INTERNATIONAL STANDARD

ISO 1607-2

Second edition
1989-11-01

Positive-displacement vacuum pumps — Measurement of performance characteristics —

Part 2: Measurement of ultimate pressure

Pompes primaires volumétriques à vide — Mesurage des caractéristiques fonctionnelles —

Partie 2: Mesurage de la pression limite

Reference number
ISO 1607-2 : 1989 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1607-2 was prepared by Technical Committee ISO/TC 112, *Vacuum technology.*

This second edition cancels and replaces the first edition (ISO 1607-2 : 1978), of which it constitutes a minor revision. The former requirement in 4.2 that the pump be run for at least 24 h has been changed.

ISO 1607 will consist of the following parts, under the general title *Positive-displacement vacuum pumps — Measurement of performance characteristics:*

— *Part 1: Measurement of volume rate of flow (pumping speed)*

— *Part 2: Measurement of ultimate pressure*

— *Part 3: Water vapour pumping capacity*

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Introduction

The purpose of ISO 1607 is to ensure that measurements of the performance characteristics of positive-displacement vacuum pumps are, as far as possible, carried out by uniform procedures and under uniform conditions. It is hoped that, as a result, measurements conducted by different manufacturers or in different laboratories, and statements of performance quoted in manufacturers' literature, will be on a properly comparable basis to the benefit of both user and manufacturer.

It is envisaged that the complete International Standard will, in due course, deal comprehensively with the measurement of a wide range of performance characteristics of the main types of positive-displacement vacuum pumps. In order, however, that useful agreements of more restricted scope may be implemented with the least possible delay, ISO 1607 is published in parts.

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Positive-displacement vacuum pumps — Measurement of performance characteristics —

Part 2:
Measurement of ultimate pressure

1 Scope

This part of ISO 1607 specifies methods of measuring the ultimate pressure of positive-displacement vacuum pumps.

The pumps considered are those which discharge the gas against atmospheric pressure and which achieve a limiting inlet pressure of less than 100 Pa[1] in one stage.

2 Definitions

For the purposes of this part of ISO 1607, the following definitions apply.

2.1 ultimate pressure, in pascals: The limiting pressure approached asymptotically in the dome, with the gas inlet valve closed and the pump in normal operation. A distinction must be made between the ultimate pressure due only to non-condensable gases, and the total ultimate pressure.

2.2 test dome; test header: A chamber of specified form and dimensions attached to the inlet of the pump through which a measured flow of gas may be admitted to the pump, and which is equipped with means of pressure measurement.

3 Apparatus

3.1 Test dome, cylindrical and of the form shown in figure 1. The axial dimension of the dome is 1,5 D, where D is the internal diameter, and the test gas entrance is on the axis at a distance D from the connecting flange and so arranged that the gas entrance into the dome is in a direction away from the pump mouth. The connection to the pressure-measuring gauge is at a distance 0,5 D from the connecting flange with its axis perpendicular to that of the dome. The axis of the test dome shall be perpendicular to the plane of the inlet flange of the pump.

The volume of the test dome (V_D) shall be at least five times the volume swept by the pump during one compression cycle (V_p). The connection to the inlet of the pump shall consist of an adaptor the length of which shall not exceed 0,5 D (see figure 1). The dome dimensions for pumps of given sizes are indicated in table 1.

Table 1

V_p litres	V_D litres	D mm
0 to 0,26	1,3	100
0,26 to 1,1	5,4	160
1,1 to 4,2	21	250
4,2 to 17	84	400
17 to 65	325	630
65 to 260	1 300	1 000

NOTE — For practical reasons the test dome is identical in form with that already adopted for the measurement of the volume rate of flow of positive-displacement pumps (see ISO 1607-1).

Insofar as the measurement of ultimate pressure alone is concerned, it is not necessary to comply with the actual gas entry arrangement specified.

The temperature of the dome shall be maintained within the limits 20 °C to 25 °C.

3.2 Gauges, for measuring the ultimate pressure due only to non-condensable gases, calibrated to an accuracy within ± 5 % for pressures greater than or equal to 1 Pa, and within ± 10 % for lower pressures.

The gauge shall be protected by a cold trap suitably designed and connected to ensure that the gauge is influenced only by the pressure due to non-condensable gases.

3.3 Vacuum gauges, for measuring the total ultimate pressure, of a type whose sensitivity is independent of the nature of the gas, or vapour, such as a diaphragm gauge.

1) 100 Pa = 100 N/m^2 = 1 mbar; 133 Pa ≈ 1 torr

The gauge shall be calibrated to an accuracy within ± 10 % of the pressure to be measured. For this measurement a vapour trap shall not be inserted in the connection line between the dome and the gauge.

4 Test method

4.1 Principle

The method adopted is that in which the ultimate pressure is measured at a specified temperature, in a specified form of test dome attached to the inlet of the pump.

4.2 Procedure

To commence the procedure, the test dome shall be connected to the inlet of the pump, after ensuring that the inner surface of the dome is clean and dry.

Gauges (3.2 and 3.3) shall be connected to the test dome depending on the measurement being undertaken. If the dome is baked out prior to the measurements, it shall, after having cooled down, be subjected for a few minutes to a pressure of at least 100 Pa by admitting dried ambient air. The gas inlet port of the dome shall then be closed.

The pump shall be run with the prescribed quantity and grade of fresh oil, and at the rotational frequency specified by the manufacturer. The ambient temperature shall be below 25 °C unless otherwise stated in the conditions of test. After starting, the pump shall be operated with gas ballast for at least 1 h, and then without gas ballast for another hour. Thereafter, the pressure measurements shall be made at intervals of 30 min. The ultimate pressure is considered to be reached when three successive measurements show no further reduction in the measured pressure.

The above test may also be carried out with full gas ballast (the gas-ballast valve being fully open). In this case the series of measurements shall not be commenced until the pump has reached its equilibrium temperature.

5 Test report

All reports of test results shall indicate the exact nature and conditions of the test performed as enumerated below.

5.1 General conditions

a) whether the results refer to the ultimate total pressure or that due only to non-condensable gases;

b) whether gas ballast was in operation.

5.2 Supplementary conditions

a) type and conditions of operation of all gauges used;

b) type of seal and sealing material used on the pump inlet;

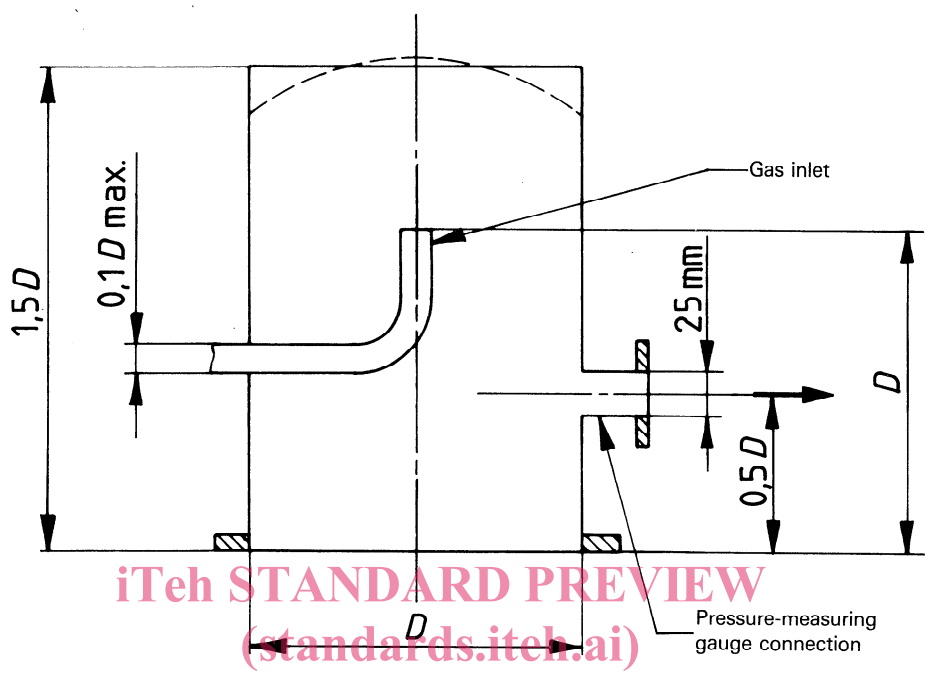
c) type of traps employed, and their temperatures during the test;

d) cooling water flow rate, if applicable;

e) rotational frequency of the pumps;

f) ambient temperature and pressure;

g) specification of the pump oil.



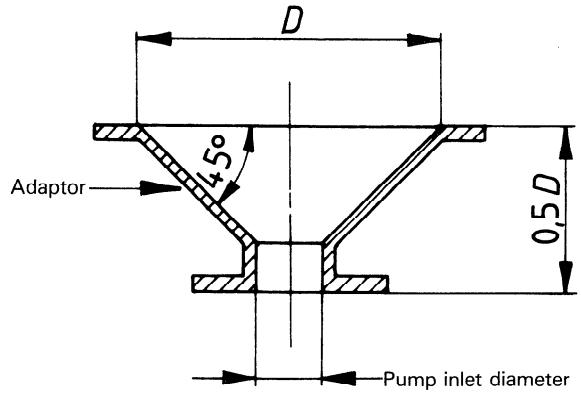


Figure 1 — Test dome

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