

ICS 19.100

CCS J 04



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

GB/T 15823-2009

**Non-destructive testing -- Test methods for helium leak testing
(English Translation)**

Issued on: May 26, 2009

Implemented on: December 1, 2009

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine of the PRC**

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1 Scope

This Standard specifies the methods and requirements for helium leak testing.

These testing methods or techniques can be used to determine the leak position or measure the leak rate. See Appendix A ~ Appendix C for specific testing techniques.

2 Normative references

The following documents contain provisions which, through reference in this

Standard, constitute provisions of this Standard. For the dated references, their subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, the parties who enter into agreement based on this

Standard are encouraged to investigate whether the latest editions of these documents are applicable. For undated reference documents, the latest editions apply to this Standard.

GB/T 5616 Non-destructive testing - Guidelines for application

GB/T 9445 Non-destructive testing - Qualification and certification of personnel (GB/T 9445-2008, ISO 9712:2005, IDT)

GB/T 12604.7 Non-destructive testing - Terminology - Leak testing

GB/T 20737 Non-destructive testing - General terms and definitions (GB/T 20737-2006, ISO/TS 18173:2005, IDT)

3 Terms and definitions

The terms and definitions established in GB/T 12604.7 and GB/T 20737 apply to this Standard.

4.1 Pre-leak testing

Before adopting a more sensitive testing method, a pre-leak testing can be

When performing pressure/vacuum leak testing, the indicating-type pressure gauge shall be directly connected to the tested part, or connected to the tested part from the remote end; so that the tester can easily observe these pressure gauges/vacuum gauges during the whole process of testing.

For large vessels or systems under test that require one or more pressure gauges/vacuum gauges, it is recommended to use a recording-type pressure gauge/vacuum gauge, to replace one of the two or more indicating-type pressure gauges/vacuum gauges.

4.3.1.4 Application

When Appendix A ~ Appendix C require the use of other types of pressure gauges/vacuum gauges, they can be used separately instead of the corresponding number of indicating-type or recording-type pressure gauges; or can be used in combination.

4.3.2 Temperature measuring device

When Appendix A ~ Appendix C require temperature measurement, the temperature measuring device shall pass the verification.

4.3.3 Standard leak

The standard leaks used for helium mass spectrometer leak testing can be divided into the following two categories:

a) Permeable standard leak - It shall be a permeable leak of glass or quartz that has been melted and calibrated. It has a helium leak rate of 1×10^{-11}

$\text{Pa} \cdot \text{m}^3/\text{s} \sim 1 \times 10^{-7} \text{ Pa} \cdot \text{m}^3/\text{s}$; shall pass the verification.

b) Channel-type standard leak - It shall be a channel-type leak calibrated with helium that allows the tracer gas to pass through a tube. It shall have a leak rate equal to or less than the product of the required testing sensitivity and the actual percentage concentration of tracer gas. It shall pass the verification.

5.1.1 Surface preparation

The surface of the tested part shall be free of oil, grease, paint and other dirt that may hinder the testing. When liquids are used to clean the parts, or the water pressure test or hydro-pneumatic test is performed before the leak testing, the tested parts shall be fully dried before the testing.

5.1.2 Seal

Before testing, plugs, cover plates, sealing grease, glue, or other suitable materials that can be easily removed after leak testing shall be used to seal all holes. The sealing material shall not contain tracer gas.

5.1.3 Testing temperature

The minimum temperature of the tested parts during the testing shall be in accordance with the requirements of each appendix; or in accordance with the provisions of relevant product design documents and of procurement technical conditions for hydraulic, hydro-pneumatic or pneumatic tests of the tested parts.

The minimum or maximum temperature during testing shall not exceed the temperature allowed by the leak testing method or technique used.

5.1.4 Pressure/vacuum (pressure limit)

Unless otherwise specified in the relevant design documents and procurement technical conditions, components, which need to be subjected to pressure leak testing, shall not be tested at a pressure exceeding 25% of the design pressure.

5.2 Testing timing

Leak testing should be performed before hydraulic or hydro-pneumatic testing.

If the acceptance party considers it necessary, a leak testing can be performed again after the hydraulic or hydro-pneumatic testing. The pressure vessel shall not be evacuated unless it is confirmed by design calculation.

5.3 Testing methods and techniques

Common helium leak testing methods and techniques are shown in Table 1.

The specific requirements of various helium leak testing methods and techniques listed in Table 1 are shown in Appendix A ~ Appendix C.

- m) Post cleaning method;
- n) Personnel qualifications.

A.2.2.1 Instruments

A helium mass spectrometer capable of sensing and measuring trace amounts of helium shall be used. One or more of the following signal devices shall be used to indicate leak:

- a) Meter - A meter on or attached to an instrument;
- b) Audible device - Loudspeaker or earphone capable of emitting audible signals;
- c) Indicator lamp - An indicator lamp that can emit visible light.

A.2.2.2 Auxiliary equipment

When needed, the following auxiliary equipment can be used:

- a) Voltage stabilizer - When there is voltage fluctuation in the power supply line, a voltage stabilizer shall be connected to the instrument;
- b) Suction gun - All parts that need to be inspected shall be scanned with a suction gun. The suction gun is connected to the instrument with a section of bellows. In order to shorten the response time and purification time, unless the testing device is specially designed to obtain a short response time and purification time with a longer hose, the length of the hose shall be about 4570 mm.

A.2.2.3 Calibrated standard leak

The calibrated standard leak can be a permeable or channel-type standard leak according to 4.3.3 of this Standard. The type of standard leak used shall be determined according to the sensitivity requirements of the instrument or equipment, or according to relevant design specifications.

A.3.1.1 Preheating

Before calibrating with the verified standard leak, the instrument shall be energized to preheat. The minimum time for preheating shall be in accordance I) Scan distance, speed and method;

- m) Acceptance criteria;
- n) Personnel qualifications.

B.2.2.1 Instruments

A helium mass spectrometer capable of sensing and measuring trace amounts of tracer helium shall be used. One or more of the following signal devices shall be used to indicate leak:

- a) Meter - A meter on or attached to an instrument;