NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 14097-2023

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 issued on 7 September 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 April 2024.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 14097-2023 sets five grades of sound power level limit for the noise emitted by reciprocating internal combustion engines, covering the engines defined in the GB/T standard its scope cites. Measurement comes first: the general provisions, the acoustic treatment of specific sound sources, and the operating conditions the engine is run under, with the measurement itself carried out in accordance with GB/T 1859.3 or by the alternative route the clause permits. The limits are then not a single figure but a calculation - the A-weighted sound power level limit for each grade follows formula (1), quoted to 0.1 decibel - followed by the noise grade assessment that places a given engine in one of the five grades. A determination method and marking rules complete the text, and an informative annex works an assessment through as an example. Machine noise is largely decided at the engine, and a grade fixed by a common method lets an assembler or a

purchaser compare engines and write a noise requirement into a contract without repeating the acoustic work themselves. Of use to engine manufacturers, genset and machinery integrators, acoustic test laboratories, and buyers specifying quieter equipment.

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 (LWGN) of engines of various noise grades shall be calculated according to formula (1), accurate to 0.1, in decibels (dB):

where:

Pr -- ISO standard power (rated power), in kilowatts (kW) (reference value: Pr0=1 kW);

nr -- Corresponding speed (rated speed) under ISO standard power, in revolutions per minute (r/min) (reference value: nr0=1 r/min);

n -- Rotating speed, in revolutions per minute (r/min) (reference value: n0=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).