

Incinerators —

Part 4: Code of practice for the design, specification, installation and commissioning of incineration plant for the destruction of hospital waste

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- Department of Health and Social Security
- Electrical Installation Equipment Manufacturers Association (BEAMA Ltd.)
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- Institute of Wastes Management
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Foreword

This Part of BS 3316 has been prepared under the direction of the Building Services Standards Committee.

The revision of BS 3316:1973 is published in four Parts in an attempt to highlight the interfaces involved in the successful specification and the design of incineration plant. BS 3316-1 to BS 3316-4 collectively supersede BS 3316:1973 which is withdrawn.

Part 1 specifies the standard performance requirements which have to be met by an incinerator, and which can be verified by testing the incinerator in accordance with the methods of test and calculation given in Part 2.

Part 2 details a comprehensive range of tests, so that testing can be performed according to the size, complexity and intended purpose of an incinerator installation. Only for large and complex installations will the full range of test methods need to be applied.

Part 3 identifies the information which should be supplied by the purchaser to the manufacturer, and the form in which this information should be presented. This information should include a requirement that the incinerator, when set to work, should meet the standard performance requirements given in Part 1.

The figures on bulk densities given in the previous edition are not included because they were found to be misleading. Hospital waste varies considerably in density between hospitals and throughout each day. The designer of the incinerator has to take that variability into account. If and when research takes place which provides useful figures on bulk density, these will be incorporated into the standard.

This Part gives guidance to both purchaser and manufacturer on the options which have to be identified and the methods of achieving certain specified requirements in a manner that will satisfy the standard performance requirements specified in Part 1. Part 4 also gives important guidance on matters such as operational training, maintenance and safety measures.

The testing of incineration plant, after the completion of installation and of setting to work, is essential to establish that the specified performance criteria are achieved in any given installation.

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 16, an inside back cover 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.

Section 1. General

0 Introduction

It is accepted that incinerators and incineration systems are designed to meet the specific needs of the purchaser and the local requirements such as the positioning of the incinerator. Standards are generally presented as descriptive or performance specifications which lay down the characteristics of a product in terms of its size, shape, materials, etc., or in terms of the function it has to perform defined by methods of test for each appropriate parameter. However, it is accepted that incineration plant do not lend themselves to either of these approaches or a combination of these approaches within one document. An incineration plant cannot be appraised satisfactorily except in its working environment and when burning the hospital waste for which it is designed. Therefore the revision of BS 3316:1973 has attempted to make a clear distinction between the interfaces involved in the successful specification and design of incineration plant.

1 Scope

This Part of BS 3316 gives guidance on the design, specification, installation and commissioning of incineration plant for the destruction of hospital waste. It also gives information on training of staff and maintenance of plant, on collection and transport of hospital waste.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 3316 the definitions given in BS 3316-1 apply.

Section 2. Incineration plant

3 Guide to design and installation of incineration plant

3.1 The incineration plant, with the flue, housing and storage areas¹⁾ associated with it should be sited within the confines of the hospital so as to:

- a) involve as short a distance as possible to those departments from which the greater part of the waste arises;
- b) avoid nuisance due to noise, smoke and smell to patients, staff or the public at large;
- c) be easily accessible to refuse collection vehicles.

It may be convenient to arrange for a shared chimney stack, toilet and outer facilities with a boiler house.

3.2 The facilities needed when installing an incinerator are as follows.

- a) A well-lit and ventilated building of fire resisting construction to house the plant, giving protection to both equipment and operator. There should be sufficient clearance around the equipment to allow access for maintenance and repair. The building should be provided with impervious floor, walls and ceiling, free from dust collection ledges and capable of being effectively hosed down to an external drain. Electrical apparatus should be hose- and drip-proof and easy to clean (see BS 5490).
- b) A covered area to the same standard of construction as the plant building, with all necessary services for the cleaning, disinfection and storage of bins, bags or other containers of waste.
- c) Adequately sized supplies of power, water and fuel for the incinerator, with isolation from outside the building in case of fire. Adequate water and drainage for hosing down of floors.
- d) Facilities for the plant operator [e.g. hand basin(s), clothes locker(s)] should be provided in accordance with statutory regulations and their positioning should be related to the siting of the incineration plant or plant house. Access to showers and toilets should also be provided.

3.3 Free air inlets should be provided for combustion air supply. Additional ventilation air may be necessary for satisfactory environmental conditions. In certain conditions where mechanical ventilation is necessary it should be suitable for combustion and environmental conditions.

4 Flue and chimney

4.1 Flue arrangements

The incinerator flue should avoid the use of sharp bends or pockets in the run of the flue. Adequate access for cleaning should be provided.

Incinerator flues should never be connected into flues for other fuel burning equipment. They should be correctly located and of sufficient height to conform to the requirements of the Clean Air Acts and of the local authority to ensure that no down wash will carry products of combustion into the hospital or nearby buildings. Any necessary authorization should be obtained by the specifier/purchaser, based on design information where appropriate.

4.2 Isolating damper

Where two or more incinerators are connected to one flue, each incinerator should be provided with an isolating damper (see BS 5885), locked open when the incinerator is in use. A damper, when shut, should safely isolate the incinerator from the flue to which it is connected.

4.3 Chimneys and flue system designed by incinerator manufacturer

4.3.1 The incinerator manufacturer should select the materials of construction to suit the design and operating conditions of the incinerator and prevent the overheating of any metal flue by diluting the flue gases with air to ensure the flue gas temperature does not exceed 400 °C.

4.3.2 Any limitation of use and any protective equipment (e.g. temperature alarm) not already specified by the purchaser in accordance with BS 3316-3, together with maintenance/inspection requirements, should be identified by the manufacturer.

4.3.3 The installation should comply with the requirements, as appropriate, of the local environmental regulations (e.g. planning approvals, chimney height and efflux velocity), together with the correct engineering practice for flue systems operating at the temperature levels involved. Considerations should include the requirements of chimney construction, fire regulations, thermal expansion and contraction, and provision for inspection, cleaning and testing.

¹⁾ See BS 5906.

4.4 Guidance on types of chimney/flue systems

4.4.1 There are three types of chimney/flue systems which could be involved:

- a) chimney mounted directly on to an incinerator;
- b) chimney system mounted elsewhere than on the incinerator, but erected solely for the purpose of exhausting gases from the incinerator;
- c) use of an existing chimney/duct system for exhausting gases from the incinerator.

4.4.2 For cases a) and b), the incinerator manufacturer is considered to have the necessary information with which to ensure that the total installation can be carried out successfully and satisfactorily.

In those cases where chimneys are mounted directly on top of incinerators, it can be economic to utilize a chimney design in which the working lifetime of the chimney can be less than that of the incinerator.

In these circumstances the manufacturer should make known the necessary information in offering the equipment and in the operating/maintenance instructions.

In most cases of chimney construction there will be other factors which determine the construction and working lifetime.

4.4.3 Where an existing chimney/flue system is to be used for a new incinerator, it is necessary to examine carefully the circumstances of use, for both incinerator and chimney, to ensure mutual suitability. The information required of the existing chimney includes:

- a) materials of construction;
- b) maximum working temperature;
- c) dimensions;
- d) any limitations imposed by the construction on:
 - 1) gas pressure related to atmospheric pressure within the chimney;
 - 2) the transmission of stress loads due to expansion and contraction;
 - 3) rate of temperature change.

4.4.4 When the chimney is not mounted directly on top of the incinerator the gas temperatures should be controlled before the flue gases can enter the chimney section itself.

5 Amount of recoverable heat

5.1 General

The quantities of heat that will be recovered will vary with the circumstances of the application, the design of the heat exchanger and the heat load.

The sizing of gas handling equipment is done using peak values of thermal and gas throughputs in order that the system capacity will be adequate. A similar procedure is needed for heat output calculation, noting that the uncertainty of fuel heat content and of fuel throughput obliges considerable design margins to be adopted.

For a worked example see Appendix A.

The thermal efficiency of heat recovery should be stated in one of the following ways:

a) *Heat exchanger efficiency*: the heat recovered expressed as a percentage of the total heat of the gases entering the heat exchanger.

b) *Design nett efficiency*: the design heat recovery expressed as a percentage of the design nett thermal input.

NOTE 1 If the fuel calorific value is taken as the gross calorific value the efficiency will then be the design gross efficiency.

c) *Tested efficiency*: the measured heat recovered expressed as a percentage of the measured heat released by incineration.

NOTE 2 The measured heat released by incineration is the sum of measured heat emission from equipment surfaces, measured heat content in waste gases and measured heat output from the heat recovery unit. That is, the heat released by incineration can only be obtained inferentially in the case of hospital waste.

NOTE 3 The "tested efficiency" is that obtained during a controlled test on a specified product and requires a number of skilled personnel for its execution.

d) *Achieved efficiency*: the perceived operating efficiency of the installation.

NOTE 4 This quantity contains disturbances due to operational discontinuities and also contains a number of assumptions that a given quantity (such as waste quantity and calorific value) remains constant, so that calculations can be performed based on heat output and auxiliary fuel input meter readings only.

In practice, the achieved efficiency will be the one upon which financial savings are realized and the tested efficiency is that which can be obtained in the course of performance assessment and would form a suitable acceptance criterion at the time of performance measurement.

It is recommended that at the time of tendering for waste heat recovery equipment, a clear statement is made of which of the criteria of efficiency a) to d) is to be used.

5.2 Economic size of plant

The preparation of a cost analysis record is recommended in each case owing to the wide variety of applications and physical considerations of size of incinerator and practical difficulties within a given proposed installation.

When it is intended to recover the maximum possible heat, an economically viable installation should burn in excess of 100 kg/h of hospital waste.