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

GB/T 1094.101-2023

**Power transformers - Part 101: Determination of sound levels -
Application guide**

电力变压器 第101部分：声级测定 应用导则

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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 101 of GB/T 1094 "Power Transformers": GB/T 1094 has issued the following parts:

- Part 1: General;
- Part 2: Temperature rise of liquid-immersed transformers;
- Part 3: Insulation level, insulation test and outer insulation air gap;
- Part 4: Lightning impulse and operating impulse test guidelines for power transformers and reactors;
- Part 5: Ability to withstand short circuit;
- Part 6: Reactors;
- Part 7: Load guidelines for oil-immersed power transformers;
- Part 10: Determination of sound level;
- Part 101: Application Guidelines for Sound Level Determination;
- Part 11: Dry-type transformers;
- Part 12: Load guidelines for dry-type power transformers;
- Part 14: Liquid-immersed power transformers using high-temperature insulating materials;
- Part 15: Gas-filled power transformers;

1 Scope

GB/T 1094.101-2023 is Part 101 of the Chinese power transformer series and is the application guide to the determination of sound levels. Transformer noise is a guaranteed quantity in most purchase contracts and the reason substations near housing are rejected, but the measurement is difficult: the source is a large distributed surface radiating mainly at twice the supply frequency and its harmonics, the near field is complex, and a figure obtained in the factory rarely matches what is heard on site. The guide explains why. It covers the physical basis of sound, the noise sources and characteristics of transformers and reactors, the measurement principle, the precautions to be taken when measuring sound levels, and the differences between factory testing and on-site measurement, with an informative annex on the sound levels caused by harmonic currents in the windings. It took effect on 1 October 2023.

This document provides guidance to manufacturers and users on how to use the measurement techniques specified in GB/T 1094:10: except basic acoustics. In addition to the principles, this document describes the noise sources and characteristics of transformers and reactors, gives practical guidelines for making measurements, and discusses possible effects: Various factors that affect the accuracy of the measurement method are also explained, and the reasons why the factory measured value differs from the field measured value are also clarified: This document applies to transformers and reactors and their associated auxiliary cooling equipment:

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text: Among them, dated references For documents, only the version corresponding to the date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document:

GB/T 1094:10-2022 Power Transformers Part 10: Determination of Sound Level (IEC 60076-10:2016, MOD)

Note: There is no technical difference between the referenced content of

GB/T 1094:10-2022 and the referenced content of IEC 60076-10:2016: GB/T 2900:

95 Electrotechnical terms transformers, voltage regulators and reactors (GB/T 2900:95-2015, IEC 60050-421: 1990,NEQ)

GB/T 3768-2017 Acoustic sound pressure method for the determination of sound power level and sound energy level of noise sources using the envelope measurement surface above the reflecting surface The simplified method (ISO 3746:2010, IDT)

3 Terms and Definitions

The terms and definitions defined in GB/T 2900:95 and GB/T 1094:10-2022 apply to this document:

4 Physical basis of sound

1 Phenomena Sound is a pressure change wave (in air, water or other elastic medium) that can be felt by the human ear: This pressure change wave passes through the medium (this The file refers to the air) from the sound source to the listener's ear: The number of times a cyclical pressure change occurs per second is called the frequency of the sound, and its measurement is in Hertz (Hz): specific frequency of sound Perceived as a distinct tone or pitch: The hum of a transformer is basically a low frequency sound at 100Hz or 120Hz, while the whistle is a high frequency sound Sound, its typical frequency value exceeds 3kHz: The normal hearing range of healthy young people is about 20Hz~20kHz: 4:

2 Sound pressure p The root-mean-square value of the instantaneous sound pressure at a specific location and a given time interval is called the sound pressure, and the unit of its measurement is Pascal (Pa): Sound pressure is a scalar quantity, and its characteristic is expressed only by its amplitude: The weakest sound pressure that a healthy human ear can perceive has a clear relationship with frequency: Generally, it is 20 μ Pa at 1kHz: perceived pain threshold It should be one million times of this value, or even higher, such as 20Pa: Due to the large range, in order to avoid using large values, decibels (dB) are used