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Designation: ~~E1226 – 12~~ E1226 – 12a

Standard Test Method for Explosibility of Dust Clouds[1]

This standard is issued under the fixed designation E1226; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Particulate solids of combustible materials present a significant risk of dust explosion if suspended in air and subjected to an ignition source. The methods of this standard can be used to determine if a dispersed dust cloud is "explosible" and, if so, to what degree it is explosible, that is, its "explosibility." Knowledge that a dust may be explosible if dispersed as a dust cloud is important in the conduct of a process hazard safety review. Contained herein is an explosibility or go/no-go screening test procedure for the purpose of determining whether a dust sample is explosible.

If a dust is explosible, the explosibility parameters, maximum explosion pressure, P_{max}; maximum rate of pressure rise, $(dP/dt)_{max}$; and explosibility index, K_{St}, are useful in the design of explosion prevention and control measures as described in national (NFPA) and international (ISO, CEN and others) explosion protection standards.

1. Scope

1.1 Purpose. The purpose of this test method is to provide standard test methods for characterizing the "explosibility" of dust clouds in two ways, first by determining if a dust is "explosible," meaning a cloud of dust dispersed in air is capable of propagating a deflagration, which could cause a flash fire or explosion; or, if explosible, determining the degree of "explosibility," meaning the potential explosion hazard of a dust cloud as characterized by the dust explosibility parameters, maximum explosion pressure, P_{max} ; maximum rate of pressure rise, $(dP/dt)_{max}$; and explosibility index, K_{St}.

1.2 Limitations. Results obtained by the application of the methods of this standard pertain only to certain combustion characteristics of dispersed dust clouds. No inference should be drawn from such results relating to the combustion characteristics of dusts in other forms or conditions (for example, ignition temperature or spark ignition energy of dust clouds, ignition properties of dust layers on hot surfaces, ignition of bulk dust in heated environments, etc.)

1.3 Use. It is intended that results obtained by application of this test be used as elements of an explosion risk assessment that takes into account other pertinent risk factors; and in the specification of explosion prevention systems (see, for example NFPA 68, NFPA 69, and NFPA 654) when used in conjunction with approved or recognized design methods by those skilled in the art.

NOTE 1—Historically, the evaluation of the deflagration parameters of maximum pressure and maximum rate of pressure rise has been performed using a 1.2-L Hartmann Apparatus. Test Method E789, which describes this method, has been withdrawn. The use of data obtained from the test method in the design of explosion protection systems is not recommended.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:[2]

D3173 Test Method for Moisture in the Analysis Sample of Coal and Coke

[1] This test method is under the jurisdiction of ASTM Committee E27 on Hazard Potential of Chemicals and is the direct responsibility of Subcommittee E27.05 on Explosibility and Ignitability of Dust Clouds.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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D3175 Test Method for Volatile Matter in the Analysis Sample of Coal and Coke
E789 Test Method for Dust Explosions in a 1.2-Litre Closed Cylindrical Vessel (Withdrawn 2007)[3]
E1445 Terminology Relating to Hazard Potential of Chemicals
E1515 Test Method for Minimum Explosible Concentration of Combustible Dusts

2.2 *NFPA Publication:*[4]
NFPA 68 Standard on Explosion Protection By Deflagration Venting
NFPA 69 Standard on Explosion Prevention Systems
NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

2.3 *VDI Standard:*
VDI-3673 Pressure Release of Dust Explosions[5]

2.4 *ISO Standard:*
ISO 6184/1 Explosion Protection Systems, Part 1, Determination of Explosion Indices of Combustible Dusts in Air[6]

3. Terminology

3.1 For determination of terms relating to hazard potential of chemicals see Terminology E1445.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 P_{ex}—the maximum pressure rise (above the pressure in the vessel at the time of ignition) produced during the course of a single deflagration test (see Fig. 1).

3.2.2 P_m—maximum pressure rise produced during the course of a single deflagration test that is corrected for the effects of ignitor pressure and cooling in the 20-L vessel (see Sections X1.8 and X1.9).

3.2.3 $P_{ex,a}$—the maximum absolute pressure produced during the course of a single deflagration test, n – $P_{ex,a} = P_{ex} + P_{ignition}$.

3.2.4 P_{max}—the maximum pressure rise (above pressure in the vessel at the time of ignition) reached during the course of a deflagration for the optimum concentration of the dust tested. P_{max} is determined by a series of tests over a large range of concentrations (see Fig. 2). It is reported in bar.

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[3] The last approved version of this historical standard is referenced on www.astm.org.
[4] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.
[5] Available from Beuth Verlag, D-1000 Berlin, Federal Republic of Germany or American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[6] Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch. or from Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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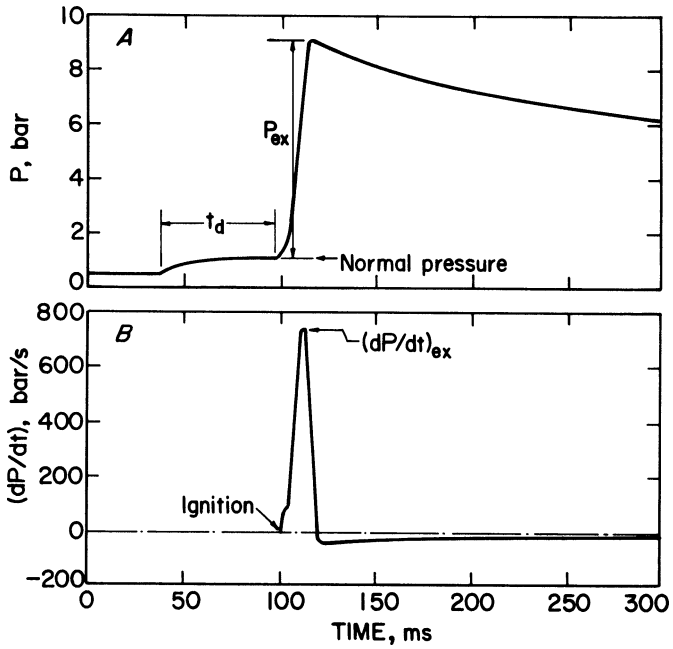

FIG. 1 Typical Recorder Tracings of Absolute Pressure, *P*, and Rate of Pressure Rise, *dP/dt*, for a Dust Deflagration in a 20-L Chamber

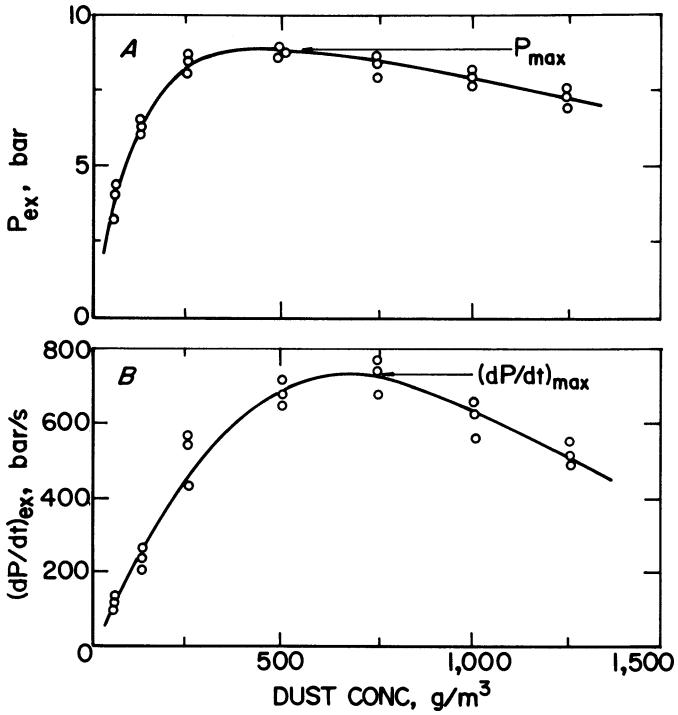

FIG. 2 P_{max} and $(dP/dt)_{max}$ as a Function of Concentration for a Typical Dust in a 20-L Chamber

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