary carbon core fibre or other equally efficient inhibitors. These blended fibres dissipate static electricity buildup by induction and are effective regardless of environment conditions where relative humidity can be 20% or less.
- 8.3.2 Static decay performance is measured by the Federal Standard 191A Test Method 5931. In this test, 5000 volts are applied to the test fabric. The test fabric must accept a minimum of 3000 volts which must decay to 10% within 0.5 second upon grounding. The test is carried out in laboratory environmental conditions of 24°C and relative humidity of 20%.

9. NOTES

9.1 Sources of Referenced Publications

- 9.1.1 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.
- 9.1.2 The publications referred to in par. 2.1.2 may be obtained from the Canada Communication Group, Publishing, Ottawa, Canada K1A 0S9. Telephone (819) 956-4802. Fax (819) 994-1498.
- 9.1.3 The publications referred to in par. 2.1.3 and 2.1.4 may be obtained from the 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.

WITHDRAWN

SUPPLEMENTARY GLOSSARY

NOTE: The trademarks listed after each term are only intended to provide the reader with examples of products currently on the market. The list of trademarks is not an endorsement of any product or manufacturer, nor is it a guarantee that the products will meet the requirements in CAN/CGSB-155.20.

Abrasion Resistance (Résistance à l'usure)

The resistance to the wearing away of any part of a material by rubbing against another surface. (Based on a definition in ASTM D123.)

Aramid (Aramide)

A long chain synthetic aromatic polyamide in which at least 85% by mass of the amide linkages are attached directly to two aromatic rings and in which imide groups may be substituted for up to 50% of the amide groups, for example, Nomex®, Kevlar®.

Blend (Mélange)

The textile industry has been developing a wide range of fibre blends to create yarns and fabrics that complement the best characteristics of each, for example, KERMEL®/fr, VULCAN®, PBI®/KEVLAR®.

Breaking Strength (Résistance à la rupture)

The ability or capacity of a specific material to withstand the ultimate tensile load or force required for rupture. (Taken from ASTM D123.)

Cellulose Fibres (Fibres cellulosiques)

Fibres composed of cellulose either from natural sources (for example, cotton, flax, jute) or regenerated by manufacturing operations (for example, rayon). Cellulose fibres are quite flammable in a natural state. Normally they must be given a finish to impart flame resistance, but some are manufactured with inherent properties for example, fire retardant treated cotton, Indura®, Proban®.

Chemical Stability (Stabilité chimique)

Degree of resistance of a material to chemicals, such as acids, bases, solvents, oils, and oxidizing agents, and to chemical reactions, including those catalyzed by light.

Colourfastness (Solidité de la couleur)

Resistance to fading, that is, the property of a dye to retain its colour when dyed (or printed) textile material is exposed to conditions or agents such as light, perspiration, atmospheric gases, or washing that can remove or destroy the colour.

Dimensional Change (Changement dimensionnel)

A generic term for changes in length or width of a fabric specimen subjected to specified conditions. (Taken from ASTM D 123.)

Flame Retardant Treatments for Fabrics (Traitement d'ignifugation des tissus)

Examples include:

- | | | |
|----|------------|--|
| a. | PROBAN® | (Albright & Wilson trademark) |
| b. | INDURA® | (Westex Inc. trademark) |
| c. | ZIRPRO® | (Wool Foundation, Nominee Company Ltd. trademark.) |
| d. | PYROVATEX® | (Ciba-Geigy trademark) |

Inherently Flame-Resistant Fibres (Fibres ininflammables)

Examples include:

- a. KEVLAR® (Dupont trademark)
- b. KERMEL® (Rhone-Poulenc trademark)
- c. NOMEX® (Dupont trademark)
- d. PBI® (Hoechst-Celanese trademark)

Moisture Properties (Propriétés hygrométriques)

Some fibres when exposed to the atmosphere pick up some moisture; the quantity varies with the fibre type, temperature, and relative humidity.

Pilling (Boulochage)

The entangling of fibres into balls (pills) which alter the appearance and texture of the fabric surface. This change can occur during washing, dry cleaning or in actual use (wearing of the garment). A pill is of such density that light will not penetrate and will cast a shadow.

Protein Fibres (natural) (Fibres protéiques [naturelles])

Animal fibres (for example, wool, silk) made up of amino acids in various configurations; for example, flame retardant treated wool, Zirpro®.

Polybenzimidazole (PBI) (Polybenzimidazole [PBI])

A manufactured fibre in which the fibre-forming substance is a long chain aromatic polymer having recurring imidazole groups as an integral part of the polymer chain, for example, PBI®/Kevlar®.

Seam Slippage (Glissement de la couture)

In sewn fabrics, the displacement of the fabric yarn parallel and adjacent to the stitch line. (Taken from ASTM D 123.)

Tearing Strength (Résistance à la déchirure)

In fabric, the force required either to start or to continue or propagate a tear in a fabric under specified conditions. (Taken from ASTM D 123).