



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

GB/T 40344.1-2021

**Vacuum technology - Standard methods for measuring
vacuum-pump performance - Part 1: General description**

Issued on: August 20, 2021

Implemented on: March 1, 2022

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

Table of Contents

1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbol	3
5 Test method	4
5.1 Measuring volume flow rate (pumping speed) by flow method	4
5.1.1 Overview	4
5.1.2 Test cover for flow method	4
5.1.3 Test device	5
5.1.4 Determination of volume flow rate	6
5.1.5 Measurement Step	7
5.1.6 Measurement uncertainty	7
5.1.7 Measurement evaluation	7
5.2 Measuring volume flow rate (pumping speed) by small hole method	7
5.2.1 Overview	7
5.2.2 Test cover for small hole method	8
5.2.3 Measuring device	8
5.2.4 Determination of volume flow rate	9
5.2.5 Small hole method measurement step	9
5.2.6 Adjustment of pressure measuring instruments	10
5.2.7 Measurement of volume flow rate	10
5.2.8 Measurement uncertainty	10
5.2.9 Measurement evaluation	10
5.3 Measurement of volume flow rate (pumping speed) by pumping method	11
5.3.1 Overview	11
5.3.2 Test cover for air extraction method	12
5.3.3 Snap Action Valve	12
5.3.4 Measuring device	12
5.3.5 Determination of volume flow rate	12
5.3.6 Measurement steps	14
5.3.7 Scope of application	14
5.3.8 Measurement and evaluation	14

5.3.9 Measurement uncertainty	14
5.4 Base pressure measurement	14
5.4.1 Operating conditions	14
5.4.2 Test steps under base pressure > 10 ⁻⁴ Pa.....	15
5.4.3 Test steps under base pressure < 10 ⁻⁴ Pa.....	15
5.4.4 Measurement evaluation	15
5.5 Compression ratio and critical foreline pressure measurement	15
5.5.1 Measuring device	15
5.5.2 Determination of compression ratio and critical foreline pressure	16
5.5.3 Measurement procedure	16
5.5.4 Measurement uncertainty	17
5.5.5 Measurement and evaluation	17
5.5.6 Special recommendations when measuring extremely high compression ratios	17
Appendix A (informative appendix) Mean free path of some important gases	18
Appendix B (Informative Appendix) Measurement Uncertainty	19
Reference	21

Foreword

GB/T 40344 "Vacuum Technology Vacuum Pump Performance Measurement Standard Method" plans to release the following parts.

---Part 1.General requirements;

---Part 2.Volumetric vacuum pump;

---Part 3.Specific parameters of mechanical booster pumps;

---Part 4.Turbo molecular pump;

This part is Part 1 of GB/T 40344.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

The translation method used in this part is equivalent to the ISO 21360-1.2020 "Standard Methods for Measuring the Performance of Vacuum Pumps in Vacuum Technology Part 1. total requirements".

The Chinese documents that have a consistent correspondence with the international documents cited in this section are as follows.

---GB/T 3163-2007 vacuum technical terms (ISO 3529.1981, MOD).

This section has made the following editorial changes.

---Chapter 4 adds the number and title of the table.

This part was proposed by China Machinery Industry Federation.

This part is under the jurisdiction of the National Vacuum Technology Standardization Technical Committee (SAC/TC18).

Drafting organizations of this section. Zhejiang Vacuum Equipment Group Co., Ltd., Zibo Vacuum Equipment Factory Co., Ltd., Taizhou Xingguang Vacuum Equipment Manufacturing Co., Ltd.

Manufacturing Co., Ltd., Hunan Vigor Magnetic Fluid Co., Ltd., Weihai Zhide Vacuum Technology Co., Ltd., Zibo City Electromechanical Pump Product Quality Inspection

Research Institute, Beijing Beiyi Innovative Vacuum Technology Co., Ltd., Taizhou Global Vacuum Equipment Manufacturing Co., Ltd., Huizhou Feikai New Materials Co., Ltd.

Co., Ltd., Shandong Bozhong Vacuum Equipment Co., Ltd., Shenyang Vacuum Technology Research Institute Co., Ltd.

Introduction

This part is the basic standard for measuring the performance data of vacuum pumps. The methods specified in this section comply with existing national standards and international standards.

Relevant regulations. The purpose of this section is to provide a document for measuring the performance data of vacuum pumps and to simplify the future evaluation of specific vacuum pumps.

Standard formulation.

The specific vacuum pump standard should include selecting the appropriate measurement method from this section, and determining the performance according to the characteristics of the specific vacuum pump

Data, limit values, specific operating conditions. When there is a difference between a specific standard and this section, the specific standard shall prevail.

Standard method for measuring performance of vacuum pumps in vacuum technology

Part 1. General requirements

1 Scope

This part of GB/T 40344 specifies three volume flow rate measurement methods, and respectively specifies the measurement of base pressure and compression ratio of vacuum

pumps.

And the method of critical foreline pressure.

The first method of measuring volume flow rate (flow method) is a basic method. inject a stable flow of gas into the vacuum pump, and measure at the same time

The inlet pressure of the pump. In actual measurement, the measurement of gas flow may be complicated or inaccurate. For this reason, two other methods are prescribed to

Avoid measuring flow directly.

The second method of measuring volume flow rate (small hole method) is suitable for very low inlet pressure (high vacuum or ultra-high vacuum) and very small flow rate

Case. The method is based on measuring the pressure ratio in the double test chamber of the test enclosure. The test cover is divided into two by a thin wall with a round hole

Chamber.

The third method of measuring volume flow rate (pumping method) is based on the method of evacuating large vessels, which is very suitable for automated measurement. pass through

The two pressure values before and after the pumping interval and the volume of the test cover are used to calculate the volume flow rate. The measurement results and the final volume flow rate are affected by different

Conditional influences, such as leakage rate and outgassing rate, gas cooling due to close to isentropic expansion during the pumping interval, and low-pressure molecular flow

The flow resistance of the connecting pipeline between the test cover and the vacuum pump increases.

The choice of measurement method depends on the properties of the particular type of vacuum pump. For example, only a vacuum pump that needs to be equipped with a backing pump needs to be measured

Critical foreline pressure. All measurement parameters of vacuum pumps not specified in this section (such as measurement of power consumption) are specified in the standards of the corresponding pumps.

To stipulate.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this article

Pieces. For undated reference documents, the latest version (including all amendments) is