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CAN/CGSB-207.1-2021

Control of evaporative emissions from portable fuel containers

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NATIONAL STANDARD OF CANADA **CAN/CGSB-207.1-2021**

Control of evaporative emissions from portable fuel containers

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

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Translation of this National Standard of Canada was conducted by the Government of Canada.

Preface

This is the first edition of the National Standard of Canada CAN/CGSB-207.1.

The following definitions apply in understanding how to implement this standard:

- “shall” indicates a **requirement**;
- “should” indicates a **recommendation**;
- “may” is used to indicate that something is **permitted**;
- “can” is used to indicate that something is **possible**, for example, that an organization is able to do something.

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Introduction

This standard provides guidance to authorities having jurisdiction for controlling Portable Fuel Container (PFC) emissions and to PFC manufacturers that voluntarily implement emissions reduction measures. This standard specifies the emission performance targets for the PFC and the test methods to be used to demonstrate that the target emission levels have been met.

This standard was developed with reference to Title 40, Code of Federal Regulations, Part 59. United States Environmental Protection Agency, Subpart F *Control of Evaporative Emissions From New and In-Use Portable Fuel Containers* and California Code of Regulations (CCR) title 13, Article 6 "*California Environmental Protection Agency Final Regulation Order for Portable Fuel Containers*" and its requirements do not exceed those of either of these regulations. PFCs that comply with the foregoing regulations can be deemed to meet the requirements of this standard.

This standard can be referenced in regulations and it is recommended that manufacturers consult both the regulations and this standard for complete information.

The goal of this standard is to minimize the emissions of Volatile Organic Compounds (VOCs) from PFCs. VOCs are volatile organic compounds that participate in atmospheric photochemical reactions, and that are not excluded compounds. Each jurisdiction or country may have different official definitions for VOCs and lists of excluded compounds based on photochemical reactivity. To minimize VOC emissions from PFCs, this standard addresses three types of Total Organic Gases (TOGs)[1]:

1) Evaporative emissions from unsealed or open containers or from leakage at seals;

2) Permeation emissions from products passing through the walls of the plastic containers; and

3) Evaporative emissions from spillage during use.

The aspects considered are:

1) PFC system durability and dispensing system performance;

2) Diurnal emission rate; and,

3) Automatic closure and opening.

VOCs, along with oxides of nitrogen (NO_x), are involved in a series of complex photochemical reactions that result in the formation of ground-level ozone, a respiratory irritant and one of the main components of smog.

Smog, a noxious mixture of air pollutants that can be seen as a haze over urban centres, has been shown to have a significant adverse impact on human health, including premature deaths, increased hospital admissions and emergency room visits. Smog can cause or aggravate health problems such as asthma, emphysema, chronic bronchitis and other respiratory problems as well as reduced resistance to colds and lung infections. The ozone in smog also inhibits plant growth and can cause widespread damage to crops and forests.

The Government of Canada has taken a number of actions to reduce VOC emissions in Canada. However, given the continued contribution of VOC emissions to air pollution, the impact of air pollution on the environment and human health, and Canada's national and international commitments, additional actions are required. Although PFCs are relatively modest VOC emission sources, cumulative emissions from the population of PFCs can be quite significant.

[1] To facilitate measurement, this standard uses TOGs as surrogates for VOCs. VOC emissions are a subset of TOG emissions.

TOG emissions from spillage during the refueling of the equipment from PFCs meeting the requirements of this standard are expected to be reduced by 50%. This is due to better control over the refueling process as a result of the automatic closure mechanism. The automatic closure mechanism eliminates emissions from spillage during transportation of PFCs. A diurnal TOG emissions limit of 0.3 grams per U.S. gallon per day is expected to reduce emissions from permeation and evaporation by 70%.

The CAN/CGSB-207.1 standard introduces limits for TOG emissions and supplements the CSA standard (CSA B376) that includes requirements for materials, impact and burst strengths and safety features for PFCs. Both standards are intended to apply to PFCs for the Canadian market and no conflicts or overlaps are anticipated.

Control of evaporative emissions from portable fuel containers

1 Scope

This National Standard of Canada applies to Portable Fuel Container (PFC) systems, and components sold separately, with a rated capacity between 1 L and 32 L that are designed, used, sold, advertised, or offered for sale for receiving, transporting, storing, and dispensing fuel used for internal combustion engines and kerosene as commonly used for heating and lighting applications.

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

Units of measurement – Quantities and dimensions used in this standard are in SI units, with the exception of the diurnal emissions limit in 5.3.

1.1 Exemptions

This National Standard of Canada may not apply to:

a. Containers approved by a nationally recognized testing laboratory as safety cans intended for industrial and commercial applications.

   Note Safety cans feature self-closing lids or valves with flame arrestor(s) in each opening and pressure relief devices, as described in the National Fire Code of Canada, Part 4.

b. Containers or vessels that are not red, yellow or blue in colour and are permanently marked as containers that are not intended for use with flammable liquids.

c. Containers that are designed and marketed solely for rapid refueling application in officially sanctioned off-highway motor sports such as car racing or motorcycle competitions, are unlikely to be used for non-racing applications and either create a leakproof seal against a stock target fuel tank or are designed to operate in conjunction with a receiver permanently installed on the target fuel tank.

d. Portable fuel tanks manufactured specifically to deliver fuel through a hose attached between the portable fuel tank and an outboard marine engine for the purpose of delivering fuel to outboard marine engines during operation.

e. Closed-system PFC systems that are used exclusively for fueling remote control model airplanes.

f. One time use portable emergency fuel containers that comply with ASTM F2874.

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this National Standard of Canada. The referenced documents may be obtained from the sources noted below.

Note The contact information provided below was valid at the date of publication of this standard.

An undated reference is to the latest edition or revision of the reference or document in question, unless otherwise specified by the authority applying this standard. A dated reference is to the specified revision or edition of the reference or document in question.

2.1 ASTM International

ASTM F2874, *Standard Specification for One Time Use Portable Emergency Fuel Containers (PEFC) for Use by Consumers.*

2.1.1 Contact information

The above may be obtained from ASTM International. Telephone: 610-832-9585, fax: 610-832-9555, Web site: www.astm.org, or from IHS Canada, telephone: 613-237-4250 or 1-800-387-4408, fax: 613 237 4251, E-mail: gic@ihscanada.ca, Web site: canada.ihs.com.

2.2 Environmental Protection Agency (EPA)

Title 40, Code of Federal Regulations, Part 59. United States Environmental Protection Agency, Subpart F *Control of Evaporative Emissions From New and In-Use Portable Fuel Containers.*

2.2.1 Contact information

The above may be obtained from Code of Federal Regulations (CFR) at https://www.govinfo.gov/content/pkg/CFR-2016-title40-vol6/xml/CFR-2016-title40-vol6-part59-subpartF.xml.

3 Terms and definitions

For the purposes of this National Standard of Canada, the following terms and definitions apply.

dispensing system
part of a PFC that is used for refueling operations which may consist of a hose, pump, nozzle, trigger, spout and associated components for detaching and reattaching the dispensing system.

diurnal emissions
evaporative emissions that occur while the PFC is closed as a result of daily temperature changes. Includes venting and permeation emissions.

evaporative emissions
TOG emissions that result from permeations of fuel through the PFC materials and from ventilation of the PFC.

PFC configuration
a unique combination of hardware (material, geometry and size) that would differ among units only with respect to normal production variability and also known as a ‘model’.

portable fuel container (PFC)
a single- or multi-compartment vessel intended for use by consumers to transport gasoline, gasoline/oil mixtures (or separate compartments of gasoline and oil), diesel, or kerosene from their distribution points to the consumer’s storage and use points, including all of the components intended for use on or with the container including those supplied by manufacturers other than the PFC manufacturer.

product category
PFCs that are similar in use, capacity, construction and permeation rate.

rated capacity
volume indicated on the PFC; may also be termed nominal capacity.

total organic gases (TOGs)
compounds of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate.

4 Symbols, acronyms and abbreviated terms

The following abbreviations and acronyms are used in this National Standard of Canada.

PFC – Portable fuel container

PFCs – Portable fuel containers

TOGs – Total organic gases

5 Requirements

5.1 General requirements

Note 1 Compliance with the requirements of this standard may be determined by an approved certification body.

Note 2 An approved certification body may be one that is accredited, for example, in accordance with ISO/IEC 17065.

5.1.1 Exceptions and alternate procedures

a. The dispensing system durability test in 6.4 may be omitted if it has been demonstrated that the PFC emissions performance is not adversely affected by this testing.

b. Alternate test procedures, which have been shown in comparison testing to be equivalent to the prescribed procedures in the accuracy and precision with which a specified parameter is determined, may be applied.

c. Special test procedures, that produce emissions measurements that are representative of in use operation, may be used for innovative products for which the cumulative evaporative emissions will be below the highest emitting representative PFC system in its product category.

5.1.2 Data from other procedures

Emission data collected, using other procedures, may be used when the demonstrated emission levels are far enough below the applicable emission requirements that the testing differences will not compromise the validity of the compliance demonstrated.

5.1.3 Labelling

a. PFCs complying with this standard shall carry the following labelling or an alternative that is consistent with the intent of this section:

   i. Month and year of manufacture;

   ii. The information “Not intended for on-road refueling” when warranted by the PFC or dispensing system design.

b. PFCs complying with this standard may carry a certification body identification and the standard designation CAN/CGSB-207.1.

c. Dispensing system components intended for distribution separately from a PFC shall identify, on the retail packaging, the manufacturer and product family of the PFCs with which they have been approved.

5.1.4 User instructions

The consumer shall be provided with bilingual English and French instructions, or equivalent graphics, for the operation and maintenance of the PFC including, as applicable:

- Instructions for filling, closing, venting and refueling;
- Instructions for assembly and disassembly if applicable;
- Identification of operations and/or equipment types that the PFC is not intended to refuel;
- Inspections and repairs for maintaining the emission controls.

5.2 Design requirements

All openings in the PFC shall be tested in their open condition unless they close automatically or are unlikely to be left open by the user during typical storage.

5.2.1 Closures

5.2.1.1 Fill opening

The fill opening shall be closed with a leak-free closure during PFC uses other than filling. The dispensing system may serve as a closure for the fill opening.

5.2.1.2 Dispensing system

a. The dispensing system and its interface with the PFC container shall not leak in any use configuration.

b. No liquid that may evaporate into the atmosphere, beyond wetted surfaces, shall be retained in the dispensing system after refueling.

c. Dispensing system components that are intended to be routinely connected and disconnected shall prevent spillage of any fuel retained in them.

5.2.1.3 Vent

Any secondary opening that relieves pressure and/or improves fuel flow during dispensing shall be normally closed and shall automatically return to the closed position when released.

5.3 Diurnal emissions limit

Evaporative emissions from PFCs shall not exceed 0.3 grams per U.S. gallon per day when tested in accordance with 6.5 to measure diurnal emissions.

Note This is intended to be the same standard as Title 40, Code of Federal Regulations, Part 59. United States Environmental Protection Agency, Subpart F *Control of Evaporative Emissions From New and In-Use Portable Fuel Containers*, §59.611(a) (version February 2, 2015) and CCR title 13 Article 6 reference CP501 s2.3 (version December 9, 2016) and, as an exception to the use of SI units, is expressed in the same measurement system.

5.4 Administration

5.4.1 Independent testing

a. Testing in accordance with section 6 shall be performed by an independent test laboratory.

Note 1 An independent laboratory is one that is not owned, operated, or affiliated with the PFC manufacturer.

Note 2 The test laboratory should be accredited, for example to ISO/IEC 17025.

b. The manufacturer shall retain the records related to all testing done on their behalf for at least five years after the testing has been completed.

c. All of the PFCs undergoing testing shall be replaced if a PFC being tested fails in a manner which cannot be repaired without the use of tools, sealant etc.

d. If any failure occurs because of a production defect of the PFC, whereby it is considered not representative of the production process, reject the result and repeat the test with a representative PFC.

5.4.2 Test article selection

a. PFCs that share similar designs, that are constructed of identical materials, and that are manufactured using identical processes, but vary only in size or color shall be considered a product family.

Note Aspects which should be common within a product family include but are not limited to:
(1) Type of material (including plasticizers, ultraviolet (UV) inhibitors, or other additives that may affect control of emissions)
(2) Production method
(3) Dispensing system and closure design
(4) Gasket material and design
(5) Specifications of O-rings and seals
(6) Emission control strategy
(7) Strategy for venting pressure.

b. A PFC configuration can be excluded from a product family if the expected emission characteristics are different.

c. A PFC configuration can be included in a product family if the expected emission characteristics will be similar over the useful life of the PFC.

d. The PFC configuration, for which the highest emission levels are reasonably expected within the product family shall be selected for testing.

Note This is typically the PFC with the smallest rated capacity in the product family.

e. All of the testing shall be performed using three PFCs of the same configuration which are selected with the most adverse production tolerances on characteristics affecting emissions performance.

f. A reference PFC conforming to the requirements of this section shall be provided.

g. Test articles shall be production products or preproduction products that represent actual production.

5.4.3 Descriptive information

a. A description of the product family and the specifications and engineering drawings of each configuration in it, including part numbers of detachable components, shall be recorded.

b. Descriptions of the materials used in the construction of the PFCs in the product family, such as the barrier type, minimum barrier thickness and molding method and including the material composition of gaskets, O-rings and seals, shall be recorded.

5.4.4 Lifecycle considerations

a. The useful life of a PFC, during which it shall continue to meet the requirements of this section, shall be five years from the date of sale to the consumer.

b. Qualification of a product family shall be valid for a production period of up to five years provided features affecting emissions performance are not altered during the production period.

c. Requalification may be performed on the basis of the previous qualification (carryover) if there have been no changes in the parameters described in 5.4.2. Test records in accordance with 5.4.1 b) and 6.1.4 c) shall be retained for an additional five years.

6 Test procedures

6.1 General test procedures

6.1.1 Fixtures and equipment

The test procedures in this section requires the following fixtures and equipment:

a. An UV light source of at least 24 W/m^2.

b. A well ventilated, temperature-conditioning enclosure, capable of controlling the internal air temperature from 18.3 °C to 35.6 °C, with a tolerance of 1.1 °C. The enclosure shall be capable of producing a variable temperature profile as specified in Table 2 of 6.5.5 and measuring the temperature inside the enclosure accurately to within ± 1.1 °C.

c. A water bath large enough to submerge a PFC to a depth of 15 cm.

d. A top loading balance, capable of a maximum mass measurement of not less than 120% of the mass of the filled container for which it is being used, shall be used to perform mass measurements. For mass measurements more than 6,200 g, the minimum sensitivity of the balance shall be 0.1 g. For mass measurement less than or equal to 6,200 g, the minimum sensitivity of the balance shall be 0.01 g. The readability of the display shall be less than half of the required accuracy.

The test procedures in this section shall be performed with the following instrumentation:

e. Pressure gauge, 0 kPa to 100 kPa, 1 kPa graduation and 0.5% full scale accuracy or better.

f. Accuracy and precision of all temperature measurements shall be ± 2.2 °C or better.

g. A barometric pressure instrument capable of measuring atmospheric pressure to within ± 70 Pa.

h. A relative humidity (RH) measuring instrument capable of measuring the RH with a sensitivity of ± 2% RH or better.

6.1.2 Test PFC configuration

a. The PFC shall be tested with the dispensing system installed in accordance with the manufacturer’s instructions except as otherwise noted.

b. Closures shall be tightened with the torque specified in Table 1 below.

Table 1: Torque requirements

Outer diameter of closure	Closing Torque, (Nm)
Less than 51 mm	2.8
51 mm and greater	5.6

6.1.3 Test fuel specification

Testing shall be performed with the grade of gasoline specified for general testing in Title 40, Code of Federal Regulations, Part 59. United States Environmental Protection Agency, Subpart F *Control of Evaporative Emissions From New and In-Use Portable Fuel Containers* §59.650(c) (version Feb. 26, 2007) as amended from time to time.

Note The specified test fuel contains 10% by volume ethanol.

6.1.4 Test records

a. The PFCs used for testing shall be uniquely identified on the PFCs and in the test data.

b. Test parameters and data shall be recorded on an appropriate form which is consistently used for the applicable test.

c. Test data, field notes and any supporting documentation and audio visual records shall be retained for at least five years.

6.2 Initial leak check

The suitability of the PFCs selected for testing is verified by:

a. Filling the PFC with water to its rated capacity and inverting it for at least 5 minutes. There shall be no leaks.

b. Dispensing approximately 25% of the liquid. There shall be no leaks or liquid retention in open dispensing system components when dispensing is stopped.

c. Repeating b. twice without refilling the PFC to check the performance at three different fill levels.

6.3 Preconditioning

The tests in this section shall be performed on PFCs prior to conducting the durability test in 6.4 and the diurnal emissions test in 6.5. The tests of 6.3.1 to 6.3.4 may be performed in any order and/or concurrently. Fuel may be removed and replaced as needed to maintain liquid level at rated capacity or not less than 40% of rated capacity when other tests in 6.3 are performed concurrently with 6.3.4. Temperature enclosures used for these tests should be purged at regular intervals to limit fuel vapour accumulation that could bias diurnal test results.

6.3.1 UV exposure test

Expose the PFC outer surfaces to an ultraviolet light of at least 24 W/m^2 or direct natural sunlight, for at least 450 hours.

6.3.2 Pressure cycling test

The sealed PFC shall be cycled between +13.8 and −3.4 kPa of the ambient atmospheric pressure over the test period for 10,000 cycles at a rate of 60 seconds per cycle. A modified closure may be used.

6.3.3 Slosh test

PFCs, filled with test fuel to 40 ± 10% of rated capacity and set in an upright position, shall be rocked at a rate of 15 cycles per minute until one million total cycles have been completed. The angle deviation shall be +15 ± 2° to −15 ± 2° from level.

6.3.4 Conditioning fuel soak

PFCs filled with test fuel to rated capacity shall be soaked for 140 days at minimum 23 °C or for 70 days at 43 ± 5 °C.

6.4 Dispensing system durability test

The durability test demonstrates that the PFC closures and dispensing system components will perform over their useful life under simulated operational use and fuel exposure. The tests in this section shall be performed consecutively. The tests in this section shall be performed on the test PFCs at the beginning and end of the conditioning fuel soak of 6.3.4.

6.4.1 Initial leak check

a. Raise the temperature of PFCs filled to 50 ± 10% with test fuel by minimum of 14 ºC for at least two hours. The PFCs shall expand slightly. This may be repeated with the closures re-secured if the PFC does not expand.

b. Submerge the expanded PFC to a depth of 15 ± 3 cm in a water bath for at least 30 seconds, tilting it back and forth while submerged to dislodge any air from external cavities. No air bubbles coming from the PFC shall be observed.

c. Remove the PFC from the water bath, dry it off and relieve the pressure in the PFC according to the manufacturer’s instructions.

6.4.2 Durability test

The durability test is performed with the PFCs filled to rated capacity with test fuel. The following steps shall be performed, in the order given, no more than once per day until each section has been performed 10 times. If at any point the spout or valve fails to return to the closed position, the container fails the test.

a. Dispensing system and vent

Repeat the following steps twice:

i. Invert the PFC and hold it inverted for a minimum of 5 seconds.

ii. Actuate the dispensing system 10 times with the PFC positioned such that the dispensing system can be actuated without dispensing fuel.

iii. Actuate the vent, if applicable, 10 times.

b. Fill opening

Remove and replace the closure on the fill opening.

c. Pump

Actuate the pump as required to fill the dispensing system for each dispensing system actuation in a. ii.

d. Other components

Remove and replace other components, such as hose connections, that are intended to be removed for storage and transportation of the PFC.

6.5 Diurnal emissions test

This test shall be performed on test PFCs after the preconditioning of 6.3 and the durability test of 6.4.

6.5.1 Leak check test PFCs

a. Raise the temperature of PFCs filled to 50 ± 10% with test fuel by a minimum of 14 ºC for at least two hours. The PFCs shall expand slightly. This may be repeated with the closures re-secured if the PFC does not expand.

b. Submerge the expanded PFC to a depth of 15 ± 3 cm in a water bath for a minimum of 30 seconds, tilting it back and forth while submerged to dislodge any air from external cavities. No air bubbles coming from the PFC shall be observed.

c. Remove the PFC from the water bath, dry it off and relieve the pressure in the PFC according to the manufacturer's instructions.

6.5.2 Prepare reference PFC

A reference PFC, identical to the test PFC and unused, is used to obtain accurate emissions test data. It shall not be exposed to fuel vapour prior to the diurnal test. It shall be filled with dry inert material to bring its mass within 10% of the mass of the test PFC when it is filled with fuel.

6.5.3 Condition PFCs

The temperature of the reference PFC and the test PFCs shall be stabilised for a minimum of 24 hours at 22.2 ± 1.1 °C and shall not be removed from the environment at this temperature for more than 15 minutes. The PFCs shall be vented in accordance with the manufacturer's instructions and statically discharged.

6.5.4 Initial weighing

The reference PFC and each test article shall be weighed within 15 minutes of being removed from the conditioning environment of 6.5.3. The ambient temperature, humidity and barometric pressure at the scale shall be recorded.

6.5.5 Diurnal emission test

The reference PFC and the test PFCs shall be placed in the temperature conditioning enclosure immediately after the initial weighing and exposed to the 24 hour duration variable temperature profile (diurnal cycle) of table 2.

The values in table 2 shall reflect those in Table 1 of Title 40, Code of Federal Regulations, Part 59. United States Environmental Protection Agency, Subpart F *Control of Evaporative Emissions From New and In-Use Portable Fuel Containers* §59.653 as amended from time to time.

Table 2: Diurnal temperature profile

Time (hours)	0	1	2	3	4	5	6	7	8	9	10	11	-
Ambient temperature (°C)	22.2	22.5	24.2	26.8	29.6	31.9	33.9	35.1	35.4	35.6	35.3	34.5	-
Time (hours)	12	13	14	15	16	17	18	19	20	21	22	23	24
Ambient temperature (°C)	33.2	31.4	29.7	28.2	27.2	26.1	25.1	24.3	23.7	23.3	22.9	22.6	22.2

6.5.6 Final weighing

The reference PFC and each test article shall be weighed within 15 minutes of being removed from the temperature conditioning enclosure of 6.5.5. The ambient temperature, humidity and barometric pressure at the scale shall be recorded.

6.5.7 Diurnal emission rate

The diurnal emission rate for each test PFC shall be calculated from the mass loss divided by the PFC's rated capacity using the equation below:

Emission rate = $(M_{initial}-M_{final})/(\text{rated capacity})\times(\text{one day})$

Where:

$M_{initial}$ = Initial test PFC mass – Initial reference PFC mass (grams)

M_{final} = Final test PFC mass – Final reference PFC mass (grams)

The emission rate (grams per U.S. gallon per day) shall be reported to one decimal place.

Units for rated capacity for this calculation are in U.S. gallons.

Bibliography

[1] CCR title 13 Article 6, *California Environmental Protection Agency Final Regulation Order for Portable Fuel Containers.*

[2] CP501, *Certification Procedure for Portable Fuel Container Systems.*

[3] Canadian Standards Association (CSA), CSA B376-M1980, *Portable Containers for Gasoline and Other Petroleum Fuels.*

[4] ISO/IEC 17025, *General Requirements for the competence of testing and calibration laboratories*.

[5] ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services*.

[6] National Research Council Canada, *National Fire Code of Canada*. Canada, 2015 edition.