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CAN/CGSB-3.0

No./N° 20.9-2005

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ICS 71.040.40

WITHDRAWAL

December 2018

Methods of testing petroleum and associated products CGSB Cetane Index of diesel fuels

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Décembre 2018

Méthodes d'essai des produits pétroliers et produits connexes Indice de cétane ONGC des combustibles diesels

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No. 20.9-2005

Supersedes CAN/CGSB-3.0
No. 20.9-95

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Methods of Testing Petroleum and Associated Products

CGSB Cetane Index of Diesel Fuels

ICS 71.040.40

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NATIONAL STANDARD OF CANADA

CAN/CGSB-3.0
No. 20.9-2005

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METHODS OF TESTING PETROLEUM AND ASSOCIATED PRODUCTS

CGSB CETANE INDEX OF DIESEL FUELS

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National Standard of Canada

CGSB Gatineau Canada K1A 1G6	METHODS OF TESTING PETROLEUM AND ASSOCIATED PRODUCTS	CAN/CGSB-3.0
	CGSB Cetane Index of Diesel Fuels	No. 20.9-2005

Supersedes CAN/CGSB-3.0
No. 20.9-95

1. SCOPE

1.1 This method describes a means for calculating the cetane index of diesel fuels (without cetane improvers) from the aniline point, distillation, density and viscosity. The index, as computed from the prescribed formula, is termed the CGSB Cetane Index (CI).

1.2 A suggested procedure is also outlined in Appendix A to estimate the cetane index, additized (CIA), based on the calculated cetane index for diesel fuels containing diesel ignition improver (DII). This procedure can be used to estimate the combustion quality when CI and DII are used, and a cetane engine test is not performed. The Appendix A does not form a mandatory part of this method.

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

2. REFERENCED PUBLICATIONS

2.1 The following publications are referenced in this method:

2.1.1 ASTM International

D 86 — Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure

D 445 — Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)

D 611 — Standard Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents

D 613 — Standard Test Method for Cetane Number of Diesel Fuel Oil

D 976 — Standard Test Methods for Calculated Cetane Index of Distillate Fuels

D 1298 — Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

D 4052 — Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter

E 29 — Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

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

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3. SUMMARY OF METHOD

3.1 The aniline point, the 10%, 50% and 90% distillation points, the density at 15°C, and the viscosity at 40°C are determined, and the CGSB Cetane Index (CI) is calculated.

4. SIGNIFICANCE AND USE

4.1 The CGSB Cetane Index is useful for estimating the ASTM cetane number of diesel fuels from properties often routinely determined on the fuels.

4.1.1 This method is more suitable for estimating the cetane number of Canadian fuels, particularly those of oil sands origin. In the range below 40 cetane number, this method is preferable to that of ASTM D 976 for estimating the ASTM cetane number.

Note: The CGSB Cetane Index is not a replacement for the ASTM cetane number as determined by ASTM D 613.

4.2 **Correlation with Cetane Number** — Based on a series of 260 Canadian diesel fuels ranging from 28 to 63 cetane number, the expected correlation of the calculated cetane index with the ASTM cetane number will be less than ±1.5 cetane numbers for 66% of the fuels evaluated.

5. PROCEDURE

5.1 **Aniline Point** — Determine the aniline point of the fuel in accordance with ASTM D 611.

5.2 **10%, 50% and 90% Distillation Recovery Temperatures** — Determine the 10%, 50% and 90% distillation temperatures of the fuel corrected for barometric pressure, based on percentage recovery, in accordance with ASTM D 86.

5.3 **Density** — Determine the density of the fuel at 15°C in accordance with ASTM D 1298 or D 4052.

5.4 **Viscosity** — Determine the viscosity of the fuel at 40°C in accordance with ASTM D 445.

6. CALCULATION

6.1 Calculate the CGSB Cetane Index by means of the following equation:

$$CI = 77.7628 + 01765\,A + 0.003867\,A^2 - 11.6150\,B + 0.5844\,B^2 - 0.6350\,V$$

where:

A = aniline point, °C

$$B = \frac{(10\% + 50\% + 90\% + 820)}{D^2} \times 500$$

V = viscosity at 40°C, mm^2/s (cSt) [1]

10%, 50%, 90% = distillation recovery points, °C (corrected for barometric pressure)

D = density at 15°C, kg/m^3

7. REPORT

7.1 Report the result to one decimal place as CGSB Cetane Index.

[1] *The SI unit for kinematic viscosity is the square metre per second. The preferred multiple for fluids in this viscosity range is the square millimetre per second, which is equivalent to a centistokes (i.e.,* 1 mm^2/s = *1 cSt).*

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8. PRECISION

8.1 The calculation of the CGSB Cetane Index from the aniline point, distillation points, density and viscosity is exact, and no precision limits can be assigned to the calculation itself.

8.2 The precision of the CGSB Cetane Index is dependent only on the precisions of the original four tests.

8.3 Assuming that test results from the four tests complied with their respective precisions, the following precision statements apply to the calculation of the CGSB Cetane Index.

8.3.1 ***Repeatability*** — The difference between two results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long term, in the normal and correct operation of the test methods, exceed 0.2 only in one case in twenty.

8.3.2 ***Reproducibility*** — The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the long term, in the normal and correct operations of the test methods, exceed 0.5 only in one case in twenty.

9. NOTES

9.1 **Reference** — This method was developed by a Task Force of the Diesel Fuel Panel of the CGSB Middle Distillate Fuels Committee. A report providing details of the development program has been published as SAE Paper No. 841344, Development of the Canadian General Standards Board (CGSB) Cetane Index.

9.2 **Related Publication**

ASTM D 4737 — Standard Test Method for Calculated Cetane Index by Four Variable Equation.

9.3 **Sources of Referenced Publications**

The following addresses were valid at the date of publication.

9.3.1 The publications referred to in par. 2.1.1 and 9.2 may be obtained from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, U.S.A., telephone (610) 832-9585, fax (610) 832-9555, Web site www.astm.org, or from IHS Canada, 1 Antares Drive, Suite 200, Ottawa, Ontario K2E 8C4, telephone (613) 237-4250 or 1-800-854-7179, fax (613) 237-4251, e-mail gic@ihscanada.ca, Web site www.ihscanada.ca.

9.3.2 The publication referred to in par. 9.1 may be obtained from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, U.S.A. Telephone (877) 606-7323 (Canada and U.S. only) or (724) 776-4970 (outside Canada and U.S.). Fax (724) 776-0790. Web site www.sae.org.

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

CETANE INDEX, ADDITIZED (CIA)

Note: *The cetane index in this appendix refers to the cetane index as measured by CAN/CGSB-3.0 No. 20.9.*

A1. The following steps are required to estimate the cetane index, additized (CIA), of diesel fuels:

— For a given blend of diesel components, develop the correlation of cetane index to the cetane number (ASTM D 613) (i.e., a particular blend of diesel components may require a cetane index of 43 to ensure that a cetane number of 40.0 is attained).

— For a given blend of diesel components, develop a response curve of added diesel ignition improver (DII) to 'cetane units' (i.e. increase in the cetane quality).

— Determine the cetane index (CI) of a particular blend of diesel fuel. If the cetane index is below the required level to assure a cetane number of 40.0, some DII must be added to bring the batch to specification.

— Determine the number of 'cetane units' (ΔCU) that must be added to the blend in the form of DII to meet the specification requirement. The DII response curve will indicate the treat rate of DII.

A1.1 Calculate the cetane index, additized (CIA), as follows:

$$CIA = CI + \Delta CU$$

A2. When the amount of DII required for a diesel blend is calculated from the cetane indexes of individual components, each individual blending component requires a correlation of cetane index to cetane number, and a DII response curve. The estimated cetane quality of the final blend with the DII is the sum of the individual CIA's for each component.

A2.1 Calculate the cetane index, additized (CIA), as follows:

$$CIA = \sum [X_i (CIA)_i]$$

where:

X_i = the decimal fraction of component "*i*" in the blend

$(CIA)_i$ = cetane index, additized, for component "*i*"

or

$$CIA = \sum [X_i (CI_i + \Delta CU_i)]$$

for "*i*" components.

A3. Report the result as Cetane Index, Additized (or CIA), rounded to the nearest whole number according to ASTM E 29.

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