

# Determination of the maximum explosion pressure and the maximum rate of pressure rise of gases and vapours —

## Part 1: Determination of the maximum explosion pressure

The European Standard EN 13673-1:2003 has the status of a British Standard

ICS 13.230; 75.160.30

National foreword

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English version

Determination of the maximum explosion pressure and the  
maximum rate of pressure rise of gases and vapours - Part 1:  
Determination of the maximum explosion pressure

Détermination de la pression maximale d'explosion et de la  
vitesse maximale de montée en pression des gaz et  
vapeurs - Partie 1: Détermination de la pression maximale  
d'explosion

Verfahren zur Bestimmung des maximalen  
Explosionsdruckes und des maximalen zeitlichen  
Druckanstieges für Gase und Dämpfe - Teil 1:  
Bestimmungsverfahren für den maximalen Explosionsdruck

This European Standard was approved by CEN on 2 January 2003.

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## Foreword

This document (EN 13673-1:2003) has been prepared by Technical Committee CEN /TC 305, "Potentially explosive atmospheres - Explosion prevention and protection", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA which is an integral part of this document.

Annexes B, C and D are informative.

Annex A is normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

This European Standard describes a test method for the determination of the explosion pressure and the maximum explosion pressure of a flammable gas/air/inert mixture at ambient temperature and pressure.

Explosion pressures and maximum explosion pressures are used in the design of explosion protection techniques, such as explosion resistant and explosion shock resistant construction. These are particularly influenced by :

- ¾ size and shape of the vessel;
- ¾ type and energy of the ignition source;
- ¾ temperature and pressure.

So it is important that they are measured at standardised conditions.

## 1 Scope

The standard test method is designed to produce measurement of the explosion pressure and the maximum explosion pressure of a quiescent flammable gas/air/ inert mixture in an empty closed volume at ambient temperature and pressure. In this European Standard the term “gas” includes vapours, but not mists.

This European Standard does not consider mixtures that contain an increased content of oxygen; or mixtures that will react spontaneously at ambient temperature and pressure. Detonation and decomposition phenomena are not considered in this European Standard.

The pressures measured by the procedures specified in this European Standard are not applicable to flameproof enclosures, that is enclosures intended to withstand an internal explosion and not to transmit it to an external explosive atmosphere, or any other closed volume where the internal geometry can result in pressure piling. Even in an enclosure of relatively simple geometry the disposition of the internal components can lead to explosion pressures significantly higher than those measured using this European Standard. Flameproof enclosures should be constructed and tested in accordance with the requirements contained in EN 50018 for electrical equipment and prEN 13463-3 for non-electrical equipment.

## 2 Terms and definitions

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

### 2.1

#### **explosion pressure, $P_{ex}$**

highest pressure occurring in a closed vessel during the explosion of a specific mixture of flammable gases with air or air and inert gases determined under specified test conditions

### 2.2

#### **maximum explosion pressure, $P_{max}$**

maximum value measured in the tests for explosion pressure when the content of the flammable gas in the mixture is varied

NOTE For the purpose of this European Standard, all pressures are expressed in bar absolute.

## 3 Test method

### 3.1 Principle

An explosive test mixture is ignited by a defined ignition source which is positioned in the centre of a test vessel. By means of a pressure measuring system, the highest pressure  $P_{ex}$  developed following the ignition of the test mixture is measured.

The maximum explosion pressure  $P_{max}$  is determined during measurements of the explosion pressure  $P_{ex}$  by varying stepwise the content of flammable gas in the mixture, until the maximum value of  $P_{ex}$  is found.

### 3.2 Apparatus

#### 3.2.1 General

The test apparatus consists of :

- ¾ a test vessel;
- ¾ equipment for preparing the test mixture;
- ¾ an ignition system;
- ¾ a pressure measuring system;

- ¾ a temperature measuring device;
- ¾ safety equipment.

### 3.2.2 Test vessel

The test vessel shall be spherical or cylindrical. The internal volume of the test vessel shall be equal to or greater than 0,005 m<sup>3</sup>. If a cylindrical vessel is used, the length to diameter ratio shall be equal to 1.

The test vessel and any equipment (valves, igniter, transducer,...) fitted on the vessel shall be designed to withstand a maximum pressure of at least 20 bar.

The vessel shall be made of stainless steel or any material free of any catalytic effects and resistant to corrosion from the initial gas mixture and the products of combustion.

The test vessel shall be fitted with sufficient ports to allow filling, evacuating and purging.

### 3.2.3 Equipment for preparing the test mixture

The test mixture can be prepared by a partial pressure method or mixing together flows of the component substances. This can be done in the test vessel or outside.

If the test mixture is prepared by a partial pressure method, the vessel used for the preparation of the mixture shall be fitted with :

- ¾ a vacuum pump and a vacuum gauge;
- ¾ pressure gauges or manometers;
- ¾ a means of achieving a uniform test mixture (e.g. a stirrer).

If the test mixture is prepared by mixing flows, the necessary components are :

- ¾ flow meters (mass or volume flow meters);
- ¾ a means of achieving a uniform test mixture (e.g. mixing chamber);
- ¾ an evaporator if liquid samples are used (see annex C for an example).

The equipment for preparing the test mixture has to be designed in such a way that the flammable gas content in the test mixture is measured with a maximum uncertainty of measurement of 10 % relative for a flammable gas content up to 2 % mol or 0,2 % absolute for a flammable gas content above 2 % mol.

### 3.2.4 Ignition system

#### 3.2.4.1 General

The igniter shall be positioned in the centre of the test vessel. Recommended ignition systems are the induction spark and the fusing wire. The test report shall state which ignition source was used.

For some special mixtures it may be necessary to use a different ignition system in order to achieve ignition of the mixture. If an alternative ignition source is used it shall be fully described in the test report. It is also recommended that specialist advice is sought on the interpretation of the results.

#### 3.2.4.2 Induction spark

A series of induction sparks between two electrodes is used as the ignition source.