

Specification for

Apparatus for physical methods of gas analysis —

Part 1: Infra-red gas analysers for
industrial use

Co-operating organizations

The Solid Fuel Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial, organizations:

Association of Boiler Setters, Chimney and Furnace Constructors	Gas Council*
Association of Consulting Engineers	Heating and Ventilating Contractors Association
British Cast Iron Research Association	Imperial Chemical Industries Limited
British Coal Utilisation Research Association*	Institute of British Foundrymen
British Coke Research Association*	Institute of Fuel*
British Electrical and Allied Manufacturers’ Association	Institution of Gas Engineers*
British Ironfounders’ Association	Institution of Heating and Ventilating Engineers
British Mechanical Engineering Federation	Institution of Mechanical Engineers
British Steel Industry*	Iron and Steel Institute
Chamber of Coal Traders	Low Temperature Coal Distiller’s Association of Great Britain Ltd.
Chemical Industries Association*	Ministry of Housing and Local Government*
Coal Utilization Council	Ministry of Power*
Coke Oven Managers’ Association	Ministry of Public Building and Works
Combustion Engineering Association	National Coal Board*
Confederation of British Industry	Society of British Gas Industries*
Council of Ironfoundry Associations	Water-tube Boilermakers’ Association*
Domestic Solid Fuel Appliances Approval Council	Women’s Advisory Council on Solid Fuel
Electricity Council, the Central Electricity Generating Board and Area Boards in England and Wales*	

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Association of British Chemical Manufacturers	Institution of Civil Engineers
British Ceramic Research Association	Institution of Electrical Engineers
British Laboratory Ware Association	Scientific Instrument Manufacturers’ Association
British Scientific Instrument Research Association	Society for Analytical Chemistry
Institute of Petroleum	Society of Chemical Industry
Institute of Sewage Purification	Society of Glass Technology
Institution of Chemical Engineers	

This British Standard, having been approved by the Solid Fuel Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 19 September 1968

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The following BSI references relate to the work on this standard:
Committee references SFE/17,
SFE/17/7
Draft for comment D65/5832

ISBN 580 00298 5

Amendments issued since publication

Amd. No.	Date	Comments

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Foreword

This standard makes reference to the following British Standards:

BS 229, *Flameproof enclosure of electrical apparatus*.

BS 816, *Requirements for electrical appliances and accessories*.

BS 1756, *Methods for the sampling and analysis of flue gases — Part 1: Methods of sampling*.

BS 2643, *Glossary of terms relating to the performance of measuring instruments*.

BS, *Standard gas mixtures*¹⁾.

This British Standard defines criteria which may be used both to express the performance of infra-red gas analysers for inline or process use and to permit the performance of available analysers to be compared on a uniform basis, thus allowing a suitable analyser to be selected to fulfil a given set of requirements.

In assessing the suitability of an instrument for giving reliable information about a process, the user requires information about functional and constructional characteristics of the instrument.

The functional characteristics are those expressing the ability of the instrument to provide the required information and may be listed as:

- Range
- Response time
- Sensitivity
- Discrimination
- Stability
- Reproducibility
- Accuracy

The constructional characteristics are those expressing the ability of the instrument to continue to provide its specified performance under process conditions and may be listed as:

- Safety
- Suitability for proposed environment
- Sample handling ability
- Frequency and ease of maintenance
- Frequency and ease of checking and calibration

In this standard, definitions in general use are listed in Clause 2, the measurement of functional characteristics is described in Clause 3 and the assessment of constructional characteristics is dealt with in Clause 4. Appendices deal with sensitivity and discrimination, with various aspects of the construction and use of these analysers and with the types of analyser in general use.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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 13 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In course of preparation.

1 Scope

This British Standard specifies the functional and constructional characteristics of infra-red gas analysers for industrial use and makes recommendations on their selection for particular applications.

2 Definitions

For the purposes of this British Standard the definitions in BS 2643²⁾ apply, with the following additions and modifications:

2.1 General definitions

No.	Term	Definition
2101	radiation	Electromagnetic energy arbitrarily defined as ranging from 5 nm to 1 μm . Conventionally, the range is divided into three intervals: 1. Ultra-violet region. Wavelength range 5–380 nm (250–3.2 eV). 2. Visible region. Wavelength range 380–760 nm (3.2–1.6 eV). 3. Infra-red region. Wavelength range 760 nm–1 μm (1.6–1.2 eV).
2102	absorption	The process by which radiation passing through a medium is progressively reduced in intensity.
2103	condensation of radiation	The process by which radiation is concentrated, e.g. by means of a lens.
2104	absorption band	A wavelength range in a spectrum within which absorption is caused by a particular medium.
2105	band broadening	An increase in width of the absorption bands of a gas due to the influence of pressure, either of the absorbing medium or of another medium mixed with it.
2106	dispersion	The process (or effect) of dividing a beam of radiation into its spectral components, e.g. by a prism.
2107	electronic transition	Transfer of electrons within an atom or molecule resulting in the absorption or emission of radiation.
2108	dipole	Electrical asymmetry in a molecule which allows it to absorb radiation.
2109	optically inert gas	A gas that shows no absorption at the wavelength of interest.
2110	spectral range SPECTRAL INTERVAL	A portion of a radiation spectrum defined by the range of wavelengths it contains.
2111	spectral resolving power	The capacity of an instrument to separate closely adjacent wavelengths of radiation.
2112	adsorption	A physico-chemical process by which constituents may be transferred from fluid streams to the surface of a solid.

²⁾ BS 2643, "Glossary of terms relating to the performance of measuring instruments".

2.2 Definitions relating to instruments

No.	Term	Definition
2201	monochromator	An optical system designed to isolate a beam of radiation containing only a very small range of wavelengths, by dispersion of a beam containing a large range.
2202	optical attenuator	A shutter or filter used to reduce the intensity of a beam of radiation without affecting the spectral distribution of the radiant energy.
2203	double-beam	An optical system in which measurement of the absorption of a beam of radiation is effected by comparison of the attenuated beam with a reference beam from the same source.
2204	null-balance	An optical system in which the reference beam of a double-beam instrument is attenuated to match the attenuation of the beam passing through the sample.
2205	chopping MODULATION	A process of interrupting a beam of radiation to produce an alternating output from a detector.
2206	amplifier gain	The ratio of the output signal from an amplifier to the input signal.

2.3 Definitions relating to characteristics

2301	sensitivity	The sensitivity of an instrument at any indicated value is the relation between the movement of the index and the change in the measured quantity that produces it; preferably expressed, at low concentrations, by the tangent of the slope of the calibration curve (see Appendix A).
2302	discrimination	The discrimination of an instrument at any indicated value is the smallest increment in the quantity measured which produces a statistically significant change in the position of the index; preferably represented graphically (see Appendix A).
2303	response time SETTLING TIME	The time taken for the index of an instrument to attain, and remain within, a specified deviation from its final value, after an abrupt change in the measured quantity (includes 2304).
2304	distance/velocity lag	The time taken for the transfer of a sample from the inlet of an instrument to the measuring point.
2305	stabilizing time	The time taken from switching on an instrument to the achievement of a stable reading.
2306	repeatability	A quantitative measure of the variability of an instrument when identical tests are carried out by a single operator in a given laboratory with the same apparatus at the minimum interval consistent with the response time of the instrument.
2307	reproducibility	A quantitative measure of the repeatability associated with operators working in different laboratories, each obtaining single (or duplicate) results and carrying out identical tests.
2308	stability	The repeatability of an instrument when identical tests are carried out at intervals of time which are long compared with the response time and the time required for taking a reading.
2309	drift	The variability of the reading of an instrument over a period of time, when the quantity to be measured is presented continuously, all other conditions remaining unchanged.