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

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**Non-destructive testing of steel products-Method for ultrasonic
testing of torsional residual stress distribution of shaft**

钢产品无损检测 轴类构件扭转残余应力分布状态超声检测方法

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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:

Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents:

This document was proposed by the China Iron and Steel Association:

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Company, China Energy Group Science and Technology Research Institute Co., Ltd., CRRC Tangshan Locomotive and Rolling Stock Co., Ltd., Jinan Second Machine Tool Group Co., Ltd: company:

The main drafters of this document are: Xu Chunguang, Guo Jianguang, Song Wen yuan, Xie Dong, Liu Haining, Dong Li, Li Peilu, Yin Peng, Shan Zhipeng, Bai Long, Li Zhe, Deng Tao, Zhang Yunlong, Sun Dong, He Chi, Zhang Yafeng, Sun Mingxue, Xue Jianzhong, Li Hongwei, Liu Shiyuan, Dong Dexiu, Li Yang, Xu Hongjiang, Li Zongqiang, Lu Yuren, Guo Jianlong, Zhang Guangxiang, Yang Guangcan, and Li Shuangyi:

Nondestructive testing of steel products - Torsional residual stress in shaft components
Ultrasonic testing method for distribution status

1 Scope

This document specifies the general requirements, testing equipment, test specimens, testing methods, and testing methods for ultrasonic testing of torsional residual stress distribution in shaft components:

Test procedures and test reports:

This document is applicable to ultrasonic testing of steel shaft components in the torsional residual stress distribution state with a frequency range of 0.1MHz~20.0MHz:

The non-destructive testing and monitoring of the service torsional stress of shaft components caused by external loads can refer to this document:

The parts can also be used for reference:

2 Normative references

GB/T 228

GB/T 7232

GB/T 9445

GB/T 10128

GB/T 12604

GB/T 27664

GB/T 32073

GB/T 38811

3 Terms and definitions

The terms and definitions defined in GB/T 7232 and GB/T 12604:1 and the following apply to this document: 3.1 The stress distributed along a certain angle within a certain depth range on the surface of a shaft component:

Note: Commonly used detection angles are 0°, 45°, and 90°:

4 Detection Principle

According to Snel's law, in order to generate and receive ultrasonic critical refracted longitudinal waves inside the surface of the shaft component being tested, the detection probe can The surface is placed in a direction at any angle to the axis, as shown in Figure 1a): According to the principle of acoustic elasticity, when the residual stress direction of the shaft component When the direction is consistent with the longitudinal wave, tensile stress

slows down the propagation speed of ultrasonic waves or prolongs the propagation time (t), while compressive stress speeds up the propagation speed of ultrasonic waves:

Or the propagation time (t) is shortened: If the ultrasonic propagation time (t_0) in the shaft component with zero stress (σ_0) is known, the ultrasonic propagation time (t_0) of the shaft component under test can be calculated based on the time difference:

The residual stress (σ) in the component is calculated by formula (1):

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