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IS 15958 (2012): Compressed natural gas (CNG) for Automotive Purposes - Specification [PCD 3: Petroleum, Lubricants and their Related Products]



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भारतीय मानक

स्वचल वाहनों के लिए संपीड़ित प्राकृतिक गैस
(सी एन जी) — विशिष्टि

Indian Standard

COMPRESSED NATURAL GAS (CNG) FOR
AUTOMOTIVE PURPOSES — SPECIFICATION

ICS 75.160.20

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Petroleum, Lubricants and Their Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

The purpose of this standard is to provide manufacturers, vehicle operators, natural gas producers, processors, fuelling station operators and others involved in handling and usage of the compressed natural gas (CNG) for automotive industry with the information on the fuel quality parameters for CNG driven vehicles.

Fuel meeting the requirements of this standard should,

- a) provide for the safe operation of the vehicle and associated equipment needed for its fuelling and maintenance,
- b) protect the fuel system from the detrimental effects of corrosion, poisoning, and liquid or solid deposition, and
- c) provide satisfactory vehicle performance under any and all conditions of climate and driving demands.

Some aspects of this standard may also be applicable for the use of CNG in stationary combustion engines.

Since natural gas is a natural product with varying composition and does not need the sophisticated processing such as applied to crude oil, it is not possible to specify an exact gas quality. However, the need of an Indian Standard is felt, in view of increased usage of CNG on public transport, specifically in metros, to combat the vehicle pollution menace. The presence of compounds like CO₂, H₂S and O₂ content vary from one natural gas composition to another depending on the source. These compounds cause corrosion to different components of the engine. The best way to handle corrosive components is through the elimination of liquid water. From the experience of the OEMs it is observed that too much of oil content is detrimental to the fuel system and also displaces the volume in the fuel circuit of the vehicle. The compressor can break down, if the hydrocarbon liquid is present in the natural gas. The formation of hydrates in the container or piping must also be prevented to avoid corrosion of the metal components.

All these pose problem in formulating a specification for CNG vehicles in satisfying the vehicle performance requirements, safety, health and environmental issues. However, attempt has been made to identify and specify the critical requirements regarding the gas composition in addition to some of the performance requirements, keeping in mind the ultimate vehicle performance.

As the supply of CNG is mostly done in the country by the retail outlets immediately after compression of the natural gas received through pipelines from the gas producers, no separate packing and marking clause has been included in the standard. However, storage, compression and supply of the material should be done as per the instructions given by the producers and by the automotive manufacturers using CNG.

Considerable assistance has been drawn from SAE paper 892133, SP-798, September 1989 'Natural gas vehicles — A review of the state of the art'.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated expressing the result of a test or analysis is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***COMPRESSED NATURAL GAS (CNG) FOR
AUTOMOTIVE PURPOSES — SPECIFICATION****1 SCOPE**

1.1 This standard prescribes the requirements and the methods of sampling and test for the compressed natural gas (CNG) for automotive purposes.

1.2 This standard pertains only to compressed natural gas as it enters the fuel containers on the vehicle. CNG delivered to a fuel refueling station tend to vary sometimes with the supply composition in the vehicles. Any alteration in this respect to meet the specification requirements thus becomes the responsibility of both the supplier and the refueling station operator, who would determine the operating conditions accordingly.

2 REFERENCES

The following standards contain provisions which through reference in this test constitute provisions of the standard. At the time of publication, the edition indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below:

| <i>IS No.</i> | <i>Title</i> |
|--|--|
| 1070 : 1992 | Reagent grade water (<i>third revision</i>) |
| 14504 : 1998/ ISO 6976 : 1995 | Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition |
| 15125 : 2002/ ISO 10715 : 1997 | Natural gas — Sampling guidelines |
| 15126 : 2002/ ISO 13443 : 1996 | Natural gas — Standard reference conditions |
| 15130 (Part 3) : 2002/ISO 6974- 3 : 2000 | Natural gas — Determination of composition with defined uncertainty by gas chromatography: Part 3 Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and hydrocarbons up to C ₈ using two packed columns |
| 15319 : 2003/ ISO 13734 : 1998 | Natural gas — Organic sulphur compounds used as odorants — Requirements and test methods |
| 15320 : 2003/ | Natural gas — Designation of the |

*IS No.**Title*

| | |
|---|--|
| ISO 15403 : 2000 | quality of natural gas for use as a compressed fuel for vehicles |
| 15641 (Part 2) : 2006/ISO 10101- 2 : 1993 | Natural gas — Determination of water by Karl Fischer method — Part 2 Titration procedure |
| ISO 14532 : 2001 | Natural gas — Vocabulary |
| ASTM D3246 – 05 | Standard test method for sulfur in petroleum gas by oxidative microcoulometry |

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 15320 and ISO 14532 shall apply.

4 REQUIREMENTS

4.1 CNG shall be free from liquids over the entire range of temperatures and pressures encountered in the storage and dispensing system, fuel containers, engine and fuel system.

4.2 The CNG fuel shall be technically free from particulate matter such as dust, dirt and mist.

NOTE — It is essential to keep debris out of the vehicle containers. For this purpose, it is recommended at least a 5 µm filter on the fuel line feeding the vehicle container. This usage constitutes a specification for debris control.

4.3 Odour

Natural gas delivered to any natural gas vehicle shall be odorized similar to a level found in the local distribution (*see* IS 15319).

4.4 CNG shall be free of methanol/glycol.

4.5 The material shall also comply with the requirements given in Table 1.

5 SUPPLY OF CNG

5.1 CNG shall be supplied in accordance with the instructions given by the automotive vehicle manufacturers using CNG.

5.2 Receipt of natural gas through pipelines by the retail outlet, storage, compression and dispensing shall be done in accordance with the instructions given by the gas suppliers.

Table 1 Requirements for Compressed Natural Gas for Automotive Purposes
(Clause 4.5)

| Sl No. (1) | Characteristic (2) | Requirement (3) | Method of Test, Ref to (4) |
|---------------|---|--------------------|-------------------------------|
| i) | Wobbe index ¹⁾ , MJ/ m ³ , <i>Min</i> | 48.8-51.0 | IS 14504 |
| ii) | Water content ¹⁾ , mg/m ³ , <i>Max</i> | 5.0 | IS 15641 (Part 2) |
| iii) | Hydrocarbons (volume percent of total organic carbon present): | | |
| | a) Methane, <i>Min</i> | 90.0 | IS 15130 (Part 3) |
| | b) Ethane, <i>Max</i> | 6.0 | do |
| | c) C ₃ and higher HC, <i>Max</i> | 3.0 | do |
| | d) C ₆ and higher HC, <i>Max</i> | 0.5 | do |
| | e) Total unsaturated HC, <i>Max</i> | 0.5 | do |
| iv) | Corrosive components: | | |
| | a) Total sulphur ²⁾ , mg/m ³ , <i>Max</i> | 20.0 | ASTM D3246-05 |
| | b) Oxygen, volume percent, <i>Max</i> | 0.5 | IS 15130 (Part 3) |
| v) | Carbon dioxide and nitrogen, volume percent, <i>Max</i> | 3.5 | do |
| vi) | Other species (mole percent): | | |
| | a) Hydrogen, <i>Max</i> | 0.1 | do |
| | b) Carbon monoxide, <i>Max</i> | 0.1 | do |
| vii) | Methane number, <i>Min</i> | 90.0 | IS 15320 |

NOTE — The requirement of oil content shall be added at a later stage when the test method for the same is available.

¹⁾ Requirements are according to IS 15126.

²⁾ Total sulphur includes the sulphur content of odorant.

5.3 Regulatory provisions by the statutory authorities in this respect shall be mandatory.

6 SAMPLING

Proper sampling of compressed natural gas (CNG) is extremely important if the tests are to be significant. Samples of CNG are examined by various test methods to determine physical and chemical characteristics. The test results are often used for custody transfer. It is, therefore, essential that the samples be

representative of the product to be tested. The representative samples of CNG shall be drawn as prescribed under IS 15125.

7 QUALITY OF REAGENTS

Unless specified otherwise, pure chemicals and distilled water shall be used in tests (*see* IS 1070).

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the result of the analysis.

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This Indian Standard has been developed from Doc No.: PCD 3 (2370).

Amendments Issued Since Publication

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