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Replacing GB 19159-2003

Automotive liquefied petroleum gases

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Standardization Administration of the PRC.

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Foreword

Chapter 4 of this standard (except for test methods) is mandatory AND the rest is recommended.

This standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB 19159-2003; as compared with GB 19159-2003, the main technical changes are as follows:

- DEFINE the scope of application as “liquefied petroleum gas for ignition type of internal combustion engine” (SEE Chapter 1);

- DELETE the limitation of the component mass fraction (SEE Table 1; Chapter 4 of 2003 version);

- DELETE the limitation on grease observation (SEE Table 1; Chapter 4 of 2003 version);

- MODIFY the total sulfur content from “< 270 mg/m^3” to “not more than 50 mg/kg” (SEE Table 1; Chapter 4 of 2003 version);

- MODIFY the evaporation residue from “not more than 0.05 mL/100 mL” to “not more than 60 mg/kg” (SEE Table 1; Chapter 4 of 2003 version);

- MODIFY the density measurement temperature from “20 °C” to “15 °C” (SEE Table 1; Chapter 4 of 2003 version);

- MODIFY the vapor pressure measurement temperature from “37.8 °C” to “40 °C” (SEE Table 1; Chapter 4 of 2003 version);

- ADD the technical requirements for motor octane number (SEE Table 1);

- Based on the temperature at the minimum vapor pressure 150 kPa, DIVIDE the product level (SEE Table 1);

- ADD the calculation method of liquefied petroleum gas motor octane number, measurement method and calculation method of the absolute vapor pressure and gauge pressure of liquefied petroleum gas, the vapor pressure limit of liquefied petroleum gas of different designations corresponding to 40 °C, AND the detection method of the odor of liquefied petroleum gas (SEE Appendix).

This standard, combining with Chinese vehicle liquefied petroleum gas resources, vehicle use characteristics and status quo, through modification, adopts the EU standard EN 589:2008 “Automotive fuels - LPG - Requirements

Automotive liquefied petroleum gases

WARNING: Failure to comply with appropriate precautions may result in the hazards for the production, storage, and use process of the products covered in this standard. This standard is not intended to advise on all safety issues related to this product. It is the responsibility of the user to establish appropriate safety and protective measures prior to the use of this standard and to determine the suitability of the relevant regulatory limits.

1 Scope

This standard specifies the classification and marking, technical requirements and test methods, inspection rules, marking, storage and transportation, safety and health requirements of automotive liquefied petroleum gas.

This standard is applicable to the liquefied petroleum gas used in the ignition type internal combustion engine.

2 Normative reference documents

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this Standard.

GB 150 Steel pressure vessels (all parts)

GB/T 8017-2012 Standard test method for vapor pressure of petroleum products - Reid method

GB 11518 Hygiene standard for liquefied petroleum gas in the air of workshop

GB 14193 Rules for filling of liquefied gas cylinders

GB 17259 Steel cylinders for the liquefied petroleum gas for vehicles

GB 18352.3 Limits and measurement methods for emissions from light-duty vehicles (China III, IV stage)

SH/T 0125 Test method for hydrogen sulfide in liquefied petroleum gas (lead acetate method) (ISO 8819:1987, MOD)

SH/T 0221 Determination method for density or relative density of liquefied petroleum gas (pressure hydrometer method) (ISO 3993:1984, MOD)

SH/T 0222 Determination method for total sulfur content of liquefied petroleum gas (Coulometric method)

SH/T 0232 Determination method for copper strip corrosion of liquefied petroleum gas (ISO 6251:1982, MOD)

SH/T 0233 Sampling method for liquefied petroleum gas

SH/T 0614 Determination method for component of industrial propane and butane (gas chromatography method) (ISO 7911:1988, MOD)

SH/T 1142 C4 fraction for industrial use - Sampling in the liquid phase

SY 5985 Liquefied petroleum gas safety control stipulation

ASTM D 6667 Standard test method for determination of total volatile sulfur in gaseous hydrocarbons and liquefied petroleum gases by ultraviolet fluorescence

ISO 8973 Liquefied petroleum gases - Calculation method for density and vapor pressure

EN 15469 Petroleum products - Test method for free water in liquefied petroleum gas by visual inspection

EN 15470 Liquefied petroleum gases - Determination of dissolved residues - High temperature gas chromatographic method

Safety supervision procedures for liquefied gas railway tanker ([87] HSZ No. 1174)

Safety supervision procedures for liquefied gas vehicle tanker (LBF [1994] No. 262)

Pressure vessel safety technical supervision procedures (ZJJJGF [1999] No. 154)

Cylinder safety supervision procedures (ZJJJGF [2000] No. 250)

3 Classification and marking

3.1 Product Classification

a) When the new product is put into production OR the product is subjected to finalization assessment;

b) When the raw materials, processing technology, and so on have significant changes AND the production is started after overhauling;

c) When there is significant difference between the exit-factory inspection results and the last type inspection results.

5.2 Batching

Under the conditions of same raw materials and processes, each tank of product as produced is treated as a batch.

5.3 Sampling

Sampling is conducted in accordance with SH/T 0233.

5.4 Judgment rules

If the exit-factory inspection results comply with the technical requirements of Chapter 4, this batch of products are judged as qualified.

5.5 Re-inspection rules

If not all the exit-factory inspection results comply with the technical requirements in Table 1, RE-TAKE double number of samples from the same batch of products to re-inspect the nonconformance items; if the re-inspection results still fail to comply with the technical requirements in Table 1, this batch of products shall be judged as disqualified.

6 Marking, storage and transportation

6.1 Marking

The filling machine used for the automotive liquefied petroleum gas which complies with the requirements of Table 1 shall have product marking.

6.2 Storage

The storage vessel for automotive liquefied petroleum gas shall comply with the provisions of GB 150 AND follow the requirements of “Pressure vessel safety technical supervision procedures”. The liquefied petroleum gas steel cylinders installed on the automotive shall comply with the requirements of GB 17259 requirements AND follow the requirements of “Gas cylinder safety supervision

Appendix A

(Normative)

Calculation method of motor octane number of liquefied petroleum gas

A.1 Overview

This appendix describes the method of calculating the motor octane number by analyzing the hydrocarbon composition of liquefied petroleum gas (LPG).

A.2 Principles

The hydrocarbon composition of the liquefied petroleum gas sample is measured by gas chromatography method, AND the motor octane number of the liquefied petroleum gas sample is calculated from the motor octane number of each component.

A.3 Determination

The concentration of each component is determined using SH/T 0614 (a component having a molar concentration of more than 0.1% in the gas sample is detected).

A.4 Calculation method and presentation

A.4.1 Calculation of liquefied petroleum gas motor octane number is shown in equation (A.1):

$$\text{Motor octane number} = \sum_{i=1}^{n} M_i c_i \qquad \cdots\cdots (A.1)$$

Where:

M_i - The motor octane factor of a component (SEE Table A.1), which shall be in line with the unit of c_i;

c_i - The proportion of a component in a liquefied petroleum gas sample, which may be any of the molar, mass or volume fraction.

Note: The motor octane factor of Table A.1 is an empirical value AND is only applicable to the calculations described in this Appendix. In the event of a dispute, a molar factor shall be used for calculation.

of the two ends is slightly inclined to ensure that the liquid can be completely discharged from either end when the instrument is placed vertically. At the top of the chamber is fitted with a suitable vent valve connection for fitting the vent valve and the pressure gauge. At the bottom of the chamber is opened a hole having an inner diameter of 13 mm for the purposes of connecting the lower chamber. It shall be noted that the connections at both ends of the opening shall not interfere with the full discharge of the liquid from the chamber.

B.3.1.2 Assembly of vent valves

The vent valve also for rinsing is a valve with a 6 mm pore diameter which is fitted on the side of the connector. Both ends of the connector are connected, through thread, to the pressure gauge and the end of the upper chamber.

B.3.1.3 Lower chamber, 33.3%

The lower chamber is a cylindrical vessel with a volume that can ensure the ratio of the upper chamber and the lower chamber at 2 ± 0.03.

B.3.1.4 Lower chamber 20%

The lower chamber is a cylindrical vessel with a volume that can ensure the ratio of the upper chamber and the lower chamber at 4 ± 0.05.

Note: When measuring the volume of the chamber, the volume of the lower chamber is calculated from the through valve baffle. The volume above the through valve baffle is considered as part of the upper chamber, AND the volume ratio between the two chambers shall be determined in accordance with the method specified in Appendix B of GB/T 8017-2012.

B.3.1.5 Connection method of through valve and upper and lower chamber

The upper end of the lower chamber has a 19 mm diameter opening to accommodate a suitable through valve with an internal flow minimum diameter of 13 mm. The side of the lower chamber is equipped with an inlet valve with a pore diameter of 6 mm.

After assembly of the instrument, the volume shall comply with the requirements AND it shall ensure that there is no leakage under the test conditions.

B.3.1.6 Static pressure test

Instrument manufacturers shall ensure that the vapor pressure tester, at 7000 kPa static pressure, has no permanent deformation.

When using the 33.3% lower chamber, CONDUCT operation in accordance with B.7.3.

When using the 20% lower chamber, CLOSE the through valve, and then OPEN the inlet valve, in order to drain the sample from the lower chamber. When there is no liquid overflows, CLOSE the inlet valve and immediately OPEN the through valve, so that the sample in the analyzer is released by about 40%.

Note 1: Note: INJECT the liquid substances of high expansion coefficient, such as propylene, into the instrument; when it is heated to test temperature, it will be able to fully expand to make the instrument be full of liquid, causing instrument breakage. Therefore, when using the 20% lower chamber for such samples, it shall quickly release about 40% sample.

Note 2: Whether cleaning or sampling, it may use a part of the sample to cool the instrument to speed up the sample transfer. To do this, CLOSE the inlet valve and fully OPEN the vent valve to allow the sample evaporate from inside, until the instrument is cooled to a temperature well below that of the sample source. Also, NOTE that the instrument is inverted so that the residue with a high boiling point is completely removed from the vent valve, AND then the vent valve is closed. RETURN the cooled instrument back to its normal vertical position, and TAKE sample as described above.

Note 3: Note: During this operation, the upper chamber is filled with liquid below ambient temperature. Since the liquid in the upper chamber will expand when the instrument is heated, it may cause upper chamber breakage. Therefore, it must quickly finish the operation of providing the free space for instrument.

B.7.3 Determination of vapor pressure

B.7.3.1 INVERT and vigorously SHAKE the instrument. And then RESTORE the instrument back to the original vertical position; IMMERSE the instrument in the constant temperature water bath which is maintained at test temperature. Except for the pressure gauge, all other parts shall be immersed below the water bath level.

At a test temperature of 50 °C or below 50 °C, the water bath temperature shall be maintained at a test temperature ± 0.1 °C.

At temperatures above 50 °C ~ 70 °C, the water bath temperature shall be maintained at a test temperature ± 0.3 °C.

B.7.3.2 After 5 minutes, REMOVE the analyzer from the water bath; INVERT and vigorously SHAKE it, and PLACE it back to the water bath again. The entire process shall be finished quickly to avoid the cooling of instrument and sample. Thereafter, REPEAT the aforementioned operations at the interval of not less

Appendix C

(Normative)

Calculation method of absolute vapor pressure and gauge pressure of liquefied petroleum gas

C.1 Overview

The absolute vapor pressure and gauge pressure of liquefied petroleum gas are calculated using the methods provided in C.2 and C.3 of this Appendix.

C.2 Calculation method of absolute vapor pressure

The calculation method of the absolute vapor pressure p_v of liquefied petroleum gas is shown in Equation C.1:

$$p_v = \sum_{i=1}^{n} p_i x_i \qquad \cdots\cdots (C.1)$$

Where:

p_i - The absolute vapor pressure mixing factor for a component at the specified temperature (SEE Table C.1);

x_i - Mole fraction of a component in a liquefied petroleum gas sample.

C.3 Calculation method of gauge pressure

The calculation method of the gauge pressure p_{ve} of liquefied petroleum gas is shown in the equation C.2:

$$p_{ve} = p_v - p_0 \qquad \cdots\cdots (C.2)$$

Where:

p_v - Absolute vapor pressure of liquefied petroleum gas samples;

p_0 - Local atmospheric pressure;

Table C.1 Absolute vapor pressure mixing factor for each component at different temperatures unit in kPa

Appendix E

(Normative)

Detection method for odor of liquefied petroleum gas

E.1 Overview

The odor of commercial liquefied petroleum gas is usually caused by unsaturated hydrocarbons, sulfur compounds or added deodorant, AND in this Appendix, it describes a method for assessing the odor of commercial liquefied petroleum gas.

WARNING: In order to minimize the chances of exposure of the odor test personnel to the gas, it is strongly recommended that this test be carried out only if all other properties meet the requirements of the indicators in Table 1 of this standard. In the test, there is a risk of exposure to certain substances in liquefied petroleum gas over the short term or long term (weighted average of 8 h reference cycle), so the operator shall refer to the relevant safety and health regulations to ensure that the exposure value does not exceed the specified limit when they are sampling, handling and testing the liquefied petroleum gas.

When the liquefied petroleum gas tested complies with the quality requirements listed in Table 1 of this standard, under the 8 h working system, if the test is not more than 2 times per hour AND the chance of inhalation of liquefied petroleum gas and air mixture is not more than 3 times (10s each time) per test, it is generally possible to ensure that the operator's exposure to liquefied petroleum gas is within the recommended exposure limits. This test only applies when the operator is exposed to the substance in the odor test. To assess the total exposure, other potential exposures need to be evaluated separately.

E.2 Test principle

USE the purified air to dilute the fully vaporized liquefied gas sample, in order to make the concentration of the gas to be tested in the mixed gas is 20% of its lower combustion limit. At least three testers shall be arranged to evaluate the odor of the mixed gas.

Note: The lower combustion limit of the gas in the air: the butane volume fraction is 1.9% AND the propane volume fraction is 2.4%.

E.3 Materials

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