INTERNATIONAL STANDARD

ISO 14269-4

First edition
1997-12-15

Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment —

Part 4:
Air filter element test method

Tracteurs et machines automotrices pour l'agriculture et la sylviculture — Ambiance dans l'enceinte de l'opérateur —

Partie 4: Méthode d'essai de l'élément du filtre à air

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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 14269-4 was prepared by Technical Committee ISO/TC 23, *Tractors and machines for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

This first edition, along with the other parts of ISO 14269, cancels and replaces ISO 3737:1976, ISO 6097:1989 and ISO/TR 8953:1987, which have been technically revised.

ISO 14269 consists of the following parts, under the general title *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment*:

— *Part 1: Vocabulary*

— *Part 2: Heating, ventilation and air-conditioning test method and performance*

— *Part 3: Determination of effect of solar heating*

— *Part 4: Air filter element test method*

— *Part 5: Pressurization system test method*

Annex A of this part of ISO 14269 is for information only.

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Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment —

Part 4:
Air filter element test method

1 Scope

This part of ISO 14269 specifies a uniform test method for determining performance levels of operator enclosure panel-type air filters. It is applicable to tractors and self-propelled machines for agriculture and forestry when equipped with an operator enclosure with a ventilation system.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 14269. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 14269 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5011:1988, *Inlet air cleaning equipment for internal combustion engines and compressors — Performance testing.*

ISO 14269-1:1997, *Tractors and self-propelled machines for agriculture and forestry — Operator enclosure environment — Part 1: Vocabulary.*

3 Definitions

For the purposes of this part of ISO 14269, the definitions given in ISO 14269-1 apply, of which the following are particularly relevant.

3.1 operator enclosure air filter element: Medium in which particulate matter is removed from the incoming air supply. [ISO 14269-1:1997, definition 2.15]

3.2 filter efficiency: Ability of the air filter element to remove particulate matter. [ISO 14269-1:1997, definition 2.16]

3.3 test dust: Particulate matter used to evaluate the filter element. [ISO 14269-1:1997, definition 2.17]

4 Air filter element performance test

The test shroud configurations for the operator enclosure filter comparison tests are given in 4.1.1 and figure 1. This test procedure also designates a recommended intake velocity for the dust mixing chamber. (See ISO 5011:1988, figure 2.)

4.1 Test equipment and instruments

4.1.1 Test equipment in accordance with figure 2, used to determine the resistance to air flow, particulate holding capacity, particulate removal efficiency, and sealing characteristics. For element configurations other than panel type, see ISO 5011.

4.1.2 Dust metering device in accordance with figure 3 which, when used with the dust injector (figure 4), is capable of metering dust over the range of delivery rates required. This dust feed system shall not change the primary particle size distribution of the particulate. The average delivery rate shall be within 5 % of the desired rate and the deviation in the instantaneous delivery rate from the average shall be no more than 5 %.

4.2 Test conditions and material

4.2.1 All air flow measurements are to be corrected to a standard condition of 25 °C at 100 kPa.

4.2.2 Test dust shall be standardized and shall be of two grades labelled fine and coarse. For typical particle size distribution and chemical composition, refer to tables 1, 2 and 3.

It is difficult to select a test dust size distribution and concentration which will be representative of all service conditions; therefore, based primarily on practical considerations, the concentration shall be 1 g/m^3 for coarse and fine dusts (1 g/m^3 is generally accepted as zero visibility conditions).

Table 1 — Chemical analysis of test dust

Chemical	Amount % (*m*/*m*)
$_2$	67-69
Fe_2O_3	3-5
Al_2O_3	15-17
CaO	2-4
MgO	0,5-1,5
Total alkalis	3-5
Ignition loss	2-3

Table 2 — Particle size distribution by volume

Size µm	Fine grade % (*V*/*V*) max.	Coarse grade % (*V*/*V*) max.
⩽ 5,5	38 ± 3	13 ± 3
⩽ 11	54 ± 3	24 ± 3
⩽ 22	71 ± 3	37 ± 3
⩽ 44	89 ± 3	56 ± 3
⩽ 88	97 ± 3	84 ± 3
⩽ 125	100	100

SiO

Table 3 — Particle size distribution by mass

Dimension d µm	Fine grade % (m/m) max.	Coarse grade % (m/m) max.
$0 < d \leqslant 5$	39 ± 2	12 ± 2
$5 < d \leqslant 10$	18 ± 3	12 ± 3
$10 < d \leqslant 20$	16 ± 3	14 ± 3
$20 < d \leqslant 40$	18 ± 3	23 ± 3
$40 < d \leqslant 80$	9 ± 3	30 ± 3
$80 < d \leqslant 200$	0	9 ± 3

4.2.3 The absolute filter shall consist of fiberglass media with a minimum thickness of 12,7 mm and a minimum density of 9,5 kg/m^3. The fiber diameter shall be 0,76 µm to 1,27 µm and the moisture absorption shall be less than 1 % by weight after exposure of 50 °C and 95 % relative humidity for 96 h. The filter shall be installed with the nap side facing upstream in an air-tight holder that adequately supports the media. The face velocity shall not exceed 50 m/min to maintain media integrity.

4.2.4 The mass of the absolute filter shall be measured to the nearest 0,01 g after the weight has stabilized and while in a ventilation oven at 105 °C ± 5 °C. If stabilization cannot be determined, the filter shall remain in the oven for at least 4 h.

4.2.5 All tests shall be conducted with air entering the air filter at a temperature of 24 °C ± 8 °C and a relative humidity of (50 ± 15) %.

NOTE — Since atmospheric conditions affect test results, when comparing performance of filters designed for the same application, tests should be conducted within the narrowest range of temperature and humidity possible.

4.2.6 The velocity of the air entering the top of the dust mixing chamber shall be a minimum of 6 m/s (see figure 1).

4.2.7 Air flow restriction and pressure drop test shall be conducted using a minimum of three points: 80 %, 100 % and 120 % of rated air flow, using the element restriction test setup shown in figure 2. Condition the unit to be tested for at least 30 min under temperature and humidity conditions equivalent to those of the test area.

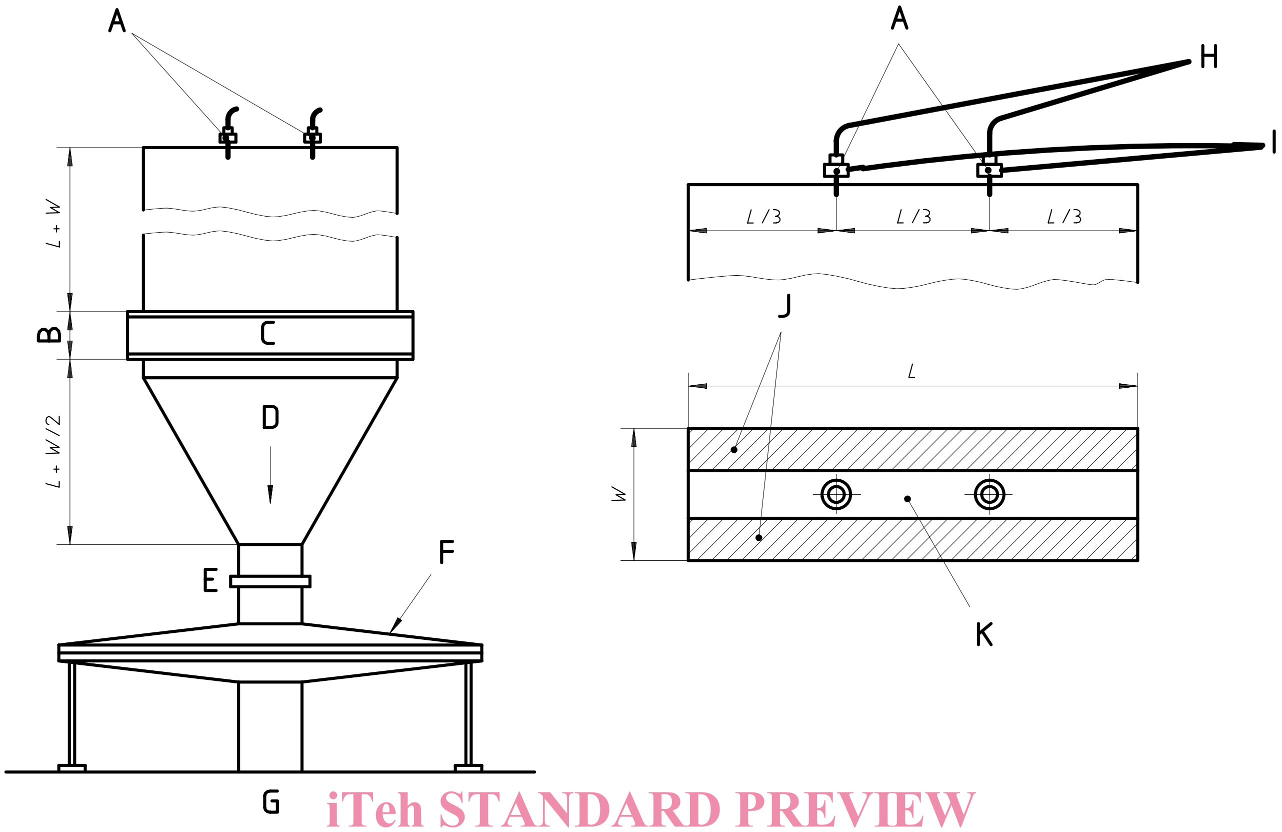
4.2.8 The air filter efficiency, E, as a percentage, is calculated as follows:

$$E = \frac{m_f}{m_f + m_A} \times 100$$

where

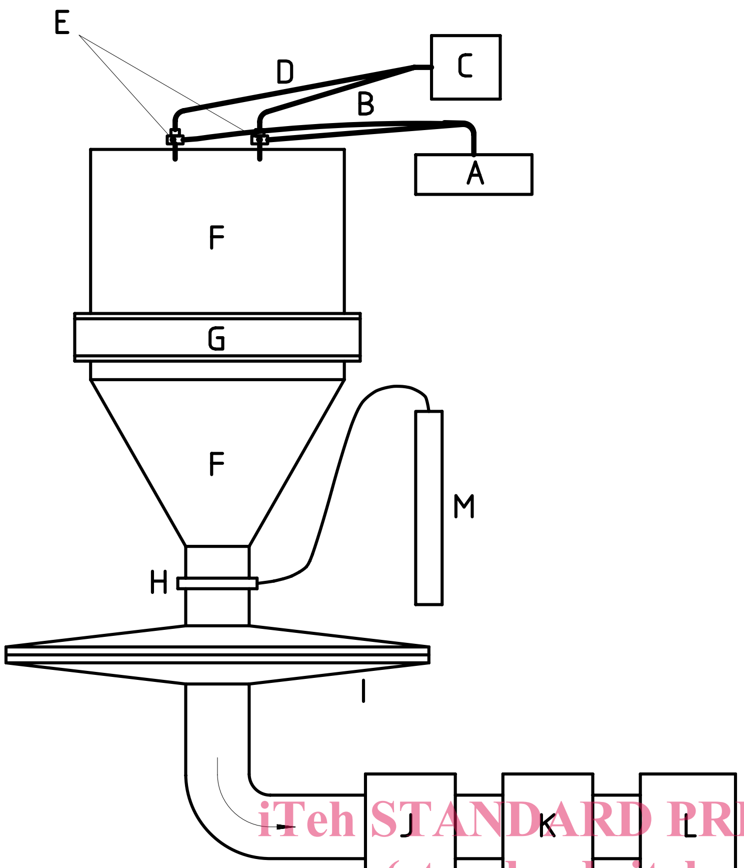
m_f is the increase in mass of the filter element under test;

m_A is the increase in mass of the absolute filter.



A: Dust injectors
B: Filter depth
C: Filter element being tested
D: Flow
E: Piezometer ring
F: Absolute filter housing
G: Blower
H: Compressed air
I: From dust feeder
J: Restrictor plates
K: Calculate velocity between top restrictor plates

Figure 1 — Test shroud



Key

A Dust metering device
B Dust transfer tubing
C Compressed air supply
D Compressed air lines
E Dust injectors
F Test shroud
G Filter element being tested
H Piezometer ring
I Absolute filter housing
J Flowrate measuring device
K Flowrate control system
L Blower or other device for inducing air flow
M Restriction measuring device

Figure 2 — Test equipment setup

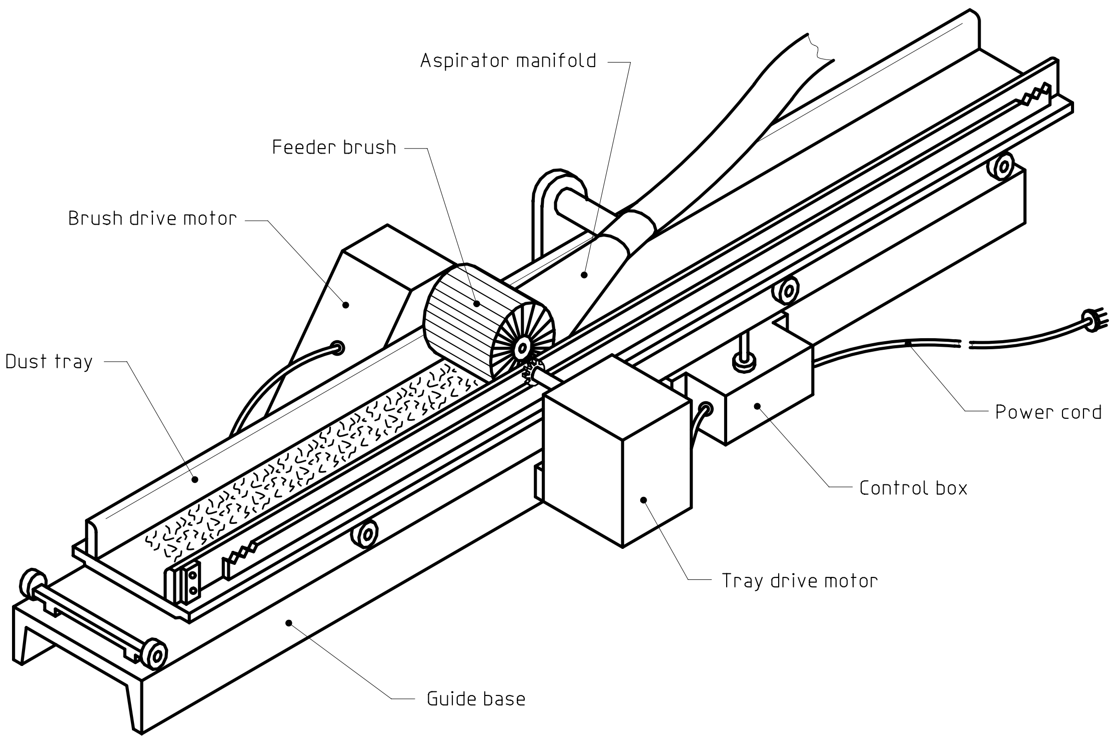


Figure 3 — Dust feeder

Dimensions in millimetres

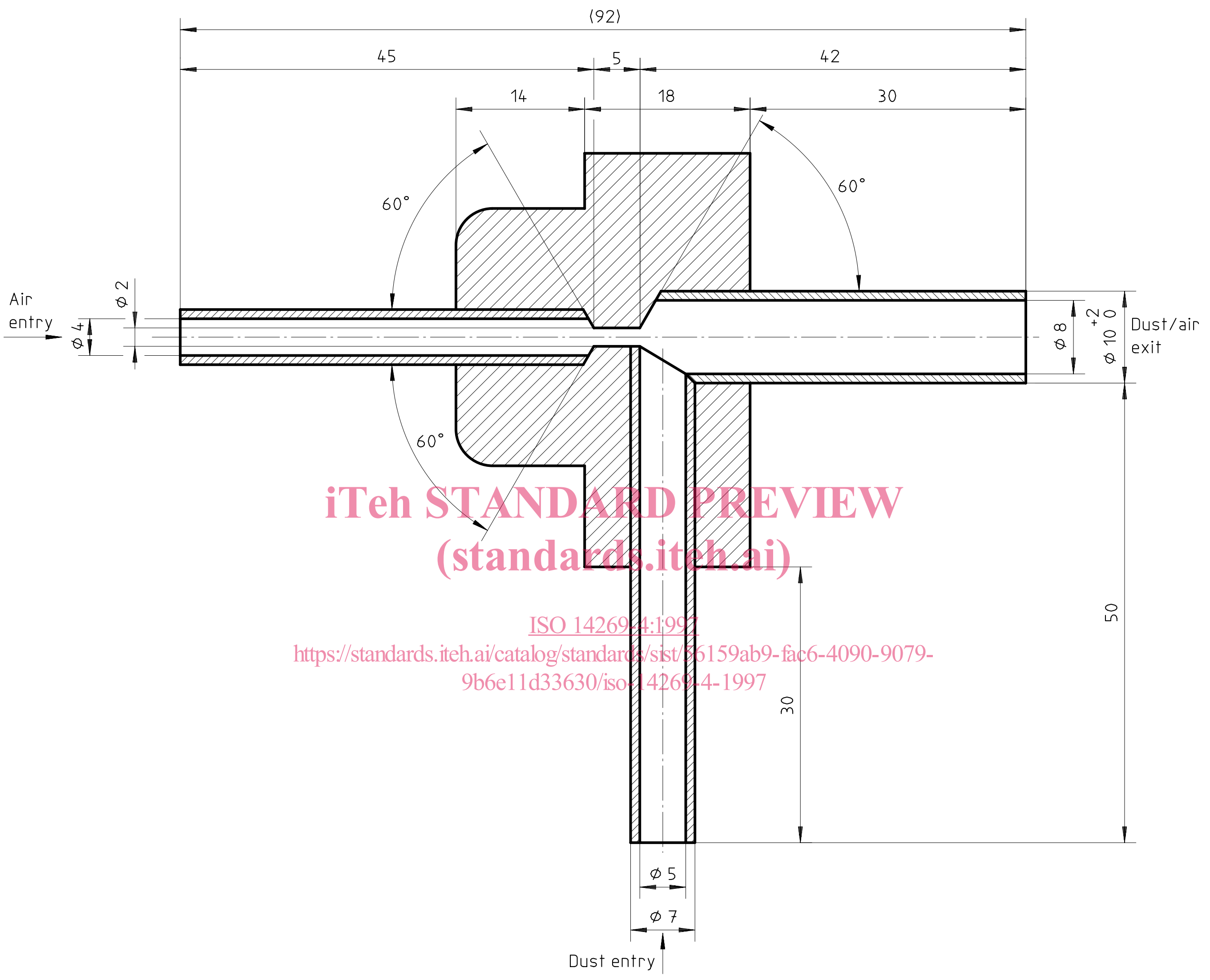


Figure 4 — Dust injector

Annex A
(informative)

Example of test report form for panel-type air filter

Test flowrate: .... m ^{3}/min

Initial restriction: .... Pa

Dust concentration (ISO 14269-4, 4.2.2): .... g/m^3

Dust type: .... fine/coarse

Minimum quantity of dust to obtain a restriction of .... Pa: .... g

Minimum efficiency of filter element at above restriction: .... %

Minimum efficiency of filter element for a restriction of 125 Pa, initial efficiency: .... %

Laboratory test conditions

	Before	**After**
Temperature	.... °C	.... °C
Relative humidity	.... %	.... %
Barometric pressure	.... kPa	.... kPa