ICS 97.200.40
CCS Y57



# NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

# GB/T 44512-2024

## Inspection and test specifications of large-scale amusement device - Ultrasonic stress testing

大型游乐设施检验检测 超声应力测试

**Issued on: September 29, 2024** **Implemented on: January 1, 2025**

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

# Table of Contents

Foreword ..... 3
Introduction ..... 4
1 Scope ..... 5
2 Normative References ..... 5
3 Terms and Definitions ..... 5
4 Test Principle ..... 6
4.1 Principle Overview ..... 6
4.2 Transverse and Longitudinal Wave Test Method for Axial Stress of Bolts and Shafts ..... 6
4.3 Critical Refracted Longitudinal Wave Test Method for Bending Stress of Steel Pipes and Steel Plates ..... 8
5 Safety and Environmental Requirements ..... 10
6 Personnel Requirements ..... 10
7 Instruments and Equipment ..... 10
7.1 Probes ..... 10
7.2 Ultrasonic Stress Tester ..... 11
7.3 Calibration Specimens ..... 11
7.4 Coupling Agent ..... 13
7.5 Calibration, Verification, Interim Verification or Inspection ..... 14
8 Testing ..... 14
8.1 General Test Procedures ..... 14
8.2 Test Procedure Card ..... 14
8.3 Preparation before Testing ..... 15
8.4 Calibration of Test Instruments ..... 16
8.5 Test Implementation ..... 16
8.6 Data Analysis and Evaluation ..... 16
9 Test Files ..... 16
9.1 Test Records ..... 16
9.2 Test Report ..... 16
Bibliography ..... 18



## Foreword

This document was issued on 29 September 2024 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 January 2025.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

This document was drafted in accordance with the rules provided in GB/T 1.1-2020 Directives

for Standardization - Part 1: Rules for the Structure and Drafting of Standardizing Documents.

Please be noted that certain content of this document may involve patents. The institution

issuing this document does not undertake the responsibility of identifying these patents.

This document was proposed by and shall be under the jurisdiction of National Standardization

Technology Committee on Ropeway and Amusement Device (SAC/TC 250).

The drafting organizations of this document: China Special Equipment Inspection & Research

Institute; Solid (Beijing) Technology Co., Ltd.; Guangxi Special Equipment Inspection and

Research Institute; Henan Special Equipment Inspection Technology Research Institute; Wuhan

Zhongke Innovation Technology Co., Ltd.; Guangzhou Special Equipment Inspection and

Research Institute; Jiangsu Province Special Equipment Safety Supervision Inspection Institute;

TsingBosch (Zhuhai) Technology Co., Ltd.; China Construction Eighth Engineering Division

Testing Technology Co., Ltd.

The main drafters of this document: Shen Gongtian, Xiang Yong, Ju Chengwei, Zhang Qiang,

Zhou Lijun, Liu Yannan, Luo Zhen, Zhang Pengfei, Liu Ran, Hu Bin, Zhang Kun, Wang

Zicheng, Zhang Junjiao, Ye Weiwen, Zhang Yang, Zhou Zhou, Chen Haiping, Ye Haibo, Wang

Xiaoliang, Huang Gong, Wang Zhiyuan, Wang Yuyun, Liu Guanghua.

Inspection and Test Specifications of Large-scale

Amusement Device - Ultrasonic Stress Testing

## 1 Scope

GB/T 44512-2024 covers measuring the stress inside the load-bearing parts of amusement rides without taking them apart. A roller coaster support, a Ferris wheel axle or a highly loaded bolt carries not only the forces the ride applies but also residual stresses left by welding and manufacture, and the two add together. Residual stress is the part nobody sees: it does not appear in the design calculation, it cannot be found by visual inspection, and where it is high it is where a fatigue crack will start. On equipment that carries the public, that matters, and it matters most on structures already in service and impossible to dismantle for examination. Ultrasonic stress measurement exploits the fact that sound travels at a slightly different speed through stressed material, which allows the stress to be read from outside the component. This document specifies the ultrasonic stress testing method for load-bearing components of large amusement devices - steel structures, bolts and shafts - and applies to in-situ measurement of axial and other stresses on installed equipment. Under ICS 97.200.40 and CCS Y57, it is written for amusement device inspection bodies, ride operators and manufacturers.

This document specifies the ultrasonic stress testing method for load-bearing components, such

as: steel structures, bolts and shafts of large-scale amusement devices.

This document is applicable to the in-situ axial stress testing of load-bearing components, such

as: solid shafts with an outer diameter of not less than 10 mm and hexagonal steel bolts, double-

threaded bolts with an outer diameter of not less than 30 mm for the amusement devices. It also

applies to the in-situ bending stress testing of load-bearing components, such as: steel pipes

with an outer diameter of not less than ?50 and a wall thickness of not less than 6 mm, and steel

plates with a wall thickness of not less than 6 mm.

Ultrasonic stress testing of load-bearing components, such as: steel structures, bolts and shafts

used by cableways and other mechanical equipment shall take this as a reference.

## 2 Normative References

The contents of the following documents constitute indispensable clauses of this document

through the normative references in the text. In terms of references with a specified date, only

versions with a specified date are applicable to this document. In terms of references without a

specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 12604.1 Non-destructive Testing - Terminology - Ultrasonic Testing

GB/T 20050 Inspection and Testing Specifications of Large-scale Amusement Device - General

Principles

GB/T 27664.2 Non-destructive Testing - Characterization and Verification of Ultrasonic Test

Equipment - Part 2: Probes

GB/T 34370.1 Nondestructive Testing of Amusement Equipment - Part 1: General Requirement

GB/T 34370.5 Nondestructive Testing of Amusement Equipment - Part 5: Ultrasonic Testing



## 3 Terms and Definitions

The terms and definitions defined in GB/T 12604.1 and GB/T 34370.1 are applicable to this

document.

7.5 Calibration, Verification, Interim Verification or Inspection

Implement in accordance with the requirements of GB/T 34370.1 and GB/T 34370.5.

## 8 Testing

8.1 General Test Procedures

8.1.1 The preparation of the test procedures shall be carried out in accordance with the

requirements of GB/T 34370.1.

8.1.2 The content of the test procedures shall at least include:

a) Document No.;

b) Scope of application;

c) Reference standards and regulations;

d) Qualifications of testing personnel;