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Replacing GB/T 14097-2018

Reciprocating internal combustion engines - Limit values of emitted noise

往复式内燃机 噪声限值

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Foreword

This document was drafted in accordance with the provisions of GB/T 1.1-2020 *Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents*.

This document replaces GB/T 14097-2018 *Reciprocating internal combustion engines - Limit values of emitted noise*. Compared with GB/T 14097-2018, in addition to structural adjustments and editorial changes, the main technical changes are as follows:

a) Some definitions in "Terms and definitions" are modified and the term "engine noise grade 5" is added (see Chapter 3; see Chapter 3 of the 2018 edition);

b) The chapter "Acoustic treatment of specific sound sources" is modified (see 4.2; see 4.2 of the 2018 edition);

c) The content of "Operating conditions" is modified (see 4.3; see 4.3 of the 2018 edition);

d) The chapter "Noise limits" is modified (see Chapter 5; see Chapter 5 of the 2018 edition);

e) The chapter "Marking" is modified (see Chapter 7; see Chapter 7 of the 2018 edition).

Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents.

This document was proposed by the China Machinery Industry Federation.

This document is under the jurisdiction of the National Technical Committee on Internal Combustion Engines of Standardization Administration of China (SAC/TC177).

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Reciprocating internal combustion engines - Limit values of emitted noise

1 Scope

This document specifies the five grades of sound power level limits of noise for reciprocating internal combustion engines.

This document applies to reciprocating internal combustion engines defined in GB/T 21404 (hereinafter referred to as "engines" unless otherwise specified).

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this text. Among them, for referenced documents with dates, only the versions corresponding to the dates are applicable to this document; for referenced documents without dates, the latest versions (including all amendments) are applicable to this document.

GB/T 1859.1 Reciprocating internal combustion engines - Measurement of sound power level using sound pressure - Part 1: Engineering method

GB/T 1859.3 Reciprocating internal combustion engines - Measurement of sound power level using sound pressure - Part 3: Precision methods for hemi-anechoic rooms

GB/T 8170 Rules of rounding off for numerical values & expression and judgment of limiting values

GB/T 21404 Internal combustion engines - Determination and method for the measurement of engine power - General requirements

3 Terms and definitions

The terms and definitions defined in GB/T 1859.1, GB/T 1859.3, and GB/T 21404 and the following terms and definitions apply to this document.

3.1 engine noise grade

Classification based on engine noise level.

3.2 engine noise grade 1; ENG1

An engine whose measured sound power level values under all operating conditions are less than or equal to its corresponding Level 1 sound power level limit.

3.3 engine noise grade 2; ENG2

An engine whose measured sound power level values in all operating conditions are less than or equal to its corresponding Level 2 sound power level limit, and whose measured sound power level value in at least one operating condition is greater than its corresponding Level 1 sound power level limit.

3.4 engine noise grade 3; ENG3

An engine whose measured sound power level values in all operating conditions are less than or equal to its corresponding Level 3 sound power level limit, and whose measured sound power level value in at least one operating condition is greater than its corresponding Level 2 sound power level limit.

3.5 engine noise grade 4; ENG4

An engine whose measured sound power level values in all operating conditions are less than or equal to its corresponding Level 4 sound power level limit, and whose measured sound power level value in at least one operating condition is greater than its corresponding Level 3 sound power level limit.

3.6 engine noise grade 5; ENG5

An engine whose measured sound power level value in at least one operating condition is greater than its corresponding Level 4 sound power level limit.

4 Measurement methods

4.1 General

Engine noise measurement shall preferably be carried out in accordance with the provisions of GB/T 1859.3, and may also be carried out in accordance with the provisions of GB/T 1859.1.

NOTE: The measurement uncertainty specified in GB/T 1859.3 is smaller than that in GB/T 1859.1, but the working conditions and operating conditions of the engine are exactly the same.

When measuring noise, the engine operating conditions shall comply with the provisions of GB/T 1859.3 (or GB/T 1859.1). Fixed-speed engines and marine engines shall operate at rated conditions; other engines shall operate at full load speed characteristics (i.e. external characteristics).

When operating under external characteristic conditions, steady-state measurement is preferred, and dynamic measurement of speed increase/deceleration can also be performed, and the operating conditions shall include rated speed operating conditions and minimum operating speed conditions. The speed interval of the operating condition is counted starting from the rated speed; the minimum operating speed condition is usually determined by the external characteristic curve provided by the manufacturer. For gasoline engines and diesel engines with a rated speed greater than 3000 r/min, the determined minimum operating speed shall be less than or equal to 1000 r/min. When measuring under steady state, the speed interval is selected according to the number system of 400 r/min, 200 r/min, 100 r/min, 50 r/min, and 25 r/min, and the number of operating conditions is at least 8; when measuring under dynamic speed increase/deceleration, the speed interval is 25 r/min, and the speed change rate shall be less than or equal to 75 r • min^{-1}/s.

5 Noise limits

5.1 Calculation of sound power level limits

The A-weighted sound power level limit (L_{WGN}) of engines of various noise grades shall be calculated according to formula (1), accurate to 0.1, in decibels (dB):

$$L_{WGN}=10\lg\left[\left(\frac{P_r}{P_{r0}}\right)^{\alpha}\left(\frac{n_r}{n_{r0}}\right)^{\beta}\right]+10\lg\left(\frac{n}{n_0}\right)^{\gamma}+C+3(N-1) \qquad \cdots\cdots\cdots\cdots(1)$$

where:

P_r -- ISO standard power (rated power), in kilowatts (kW) (reference value: P_{r0}=1 kW);

n_r -- Corresponding speed (rated speed) under ISO standard power, in revolutions per minute (r/min) (reference value: n_{r0}=1 r/min);

n -- Rotating speed, in revolutions per minute (r/min) (reference value: n_0=1 r/min);

N -- The ordinal number of the noise grade (Grade 1: N = 1; Grade 2: N = 2; Grade 3: N = 3; Grade 4: N = 4).

The indices α, β, and γ and the constant C are selected according to Table 1.

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