

ICS 77.040.10

CCS H 22



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

GB/T 29459.3-2025

**Small punch test methods of metallic materials for in-service
pressure equipment - Part 3: Method of test for fracture
toughness**

在役承压设备金属材料小冲杆试验方法 第3部分：断裂韧度试验方法

Issued on: October 31, 2025

Implemented on: October 31, 2025

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

Table of Contents

- 1 Scope
- 2 Normative references
- 3 Terms, Definitions and Symbols
 - 3.1 Terms and Definitions The terms and definitions defined in
- 4 Test Classification
- 5 Standard small punch test
- 6 Slotted small punch test
- 18 References

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 Part 3 of GB/T 29459 "Test Methods for Small Punch Rods of Metallic Materials for In-Service Pressure Equipment". GB/T 29459 has been... The following sections were published.

1. General Provisions;

2. Methods for testing tensile properties at room temperature;

3. Fracture toughness test methods. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Boilers and Pressure Vessels (SAC/TC262). This document was drafted by: East China University of Science and Technology, China Special Equipment Inspection and Research Institute, China Petrochemical Engineering Construction Co., Ltd., and Hubei Special Equipment Inspection and Research Institute. Equipment Inspection and Testing Research Institute, China University of Petroleum (East China), Fujian University of Science and Technology, Sinopec Shanghai Gaoqiao Petrochemical Co., Ltd., Shanghai Lankai Equipment Technology Co., Ltd., Lanzhou Lanshi Heavy Equipment Co., Ltd., Sinopec (Tianjin) Petrochemical Co., Ltd., Wuhan Run Zhida Petrochemical Equipment Co., Ltd., Shanghai Special Equipment Supervision and Inspection Technology Research Institute Co., Ltd., Gansu Special Equipment Inspection and Testing Research Institute, Jinan Branch of China Petroleum & Chemical Corporation, Gansu Lanke Petrochemical High-tech Equipment Co.,

Ltd., Lanzhou Petroleum Machinery Industry Chemical Equipment Testing Institute Co., Ltd., Shanghai Lanbin Petrochemical Equipment Co., Ltd. The main drafters of this document are. Guan Kaishu, Wang Qiongqi, Xu Tong, Song Ming, Li Cang, Deng Yangchun, Sun Haisheng, Jia Guodong, Zhong Jiru, and Wang Jinguang. Gong Lingzhu, Liu Zuoping, Su Houde, Shen Hongjie, Yang Yuqing, Si Jun, Zhang Kai, Chen Yong, Shu Runtao, Zhang Yuanyou, Guo Jingqian, Zhang Meihua, Xu Xiaomei Feng Huanlin, Sun Baocai, Jia Xiaoliang, Zhang Xuetao, Zheng Weixin.

Detecting the degradation of materials in in-service pressure equipment has always been a hot topic in in-service inspection. Traditional non-destructive testing is insufficient for evaluating materials. Mechanical properties. Surface metallography can only reveal changes in the material's microstructure and is insufficient for quantitatively evaluating its mechanical properties. Conventional mechanical property testing methods... This method requires large sample volumes, and sampling can cause significant damage to the equipment. GB/T 29459 "Test Method for Small Punch Rods of Metallic Materials for In-Service Pressure Equipment" It is a standard for micro-destructive sampling mechanical property testing. GB/T 29459 aims to standardize the small punch test method and realize the material sampling method for small punch tests. The standard mechanical properties are proposed to consist of six parts.

1. General Provisions. The purpose is to standardize the general requirements for small punch tests, including specimens, testing apparatus, fixtures, and testing procedures. Suddenly, etc.
2. Tensile property testing methods at room temperature. The purpose is to obtain the standard tensile properties of materials through small punch tests.
3. Fracture Toughness Test Methods. The aim is to obtain the standard fracture toughness of materials through small punch tests.
4. Creep Performance Test Methods. The purpose is to obtain the standard creep performance of materials through small punch tests.
5. Test Methods for the Ductile-Brittle Transition Temperature. The purpose is to obtain the standard ductile-brittle transition temperature of materials through small punch tests.
6. Fatigue Performance Testing Methods. The aim is to convert the results of small punch tests into standard material fatigue properties. This document obtains the equivalent fracture strain of the specimen after a tensile test with a small punch, or by using a multi-specimen method with slotted small punch specimens. The crack propagation resistance curve of the material provides an empirical correlation method for fracture toughness. Test Methods for Small Punch Rods of Metal Materials in In-Service Pressure Equipment Part

1 Scope

GB/T 29459.3-2025 is the Chinese national standard covering getting fracture toughness out of a disc a few millimetres across - the small punch test on a sample scooped from a vessel still in service, the load-displacement curve and the correlation back to a conventional toughness value, with the limits of that correlation stated. The point is that a running vessel cannot spare a standard specimen. Part 3 of the series, first edition. Issued on 31 October 2025, it has been in force since 31 October 2025.

This document describes a small punch test method for obtaining fracture toughness of in-service pressure equipment. This document applies to ferritic steels used in pressure equipment.

2 Normative references

The contents of the following documents, through normative reference, constitute essential clauses of this document. Dated citations are not included. For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. This document.

GB/T 29459.1 Test methods for small punches made of metallic materials for in-service pressure equipment - Part

3.1 Terms and Definitions The terms and definitions defined in

GB/T 29459.1 and the following terms and definitions apply to this document.

3.1.1 Standard small punch test Fracture toughness was obtained by tensile testing of small punches at room temperature.

3.1.2 Notched small punch test Several slotted specimens of the same nominal size were subjected to monotonic loading to obtain the resistance curve and fracture toughness of the small punch test.

3.1.3 h_f Minimum thickness after a standard small punch test. 3.1.4 ϵ_{oneq} The natural logarithm of the ratio of the original thickness of a standard small punch specimen to the minimum thickness of the specimen after testing.

3.1.5 In the slotted small punch test, the curve of J integral as a function of crack steady propagation was obtained by empirical correlation.

3.1.6 Grooving is one of two types of grooving in the grooved small punch test specimen. Its characteristic is that the groove is cut into the conventional small punch test specimen.