ICS 27.020
CCS J 90

中华人民共和国国家标准
NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 20787-2023
Replaces GB/T 20787-2006

Reciprocating Internal Combustion Engines—Measurement Method for Structure-Borne Noise
往复式内燃机 结构噪声测量方法

(English Translation)

Issued on 2023-09-07 **Implemented on 2024-04-01**

Jointly Issued by
State Administration for Market Regulation of the People's Republic of China &
Standardization Administration of the People's Republic of China

CONTENTS

FOREWORD

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

This document replaces GB/T 20787-2006 "*Reciprocating internal combustion engines - Test code for the measurement of structure-borne noise emitted from high-speed and medium-speed reciprocating internal combustion engines measured at the engine feet*". In addition to structural adjustments and editorial modifications, the following technical deviations have been made with respect to GB/T 20787-2006:

a) Modified the "Scope" (See Clause 1 vs. Clause 1 of GB/T 20787-2006);

b) Modified the "Terms and Definitions" (See Clause 3 vs. Clause 3 of GB/T 20787-2006);

c) Deleted the "Symbols" (See Clause 4 of GB/T 20787-2006);

d) Added the requirements for "Measurement Environment" (See Clause 4);

e) Added the requirements for "Measuring Instruments" (See Clause 5);

f) Modified the requirements for "Installation and Operation Conditions" (See Clause 6 vs. Clause 6 of GB/T 20787-2006);

g) Modified the requirements for "Acceleration Measurement" (See Clause 7 vs. Clauses 8 to 11 of GB/T 20787-2006);

h) Added the requirements for "Calculation" (See Clause 8);

i) Added the requirements for "Information to be Recorded" (See Clause 9);

j) Added the requirements for "Report" (See Clause 10);

k) Added the requirements for "Other connections between the engine and the test surroundings" (See Annex A);

l) Added the requirements for "Corrections to the height of sensor contact plane" (See Annex B);

m) Modified the requirements concerning the upper limiting frequency in the "Determination of the test frequency range" (See Annex C vs. Clause 7 of GB/T 20787-2006).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The organizations issuing this document shall not be held responsible for identifying any or all such patent rights.

This document was proposed by the China Machinery Industry Federation.

This document was prepared by SAC/TC 177 (National Technical Committee on Internal Combustion Engines of Standardization Administration of China).

This document was mainly drafted by Shanghai Internal Combustion Engine Research Institute Co., Ltd., Commercial Vehicle Technology Center of Shanghai Automotive Group Co., Ltd., Guangxi Yuchai Machinery Co., Ltd., Shanghai Institute of Electrical Engineering, Shanghai Motor Vehicle Testing and Certification Technology Research Center Co., Ltd., Tongji University, Tianjin Internal Combustion Engine Research Institute (Tianjin Motorcycle Technology Center), Shanghai Automotive Group Co., Ltd., Pan Asian Automotive Technology Center Co., Ltd Weichai Power Co., Ltd. and Hunan Liyu Gas Power Co., Ltd.

Chief drafters of this document are Zhang Hongbo, Song Xiangtai, Luo Miao, Yuan Weiping, Hu Aihua, Jiang Changlong, Yuan Ziyao, Li Songlin, Zhou Yi, Jia Bin, Jing Yabing, Liu Tao, Wang Xiaohu, Xu Chao, Lu Zhongdong, Wang Decheng, Song Endong, Yang Kai, Sun Ming, Ye Huaihan, Liu Ying, Qiao Liangliang, and Wang Hongjian.

This document was first issued in 2006; this edition is the first revision.

INTRODUCTION

Noise in buildings, structures, ships, aircraft and land vehicles often arises from the use of reciprocating internal combustion engines, and may be the dominant noise source. Even where it is not dominant, it may produce a background noise. These noises can be transmitted in at least two ways as given below.

— Directly into the surrounding air, i.e., airborne noise. GB/T 1859 specifies methods for determining the airborne noise output of internal combustion engines.

— Through excitation or vibration in the supporting structure, pipes and shafts, i.e., structure-borne noise. These vibrations pass through the structure as structural vibration, exciting in turn the surface of the structure, resulting in the radiation of so-called secondary sound or structure-borne noise.

The ability of the source of vibration (the engine) to generate vibration in the structure in which it is mounted depends on the amount of motion of the engine at its mounting points and the properties of the engine mounting system and the supporting structure. Vibration from the engine feet may be in the vertical sense, which is the one most easily visualized, but may also be longitudinal or transverse with respect to the crankshaft. The vibration source may also cause rotational input, resolved about each of the three orthogonal axes.

The passage through the structure of any vibration which has been caused in it can be very difficult to control, particularly at low frequencies. There are many possible modes of vibration of the structure which could be responsible for the transmission (compression, torsional or flexural modes). Only breaks in the continuity of the structure are likely to be completely effective, and this is not usually possible. Damping of the structure may be effective for some propagation modes, particularly at high frequencies/ short wavelengths, but will not be sufficiently effective at low frequencies.

In spite of the difficulties in controlling the propagation of vibration within the structure, there are obvious benefits in knowing the characteristics of the engine as a vibration source so that a choice may be made amongst various competing mounting engines, or the engine mounts can be designed to comply with the vibration properties of the engine selected.

Reciprocating Internal Combustion Engines —Measurement Method for Structure-Borne Noise

1 SCOPE

This document specifies the measurement method for structure-borne noise of reciprocating internal combustion engines.

This document is applicable to the reciprocating internal combustion (hereinafter referred to as “engine”, unless otherwise specified) defined in GB/T 21404.

2 NORMATIVE REFERENCES

The following normative documents contain provisions which, through normative reference in this text, constitute essential provision of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendment) applies.

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 6072.1 Reciprocating internal combustion engines - Performance - Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use

GB/T 6072.3 Reciprocating internal combustion engines - Performance - Part 3: Test measurements

GB/T 13824 Mechanical vibration of rotating and reciprocating machinery—Requirements for instruments for measuring vibration severity

GB/T 14777 Geometrical orientation and directions of movements

3 TERMS AND DEFINITIONS

For the purpose of this document, the terms and definitions given in GB/T 6072.1, GB/T 13824, and GB/T 14777, as well as the following apply.

3.1 structure-borne noise

vibration transmitted through solid structures in the frequency range of audible sound

Note: For the purpose of this document, the structure-borne noise refers to the vibration transmitted at the engine feet.

3.2 contact area

area of engine supports in contact with the surrounding structure, in particular with the isolator (e.g., rubber)

3.3 translational velocity level, L_v

Ten times the logarithm to the base 10 of the ratio of the square of the velocity (v) to the square of a reference value (v_0)

Note 1: The translational velocity level can be calculated according to Formula (1):

$$L_v = 10\lg\left(\frac{v^2}{v_0^2}\right) \qquad \cdots\cdots(1)$$

Where,

v is the velocity, in m/s, along the direction of a specific axis at the measuring position;

The following pages are left blank intentionally.