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CAN/CGSB-3.512-2018

Amendment No. 1, April 2022

Supersedes CAN/CGSB-3.512-2013

Automotive ethanol fuel (E50-E85 and E20-E25)

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NATIONAL STANDARD OF CANADA

CAN/CGSB-3.512-2018
Amendment No. 1, April 2022

Supersedes CAN/CGSB-3.512-2013

Automotive ethanol fuel (E50-E85 and E20-E25)

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

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Preface

This National Standard of Canada CAN/CGSB-3.512, *Automotive ethanol fuel (E50-E85 and E20-E25)*, was published in September 2018. This Amendment No. 1 was developed to provide consistency with the latest revisions of standards CAN/CGSB 3.5-2021 and CAN/CGSB-3.511-2021 and to update information on government regulations.

Changes since the previous edition

Amendment

- Addition of ASTM D3120 in 7.7 and footnote d.
- Removal of ASTM D1613 as alternate test method in 7.9.
- Addition of ASTM E1064 as alternate test method in 7.14.
- In Table 2B, footnote b was revised to better reflect the *Ontario Volatility regulation*.
- In Table 2C, footnote a was revised to better reflect the *Ontario Volatility regulation* and references to footnote a were modified.
- In Table 2D, footnote d was modified to indicate that the 62 kPa limit in the *Ontario Volatility regulation* is absolute. References to footnote d were also modified.
- In Table 2E, footnotes a & b were modified.
- In Table 2F, addition of footnotes a & b to refer to Newfoundland and Ontario Regulations.
- Update of regulations in Annex C. See C.2.3.1, C.2.3.2, C.7.1, C.2.7.3 and C.10.1.

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.

Notes accompanying clauses do not include requirements or alternative requirements. The purpose of a note accompanying a clause is to separate explanatory or informative material from the text. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

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Automotive ethanol fuel (E50-E85 and E20-E25)

1 Scope

This National Standard of Canada applies to two types of automotive fuel: type 1, 50 % to 85 % by volume denatured fuel ethanol with gasoline and type 2, 20 % to 25 % by volume denatured fuel ethanol with gasoline. Both types are for use in flexible-fuel vehicles over a wide range of climatic conditions.

Users of this standard are advised to consult the owner's manual and/or the original equipment manufacturer regarding the suitability of the specific fuel blend prior to its use.

Fuel produced to this standard is not for use in conventional vehicles designed to operate on gasoline containing up to 10 % or 15 % by volume ethanol. Precautions for the use of automotive ethanol fuel type 1 and type 2 are also identified[1].

Type 1 (E50–E85) varies from 85 % to as low as 50 % by volume denatured fuel ethanol under respectively warm and cold seasonal conditions, and also by geographic location. The proportion of gasoline is increased for use at lower temperatures to increase volatility to improve flexible-fuel vehicle (FFV) startability and driveability, and also to reduce the risk associated with flammable ullage spaces.

For type 2 (E20-E25), the composition in this standard uses gasoline that complies with CAN/CGSB-3.5 or BOB suitable for CAN/CGSB-3.511 to meet the seasonal volatility requirements that ensure adequate startability, driveability and to reduce the risk associated with flammable ullage spaces (see Tables 2A to 2H).

The testing and evaluation of a product against 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 the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

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 Canadian General Standards Board (CGSB)

CAN/CGSB-3.0 — *Methods of testing petroleum and associated products*:

No. 14.3 — *Standard test method for the identification of components in automotive gasoline using gas chromatography*

No. 19.5 — *Determination of lead in automotive gasoline (Atomic absorption)*

[1] See clause 10 and Annex B.

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No. 28.8 — *Visual haze rating of liquid fuels*

No. 60.32 — *Standard test method for determination of the corrosiveness to silver of gasoline, middle distillate fuels and oxygenated fuels using silver wool: Rapid ultrasonic method*

CAN/CGSB-3.5 — *Automotive gasoline*

CAN/CGSB-3.511 — *Oxygenated automotive gasoline containing ethanol (E1–E10 and E11-E15)*

CAN/CGSB-3.516 — *Denatured fuel ethanol for use in automotive spark-ignition fuels*

2.1.1 Contact information

The above may be obtained from the Canadian General Standards Board, Sales Centre. Telephone: 1-800-665-2472. E-mail: ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site: www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html.

It may also be obtained from the Government of Canada Publications, Publishing and Depository Services, Public Services and Procurement Canada. Telephone: 1-800-635-7943 or 613-941-5995. Fax: 1-800-565-7757 or 613-954-5779. Email: publications@tpsgc-pwgsc.gc.ca. Web site: http://publications.gc.ca/site/eng/home.html.

2.2 Environment and Climate Change Canada (ECCC)

Benzene in Gasoline Regulations (SOR/97-493)

Sulphur in Gasoline Regulations (SOR/99-236)

2.2.1 Contact information

The above may be obtained from the Department of Justice Canada, Communications Branch. Telephone: 613-957-4222 or TTY 613-992-4556. Fax: 613-954-0811. Web site: www.laws.justice.gc.ca.

2.3 Canadian Fuels Association

Weather Data

2.3.1 Contact information

The above may be obtained from http://www.canadianfuels.ca/Fuels-and-Transportation/Conventional-Transportation-Fuels.

2.4 ASTM International

Annual Book of ASTM Standards (see Annex A)

2.4.1 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 Markit, telephone: 613-237-4250 or 1-800-267-8220, fax: 613-237-4251, Web site: www.global.ihs.com.

2.5 NACE International

TM-0172 — *Determining Corrosive Properties of Cargoes in Petroleum Product Pipelines*

2.5.1 Contact information

The publication may be obtained from NACE International. Web site: www.nace.org.

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2.6 See informative Annex C for federal, provincial and territorial acts and regulations that can apply to automotive ethanol fuel.

3 Terms and definitions

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

10th percentile low-end design temperature
temperature at or below which 10% of the hourly ambient air temperatures are observed to occur for an indicated half-month period at a specified weather station.

Note: The 10% low-end design temperature for weather stations in Canada by half-month period may be obtained from the weather data. The data are based upon an analysis of hourly weather readings from weather stations across Canada taken over a minimum of 10 years to a maximum of 30 years per station over the period from 1981 to 2010 inclusive.

antiknock index
average of the Research (*RON*) and Motor (*MON*) octane number for the fuel, i.e. (*RON* + *MON*)/2.

automotive ethanol fuel type 1 (E50-E85)
seasonally adjusted blend (as defined by Tables 2A to 2H) for use in FFVs consisting nominally of 50 % to 85 % by volume denatured fuel ethanol with gasoline (see definition of gasoline).

automotive ethanol fuel type 2 (E20-E25)
seasonally adjusted blend (as defined by Tables 2A to 2H) for use in FFVs consisting nominally of 20 % to 25 % by volume denatured fuel ethanol with gasoline (see definition of gasoline).

benzene emissions number (BEN)
estimate of the evaporative, running and tailpipe benzene emissions from vehicles, calculated in accordance with schedule 1 of the *Benzene in Gasoline Regulations* (see Annex C, C.1.5).

blendstock for oxygenate blending (BOB)
gasoline blendstock that when blended with additives and 1.0 % to 10 %, or 11 % to 15 % by volume denatured fuel ethanol produces an oxygenated gasoline that complies with CAN/CGSB-3.511.

denatured fuel ethanol
commercially manufactured ethanol containing denaturant, as required by the *Denatured and Specially Denatured Alcohol Regulations* – SOR/2006-103, which makes the ethanol suitable for use in automotive spark ignition engines and unsuitable for beverage or medicinal use.

driveability index (DI)
parameter based on distillation temperatures. It is designed to ensure good vehicle performance relating to time to start, stalls, hesitations, stumbles, surges and backfires (see Annex D).

It is defined for type 2 automotive ethanol fuel as:

$$DI = 1.5 \times T_{10} + 3 \times T_{50} + T_{90} + 100$$

where:

$T10$, $T50$, $T90$ = temperatures (°C) at 10%, 50%, and 90% evaporated in ASTM D86 or in ASTM D7345 bias-corrected to predicted ASTM D86.

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DI can be converted to its degrees Fahrenheit equivalent, as follows:

DI_F = 1.8 x *DI* + 176

where:

DI_F = *DI* based on °F

DI = *DI* based on °C

ethanol
ethyl alcohol, the chemical compound CH_3CH_2OH.

flexible fuel vehicle (FFV)
vehicle that is specifically designed by the original equipment manufacturer or the manufacturer of record to operate on fuel blends consisting nominally of 0 % to 85 % by volume denatured fuel ethanol with gasoline.

gasoline
automotive fuel meeting the requirements of CAN/CGSB-3.5 or BOB (see definition of blendstock for oxygenate blending (BOB)).

point of blending
location where denatured fuel ethanol is added to produce type 1 or type 2 automotive ethanol fuel. Blending does not include the mixing of finished products or the addition of additives.

point of retail sale
location where the end user takes delivery of the product.

primary terminal
distribution facility that

a) is connected directly to a refinery, or

b) can be supplied by pipeline from a refinery, or

c) receives imported product directly, or

d) is located on the Great Lakes and can be supplied by ship.

4 Classification

4.1 The automotive ethanol fuel shall be supplied in the following types, as specified (see 9.1).

Type 1 (E50-E85)

Type 2 (E20-E25).

5 General requirements

5.1 The automotive ethanol fuel shall comply with this standard at the point of retail sale, except for the volatility requirements specified in 5.2.

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5.2 Volatility requirements

The geographical zones are described in Table 1 and shown in Figures 1, 2 and 3. The limiting values of volatility properties for each zone are listed in Tables 2A to 2H.

5.2.1 The volatility requirements specified in 7.25 and 7.26 shall be for the period and geographic zone of intended use, detailed in Tables 2A to 2H, with compliance at one of the following:

a) Primary terminal;

b) Point of entry into Canada.

The volatility schedules detailed in Tables 2A to 2H include a half-month period for turning over inventory at service stations, when necessary. A longer turnover period at times close to seasonal weather changes could result in degraded vehicle performance.

5.2.2 Vapour pressure, maximum

Maximum DVPE limits at or below 72 kPa are set by provincial regulations to minimize evaporative losses in fuel distribution and from vehicles and equipment. DVPE limits at or below 72 kPa in Tables 2A to 2H may be waived by the regulator but shall not exceed 72 kPa (see Annex C).

5.3 The automotive ethanol fuel shall be a stable homogeneous liquid free from foreign matter and dissolved material that can clog filters or nozzles or damage equipment designed for its use.

5.4 The automotive ethanol fuel shall be visually clear and free from undissolved water, sediment and suspended matter under the temperature and conditions at the point of retail sale. The automotive ethanol fuel shall be thoroughly mixed to prevent the sale of compositions that do not meet the standard or are potentially damaging due to stratification in dispensing tankage.

5.5 The automotive ethanol fuel may contain additives designed to improve its characteristics. Additives include but are not limited to corrosion inhibitors, deposit control additives (also called detergents) (see 6.1.1 and 7.27), metal deactivators and oxidation inhibitors. Additives designed and tested to enhance performance shall be added in amounts less than 1.0 % by volume, unless otherwise specified in this standard (see 10.3 and Annex B, B.4).

5.6 Impurities such as aldehydes, ketones, amines, acid esters and soluble polymers shall not be added except as functional components of additives. Halogenated compounds, silanes, fusel oils, used lubricating oils and used solvents or other such materials shall not be added, except as normally occurring trace constituents.

6 Detailed requirements for denatured fuel ethanol and gasoline components

6.1 Denatured fuel ethanol

The denatured fuel ethanol (see 7.5) shall meet the requirements of CAN/CGSB-3.516, type 2.

6.1.1 Deposit control additive

Only deposit control additives that are soluble in denatured fuel ethanol may be added to the denatured fuel ethanol component (see 7.27 and Annex B, B.4).

6.2 Gasoline component

The gasoline component of automotive ethanol fuel shall meet the requirements of CAN/CGSB-3.5 or BOB (see section 3).

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7 Detailed requirements for automotive ethanol fuel type 1 (E50-E85) and type 2 (E20-E25)

7.1 Automotive ethanol fuel shall comply with the specified limiting values (see 7.5 to 7.26 and Tables 2A to 2H). The specified limiting values shall not be changed. This precludes any allowances for the test method precision and for adding or subtracting digits.

7.1.1 The precision of some ASTM test methods has not been demonstrated for use with automotive ethanol fuel. Several test methods listed in Annex A are in the development stages or lack precision and bias determinations for automotive ethanol fuel. However, ASTM D5191, D5453 and D7923 include precision for automotive ethanol fuel.

7.1.2 For purposes of determining conformance with the specified limiting values, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand digit used in expressing the specified limiting values, in accordance with the rounding-off method of ASTM E29. There is one exception (see 7.21).

7.1.3 Zeroes trailing the last nonzero digit for numbers represented with a decimal point are significant digits, in accordance with ASTM E29.

7.1.4 Where test values differ between two parties, a resolution shall be in accordance with ASTM D3244 in order to determine conformance with the specified limiting values, with the criticality of the limits fixed at $P = 0.5$.

7.2 Test methods other than those referenced in this standard may be used only if they have been validated in accordance with ASTM D3764 or D6708. Test methods validated in accordance with ASTM D4855 prior to 2010 may also be used. These are referred to as validated test methods.

7.2.1 Differences in precision, sensitivity and bias between referee test methods referenced in the standard and the validated test methods shall be considered.

7.2.2 Validated test methods shall only be used within the bounds of data covered in their validation.

7.3 In the event of a dispute, the procedures given in 7.1.2, 7.1.3 and 7.1.4 shall be used.

7.3.1 If parties in a dispute cannot agree on an analytical method to resolve the dispute, the method listed in the standard shall be used. Where more than one method is listed for a given detailed requirement, the referee method shall be used.

7.4 Differences in precision, sensitivity and bias between the referee test methods and others referenced in the standard shall be considered. When using alternate test methods referenced in this standard, users are cautioned to develop their own supporting data for correlation with the referee test method if the results are outside of the range quoted for the specific alternative test method’s precision and bias.

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	Property	Specified limiting values				Test method
		Type 1 (E50-E85)		Type 2 (E20-E25)		
		Min.	Max.	Min.	Max.	
7.5	Denatured fuel ethanol, at point of blending, % by volume	50.	85	20.	25	See footnote[a]
7.6	Ethanol, % by volume	46	84	18	25	CAN/CGSB-3.0 No. 14.3[b] ASTM D5501
7.7	Sulphur, mg/kg (see 7.29)	—	80.	—	80.	ASTM D5453[b], D7039 or D3120[d]
7.8	Methanol, % by volume	—	0.5	—	0.5	CAN/CGSB-3.0 No. 14.3[b] or ASTM D4815
7.9	Total acidity, as acetic acid, mg/L (% by mass)					ASTM D7795
	a. In absence of corrosion inhibitors and detergents	—	40. (0.0051)	—	—	
	b. In presence of corrosion inhibitors and detergents	—	56 (0.0070)	—	—	
7.10	Solvent-washed gum content, mg/100 mL	—	5	—	5	ASTM D381
7.11	Copper strip corrosion, 3 h at 50 °C	—	No. 1	—	No. 1	ASTM D130
7.12	Corrosion, steel in water	—	B+	—	B+	NACE TM-0172[b] or ASTM D7548
7.13	Chloride, mg/kg	—	1	—	—	ASTM D7319[b] or D7328
7.14	Water, % by mass	—	1.0	—	1.0	ASTM D7923[b], E203, E1064 or D6304
7.15	Lead, mg/L	—	5	—	5	CAN/CGSB-3.0 No.19.5
7.16	Phosphorus, mg/L	—	1.3	—	1.3	ASTM D3231
7.17	Silver corrosion (see Annex B, B.5)	— —	B No. 1	— —	B No. 1	CAN/CGSB-3.0 No. 60.32[b] or ASTM D7671
7.18	Appearance at 20 to 25 °C, visual haze rating	—	1	—	1	CAN/CGSB-3.0 No. 28.8

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	Property	Specified limiting values				Test method
		Type 1 (E50-E85)		Type 2 (E20-E25)		
		Min.	Max.	Min.	Max.	
7.19	Benzene content, % by volume (see 7.28)	—	1.5	—	1.5	CAN/CGSB-3.0 No. 14.3
7.20	Oxidation stability, (Induction period) min.	—	—	240.	—	ASTM D525
7.21	Antiknock index (AKI)[C]	—	—	91.0	—	ASTM D2699[b] D2700[b] D2885
7.22	Electrical conductivity, µS/m	—	500.	—	—	ASTM D1125
7.23	Sulphate, mg/kg	—	4	—	—	ASTM D7319[b] D7318 or D7328
7.24	pHe	6.5	9.0	—	—	ASTM D6423
7.25	Dry vapour pressure equivalent (DVPE)	See Tables 2A to 2H				ASTM D5191[b] D4953
7.26	Driveability index	—		See Tables 2A to 2H		See Section 3, driveability index

[a] Metered (measured) volumes may be used for reporting in place of analytical tests.

[b] The referee method to be used in the event of a dispute.

[c] The antiknock index shall be reported to the nearest 0.1 unit at point of manufacture or point of import and to the nearest 0.5 unit at the point of sale using the rounding method described in ASTM E29 (see 7.1.2).

[d] ASTM D3120 is only an alternate test method for type 2 (E20-E25).

7.27 Deposit control additive

7.27.1 Type 1 (E50-E85)

The gasoline component shall meet the deposit control requirements of CAN/CGSB-3.5.

7.27.2 Type 2 (E20-E25)

Type 2 automotive ethanol fuel retailed in Canada shall contain a deposit control additive (sometimes referred to as a detergent package) sufficient to meet either:

a) an intake valve deposit requirement of less than 100 mg average deposit mass per valve after a 16 093.0 km (10 000 mile) driving cycle, or less than 25 mg average deposit mass per valve after a 8046.5 km (5000 mile) driving cycle as specified by ASTM D5500, or

b) an intake valve deposit requirement of less than 135 mg average deposit mass per valve after a 100 h dynamometer test cycle as specified by ASTM D6201.

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7.27.2.1 Proof of performance shall be provided by:

a) Certification by the deposit control additive supplier that the dosage recommended to the gasoline marketer/producer meets or exceeds the minimum as listed with the U.S. EPA, or

b) Certification by the marketer/producer that the gasoline meets the intake valve deposit limits given in 7.27.2 for the ASTM D5500 test, or

c) Certification by the marketer/producer that the gasoline meets the intake valve deposit limits given in 7.27.2 for the ASTM D6201 test.

7.27.3 In any case, the marketer/producer shall maintain records of volumes of gasoline and additives, to show that the gasoline does contain the amount of additive stated.

7.28 Benzene and BEN (benzene emissions number) are specified by the federal *Benzene in Gasoline Regulations* (see Annex C, C.1.5). In accordance with the regulation, the maximum benzene content allowed for any batch of complying gasoline is 1.5 % by volume; this applies to primary suppliers (manufacturers, importers and blenders) who elect to produce gasoline with an annual pool average of 0.95%. The regulation also permits primary suppliers to elect a 1.0 % by volume flat limit without an associated yearly pool average. A number of options exist for the BEN limit, for details consult the *Benzene in Gasoline Regulations*.

7.29 Sulphur is specified by the federal *Sulphur in Gasoline Regulations* (see Annex C, C.1.6). In accordance with the regulations, the maximum sulphur content allowed for any batch of complying low-sulphur gasoline is 80 mg/kg. Primary suppliers (refiners, blenders or importers) may elect to meet an annual pool average of 10 mg/kg. The regulation also permits primary suppliers to elect a 12 mg/kg flat limit without any associated yearly pool average. A temporary sulphur compliance unit trading system is in effect from January 1, 2020 until December 31, 2025.

8 Inspection

8.1 Sampling

Sampling equipment and procedures shall be designed and used to obtain representative samples of a product. Sample lines, hoses, etc. should be adequately flushed prior to taking a sample. Samples should be stored in a cool, dark place. Procedures shall be in accordance with ASTM D4057, D4177 or D5854 with the following modifications:

a) Do not use water displacement.

b) Rinse the container with the fuel being sampled.

c) The sample shall be collected in containers that are compatible with automotive ethanol fuel. Where practical, glass containers should be used for sampling.

d) Sample volume shall be consistent with the requirements of the testing laboratory, or the authority having jurisdiction, or both. Unless otherwise specified [see 9.1 c)], a sample of at least 3 L shall be collected.

8.1.1 On-line analyses

The sampling system used for ASTM D2885 may also be used for other on-line analyses. Results may be obtained either as volumetric weighted averages of multiple determinations or as single determinations on proportional samples. The sampling system shall be connected to the on-line analyzer in a manner that ensures sample integrity is maintained.

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9 Options

9.1 The following options shall be specified in the application of this standard:

a) The type of fuel, type 1 (E50-E85) or type 2 (E20-E25);

b) Volatility requirements (Tables 2A to 2H);

c) Sample size, if other than as specified (see 8.1.d).

10 Precautions

10.1 Health and safety

Users should refer to the supplier's safety data sheet (SDS) for guidance on the safe handling of automotive ethanol fuel type 1 (E50-E85) and type 2 (E20-E25).

10.2 Equipment

Equipment in contact with automotive ethanol fuel type 1 (E50-E85) and type 2 (E20-E25) should be approved by the appropriate authority having jurisdiction for use with these fuels. Otherwise, component degradation, fuel contamination and component failure can result (see Annex B, B.1).

Underwriters Laboratories (UL) has established requirements in document Subject 87A-E85, which address gasoline and ethanol fuel blends up to E85[2]. The UL certification path in Subject 87A-E25 addresses gasoline and mid-level ethanol fuel blends up to E25 and applies to type 2 (E20-E25) in this standard.

10.3 Incorporating additives

The user is cautioned against incorporating other additives in the fuel unless detailed test data are first obtained to confirm that performance is improved with no harmful side effects.

The automotive ethanol fuel shall not contain any materials such as drag reducing additive or its degradation products that separate after blending.

10.4 Startability and driveability

Users of fuel meeting this standard should consult the motor vehicle owner's manual for advice on cold weather starting. Tables 2A to 2H require progressively higher vapour pressures that are required under lower temperature conditions.

10.5 Transportation, storage and handling

See Annex B for additional precautionary information on transportation, storage, handling and dispensing of denatured fuel ethanol and automotive ethanol fuel.

[2] Contact Underwriters Laboratories of Canada at www.ul.com for information on dispensing equipment.

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Table 1 — Geographic zone definitions

Zone	Short description	Definition[a]
A	Coastal British Columbia	All the islands off the coast of British Columbia, the Lower Fraser Valley (LFV)[b] and that portion of the mainland within a nominal 100 km of the west coast of British Columbia between latitudes 49° 30′ North and 54° North[c].
B	South Western Canada	The portions of Ontario west of 90° West longitude and south of latitude 53° North, Manitoba south of latitude 53° North, Saskatchewan south of latitude 53° North, Alberta south of latitude 54° North, British Columbia south of latitude 54° North excluding Zone A (Coastal British Columbia).
C	Northern Ontario and Central Quebec	The portions of Ontario north of latitude 46° North, south of latitude 53° North and east of 90° West longitude and Quebec north of latitude 46° North and south of latitude 51° North.
D	Southern Ontario and Southern Quebec	The portions of Ontario and Quebec south of latitude 46° North, including the Seaway Corridor Sub Zone (SCSZ)[d].
E	Atlantic Canada	The island of Newfoundland, the provinces of New Brunswick, Nova Scotia and Prince Edward Island and les Îles-de-la-Madeleine.
F	Northern Canada	The portions of British Columbia and Alberta north of latitude 54° North, Saskatchewan, Manitoba and Ontario north of latitude 53° North; Quebec between latitudes 51° North and 55° North; and Labrador south of latitude 55° North.
G	Yukon	The Territory of the Yukon.[e]
H	Arctic Canada	All of the Northwest Territories, Nunavut and the portions of Quebec (Nunavik) and Labrador north of latitude 55° North.[e]

[a] See Figures 1, 2 and 3 for the approximate locations of the geographic zones.

[b] The Lower Fraser Valley sub-zone means that part of British Columbia bounded on the north by latitude 49°30', on the west by longitude 123°20', and on the east by longitude 121°15'. It is defined in the BC *Cleaner Gasoline Regulation* (see Annex C, C.2.2.1).

[c] Zone A includes the towns of Whistler and Pemberton. The town of Bella Coola may be supplied with either Zone A or Zone B quality.

[d] The Seaway Corridor Sub-Zone (SCSZ) is defined in two parts:

1) That part of Ontario that lies south of a straight line passing through Arnprior and Grand Bend. Where the line so described runs across a local municipality, the entire local municipality is part of the sub-zone. This is defined by the *Ontario Regulation* (see Annex C, C.2.7.1);

2) That part of Southwestern Quebec defined in the Québec *Petroleum Products Act* (see Annex C, C.2.9.1) as "The Outaouais-Montréal Corridor". See Annex E for the municipalities in the Outaouais-Montréal Corridor.

[e] Type 1 (E50-E85) and type 2 (E20-E25) fuels are not intended for regions where fuels are normally provided in bulk only periodically during the year. Geographic zones G (Yukon) and H (Arctic Canada) are such areas and the tables for those zones are provided for reference should a fleet or commercial enterprise wish to use these fuels in those zones.

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Figure 1 — Map of geographic zones — Canada overview

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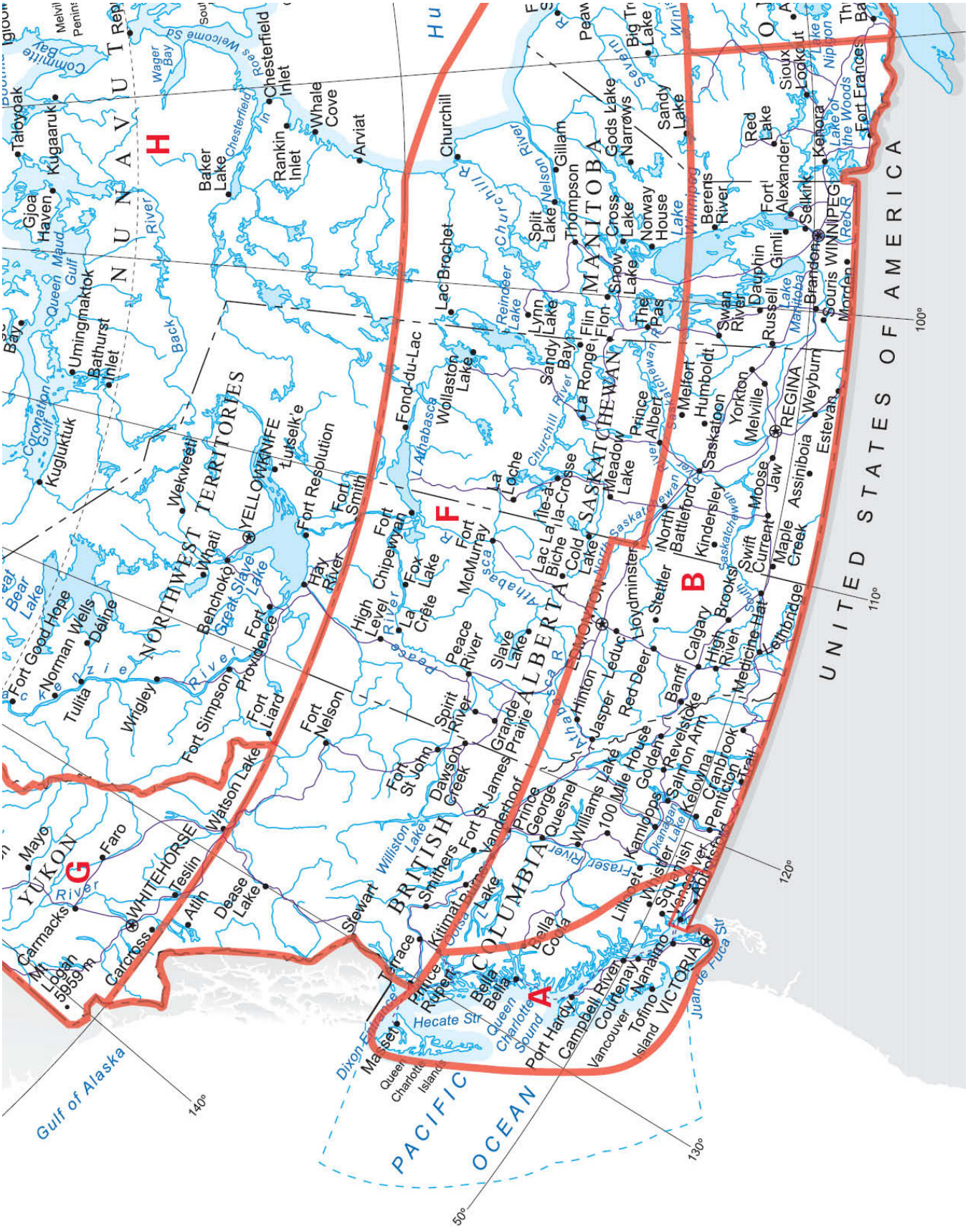

Figure 2 — Map of geographic zones — Western Canada

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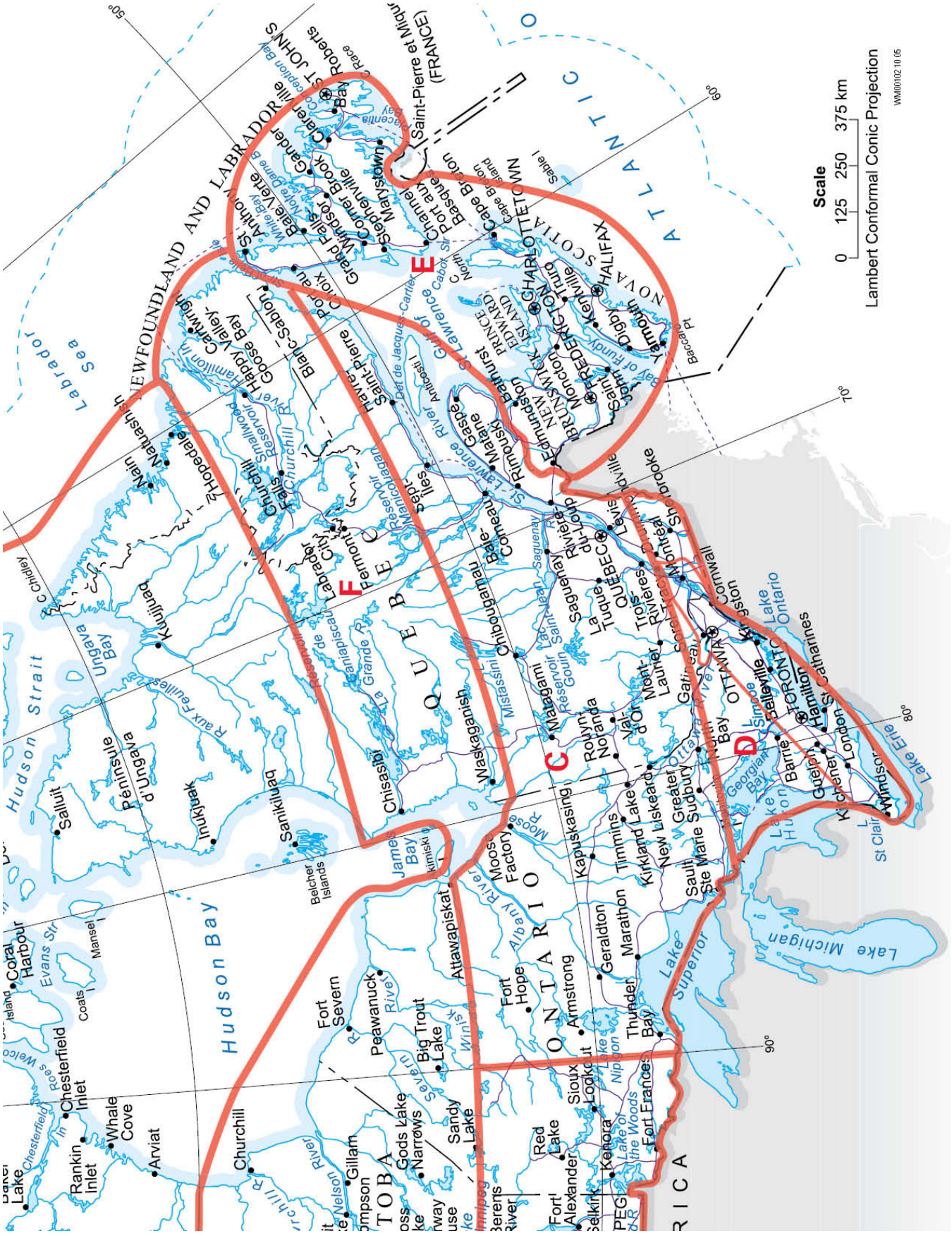

Figure 3 — Map of geographic zones — Eastern Canada

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Table 2A — Volatility requirements for Zone A (Coastal British Columbia)

Zone volatility limits		Coastal British Columbia All the islands off the coast of British Columbia, the Lower Fraser Valley (LFV)[a] and that portion of the mainland within a nominal 100 km of the west coast of British Columbia between latitudes 49° 30´ North and 54° North.						
		Type 1 (E50-E85) fuel			Type 2 (E20-E25) fuel			
		DVPE		LFV DVPE	DVPE		LFV DVPE	Driveability index
Month	Dates	Min. (kPa)	Max. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (kPa)	Max.[b] (°C)
January	1-15	45	110.		45	110.		575
January	16-31	45	110.		45	110.		575
February	1-15	45	110.		45	110.		575
February	16-28 (29)	45	110.		45	110.		575
March	1-15	45	110.		35	110.		590.
March	16-31	45	110.		35	110.		590.
April	1-15	45	110.		35	110.		590.
April	16-30	35	97	72[c]	35	97	72[c]	590.
May	1-15	35	97	72	35	97	72	590.
May	16-31	35	97	72	35	97	72	590.
June	1-15	35	72	62	35	72	62	590.
June	16-30	35	72	62	35	72	62	590.
July	1-15	35	72	62	35	72	62	590.
July	16-31	35	72	55	35	72	55	590.
August	1-15	35	72	55[c]	35	72	55[c]	590.
August	16-31	35	72	62[c]	35	72	62[c]	590.
September	1-15	35	97	72	35	97	72	590.
September	16-30	35	97		35	97		590.
October	1-15	45	110.		35	110.		590.
October	16-31	45	110.		35	110.		590.
November	1-15	45	110.		35	110.		590.
November	16-30	45	110.		45	110.		575
December	1-15	45	110.		45	110.		575
December	16-31	45	110.		45	110.		575

[a] The Lower Fraser Valley sub-zone means that part of British Columbia bounded on the north by latitude 49°30', on the west by longitude 123°20', and on the east by longitude 121°15'. It is defined in the BC *Cleaner Gasoline Regulation* (see Annex C, C.2.2.1).

[b] If the required maximum vapour pressure is less than 72 kPa then the maximum DI shall be 597.

[c] LFV: 72 kPa maximum applies starting April 16, 55 kPa maximum only applies ending August 14, 62 kPa maximum applies starting August 15. From July 16 to August 14, a 7 kPa waiver on maximum Vapour Pressure is allowed for specific ethanol blends under the BC *Cleaner Gasoline Regulation* (See Annex C, C.2.2.1).

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Table 2B — Volatility requirements for Zone B (South Western Canada)

Zone volatility limits		South Western Canada The portions of Ontario west of 90° West longitude and south of latitude 53° North, Manitoba south of latitude 53° North, Saskatchewan south of latitude 53° North, Alberta south of latitude 54° North, British Columbia south of latitude 54° North excluding Zone A (Coastal British Columbia).				
		Type 1 (E50-E85) fuel		Type 2 (E20-E25) fuel		
		DVPE		DVPE		Driveability index
Month	Dates	Min. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (°C)
January	1-15	85	110.	85	110.	540.
January	16-31	85	110.	85	110.	540.
February	1-15	85	110.	65	110.	550.
February	16-28 (29)	65	110.	65	110.	550.
March	1-15	65	110.	65	110.	550.
March	16-31	65	110.	50.	110.	560.
April	1-15	45	97	45	97	575
April	16-30	45	97	45	97	575
May	1-15	45	86	45	86	575
May	16-31	35	86	35	86	590.
June	1-15	35	72	35	72	590.
June	16-30	35	72	35	72	590.
July	1-15	35	72	35	72	590.
July	16-31	35	72	35	72	590.
August	1-15	35	72	35	72	590.
August	16-31	35	72	35	72	590.
September	1-15	35	86[a]	35	86[a]	590.
September	16-30	45	86	45	86	590.
October	1-15	45	97	45	97	575
October	16-31	45	110.	45	110.	575
November	1-15	65	110.	50.	110.	560.
November	16-30	65	110.	50.	110.	560.
December	1-15	85	110.	65	110.	550.
December	16-31	85	110.	65	110.	550.

[a] The *Ontario Volatility Regulation* sets a maximum limit of 72 kPa starting June 1 and ending on either August 31 or September 14, depending upon specific conditions (see Annex C, C.2.7.1). Note that the 72 kPa limit is defined as being absolute in this Regulation.

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Table 2C — Volatility requirements for Zone C (Northern Ontario and Central Quebec)

Zone volatility limits		Northern Ontario and Central Quebec The portions of Ontario lying north of latitude 46° North, south of latitude 53° North and east of 90° West longitude and Quebec lying north of latitude 46° North and south of latitude 51° North.				
		Type 1 (E50-E85) fuel		Type 2 (E20-E25) fuel		
		DVPE		DVPE		Driveability index
Month	Dates	Min. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (°C)
January	1-15	85	110.	85	110.	540.
January	16-31	85	110.	85	110.	540.
February	1-15	85	110.	85	110.	540.
February	16-28 (29)	85	110.	65	110.	550.
March	1-15	65	110.	65	110.	550.
March	16-31	65	110.	50.	110.	560.
April	1-15	65	110.	50.	110.	560.
April	16-30	45	97	45	97	575
May	1-15	45	97	45	97	590.
May	16-31	45	86	35	86	590.
June	1-15	35	72	35	72	590.
June	16-30	35	72	35	72	590.
July	1-15	35	72	35	72	590.
July	16-31	35	72	35	72	590.
August	1-15	35	72	35	72	590.
August	16-31	35	72	35	72	590.
September	1-15	35	97[a]	35	97[a]	590.
September	16-30	45	110.	35	110.	590.
October	1-15	45	110.	45	110.	575
October	16-31	45	110.	45	110.	575
November	1-15	65	110.	45	110.	575
November	16-30	65	110.	50.	110.	560.
December	1-15	85	110.	65	110.	550.
December	16-31	85	110.	65	110.	550.

[a] The *Ontario Volatility Regulation* sets a maximum limit of 72 kPa starting June 1 and ending on either August 31 or September 14, depending upon specific conditions (see Annex C, C.2.7.1). Note that the 72 kPa limit is defined as being absolute in this Regulation.

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Table 2D — Volatility requirements for Zone D (Southern Ontario and Southern Quebec)

Zone volatility limits		Southern Ontario and Southern Quebec The portions of Ontario and Quebec south of latitude 46° North, including the Seaway Corridor Sub-Zone (SCSZ)[a].						
		Type 1 (E50-E85) fuel			Type 2 (E20-E25) fuel			
		DVPE		SCSZ DVPE	DVPE		SCSZ DVPE	Driveability index
Month	Dates	Min. (kPa)	Max. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (kPa)	Max.[b] (°C)
January	1-15	85	110.		65	110.		550.
January	16-31	85	110.		65	110.		550.
February	1-15	85	110.		65	110.		550.
February	16-28 (29)	65	110.		50.	110.		560.
March	1-15	65	110.		50.	110.		560.
March	16-31	45	110.		45	110.		575
April	1-15	45	97		45	97		575
April	16-30	45	97		35	97		590.
May	1-15	45	86		35	86		590.
May	16-31	35	72[c]		35	72[c]		590.
June	1-15	35	72	62	35	72	62	590.
June	16-30	35	72	62	35	72	62	590.
July	1-15	35	72	62	35	72	62	590.
July	16-31	35	72	62	35	72	62	590.
August	1-15	35	72	62	35	72	62	590.
August	16-31	35	72	62	35	72	62	590.
September	1-15	35	72[c]		35	72[c]		590.
September	16-30	35	97		35	97		590.
October	1-15	45	97		45	97		575
October	16-31	45	110.		45	110.		575
November	1-15	45	110.		45	110.		575
November	16-30	45	110.		45	110.		575
December	1-15	65	110.		50.	110.		560.
December	16-31	65	110.		50.	110.		560.

[a] The Seaway Corridor Sub-Zone (SCSZ) is defined in two parts:

1) That part of Ontario that lies south of a straight line passing through Arnprior and Grand Bend. Where the line so described runs across a local municipality, the entire local municipality is part of the sub-zone. This is defined by the *Ontario Volatility Regulation* (see Annex C, C.2.7.1);

2) That part of Southwestern Quebec defined in the Québec *Petroleum Products Act* (see Annex C, C.2.9.1) as “The Outaouais-Montréal Corridor”.

[b] If the required maximum DVPE is less than 72 kPa then the maximum DI shall be 597.

[c] In the Ontario portion of the SCSZ, the *Ontario Volatility Regulation* sets a maximum limit of 62 kPa starting on either May 15 or June 1 and ending on September 14, depending upon specific conditions (see Annex C, C.2.7.1). Note that the 62 kPa limit is defined as being absolute in this Regulation.

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Table 2E — Volatility requirements for Zone E (Atlantic)

Zone volatility limits		Atlantic Canada The island of Newfoundland, the provinces of New Brunswick, Nova Scotia and Prince Edward Island and les Îles-de-la-Madeleine.								
		Type 1 (E50-E85) fuel				Type 2 (E20-E25) fuel				
		DVPE		Newfoundland DVPE		DVPE		Newfoundland DVPE		Driveability index
				Class 1[a]	Class 2[b]			Class 1[a]	Class 2[b]	
Month	Dates	Min. (kPa)	Max. (kPa)	Max. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (kPa)	Max. (kPa)	Max. (°C)
January	1-15	85	110.	107		65	110.	107		550.
January	16-31	85	110.	107		65	110.	107		550.
February	1-15	85	110.	107		65	110.	107		550.
February	16-28 (29)	65	110.	107		50.	110.	107		560.
March	1-15	65	110.	107		50.	110.	107		560.
March	16-31	45	110.	107		45	110.	107		575
April	1-15	45	110.	107		45	110.	107		575
April	16-30	45	97	107		35	97	107		590.
May	1-15	45	97[c]	97		35	97[c]	97		590.
May	16-31	45	72	97	72	35	72	97	72	590.
June	1-15	35	72	86	72	35	72	86	72	590.
June	16-30	35	72	86	72	35	72	86	72	590.
July	1-15	35	72	86	72	35	72	86	72	590.
July	16-31	35	72	86	72	35	72	86	72	590.
August	1-15	35	72	97	72	35	72	97	72	590.
August	16-31	35	72	97	72	35	72	97	72	590.
September	1-15	35	72	107	72	35	72	107	72	590.
September	16-30	35	97	107	97	35	97	107	97	590.
October	1-15	45	110.	107		35	110.	107		590.
October	16-31	45	110.	107		45	110.	107		575
November	1-15	45	110.	107		45	110.	107		575
November	16-30	45	110.	107		45	110.	107		575
December	1-15	65	110.	107		50.	110.	107		560.
December	16-31	65	110.	107		50.	110.	107		560.

[a] Newfoundland Class 1 is that part of the Island on Newfoundland lying north of latitude 49° (see Annex C, C.2.5.1).

[b] Newfoundland Class 2 is that part of the Island on Newfoundland lying south of latitude 49° (see Annex C, C.2.5.1).

[c] In Nova Scotia and New Brunswick, the 72 kPa maximum is required at Terminals starting May 15 (see Annex C, C.2.6.1 and C.2.4.1).

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Table 2F — Volatility requirements for Zone F (Northern Canada)

Zone volatility limits		Northern Canada The portions of British Columbia and Alberta north of latitude 54° North; Saskatchewan, Manitoba and Ontario north of latitude 53° North; Quebec lying between latitudes 51° North and 55° North; and Labrador south of latitude 55° North.				
		Type 1 (E50-E85) fuel		Type 2 (E20-E25) fuel		
		DVPE		DVPE		Driveability index
Month	Dates	Min. (kPa)	Max.[a,b] (kPa)	Min. (kPa)	Max.[a,b] (kPa)	Max. (°C)
January	1-15	85	110.	85	110.	540.
January	16-31	85	110.	85	110.	540.
February	1-15	85	110.	85	110.	540.
February	16-28 (29)	85	110.	85	110.	540.
March	1-15	85	110.	65	110.	550.
March	16-31	65	110.	65	110.	550.
April	1-15	65	110.	50.	110.	560.
April	16-30	45	97	50.	97	560.
May	1-15	45	97	45	97	575
May	16-31	45	97	45	97	575
June	1-15	35	97	35	97	590.
June	16-30	35	86	35	86	590.
July	1-15	35	86	35	86	590.
July	16-31	35	86	35	86	590.
August	1-15	35	86	35	86	590.
August	16-31	35	86	35	86	590.
September	1-15	45	97	35	97	590.
September	16-30	45	97	45	97	575
October	1-15	45	110.	45	110.	575
October	16-31	65	110.	45	110.	575
November	1-15	65	110.	50.	110.	560.
November	16-30	85	110.	65	110.	550.
December	1-15	85	110.	85	110.	540.
December	16-31	85	110.	85	110.	540.

[a] Labrador is additionally subject to the Newfoundland Class 1 DVPE maximum requirements as shown in Table 2E (see Annex C, C.2.5.1).

[b] The *Ontario Volatility Regulation* sets a maximum limit of 72 kPa starting June 1 and ending on either August 31 or September 14, depending upon specific conditions (see Annex C, C.2.7.1). Note that the 72 kPa limit is defined as being absolute in this Regulation.

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Table 2G — Volatility requirements for Zone G (Yukon)

Zone volatility limits		Yukon The Territory of the Yukon				
		Type 1 (E50-E85) fuel		Type 2 (E20-E25) fuel		
		DVPE		DVPE		Driveability index
Month	Dates	Min. (kPa)	Max. (kPa)	Min. (kPa)	Max. (kPa)	Max. (°C)
January	1-15	85	110.	85	110.	540.
January	16-31	85	110.	85	110.	540.
February	1-15	85	110.	85	110.	540.
February	16-28 (29)	85	110.	85	110.	540.
March	1-15	85	110.	65	110.	540.
March	16-31	65	110.	65	110.	550.
April	1-15	65	110.	50.	110.	550.
April	16-30	45	110.	45	110.	560.
May	1-15	45	97	45	97	575
May	16-31	45	97	35	97	590.
June	1-15	35	97	35	97	590.
June	16-30	35	86	35	86	590.
July	1-15	35	86	35	86	590.
July	16-31	35	86	35	86	590.
August	1-15	35	86	35	86	590.
August	16-31	45	97	35	97	575
September	1-15	45	110.	35	110.	575
September	16-30	45	110.	45	110.	575
October	1-15	45	110.	45	110.	575
October	16-31	65	110.	50.	110.	560.
November	1-15	65	110.	65	110.	540.
November	16-30	85	110.	85	110.	540.
December	1-15	85	110.	85	110.	540.
December	16-31	85	110.	85	110.	540.

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Table 2H — Volatility requirements for Zone H (Arctic Canada)

Zone volatility limits		Arctic Canada All of the Northwest Territories, Nunavut, and the portions of Quebec, Nunavik and Labrador north of latitude 55° North.				
		Type 1 (E50-E85) fuel		Type 2 (E20-E25) fuel		
		DVPE		DVPE		Driveability index
Month	Dates	Min. (kPa)	Max.[a] (kPa)	Min. (kPa)	Max.[a] (kPa)	Max. (°C)
January	1-15	85	110.	85	110.	540.
January	16-31	85	110.	85	110.	540.
February	1-15	85	110.	85	110.	540.
February	16-28 (29)	85	110.	85	110.	540.
March	1-15	85	110.	85	110.	540.
March	16-31	85	110.	85	110.	550.
April	1-15	85	110.	65	110.	550.
April	16-30	65	97	50.	97	560.
May	1-15	65	97	50.	97	560.
May	16-31	45	86	45	86	575
June	1-15	45	86	45	86	575
June	16-30	45	86	45	86	575
July	1-15	45	86	45	86	575
July	16-31	45	86	45	86	575
August	1-15	45	86	45	86	575
August	16-31	45	97	45	97	575
September	1-15	50.	97	50.	97	560.
September	16-30	65	110.	65	110.	550.
October	1-15	65	110.	65	110.	550.
October	16-31	65	110.	65	110.	550.
November	1-15	85	110.	85	110.	540.
November	16-30	85	110.	85	110.	540.
December	1-15	85	110.	85	110.	540.
December	16-31	85	110.	85	110.	540.

[a] Labrador is additionally subject to the Newfoundland Class 1 DVPE maximum requirements as shown in Table 2E (see Annex C, C.2.5.1).

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Annex A
(normative)

Referenced ASTM International publications (see 2.5)

Annual Book of ASTM Standards

ASTM D86 Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

ASTM D130 Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

ASTM D381 Standard Test Method for Gum Content in Fuels by Jet Evaporation

ASTM D525 Standard Test Method for Oxidation Stability of Gasoline (Induction Period Method)

ASTM D1125 Standard Test Methods for Electrical Conductivity and Resistivity of Water

ASTM D2699 Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel

ASTM D2700 Standard Test Method for Motor Octane Number of Spark-Ignition Engine Fuel

ASTM D2885 Standard Test Method for Determination of Octane Number of Spark-Ignition Engine Fuels by On-Line Direct Comparison Technique

ASTM D3120 Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry

ASTM D3231 Standard Test Method for Phosphorus in Gasoline

ASTM D3244 Standard Practice for Utilization of Test Data to Determine Conformance with Specifications

ASTM D3764 Standard Practice for Validation of the Performance of Process Stream Analyzer Systems

ASTM D4057 Standard Practice for Manual Sampling of Petroleum and Petroleum Products

ASTM D4177 Standard Practice for Automatic Sampling of Petroleum and Petroleum Products

ASTM D4815 Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography

ASTM D4855 Standard Practice for Comparing Test Methods

ASTM D4953 Standard Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)

ASTM D5191 Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method)

ASTM D5453 Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel and Engine Oil by Ultraviolet Fluorescence

ASTM D5500 Standard Test Method for Vehicle Evaluation of Unleaded Automotive Spark-Ignition Engine Fuel for Intake Valve Deposit Formation

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ASTM D5501 Standard Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20% Ethanol by Gas Chromatography

ASTM D5854 Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products

ASTM D6201 Standard Test Method for Dynamometer Evaluation of Unleaded Spark-Ignition Engine Fuel for Intake Valve Deposit Formation

ASTM D6304 Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration

ASTM D6423 Standard Test Method for Determination of pHe of Denatured Fuel Ethanol and Ethanol Fuel Blends

ASTM D6708 Standard Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material

ASTM D7039 Standard Test Method for Sulfur in Gasoline, Diesel Fuel, Jet Fuel, Kerosine, Biodiesel, Biodiesel Blends, and Gasoline-Ethanol Blends by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry

ASTM D7318 Standard Test Method for Existent Inorganic Sulfate in Ethanol by Potentiometric Titration

ASTM D7319 Standard Test Method for Determination of Existent and Potential Sulfate and Inorganic Chloride in Fuel Ethanol and Butanol by Direct Injection Suppressed Ion Chromatography

ASTM D7328 Standard Test Method for Determination of Existent and Potential Inorganic Sulfate and Total Inorganic Chloride in Fuel Ethanol by Ion Chromatography Using Aqueous Sample Injection

ASTM D7345 Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Micro Distillation Method)

ASTM D7548 Standard Test Method for Determination of Accelerated Iron Corrosion in Petroleum Products

ASTM D7671 Standard Test Method for Corrosiveness to Silver by Automotive Spark–Ignition Engine Fuel–Silver Strip Method

ASTM D7795 Standard Test Method for Acidity in Ethanol and Ethanol Blends by Titration

ASTM D7923 Standard Test Method for Water in Ethanol and Hydrocarbon Blends by Karl Fischer Titration

ASTM E29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

ASTM E203 Standard Test Method for Water Using Volumetric Karl Fischer Titration

ASTM E1064 Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

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Annex B
(informative)

Precautionary information for transportation, storing, handling and dispensing denatured fuel ethanol and automotive ethanol fuel type 1 (E50-E85) and type 2 (E20-E25)

B.1 Storage and dispensing

Automotive ethanol fuel should be transported, stored and dispensed using equipment specifically designed for this purpose. Note that ethanol can corrode aluminum alloys. Since denatured fuel ethanol is an electrolyte (see B.2), it will promote the formation of galvanic corrosion cells when in contact with dissimilar metals. The galvanic reaction will introduce metallic ions of the anodic metal into the fuel, which can result in plugged vehicle fuel filters. Brass in direct contact with aluminum in denatured fuel ethanol has resulted in galvanic corrosion, giving rise to fuel contamination.

B.1.1 Product cleanliness at dispensers

If verifying dispensing hose compatibility with the fuel, collect the first litre of product from a dispenser nozzle, preferably after the dispenser has been inactive, such as first thing in the morning.

B.1.2 There is a suitable report published by the US department of Energy from July 2010, *Handbook for Handling, Storing, and Dispensing E85*, DOE/GO-102010-3073[3].

B.2 Water

Automotive ethanol fuel is hygroscopic, and it can eventually absorb enough moisture from the ambient air to cause the fuel to separate into two phases or layers. Separation can be avoided if fuels are clear and bright initially, and care is taken during storage, distribution and use to prevent contact with water or humid air. Phase separation is a greater risk at lower temperatures.

B.3 Denaturant

The choice of a denaturant can be impacted by the *Benzene in Gasoline Regulations* and the *Sulphur in Gasoline Regulations*.

B.4 Deposit control additives

Some deposit control additives commonly used in gasolines can have limited solubility in ethanol blends covered by this standard, resulting in hazy fuels and possible precipitates. This should be considered when blending the gasoline component with denatured fuel ethanol.

B.4.1 Intake valve deposits

Ethanol and some additives in ethanol can generate engine deposits and intake valve deposits (IVD). However, the standard IVD tests require use of an engine that is not compatible with automotive ethanol fuel. There are currently no sanctioned test methods for evaluating the effectiveness of detergents in preventing induction system deposits with automotive ethanol fuel. A number of additive companies have developed tests for evaluating the performance of detergents in automotive ethanol fuel blends.

[3] This report is available at the US Department of Energy at www.afdc.energy.gov/pdfs/48162.pdf.

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B.4.1.1 If vehicle performance degrades due to deposits, one mitigating action is to operate an FFV on gasoline meeting CAN/CGSB-3.5, 3.511 or type 2 automotive ethanol fuel periodically, following the vehicle manufacturers' recommendations, which allows the detergent in gasoline to clean deposits.

B.5 Fuel level sending units

Premature failure of some silver alloy fuel level sending units can relate to reactive sulphur species in the fuel.

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Annex C
(informative)

Federal, provincial and territorial acts and regulations applicable to automotive ethanol fuel type 1 (E50-E85) and type 2 (E20-E25)[4]

C.1 Federal acts and regulations[5]

C.1.1 ***Fuels Information Regulations, No. 1*** (C.R.C. c. 407, as amended by SOR/79-280, 80-138, 2000-105)

These regulations require producers and importers to submit information on sulphur and additive contents (other than lead) for liquid fuels.

C.1.2 ***Gasoline Regulations*** (SOR/90-247, as in effect)

These regulations limit the lead content in unleaded gasoline, restrict leaded gasoline use, and require reporting of lead used in gasoline production. They also limit phosphorus content in gasoline.

C.1.3 ***Contaminated Fuel Regulations*** (SOR/91-486)

These regulations prohibit the importation of fuel that has been contaminated with hazardous wastes.

C.1.4 ***Transportation of Dangerous Goods Regulations*** (SOR/2001-286)

These regulations give detailed packaging, labelling and documentation requirements for transporting gasoline samples within Canada.

C.1.5 ***Benzene in Gasoline Regulations*** (SOR/97-493)

These regulations establish the limits for benzene and BEN in gasoline (see 7.19), and the limits for sulphur, benzene and aromatics in oxygenates.

C.1.6 ***Sulphur in Gasoline Regulations*** (SOR/99-236)

These regulations establish the limits for sulphur in oxygenates and in gasoline (see 7.7).

C.1.7 ***Denatured and Specially Denatured Alcohol Regulations*** (SOR/2005-22, 2005-02-01).

This regulation is made under the *Excise Act*, 2001*, Denatured and Specially Denatured Alcohol Regulations*, P.C. 2005-45, 2005-02-01.[6]

C.1.8 ***Renewable Fuel Regulations*** (SOR/2010-189)

These regulations require the use of renewable fuels in Canada.

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[4] The regulations listed are subject to revision by the relevant authority. The user should consult the relevant authority to confirm the current regulations. The information provided about the regulations is for information only. In case of conflict, the text of the regulation takes precedence. If any of the Web sites referenced become inoperative, regulations may also be found at the Web site www.canlii.com.

[5] Refer to the latest versions. Federal acts and regulations are obtainable from the Canada Gazette website at www.gazette.gc.ca and consolidated acts and regulations may be available from http://laws.justice.gc.ca/.

[6] Available from the Department of Justice website at http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-22/FullText.html.

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C.2 Provincial and territorial regulations

C.2.1 Alberta

C.2.1.1 Renewable fuel requirements

Renewable fuel requirements are controlled under the *Renewable Fuel Standard Regulation*, Regulation 29/2010.

C.2.2 British Columbia

C.2.2.1 General requirements and vapour pressure

Vapour pressure is controlled under the *Environmental Protection Act* and the *Cleaner Gasoline Regulation* (B.C. Reg. 498/95)[7].

C.2.2.2 Renewable content and carbon intensity requirements

Requirements for renewable fuel volumes and reduction of fuel carbon intensity are controlled under the *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* and the *Renewable and Low Carbon Fuel Requirements Regulation* (BC Reg. 394/2008).[7]

The Regulation specifies that fuel containing more than 10% ethanol shall be labelled in accordance with section 7.3 of the Regulation.

C.2.3 Manitoba

C.2.3.1 General requirements

General requirements are controlled under the latest version of the *Dangerous Goods Handling and Transportation Act,* including the *Dangerous Goods Handling and Transportation Regulation* (55/2003) and the *Storage and Handling of Petroleum Products and Allied Products Regulation* (188/2001).[8] However, these two regulations do not address fuel quality.

C.2.3.2 Ethanol requirements

Ethanol requirements including maximum vapour pressure limits for “splash blends” are controlled under the *Ethanol General Regulation*, Regulation 165/2007, as amended by M.R. 118/2011 and M.R. 149/20. This Regulation does require that ethanol blended gasoline comply with CAN/CGSB-3.512 unless it is “splash blended” with gasoline complying with CAN/CGSB-3.5.

C.2.4 New Brunswick

C.2.4.1 Vapour pressure

Vapour pressure is controlled under the *Clean Air Act* and regulations — *Air Quality Regulation* (N.B. Reg. 97-133).

C.2.5 Newfoundland and Labrador

C.2.5.1 Vapour pressure

Vapour pressure is controlled under the *Environmental Protection Act* (O.C. 2003-229) — *Gasoline Volatility Control Regulations* (62/03).

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[7] Available from the government of British Columbia at www.bclaws.gov.bc.ca.

[8] Available from the Government of Manitoba at https://web2.gov.mb.ca/laws/regs/.

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C.2.6 Nova Scotia

C.2.6.1 Vapour pressure

Vapour pressure is controlled under the *Environment Act* and Regulations - *Air Quality Regulations* (N.S. Reg. 28/2005 as amended by N.S. Reg. 8/2020).

C.2.7 Ontario

C.2.7.1 Vapour pressure

Vapour pressure is controlled under the *Ontario Regulation* 271/91, *Gasoline Volatility* as amended by *Ontario Regulations* 45/97 and 112/20.[9]

C.2.7.2 Fuel products

Standards describing fuel products are listed under the *Technical Standards and Safety Act*, 2000 — O.Reg. 223/01, *Liquid Fuels* (O.Reg. 217/01) — *Liquid Fuels Handling Code*.

C.2.7.3 Ethanol requirements

Bio-based content requirements are controlled under *Ontario Regulation* 663/20*, Cleaner Transportation Fuels: Renewable Content Requirements for Gasoline and Diesel Fuels*. This Regulation refers to a Guideline entitled "Technical Guideline: Cleaner Transportation Fuels" published by the Ontario Ministry of Environment, Conservation and Parks. The Guideline requires "blended gasoline" sold in Ontario to meet the relevant CGSB Standard: CAN/CGSB-3.5, CAN/CGSB-3.511 or CAN/CGSB-3.512.

C.2.8 Prince Edward Island

C.2.8.1 General requirements

General requirements are controlled under the *Petroleum Products Act Regulations* (EC 38/91), as amended by EC 639/93, 639/97, 762/98, 699/2000.[10]

C.2.9 Quebec

C.2.9.1 General requirements

The general requirements are controlled under the *Loi sur les produits pétroliers,* RLRQ, c. P-30.01, *Règlement sur les produits pétroliers,* (RLRQ, c. P-30.01 r.2) or *Petroleum Products Act*, CQLR, c. P-30.01, *Petroleum Products Regulation,* (CQLR, c. P-30.01 r.2)[11]. This regulation lists Quebec quality requirements for aviation gasolines, aviation turbine fuels, automotive gasolines, gasolines containing denatured fuel ethanol for use in automotive spark ignition fuels, diesel fuels, diesel fuels containing biodiesel (B100) for blending in middle distillate fuels, fuel oil types 0, 1 and 2, and fuel oil types 4, 5 and 6. Amendments and editions published apply only 90 days after the last day of the month that the French text of the amendments or editions was published. The Direction générale des combustibles propres et des réservoirs of the ministère de l'Énergie et des Ressources naturelles is responsible for the application and revision of this regulation. Web site: https://mern.gouv.qc.ca/en/energy-transition/.

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[9] Available from Ontario e-Laws web site at www.e-laws.gov.on.ca/.

[10] Available from the Government of Prince Edward Island at *Petroleum Products Act Regulations* (princeedwardisland.ca).

[11] Available from Les Publications du Québec, telephone: 1-800-463-2100 or 418-643-5150. Fax: 1-800-561-3479 or 418-643-6177. Also available on-line at https://www.legisquebec.gouv.qc.ca/en/document/cs/P-30.01%20/.

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C.2.10 Saskatchewan

C.2.10.1 Ethanol requirements

Ethanol requirements are controlled under the *Ethanol Fuel (General) Regulations*, RRS c E-11.1 Reg 1[12].

C.2.11 Yukon

C.2.11.1 General requirements

The general requirements are controlled under the *Gasoline Handling Act and Regulations — Gasoline Handling Regulations* (O.C. 1972/137).

[12] Available from the Government of Saskatchewan at Publications Saskatchewan.

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Annex D
(informative)

Discussion of volatility requirements

D.1 Type 2 (E20-E25) automotive ethanol fuel driveability index

The driveability index for type 2 (E20-E25) automotive ethanol fuel is based on the driveability index for CAN/CGSB-3.5, *Automotive Gasoline* with the addition of a term of 100 to account for ethanol content. The term of 100 is equivalent to multiplying the volume % ethanol by a factor of 5 for E20, which is similar to the factor determined in CRC Report No. 666[13], though this report dealt primarily with non-FFVs. Limited driveability data are available for blends above E20, and based on OEM experience, multiplying the volume % ethanol by a factor of 5 would be overly severe for E25 in FFVs. Therefore, the fixed term of 100 was selected for E20-E25, which takes into account available literature, uncertainties and OEM experience with FFVs.

D.2 Vapour pressure

Vapour pressure typically rises with the addition of low levels of ethanol to gasoline. One study[14] that included adding up to 30 % by volume ethanol (E30) showed an increase of up to 15 kPa. Most of the data showed an increase of less than about 10 kPa for the E20 and E30 blends, and that the increase varied inversely with the base gasoline's vapour pressure. It is therefore anticipated that a type 2 (E20-E25) blend would generally result in increases in vapour pressure of less than 10 kPa.

The minimum vapour pressure requirements were determined using the 10th percentile low-end design temperatures (see 2.3 and 10th percentile low-end design temperature in section 3).

The NRCan sponsored E50 – E85 Volatility Project[15] determined the upper flammability limits of various blends and that study was used to update the type 1 minimum vapour pressure limits and set vapour pressure limits for type 2.

Note: Tables 2A to 2H replace the "volatility class geographic locality table" in previous versions of this document.

[13] https://crcao.org/publications/performance/.

[14] http://www.api.org/~/media/Files/Policy/Fuels-and-Renewables/2016-Oct-RFS/The-Truth-About-E15/E10-Blending-Study-Final-Report.pdf.

[15] http://papers.sae.org/2017-01-1352/.

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Annex E
(normative)

List of municipalities in the Outaouais-Montréal corridor

Municipalities are listed either by regional county municipalities (RCM) or by administrative region or metropolitan community. The indicated numbers correspond to the codes assigned to each municipality, RCM, administrative region or metropolitan community in the Répertoire des municipalités published by the Ministère des Affaires municipales et de l'Habitation.

530 PIERRE DE SAUREL
53085 Saint-Gérard-Majella, P

550 ROUVILLE
55023 Saint-Césaire, V
55030 Sainte-Angèle-de-Monnoir, M
55037 Rougemont, M
55048 Marieville, V
55057 Richelieu, V
55065 Saint-Mathias-sur-Richelieu, M

560 LE HAUT-RICHELIEU
56083 Saint-Jean-sur-Richelieu, V
56097 Mont-Saint-Grégoire, M
56105 Sainte-Brigide-d'Iberville, M

570 LA VALLÉE-DU-RICHELIEU
57005 Chambly, V
57010 Carignan, V
57020 Saint-Basile-le-Grand, V
57025 McMasterville, M
57030 Otterburn Park, V
57033 Saint-Jean-Baptiste, M
57035 Mont-Saint-Hilaire, V
57040 Beloeil, V
57045 Saint-Mathieu-de-Beloeil, M
57050 Saint-Marc-sur-Richelieu, M
57057 Saint-Charles-sur-Richelieu, M
57068 Saint-Denis-sur-Richelieu, M
57075 Saint-Antoine-sur-Richelieu, M

590 MARGUERITE D'YOUVILLE
59010 Sainte-Julie, V
59015 Saint-Amable, M
59020 Varennes, V
59025 Verchères, M
59030 Calixa-Lavallée, M
59035 Contrecoeur, V

600 L'ASSOMPTION
60005 Charlemagne, V
60013 Repentigny, V
60020 Saint-Sulpice, P
60028 L'Assomption, V
60035 L'Épiphanie, V
60040 L'Épiphanie, P

630 MONTCALM
63005 Sainte-Marie-Salomé, P
63013 Saint-Jacques, M
63023 Saint-Alexis, M
63030 Saint-Esprit, M
63035 Saint-Roch-de-l'Achigan, M
63040 Saint-Roch-Ouest, M
63048 Saint-Lin–Laurentides, V
63055 Saint-Calixte, M
63060 Sainte-Julienne, M
63065 Saint-Liguori, P

640 LES MOULINS
64008 Terrebonne, V
64015 Mascouche, V

13 OUTSIDE AN RCM/LAVAL
65005 Laval, V

663 OUTSIDE AN RCM/COMMUNAUTÉ MÉTROPOLITAINE DE MONTRÉAL
58007 Brossard, V
58012 Saint-Lambert, V
58033 Boucherville, V
58037 Saint-Bruno-de-Montarville, V
58227 Longueuil, V
66007 Montréal-Est, V
66023 Montréal, V
66032 Westmount, V
66047 Montréal-Ouest, V
66058 Côte-Saint-Luc, V
66062 Hampstead, V
66072 Mont-Royal, V
66087 Dorval, V
66092 L'Île-Dorval, V
66097 Pointe-Claire, V
66102 Kirkland, V
66107 Beaconsfield, V
66112 Baie-d'Urfé, V
66117 Sainte-Anne-de-Bellevue, V
66127 Senneville, VL
66142 Dollard-des-Ormeaux, V

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16 OUTSIDE AN RCM/MONTÉRÉGIE
67802 Kahnawake, R.I.
69802 Akwesasne, R.I.

670 ROUSSILLON
67005 Saint-Mathieu, M
67010 Saint-Philippe, M
67015 La Prairie, V
67020 Candiac, V
67025 Delson, V
67030 Sainte-Catherine, V
67035 Saint-Constant, V
67040 Saint-Isidore, P
67045 Mercier, V
67050 Châteauguay, V
67055 Léry, V

680 LES JARDINS-DE-NAPIERVILLE
68020 Sainte-Clotilde, M
68025 Saint-Patrice-de-Sherrington, M
68040 Saint-Jacques-le-Mineur, M
68045 Saint-Édouard, M
68050 Saint-Michel, M
68055 Saint-Rémi, V

690 LE HAUT-SAINT-LAURENT
69010 Franklin, M
69017 Saint-Chrysostome, M
69025 Howick, M
69030 Très-Saint-Sacrement, P
69037 Ormstown, M
69045 Hinchinbrooke, M
69050 Elgin, M
69055 Huntingdon, V
69060 Godmanchester, CT
69065 Sainte-Barbe, M
69070 Saint-Anicet, M
69075 Dundee, CT

700 BEAUHARNOIS-SALABERRY
70005 Saint-Urbain-Premier, M
70012 Sainte-Martine, M
70022 Beauharnois, V
70030 Saint-Étienne-de-Beauharnois, M
70035 Saint-Louis-de-Gonzague, P
70040 Saint-Stanislas-de-Kostka, M
70052 Salaberry-de-Valleyfield, V

710 VAUDREUIL-SOULANGES
71005 Rivière-Beaudette, M
71015 Saint-Télesphore, M
71020 Saint-Polycarpe, M
71025 Saint-Zotique, M
71033 Les Coteaux, M
71040 Coteau-du-Lac, M
71045 Saint-Clet, M
71050 Les Cèdres, M
71055 Pointe-des-Cascades, VL
71060 L'Île-Perrot, V
71065 Notre-Dame-de-L'Île-Perrot, V
71070 Pincourt, V
71075 Terrasse-Vaudreuil, M
71083 Vaudreuil-Dorion, V
71090 Vaudreuil-sur-le-Lac, VL
71095 L'Île-Cadieux, V
71100 Hudson, V
71105 Saint-Lazare, V
71110 Sainte-Marthe, M
71115 Sainte-Justine-de-Newton, M
71125 Très-Saint-Rédempteur, M
71133 Rigaud, M
71140 Pointe-Fortune, VL

720 DEUX-MONTAGNES
72005 Saint-Eustache, V
72010 Deux-Montagnes, V
72015 Sainte-Marthe-sur-le-Lac, V
72020 Pointe-Calumet, M
72025 Saint-Joseph-du-Lac, M
72032 Oka, M
72043 Saint-Placide, M

730 THÉRÈSE-DE-BLAINVILLE
73005 Boisbriand, V
73010 Sainte-Thérèse, V
73015 Blainville, V
73020 Rosemère, V
73025 Lorraine, V
73030 Bois-des-Filion, V
73035 Sainte-Anne-des-Plaines, V

15 OUTSIDE AN RCM/LAURENTIDES
74005 Mirabel, V

750 LA RIVIÈRE-DU-NORD
75005 Saint-Colomban, V
75017 Saint-Jérôme, V
75028 Sainte-Sophie, M
75040 Prévost, V
75045 Saint-Hippolyte, M

760 ARGENTEUIL
76008 Saint-André-d'Argenteuil, M
76020 Lachute, V
76025 Gore, CT
76030 Mille-Isles, M
76035 Wentworth, CT
76043 Brownsburg-Chatham, V
76055 Grenville, VL
76052 Grenville-sur-la-Rouge, M
76065 Harrington, CT

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770 LES PAYS-D'EN-HAUT
77022 Sainte-Adèle, V
77030 Piedmont, M
77035 Sainte-Anne-des-Lacs, P
77043 Saint-Sauveur, V
77050 Morin-Heights, M

800 PAPINEAU
80005 Fassett, M
80010 Montebello, M
80015 Notre-Dame-de-BonSecours, M
80020 Notre-Dame-de-la-Paix, M
80027 Saint-André-Avellin, M
80037 Papineauville, M
80045 Plaisance, M
80050 Thurso, V
80055 Lochaber, CT
80060 Lochaber-Partie-Ouest, CT
80065 Mayo, M
80070 Saint-Sixte, M
80078 Ripon, M
80085 Mulgrave-et-Derry, M

07 OUTSIDE AN RCM/OUTAOUAIS
81015 Gatineau, V

820 LES COLLINES-DE-L'OUTAOUAIS
82005 L'Ange-Gardien, M
82010 Notre-Dame-de-la-Salette, M
82015 Val-des-Monts, M
82020 Cantley, M
82025 Chelsea, M
82030 Pontiac, M
82035 La Pêche, M

840 PONTIAC
84005 Bristol, M
84010 Shawville, M
84015 Clarendon, M
84020 Portage-du-Fort, VL
84025 Bryson, M
84030 Campbell's Bay, M
84035 L'Île-du-Grand-Calumet, M
84040 Litchfield, M
84045 Thorne, M

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