

ICS 19.100
CCS J04



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

GB/T 43144-2023

**Non-destructive testing - Acoustic emission testing - Test
method for damage qualification of reinforced concrete beams**

无损检测 声发射检测 钢筋混凝土梁损伤评定的检测方法

Issued on: September 7, 2023

Implemented on: September 7, 2023

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

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1. Structure and Drafting Rules of Standardization Documents" Drafting. This document is modified to adopt ISO 16837.2019 "Testing Method for Damage Assessment of Reinforced Concrete Beams by Acoustic Emission Testing by Non-destructive Testing". The technical differences between this document and ISO 16837.2019 and their reasons are as follows:

- a) Replaced ISO 12716 (see Chapter 3) with normatively cited GB/T 12604.4 to adapt to my country's technical level, adding operability;
- b) Change "The attenuation characteristics should be considered when determining the installation location of sensors" to "The attenuation characteristics should be considered when determining the installation location and number of sensors. "Reduce characteristics" (see Chapter 4), increase operability and facilitate the implementation of standards;
- c) Change the description of A_t to "the cumulative number of acoustic emission activities in the last maximum load cycle" [see formula (2)] to clarify its content righteousness, eliminating ambiguity;
- d) Added suggestions for the use of sensor test data (see Chapter 6) to improve operability. The following editorial changes have been made to this document.

---Change the abscissa axis title "LR" and the ordinate axis title "CR" to "L" and "C" respectively (see Figure 1), so that the "loading ratio" is consistent with The sign of "unloading ratio" remains consistent;

---Added Appendix A (Informative) "Acoustic Emission Sensor Arrangement Method";

---Added Appendix B (informative) "Method for determining Lo ". Please note that some

content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents. This document is proposed and coordinated by the National Nondestructive Testing Standardization Technical Committee (SAC/TC56). This document was drafted by: Changsha University of Science and Technology, Shanghai Institute of Materials Co., Ltd., Changsha Pengxiang Electronic Technology Co., Ltd., Shenzhen University School, Hydraulic Metal Structure Quality Inspection and Testing Center of the Ministry of Water Resources, Southeast University. The main drafters of this document. Wang Lei, Hu Hongwei, Ding Jie, Wang Xianghong, Lu Duo, Jiang Tianyong, Chen Weijun, Hong Shuxian, Li Dongfeng, Ding Hui, Wu Weiping, Yan Jingli, Ma Yafei, Xu Xiaoqiang, Dai Lichao, Huang Ke. Non-destructive testing acoustic emission testing Detection method for damage assessment of reinforced concrete beams

1 Scope

GB/T 43144-2023 gives the acoustic emission method for assessing damage in reinforced concrete beams, adopting ISO 16837 with modifications. Concrete tells you it is cracking before the crack is visible: each microcrack releases a burst of elastic energy that sensors on the surface pick up, and the pattern of that emission under load - how much arrives, and whether it arrives again when the load is reapplied - distinguishes a beam that is settling into its service condition from one that is progressively failing. That distinction is what a bridge or building owner needs from a load test. The standard sets the detection system, the treatment of environmental noise, the testing procedure and the test report, with informative annexes on the arrangement of the sensors and on the determination of the load ratio. It took effect on 7 September 2023.

This document specifies acoustic emission testing methods for damage assessment of reinforced concrete beams. This document is applicable to damage assessment of in-service reinforced concrete beams used in bridges, docks and buildings.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to this document.

GB/T 12604.4 Non-destructive testing terminology acoustic emission testing (GB/T 12604.4-2005, ISO 12716.2001, IDT).

3 Terms and definitions

The terms and definitions defined in GB/T 12604.4 and the following apply to this

document.

3.1 Acoustic emission activity/AE activity Acoustic emission impacts or counts occur in concrete under stress conditions.

3.2 Kaiser effect Kaiser effect When a material or structure is stressed, removed, and re-stressed, little acoustic emission activity occurs until the previous maximum load is exceeded. The phenomenon of movement (3.1).

3.3 Felicity ratio Felicity ratio When stress is applied to a material or structure, stress is removed, and stress is reapplied, the load at which acoustic emission activity occurs is the same as the previous maximum load. ratio.

Note. The Felicity ratio shows the degree of consistency with the Kaiser effect (3.2).

4 Detection system

Considering acoustic coupling, the acoustic emission sensor that detects the acoustic emission signal generated by the concrete structure should have sufficient sensitivity. Acoustic emission sensing The device should also be robust enough to withstand the effects of temperature changes, humid environments and mechanical vibrations. Acoustic emission sensors should be placed appropriately position to cover the target area. See Appendix A for the layout method of acoustic emission sensors. Prior to inspection, the attenuation characteristics of the target structure should be estimated by using standard sound sources. Determine the installation location and quantity of sensors Consider attenuation characteristics. The internal noise of the amplifier should be low, and the peak value of the input voltage should be less than $20\mu\text{V}$ (26dBAE , when $0\text{dBAE}=1\mu\text{V}$). put The amplifier should also be robust enough to withstand environmental influences and have appropriate protection.