

ICS 23.160
CCS J 78



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

GB/T 40344.4-2025

**Vacuum technology - Standard methods for measuring
vacuum-pump performance - Part 4: Turbomolecular vacuum
pumps**

真空技术 真空泵性能测量标准方法 第4部分：涡轮分子泵

(English Translation)

Issued on: August 1, 2025

Implemented on: November 1, 2025

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

Table of Contents

Preface
Introduction
1 Scope
2 Normative references
3 Terms and Definitions
4 Symbols
5 Test Method
5.1 Test gas
5.2 Measurement of volume flow rate (pumping speed)
5.3 Measurement of Maximum Flow
5.4 Measurement of critical foreline pressure
5.5 Compression Ratio Measurement
5.6 Measurement of base pressure
5.7 Vibration Measurement
6 Test Report
6.1 Volume flow rate
6.2 Compression ratio
6.3 Maximum flow
6.4 Critical foreline pressure
6.5 Basic Pressure
6.6 Vibration
Appendix A (Informative) Derivation of Formula (4) and Formula (5)
References

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.

This document is part 4 of GB/T 40344 "Vacuum technology, standard method for measuring vacuum pump performance". GB/T 40344 has been published. The following parts are published.

- Part 1: General requirements;
- Part 2: Positive displacement vacuum pumps;
- Part 3: Specific parameters of mechanical booster pumps;
- Part 4: Turbomolecular pumps.

This document is equivalent to ISO 21360-4:2018 "Vacuum technology - Standard methods for measuring vacuum pump performance - Part 4: Turbomolecular Pump.

Introduction

The original vacuum pump standard system has put forward different requirements for the measurement of certain vacuum pump performance parameters, measurement devices and performance measurement.

The methods and other contents are repeated and not clearly stated. The formulation of specific vacuum pump standards is based on the overall requirements and is measured according to their respective characteristics.

If the measurement method of a specific vacuum pump deviates from the general requirements, the specific standard shall prevail.

GB/T 40344 "Vacuum Technology Standard Method for Measurement of Vacuum Pump Performance" aims to propose a standard from the perspective of the commonality and characteristics of vacuum pump performance.

The standard measurement method, namely the general requirements and specific vacuum pump standards, is planned to consist of 6 parts.

--- Part 1: General requirements. Aims to provide a basic document for measuring vacuum pump performance parameters, simplifying the future The development of vacuum pump standards includes three methods for measuring volume flow rate, as well as vacuum base pressure, compression ratio and critical fore stage. Method of measuring pressure.

--- Part 2: Positive displacement vacuum pumps. Aims to supplement the standard method for performance measurement of positive displacement vacuum pumps based on general requirements.

It includes measurement methods for volume flow rate, base pressure, water vapor tolerance, power consumption and minimum starting temperature of positive displacement vacuum pumps.

--- Part 3: Specific parameters of mechanical booster pumps. Aims to describe the maximum allowable pressure difference, effective compression ratio, zero flow Measurement methods and special requirements for compression ratio and relief valve pressure difference.

--- Part 4: Turbomolecular pumps. It is intended to be based on the general requirements and describes the flow method and the small hole method to measure the turbomolecular pump body.

Methods and devices for measuring the cumulative flow rate, as well as methods for measuring parameters such as maximum flow, critical front stage pressure, compression ratio, base pressure, vibration, etc. Method and measuring device.

--- Part 5: Non-evaporable getter (NEG) vacuum pumps. This part is intended to provide a general description of the non-evaporable getter (NEG) vacuum pumps. It is supplemented by standard methods for measuring pump performance.

--- Part 6: Cryogenic vacuum pumps. Aims to provide a standard method for measuring the performance of cryogenic vacuum pumps based on general requirements. Replenish.

1 Scope

This document and GB/T 40344.1 describe the performance measurement method of turbomolecular pumps and are applicable to all specifications and types of turbines. Molecular pump. Includes.

--- With mechanical bearings or magnetic bearings;

---With or without additional traction stage or other rotor extraction stage;

---With one or more air inlets.

Since the turbomolecular pump is supported by a backing pump, the volume flow rate-inlet pressure curve cannot fully determine the performance of the turbomolecular pump.

When the turbomolecular pump is used, the driving device and the front stage pressure both affect its performance parameters.

The following contents are used to supplement the determination of its performance parameters.

---The flow rate and foreline pressure of the turbomolecular pump;

---Compression ratio curve (compression ratio of turbomolecular pump-foreline pressure).

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 40344.1-2021 Vacuum technology Standard methods for measuring vacuum pump performance Part 1: General requirements (ISO 21360-1. 2020, IDT)

3 Terms and Definitions

The terms and definitions defined in GB/T 40344.1 and the following apply to this document.

3.1 p_c

The maximum foreline pressure (p_3) at the outlet at which the turbomolecular pump and its drive can continue to operate without damage or overload while the compression ratio p_3/p_1 is still greater than 10 and the purge gas is turned off.

Note 1: p_1 is the (high) vacuum pressure at the turbomolecular pump inlet. At this operating pressure, the turbomolecular pump speed can be reduced. The value of p_c depends on the speed and Gas type, so both should be indicated along with the value of p_c .

Note 2: Measurements with purge gas may result in different results [When removing light gases at the inlet, the use of heavy purge gas will affect the critical foreline pressure (p_c) performance]. Therefore, the purge gas flow rate should be zero.

3.2 Maximum throughput

Q_{max}

The highest gas load that a turbomolecular pump can continuously pump without damage or destruction.