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Vacuum technology — Turbomolecular pumps — Measurement of performance characteristics

*Technique du vide — Pompes turbomoléculaires — Mesurage des
caractéristiques fonctionnelles*



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Foreword

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ISO 5302 was prepared by Technical Committee ISO/TC 112, *Vacuum technology*, Subcommittee SC 3, *Vacuum pumps — Performance*.

Vacuum technology — Turbomolecular pumps — Measurement of performance characteristics

1 Scope

This International Standard specifies methods for the measurement of performance characteristics of turbomolecular pumps. It is applicable to all sizes and all types of turbomolecular pumps

- a) with mechanical or magnetic bearings, and
- b) with or without an additional drag stage.

NOTE Since turbomolecular pumps are backed by primary pumps, their performance cannot be completely defined without having the following in addition to the curve of the volume flow rate against suction pressure:

- the throughput curve,
- the compression ratio curve, and
- the curve for the variation in inlet pressure,

over the whole of the range concerned and for various gases.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3529-2, *Vacuum technology — Vocabulary — Part 2: Vacuum pumps and related terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3529-2 and the following apply.

3.1 critical backing pressure

p_c
maximum backing pressure p_2 while the pump still has a compression rate $p_2/p_1 \geq 2$ and the purge gas flow is on

NOTE p_1 is the (high) vacuum pressure on inlet.

3.2

maximum throughput

$Q_{\max}$

highest gas load, in pascal litres per second (Pa·l/s) [millibar litres per second (mbar·l/s)], that can be pumped continuously without damage or destruction of the pump

NOTE The limiting parameter depends on the design of the pump. In most cases it will be given as a maximum temperature at a defined location. The value of $Q_{\max}$ depends on the gas pumped, the backing pump used, and the conditions of cooling, etc.

3.3

volume flow rate

q_V

volume of gas which, under ideal conditions, flows from the test dome through the pump inlet per unit time

NOTE 1 For practical reasons, however, the volume flow rate of a given pump and for a given gas is conventionally taken as equal to the quotient of the throughput of this gas and of the equilibrium pressure at a given point. The units adopted for the volume flow rate are cubic metres per hour (m³/h) or litres per second (l/s).

NOTE 2 The term “pumping speed” and symbol “S” are sometimes used instead of “volume flow rate”.

3.4

ultimate pressure

value towards which the pressure in the test dome approaches asymptotically

NOTE 1 It is the lowest pressure obtainable with the pump.

NOTE 2 It is recommended not to give ultimate pressure values in the manufacturer's specification. Therefore, no procedure to measure the ultimate pressure is given in this International Standard. However, if the manufacturer lists the ultimate pressure, the operating conditions under which the measurement is made should be stated.

3.5

minimum operational pressure

p_0

pressure obtained in the dome 48 h after the bake-out procedure

3.6

compression ratio

K_{eff}

ratio of the backing pressure p_2 to the inlet pressure p_1 of the turbomolecular pump

$$K_{\text{eff}} = p_2/p_1$$

NOTE To obtain the compression rate at zero flow rate, K_0 , for a given gas, the partial pressure of this gas in the outlet duct should be at least 90 % of p_2 .

3.7

maximum working pressure

$p_{1\max}$

highest pressure on the inlet side that the turbomolecular pump and the driving device can withstand without being damaged