The Journal of the Institute of Hospital Engineering November 1983

HOSPITAL ENGINEERING

■ Special waste disposal issue

HOSPITAL ENGINEERING is published ten times a year by Tully Goad Vinall. In January and July the HOSPITAL ENGINEERING Newsletter is circulated to Institute Members only.

Individual copies cost
£3.25 UK postage paid

The Annual Subscription is UK: £28.50 Overseas: £35.00 USA: $55 Canada: $67

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UK ISSN 0309-7498

Photoset by Hive Photosetting

Printed by Marsan Printing Company, London SE14 6EB

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HOSPITAL ENGINEERING

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Volume 37 No 9 November 1983

Front cover: Hospital waste being loaded into an automatic loader of an incinerator located at Leicester General Hospital

OPINION
Ignorance can be taxing

The Englishman has a hackneyed reputation for turning to the weather as a topic of conversation to break that awkward silence. The motive may be that one does not need to be knowledgeable of the science of atmosphere to have an opinion. In recent months the 'chart-topping' discussion topic seems to have changed to that of the health service. Here again, you don't have to be knowledgeable about the workings of the service to have an opinion. Unfortunately those whom one would expect to be knowledgeable seem to lack appreciation of existing practices.

Take for instance the subject of privatisation which is just one of the emotive topics being discussed at the moment. This journal is the wrong place in which to argue for or against, but it should be recognised that, within the Works discipline, the use of the private sector is nothing new, for instance building and engineering contractors, specialist maintenance contractors, design consultants and quantity surveyors, to name but a few. Their appointment is necessary as it would not make economic sense to have on our staff establishment specialists and trades staff who could only be usefully employed for part of the time. In other words, the everyday workload is taken care of by directly employed staff and the specialist work and 'peaks' in work load contracted out to the private sector.

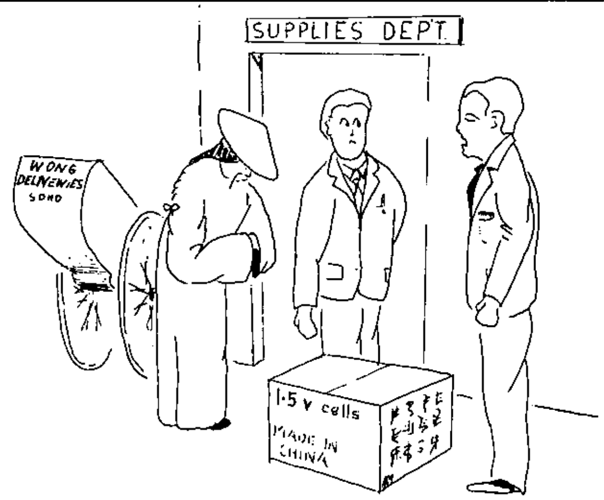
Yet, as an incentive to consider privatisation as though it were something new, a recent Health Circular advises that the Government is making arrangements for refunding VAT, which hitherto has had to be paid, for services rendered by private contractors. The Circular ends by asking health authorities to continue to develop the use of private contractors for the whole range of support services. Works have over many years and out of economic necessity developed to a fine art the use of private contractors without the opportunity to reclaim VAT for those services which are rated. If it is possible now for the rules that appertain to reclaiming VAT to be modified, one asks the question, why this has not been done before? To me it seems a lost opportunity for the health service, over the years, to save vast sums of revenue money paid out in non-reclaimable VAT.

The workings of the service are so complex that it is little wonder that people, even employees within the service, are not too familiar with the various functions and interactions between disciplines. As a Works Officer, I can forgive the frustrated nurse who calls me to report a dripping tap or the local resident who telephones me to report a plague of ants in her kitchen at home when she really wants the Local Authority Environmental Health Department. How can we get across to the users the detailed workings of the different functions that make a hospital work?

The TV series 'Emergency Ward 10' and 'Angels' did nothing to enlighten the public on the behind-the-scenes working of a hospital. The public easily identify with the doctor and nurse team but recently, it looked as though the record was to be put straight by the screening of TV Channel 4 series 'The Nation's Health'. Alas, up until now it seems a great opportunity has been missed. True, it does mention the DMT (District Management Team) and the District Administrator but whereas in a Western you knew who the sheriff was by his badge and the 'baddie' by his mean looks and unlawful deeds, the non-medical characters are so anonymous and seem to be portrayed as an obstacle to the service offered to the patient.

The TV series 'Hospital' came the nearest to portraying the function (and frustration) of each discipline in a typical District, but time allowed only a brief encounter with the various disciplines, albeit those who knew the Area Engineer recognised him walking down the corridor.

For the sake of those employed within the service and especially the public, isn't it time someone tapped the resources of inspiration provided by the workings of hospital and District administration? If the relationships and workings of the various departments that beaver away so anonymously to make comprehensive health care function were factually and accurately portrayed there should be enough drama for a whole series!



"NO!, I ASKED FOR COOLER BATTERIES"

Institute News

Annual Subscriptions

Following a careful review of the Institute's annual Income and Expenditure Council is obliged to increase rates of annual subscription as from 1st January next (subscription rates have been held steady for two years) in all prudence and to properly safeguard the Institute's finances.

Council is delighted that the Institute had become a nominated body to the New Engineering Council but points out that the consequential financial commitment will be very substantially greater than that which stemmed from the relationship with CEI.

The new rates of annual subscription will be:-

Fellow	£30
Member	£23
Graduate	£16
Students	£5
Associates	£30
Affiliates	£50
Retired Members	£7.

Council agreed to leave the rate of Students unchanged to encourage membership.

Members are reminded that they are entitled to full tax relief on annual subscriptions to this Institute. When claiming relief members should quote Inland Revenue letter of 5.10.70 reference CI/Sub/1687.

From the branches

The North Western Branch held its first meeting of the 1983/84 season on Wednesday 28th September at Astley Hospital, Leigh, when Mr D. Unsworth, the Director of Technical Services, NCB Western Area, gave a paper on **The latest developments in Coal Fired Boiler Plant.**

Mr Unsworth's talk included descriptions of various types of coal storage and coal conveyancing plant, followed by firing techniques, stokers and fuel delivery equipment and finally, the removal and handling of ash. The talk was well illustrated and followed by a very good discussion.

The meeting was well attended, the room being filled to capacity by an audience which included many visitors and members from distant parts of the branch area.

Obituary

Mr Robert Brown, a retired Consultant with Hoare Lea & Partners died on 11 October 1983 at the age of 65 years.

He joined Hoare Lea & Partners, Consulting Engineers, at their Plymouth Office in 1958 as a Senior Engineer, and was appointed an Associate in 1966. In 1968 he moved to the Bristol office as a Partner, where he worked until 1974, when he transferred to the Birmingham office.

In 1978 he returned to Bristol and became a Consultant to the partnership, retiring from active involvement with the practice in April of this year. He was a Member of the Association of Consulting Engineers, and a Fellow of the Chartered Institution of Building Services, of the Institution of Hospital Engineers, and of the Faculty of Building.

He was a very active Rotarian, in Plymouth, Birmingham and Bristol, where he served on the Rotary Council for a number of years.

He will be greatly missed by his many friends and colleagues. Mr Brown leaves a widow, Joan, 4 sons and a daughter.

IHEX 84

First-ever exhibition at Annual Conference

16–17 May 1984. Dragonara Hotel, Bristol. Hospital Engineering exhibition held in conjunction with the Annual Conference of The Institute of Hospital Engineering.

Information and further details available from: T. Jarvis (Exhibitions) Ltd, 75 Masons Hill, Bromley, Kent BR2 9HP. Telephone 01-464 4129.

FORTHCOMING BRANCH MEETINGS

Midlands Branch: *Hon Sec. W. Turnbull TN Birmingham (021) 378 2211 ext 3590*

23rd November	Water Supplies and Contingency Planning	Seminar Room 2 Post Graduate Medical Centre Queen Elizabeth Hospital Edgbaston, Birmingham

North Western Branch: *Hon Sec. E. A. Hateley TN Manchester (061) 236 9456 ext 266*

21st November Visit to Dinorwic Power Station.

NEXT MONTH
December International issue

Prevention of Hospital Infection – Prof Eduardo Caetano
Biosafety for Hospital Engineers – Vinson Oviatt
Energy recovery from the burning of hospital waste – Clive Chamberlain
Plus the usual Institute and product news

This paper was presented at the 1983 Annual Conference of The Insitute of Hospital Engineering. Dr Chamberlain is Managing Director of Universal Machinery & Services Limited of Leeds.

Modern approaches to incineration practice

C T CHAMBERLAIN BSc PhD CEng FInstE FIGasE

Introduction

During recent years, there have been many changes in the incineration of hospital waste – brought about by the changes in the waste materials themselves, by the impact of legislation such as the Health & Safety at Work Act and by the diminishing availability of alternative (non-combustion) means of disposal.

This has been recognised by the British Standards Institution and the present standard for 'Large Hospital Incinerators' – BS3316 – has undergone thorough review, resulting in the production of a draft revised Standard. This paper is presented to outline some of the technical reasoning behind the new Standard, especially where changes have been introduced over the older version. The subject matter of the draft Standard is contained in four sections and this paper discusses the guidance section on design, specification and installation/commissioning.

Waste handling at the incinerator

The recent publication of 'The Safe Disposal of Clinical Waste'* sets out suitable means for containment of waste prior to its arrival at the incinerator house, and it is expected that colour-coded bags will soon be in general use. The provision of facilities for *reception, storage and transfer* of waste is related very much to the design of the building and to the quantities of waste which will require to be handled. For a small quantity (say 1 tonne or less), there are unlikely to be serious problems, but the handling of larger quantities such as in large hospitals and centralised 'district' facilities, must be taken seriously. Whilst recognising that there is a cost effectiveness balance in providing suitable facilities, it is nowadays essential to recognise that the prevention of unauthorised access and the provision of safe handling means are matters of obligation rather than choice or good design.

Waste storage

Hospital waste in bags has a bulk density usually about 60-70 kg/m^3 and appreciably lower for cartons and packaging. Additionally, if bags of waste are stored in piles, rather than in the more convenient containers, the requirements of safety in handling dictate that the pile should not exceed about 1.5m in height. From these data, and from the expected waste arising together with the intended period of waste storage capability (say, one day) it is possible to design the storage space required.

Transfer to Incinerator

In installations designed for up to 1 tonne per day of waste, the bags will almost certainly be handled entirely by the incinerator operator and charged manually into the incinerator.

Larger installations will generally be equipped with loading equipment of some kind, and the bags of waste filled into the loader rather than the incinerator proper. In such cases, multiple handling should be avoided and, where possible, the container should be brought up to the loading equipment so that a single transfer of bags can take place. Since the height to the top of such loading equipment can be from 1.0 to 1.7m, it may be useful to consider an elevator conveyor in some cases.

The largest installations – say for

Conveyor elevator to assist filling of loading machine

**The Safe Disposal of Clinical Waste', Health and Safety Executive HMSO (1982)*

5 tonnes/day or more – can hardly be worked satisfactorily using manual transfer. Here, it is more cost-effective to consider direct tipping of containers in to the loading equipment (which might be mounted on the side or the top of the incinerator). In such equipment, a fully automatic discharging system for containers might be integrated with a washing system for cleaning of stained containers.

The combustion of waste

It was recognised at the beginning of the preparation of the revision of BS3316 that, whereas the earlier 1973 document had been concerned with effectively one general type of incinerator (the grate type), there was a need to accommodate not only the wider range of equipment currently available but also those developments of incinerators which might be expected during the 'useful life' of the revised Standard. Accordingly, it was realised that a 'product' type of specification could not be used, and that a *'performance'* specification would be more suitable.

Even thouth there are a number of methods available for the control of incineration, it is still hospital waste that is being destroyed, and some observations on the processes involved are useful. When waste is charged into a hot furnace there begins immediately a process of devolatilisation – the rate of which depends on the furnace temperature, the volatility of the material and the surface area of material exposed to heat at any time, as well as the mode of heat transfer which dominates at that time. When devolatilisation is complete, a char residue remains, and this can only burn by direct oxidation on the solid surface of the char. A simple model is represented in Figure 1.

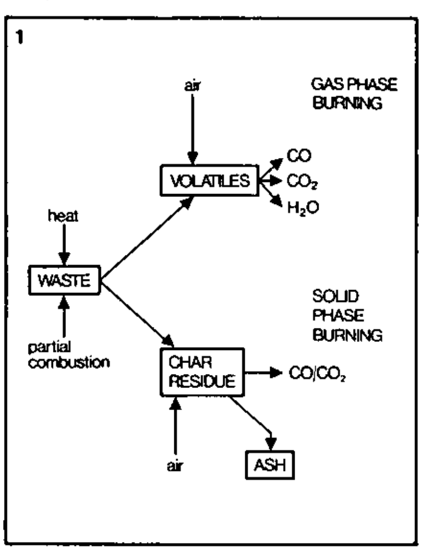


Figure 1 Model of hospital waste combustion

Hospital waste contains many different materials, each of which possess their own characteristic behaviour when charged into the incinerator. So far as the furnace reactions are concerned, there are, broadly, three types of material:

Wet material	dries slowly ... ignites slowly much water vapour
– associated with low temperatures and low rate of heat release.	
Plastic material	volatises readily at low temperatures (very fast if large surface area) most of the material burns in the gas phase
Cellulosic material (paper, cardboard)	produces mainly volatiles but not nearly as fast as plastics – needs higher temperatures

As a general conclusion , most of the common components of hospital waste burn in the gas phase rather than the solid phase. Necessarily, therefore, the arrangement of combustion air must take due account of the devolatilisation behaviour in order to provide the degree of control of combustion which is essential to satisfactory combustion.

In practice, the above simplified concepts are further modified by:

- Effect of quantity charged;
- Effect of changes in waste composition;
- Effect of safety requirements.

Effect of quantity charged

In the context of practical incinerator operation, the model outlined above must be modified to allow for the charging of quite large quantities of waste at a time – usually 'on top' of the burning material from earlier charges.

NOTE: The obvious exception to this is the feeding of shredded waste.

In the majority of incinerator installations, the equivalent to boiler stoking practice – a little and often – can no longer be used on the grounds that it is labour intensive and dangerous.

There are two common methods of feeding of large quantities:

A few times per hour	Charges from 0.5 to $2.0m^3$, depending on the capacity of the incinerator. In this type of feeding, it is necessary for the supply of combustion air to be regulated suitably, and for the temperatures in the burning chambers to be controlled, both in order to obtain satisfactory combustion behaviour and to prevent equipment damage.
Bulk charges	The primary combustion chamber is filled with waste a few times per day. Here, it is necessary for a suitable 'programmed' control to be used, so that different stages of devolatilisation, combustion and cooling can take place under the correct conditions.

Effect of changes in waste composition

From a combustion point of view, the changes in composition from one bag of waste to another introduce further complications, such that the 'correct' quantities of air required change also. Invariably, the rate of devolatilisation also changes at the same time. These two effects combined together are the reason why incineration of this type of waste calls for such ingenuity on the part of designer and user. It is also the reason why there have been devised a number of

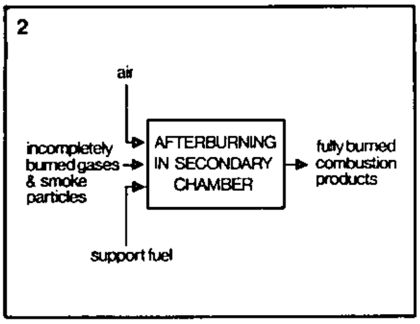


Figure 2 Secondary combustion

apparently different technical solutions to the requirements.

In short, the requirements are for: Control of rate devolatilisation; Flexible burning capability for volatile gases.

The latter calls for some form of *afterburning* in which high temperatures and free oxygen are essential. See Figure 2. The process of afterburning is chemically easy to describe, but physical complications arise from the massive variations in the flow rate and temperature of unburnt gases entering the afterburner section of an incinerator. For these reasons, a support flame is provided as a sure means of ignition of unburnt gases; however, the minimum fuel consumption is essential.

Each combination of primary and secondary combustion chamber has a finite upper limit of smoke-burning capability and the continued operation of an incinerator within those limits requires the control of the waste charged (quantity and, if necessary, 'mix' of waste), the temperatures and the air supplies. There *are* differences in the capability of different incinerators (depending on the dimensioning criteria and the control methods employed) and this capability has to be matched to the intended application.

Effect of safety requirements

Many aspects of safety naturally relate to the *construction* of an incinerator, but a number relate also to the interfaces between the operator and the equipment. Of greatest importance is the need to prevent ACCESS by operators to the charging and ash removal apertures when the conditions inside are either too hot for safety (hand-firing) or deficent in air (flash-back when door opened).

The smallest incinerators tend still to be hand filled either at the working temperature or after a period of time has elapsed since the previous charge – to allow time for volatile components to escape. The quantities of waste to be handled are also quite small and it is considered reasonable to expect operators to wear adequate protective clothing for the short periods of time when loading is actually taking place.

Those incinerators which are 'bulk-loaded' are also hand-filled (except for the largest versions), but at much lower temperatures, such that ignition of the fresh charge of waste does not normally take place during charging. There has been much discussion of what temperature can be regarded as safe in these circumstances and in the author's experience reloading should not take place much above 200°C except for small ovens which can be re-filled in a short time.

Many incinerators now have automatic loading and combustion control ranging from quite simple systems to complex control analogues. In these types of equipment, the powerful mechanical devices used to transfer waste into the incinerator have their own maintenance and safety requirements; there are also those additional factors with automatic plant which involve the possible modes in which they can 'fail' during operation. By far the biggest requirement is for the provision of safe routines to be followed in normal and abnormal circumstances.

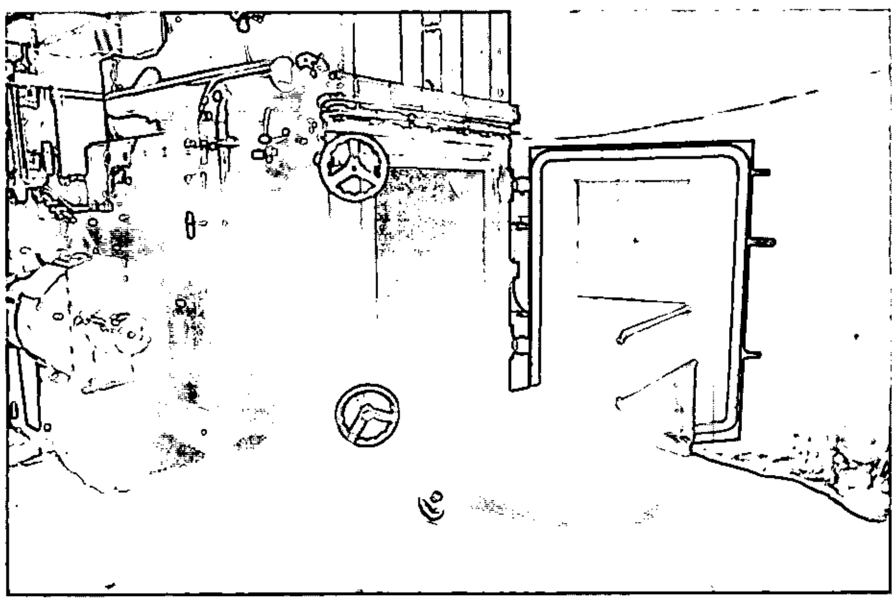
Ash Removal

The author knows of very few hospital incinerator installations where there has been sufficent design consideration given to ash removal and where satisfactory provision has been made.

With waste in the U.K., the quantities of ash are usually 7–10% by weight of the material charged, so the weight of ash is, typically, from 100 to 300 kg/day at a bulk density of about 300 kg/m^3. This means that the ash from one day's burning can be contained in a few dustbins. The problem is that the process of removing this quantity from the incinerator and then its transfer to the type of container provided for removal of ash from site produces such dust emission that the whole incinerator area can easily be permanently unpleasant and dirty.

The removal of ash by vacuum transfer is rarely successful because of the metallic components in the residue which block those sizes of pipes which are economic to provide for this type of equipment. It is however simple enough for a suitable vacuum cleaner to be provided for 'housekeeping' work so that the dust produced can be cleaned up.

There is no simple 'recipe' for this problem, since any equipment purchased is utilised for only a few minutes per day and so is uneconomic. The best contribution will come from the design layout and from providing a workable means of transfer of ash



Typical arrangement for manual ash removal into the 'paladin' bin or road vehicle container.

Incinerator Chimneys

This subject is very topical on account of the chimney failures which have become apparent in the last few years. Those instances in which the incinerator chimney is mounted directly on top of the incinerator have not caused special concern because:

(a) Such chimneys are not very high, and even if they have to be replaced during the life of the incinerator are not so costly as to be remarkable.

(b) They are supplied by the incinerator manufacturer and are adapted/constructed to work with the appliance they serve.

(c) There are normally no difficulties in identifying such responsibility as may arise.

As the requirements for Chimney Height control have been applied to incinerators, this has resulted in taller and taller chimneys being used – not infrequently costing as much as the incinerator itself! Furthermore, the desingers have had the task of adapting the chimney construction to the anticipated properties of the flue gases produced. This is the part which is going wrong in many installations and it is essential to establish what is happening.

Steel Chimneys

Where the temperature of flue gases does not exceed the temperature at which the selected steel will retain its yield strength there is no reason not to use steel, providing the design of the chimney contains adequate provision for *expansion.* If air cooling (or other means of cooling) is used, gas temperatures can be contained to 400°C or so and *mild steel* is eminently suitable – otherwise a more refractory steel has to be chosen. However, stainless and similar steels are extremely expensive and it would seem from experiences around the country that these can fail too . . . .

Modes of failure with steel liners and chimneys

For present purposes, it is assumed that external insulation is provided – of 50 or 75 mm thickness – since uninsulated flues are now rare.

Acid corrosion

Many analyses of incinerator flue gases have shown that the concentration of corrosive acid gases (Chlorine and Sulphur acids) is only a few mg/Nm^3 and rarely exceeding 150 mg/Nm^3. Unless spray cooling of the gases is practised, it is very uncommon to encounter acid corrosion as a major cause of liner failure if the plate thicknesses are maintained in accordance with the requirements of BS 4076 'steel chimneys'.

Oxidation

If a duct is operated consistently at temperatures higher than 400:C but beneath those at which deformation will occur, there will be a progressive 'flaking' off of oxide layers from the metal surface, leading to reduced metal thickness and, ultimately, failure. This type of failure is progresseve and rarely catastrophic given normal inspection routines.

Overheating

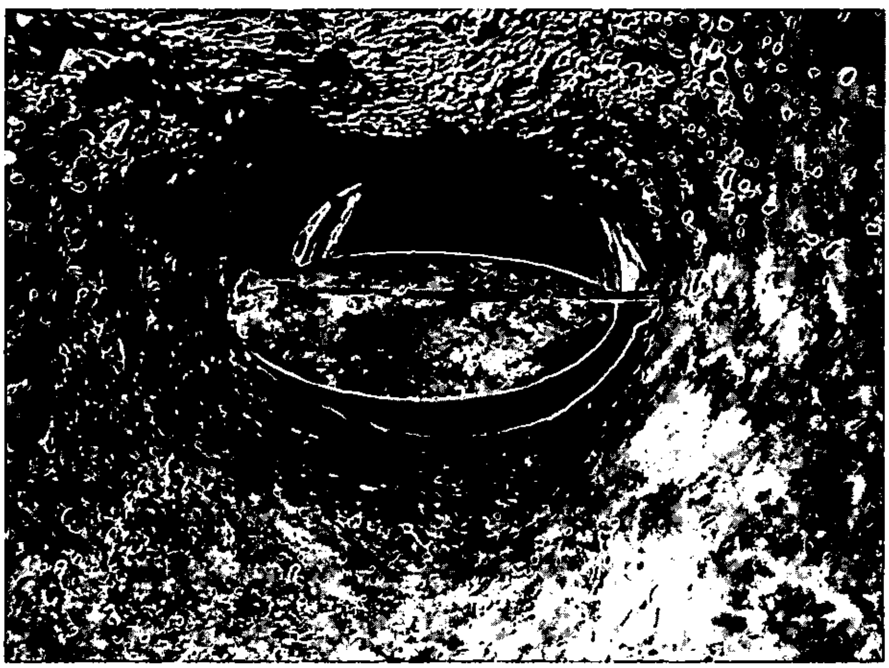
The most common cause of this catastrophic failure (in which plastic deformation of the platework occurs) is the combined effect of overfilling of an incinerator with the presence of quantities of high calorific value waste such as plastics. In this situation, actively burning flames pass along the outlet duct and chimney, there having been insufficient volume of combustion chamber or air supply with which to complete combustion. The metal temperatures rise way above those at which steel (even sometimes stainless steel!) has any appreciable strength and flue collapse follows. In this situation also, the use of air cooling systems can make matters worse by providing additional combustion air inside the duct.

The general conclusion to be drawn is that the present-day cost of flues and flue replacement renders an effective means of preventing failure quite essential. In this context, the designer must establish clearly the maximum working temperature of the flue or liner and then the incinerator manufacturer must provide:

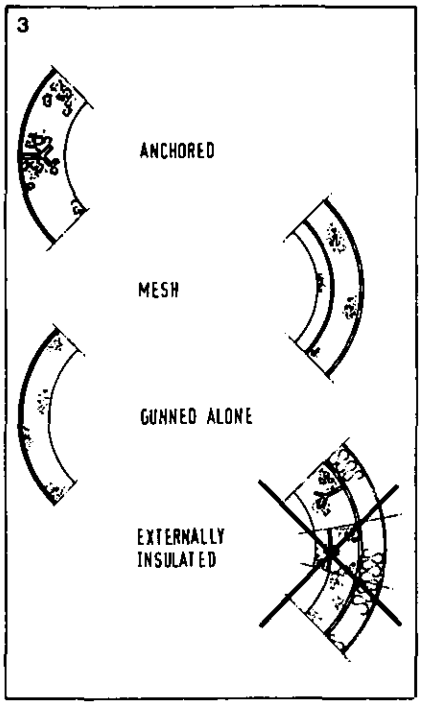
(a) Satisfactory cooling means;

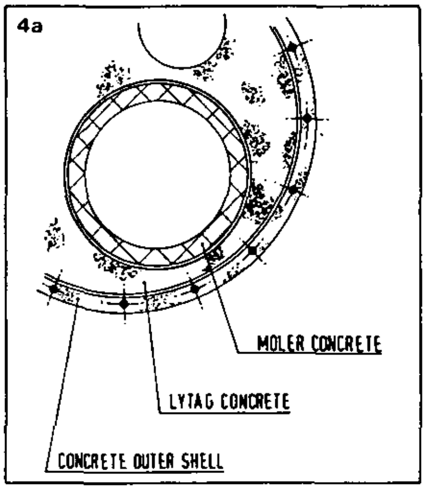
(b) Such control equipment as will *prevent* excessive flue gas temperatures reaching the chimney, with a back-up 'policeman' control to operate in the event of control failure.

It is important also to make due allowance in chimney design for those cases in which the incinerator operates by natural draught and where an increase in chimney height would so change the available draught as to affect the operation of the incinerator. There are many means available to prevent excessive draught from harming the everday operation (draught control, choice of chimney diameter, chimney 'break', etc.) and a suitable choice should be made according to the circumstances.



View of incinerator flue which has suffered severe overheating. Extensive plastic deformation of 6 mm steel plate





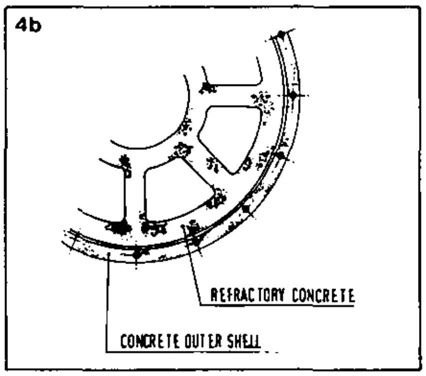


Figure 3 Examples of refractory linings to steel flues
Figure 4a Example of refractory lined chimney with additional liner
Figure 4b Example of refractory lined chimney without additional liner

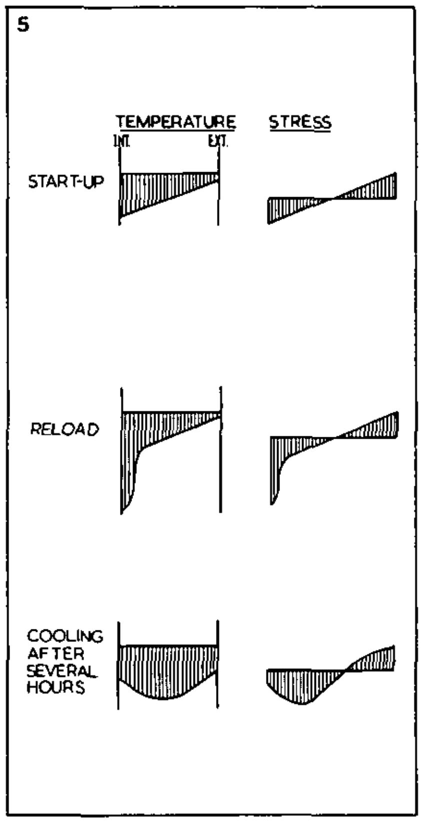


Figure 5 Thermal stress variations in refractory lined incinerator chimneys

Refractory and refractory-lined chimneys

It is this type of chimney which has given the most trouble in terms of unexpectedly short life and, on some occasions, catastrophic failure. In each case of trouble or failure, the refractoriness of the inner lining material has not been in doubt – indeed, it is the refractory properties which led to the selection of this type of material putatively to withstand the high temperatures of flue gas put out by incinerators (even when being overcharged).

There are many different methods of construction, but broadly there are two main types:

Type 1: Linings applied to a structural member of steel or concrete.

Type 2: Linings which are part of the structure of the chimney.

Typical examples are shown in Figures 3 and 4a/4b.

Linings applied to a structural member are either applied wet by gunning or casting or as pre-cast rings or sections.

Linings which are part of the chimney structure are cast or positioned during the process of erection of the chimney and filled behind with insulating or 'fill' material.

Each of the types of refractory-lined chimney have shown failure or short workig life, whilst at the same time each of the types have also been trouble-free. There has to be some commonality of cause for failure over such a wide range of methods of construction – after eliminating direct mechanical problems of construction technique or workmanship.

It appears that the prime cause of failure is the effect of **thermal shock,** and the ways in which this operates are discussed below, together with other effects which exacerbate the conditions once thermal shock has taken place. See Figure 5.

Thermal shock is the effect of changes *of temperature upon the* strength of a refractory matrix; more specifically, it is the effect of the **rate of change** of temperature. The expansion of refractories lie in the range from 0.5 to 1.0% change in linear dimension from cold up to the working temperature. As this change occurs, the matrix experiences **compression** during heating and **tension** during cooling. Both fired and unfired refractories have much less strength in tension than in compression and, in short, they crack. Such cracking can occur on the micro scale (hairline cracks) or on a more massive scale (pieces of refractory moving their position between hot and cold). That this process has particular significance for incinerators derives from two causes:

Start-up with dry waste and a 'good' draught it is quite possible for offtake gas temperatures to rise by say, 500 degrees in 10 minutes or so – corresponding to a **rate** of temperature change of ca. 3000 deg C/hr!

Re-load: when fresh waste is thrown onto a burning bed, the fast production of volatiles results in a **further** increase in temperature of say 300 degrees in a much shorter time of 2/3 minutes – *corresponding to a rate of* temperature change of ca. 6000 deg C/hr!

These conditions are unique to incinerators, and are found most frequently with hand-fired incinerators. The use of air cooling has the effect of greatly diminishing the range of temperature change and so, typically, halving the rates of change given above. None of the cooling methods can eliminate this effect, but air cooling to a maximum temperature of say 400°C provides the best amelioration. It is relevant to suggest at this point that the use of waste heat recovery as a means of cooling the gasses is a most efficacious way of eliminating thermal shock, so long as the final gas temperature is not so low as to allow liquid condensation to occur . . . .

The physical mechanism by which failure occurs in each of the different type of construction varies coniderably, and is not discussed further here. It is maintained, however, that if the thermal shock cannot be contained, the risk to refractory linings of chimneys is high.

One further process must be discussed in the context of this paper, namely, the effect of overpressure in refractory-lined flues. By this is meant the situation in which, by means of an induce draught fan, the pressure of gas in the lower sections of a chimney is higher than the outside air pressure. In this case, the combustion products are forced through the micro or the macro cracks in the matrix, from whence they find their way to the external surface of the chimney. Since there is a temperature gradient across the chimney structure it is quite common for the combustion products to pass 'through' both their acid and water dew points within the matrix of the chimney. In such circumstances, condensation occurs within the chimney and the long-term effect is for the refractory material to be attacked chemically, leading to eventual failure, see Figure 6. There is an unequivocal cure for this problem; don't allow the gas pressure at any point in the flue and chimney construction to exceed the atmospheric pressure at any point.

There is a further cause of pressure difference between the inside and outside of the flue, namely wind effects on the static pressure on the windshield surface. See Figure 7. This applies when there are low velocities (say‹5 m/second) inside the chimney and moderate wind speeds outside (say›12 m/second=43 km/hour).

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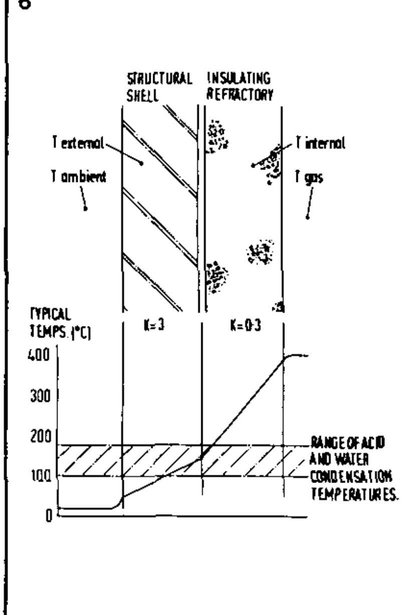

Figure 6 Condensation in refractory lined chimney

Implementing New Incinerator Standards

Both the DHSS* and the British Standards Institution are finalising standards for incinerators, which, together with other obligations (eg Health and Safety at Work Act) will result in a more carefully and more closely defined set of requirements of hospital incinerators than ever before. As a result of all this work, two issues now loom large:

(a) Implementation will cost money

(b) There are several hundreds of existing incinerators of which only a relative few will comply with all the requirements.

At the rates of replacement which have been obtained in recent years, some 10 years or more would be needed to replace all the obsolete incinerators still in daily use. In some cases, equipment which cannot be used cannot be replaced either. . . .

**DHSS Model Specification for Building Services in Health Care Buildings, Part C, Section 15 'Incinerators', first issue July 1982.*

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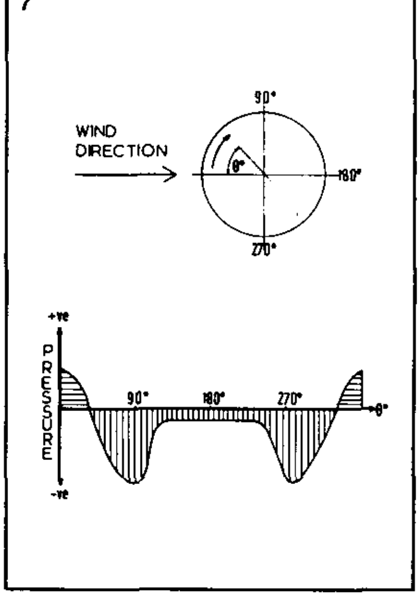


Figure 7 Surface static pressure distribution around a circular chimney in crossflow wind conditions

Existing installations

The minimum standards which are relevant to *existing* installations (as opposed to those which are brought into play when a *purchase* of new plant is undertaken) concern the following:

- Control of smoke and particulate matter emissions
- Safe charging of waste
- Coping with higher calorific value wastes

In many cases it is possible to upgrade the performance and degree of safety of existing incinerators at a fraction of the cost of new plant. The major objective of such upgrading is to improve the *control* of combustion (even if there is a necessary reduction of capacity and corresponding increase in the operating hours each day). Further improvement can be obtained in the safety of operation by so-called 'retro-fitted. This kind of modification is expensive and is usually limited to the larger capacity installations.

Maintenance

The older type of incinerators were themselves very simple and had few or no controls. As a result, there was little need for the provision of sophisticated maintenance routines. This situation is different with the modern automatic type of incinerator. There are a number of 'systems' to be considered, viz:

- Combustion control
- Access prevention
- Fire detection and control
- Loading machinery with motive power source.
- Supervisory instruments (chimney temperature, pressure, rotation sensors)

The preservation of equipment function and of safety levels demands that such systems are both maintained correctly and tested at sufficent frequency to prove the continued protection of the system in question. This means that the maintenance of an incinerator plant calls for a *range* of skills rather than mechanical or electrical maintenance alone. The multidisciplinary maintenance function is becoming more common in hospitals and, as such, is not likely to overextend the personnel available. In the author's experience, however, the resources within hospitals may not always be sufficiently *available* for sufficent attention to be paid to this type of equipment. One partial solution is for the equipment manufacturer to be involved in some of the work, especially that which requires a lot of effort within a short period of time such as refractory repair and general overhaul.

Conclusions

There have been many changes in the demands made upon both user and manufacturer of hospital incineration plant – following the many advances in medical practice itself – and there is a sufficient understanding of the requirements for satisfactory equipment to be available.

The impact of recent legislation has been to make yet more stringent demands upon the construction and use of incinerators. Finally, ancillary plant and equipment, such as the chimney, has been subjected to the unique conditions of use associated with incinerator operation and this too is now well enough understood for satisfactory performance to be achieved.

This paper was given at the 1983 Annual Conference of The Institute of Hospital Engineering. Mr Wright is principal inspector for the Chelmsford area of the Health & Safety Executive.

Safety and environmental issues with waste disposal in hospitals

M R WRIGHT BA

The purpose of this paper is to examine the types of waste which are generated from a hospital, particularly large general hospitals equipped with full function pathology facilities, to consider certain of the hazards which might be presented by waste and to examine certain of the precautions which should be adopted.

The context in which these aspects are to be dealt with is the hospital premises and the liability of waste disposal operations to affect as regards their health and safety persons employed within hospital boundaries. The broader environmental issues which may result from waste disposal, ie general atmospheric pollution, water pollution and quite simply general nuisance are outside the terms of reference for this paper.

The legal requirements concerning the control of hazards arising from waste in hospitals and with which I am concerned are contained essentially in the Health and Safety at Work etc Act 1974. Although in addition both the Factories Act 1961 and the Offices, Shops and Railway Premises Act 1963 apply to parts of hospital premises none of the 3 Acts deal specifically with the types of waste with which we are concerned.

The Health and Safety at Work etc Act 1974 sets down general principles for Employers and Employees alike. Detailed requirements about specific hazards are contained in Codes of Regulations, Codes of Practice (approved or otherwise) and other forms of general guidance.

Accepting the fact of crown status for NHS Hospitals the Health and Safety Executive through HM Factory Inspectorate enforces the Health and Safety at Work etc Act 1974 and all relevant statutory provisions in hospital premises and problems arising from waste and its disposal is merely one aspect of health and safety matters with which the Inspectorate is concerned in hospitals.

For the purpose of this paper waste has been grouped under 5 main headings ie:

- **a.** Clinical and infected waste.
- **b.** Chemical waste.
- **c.** Radioactive waste.
- **d.** Asbestos.
- **e.** Other.

Clinical and infected waste is the subject of a guidance document issued in 1982 by the Health and Safety Commission on the advice of its Health Services Advisory Committee. This Committee which was appointed in 1980 to advise the Commission on health and safety in the work of health services is composed of members drawn from the Health Authorities and from the Trades Unions with a chairman employed by the Health and Safety Executive.

Following the expressions of concern from a number of sources about incidents arising from the handling transport and disposal of clinical waste the committee studied the matter and felt it necessary to issue formal guidance.

The guidance itself is limited in its application and does not deal with radioactive waste, food declared unfit for human consumption, the handling and disposal of Category A Pathogen waste or the design and standards of incinerators.

However paragraph 2 of the Guidance does define clinical waste as being "waste arising from medical, nursing, dental, veterinary pharmaceutical or similar practice, investigation, treatment, care teaching or research which by nature of its toxic, infectious or dangerous content may prove a hazard or give offence unless previously rendered safe and inoffensive. Such waste includes human or animal tissue or excretions, drugs and medicinal products, swabs and dressings, instruments or similar substances and materials".

This broad definition of clinical waste is then broken down into 5 groups one of which is further subdued into 3 sub-groups.

Group A consists of

a. Soiled surgical dressings swabs and all other contaminated waste from treatment areas.

b. Material other than linen from cases of infectious disease.

c. All human tissue (infected or not) animal carcases and tissues from laboratories and all related swabs and dressings.

Group B is defined as discardable syringes, needles, cartridges, broken glass and any other sharp instruments.

Group C relates to laboratory and post-mortem room waste other than waste included in Group A.

Group D is certain pharmaceutical and chemical waste; that is unused or partially used medicinal products.

Finally **Group E** concerns used disposable bed-pan liners, urine containers, incontinence pads and stoma bags.

Although reference has been made in the previous category to chemicals I prefer to deal with chemicals as a separate category. In this case there is no single guidance code issued by the Health and Safety Commission. There are however, various guidance booklets on chemicals many of which contain information about disposal procedures.

The chemicals to which I refer will in general be used in the hospital laboratories and include substances which may be flammable, toxic or corrosive.

Disposal of radioactive waste is subject to the Code of Practice for the protection of persons against ionizing radiations arising from medical and dental use. This is a DHSS publication and was first published in 1957. The current edition was published in 1972.

As with clinical waste radioactive waste is sub-divided into a number of types ie:

a. Sealed sources.

b. Excreta from patients treaded with radionuclides.

c. Unwanted solutions of radionuclides for therapeutic use.

d. Normal low-level liquid waste eg from washing of apparatus or liquid scintillation-counting residues.

e. Normal low-level solid waste eg paper, glass.

f. Waste from spills and decontamination.

Gases.

Asbestos has been identified as a category of waste simply because of the hazard it presents and the emotive affect it has. In many hospitals there are very considerable quantities of asbestos present especially in the form of lagging, either contained in the building structure or associated with heating plant and pipe runs. Although not by definition waste when in this state it is often because of age and mistreatment in a poor condition and to be true very little better than waste. Further as many health authorities are pursuing a systematic policy of removing asbestos the problem of disposal is going to remain for many years.

In 1981 an Approved Code of Practice together with a Guidance Note was issued under Section 16 of the Health and Safety at Work Act etc Act 1974 entitled 'work with asbestos insulation and asbestos coating'.

The final category of waste, other, will include normal domestic refuse such as cans, bottles and paper. Also such items as electrical discharge lamps which in the form of fluorescent fittings may be widely used in hospital premises.

The safe disposal of clinical waste is the subject of a guidance publication issued by the Health and Safety Commission. I have already outlined the categories defined in the publication but paragraph 5 should be noted in particular. "The employer should have a clearly defined policy for the segregation storage, handling, transportation and disposal of clinical waste".

One important category of clinical waste is excluded from the guidance and this concerns Category A Pathogen waste. Category A Pathogens are listed in the Code of Practice for the Prevention of Infection in clinical laboratories and post mortem rooms. The Advisory Committee on Dangerous Pathogens is presently reviewing the procedures of the disposal of such waste.

Much of the detailed disposal matters of clinical waste is of course the direct concern of for example laboratory and medical staff. Nevertheless the ultimate responsibility for final disposal is generally the concern of hospital engineers.

Consequently the guidance on disposal identifies the need for the training of all staff who may be involved in dealing with clincal waste. This is vitally important because of in particular the colour coding of the containers for clinical waste.

Staff are divided into 3 main groups.

Firstly those who work in areas from where the waste originates. Amongst other aspects they need training to ensure the proper segregation of various types of waste.

The second group are those whose job entails them moving waste within a hospital. They for example must be trained about the procedures involving accidental spillage.

The third group (who may not be Health Authority employees) are those who move the waste from one site to another. Again they must know the procedures to follow in the event of spillages but they should also be fully advised as to the nature and dangers of the waste being transported.

The Guidance then proceeds to recommend the use of easily identifiable colour-coded containers ie:

Black	Normal household waste
Yellow	All waste destined for incineration
Yellow and Black Band	Waste (eg home nursing waste) – preferably for incineration but if separate collection and disposal arrangements are made – by landfill
Light Blue or transparent with light blue inscriptions	Waste for autoclaving before ultimate disposal

Having identified the colour coding

for the containers the guidance publication then deals with the segregation, storage, transportation and primary treatment of clinical waste. For example all human tissue and limbs should be disposed of by incineration and must not be mixed with other waste for collection.

The disposal of sharps and needles continues to cause problems and not just for hospitals. Reports are regularly received about dustmen being cut by glass or other objects whilst removing domestic refuse. The consequences can however be more severe in hospitals. For example a nursing auxiliary who was disposing of sharps in an inadequate container suffered a puncture injury into a vein. She was absent from work for 2 weeks with a severe general infection ascribed by the Consultant Microbiologist to the infected needle.

Both a porter and a cleaner who received similar wounds on infected sharps subsequently contacted Hepatitis B. During the early 1970's at a hospital a number of such infections were attributed to poor disposal of sharps.

The standard of the container for shaprs is described in Appendix 4 of the publication. A number of proprietary containers are now available.

Infections resulting from the handling of infected waste may not be readily identifiable. However a fatal case of typhoid is on record to a laboratory ancillary worker whose duties included the removal of clinical waste. Shortly before his fatal illness he was found handling loose typhoid infected culture dishes. Guidance on the disposal of clinical waste arising from chemical pathology, haematology and blood transfusions, microbiology, histology and post mortem rooms is given in the Code of Practice for the Prevention of Infection in Clinical Laboratories and Post Mortem Rooms.

The disposal of chemicals is of course not a problem unique to hospitals. Universities, schools and industry will have the problem. The main distinction certainly between Hospitals and Industry is generally the scale of the problem. In most cases hospitals are small scale users by comparison so that consequently the experiences and practices of educational premises can be referred to with relevance.

Many Universities have for example brought out publications which deal with the general hazards of laboratories and the practical problems of waste disposal. Both the University of Manchester Institute of Science and Technology and Imperial College London have for example published safety manuals which deal with these matters.

Disposal of radioactive materials is in the UK subject to the Radioactive Substances Act 1960 which is enforced by the Dept of the Environment. However NHS hospitals are exempt from registering under Section 1 of the Act although administratively it has been agreed that health authorities will follow the conditions normally laid down by the Department.

There is of course the DHSS Code of Practice for the Protection of Persons against Ionizing Radiations arising from Medical and Dental use, which was revised in 1972. New Regulations to be issued by the Health and Safety Commission will replace this Code.

In the meantime Section 10 of the existing code gives guidance on the procedures.

Possibly the matter which excites most interest at the present time is asbestos. Paragraphs 27-35 of the Approved Code of Practice 'work with asbestos insulation and asbestos coating' detail the procedures for handling asbestos waste. Pre-planning is of course the prime pre-requisite. The provision of proper waste receptacles, identification of the waste, training of staff and proper control of any spillages are all requried by the Code.

It is not the purpose of this paper to go into detail about incineration plant. BS 3316 is of course still relevant although its replacement is well under way. Apart from integral safety the problems presented to HSE inspectors generally concern the provision of adequate protective clothing for the operator and the provision of reasonable environment for that operator.

Gas fired plant in particular should of course be properly maintained and proper gas protection devices as flame failure be provided.

In conclusion under the category of other it is worth identifying the hazard which may be presented by electrical discharge lamps when large scale disposal by fragmentation is undertaken. Two problems arise firstly flying glass and secondly because of chemicals within the lamp there may be toxic and corrosive hazards. In common with the other hazards identified in this paper the matter requires pre-planning and the adoption and implementation of an effective policy of control.

Mr Browes is product engineer, environmental engineering Department, Robert Jenkins Systems Limited of Rotherham.

What is hospital waste?

A BROWES BTech CEng MIChem E

Those people involved in specifying, designing and building hospital waste incineration systems need to have a reasonably clear understanding of the material they intend to burn. This has always been the case since, as a general rule, incinerators are sized on the rate of thermal input with due consideration to other factors like bulk density, variations in waste type and moisture content. Assigning values to gross calorific value was not always a critical matter since an incinerator would either work satisfactorily or not and the better designed units usually did. With the advent of energy recovery systems, however, a greater level of attention has necessarily been given to estimating the gross calorific value such that the amount of recoverable energy can be more accurately predicted.

The short answer to the question that gives this article it's title is that nobody really knows what hospital waste is. In recent years few people have expended the effort and unpleasantness involved in opening up several hundred bags of waste, segregating the contents and analysing the constituent portions. It is relatively easy to assess the level of waste arisings by both weight and volume in a survey at hospital level, but the best we can hope for in terms of knowing what is in the black, yellow or red bags is to postulate credible suggestions that seem to fit other known 'facts'.

Using acutal incineration and energy recovery systems as full scale calorimeters, there seems to be a reasonable concensus of opinion that general hospital waste has an average gross calorific value somewhere in the range 15120 KJ/kg to 19770 KJ/kg with 17450 KJ/kg being as good a figure to use as any.

Usually these systems have been at the larger general hospitals and to maximise the benefit of installing them the removal from site of 'safe' packaging type waste has been minimised or discontinued. This has two basic effects on the character of the waste.

Firstly a consistently high percentage of paper and cardboard, in what becomes a higher base load, causes a buffering effect and on average the variations are minimised. Secondly the gross calorific value stabilizes close to that of paper and cardboard, typically 16284 KJ/kg, but is often a little higher due to the energy enrichment attributable to the presence of plastics. Most plastics, polythene and polypropylene will have a gross calorific value in excess of 45360 KJ/kg.

One credible combination of constituents would be as follows:

Where waste segregation takes place, and at smaller hospitals, the combination of constituents will vary quite significantly, particularly at specialist hospitals. Consider the effect on the constituents of table 1 below if 80% of the paper and cardboard were removed – for disposal by the local authority. The combination then becomes as table 2.

The effect is significant, but not alarming. The plastics contents has doubled and yet the average gross calorific value has only increased by 7%. Some specifiers suggest that the proposed incinerator should be capable of accepting waste constituents present in proportions of up to 50% w/w. This attempts to cater for the huge variances that can be expected particularly at the smaller hospitals. Obviously, this presents a whole series of worst cases since an increase in one constituent has to be at the expense of others. In these cases, using the five constituent categories, the average gross calorific value could vary from 3100 KJ/kg to 30800 KJ/kg. The specifier has to take care to clearly indicate his intended requirement, ie does he mean that the incinerator should be rated to handle waste at 17450 KJ/kg with occasional single charges of other extremes, or does he mean that it should be rated for continuous operation at some extreme condition(s)?

Currently available designs, like the well proven CONSUMAT starved air units, can cater for all reasonable variations in waste character. Their technology of operation is intrinsically stable and control features are employed to counter variations of waste type and quantities. They are still

TABLE 1

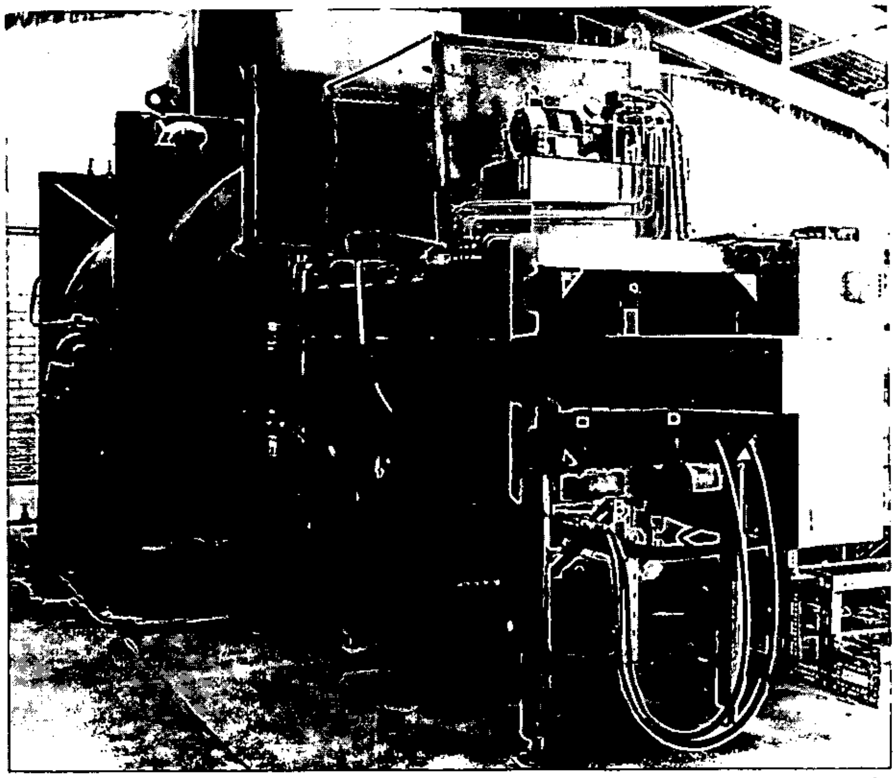
Material	Gross CV	% w/w	Contribution to average CV
Paper/cardboard	16284 KJ/kg	62½	10180 KJ/kg
Plastic	45360 KJ/kg	15	6804 KJ/kg
Water	–	5	–
Non combustibles	–	10	–
Miscellaneous	6210 KJ/kg	7½	466 KJ/kg
Average	17450 KJ/kg	100	17450 KJ/kg

TABLE 2

Material	Gross CV	% ww	Contribution to average CV
Paper/cardboard	16284 KJ/kg	25	4070 KJ/kg
Plastic	45360 KJ/kg	30	13608 KJ/kg
Water	–	10	–
Non combustibles	–	20	–
Miscellaneous	6210 KJ/kg	15	932 KJ/kg
Average	18610 KJ/kg	100	18610 KJ/kg

thermally rated on the basis of loading rate and gross calorific value and to ensure an economic size is selected, ultimately performing well, the specifier should consider the points raised.

One final comment is warranted to clarify popular misconceptions about the toxic nature of combustion products arising from the incineration of plastic waste. The author has noticed that many engineers regard the terms 'plastic' and 'PVC' as synonymous. This is not the case. Most plastics are relatively pure hydrocarbons, eg polythene, polypropylene and polystyrene. Polyvinyl-chloride is extensively halogenated, being 57% by weight chlorine, and it is PVC and other halogenated plastics that give rise to toxic combustion products like hydrogen chloride. Fortunately, the non halogenated plastics predominate and their usual combustion products, water and carbon dioxide, are harmless. To ensure acceptable exhaust gas conditions the presence of PVC and other halogenated materials has to be kept to a very low level.



Hospital waste incineration system with typical waste processing capability of 360kg/h.

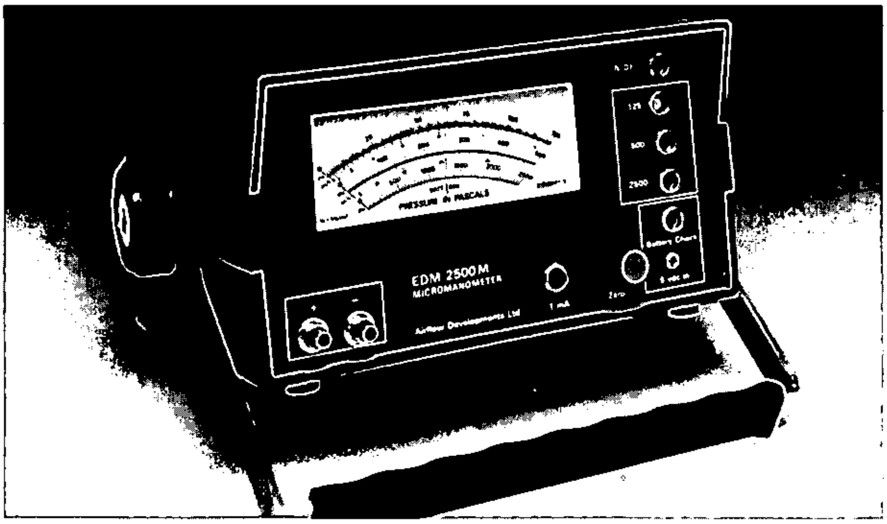
Product News

All electronic micromanometer

The entirely new electronic dry manometer, EDM 2500 will measure pressures over three ranges on clear, analogue scales and has the added facility of simultaneous direct reading of velocities up to 28 m/s (5500 ft/min) at standard conditions.

The instrument is more practical and easy-to-use than a liquid-filled manometer and the robust construction makes it ideal for on-site use. A carrying case is available which enables the unit to be carried round the neck permitting measurements to be taken by one person.

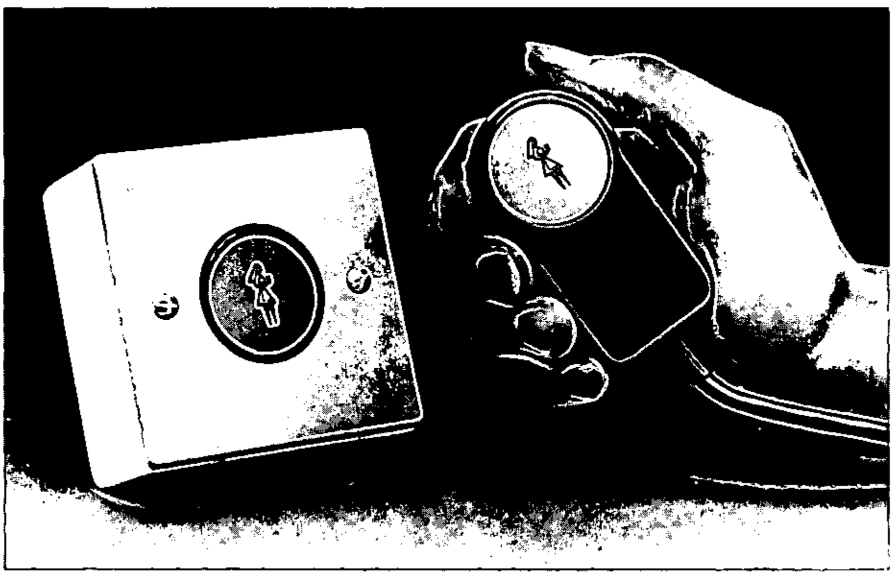
There are two versions of the EDM 2500 giving readings in metric or imperial units over the range 0 to 2500 Pa or 0 to 10in.w.g. The instrument is powered by four 1.5V batteries, but can also be operated from mains supply using a battery eliminator. A recorder output is provided which gives a signal for recorders, remote displays, data processors, etc.



The EDM 2500 electronic dry manometer

An accessory kit for the EDM 2500 can be supplied containing all the equipment necessary to carry out a full test. The kit is packed into a handy carrying case and comprises a pitot-static tube with instruction book, a manometer balancing valve, two lengths of PVC tubing, an air velocity slide-rule and two thermometers. All these items are also available separately, together with a wide range of pitot-static tubes suitable for use with the EDM 2500.

Further details from Airflow Developments Ltd, Lancaster Road, High Wycombe, Buckinghamshire HP12 3QP. Telephone (0494) 25252/443821.



Easier-to-use and see electronic nurse-call buttons

The new call push, available immediately, has a larger diameter (34mm) button than currently available, making it especially suitable for elderly or other patients with limited dexterity. This reflects the trend to larger call buttons which can be activated by a touch of one's knuckle, or fist even. It is mounted on a stainless steel front plate.

The new portable patient call push is an adaptation of an existing call push but it now incorporates a 'reassurance' light emitting diode. It comes with two metres of flexible pvc sheath cable connected to a 2-pole jack plug. The button is housed in moulded, dark brown plastic. Additionally, a dark brown plastic stowage hook is supplied for screwing onto wall, bedhead, panel or locker.

The large orange push button on the portable unit emits a permanent glow, enabling the patient to easily locate it.

Further details from Static Systems Group, Heath Mill Road, Wombourne, Wolverhampton WV5 8AN. Tel: (0902) 895551.

PLEASE NOTE DETAILS OF CHANGE OF PUBLISHER ON PAGE 1

New across-stack gas analyser

A new type of across-stack gas analyser for multi-component analysis, known as the TPA 330, has been designed for process plant used in a wide variety of industries including petro chemicals, chemicals, and materials processing. The analyser also has wide applications in power generation; factory, office, hospital and public building heating and ventilating systems; and is ideal for use with marine boilers.

The TPA 330 gas analyser, which is a dual wave length single beam instrument may be used for testing hydro-carbons, carbon monoxide, carbon dioxide, water vapour, nitrogen oxides, sulphur dioxide and a number of other gases with hetero-atomic molecules.

The new gas analyser has a number of advantages when compared with conventional systems. In particular, the need to handle samples is eliminated, response rate and sensitivity are superior and the sample is more representative.

Monitoring of the sample is performed by measuring infra-red radiation absorption by individual gases; a colimated transmitter beam derived from an infra-red source is used for this purpose.

Measurement is effected by comparing the characteristic wave-length of the gas with a second wave-length. The radiation transmitted through the gas is converted to an absorbance reading by an amplifier to give an output signal proportional to the concentration.

Signal processing for multi-component applications is by microprocessor where full correlation of the related components is performed.

The TPA 330 across-stack gas analyser consists of a transmitter, a receiver and a control unit suitable for IP55 and Ex(dip) mounting. The transmitter contains an infra-red source, a focussing system and a modulator. The receiver also contains a focussing system together with a pyro electric detector and pre-amplifier. The control unit may be placed in a safe area at up to one hundred metres from the transmitter and receiver.

The transmitter and receiver are fitted with an air purge system to prevent window contamination. The air purge system can operate using stack under pressure instrument air or fan to avoid sooting up during boiler start up.

Overall dimensions of the transmitter receiver units are 396mm x 265mm each. A number of optional extras are available and customers are provided with a choice of analogue or digital display of the readings.

Further details from: Telsec Process Analysers Ltd, Orton Southgate, Peterborough. Tel: Peterborough (0733) 235500.

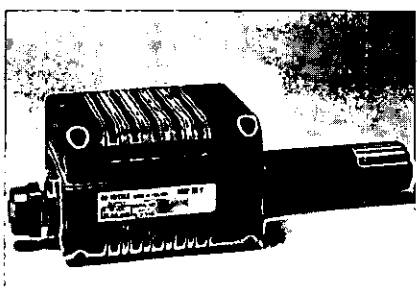
Permanently mounted temperature & humidity probes

A new highly accurate temperature and humidity probe, designed specifically for the environmental control industries, with the electronics are contained in an ABS plastic housing. Fulfilling the requirements of IP 65 regarding tightness and splash proofing, the probes simultaneously measure relative humidity and temperature, which is designed for wall mounting.

The HMP 111Y is a wall-mounted unit, has a 97mm long probe fitted with Humicap humidity, sensor and PT 100 temperature sensor. It is equipped with 216u sintered filters, but can be supplied with plastic grids or fine filters if required. This instrument is highly suitable for clean-rooms, computer rooms and environmental control of storage areas.

Humidity can be measured from 0-100% RH, and temperature between −40°C to 115°C. Input power requirements are 9-15 VDC, and the output signals which may be fed to any monitoring device. (Outputs humidity (0-1VDC) and temperature (10mV/°C).

Further details from Vaisala (UK) Limited, 11 Billing Road, Northampton NN1 5AW. Tel: (0604) 22415.



Permanently mounted humidity and temperature probe

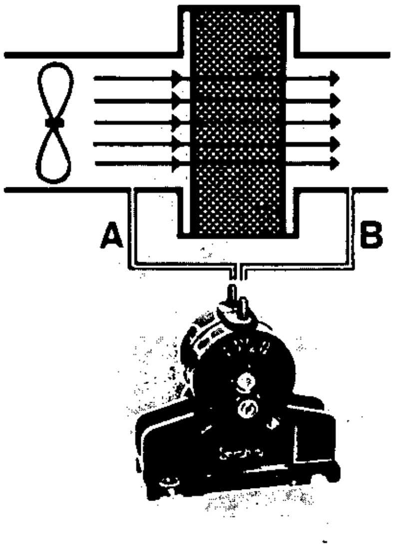
Pressure impulse system indicates when air duct filters need replacing

Clogged filters in cooling or ventilation systems can lead to many problems from equipment damage to an increase in health hazards.

A simple and very reliable pressure impulse system, manufactured by Bircher AG of Switzerland and marketed exclusively in the UK, is now available. The 'DW' pressure impulse system utilises proven electro-pneumatic principles to sense the increase in air pressure as a filter becomes soiled.

Typically, the system would be linked to the blower fan with a DW pressure impulse switch connected to either side of the filter. As soiling builds-up in the filter, pressure on one side increases thus creating an imbalance. When the differential pressure reaches a predetermined level the system can be switched off or a signal lamp or audible alarm can indicate the filter needs replacing.

Further details from Radiatron Components Limited, 76 Crown Road, Twickenham, Middlesex. Telephone 01-891 1221.



Pressure impulse system

HR General-purpose cryostat

The R2 rotary microtome is extremely rigid, completely rust-proof and designed to be self-compensating to keep it independent of any temperature variations. It features stainless steel, frictionless bearings and enables sections to be precisely cut from 1 to 25 microns. The self-aligning, easy to adjust guide plate ensures flat, uniform and crease-free sections.

An important feature of the HR Type is the balanced manual drive with a safety lock on the top of the stroke for the microtome.

The ergonomically-designed extra wide chamber with its large clear-view window and access port enables relaxed user operation whilst the circuitry and component layout of the cooling system ensure reliability.

A hermetically sealed compressor gives a range of 0° to −35°C, dependent upon the refrigerant gas employed and the ambient temperature.

With a voltage requirement of 240/110V and 50/60Hz operation, the HR Cryostat is an ideal general-purpose instrument for routine histology, research or teaching and suitable for cutting all types of histological, cytological and technological materials.

Accessories include a bench freezer and tools for rapidly freezing specimens, microtome knives, and a range of specimen holders.

Further details from SLEE Group, Laboratory Equipment Division, Lanier Works, Hither Green Lane, London SE13 6QD. Telephone 01-318 3021.

HR general purpose cryostat

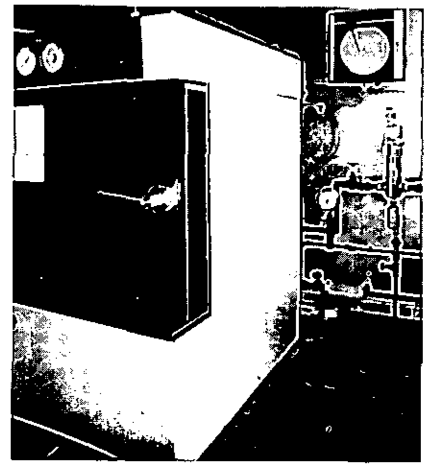
Filter ensures equipment and containers contaminant-free

The rapid isolation and identification of bacteria from clinical specimens plays an essential role in modern medical treatment. This facilitates effective antibiotic treatment to be administered thus bringing early relief to the sufferer. To ensure that bacteria are accurately identified the culture media must be absolutely free from external contamination.

Following the installation of a new autoclave at North Shields Preston Hospital, a high degree of contamination of agar, saline and other fluids was experienced due to the carry over of scale and other deposits from the domestic steam source to the autoclave. Eventually a premature parts failure occurred in the autoclave, and following consultation with the commissioning engineers, it was decided that steam filtration was necessary.

The Microbiology Laboratory of North Shields Preston Hospital deals with a catchment population of 147,000, 721 beds and the various clinics associated with a general hospital. This generates large numbers of specimens for examination. The bacteria are isolated from a wide range of clinical specimens including swabs from infected areas of the body, urine, blood and other body fluids, faeces, sputa and skin samples. Laboratory examination includes the cultivation of these specimens in plastic dishes containing a gell consisting of nutrient agar and horse blood. To form the cultivating gell, nutrient agar powder is mixed with water, then placed in an autoclave and heated to 121°C at a pressure of 15lb/sq.in. for 15 minutes, to melt and sterilise the agar. The solution is then cooled to 56°C, horse blood is added and the culture medium is poured into dishes and allowed to cool and set.

The autoclave is also used for sterilising glass bottles with loose fitting plastic caps, broths, saline solution, water, general laboratory glassware and equipment. During the steam cycle, all of these items (and the autoclave interior) were heavily stained by solids, i.e. rust, silica and pipescale.



The autoclave at North Shields Preston Hospital with, right, the recently installed filter system.

Most disconcerting was the blackening of specimen bottle tops with rust. In consequence the contents of these containers were highly suspect with regard to their suitability for use in microbiological analyses, casting doubt on the accuracy and reliability of bacteria isolation and identification.

As a result of consultation with the hospital engineering department, a 23/30R filter unit was installed, as close as possible in the pipework, to the autoclave itself. Following installation of the filter unit in January, the system has operated satisfactorily. Sterilised equipment, containers and caps are now free from staining, eliminating the necessity for additional cleaning of caps, containers and equipment, and reducing the maintenance necessary on the autoclave.

Type 23/R steam filters are specifically designed to eliminate staining and spotting of sterilised hospital containers and rusting of hospital instruments, caused by wet or dirty steam supplies to the autoclave.

Reduced staining of autoclave interiors results in corresponding reduction in time-consuming cleaning operations. The Type 23/R filter incorporates a patented Microfibre element in a rugged stainless steel housing specifically designed for steam service. Standard items included are a stainless steel condensate drain and a high integrity pressure relief valve.

Further details from Balston Limited, Medway Mill, Monckton's Lane, Maidstone, Kent ME14 2QB. Telephone: (0622) 52201.

News

Model of new district general hospital for Bournemouth

Go-ahead for new hospital

Government approval has been given for the building of Bournemouth's new district general hospital. The 670-bed hospital will be built in two phases on a 40-acre site in Castle Lane, Bournemouth. Building work on the first phase of development, which will cost about £20.5 million including fees and equipment, will start in January 1984, and is expected to be completed early in 1987. The second phase, costing a further £17 million, will follow and is due for completion in 1990.

The first phase will include 224 general acute beds, 49 geriatric assessment beds, eight intensive therapy and coronary care beds, operating theatres, X-ray and rehabilitation facilities, a pharmacy, an education centre and residential accomodation.

Some of these services will be expanded in the second phase of the development, which will provide 389 beds and new out-patient and accident and emergency departments.

A spokesman for the Wessex Regional Health Authority said the announcement was 'great news.' He confirmed that tenders for work on the first phase of the scheme would be invited immediately.

Biological hazards of medical devices

The British Standards Institution has published a further Part of BS 5736 **Evaluation of medical devices for biological hazards.** Entitled Part 7 **Method of test for skin irritation of extracts from medical devices** it describes one of a series of test methods for assessing the toxicity problems associated with medical devices in direct contact with body tissues, or substances that are introduced into the body other than by oral means.

Part 7 deals with a test to assess skin irritation resulting from leachable endogenous or extraneous substances present in or on a medical device, and specifies the use of polar and non-polar solvents to obtain suitable extracts for testing. The method is recommended for initial assessment of devices in the following categories:

Category C: For short-term use (ie from a few minutes to several weeks) within the body or in contact with mucosal surfaces eg tracheal tubes, urinary catheters, intravenous cannulae.

Category D: Devices for use in contact with the skin, eg splints.

Category E_2: Devices used to contain or administer substances by means of routes other than those in E_1, eg eyedrop containers.

Part 7 should be read in conjunction with Part 8 which describes a method of test that does not use extracts.

Copies of BS 5736: Part 7 may be obtained from the Sales Department, British Standards Institution, Linford Wood, Milton Keynes MK14 6LE. Price: £6.00 (£3.00 to BSI subscribing members).

Hospital installs pre-fabricated GRP corridor

Link corridor at the Murray Royal Hospital, Perth

The Murray Royal Hospital in Perth has recently installed an unusual link corridor between two parts of the hospital, built entirely of modular structural glass fibre panels.

The corridor, designed by Dorward Matheson Gleave & Partners, Architects, based in Glasgow, features unitary construction and can be of any length, or width up to a maximum of approximately 4 metres. The design of the corridor was further complicated by the need to accommodate a change in level between the two buildings of approximately 1.5 metres.

The GRP panels comprise skirt, wall and roof units moulded simultaneously, complete with internal and external final finishes all applied in the factory, together with gasket glazed windows as appropriate. The units incorporate a 100mm thick foam core providing an insulation factor almost twice as good as that currently required by the building regulations.

The profile of the preformed panels contributed to the structural stability without the need to incorporate a steel frame. The engineering design accommodates wind speeds up to 190 kilometers per hour together with a snow loading factor. The superstructure incorporating GRP for all components virtually eliminates problems associated with the differential coefficient of expansion.

The modular panels are 1200mm wide and simply bolted to each other as well as to the conventional elevated concrete walk-way. The complete structure is waterproofed by means of a triple water barrier comprising wet applied mastic, a compressed gasket, and an internal GRP cover-plate incorporating a drain channel.

Internal services are accommodated in conventional trunking mounted directly on to the GRP. This trunking together with handrails and radiator panels is secured to mounting profiles moulded into the inner section during factory construction.

The corridor is 110 metres long and was erected by local contractors, the bulk of the work being completed in approximately four weeks.

Further details from Concargo Ltd, Winterstoke Road, Weston-Super-Mare, Avon BS24 9AH.

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Informal enquiries will be welcomed by Mr W A Askew, District Works Officer Telephone: 01 263 9551.

Application forms and job descriptions obtainable from the District Personnel Department, District Offices, Whittington Hospital, Highgate Hill, London N19 Telephone: 01 272 3070 Ext 4116.

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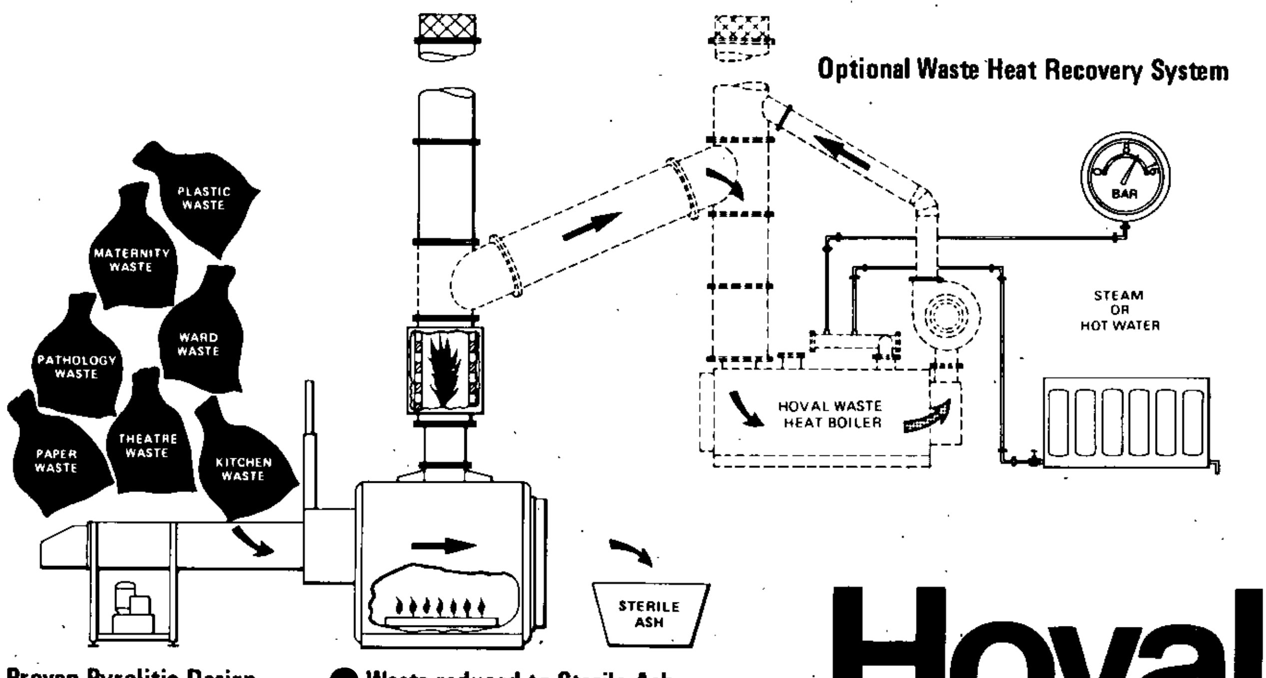

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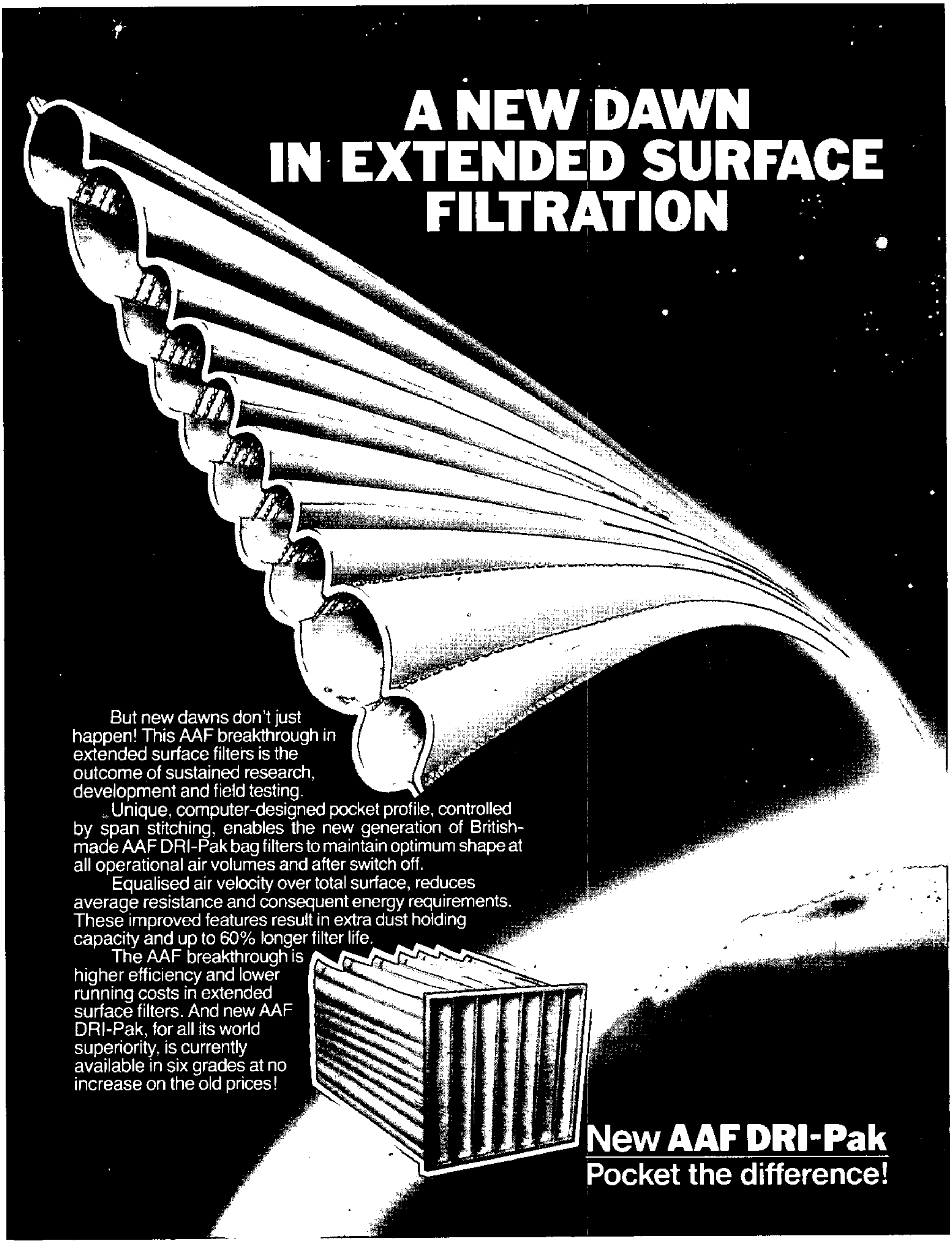
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