

ICS 23.100.10

CCS J 20



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

GB/T 17483.1-2024

Replacing GB/T 17483-1998

**Hydraulic fluid power - Test code for determination of noise
level - Part 1: Hydraulic pumps**

液压传动 噪声测定规范 第1部分:液压泵

Issued on: September 29, 2024

Implemented on: September 29, 2024

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

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4 Measurement uncertainty

4 When measurement is carried out according to this document, the standard deviation of the A-weighted sound power level shall not exceed 2 dB(A). The standard deviation of the sound power level of each frequency band shall not exceed the values of Table 1, which gives 5.0 dB at a centre frequency of 125 Hz, 3.0 dB at 250 Hz, 2.0 dB at 500 Hz, 2.0 dB from 1000 Hz to 4000 Hz and 3.0 dB at 8000 Hz. A note to the table states that these figures cover the permitted variation in the positioning of the measurement points and in the choice of the specified measurement surface, but not the variation in the sound power output of the source between repeated tests. The method given in GB/T 3767 meets this requirement.

5 Test environment

5 The test shall be carried out in one of three environments: a laboratory or a flat outdoor area that is suitably isolated from background noise and provides a free field over one reflecting plane, meeting the environmental requirements of GB/T 3767; a laboratory or a flat outdoor area that is suitably isolated from background noise and provides a free field over two mutually perpendicular reflecting planes, meeting the environmental requirements of GB/T 3767; or a hemi-anechoic room meeting the environmental requirements of GB/T 6882.

6 Measuring instruments

6.1 The uncertainty class and the systematic error of the instruments used to measure the flow, pressure, rotational speed and fluid temperature of the pump are determined according to Annex A. The accuracy class shall be not lower than class C.

6.2 The acoustic measuring instruments used shall comply with GB/T 3785 (all parts), and their performance and calibration shall comply with GB/T 3241, that is, instruments of type 2 for engineering grade measurement.

7 Installation of the pump

7.1.1 The pump may be installed at any position of the sound source arrangement and the measurement surface, or microphone traverse line, prescribed by GB/T 3767 for the environment in use.

7.1.2 The pump shall be installed in such a way that the noise radiated through the base while the pump vibrates is kept to a minimum.

7.1.3 The mounting bracket shall be made of a highly damping material or of a sound absorbing and sound insulating material that meets the requirements.

7.1.4 Where necessary, vibration isolation measures shall be used even when the pump is already firmly installed.

7.1.5 The flange shall be the smallest that is practicable, so that the interference from noise radiated towards the pump shaft end is reduced to a minimum.

7.2 The drive motor shall be installed outside the test space; where it is installed inside, it shall be enclosed in a sound insulating hood until the requirements of the test environment are met. The drive shaft shall be connected through a flexible coupling.

7.3.1 All filters, coolers, tanks and throttle valves needed in the circuit shall meet the requirements of the operating conditions of Clause 8.

7.3.3 The inlet and outlet pipes shall be installed with the diameter recommended by the

manufacturer; when the inlet pipe is installed, particular care shall be taken over its tightness so that air does not enter the circuit.

7.3.5 Standing waves in the outlet pipe increase the airborne noise radiated by the pump. The length of pipe between the pump outlet and the loading valve shall be such that the effect of those standing waves on the radiated airborne noise is kept to a minimum; this can be achieved by a suitable choice of pipe and hose lengths.

7.3.6 A stable loading valve shall be used. A note states that an unstable loading valve in the pump outlet line generates noise and transmits it through the fluid and the pipework, and that this noise can become airborne noise of the pump.

7.3.7 The loading valve shall be far from the pump under test and should be installed outside the test space, so that the interaction is kept to a minimum.

7.3.8 Where necessary, all fluid pipes and the loading valve in the test space shall be wrapped in sound insulating material. The material used shall attenuate by at least 10 dB over the range 125 Hz to 8000 Hz, and by more at high frequencies.

8 Operating conditions

8.1 The sound power level of the pump may be determined under any required operating condition.

8.2 Throughout the test the test parameters shall comply with Table 2, which gives the permitted range of variation of the average indicated value for accuracy classes A, B and C: rotational speed $\pm 0.5\%$, $\pm 1.0\%$ and $\pm 2.0\%$; flow $\pm 0.5\%$, $\pm 1.5\%$ and $\pm 2.5\%$; pressure below 2×10 to the power 5 Pa, $\pm 1 \times 10$ to the power 3 Pa, $\pm 3 \times 10$ to the power 3 Pa and $\pm 5 \times 10$ to the power 3 Pa; pressure at or above 2×10 to the power 5 Pa, $\pm 0.5\%$, $\pm 1.5\%$ and $\pm 2.5\%$. A footnote states that the ranges listed are deviations of the reading of the indicating instrument and not the error range of the instrument span, that they serve as an indicator of steady state and are also used where results are presented graphically for parameters held at a fixed value, and that the actual indicated values are used in any later calculation of power, efficiency or power loss.

8.3 Where the pump under test carries accessories such as an auxiliary pump or valves, those accessories shall be tested together with the pump as one unit, so that the airborne noise level of the pump includes the noise they radiate.

10 Determination procedure

10.1.1 The background noise is measured under the operating condition of the test. Over the prescribed frequency range the band sound pressure level of the background noise at each measurement point shall be at least 6 dB below the band sound pressure level of the pump.

10.1.2 Where it is not convenient to measure the background noise band by band, the A-weighted background noise level may be measured; at each measurement point it shall be at least 6 dB below the A-weighted noise level of the pump. A note states that for this measurement the pump is wrapped in sound insulating material whose transmission loss over the whole frequency range is at least 10 dB.

10.1.3 Once the background noise has been measured, a correction shall be applied; the correction value is taken from Annex D.

10.1.4 Where the background noise level is found to be too high, the noise control of the pump installation, of the drive or of the hydraulic circuit shall be examined again against the requirements of the test environment.

10.1.5 The direction of the sound level and the observation time shall comply with GB/T 3767.

10.2.1 Before the test the pump is run long enough to drive the air out of the system; it is then set to the operating condition to be tested and the operating parameters are held steady within the range of Table 2. In each test the following are measured: the rotational speed in revolutions per minute, the flow in litres per minute, the inlet pressure in megapascals, the outlet pressure in megapascals, the inlet oil temperature in degrees Celsius, the band sound pressure level at each measurement point over the prescribed frequency range in decibels, and the A-weighted sound pressure level at each measurement point in decibels.

10.2.2 At the end of a series of tests, or 1 h after the test, the first determination of the series is repeated. Where at any measurement point the A-weighted sound level differs from the first measurement by more than 2 dB, the whole test result is invalid.

10.3 The sound pressure level and the sound power level of the pump are calculated according to Annex E.

12 Test report

12 The test report shall contain at least the A-weighted sound pressure level and the band sound pressure levels, in octave or one third octave bands over the frequency range 125 Hz to 8000 Hz, for each set of operating conditions; and a statement of the sound power level obtained in accordance with this document and with the provisions of GB/T 3767 for determining the sound power level of a noise source.

B Annex B (normative) Position and number of the noise measurement points (hemispherical measurement surface)

B A hemispherical measurement surface is used, whose centre lies at the projection of the acoustic centre of the pump under test on the reflecting plane; where the acoustic centre of