



Explosive atmospheres

Part 20.2: Material characteristics— Combustible dusts test methods



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-

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Australian Standard[®]

Explosive atmospheres

**Part 20.2: Material characteristics—
Combustible dusts test methods**

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PREFACE

This Standard was prepared by the Standards Australia Committee MS-011, Classification of Hazardous Areas, to supersede AS/NZS 61241.2.1:2000, *Electrical apparatus for use in the presence of combustible dust*, Part 2.1: *Test methods—Methods for determining the minimum ignition temperatures of dust*, AS/NZS 61241.2.2:2000, *Electrical apparatus for use in the presence of combustible dust*, Part 2.2: *Test methods—Method for determining the electrical resistivity of dust in layers*, and AS/NZS 61241.2.3:2000, *Electrical apparatus for use in the presence of combustible dust*, Part 2.3: *Test methods—Method for determining the minimum ignition energy of dust/air mixtures*.

The objective of this Standard is to describe the test methods for the determination of the characteristics of combustible dusts, including whether the dust is combustible or not, in order to permit the classification of areas where such materials exist to enable the proper selection and installation of equipment for use in the presence of combustible dust. This includes such variables as the dust being in the form of a cloud or layer, the particle size, moisture content, explosibility and ignition temperatures.

This Standard addresses the characteristics of dusts at standard atmospheric conditions, as defined in the Scope.

This Standard does not include pyrophoric substances or inherently explosible materials, such as recognized explosives, propellants (e.g. gunpowder, dynamite), or dusts of explosives and propellants that do not require atmospheric oxygen for combustion.

This Standard is identical with, and has been reproduced from ISO/IEC 80079-20-2:2016, *Explosive atmosphere—Part 20-2: Material characteristics—Combustible dusts test methods*

As this Standard is reproduced from an International Standard, the following applies:

- (a) In the source text ‘this part of ISO/IEC 80079’ should read ‘this Australian Standard’.
- (b) A full point substitutes for a comma when referring to a decimal marker.

There are no normative references in the source document.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annexes to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

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NOTES

AUSTRALIAN STANDARD

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 $-20\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$,
- 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 $1 \times 10^3\ \Omega\cdot\text{m}$

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 $1 \times 10^3\ \Omega\cdot\text{m}$

3.1.2**non-conductive dust**

combustible dust with electrical resistivity greater than $1 \times 10^3 \Omega \cdot m$

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).

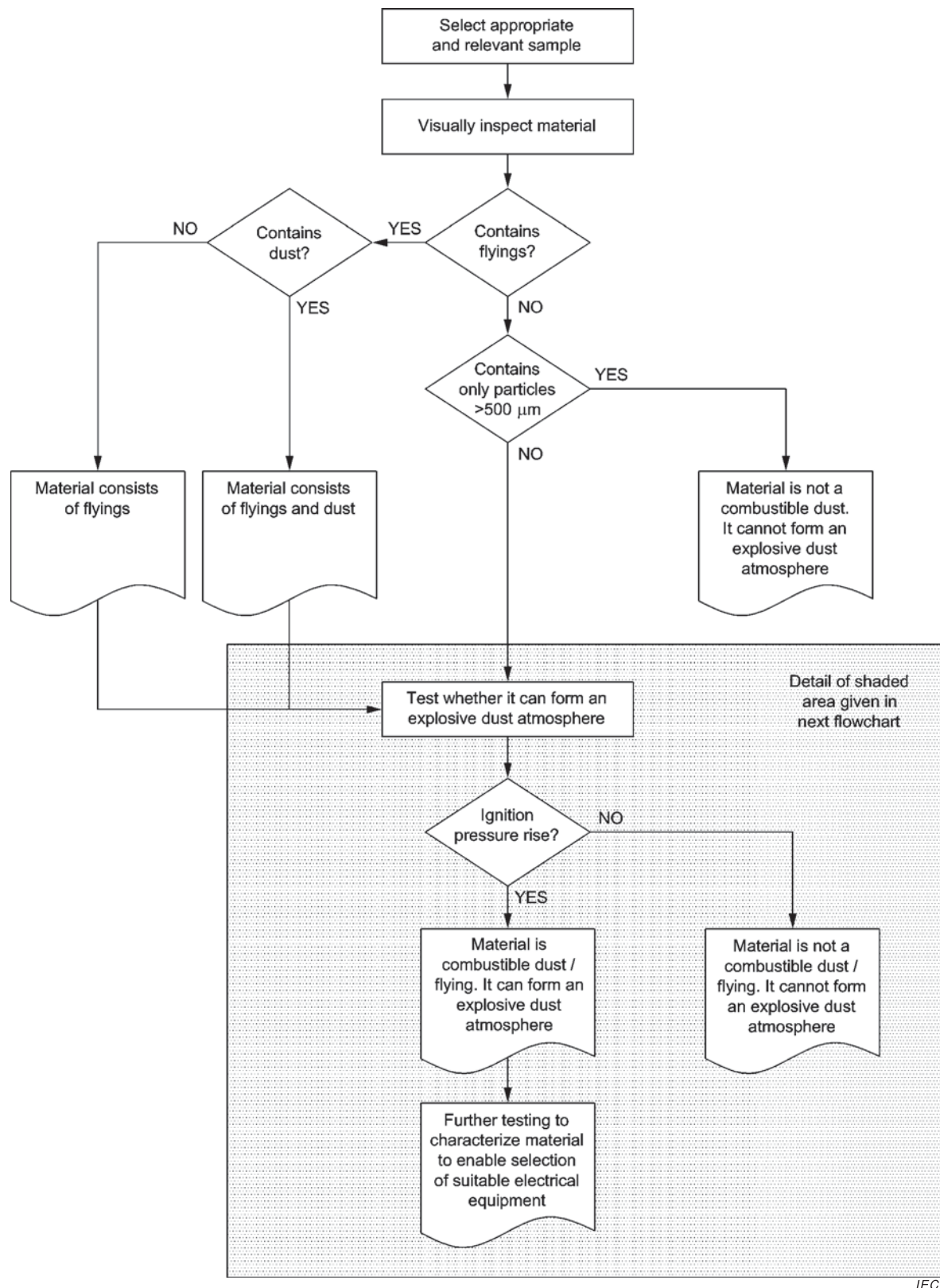
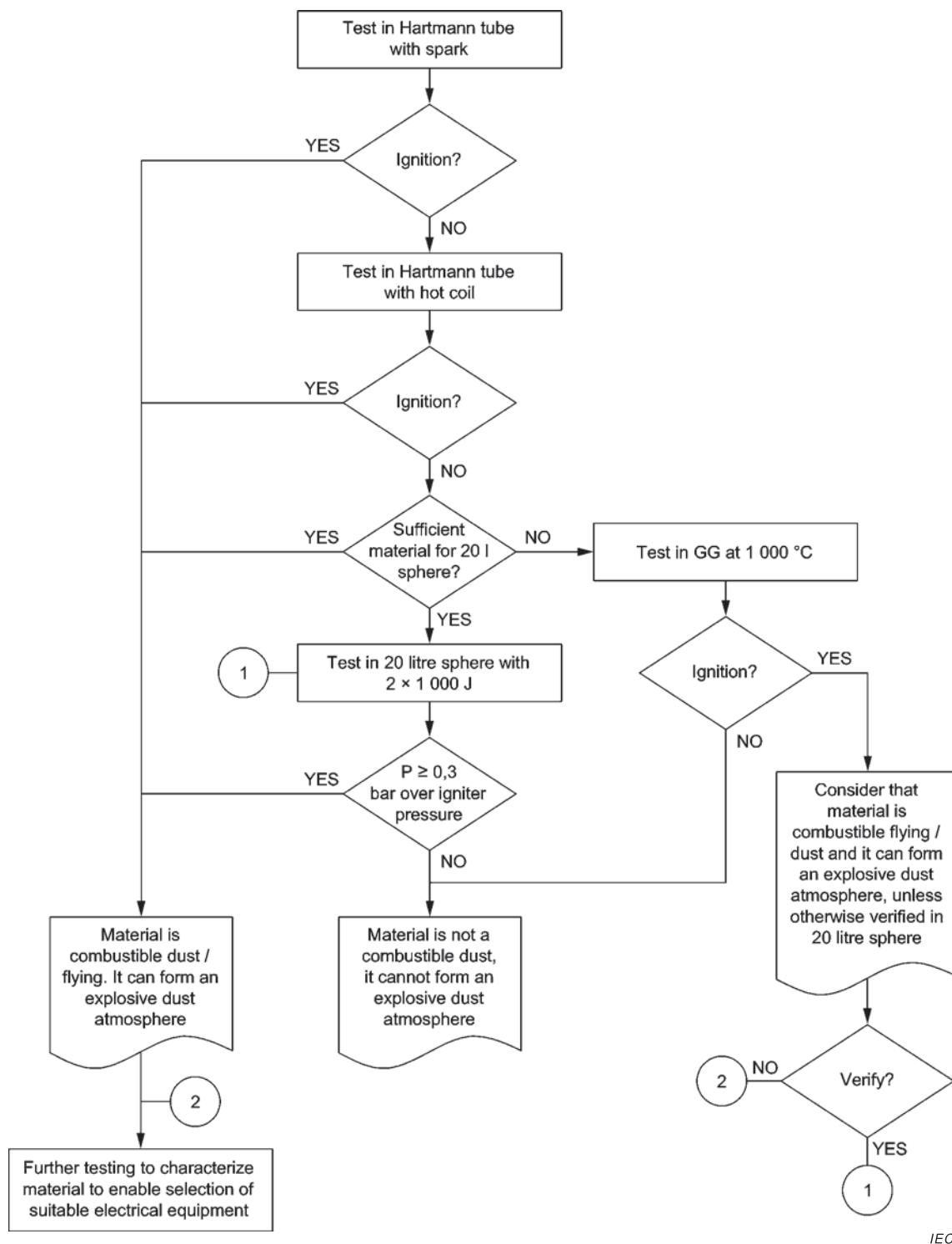


Figure 1 – Protocol for characterisation of combustible dust or combustible flying



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

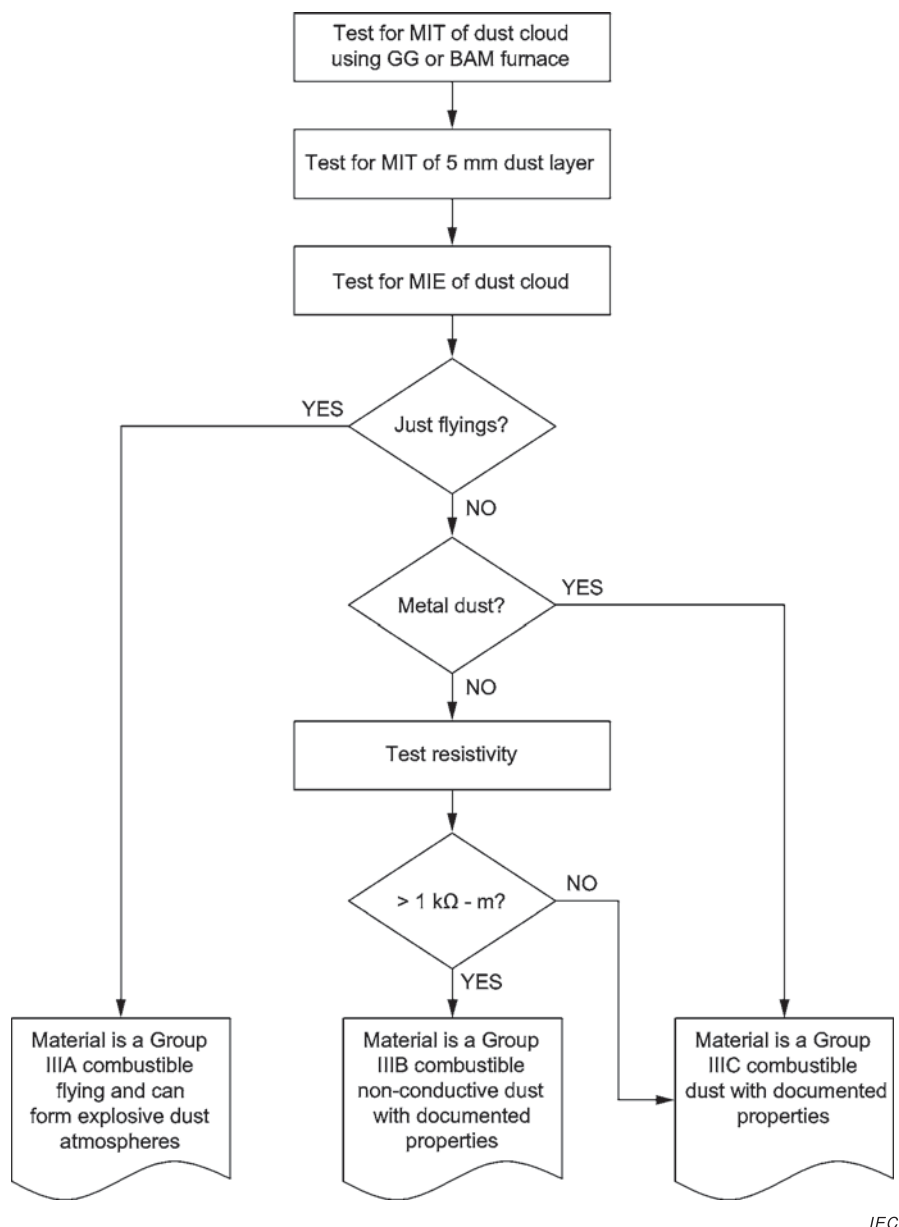


Figure 3 – Tests to characterise combustible dust or combustible flying

7 Test methods for determination of whether a material is a combustible dust or a combustible flying

7.1 Modified Hartmann tube

7.1.1 General

Dust is dispersed in a tube to form a dust cloud, and ignition trials are attempted with two different ignition sources.

7.1.2 Test equipment

The test equipment consists of a vertical tube closed at the bottom with a dispersion cup (volume approximately 1,2 l, internal diameter (70 ± 5) mm).

As ignition sources