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

GB/T 44050.2-2024

**Hydraulic fluid power - Determination of fluid-borne noise
characteristics of components and systems - Part 2:
Measurement of speed of sound in a fluid in a pipe
(English Translation)**

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is part 2 of GB/T 44050 "Determination of noise characteristics of hydraulic transmission oils". GB/T 44050 has been published in Lower part.

--- Part 1: General;

--- Part 2: Measurement of sound velocity of oil in pipelines.

This document is modified from ISO 15086-2:2000 "Determination of noise characteristics of hydraulic transmission oils Part 2: Determination of sound velocity of oil in pipes" Measurement".

The technical differences between this document and ISO 15086-2:2000 and their reasons are as follows.

--- The pressure fluctuation frequency range (see Chapter 1, Chapter 1 of ISO 15086-2:2000) has been changed to adapt to my country's technical requirements.

Improve operability;

--- Replaced ISO 5598:1985 with the normative reference GB/T 17446, and added the normative reference GB/T 44050.1 (see Chapter 3) to adapt to my country's technical conditions and improve operability;

--- Changed the terms and definitions (see Chapter 3, Chapter 3 of ISO 15086-2:2000) to comply with my country's writing rules;

--- The frequency range for measuring harmonics with instruments (see 5.3, 5.3 of ISO 15086-2:2000) has been changed to adapt to my country's technology Conditions, improve operability;

--- Changed formula (C.2), formula (C.3), formula (C.34), formula (C.36) (see Appendix C, Appendix to ISO 15086-2:2000) C) to maintain consistency with relevant standards;

--- Deleted Figure C.1 (see Figure C.1 of ISO 15086-2:2000) to adapt to my country's technical conditions;

---Change "the pressure fluctuation of the circuit should at least cover the frequency range between the first and second order 'anti-resonance' frequencies of the closed pipeline" to Change to "The pressure fluctuations in the circuit should at least cover the frequency range between the first and third anti-resonance frequencies of the closed pipeline" (See C.3, C.3 of ISO 15086-2:2000) to adapt to my country's technical conditions and improve operability;

--- Changed the requirements for iterative calculation (see C.3, C.3 of ISO 15086-2:2000) to adapt to my country's technical conditions and improve operability.

Acting nature.

The following editorial changes were made to this document.

--- The symbols in Chapter 4 are presented in the form of a table, and the units and notes of the symbols are added. The numbers of subsequent tables are postponed accordingly;

---Change the symbol "fi" to "fai";

--- Replaced ISO 1000 with the informative reference ISO 80000 (all parts);

- Replaced ISO 1219-1:1991 with the informative reference GB/T 786.1;
- Redrawn Figures 1 to 3;
- Changed the symbols and units of the horizontal and vertical axes in Figure 4, and deleted the "Index Number Description";
- Added an example of pressure sensor calibration distribution (see Figure 3), and the numbering of subsequent figures is postponed accordingly;
- Added piping example (see Figure C.1), and the numbering of subsequent figures is postponed;
- Corrected the editorial error of ISO 15086-2:2000, changing "Formula (C.10) can be written as" in C.2.3 to "Formula (C.2.2) can be written as";
- Adjust the numbers of all formulas in order and quote them one by one in the text.

Introduction

In hydraulic fluid power systems, power is transmitted and controlled by pressurized fluid in a closed circuit.

In the process of generating fluid power, fluid noise (flow fluctuation and pressure fluctuation) will be generated, which will lead to structure-borne noise and air noise.

The transmission of sound is affected by the impedance of the components in the hydraulic circuit.

GB/T 44050 aims to standardize the determination of noise characteristics of hydraulic components and system oils and consists of three parts.

--- Part 1: General. The purpose is to provide a transfer matrix theory for determining the noise characteristics of hydraulic components and system oils, Provides guidance for determining the characteristics of oil noise.

--- Part 2: Measurement of sound velocity of oil in pipelines. The purpose is to determine the sound velocity of oil in pipelines by measuring the pressure sensor installed in the pipeline.

Method for measuring the speed of sound in a closed oil in a pipeline.

--- Part 3: Measurement of hydraulic impedance. The purpose is to determine the hydraulic impedance of the hydraulic element by measuring the pressure sensor installed in the pipeline.

The method of measuring the impedance characteristics of the device.

If the speed of sound in oil can be accurately obtained, the oil noise characteristics of hydraulic components and systems can be measured with appropriate accuracy.

GB/T 44050.2 is based on the application of plane wave transmission line theory in the analysis of oil pressure fluctuations in rigid pipelines, and determines the acoustic Speed measurement method.

Determination of Noise Characteristics of Hydraulic Transmission Oil Part 2: Measurement of sound velocity of oil in pipelines

1 Scope

This document describes a method for determining the speed of sound in a pipeline fluid from the measurement data of a pressure sensor installed in the pipeline.

This document is applicable to hydraulic circuits operating under steady-state conditions, with pressure fluctuations in the frequency range of 10 Hz to 3000 Hz.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

GB/T 17446 Fluid power systems and components vocabulary (GB/T 17446-2024, ISO 5598:2020, MOD) GB/T 44050.1 Determination of noise characteristics of hydraulic transmission oil Part 1: General principles (GB/T 44050.1-2024, ISO 15086-1:2001,MOD)

3 Terms and definitions

The terms and definitions defined in GB/T 17446 and GB/T 44050.1 and the following apply to this document.

Measuring pipe measurement pipe the pipe with the pressure sensor installed.

The frequency at which the magnitude of the pipe entrance impedance is extremely small.

4.1 Notation

The symbols listed in Table 1 apply to this document.

Table 1 Symbols

Symbol	Description	Unit
A, A', B, B'	complex coefficient	$\text{m}^3 \cdot \text{s}^{-1} \cdot \text{Pa}^{-1}$
a, b	Frequency-dependent wave propagation coefficients	Hz
b_e	Effective bulk elastic modulus	Pa
c	Speed of sound in oil	$\text{m}^3 \cdot \text{s}^{-1}$
d	Pipe inner diameter	m