ISO/IEC 80079-20-2

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 20-2: Material characteristics – Combustible dusts test methods

Atmosphères explosives –
Partie 20-2: Caractéristiques des produits – Méthodes d'essai des poussières combustibles

ISO/IEC 80079-20-2:2016-02(en-fr)

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard ISO/IEC 80079-20-2 has been prepared by subcommittee 31M: Non-electrical equipment and protective systems for explosive atmospheres, of IEC 31: Equipment for explosive atmospheres.

It is published as a double logo standard.

This first edition cancels and replaces the first edition of IEC 61241-2-1 published in 1994, the first edition of IEC 61241-2-2 published in 1993 and the first edition of IEC 61241-2-3 published in 1994, combining the requirements into a single document, and is considered to constitute a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
31M/102/FDIS	31M/108/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 15 P-members out of 21 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

"A list of all parts in the IEC 60079 series, under the general title *Explosive atmospheres*, as well as the International Standard 80079 series, can be found on the IEC website."

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

Significant changes with respect to IEC 61241-2-1:1994, IEC 61241-2-2:1993 and IEC 61241-2-3:1994

		Type		
Explanation of the significance of the changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Normative references	2	X		
Terms and Definitions	3	X		
Dust sample Requirements	4	X		
Combustible Dust Determination	5	X		
Procedure for Characterisation of combustible dust or combustible flying	6	X		
Test methods for determination of a combustible dust or a combustible flying	7	X		
MIT of a dust cloud	8.1	X		
MIT of a dust layer	8.2	X		
MIE of a dust/air mixture	8.3	X		
Tests on resistivity	8.4	X		
Measurement of temperature distribution on the surface of the hot plate	Annex A	X		
Godbert-Greenwald oven	Annex B	X		
Examples of spark-generating systems	Annex C	X		
Vertical tube apparatus	Annex D	X		
20-litre sphere	Annex E	X		
BAM oven	Annex F	X		
Data for dust explosion characteristics	Annex G	X		
1m^3 vessel	Annex H	X		

EXPLOSIVE ATMOSPHERES –

Part 20-2: Material characteristics – Combustible dusts test methods

1 Scope

This part of ISO/IEC 80079 describes the test methods for the identification of combustible dust and combustible dust layers in order to permit classification of areas where such materials exist for the purpose of the proper selection and installation of electrical and mechanical equipment for use in the presence of combustible dust.

The standard atmospheric conditions for determination of characteristics of combustible dusts are:

- temperature –20 °C to +60 °C,
- pressure 80 kPa (0,8 bar) to 110 kPa (1,1 bar) and
- air with normal oxygen content, typically 21 % v/v.

The test methods defined do not apply to:

- recognized explosives, propellants (e.g. gunpowder, dynamite), or substances or mixtures of substances which may, under some circumstances, behave in a similar manner or
- dusts of explosives and propellants that do not require atmospheric oxygen for combustion, or to pyrophoric substances.

2 Normative references

None.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
combustible dust
finely divided solid particles, 500 μm or less in nominal size, which may form explosive mixtures with air at standard atmospheric pressure and temperatures

Note 1 to entry: This includes dust and grit as defined in ISO 4225.

Note 2 to entry: The term 'solid particles' is intended to address particles in the solid phase but does not preclude a hollow particle.

3.1.1
conductive dust
combustible metal dusts and other combustible dusts with electrical resistivity equal to or less than 1×10^3 Ω·m

Note 1 to entry: Metal dust is treated as conductive dust because it is assumed that surface oxidation cannot be depended upon to always ensure electrical resistivity greater than 1×10^3 Ω·m

3.1.2
non-conductive dust
combustible dust with electrical resistivity greater than 1×10^3 Ω·m

3.2
combustible flyings
solid particles, including fibres, where one dimension is greater than 500 μm in nominal size, which may form an explosive mixture with air at standard atmospheric pressure and temperature

Note 1 to entry: The ratio of length to width is 3 or more.

Note 2 to entry: Examples of flyings include carbon fibre, rayon, cotton (including cotton linters and cotton waste), sisal, jute, hemp, cocoa fibre, oakum and baled waste kapok.

3.3
explosive dust atmosphere
mixture with air, under atmospheric conditions, of combustible substances in the form of dust, fibres, or flyings which, after ignition, permits self-sustaining propagation

3.4
minimum ignition temperature of a dust layer
lowest temperature of a hot surface at which ignition occurs in a dust layer under specified test conditions

3.5
minimum ignition temperature of a dust cloud
lowest temperature of a hot surface on which the most ignitable mixture of the dust with air is ignited under specified test conditions

3.6
minimum ignition energy (of a combustible dust/air mixture)
lowest electrical energy stored in a capacitor which upon discharge is sufficient to effect ignition of the most sensitive dust/air mixture under specified test conditions

4 Dust sample requirements

4.1 Receipt of sample for testing

A material safety data sheet or equivalent with the sample.

The test material shall be provided in suitable packaging, labelled according to relevant guidelines labelled according to relevant guidelines, and appropriate transportation.

NOTE It is usual to provide a quantity of at least 0,5 kg for testing. If sample preparation is required this may be insufficient. If only a smaller volume of material is available then the full range of testing may not be possible.

4.2 Characterisation of sample

The sample shall be representative of the material as it appears in the entire process operated.

NOTE Many unit operations such as extract systems will separate dust into finer fractions than seen in the main processing equipment and this is accounted for when taking the sample.

If the sample is not representative of the material as found in the process then sample preparation shall be carried out to apply the worst case conditions.

At least the following information about the sample shall be provided:

– minimum particle size,
– median particle size,
– maximum particle size,
– particle distribution,
– moisture content, and
– method of determination (e.g. optical methods or sieving).

If the applicant cannot provide usable data then this shall be determined separately.

4.3 Preparation of sample

If it is not possible to test the sample as received, or if the sample is no longer representative of the process material then it may be necessary to condition or alter the sample for testing. This may include

– grinding/sieving,
– drying and
– humidifying.

Any apparent changes noted in the properties of the dust during preparation of the sample, for example, by sieving or owing to temperature or humidity conditions, shall be stated in the test report.

NOTE 1 Sample preparation such as grinding and sieving, or drying can alter the material characteristics. Where finer fractions are present in a facility it is appropriate to take fractions of less than 63 μm to give the most easily ignitable mixtures. When the sample is a mixture of substances, the sample preparation can result in a change to the sample's composition.

NOTE 2 The presence of solvents can become altered in the sample preparation process.

4.4 Test conditions

The tests shall be carried out at standard atmospheric temperature of 20 $^{+10}_{-10}$ °C and standard atmospheric pressure of 80 kPa to 110 kPa (0,8 bar to 1,1 bar) unless otherwise specified.

5 Combustible dusts and combustible flyings determination

5.1 Test sequence

The sequence followed for the determination of the material properties of combustible dust and combustible flyings is given in 5.2, Clause 6 and Figure 1, Figure 2 and Figure 3.

NOTE 1 Refer also to the information referenced in Annex G.

NOTE 2 Testing in the Hartman tube is a screening method. The test procedure can be directly started with the 20 litre sphere or the GG Oven.

5.2 Tests to determine whether material is a combustible dust or combustible flying

5.2.1 Visual inspection

Make a visual inspection of the test material (by microscope if necessary) to determine whether the material consists of combustible flyings:

- If the material consists of combustible flyings with dust then continue the test procedure in a Hartmann tube (see 5.2.3) to determine whether the combination of the two is combustible dust.
- If the material consists only of combustible flyings then continue the test procedure in a Hartmann tube (see 5.2.3) to determine whether it is combustible flyings.

5.2.2 Determine particle distribution

For material which does not contain combustible flyings check the particle size distribution:

- If there are no particles less than 500 μm in size then the material is not a combustible dust.
- If there are any particles less than 500 μm in size then continue the test procedure in a Hartmann tube to determine whether it is a combustible dust.

5.2.3 Ignition test in the Hartmann tube

5.2.3.1 Test in a Hartmann tube with a spark (see 7.1):

1) If ignition occurs, the material is a combustible dust or a combustible flying (proceed to the procedure for characterisation of combustible dust or combustible flying (see Clause 6)).
2) If no ignition occurs:
   a) proceed to a Hartmann tube with a hot coil ignition source (see 7.1);
   b) it can be assumed that the minimum ignition energy is greater than 1 J and the test material is hard to ignite.

5.2.3.2 Test in a Hartmann tube with a hot coil ignition source (see 7.1):

1) If ignition occurs, the material is a combustible dust or a combustible flying, (proceed to the procedure for the characterisation of combustible dust or combustible flying (see Clause 6).
2) If no ignition occurs:
   a) proceed to the test in the 20-litre sphere (see 7.2);
   b) it can be assumed that the minimum ignition energy is greater than 10 J.

5.2.4 Ignition test in the 20-litre sphere

Test in the 20-litre sphere (see 7.2):

- If ignition occurs the material is a combustible dust or a combustible flying (proceed to procedure for characterisation of combustible dust or combustible flying (see Clause 6)).
- If no ignition occurs then the material is not a combustible dust or a combustible flying and the testing procedure is completed.

NOTE Although the material does not form explosive mixtures with air, it can still ignite as a combustible dust layer.

If there is insufficient material available for testing in a 20-litre sphere then testing in the Godbert-Greenwald (GG) oven at 1 000 °C is an acceptable alternative (see 7.3):

- If no ignition occurs at 1 000 °C then the material is not a combustible dust or a combustible flying.
- If there is an ignition at 1 000 °C then the material should be subject to further verification in the 20-litre sphere before declaring it combustible or non-combustible.

6 Procedure for characterisation of combustible dust or combustible flying

The following is the procedure for the characterisation of combustible dust or combustible flying:

– test for dust cloud minimum ignition temperature (MIT) (see Clause 8):
  a) GG oven (see 8.1.2) or
  b) BAM oven (see 8.1.3)
– test for dust layer MIT (see 8.2);

– test for minimum ignition energy (MIE) of dust cloud (see 8.3);
– test for resistivity of bulk dust (see 8.4).

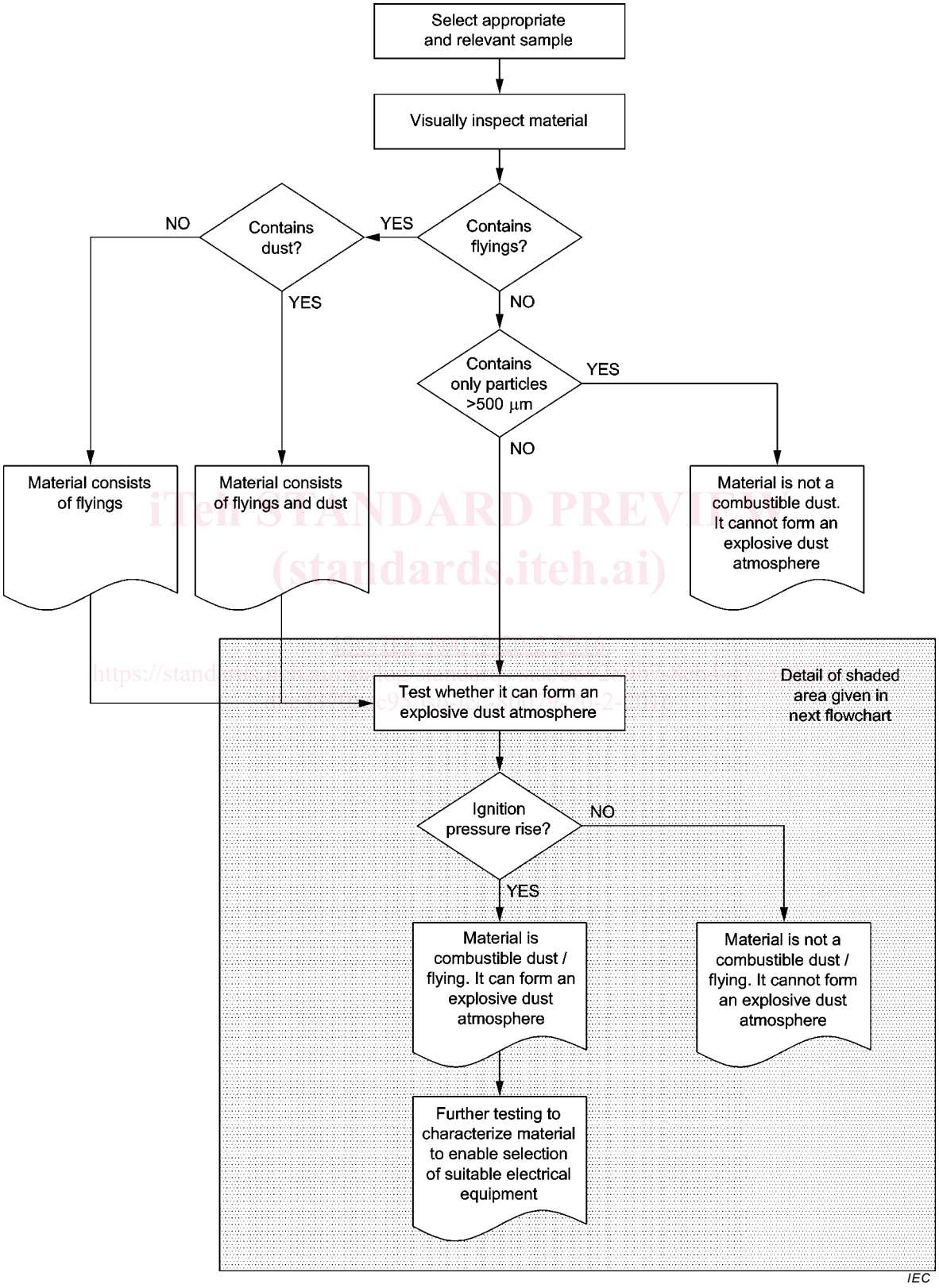

Figure 1 – Protocol for characterisation of combustible dust or combustible flying

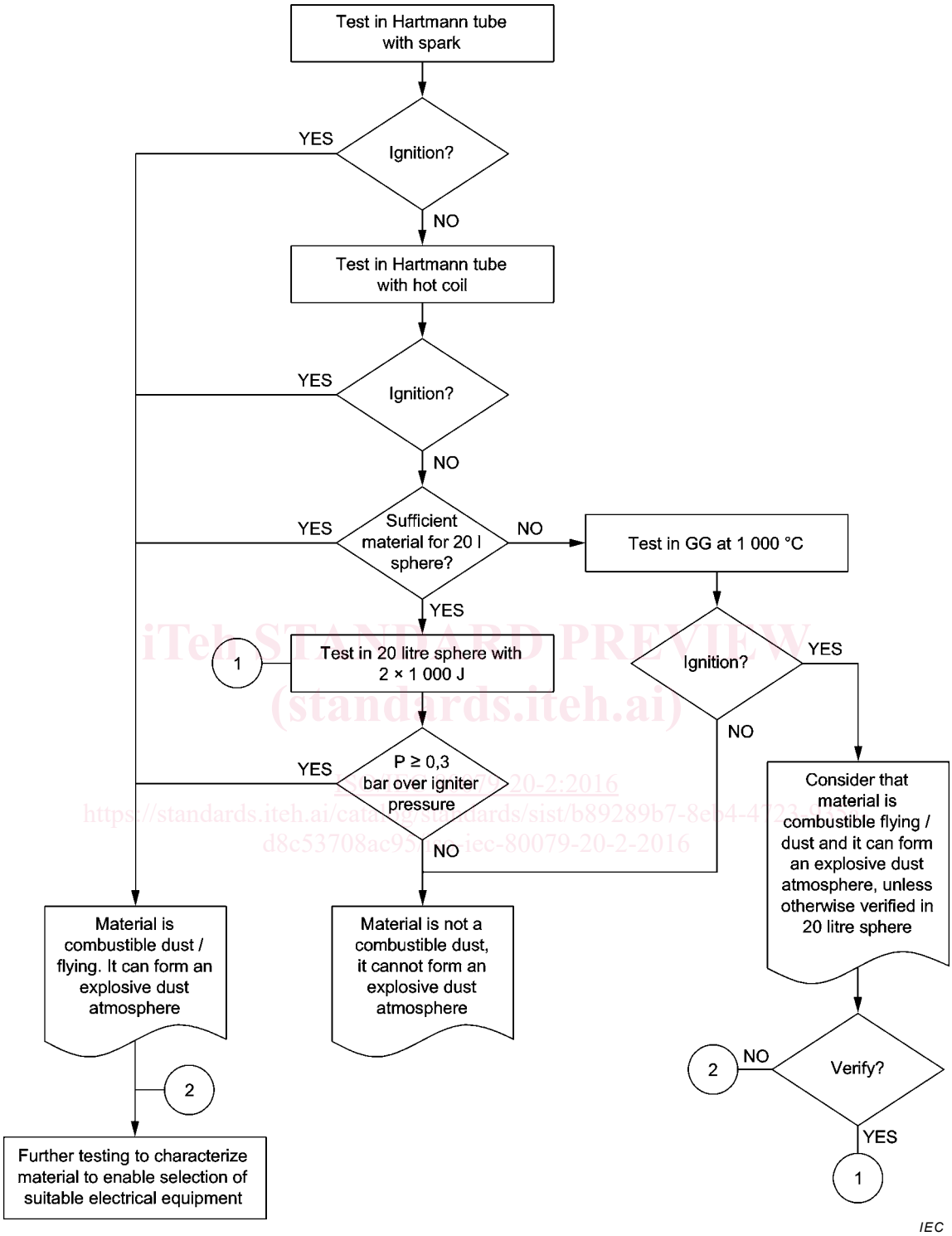

Figure 2 – Tests to define ability to form explosive dust atmosphere (combustible dust/combustible flyings)