

CONFIRMED
DECEMBER 2007

Guide to

Smoke measurement units — Their basis and use in smoke opacity test methods

ICS 13.220.40

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- Association of Roof Light Manufacturers
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- British Rigid Urethane Foam Manufacturers' Association
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- Timber Research and Development Association
- UK Steel Association
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This British Standard, having been prepared under the direction of the Health and Environment Sector Board, was published under the authority of the Standards Board and comes into effect on 15 January 1998

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The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Ministry of Defence
- University of Edinburgh
- Warrington Fire Research Centre

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference FSH/21
Draft for comment 95/542183 DC

ISBN 0 580 28955 9

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Foreword

This British Standard has been prepared by Technical Committee FSH/21. Several British and International Standards have been published relating to measurement of smoke by optical methods. Several apparatus and series of units have been used in these publications. This document is intended to describe the origins of the units used in these standards and any relationships between the units.

The recent national work on fire engineering solutions within FSH/24 and the activity within ISO TC/92/SC4 demonstrates the demand for data for use in assessment of fire risk. An integral part of this assessment concerns the propensity of products to produce smoke, and this needs to be assessed from data generated in standard smoke tests. The latter consist of different types of tests measuring different parameters and utilizing different units. There is a need for smoke to be measured and assessed in a standard way such that comparisons of the performance of products can be made. This is not always possible and this guide examines the available data sources and the units used to measure the smoke parameters being assessed.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

Guide

Introduction

Smoke which consists of airborne particulates and aerosols reduces visibility because of light absorption and scattering. This has the potential of impeding victims' escape from fires because low visibility creates difficulties in locating escape routes and seeing escape signs. Visibility depends on many factors [1], but correlations have been established between visibility distances in smoke and the magnitude of the extinction coefficient of the smoke (often expressed as the $\log_{10}$ analogue i.e. optical density per unit light path length) [2]. Two relationships determined by Jin are shown in Figure 1 [3].

The production of smoke and its optical properties may be measured in stand-alone tests or simultaneously with other fire properties. The former tests are usually small scale where the smoke produced is held in the chamber in which it is generated. The latter (with the notable exception of the cone calorimeter) are commonly large scale and are usually dynamic tests where the smoke is ducted away from the zone of generation. Smoke measurements made in one test may be expressed in the same units as those from another test or they may be related mathematically. Extreme care should be used when comparing results from different tests and the analyst should examine the decomposition models used in the tests as well as the parameters being measured before comparing results from different methods.

Measurements quoted using the same units may refer to very different parameters which cannot be directly compared.

The same parameter measured using the same units in different test methods may show differences in results arising from different smoke propensities of the product or differences in the decomposition methods used in the two tests.

An understanding of smoke measurement units is essential when attempting to predict full scale experimental results from small scale tests results.

1 Scope

This British Standard describes the theory of optical measurement of smoke. It describes the different parameters measured, gives examples of the commonly used units, and describes relationships between different parameters. It also reviews some commonly used optical test methods for smoke measurement.

2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.