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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 44040-2024

**Measurement methods for the noise emitted by heavy-duty
vehicles under multiple operating conditions**

重型汽车多工况行驶车外噪声测量方法

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1 Scope

GB/T 44040-2024 specifies how the exterior noise of a heavy-duty vehicle is measured under multiple operating conditions. The established type approval measurement is a single accelerated pass-by, and it has a well-known weakness: a vehicle can be optimised to be quiet in exactly that manoeuvre and remain loud in the ones it actually performs on a real street, pulling away from a junction, climbing a gradient, running at steady speed, using an engine brake. This standard measures those instead. It specifies the test site and its acoustic requirements, the instrumentation and its calibration, the microphone positions, the definition of each operating condition and the way the vehicle is driven through it, the measurement and the treatment of the results including the correction for background noise and for the reference conditions, the number of runs and the statistical evaluation, and the reporting. For a truck or bus maker, an authority setting local noise rules, or an acoustics laboratory in China, this is the method behind a realistic noise figure.

This document specifies the terms and definitions, measuring instruments, measuring conditions, measuring requirements and methods for the measurement of noise emitted by heavy-duty vehicles in multiple driving mode conditions. This document is applicable to the measurement of noise emitted by heavy-duty M3, N2, N3 and M2 vehicles with a maximum gross mass greater than 3500 kg, in multiple driving mode conditions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 3730.1, Terms and definitions of motor vehicles -- Trailers and combination vehicle -- Part

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 3730.1, GB/T 3730.2, GB/T 15089, GB/T 19596, GB/T 38146.2 as well as the followings apply.

3.1 test mass m_t The mass of different types of test vehicles used for noise testing after being loaded according to different load conditions. NOTE. The unit is kilogram (kg).

3.2 total power of vehicle P_n The total power of the power sources that directly drive the vehicle. NOTE

1.The unit is kilowatt (kW). NOTE

2.The total power of a vehicle using a fuel engine refers to the maximum net power of the engine measured in accordance with GB/T 17692.The total power of a pure electric vehicle refers to the sum of the peak powers of all drive motors measured in accordance with GB/T 18488.2.The total power of a hybrid vehicle refers to the sum of the maximum net power of the engine measured in accordance with GB/T 17692 and the peak power of the drive motor measured in accordance with GB/T 18488.2.The total power of a fuel cell vehicle refers to the peak power of the drive motor measured in accordance with GB/T 24554.

3.3 engine speed at maximum net power According to GB/T 17692, the engine speed corresponding to the maximum net power output. NOTE

1.The unit is revolutions per minute (r/min). NOTE

2.If the engine can obtain maximum net power at different speeds, the highest speed corresponding to the maximum net power of the engine is the maximum net power speed.

3.4 reference point A positioning point used to represent the vehicle position when making noise measurements on a test vehicle. NOTE

1.For test vehicles with front-mounted engines (drive motors), the reference point is the frontmost point of the test vehicle. For test vehicles with mid-mounted or rear-mounted engines (drive motors), the reference point is the edge of the engine (drive motor) near the front end of the test vehicle in the direction of travel. NOTE

2.For test vehicles with multiple drive motors, when the main drive motor or the front drive motor (multiple drive motors have equal power) is placed in front, the reference point is the frontmost point of the test vehicle. When the main drive motor or the front drive motor (multiple drive motors have equal power) is placed in the middle or rear, the reference point is the edge of the main drive motor or the front drive motor close to the front end of the test vehicle in the driving direction.

4 Measuring instruments

4.1 Acoustic measuring instruments The sound level meter or other equivalent measurement system used for measurement shall meet the requirements of Class 1 sound level meter specified in GB/T 3785.1 (including windshield if applicable). When measuring, the "F" time weighting characteristic and "A" frequency weighting characteristic of the sound level meter shall be used. When using a sound level meter or measurement system that can automatically collect and measure the "A" weighted sound pressure level, the reading time interval shall not exceed 30 ms.

4.2 Calibration of acoustic measuring instruments Before and after the measurement, the acoustic measuring instrument shall be calibrated with a Class 1 sound calibrator that complies with the provisions of GB/T 15173. Without any further adjustment, if the difference between the last calibration reading and the previous calibration reading exceeds 0.5 dB(A), the measurement result after the previous calibration shall be deemed invalid.

4.3 Other measuring instruments The measuring instruments shall include the following equipment. The accuracy shall meet the following requirements.

- a) Speed measuring instrument. $\pm 2\%$;
- b) Vehicle speed measuring instrument. $\pm 0.5\%$;
- c) Thermometer. $\pm 1^\circ\text{C}$;
- d) Anemometer. $\pm$
0.5 kPa;
- f) Relative humidity meter. $\pm 5\%$;
- g) Tire pressure gauge. ± 10 kPa.

5 Measuring conditions

5.1 Measuring site The measuring site shall comply with the relevant provisions of GB/T 22157 and be kept clean and dry.

5.2 Measuring area The measuring area dimensions and microphone arrangement are shown in Figure 1. The AA' line is the acceleration start line. The BB' line is the acceleration end line. The CC' line is the center line of the driving lane. The measuring section length is $2 \times (10 \text{ m} \pm$

0.05 m). The microphone height above the ground shall be

0.02 m. Meteorological parameter measuring instruments shall be placed near the measurement site, at a height of

0.02 m from the ground.

5.3 Environmental requirements Measurements shall not be made under adverse weather conditions. During noise measurements, the ambient temperature shall be between 5°C~40°C (the lowest ambient temperature can be 0°C), and the wind speed (including gusts) at the close to the PP' line.

6.3.1.2 Start the test vehicle until the engine speed or power system is stable. Measure the maximum "A" weighted sound pressure level $L_{start, j}$ on both sides during the whole process (the unloading noise of the compressed air system is not included). Keep it to one decimal place.

6.3.1.3 Measure the starting condition noise twice in succession. If the difference between the two measurement results on the same side of the test vehicle is not greater than 2 dB(A), the measurement result is valid. Record the speed of the test vehicle after each measurement of the engine stabilization $n_{test, j}$, and keep it to an integer. Take the arithmetic average of the two valid noise measurement results on each side. Take the higher value of the arithmetic average of both sides. Keep it to one decimal place as the starting condition noise result L_{start} .

6.3.2 Low-speed acceleration conditions

6.3.2.1 Vehicle speed and engine speed conditions When the reference point passes through the BB' line, the vehicle speed v_{test} shall be within the range of 30 km/h $\pm$ 2 km/h. The engine speed n_{test} shall not exceed 90% S. If the test vehicle's acceleration performance is limited, the test vehicle speed can be adjusted appropriately and noted in the record sheet.

6.3.2.2 Gear selection 6.3.2.2.1 Test vehicle capable of locking transmission ratio The test vehicle shall be selected that can accelerate stably, with the vehicle speed and engine speed meeting the conditions in 6.3.2.1, and the gear position where n_{test} is closest to 90%S shall be measured. 6.3.2.2.2 Test vehicle with transmission ratio that cannot be locked The gear selector shall be in the fully automatic position. During the measurement, the test vehicle is allowed to shift into a lower gear with greater acceleration, but not into a higher gear with less acceleration (except after the reference point passes the BB' line). Electronic or mechanical devices are allowed to prevent the test vehicle from downshifting to a gear that is not commonly used for road driving during the measurement.

6.3.2.3 Measuring methods The vehicle speed and engine speed conditions of

6.3.2.1 and the gear position of

6.3.2.2 are used for measurement. When the reference point passes through the AA' line, the accelerator pedal is pressed to the bottom as quickly as possible (the test vehicle shall not be downshifted to a gear position that is not commonly used for road driving). Keep the