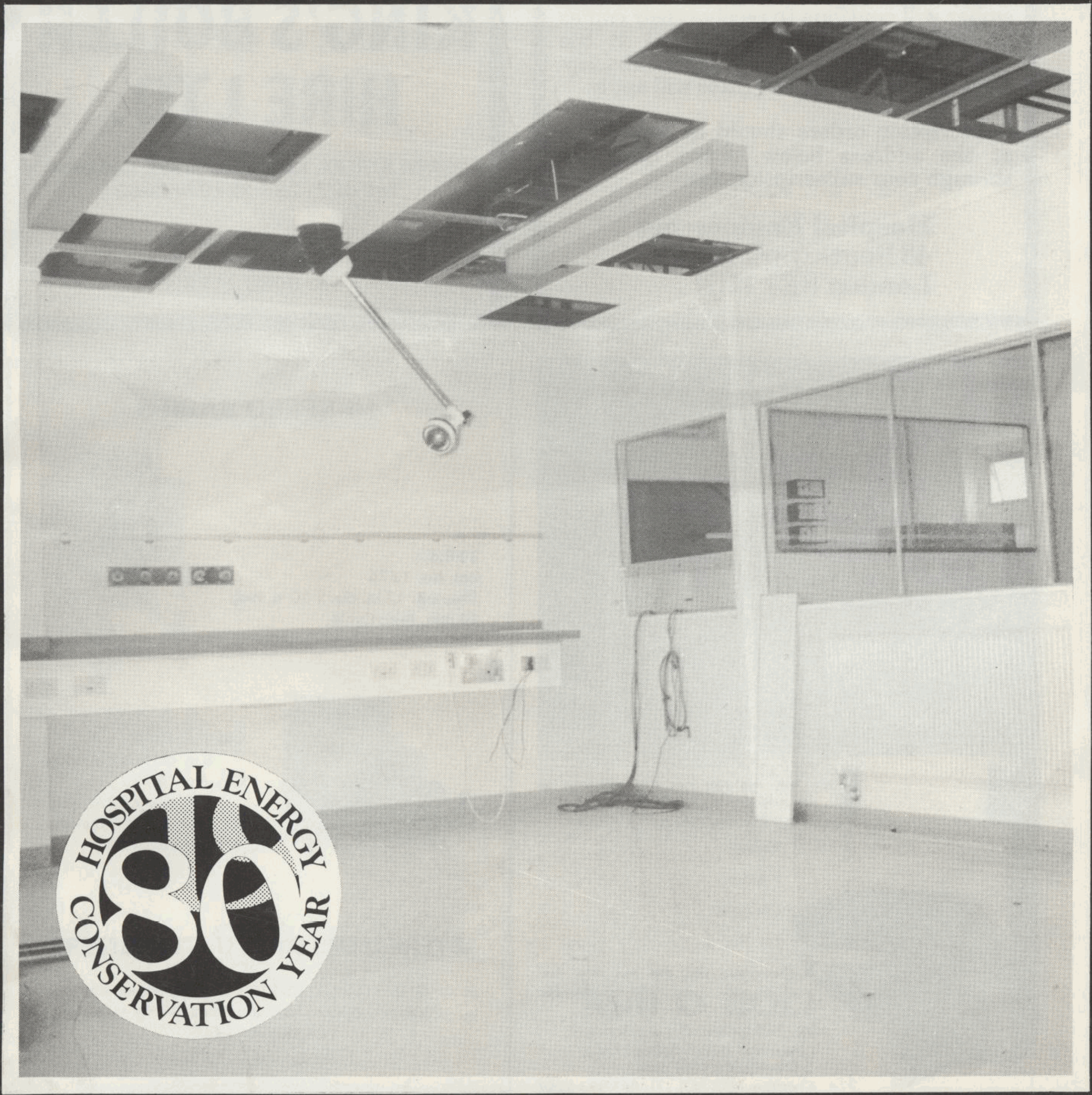
The Journal of the Institute of Hospital Engineering November 1980

HOSPITAL ENGINEERING



Access to Engineering Services for Maintenance

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HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

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November 1980

Volume 34 No. 9

Front Cover:
Access to ventilation ductwork in an Intensive Care Unit *(see page 23)*.

Institute News

NO Increase in Annual Subscription

Despite the current inflationary pressures, Council of the Institute has determined to hold the present annual subscriptions for a further 12 months, so that there will be no increase in the current rates for 1981.

Chartered Engineers

We are pleased to record that through its Affiliate Membership of the Council of Engineering Institutions, the Institute has been able to successfully sponsor the below named members for registration as Chartered Engineers.
Derek Clayton
Peter Jackson Field
Douglas E. R. Fox

Northern Regional Health Authority Apprentice Awards

The annual presentation of certificates to apprentices who had successfully completed their course of training under the NRHA Training Scheme took place on 9th October 1980, when Mr. G. Chetwynd, Chairman of the NRHA presented certificates to eight apprentices.

It was also the first occasion of the presentation of the 'Jack Fletcher Awards' to two apprentices.

The late Jack Fletcher, as members will recall, frequently submitted articles to this magazine specifically designed to assist student engineers in the development of their careers.

Following his untimely death, and in recognition of the significant contribution he made to the training of Health Service Engineers throughout his career, the RHA decided to donate an Annual Award to the value of £25 to the best all-round apprentice selected from those in the Second and Third Year of their training.

In addition, the Works Staff from the whole of the Region, decided to donate an Annual Award to the value of £15 to the best apprentice on completion of his First Year of training. The awards to be known as the 'Jack Fletcher Awards'.

This year the recipients of these awards were:

Mr. Craig Baxter — Apprentice Electrician of the South West Durham District Health Authority, in his Third Year of training, and

Mr. Donald Newton — Apprentice Electrician, at the South Tees District Health Authority, on completion of his First Year of training.

Mr. Donald Newton

Both apprentices selected a prize of technical books and tools and these were presented by Mr. Chetwynd, Chairman of NRHA.

Mr. Craig Baxter

Natural Ventilation by Design

Chartered Institute of Building Services

The second CIBS Symposium of the 1980/81 season will be held at the Building Research Establishment, Garston, Watford on 2nd December 1980. The papers include:
A review of ventilation requirements; Natural ventilation principles; Ventilation measurement in housing; Problems in commercial and industrial ventilation; Natural ventilation in the PSA estate; and Natural ventilation in the modern hospital. The cost is £35, but to members of CIBS and students it is only £30. The fee includes preprints of all six papers, coach transfer to and from Watford Junction, morning coffee, lunch with wine, afternoon tea and tour of the wind tunnels and ventilation equipment at BRE.

Assessment of Energy Resources

This is the subject for the Watt Committee on Energy Ninth Consultative Council meeting at The Institution of Electrical Engineers, Savoy Place, London WC2 on Tuesday, 2nd December 1980.

The subject will be presented in an appropriately informative style to be valuable to architects, engineers, designers and others. It will give an appreciation of geological fuels, how and where they occur, the estimation of quantities in-place and what may be recoverable at any time. There will be dicussion on the accuracy and limitations of energy reserve estimates.

After an opening paper on the geological constraints of reserves, the speakers will discuss the definition of energy resources, the techniques used in their measurement and the extent of the resources thus evaluated. These subjects will be covered under the following headings:

Geological and other constraints on resources — Prof A. J. Smith
World Oil and Gas — D. C. Ion
UK oil and Gas — Dr. C. Fothergill
World Coal — J. E. B. Holtom
UK Coal — Sir Derek Ezra
World and UK Nuclear Fuels — Dr S. Bowie

This Open Session of Consultative Council is from 10.30 a.m. to 4.30 p.m., and morning coffee is served from 10 a.m. The presentations are primarily designed for the nominated representatives of member institutions. However, additional institute members are admitted at the Secretary's discretion, and anyone interested should contact the Watt Committee on 01-245 9238 (price including full lunch and VAT £24.90 per person).

Book Reviews

International Hospital Vade Mecum and English, French and Spanish Glossary

by Paul Aurousseau
Publisher: SEDIP/GALULA 49, rue Servient 69003 LYON — FRANCE
Tel: (78)71.00.55
Price: US $55, postage paid.

The *International Hospital Vade Mecum* is the first work of its kind in which the hospital, and hospital life are considered, not from a national point of view, but as world-wide institutions.

Every country is well acquainted with its own hospital organization, but is often baffled as soon as it is a question of working outside its frontiers. There are, for instance such things as requests for information, hospital planning and construction, study travel, purchasing and selling equipment. The object of this directory, compiled by a specialist well known in the international sphere, is essentially to be of practical daily use in these matters.

The work starts with three extensive (196 page) vocabularies in the English, French and Spanish languages. These three tongues are the official languages of the International Hospital Federation and are used, or understood, in the greater part of the world. The expressions selected are those which are most often employed in the everyday vocablary of the doctor, nurse, administrator, planner, architect and engineer. They do not, of course, include all the terms employed in these professions, but a comprehensive, indeed splendid, foundation has been laid for future editions.

There follows the *Vade Mecum* — a list of the address, telephone and telex number of international institutions, health ministries, hospital federations and associations, hospital administration schools, and hospital research institutes, hospital and medical journals, hospital directories and registers of doctors, research departments, architectural practices, engineers, and other specialists.

The directory includes lists, nation by nation, of the main manufacturers of specialised equipment. It gives import and export organizations and the main exhibitions of medical, surgical and general hospital equipment.

It is intended to revise the volume every three years, to enable existing material to be brought up to date, and to add further information.

Energy Education Requirements and Availability

This 130 page report presents the results of surveys carried out by The Watt Committee for the Department of Energy, on the reqirements of Industry and Commerce for training in energy subjects, and on the teaching of energy topics in higher education.

The report provides the results of a very full survey of what is available in higher education. Schools and their careers masters will find it helpful in advising pupils. University graduates will find it of assistance in their selection of postgraduate and post-experience courses and it will also be most helpful to industry and commerce. It is clear from the comparison of the surveys that large sections of industry and commerce are not aware of the facilities offered by institutions of higher education.

Post-experience and mid-career courses are seen as offering a flexible response to immediate energy problems. There is a recognition of the problems involved in making these attractive to industry, and of means by which this might be done, but it is also felt that these should be of financial benefit to the educational institutions themselves.

In general a combination of sound engineering or scientific education and experience, with strong management capability, are considered sufficient to implement rational energy utilisation policies. It was also stressed that energy is one of many matters with which industry has to deal and may be integrally bound up with, for example, overall process design.

As a result, the emphasis tends to be on the specific and practical, as opposed to the theoretical or general, aspects of energy education.

The report is available price £22.50 including postage within the British Isles, from The Watt Committee on Energy Ltd, 75 Knightsbridge, London SW1X 7RB.

Basil Hermon is Regional Works Officer, South West Thames Regional Health Authority. At present he is the Chairman of the Education Committee. His interest in international matters stems from his membership of the International Affairs Committee 1975-79 and as a member of Council of the IFHE 1971-74.

Why IFHE?

B. A. HERMON CBE CEng

The International Federation of Hospital Engineering is now ten years of age and it has recently held its very successful 6th Congress in Washington but there are members of the IHospE who ask, what is it trying to achieve? Why does the Institute devote time and energy to it? Why do we devote four issues of *Hospital Engineering* to it every year?

At the first International Congress of Hospital Engineering held in Rome in 1970 it soon became apparent that FENATO, the Italian equivalent of the IHospE, were wanting to demonstrate to their Ministers the need for an active hospital construction programme with good planning decisions and the importance of hospital engineering in these processes. It also became clear that hospital engineers in other countries felt the need to project the hospital engineering dimension, to coin the Finniston term, and that this could best be achieved by joining hospital engineering organisations together across the world to exchange information, and help those in need through frequent contact and congresses to be held every two years.

The Federation's objectives are:

a) to promote, develop and disseminate hospital engineering technology;
b) to compare international experience;
c) to promote the principle of integrated design by improved collaboration between the professions;
d) to promote more efficient management of operation, maintenance and safety of hospitals, their engineering installations, equipment and buildings;
e) to offer collaboration with other international organisations.

In the initial years it was perhaps natural for the other countries to look to the IHospE for a lead. The Institute had built up a lot of experience and a good reputation since it was first formed as the Institution of Hospital Engineers in the 1940s. The UK was some nine years into the most ambitious hospital construction programme of any country at that time. The IHospE had a very successful journal, the DHSS had some of the best guidance material in the world and the only hospital engineering training centre in the world is at Falfield.

Other countries quickly joined the original six and the total number now represented in the Federation is 31. This means that experience can be drawn from a much wider net than before and it can no longer be taken for granted that we in the UK have more to offer than other countries who have been constructing hospitals over the last 10 or 20 years. We need to keep abreast with experience in other countries.

The comment is frequently made that good ideas are often born in the UK but we lose the initiative and allow ourselves to be overtaken. This has happened in manufacturing and many other examples can be found. This must not happen to hospital engineering in the UK.

Hospital engineering should be seen as an industry which not only serves the British public but also makes a valuable contribution to the economy through exports of plant, equipment and design and construction expertise. It is difficult to assess just how much the IHospE contributes to this effort through its membership of IFHE but it is often approached by visitors from abroad for assistance in making contact.

Hospital Engineering has made a major contribution to the worldwide projection of the British image. 1250 copies are sent out to 25 countries each year and since the Washington Congress there have been enquiries which may lead to the number of copies being more than doubled. Whilst it is open for any firm to advertise in the Journal practically all the advertisements are placed by British firms although it is questionable whether they make the best of this opportunity to reach the foreign markets. There is no other journal through which hospital engineers in the UK can learn about engineering practice abroad and avoid becoming too inward-looking.

I hope the Institute Council and members will see the advantage of continuing its major contribution to the development of IFHE as it enters its second decade.

The Institute of Hospital Engineering

Code and Rules of Conduct and Disciplinary Regulations

CODE OF CONDUCT

Every Member shall at all times so order his conduct as to uphold the dignity and reputation of his profession and to safeguard the public interest in matters of safety and health and otherwise. He shall exercise his professional skill and judgment to the best of his ability and discharge his professional responsibilities with integrity.

RULES OF CONDUCT

The Council shall from time to time promulgate Rules of Conduct and shall have power to require all Members to conform to such rules. The Rules of Conduct may be amended, varied or rescinded as the Council may think fit provided that they shall not be inconsistent with the principles of the Code.

REGULATIONS

Preamble

A code of conduct designed to embody broad ethical principles is necessarily drawn up in general terms. Rules set out in the following regulations indicate the manner in which Members are required to conduct themselves in most situations. For situations not specifically encompassed by the Rules, the principle to be followed is that, in any conflict between a Member's personal interests and those of the community, the latter should take precedence.

Rules of Conduct

1. When discharging his professional duties, a Member:

(a) Should satisfy himself as to their scope, obtaining in advance any necessary clarification or confirmation and shall not accept professional obligations which he believes he has not sufficient competence or authority to perform.

(b) Shall accept responsibility for all work carried out by him, or under his supervision or direction, and shall take all reasonable steps to ensure that persons working under his authority are competent to carry out the tasks assigned to them and that they accept responsibility for work done under the authority delegated to them.

(c) Shall. when asked for professional advice, give an opinion that is objective and reliable to the best of his ability.

(d) Shall, if his professional advice is not accepted, take all reasonable steps to ensure that the person who over-rules or disregards his advice is aware of the possible consequences.

2. Except when legally authorised in the national or public interest, a Member shall not do anything, or permit anything under his authority to be done, of which the probable and involuntary consequences would, in his professional judgment, endanger human life or safety, expose valuable property to the risk of destruction or serious damage, or needlessly pollute the environment.

3. In his work, a Member shall respect all relevent laws and statutory regulations.

4. In respect of his professional relationship with employers, colleagues or clients, a Member:

(a) Shall not maliciously or recklessly injure or attempt to injure, whether directly or indirectly, the professional reputation of another.

(b) Shall disclose to his client or employer any benefits or interests that he may have in any matter in which he is engaged on their behalf.

(c) Shall neither communicate to any person, nor publish any information or matter, not previously known by him or published in the public domain, which has been communicated to him in confidence by a client or employer without the express authority of that client or employer.

5. A Member shall not solicit work improperly as an independent adviser or consultant, either directly or by an agent, nor shall he improperly pay any person, by commission or otherwise, for the introduction of such work.

6. A Member shall not be the medium of payments made on his employer's behalf unless so requested by his employer, nor shall he, in connection with work on which he is employed, place contracts or orders except with the authority of and on behalf of his employer.

7. A Member working overseas shall observe these rules so far as they are applicable; but where there are recognised standards of professional conduct in the country in which he is employed, he may adhere to them.

8. A Member shall be guilty of improper conduct if he is convicted by a competent tribunal of a criminal or civil offence which, in the opinion of the Council of the Institute, renders him unfit to be a Member.

9. If, in the opinion of the Disciplinary Body, a Member is precluded from performing his professional duties in a manner consistent with the standards of his profession, as a result of having been adjudicated bankrupt or making a composition with his creditors, he may be deemed guilty of improper conduct.

Disciplinary Regulations

DISCIPLINE

In the following the expression 'professional misconduct' means:

(a) any breach of the provisions of the Articles of Association or any regulations or rules made thereunder; and

(b) any other conduct which shall indictate unfitness to be a member or shall otherwise be unbefitting to a member as such.

Subject to the regulations made hereunder, the Disciplinary Body constituted under those regulations may:

(a) expel from the Institute; or

(b) require the resignation immediately, or at the end of the current year, of; or

(c) reprimand

any Member who shall be found, in accordance with these regulations to be guilty of professional mis-conduct and upon such expulsion or resignation taking effect the Board shall cause his name to be removed from the list of members and he shall thereupon cease to be a Member of the Institute.

1. The Council shall make and may alter, add to or revoke regulations for the purpose of:

(a) appointing or setting up (either temporarily or for a period or ad hoc) a body or bodies (hereinafter referred to as 'the Investigating Panel') to investigate any complaint of professional misconduct on the part of a Member;

(b) constituting a Disciplinary Body (hereinafter referred to as 'the Disciplinary Body') to adjudicate upon any such complaint.

2. Such regulations may make provision for:

(a) the notification by the Council to a Member of the receipt of a complaint of such professional misconduct;

(b) enabling the Investigating Panel to require the Member to give an undertaking to refrain from continuing or repeating the conduct if after such investigation they find a prima facie case of professional misconduct;

(c) enabling the Disciplinary Body to award costs in connection with the investigation of and adjudication on any such complaint;

(d) the publication of decisions of the Disciplinary Body;

(e) determining the constitution and membership of the Investigating Panel and the Disciplinary Body; and

(f) dealing with any other matter which may be relevant to the fulfilment by the Investigating Panel or the Disciplinary Body of its functions under Regulations.

3. Such regulations shall be designed to secure that:

(a) any complaint of professional misconduct shall be properly investigated by the Investigating Panel and (if sufficiently serious) properly adjudicated upon by the Disciplinary Body consisting of Members of the Council;

(b) before being called on to deal with any complaint of professional misconduct a Member shall know what is the complaint; and

(c) before being found guilty of professional misconduct such member shall be given a full and fair opportunity of being heard; and

(d) in all other respects the investigation shall be made and the proceedings conducted and the decision reached in accordance with natural justice, and that there is no duplication of proceedings with any other Institution, being a Corporation Member or Affiliate of the Council of Engineering Institutions to whom the complaint has been referred.

REGULATIONS

Disciplinary Procedure

1.(1) When a complaint of professional misconduct against a Member has been received, the Chief Official shall so inform the Member.

(2) The Council shall then appoint:

(a) An Investigating Panel consisting of not less than three Chartered Engineers to investigate whether a breach of the Code and Rules of Conduct has occurred.

(b a Disciplinary Body consisting of not less than five members, to hear and adjudicate any charge of professional misconduct arising from the Investgating Panel's inquiries.

The Chairman of the Investigating Panel and of the Disciplinary Body respectively shall be Chartered Engineers of standing.

(3) No member shall be eligible to serve both as a member of the Investigating Panel and of the Disciplinary Body at the same time or to hear a charge of professional Misconduct arising out of an investigation made when he was a member of the Investigating Panel.

2. The Investigating Panel shall make enquiries, by correspondence or otherwise, as it may think fit, into the complaint or question.

3. At the conclusion of its enquiries, the Investigating Panel shall decide:

(a) to refer the matter to the Disciplinary Body, or

(b) to require the Member to give an undertaking to refrain from continuing or repeating the conduct, or

(c) that no prima facie case of professional misconduct has been established.

The decision of the Investigating Panel shall be communicated to the Member in writing by the Chief Official forthwith.

4. If the Investigating Panel refers a matter to the Disciplinary Body, it shall make a specific charge or specific charges of professional misconduct in writing against the Member whose professional conduct is in question,together with a report of the enquiry made by the Investigating Panel and the relevant correspondence and documents (if any). A copy of the reference shall be supplied to the Member at the same time.

5. A member charged before the Disciplinary Body shall be given reasonable notice of the charge and shall be entitled to be present and represented at the hearing, to challenge any evidence of misconduct on his part, to produce such evidence as he may think fit, and to be heard either in person or through the representative acting in his defence.

6.(1) The Disciplinary Body shall hear and adjudicate any charge of professional misconduct against a Member and shall report its findings to the Council.

(2) Copies of the report of the findings of the Disciplinary Body shall also be given to the Council of Engineering Institutions and all Corporation Members or Affiliates thereof of which the Member is a corporate member, subject, however, to the provisions of paragraphs 9.(2) and 11 below in the case of an appeal.

7. If the Disciplinary Body determines that a charge has been proved, it may:

(1) expel the Member, or

(2) require the resignation of the Menber immediately or at the end of the current year, or

(3) reprimand the Member.

8. The decision of the Disciplinary Body shall be communicated to the Member in writing by the Chief Official forthwith.

9.(1) The Member shall have the right to appeal against the decision of the Disciplinary Body but only on the ground that the proceedings have been improperly conducted.

(2) Any appeal shall be made in writing to the Secretary at the office of the Institute within twenty-one days of the posting of the notification of the decision to the Individual Member.

10. Appeals shall be considered by an appeal body comprised of three persons, none of whom has been concerned with the case at an earlier stage and whose findings shall be final. This appeal body shall include the President of the Institute.

11. If a Member is to be expelled or required to resign, but wishes to appeal against the decision, no notification shall be sent to any Corporation Member or Affiliate of the Council of Engineering Institutions until after the appeal has been heard.

Costs

12.(1) If the Disciplinary Body decides that a complaint has been substantiated, it shall have power to order the member concerned to pay a specified sum towards the costs both direct and incidental, of inquiries of the Investigating Panel and the hearing of the Investigating Panel and the hearing of the Disciplinary Body.

(2) If the case is Dismissed, the Disciplinary Body shall be empowered to order that the whole or part of such costs shall be paid from the funds of the Institute and where appropriate, to seek to recover the whole or part of the expenditure from the complainant.

(3) In either event, the Disciplinary Body shall have complete discretion whether and in what manner it should exercise the powers conferred by the Regulations.

This paper was given at the Institute's Annual Conference at Seaton Burn in May this year. The authors are both with AAF Limited.

Air Filtration

G. Watt
P. Benson

Airborne contaminant is identified as having two basic sources, that which is naturally produced and that which is man made. Man is responsible for huge quantities of fumes, oxides, smokes, mists and the dust burden which is generated by city centre activities such as building, demolition and construction. Add to this the deposits from worn tyres, vehicle brake linings and vehicle exhausts. Inside buildings, contaminant is generated by the presence and movement of people, where lint and skin scales are constantly being shed, just as machines are generating contaminant, and fibrous particulate is being introduced to the atmosphere from carpeting and fabric decorations, etc.

The centre of London, for instance, will produce around 80 tons of airborne contaminant naturally, per square mile per annum (a figure available through the Warren Springs Laboratory, Department of Trade and Industry).

Industrial processes are responsible for the generation of fly ash, soot, and hydrocarbonous contaminant resulting from the combustion emission of both liquid and solid fuels. Much of this is considered noxious and worthy of the attention of the alkali inspectorate. This hydrocarbonous contaminant, sometimes termed carbon black, has been identified by the filtration industry as the most staining element of airborne contaminant.

Natural phenomena such as fog, smog and combined carbon (the result of decaying animal and vegetable waste), wind and dust, all contribute to the levels of airborne contaminant which have to be controlled by the application of air filters.

The micron is the unit of measurement used to quantify the sizes of airborne contaminant, and in order to assess the problem, it is helpful to be aware of the comparative smallness of a micron. This can be seen by the fact that the full stop at the end of this sentence is around 100 microns in size.

Much of the contaminant which is controlled within the Hospital environment is extremely small, i.e. viruses and bacteria are, to a large degree, sub-micronic, and much of the airborne dirt circulating around the Hospital interior is also sub-micronic in nature and, if uncontrolled, is responsible for expensive staining and discolouration. This demands the costly attention of the maintenance department to undertake, wash-down and redecoration programmes in both wards and general hospital areas.

Of the dirt types previously mentioned, fly ash is largely sub-micronic and therefore penetrating and difficult to contain. Other examples of sub-micronic particles are such materials as cigarette smoke, which freely circulates building interiors, causing staining, discolouring and becoming an unwelcome ingress into sensitive or critical areas. People moving within the hospital complex generate continuous amounts of contaminate which in the interests of 'good housekeeping' requires the effective application of air filters.

The effect of wind is a significant contributory factor in assessing the levels of particulate matter in our atmosphere. A light breeze will carry airborne dirt for vast distances. Agricultural operations in rural areas will contribute dirt to city centre hospital filter intakes, just as prevailing winds will distribute city dirt to rural areas.

The first step in recognising the problem is to analyse the general family group of contaminants with which air filters will have to contend. Airborne particulate matter is largely made up of the contaminant types shown in *Figure 1*.

Figure 1.

Carbon	Virus
Pollen	Paint
Lint	Limestone
Fly ash	Soot
Insects	Hair
Plastics	Cement
Glass	Oil

The next step in being able to deal positively with the problem is to recognise the make-up of those contaminants by quantity and by size. *Figure 2* indicates the breakdown of the previously mentioned contaminants and categorises them by size and scale. By using 5 microns as a datum line, we can recognise that type of contaminant which is larger than 5 microns, and that which is smaller than 5 microns. This is important since the collection principle used by air filters is fundamentally different for those particles larger than 5 microns than for those below this line.

To quantify the problem, it is likely that any sample of only one cubic foot of air taken within the United Kingdom, will contain around 10 million dirt particles of the types previously mentioned.

Figure 3 indicates that of the 20 million dirt particles likely to be found in a sample of 2 cubic feet, analysis by particle deposition, by size and weight, will clearly indicate the characteristics of airborne contaminant and therefore the necessary type of filtration which is likely to be effective in its containment. As can be seen from *Figure3*, that dirt which is 5 microns and above in size, constitutes around 98% of all the *weight* of airborne contaminant. This dirt is best looked after, because of its weight and size characteristics, by a primary (or roughing) filter. However, and conversely, the contaminant which is below 3 microns in size, although representing very little of the weight characteristics, does in fact constitute 98% of the *number* of dirt particles in any given air sample. With the problem of minute, lightweight dust being responsible for the greatest quantities of contaminant, this clearly indicates the need for a different method of contaminent. Because of the weightless nature of the dirt and its microscopic size, a more efficient method of filtration is required and this means the application of an extended surface filter to provide medium to high efficiency filtration, on this *particularly penetrating and staining dirt size.*

For that dirt which is sub-micronic in size, then the HEPA (High Efficiency Particulate Air Filter principle of filter operation is required if effective containment to specified levels of air cleanliness is to be achieved

The physics of air dictate that only three basic principles of dirt collection exist. They are namely, Impingement (for the collection of weighty dirt of over 5 microns in size), Diffusion (for the collection of smaller dirt from below 5 microns in size down to sub-micronic particles) and Electrostatic Precipitation, (which is effective in the collection of airborne particulate over the whole size range.)

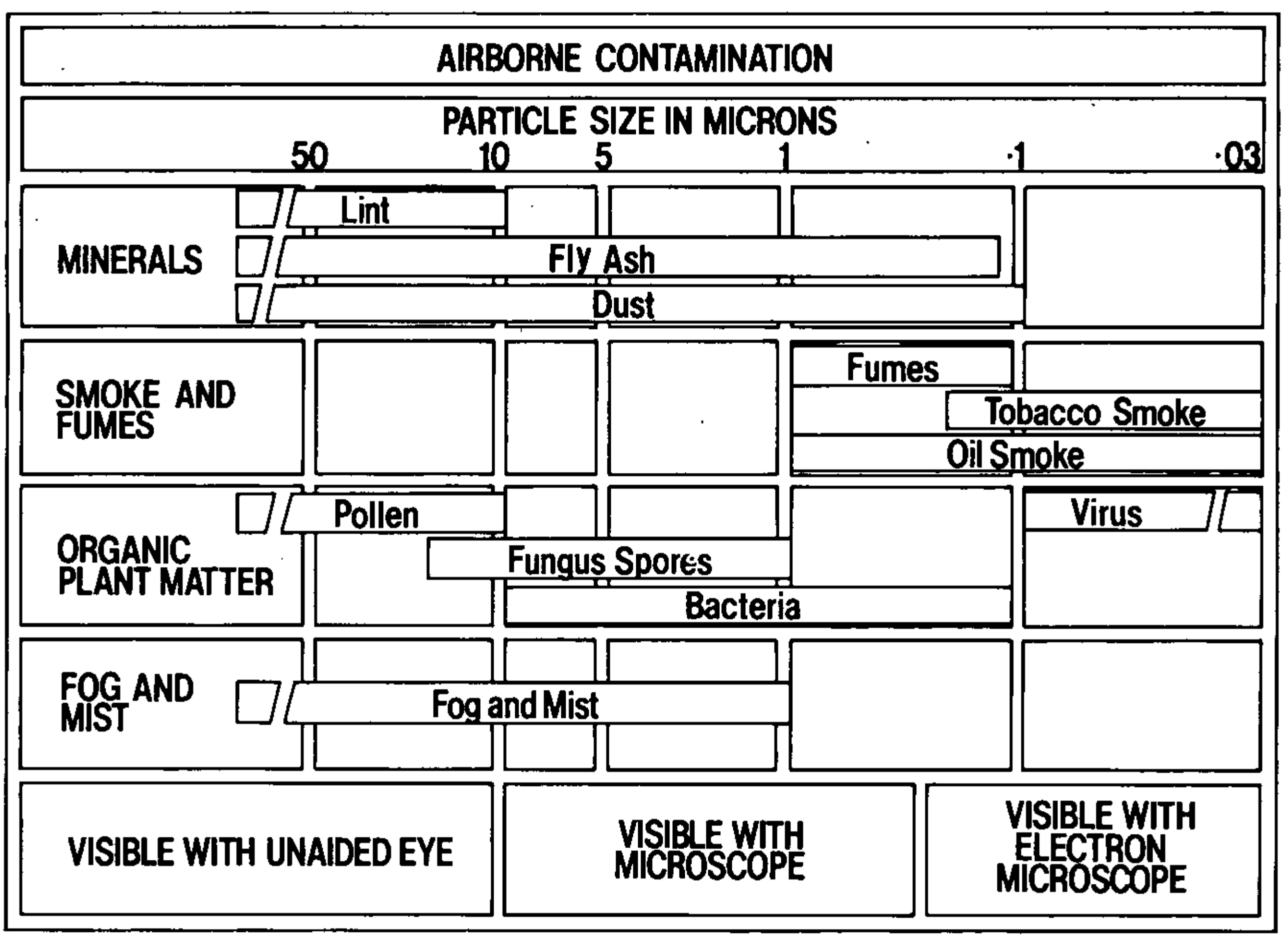
Viscous Impingement

Viscous impingement derives the name from the fact that the impingement principle is applied in conjunction with an oil wetting process to retain that dirt which has impinged upon the target fibres within the filter matrix. The types of filters utilising this principle are what have become commonly known as primary filters. These are all either the washable type, the permanent metal rechargeable type, the replaceable throwaway type, or the automatic roll filter.

A matrix of target fibres is produced into a mat, usually varying in depth between 1 inch and 2 inches, and this collection principle is most effective when utilised with velocities of air through the media of between 300 and 600 feet per minute. Normally the filter face area will dictate that this velocity is maintained. At this velocity the particulate matter which is over 5 microns in size and has appreciable weight, has sufficient mass and momentum to break through the resistance fields on offer around the target fibres and impinge onto one of the target fibres. An adhesive coating around the fibre will mean that the dirt particle will then stick to the fibre and will not merely bounce from one target fibre to another, and exit through the clean air side of the filter. To be in accord with good practice this coating should be a thixotropic material, which would therefore eliminate the migration of oil. By using a thixotropic gel instead of an oil the problem of oil carry-over from the filter is overcome.

For best results a filter fibre matrix which utilises a spun media with a fibre diameter of a single filament type reducing in a continuous filament from 50 microns in diameter down to around 15 microns in diameter, allows for the make up of the matrix to be produced in a progressive density form. Progressive

Figure 2.



density of the matrix will permit an open weave at the air entry side of the media and a closer fibre pattern at the air leaving side, where the fibres will be at their thinnest diameter. In this way large dirt particles will collect towards the air entry side of the filter, while the smaller contaminants will be allowed to penetrate into the media, hence the full depth of media will be utilised for the collection of dirt while providing a low resistance curve to air flow, ultimately meaning a long lasting filter, and one effective in the collection of the contaminant type 5 microns and above.

As the dirt particles impinge upon the target fibre the particles themselves become encapsulated by the gel and will therefore present larger target areas for the next batch of dirt coming through. This wicking action is responsible for the efficiency of the filter increasing throughout its life. At a time when the air filter has reached its recommended final resistance, it will in fact be performing at around its peak efficiency.

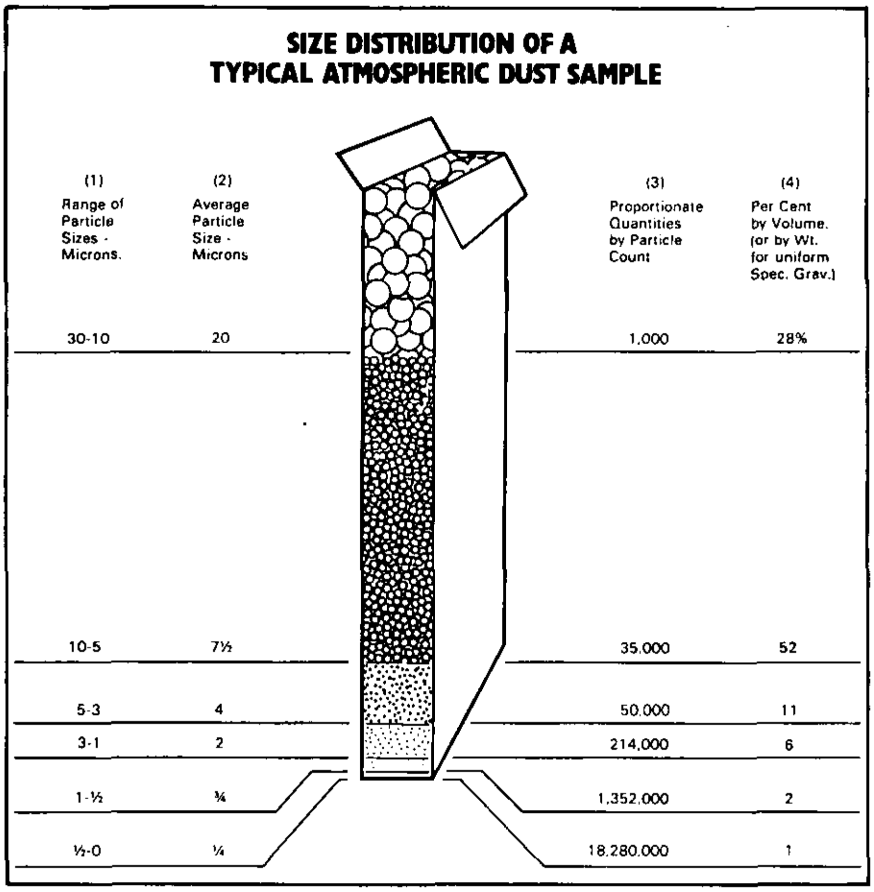


Figure 3.

Diffusion

Diffusion is the collection principle which is most effective in containing contaminant below 5 microns down to sub-micronic sizes. This dirt, being so numerous and effectively weightless, has to be contained by a different principle. The diffusion principle requires an approach velocity still around 500 feet per minute to the same filter face area as was applicable to the primary filter (viscous impingement) type. In this case, however, the filter media has a largely extended surface behind the face area, made up of filter target fibres within the diameter range of between threequarters of a micron in diameter to about 2½ microns in diameter. These extremely fine fibres are very densely packed together, and the extended surface filter media area should be sufficient to produce a velocity through the media of between 21 to 35 feet per minute.

At this velocity through the media these virtually weightless particles being carried into the densely packed dry media have the characteristic of being laid onto the fibre and retained there at that velocity. Intermolecular attraction is sufficient to hold the dirt particles on the target fibres and not have them blown out of the clean air side of the media. Velocity higher than 35 feet per minute would have the effect of 'bouncing' these weightless dirt particles from one fibre area to another and out of the clean air side. Velocities up to 35 feet per minute are sufficient to allow the dirt particle to be held onto the fibre.

Assisting in this collection process is Brownian Motion. This is the effect of the constant bombardment of gas molecules on the almost weightless particles, causing them to take many random courses of direction as they travel through the media, and therefore presenting many opportunities for them to collide with one of the target fibres on offer.

Filters adopting this principle are termed medium to high efficiency extended surface filters and can generally be classified as what the industry has come to regard as secondary filters. Bag filters is another description generally applied to these units.

By utilising a microfine glass paper matrix, and pleating the material to provide maximum filter surface extension, thereby reducing velocity to about 6 FPM, HEPA filters achieve excellent results for sterile and clean areas of Hospitals. Efficiencies of 99.9%+ on the DOP Test Method are achieved by this means.

In analysing the two physical principles it is clear, as can be seen in *Figure 4*, that a basic natural law is operating. That is, as velocity increases, a filter's effectiveness in the collection of larger particles increases. (Line E 1). As the velocity decreases, the filter's effectiveness in the collection of smaller particles increases (Line ED). If an attempt to mix the two principles is made within the construction of one integrated filter unit, a mean efficiency (Line A) is the best that can be achieved, because the filter design will be operating with air speeds which will be too high to be effective in the collection of larger dirt particles. The too slow to be effective in the collection of larger dirt paricles. The emergent ruling is that, although a primary and secondary filter can be installed in line, they should always be separate constructions. To attempt to mix the two principles into one integrated filter will yield an efficiency level which is unacceptable in effectiveness.

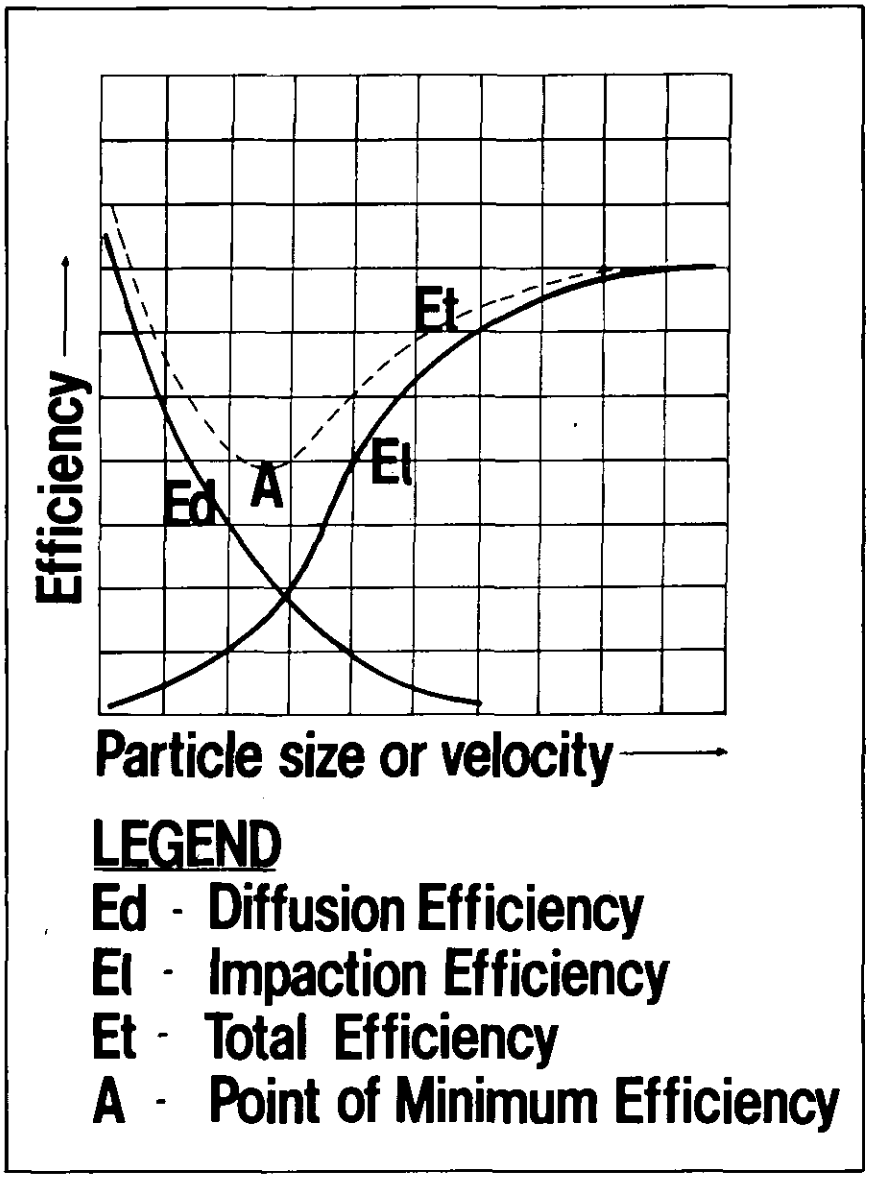


Figure 4.

Electrostatic Precipitation

Air cleaning devices using the electrostatic precipitation principle are constructed by placing an ionizing wire *(Figure 5)* into an air stream which is still around 500 feet per minute. Behind the ionizing wire are a series of collection plates. These collection plates have an equal number ground positively and an equal number ground negatively. As the airborne contaminant passes through the corona field produced by the ionizing wires, the airborne contaminant is charged electrically making the particles ions. The ions are therefore attracted to and attach themselves to the collection plates. Negative ions attach themselves to positively ground plates and positive ions attach themselves to negative ground plates.

The space between the plates is gradually occupied by these dirt particles which agglomerate. As the space between the plates reduces, an inertia field develops and the velocity of 500 feet per minute is sufficient to blow the then agglomerated particles out of the clean air side of the electrostatic air cleaner. Behind the electrostatic air cleaner, the placing of a medium to high efficiency extended surface filter or a primary filter will, to a very efficient level, collect and contain these agglomerated particles. Because the electrostatic precipitator has converted airborne contaminants throughout the whole size range into agglomerates, they are processed into very collectable units and the effectiveness of electrostatic precipitation is thus at a very high level.

Eurovent 4/5 Industry Accepted Test Method

Independent testing houses are available to the industry and will give unbiased reported valuations of the performance of assessed air filters. This information is used to obtain knowledge of the performance characteristics of the filters before selection or design into a system. Previously the industry relied on a number of BS tests to provide this evaluation criteria but through the development of air filter technology and testing technology, a more standardised world wide means of evaluation has become available via the EUROVENT 4/5 Test. The EUROVENT 4/5 test is based on the ASHRAE air filter test and provides very useful criteria to the selector.

EUROVENT 4/5 evidences two readings of how thoroughly an air filter will clean the air. One is called efficiency, the other is called arrestance. The correct terminology for efficiency is *atmospheric dust spot efficiency*. This is simply because the filter under test will have passing through it only atmospheric air to determine its effectiveness in the collection of all airborne contaminants within our atmosphere. This measurement is particularly useful in gauging *how effective the proposed* filter will be in providing a reduction in staining. *Efficiency* is therefore commonly used to determine the effectiveness of a high efficiency extended surface filter in containing the contaminant which is staining in nature, weightless, and below 3 microns in size.

Arrestance is a weight test utilising a synthetic test dust which is made up as closely as possible to represent the type of contaminant which is inherent in building systems. Arrestance indicates by percentage the *weight* of airborne contaminant a filter is capable of removing from the air stream as it passes through the filter. Because we know that the weight content of airborne contaminant refers to that particulate which is around 5 microns and above in size, *arrestance* is used by the industry to determine the effectiveness of a pri-

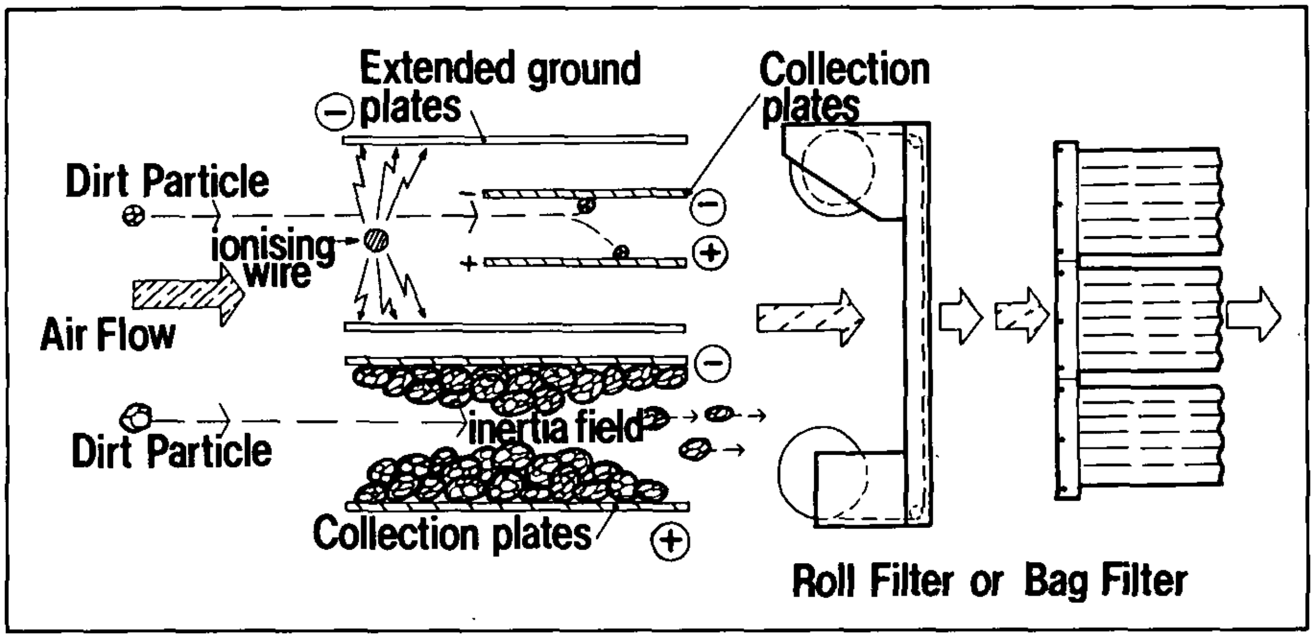


Figure 5.

mary filter in containing that type of airborne particulate. The correct *terminology for arrestance in this* context is *Synthetic Dust Weight Arrestance.*

Because it is recognised that contaminate of 5 microns and above in size is of the type which will cause problems in plant room areas, i.e. clogged fans, coils and motors, the industry can use *arrestance* to evaluate the likely performance of a *primary* filter which would be installed in the system to prevent this type of dirt problem.

To illustrate the drastic different between arrestance and efficiency, a primary filter will probably have an *arrestance* value of 75 or even 80 percent, but is unlikely to have anything *better than a 20 percent reading on* atmospheric dust spot *efficiency.* Therefore the primary filter type will be shown to be effective in the collection of the heavier dirt particles, which will clog fans, coils and motors, but will have little or no significant *effect in reducing* throughput of staining contaminant into conditioned spaces.

Conversely, a high efficiency extended surface filter will *combine* a very high *arrestance* value, in some cases even 100%, with a very high atmospheric dust spot *efficiency* reading, say 95% indicating that this filter will virtually prevent all 'clogging' dirt from entering the plant room *and* will prevent *staining from* occurring in conditioned spaces over months or years of operation.

The EUROVENT 4/5 test cannot be conducted on site but requires a finely calibrated testing available only in laboratory conditions. The test is accurately controlled and monitored throughout and five characteristics will be reported. They are:

Initial resistance to air flow;

Initial atmospheric dust spot efficiency;

Average atmospheric dust spot efficiency;

Average synthetic dust weight arrestance;

Dust Holding capacity.

The dust holding capacity figure tells us the total weight of synthetic test dust the filter is capable of holding before reaching its recommended final resistance. In this way one filter can be measured against another, on the basis that the higher the dust holding capacity on the EUROVENT 4/5 test the longer it will last in the system after installation in the building.

The step-by-step procedure of the EUROVENT 4/5 test is as follows:

a. The *filter to be tested is placed* into the rig;

b. From an incline manometer the *filter's initial resistance* (or clean resistance) to air flow is read and reported;

c. *Initial atmospheric* dust spot efficiency is then deduced. This is a very important reading as the filter is at its least capable air cleaning state when first installed in the system. When it starts to load with dirt, it is more efficient than when it is clean. In certain areas it may not be advisable to drop below a recognised *level of air cleaning efficiency.* While the filter under test may have an average atmospheric dust spot efficiency which is acceptable, it will be necessary to know if its initial atmospheric dust spot efficiency is compatible with the design parameters set for it. Therefore, with the filter under test installed into the rig, the fan turned on to a previously determined rate of air flow; and having read the initial resistance air flow, the first initial atmospheric dust spot efficiency reading is taken.

This is done by means of installing into the rig a translucent paper target upstream of the test filter and another downstream of the test filter.

The *factor being determined is the* time it takes the filtered air to stain the downstream target to the same degree as the unfiltered air stained the upstream target.

If the air approaching the test filter dirtied the upstream target to x-*degree in 6 minutes*, and the filtered air took 60 minutes to stain the downstream target to the same degree, then the efficiency calculation formula would indicate that at that point in the test the filter was 90% efficient.

d. Having taken the atmospheric dust spot efficiency a measured amount of synthetic test dust is then fed to the filter under test, in order to simulate and accelerate the life conditions the filter will experience after installation in an ACHV system.

The synthetic test dust is made up of 5% cotton linters, 23% carbon black, and 72% standardised air cleaner test dust. A measured amount is accurately weighed and fed to the filter under test. If 100 grammes weight of test dust were fed, and the filter gained 90 grammes weight, the synthetic dust weight arrestance at that point in the test would be recorded as being 90%.

Having fed a measured amount of the synthetic test dust the test will then take account of how much the filter's resistance to air flow has increased, in the knowledge that its resistance to air flow will increase as it collects dirt. Secondly, because some dirt is now within the filter it is a known fact that the filter's efficiency will have increased. It will therefore be necessary to take a further reading of resistance to air flow *and* a further reading of atmospheric dust spot efficiency. This series of feeding increments of synthetic dust to the filter will continue until the filter has reached its final recommended operating resistance.

Each time an increment of synthetic dust has been fed, a further atmospheric dust spot efficiency reading will be taken, as the filter will have gained in efficiency capability, and in resistance to air flow.

The test requires that a minimum of 5 synthetic dust weight increments will be fed to the filter before it reaches its final resistance.

e. The average of the synthetic dust weight arrestance readings and the atmospheric dust spot efficiency readings, will then be reported as an *average dust weight arrestance* and an *average atmospheric dust spot efficiency*. These figures will allow the test report to highlight how thoroughly the filter will clean the air throughout its life, of both the large 'plant-clogging' dirt and the fine, penetrating, 'stain-causing' dirt.

Because the arrestance percentage tells us the weight of the dirt the filter is capable of removing from the air stream as it passes through, it also helps in the calculation of the dust holding capacity of the filter. The dust holding capacity allows the calculation of the anticipated filter life, once installed in a system.

f. Dust holding capacity is measured by taking the total weight of synthetic test dust fed to the filter throughout the test, i.e. from initial to final resistance, and multiplying it by the average synthetic test dust weight arrestance percentage. For instance, if a filter received, from beginning to end of the test, 328 grammes of synthetic test dust, and its average dust weight arrestance percentage was reported as being 99%, that calculation would yield a dust holding capacity of 325 grammes.
328 x 99% = 324.72 grammes.

While this measurement does not provide months or fan hours of operation, it does allow the selectord the following benefit:

If a filter currently being used has a reported EUROVENT 4/5 Dust Holding Capacity of 100 grammes, it could be compared to another filter on offer which has a EUROVENT 4/5 Dust Holding Capacity of 200 grammes. If the first filter with the 100 grammes dust holding capacity lasts 6 months in any given system, the filter with the 200 gramme dust holding capacity can clearly be expected to last 12 months in the same system. In this way the filter can be evaluated on how thoroughly it will clean the air and how long it will last, and if thes two factors are considered in conjunction with the unit cost of the filter, then a proper cost/value analysis can be conducted to ensure the best possible and most cost-effective filter selection.

GENERAL NOTES

In summarising the foregoing, it should be borne in mind that weather plays a very important part in the job that any selected air filter will do once it is installed in the system *Figure 6* indicates the effect that weather has on airborne contaminants. On the left of the panel are shown typical weather conditions expeienced throughout the year in the United Kingdom. Because our weather changes frequently it is very important to look at the effect of weather changes on the size of particles which will be in the atmosphere. This chart is based on the number of airborne particles in two cubic feet of air and we can see, just to pick one example, the effect of weather on half micron particles is dramatic. In a snowy-wet condition we can see 1.3 million half micron dirt particles. If the weather then changes to a dry foggy condition, it can be seen that the number of these particles increases to around 13 million. Clearly, therefore, it is necessary to recognise this effect when selecting a filter to protect a conditioned space. The conditioned space may be well served by one filter type provided the weather remains constant. As the weather is constantly changing, it will be necessary to consider space, irrespective of the weather.

At all times the conditioned space will determine which type of filter

Figure 6.

TYPICAL PARTICLE COUNTS

WEATHER CONDITION	PARTICLE SIZE - MICRONS			
	0·5	1·0	5·0	10·0
SNOW-WET	1,280,000	69,970	1,205	150
SUNNY	1,641,000	106,900	1,133	266
FINE	3,800,300	121,000	3,850	720
RAIN	4,157,000	134,350	3,400	650
DAMP-FOGGY	4,854,500	96,000	4,000	1,000
DRY-FOG	13,081,800	604,800	8,100	1,960

should be selected. Naturally critical areas in Hospitals, such as operating *theatres, fever wards, intensive care* units, premature baby wards require the application of very carefully selected filters on the basis of the efficiency they will provide. In the manufacturing of medicines within the pharmaceutical industry, stringently clean air conditions must exist if the medicines are to be usable. On a more general level the manufacturing operations of micro-chips and computers demand air cleanliness to be at levels appropriate *for the end product.*

With regard to the maintenance of decoration standards within buildings, especially hospitals where the volume of traffic by people is considerable, then it is necessary to recognise that proper air filter selection will extend the period between washdown and redecoration, and therefore provide cost economies in the general running of the hospital environment.

Filter applications of an even more general level bring about the need for care to be taken in the selection of the filter for such installations as food processing, art galleries and commercial buildings. Wash down and redecoration is an extremely high proportion of any maintenance budget, and it can be controlled economically and effectively by the application of properly selected air filters. Grilles in conditioned spaces can become dirty through eddying effects on the contaminant which is brought into the space by people, and is there because of the fabrication within that space. However, an extremely high contributory factor to the dirt which surrounds inlet grills is that dirt within ductwork, plant rooms and from the air which is circulated to the space which will cause staining to be visible on grilles. This can be prevented by the proper application of air filters.

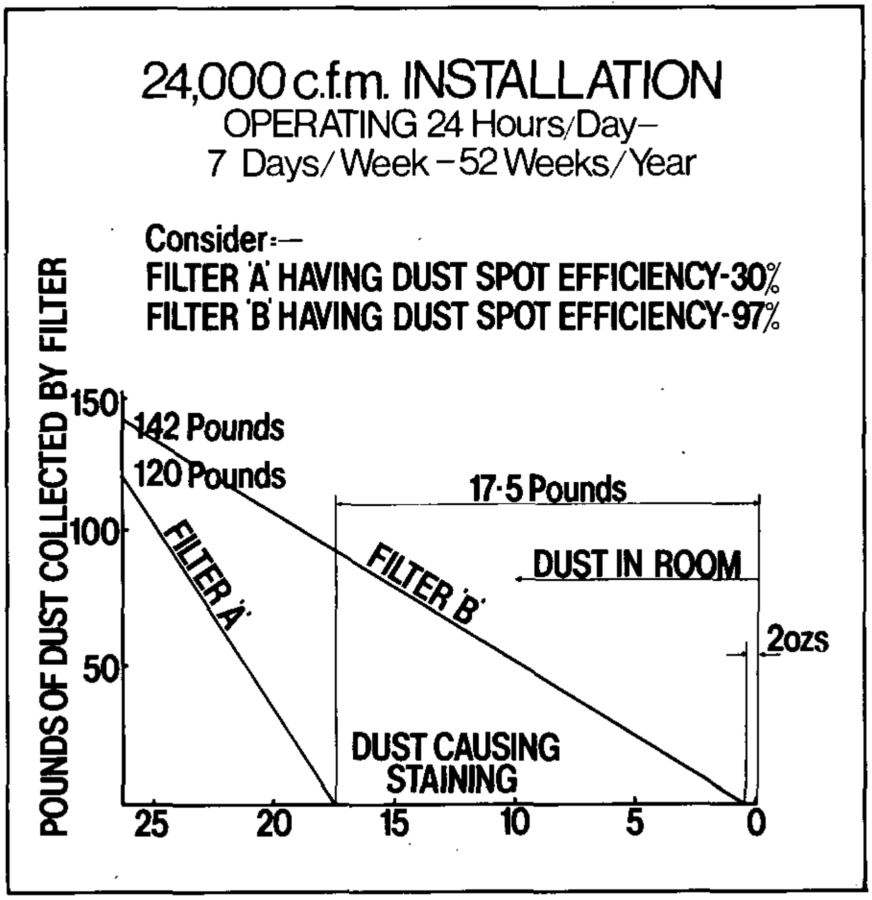


Figure 7.

Plant Room Equipment

There are known cases of heating and cooling coils being rendered non-effective in as short a space of time as nine months, simply through the improper selection of primary filters to protect the coils from the heavy dirt which clogs between the fins of the units.

An evaluation of a 24,000 CFM installation in central London *(Figure 7)* shows that by applying in this plant two filter types, one with a 97% atmospheric dust spot efficiency and one with a 30% atmospheric dust spot efficiency, the conditioned space suffered to largely varying degrees. Those areas served by the high efficiency filters allowed into the conditioned space some two ounces of dirt in 12 months. Those areas served by the lower efficiency filters allowed into the conditioned space some $17^{1/2}$ pounds of dirt in 12 months. In recognising that the contaminant type from which the $17^{1/2}$ pounds of dirt came was made up of the very small size (dirt 2 microns and below) we also recognise this is the most staining contaminant. In a twelve month period $17^{1/2}$ pounds of this type of dirt is sufficient to require immediate redecoration. The problem would have been more serious if the conditioned space had contained a sensitive manufacturing operation or was in any way in a health building.

The EUROVENT 4/5 test result if used properly, will clearly indicate which filter ought to be selected for which installation. Because the report will outline the arrestance, the efficiency, and the dust holding capacity, and the operating resistances for the filter, it provides all the information required to make proper selection.

It is impossible by looking at a filter media to determine which filter is designed well enough to provide long lasting performance, and which filter is not. By looking at media, either of a primary or a secondary filter, it is very difficult to know whether one media is more effective than another. The results from the EUROVENT 4/5 test will clearly indicate which is the most cost effective filter on offer, in terms of how long it will last and how thoroughly it will clean the air. Clearly it would not be practical to consider test results from manufacturers' own *test rigs.* These test rigs are useful for manufacturers' own quality control operations, for product development operation, and for research. For results of an unbiased nature it is always necessary to consider reports which come from independent testing houses, and most reputable manufacturers will recognise the need for this and make them available to interested selectors.

This paper was presented at the Institute's first symposium on Energy Conservation in March this year. It was first presented to an Institution of Municipal Engineers' seminar in November 1979.

The author was until recently Assistant Director, Directorate of Mechanical and Electrical Engineering Services, Property Services Agency, Department of the Environment.

The Energy Programme of the Property Services Agency

H. DIXON BScEng CEng FIMechE ACGI HonFIMechTE

Following a PSA Finance and Audit observation in 1971, observing the escalation of the annual costs of fuel and electricity, the Property Services Agency set up a Fuel Economy Unit, manned by headquarters staff of the Directorates of Home Regional Services and Engineering Services Development (now Mechanical and Electrical Engineering Services). Early work was concentrated on the further development of Optimum Start Control and the placing and supervision of a national contract for installation of the system in selected Crown buildings. At the same time, part-time Fuel Economy Officers were appointed in the Regional Head-

1. Cost of energy consumed by PSA in Civil Estate Buildings in the past 7 years, at constant prices (£m.). Weather and Estate Size corrected.
(includes solid/liquid fuel and electricity consumed by prisons)

1972/3	1973/4	1974/5	1975/6	1976/7	1977/8	1978/9
67.39	54.67	50.32	45.95	45.04	45.72	44.8

2. Percentage saving in gas/oil consumed by a random sample of 53 Civil Estate Buildings, compared with 1972/3 and taken without knowledge of occupants or engineering staff.

1973/4	1974/5	1975/6	1976/7	1977/8	1978/9
9.0%	18.70%	24.0%	33.8%	28.10%	35.0%

FIG. 1

RESIDENTIAL TRAINING & CONFERENCE CENTRE –CARDINGTON

Mechanical & Electrical Engineering Training Branch Courses.

A limited but currently increasing (1979) number of places will be available for students from organisations outside DEO/DTP

BOILER HOUSE PRACTICE
REFRIGERATION AND AIR CONDITIONING
DIESEL ENGINE
BOILER HOUSE AND HEATING FOR INDUSTRIAL STAFF – FOR E.P.O.'s
WATER TREATMENT
HEATING AND AIR CONDITIONING SYSTEMS CONTROLS
GENERAL CONTROL AND SUPERVISORY SYSTEMS
MID CAREER TRAINING IN ELECTRICAL ENGINEERING
AIR CONDITIONING DESIGN
MECHANICAL TO ELECTRICAL CONVERSION
ELECTRICAL TO MECHANICAL CONVERSION
} held at Royal School of Military Engineering, Chatham, Kent.

APPLICATIONS FOR COURSES AND CURRENT BROCHURE TO:— Residential Training & Conference Centre
RAF Cardington,
Bedfordshire MK42 0TF
Tel: 0234-58651

FIG. 2

quarter Offices in the UK to assist in supervision of the OSC contract and to undertake the general promotion of Fuel Efficiency and Economy.

Following the OPEC crisis in late 1973, the impetus and direction of the work was altered to increase the bias towards the improvement of monitoring and control of existing installations. A training programme for technicians and Craftsmen was instituted. At the same time, a target for fuel savings was set at 30% of the 1972/73 consumption to be achieved by mid 1979.

In spite of the apparent severity of the target, records indicate that it was achieved for the Civil Estate in 1975/76 and that, in the following year, a peak of 33% was achieved *(Figure 1)*. The accounting system is imperfect and these must be regarded as best estimates. The equivalent peak savings on part of the Defence Estate for which we are responsible were 25.2% Army and 29.5% RAF, based on MOD information. The target has been raised to 35%.

Not all of the original hopes and intentions have been fulfilled. The following review indicates where action has been effective and, so that others may avoid the pursuit of unprofitable activities, where solutions have still to be found. It has been a steady principle to avoid any project which does not appear to be cost-effective, to concentrate on those which appear to be most cost-effective and to make the best possible use of scarce, trained personnel. All projects are type-tested to obtain conservative estimates of possible benefits.

There are over 6,000 properties in the Civil Estate. Defence barracks, airfields etc occupy about 89,000 hectares of land, possibly a further 20,000 buildings. The greatest shortage is in trained personnel. We have never been able to deploy more than the equivalent of about 58 full-time professional and technical staff to the work. The controlling staff consists of technicians, originally part-time in the territorial organisation headquarters but now on a full-time basis. Training courses for technicians in Boiler House Practice, Controls etc are provided at the Mechanical and Electrical Training School at Cardington *(Figure 2)*. Further training results from the continuous dialogue and exchange of information with the headquarters unit as well as the staff in the depots whose work they control. Most of them have the basic academic training on which to build the requisite control theory and practice from the HQ unit's publications and manufacturer's data. Extra topics for study and application are introduced at annual seminars which they attend; strategies and policies are formulated and agreed and the delegates return to their posts with the basis of an extra programme of work. These seminars have provided a motivating force for real progress, a great deal of initiative in the field and a competitive spirit. Every technician requires the support of skilled craftsmen to undertake the maintenance and adjustment of the installations under his control. Although the adjustment of burners and system controls can be given to manufacturers' service staff or maintenance contractors, in practice this has not led to economy in fuel. This is partly due to lack of well trained contractor's staff and partly to the difficulty of specifying performance. There are also commercial constraints on contractors which reflect badly on system performance.

Heating, ventilating and air conditioning control systems require a combination of mechanical and electrical skills which are not usually taught to engineering craftsmen. In order to generate the necessary skills, a grade of Engineering Plant Operator (EPO) was adopted and suitable candidates are given a four weeks' training course at Cardington, supplemented by on-the-job instruction on controls and control systems. The EPO's undertake regular inspections of boilers and control systems, adjust them to produce a high level of operating efficiency, undertake first-line maintenance and report serious faults for makers' or workshop repair.

The foregoing refers mainly to gas and oil-fired installations, most of which are automatically controlled. However, there still remains an element of coal-burning in the Government Estate, justified by competitive prices for large users near to existing coalfields. Most of these installations, although they employ automatic stokers, have to be attended and are, therefore, manually controlled. In fact, most large installations will often operate more efficiently and economically if manually rather than automatically controlled, since a well-trained stoker can predict as well as adjust and can adapt his strategy to changing conditions in the plant he controls. If plant is sufficiently large, the extra cost of attendance is justified by increased efficiency.

Many of PSA's stokers have been trained for and passed the Boiler Operator's Certificate (BOC) of the City and Guilds of London Institute. Over the past 25 years, the more general adoption of automatic gas and oil fired plant resulted in a reduced demand for stoker training and some redundancy among stoking staff. The BOC curriculum changed in emphasis towards power station employees. The training staff from Cardington have been engaged with City and Guilds in preparing training courses and examinations more suited to our types of installation. The C & G Boiler Operators Course No. 650 was issued in 1978; training has been resumed and successful candidates are entitled to a bonus.

Reference has already been made to the shortage of manpower trained in Fuel Economy. Most engineers and technicians are trained for design and production. Maintenance and operational techniques tend to be relatively neglected. In order to employ limited manpower resources to the greatest possible effect it is necessary to measure the performance of individual systems, to detect abnormalities and direct attention to them. Since we expect to find serious operating faults, the system of measurement can be relatively coarse. Many of our installations are relatively small and few compare in size with industrial process installations. It was therefore decided to concentrate on medium and large plant where the annual fuel consumption would justify the cost of performance measurement and the costs of extra visits to undertake corrective action. The importance of concentrating on the most cost-effective activities cannot be overstressed.

A specification for a measuring system requires that measurements

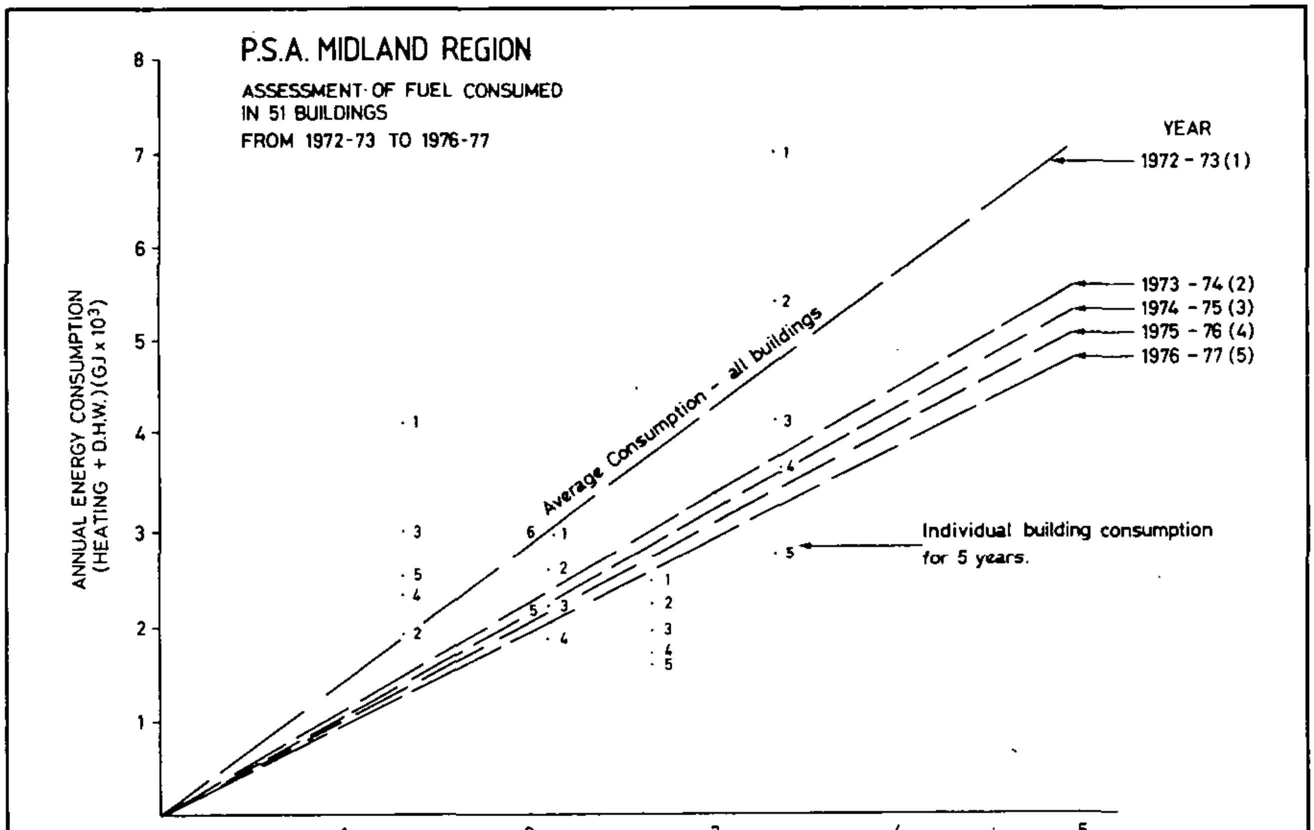


FIG. 3

should be relatively simple and that initial interpretation should be possible without having to visit the site. The system should be capable of indicating serious faults within a short time of their occurrence. There has been considerable debate on the best system to apply. The classical method of measuring heating demand is by the use of 'Degree days'. For a given period of time, the multiple of time and temperature below a given base temperature is calculated and summated. The base temperature is that at which no heating would be required. Theory suggests that fuel used for heating should be proportional to the number of degree days. In practice, the relationship is not proportional because most installations provide domestic hot water, for which the demand is not proportional to temperature. In addition, unless the boilers are actually turned off when the base temperature is reached, there is a standing loss of heat required to maintain the system at readiness. Degree days are published monthly. In order to obtain a reliable relationship between fuel used and degree days, it would be necessary to operate for ten months at least. Moreover in any year, there are less than nine months of heating season. Thus it would take over a year to establish a relationship and it would be a month or more before a fault was detected.

Another suggested method of measurement is to use an index of annual fuel consumption per unit of building volume or floor area. This is the target concept and depends on comparisons between different buildings of similar type, such as offices or schools. This is a useful concept for some aspects of energy conservation. However, it also suffers from the disadvantage of requiring 12 months' measurement before comparisons are possible and, whilst it will pinpoint the more extravagant users of energy, it is not diagnostic. If extravagant use is due to the type of building and its form and shape, remedies may be quite impracticable. Another disadvantage is that if a building is continuously occupied and heated, it will obviously use a lot more heat than one which is only occupied intermittently. Thus, any target measurement has to be adjusted for occupancy and, unfortunately, the effect of heating-up times is not simple to judge. This system has been applied to a group of 51 buildings in one UK region over a period of five years. *Figure 3* shows the best fit lines relating fuel consumption to floor area for the five years. It has demonstrated an overall reduction in fuel consumption by the group over the period in gradual and decreasing stages. As expected, it seems not to have been possible to make extra large savings in the original relatively heavy users.

Past experience suggested that for a well operated installation, the sophistication of the degree day system is not necessary. A relationship between fuel consumption and average outside air temperature might be a suitable alternative. This would have the advantage that, for the sizes of installation to be monitored, measurements could be made at least weekly and, for large installations, even daily. The average outside air temperature could be obtained from the local meterological station or by daily readings of a max-min thermometer at the actual site. (The latter has proved necessary in some cases). Fuel consumption could be obtained from meters, if fitted, or from stock and delivery records. None of this would require more than simple clerical skills. The data could be analysed over 12-week periods and, if the relationship were linear, could be processed on a simple desk computer, such as were available in our Regional Offices. A graph could be produced *(Figures 4 and 5)* showing the best-fit correlation between air temperature and fuel consumption. In addition, if required, the computer could provide a control band, above and below the best fit, within which normal performance might be expected *(Figure 6)*. The diagram indicates the proportion of points which may be expected to be within the boundaries of one, two and three Standard Errors of Estimate. A change from these proportions indicates a change in performance.

Figure 4 gives the results of field trials which showed that this would succeed for most, well-operated installations. There are exceptions, however. If the occupancy of the buildings were variable, the system would not work. This applies to, say, Army barracks, where troops may be absent for substantial periods on schemes, exercises and operations. The problem appears to be marginal and can be overcome by omitting periods of abnormal occupancy. Unfortunately, during the first 12 weeks of operation of the system, the average weekly temperature was almost constant and provided nothing useful. Fortunately, the next period started with a cold snap and continued with a spell of progressively milder weather.

At the last Fuel Economy seminar, it was decided to test reaction to the suggestion that the system be abandoned. There was an immediate and strong response when it was forcibly pointed out that this was the only system available to detect when things were going wrong, indicated by a consumption significantly above average.

Up to now, the monitoring system has been mainly used to detect installations in which system controls were not operating correctly, so that con-

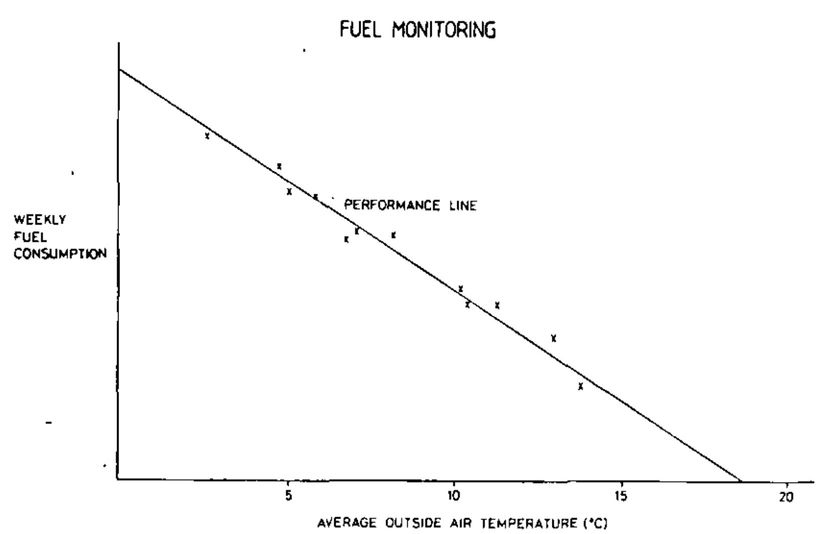


FIG. 4

sumption was not related to weather. *In some cases controls* were missing, probably due to changes from manual to automatic firing, where the systems had not been completely modified to take account of the different firing system, usually oil or gas instead of coal or coke. Design instructions have been issued to assist technicians to select appropriate combinations of controllers to suit every possible type of system.

In most cases, however, the remedial action is by control adjustment by EPO's or other trained staff. Small portable temperature recorders have been issued to them so that, by measuring typical room temperatures, they can judge the amount of control adjustment required. The intercept on the horizontal axis is adjusted under mild weather conditions by alteration to programme controllers. At the other end of the line, the intercept on the vertical axis is altered in cold weather. The recorder is also used to detect the need for adjustment of Optimum Start Controllers, if room temperatures are attained too early or too late in relation to the start of work.

There are some further aspects of the application of the monitoring system which are still being explored. The intercept on the vertical axis measures the weekly fuel consumption at 0%C outside. Under these conditions a burner operating at constant output should be operating about 80% of the time that the building is occupied plus, say, about 25 hours per week for pre-heating ie about 65 hours per week for an office building. If the indicated fuel burnt *per week is less than the* burner would use in 65 hours, the implication is that it is stopping and starting unnecessarily. A reduction in the burner size may then be possible, resulting in an increase in boiler efficiency. There is probably a limit of about 8% saving on consumption if this is done. However, there are risks of boiler corrosion to be avoided. There is also the possibility that if there is excessive variation in the measured results (scatter) a reduction of burner *size based on use of the* mean would result in undercapacity. Current investigations are aimed at deciding the amount to allow for scatter.

Scatter is due to a combination of normal errors of measurement, the effects of solar gain and variations in wind speed and direction. It has been suggested that a wide scatter

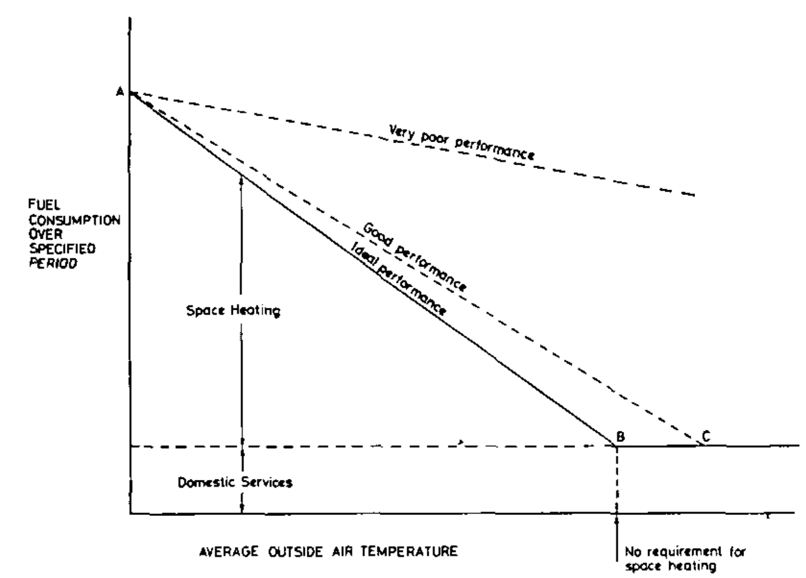


FIG. 5

is an indication of a draughty building. There is also a hint that it can be caused by *differences in level in* fuel storage tanks.

Optimum start control has been applied throughout the Civil Estate and work continues for MOD. It is applied only to buildings which are normally occupied for less than 14 hours per day. For economic appraisal of conversions, OSC saves about 10% of consumption compared with Fixed Time Start Control and about 25% versus Night Depression Systems. A second-generation of these controllers is now available, *using solid-state* electronic circuitry, which are easier to adjust for changes in occupancy and simpler to maintain. There also appears to be a prospect of lower prices for them which will increase the scope for their use.

In the Defence Estate, systems are being reviewed for the application of OSC and other system controls. In some cases, savings of as much as 50% are expected. This work is proceeding relatively slowly because each system has to be surveyed thoroughly to define the scope for modification. Much of the work has to be done in the summer.

Investigations and field trials have shown that if individual rooms or zones in office buildings can be thermostatically controlled, savings of at least 15% can be expected. The work is likely to be relatively costly. It involves thorough analysis of the hydraulic characteristics of existing heating circuits to avoid failures. It will probably be limited in scope because of the cost-benefit implications and progress will be *relatively slow. Figure 7* indicates the expected savings derived by computer analysis and confirmed by field trials.

There are many single and multi-boiler heating installations in which the application of improved control techniques would improve the ways in which the boiler output is matched to system demand. Field trials have been mounted in which these methods have been applied. The prospects seem to be that about 8% of fuel consumption can be saved. Up to now *it has been difficult to establish this* potential accurately, partly due to the difficulties of finding identical pairs of buildings with identical occupancy patterns. Another problem is that contractors engaged in the work of modification are familiar with conventional control systems and are not easily converted to the new principles being introduced.

In the electrical field, some of our earlier hopes of introducing centralised and automatic control of *lighting have not yet been realised.* In general, the cost-effectiveness of altering existing wiring circuits is insufficiently attractive. Such improvements, as well as the use of task-lighting, will have to wait until major re-wiring has to be undertaken or the opportunity can be taken to introduce systems in new buildings.

Monitoring of electrical consumption has been improved by arranging for local management to be provided with computer analyses of their buildings, *showing consumption* trends over three years and drawing attention to cases where there is a *prima facie* case for changing to more advantageous tariffs.

Particularly in the Defence field, work is proceeding with the replacement of existing, relatively inefficient lamps with high and low pressure sodiums. We would like manufacturers to develop plug-in replacements but, in practice, usually have to replace or provide special controllers. These replacements are particularly effective for flood-lighting and hangar and workshop systems. There are some applications in street-lighting as well.

We have completed a national contract for power factor correction and are extending the application of maximum demand control, using existing voice-alarm systems.

In catering equipment, the experimental work on the application of timing and thermostatic controls and electronic ignition is being incorporated into new contracts. The savings in this field have been up to 60% in electricity and gas consumption.

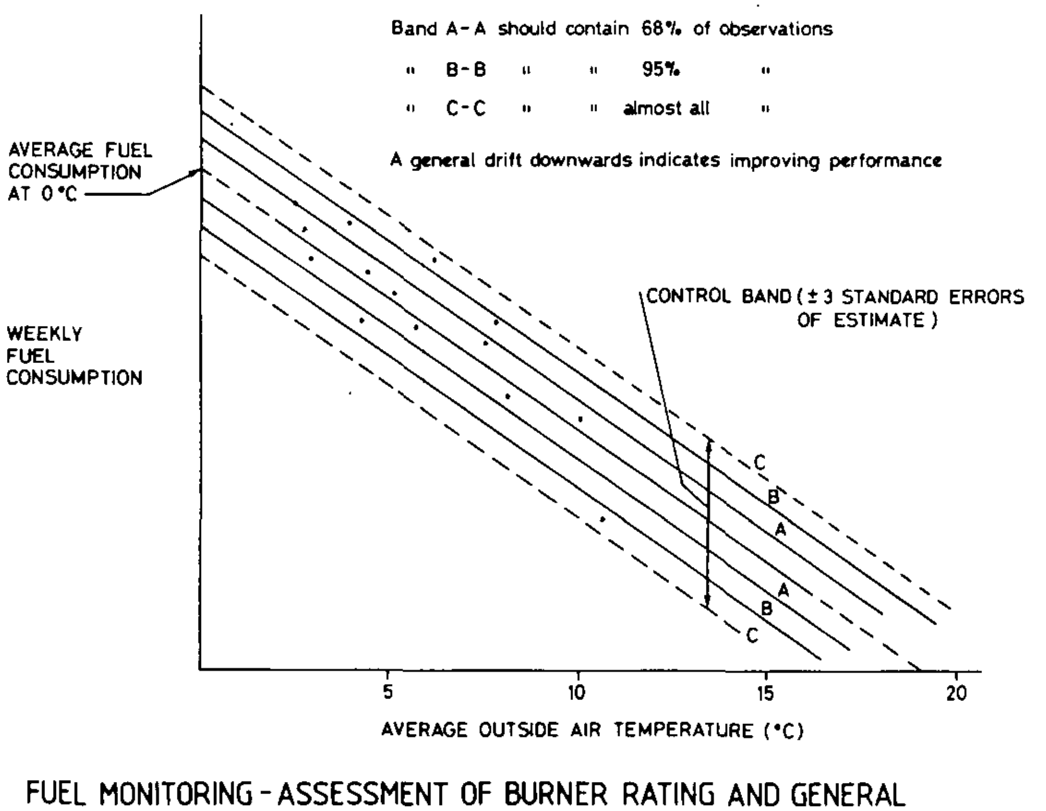
For existing buildings, quite a lot of work has been done on improvement by such measures as loft insulation and cavity filling, which are relatively cost-effective. The availability of extra funds ought to enable us to do more of this work, particularly in Service Married Quarters, for which executive instructions have been issued. In some hangar and workshop buildings it has proved very cost-effective to add thermal insulation to walls.

Our architectural group has issued a design guide for Energy Conservation in New Buildings and we hope to reduce the energy requirements of new projects compared with the past. Work is proceeding on the setting of design targets for new buildings, both in PSA and in the Chartered Institution of Building Services. There are some difficult problems posed by the restrictions of sites and locations which may prevent us from achieving ideals. Moreover, it would be a dull world if every building was designed exclusively to conserve energy. The Royal Institution of British Architects is showing a welcome enthusiasm about energy conservation in new design.

One of the greatest sources of heat loss from buildings is due to leaks. It is virtually impossible to produce a building in which cracks are not present or will not develop due to expansion and contraction of the structure due to changes in temperature. Simple draught-stripping by many of the flexible materials available is easy and cost-effective. More serious problems arise in hangars and workshops where we are applying flexible curtains to doorways and brush strips which close up the large gaps between doors.

In many buildings, external sealing of the cladding may be a relatively expensive business and we have no rapid method of measuring the results. A project has been mounted by the Buildings Research Establishment to see if we can devise a method of measuring air changes in buildings which can be easily used, does not require sophisticated equipment and will give rapid results. Since the results depend on the variation of wind speeds and direction, high levels of accuracy cannot be expected. Confidence in the cost-effectiveness of remedies should, however, be possible for a large number of buildings.

Like many other organisations, we



FUEL MONITORING - ASSESSMENT OF BURNER RATING AND GENERAL PERFORMANCE

FIG. 6

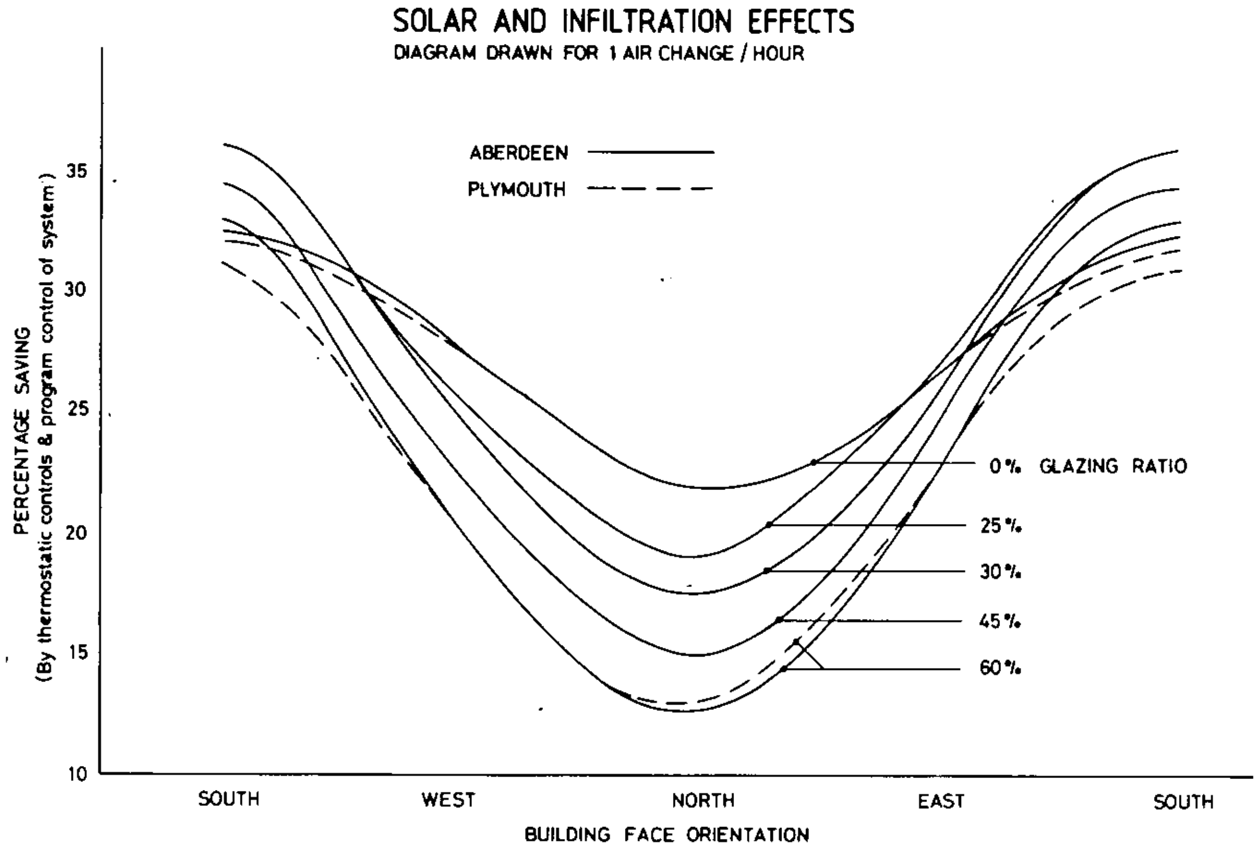


FIG. 7

have buildings scattered over wide areas of cities, towns and country. To maintain operational control of all of them is a difficult and expensive task. We are currently exploring the application of mini and/or micro computer systems to monitor plant performance, detect faults and enable a central controller to adjust and set controls to current conditions. Part of the benefit, assuming that the systems can be cost-effective, will result from energy savings.

PSA publications on Energy Conservation can be obtained from The Chief Librarian, Property Services Agency, Room C201, Whitgift Centre, Wellesley Road, Croydon CR9 3LY. Tel 01-686 8710. Ext 4499.

Most of the savings achieved have been obtained with the active cooperation and, in many cases, even encouragement from building occupants. It is to be hoped that these relationships will continue.

To get the greatest savings at the least expense it is necessary to appreciate that all engineering designers must allow for chance variables in every system they produce. These are akin to the safety factors in structural design. In energy consuming systems, these factors can be trimmed out by skilled operators. This must be done with care but the rewards are immediate and the costs are negligible. All that is required is training, motivation and enthusiasm right down to the work face.

Energy Conservation Measures in approximate order of Cost Effectiveness

1 PLANT MANAGEMENT — improved operation techniques, performance monitoring and training maintenance and operation personnel.

2 OPTIMUM START CONTROL — replacing night set-back control systems in heating installations over 100 kW installed capacity, and where heating is required for less than 14 hours per day.

3 SIMPLE TIME CONTROLS — replacing night set-back control systems in intermittent heating installations below 45 kW installed capacity.

4 OPTIMUM CHARGE CONTROL — to regulate the charging rate of off-peak electrical storage heaters used in commercial buildings.

5 HIGH PRESSURE SODIUM LUMINAIRES — replacing tungsten or combined mercury and tungsten luminaires for floodlighting, hangar and workshop areas, provided the tasks to be illuminated are not critically dependent on colour.

6 INTERNAL SPACE TEMPERATURE CONTROL — individual and zone controllers in buildings otherwise using weather compensated control only.

7 ROOF INSULATION — in uninsulated roofs.

8 CAVITY WALL FOAM FILL.

9 INTERNAL INSULATION — roof spaces and walls in workshop/store areas.

10 DRAUGHT STRIPPING — cost effectiveness is uncertain.

11 BOILER CONTROL — matching output to demand. Studies in hand. Past field trial results uncertain.

NOTE: In particular cases the ranking order may be different.

The Author is the Area Works Officer of Berkshire Area Health Authority and gave this paper at the 21st International Hospital Congress in Oslo in June 1979.

Access to Engineering Services for Maintenance

P. J. TANKARD MIMechE AMBIM FIHospE

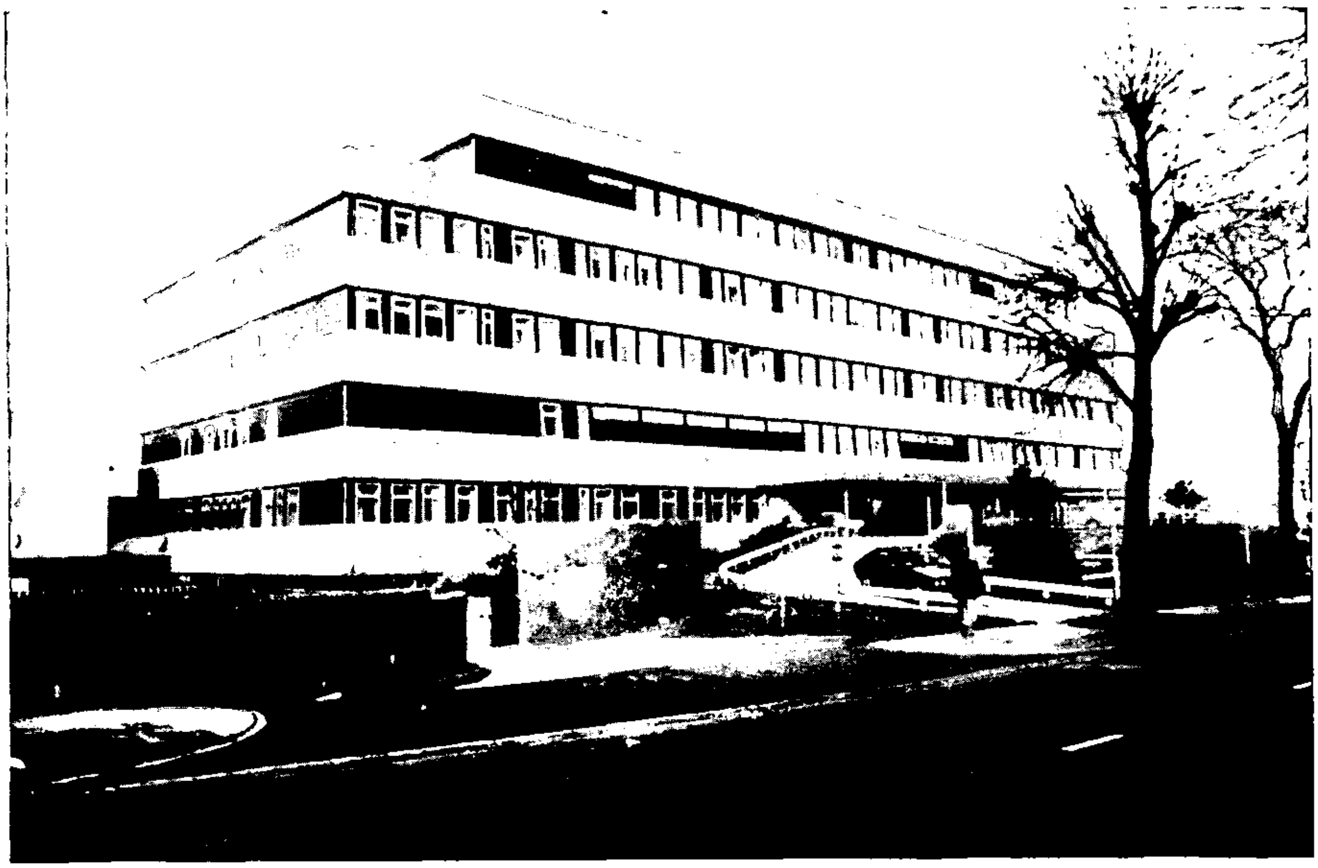
There is a constant need to remind designers of hospital buildings that there is a conflict between the medical demands for clean surfaces in clinical areas in hospitals, and the need to have engineering services accessible for maintenance, testing and for alterations and extensions.

The designer, under pressure from doctors, is tempted to bury the pipework and other services, or otherwise case them in within the fabric of the building, with resulting high cost penalties in terms of loss of service, high cost of repairs and, sometimes, unnecessary building damage.

It is important, therefore, to consider the maintenance operational policy at an early stage in the design process to enable the design of proper access to engineering services to be provided.

Factors determining the approach are:

Figure 1. Royal Berkshire Hospital Maternity Unit.



Intensity of engineering services required in the building
Future flexibility of layout
Consequences of failure of engineering services
Frequency of maintenance operations
Space required for engineering plant

The general features desirable from a maintenance engineer's point of view are:

Access to plant rooms without the need to enter clinical or other working areas.

All pipework and other services to be accessible either on the surface (which is not usually possible) or contained in properly designated space within the building, with means to work on it without dismantling the building fabric.

Ability to monitor plant performance and environmental conditions without requiring entry into clinical areas.

A Maternity Unit which is of deep plan design and therefore has a high level of internal ventilation of the central core. The designers recognised quite clearly the need to separate the dirty maintenance problems from the clinical areas by providing a 1.3m void over each floor area with access from a basement staircase at three points up through the building.

Figure 2. The maintenance staircase.

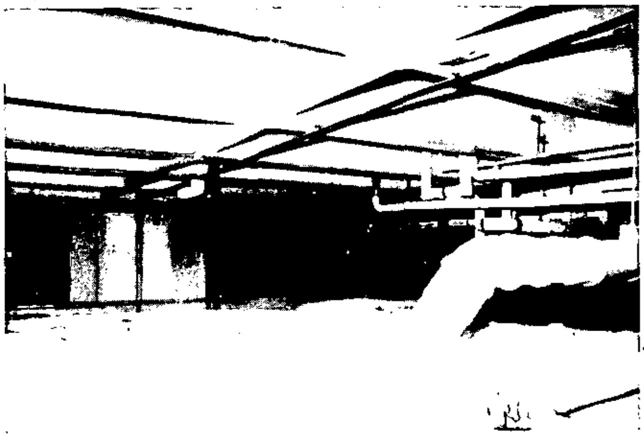


Figure 3. The service void.

Services drop within partitions to outlets at ward level and drainage drops to the void below — All isolation valves in pipework are also contained within the void. Anyone used to day to day situations which arise in hospitals can visualise crises where services need isolation in an emergency — flooding due to water joint failure — tops of taps becoming disconnected. The maintenance engineer when called to this situation in this building has to go to the basement, climb the stairs to the relevant floor, crawl through the void to find the isolation valve — probably needing to refer to a drawing to identify the particular valve required — in order to isolate the service. Clearly, an unnecessarily complicated procedure.

This is a situation where access to services was considered and provided at considerable expense, but the maintenance policy and procedure was not properly defined at the design stage. This is probably an extreme situation, but good design need cost no more if maintenance is considered at an early stage.

An example of a much simpler and considerably cheaper solution which has proved to be useful for local isolation of pipework. (See figure 4)

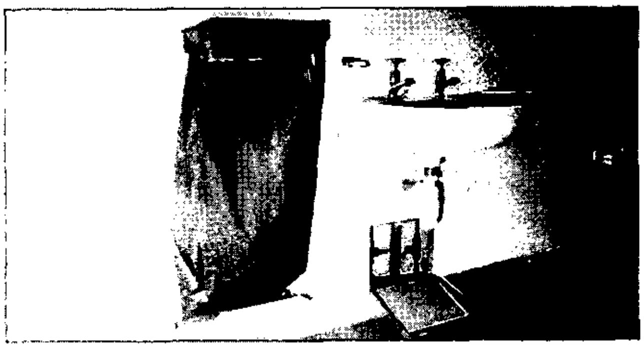


Figure 4. Isolation Access.

Operating theatres are a particular problem for the maintenance engineer in that not only are the services more vital in ensuring reliability, but access is difficult due to pressures on operating time. There is also the requirement for staff to change clothing and any work carried out must be compatible with clean conditions.

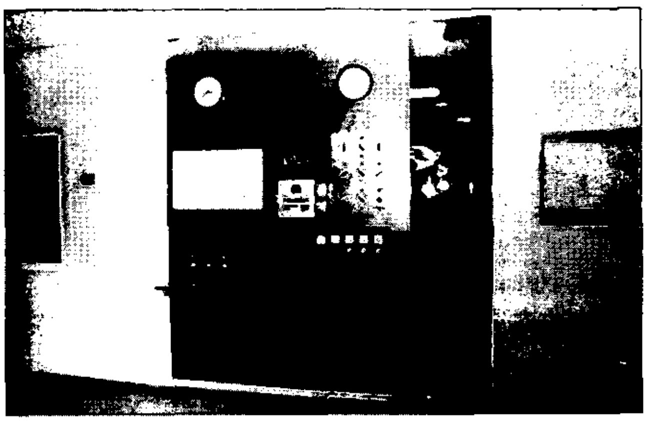


Figure 5. Control panel, front. On this operating theatre control panel maintenance of the equipment can be carried out by access to the rear of the panel.

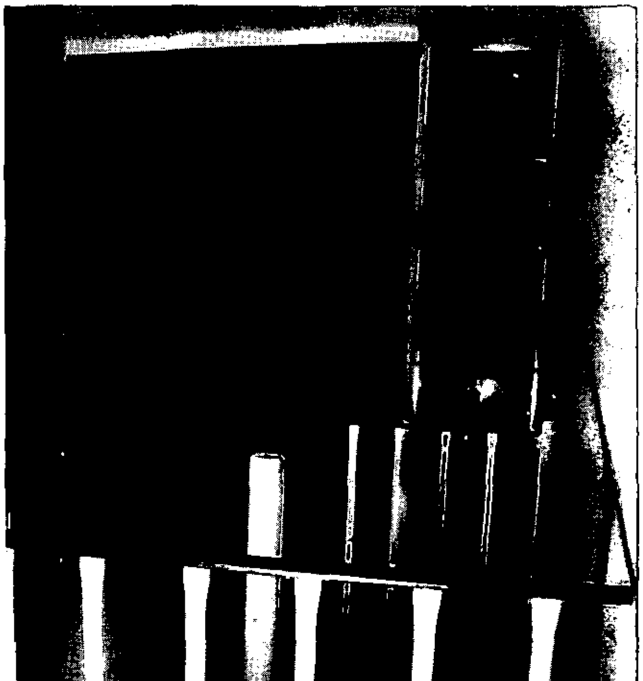


Figure 6. Operating Theatre panels rear access.

A similar problem arises in access to sterilizers serving sterile packing departments.

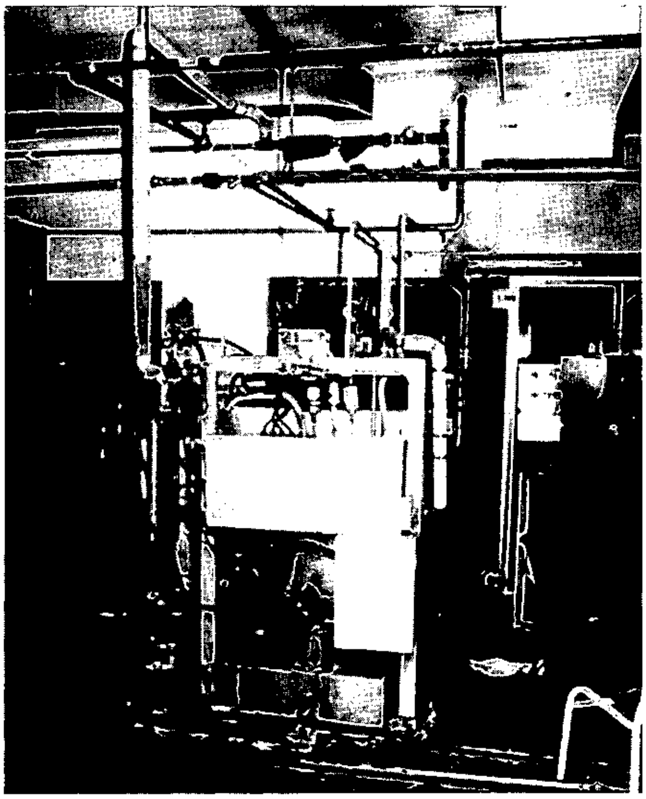


Figure 7. Eye Block Sterilizer doors.

False ceilings with removable ceiling tiles are a good solution for the maintenance engineer from an access point of view, without the need to enter into the sterile department.

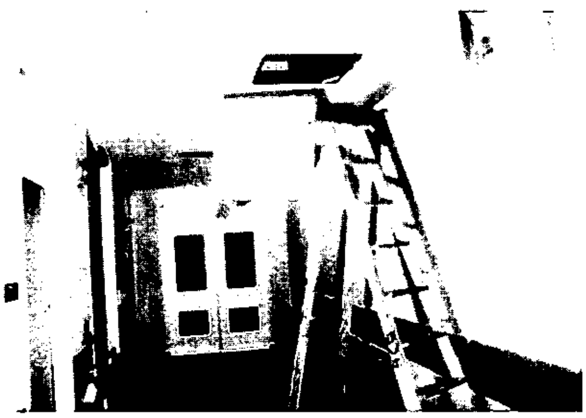


Figure 8.

Selected tiles can be removed by screw fixings at changes in direction af services, isolation valves and dampers in ventilation ductwork. They also give a readily demountable surface for changes in the engineering services.

The application of new legislation in the United Kingdom in the form of the Health and Safety at Work etc Act 1974 has imposed a responsibility on employers and employees to provide safe working conditions and procedures. This has some legal implications on the question of access for maintenance work. For instance, access to this roof top plant room, shown in figure 12, is over a roof which is in fairly close proximity to the roof edge.

Figure 9 (see front cover). Intensive Care Unit. A section of ceiling tiles have been removed for the installation of ventilation ductwork in an Intensive Care Unit.

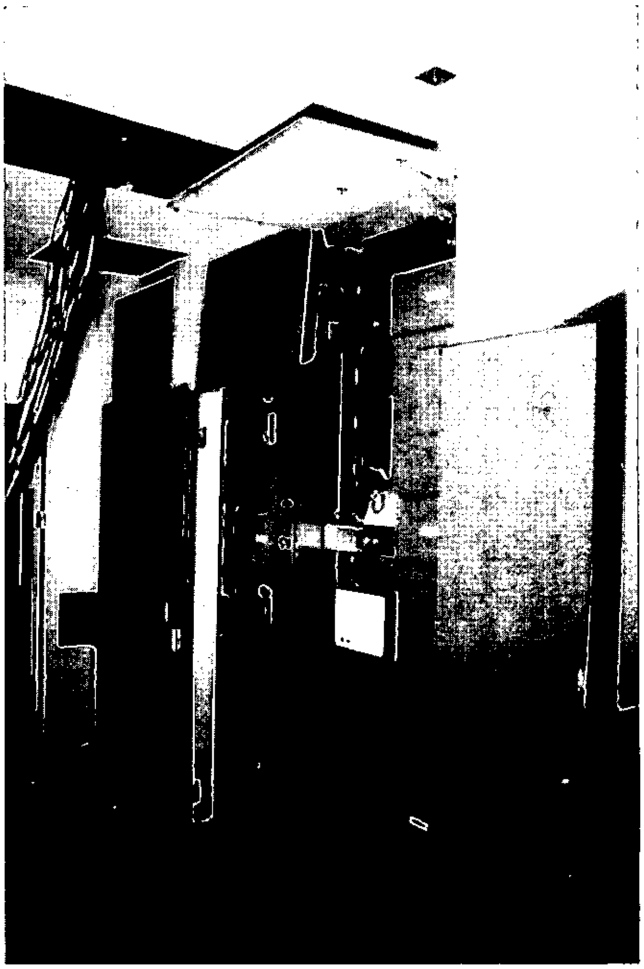


Figure 10.

The installation of electrical wiring in the same area as Figure 9. Note here the access to electrical switch gear — a lockable cupboard off a main corridor — simple but very practical.

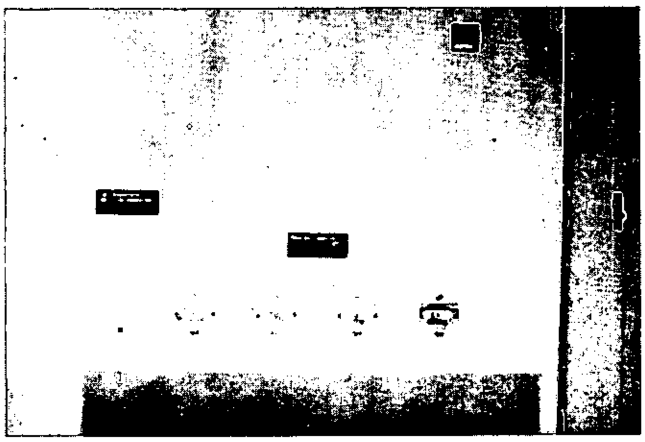


Figure 11. Medical Gas Isolation.

This arrangement in now a standard approach for Isolating medical gases in an emergency (break glass in the case of fire) and at the same time enables properly authorised isolation for maintenance by means of key access.

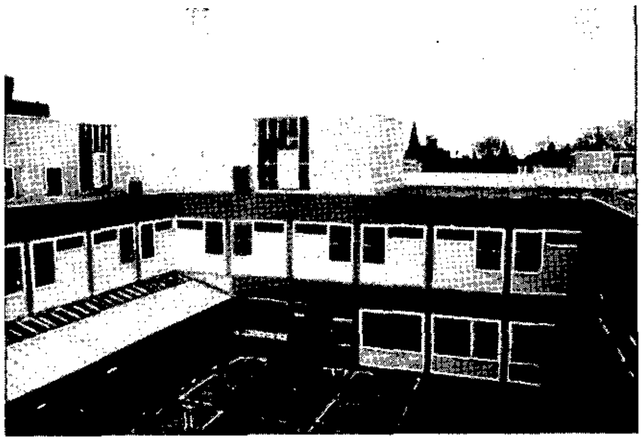


Figure 12. Roof. Guard rails should be provided here to ensure access in such positions.

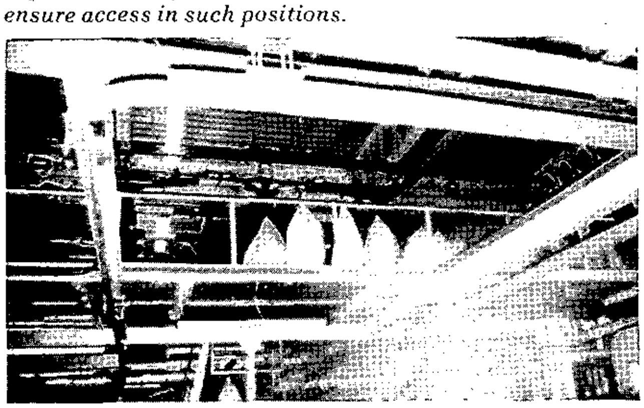


Figure 13. Laundry Monorail.

A similar problem arises here in a hospital laundry which has a monorail system for the storage of dirty laundry. The monorail has a series of operating points for directing bags to different rails. These point require frequent adjustment and lubrication to ensure correct operation. — Access by ladder, the only means originally provided, was most hazardous and so this platform was provided to allow this work to be done in safe working conditions.

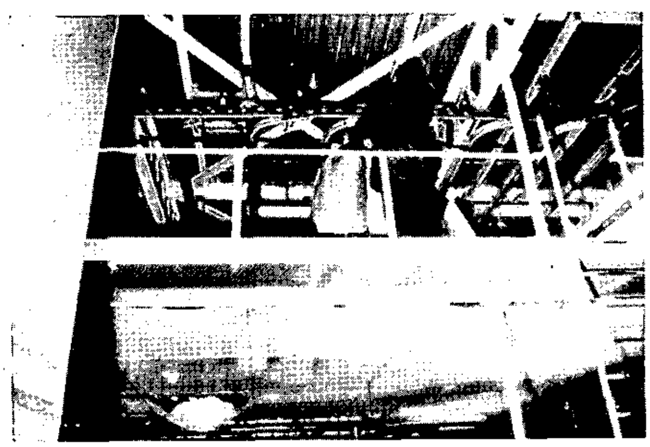


Figure 14. The Platform.

I mentioned in the list of the maintenance engineer's requirements the need for access for replacing large and heavy plants.

It should not be necessary to cut a new door in the laundry wall when the time comes to replace a washing machine, which was the case at Battle — see Figure 15.

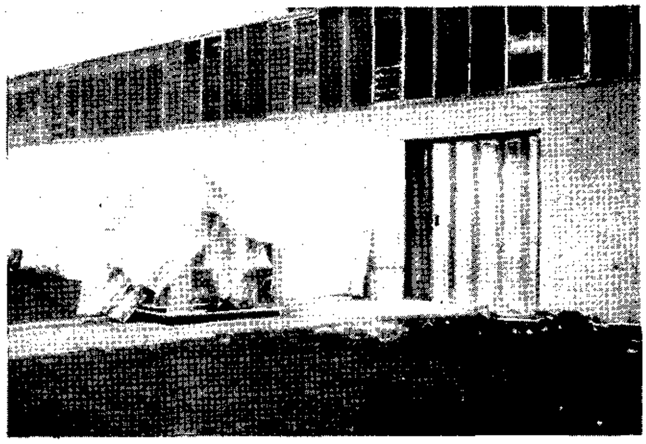


Figure 15. Laundry Door.

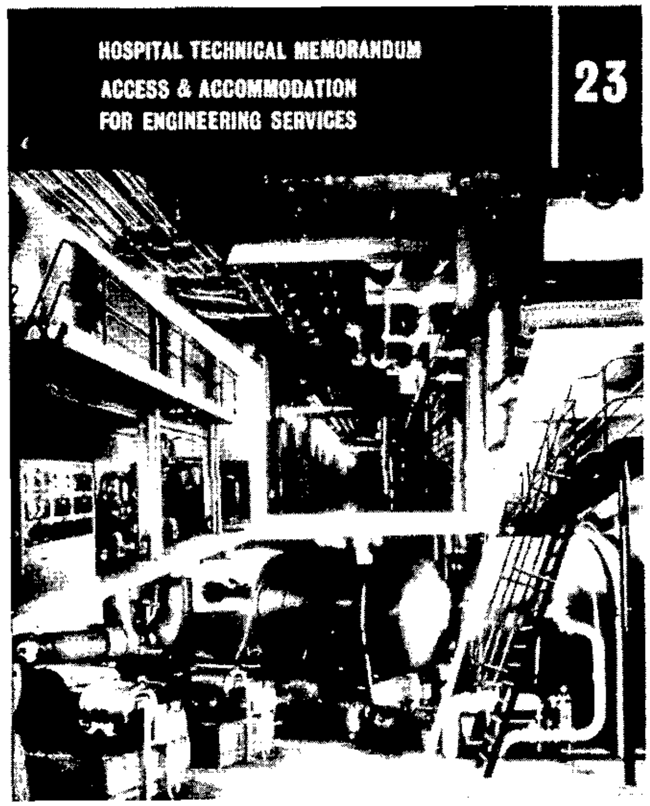
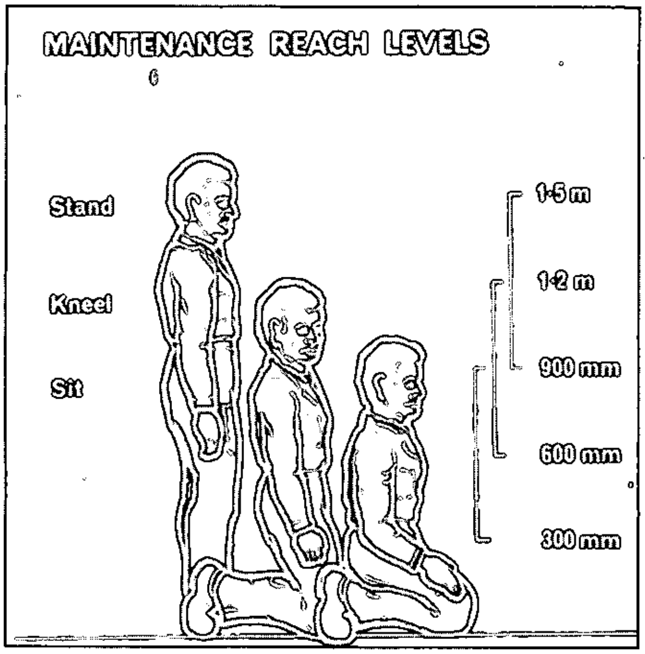


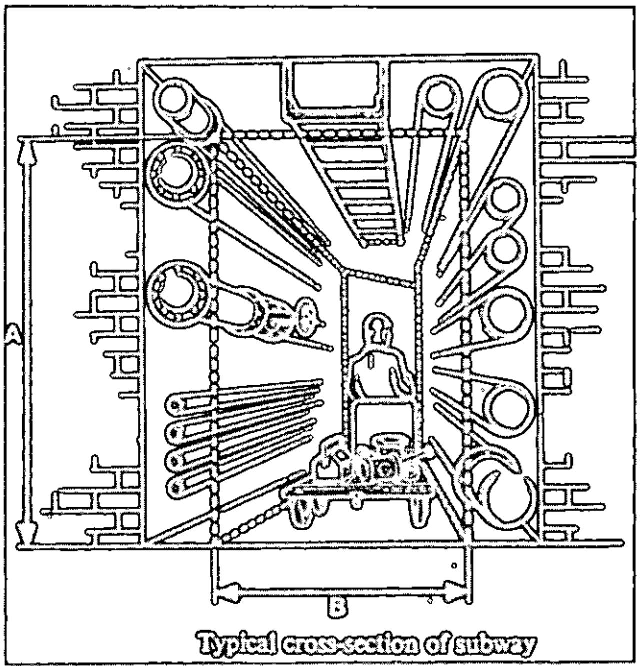
Figure 16. Front cover of Hospital Technical Memorandum Number 23.

This document published by the Department of Health and Social Security identifies some of these problems and gives some recommendations of good principles which should be applied.

Figures 17–19 (overleaf) are examples of recommended good practice which should be adopted to provide proper maintenance access contained in this document.

In conclusion I would emphasis the need to consider these problems in the earliest stages of the design process — dealt with at this stage, the cost of good maintenance access to engineering services will be seen as an integral part of the facilities to be provided and the cost of its provision will be kept to a minimum. When this is done successfully, the building will not only be correct from a functional user's point of view, but will also enable the engineer to give an efficient operational maintenance service at minimum cost.





Dimensions of free space	Pedestrian use only	Pedestrians and trolleys	Pedestrians and powered vehicles
A B	2·0 m 1·1 m	2·0 m 1·2 m	•2·0 m •1·4 m

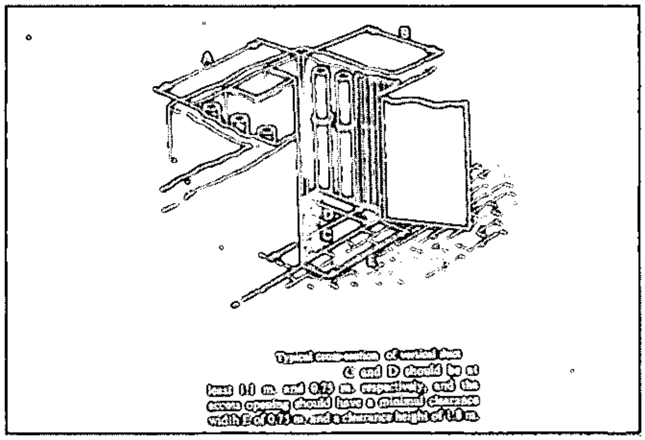


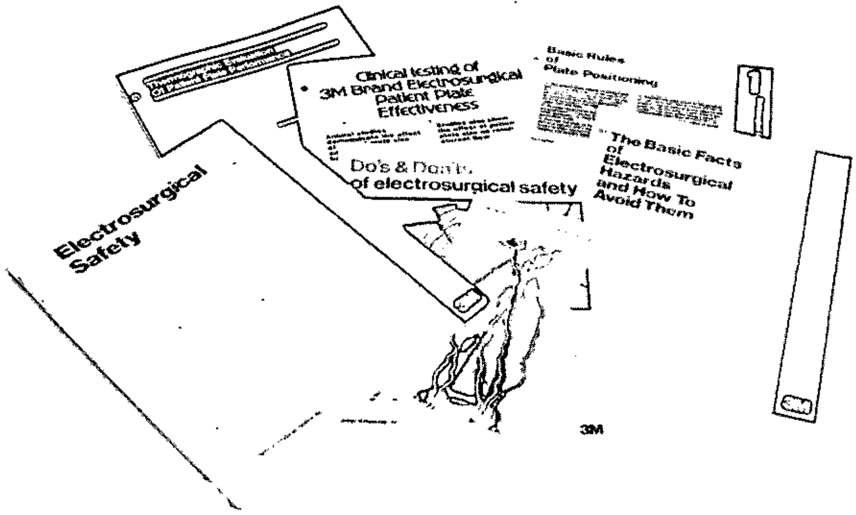
Figure 17 (top left). Recommended maintenance reach levels.
Figure 18 (left). Typical cross-section of vertical duct. C and D should be at least 1.1m. and 0.75m. respectively, and the access opening should have a minimal clearance height of 1.8m.
Figure 19 (above). Cross-section of typical subway.

Product News

Electrosurgical Safety

Electrosurgical safety is the subject of a new series of leaflets which 3M United Kingdom Limited plan to start publishing shortly. Distribution will be only to those who specifically request the series.

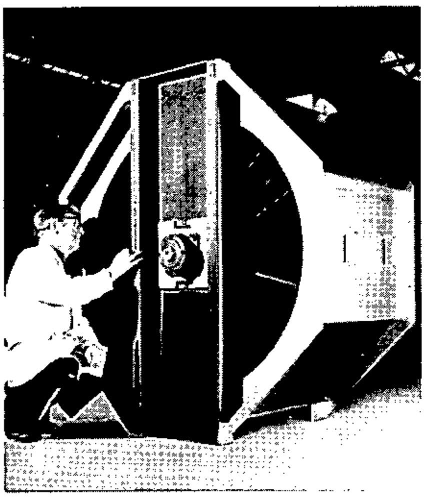
Those requesting the leaflets will first receive a neat binder to keep issues in as they become available. Those who would like to receive the series are asked to send in their names and addresses so that printing quantities can be established.



Contact Mr. Ian Francis, Surgical Products Group, 3M United Kingdom, 3M House, PO Box 1, Bracknell, Berkshire. RG12 1JU. Telephone Bracknell (0344) 58281.

Combustion Pre-heaters

A new range of combustion air preheaters specifically aimed at making fuel economies in the plant boiler and process furnace markets has been launched by the HOWDEN Glasgow based international engineering group. The air preheaters are designed to recover waste heat from the combustion gases and to recycle it by supplying hot air either for combustion or process requirements such as drying, product preheating or space heating.



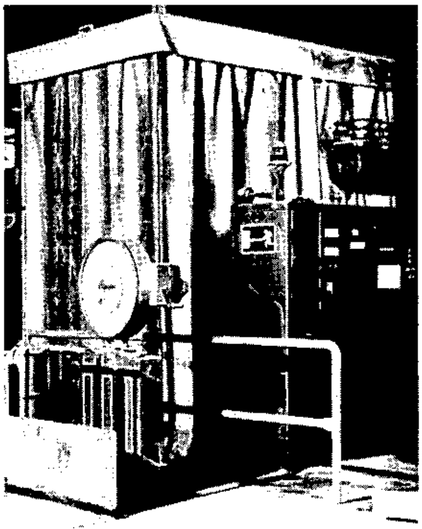
Further information: Mr. J. B. Bain, James Howden & Company Limited, 195 Scotland Street, Glasgow G5 8PJ. Telephone: 041-429 2131.

Sound Deadening

To help overcome the exhausting effects of protracted high frequency noise Visurgis (Great Britain Limited are introducing a versatile new range of sound deadening materials.

Optimit — available in a range of thicknesses from 0.5 mm to 3.0 mm — can be rapidly and economically tailormade to form noise controlling screens with applications right through industry, commerce, schools, hospitals and public places.

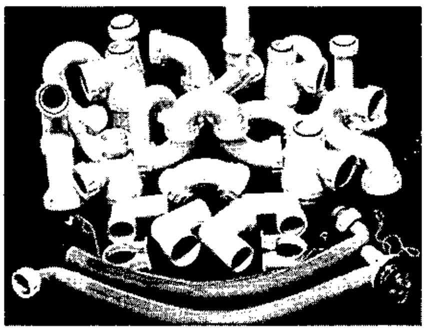
The material, which is a rubber compound, is unaffected by humidity and the effects of ozone ageing, and can have excellent resistance to acids, alkalines, oils, solvents, ultra violet rays and heat. It can also be fired resistant.



Optimit is available from Visurgis (Great Britain) Limited, Towerfield Close, Shoeburyness, Essex. Tel: (03708) 5955.

New Traps

Hunter Plastic Industries Ltd. has introduced an improved and extended range of white polypropylene tubular and bottle traps for use with both ABS and PP 36 mm and 43 mm diameter waste systems.



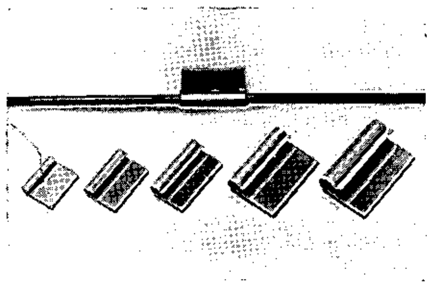
The traps all incorporate multisocket outlets which allow simple jointing of plastic pipe to BSS 5254 and 5255 or copper pipe to BS 2871 by means of compression nut and olive.

Illustrated free brochure available from: Hunter Plastic Industries Ltd, Nathan Way, London SE28 0AE. Tel: 01-855 9851.

New cable clips

Panduit, manufacturers of cable ties, wiring aids and connectors to DIN 41612, have introduced a new adhesive backed J clip (AJC) for retaining wires, cords and tubing.

These low profile J clips have a flexible lead-in edge which allows easy insertion and yet provides a high retention force. This design feature allows quick addition or removal of wires to facilitate revisions. The adhesive backing, which has a peel-off paper cover, eliminates the need to drill holes for screw fasteners. Typical applications for Panduit J clips include mounting of cords, wires and tubing to clean flat surfaces, CATV installations, electronic and electrical equipment and appliances. They can also be used to route pneumatic hoses. Five different sizes are available to mount bundle diameter up to .38" with a maximum support of 1 lb. J clips are made from PVC and they are supplied in light grey colour.



Futher information is available on request from Panduit Limited, 61-65 Revenge Road, Chatham, Kent, ME5 8YT. Tel: (0634) 660811 Telex 965393.

Real Time Aerosol Monitor

A new Real Time Aerosol Monitor is now available from Analysis Automation Limited of Eynsham, Oxford, manufacturer and supplier of gas analysers and systems for on-line process control and environmental monitoring.

The GCA Model RAM-1 operates on an advanced light scattering principle and allows continuous measurements of atmospheric dust and particulates concentration displaying the readings on a liquid crystal display. The Model RAM-1 features three measurement ranges, 0—2/0—20/0—200, with sensitivity

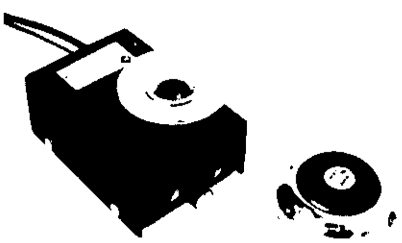
down to 0.001 mg/m^3 on the lowest scale. It is a fully portable unit weighing less than 10 lbs, featuring built-in rechargeable batteries which will provide power for up to six hours continuous use. In addition, when plugged into mains power the unit will run continuously. The Model RAM-1 should find wide use for many industrial and research applications, including worker protection, industrial hygiene surveys, inhalation/animal exposure studies and efficiency determination of respirator and control systems.

Contact: Analysis Automation Ltd, Eynsham, Oxford. 0865 881888.

Gas Burner for Labs

Flammatic operates economically on natural or town gas, or bottled butane, propane, methane etc. with flame temperatures up to 1650°C. Electronic ignition control is via an optional foot pedal or any remote control system, such as contact thermometer, timer, microswitch, relay, push button etc.

Standard versions of Flammatic are available for operation on natural gas. Operation is from 220/240V 50Hz supply.



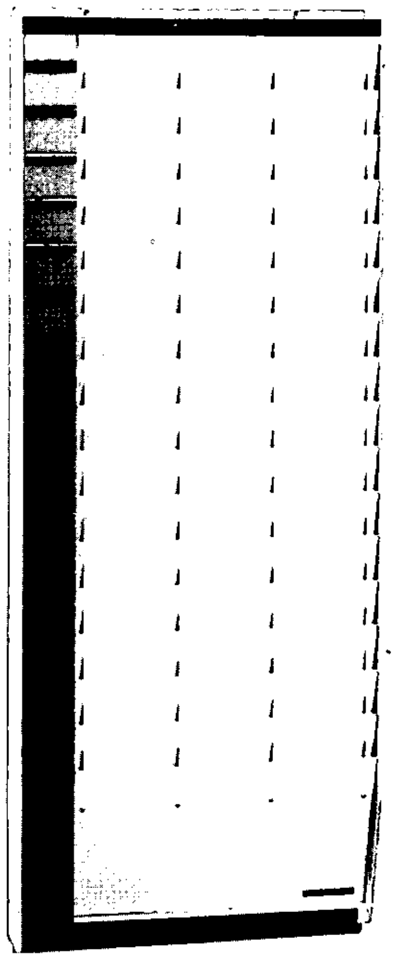
Information: Microflow Pathfinder Ltd, Fleet Mill, Minley Road, Fleet, Hants. (02514) 28441.

Loading Boards

With the introduction of the DHSS bonus scheme for NHS maintenance staff, Woodcon Products have been supplying in various areas Loading Boards for the allocation of work to engineers and electricians, etc. for use in conjunction with Planned Maintenance programmes.

The boards are constructed to hold the JOB/BONUS cards, which are loaded and displayed in priority order against the names of the maintenance staff.

The photograph is of a typical panel that has been supplied, but they can also be produced in other sizes and configurations as required.



Woodcon Deepslot boards are supplied in 12 standard pocket depths from 1¼" to 10", and are designed wherever possible to use existing documentation for planning purposes, eliminating the need to transfer information onto another card or signal.

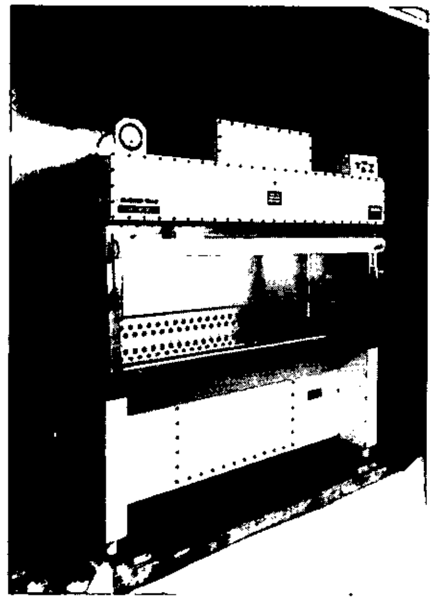
Contact: Woodcon Products, Peter Rd, Commerce WS7, Lansing, Sussex Tel: 09063 65946.

Hepaire accept Baker agency for UK

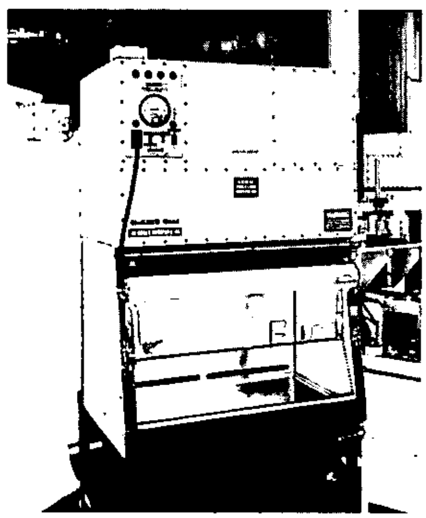
Hepaire Manufacturing Ltd. now market exclusively the Baker Company Inc. range of laminar flow and containment hoods throughout the UK.

The addition of the Baker equipment increases Hepaire's range of laminar flow, clean air and fume extraction equipment for Hospitals, Laboratories and numerous industrial applications.

The illustration shows Baker Class II BioGARD Safety Cabinets — bench top Model 315 and free-standing Models B40—112 and B60—112 (4' and 6' work surfaces respectively).



In addition to the models illustrated, the Baker Company also produce a wide range of laminar flow cabinets and offer specialist advice and assistance on Class III requirements.



Further information from: David Gray, Hepaire Manufacturing Ltd., Station Road, Thatcham, Newbury, Berkshire. RG13 4JE. Tel:(0635 67067)

Mira Mixing Valve

A unique thermostatic mixing valve, claimed to be the world's most advanced, and incorporating an entirely new method of temperature control has just been launched by shower manufacturer Walker Crosweller & Co. Limited, of

Cheltenham. Called the Mira 15 series, the new valves are said to be superior to traditional valve designs in that they give faster, more accurate control, over an extremely wide pressure range, ensure maximum user safety and require less maintenance. Furthermore the new valve is claimed to have a longer working life than any other comparable mixing valve because of its intrinsic design and the materials used.

The temperature stability and response time means the valve is suitable for hospital process applications as well as for ablutionary purposes. Typical of its potential application could be the processing of X-ray film. This and indeed any hospital process that relies on precise temperature control of water for its success is an ideal application.

Contact: Walker and Crosweller & Co. Ltd., 6 St. James Square, Cheltenham, Gloucestershire. 0242 514418.

Daylight loading system for X-Ray film

Recently installed in the Link Block X-Ray Department of the London Hospital, Whitechapel, is the new Daylight Loading System from 3M United Kingdom Limited. The 3M Daylight Loading System brings to the London Hospital for the 1980's a totally integrated, automatic unit which offers the facility to load and unload cassettes and process film in daylight conditions in 105 seconds.

Economical and simple to use, the new system is situated in a three-room Barium area — the Link Block. It offers the radiographer more time with patients, the first priority, and less time handling cassettes. Compact in size and occupying just 1.5 sq. metres, the unit offers vital space saving features.

Contact: 3M UK Ltd., PO Box 1, Bracknell, Berks. (0344) 26726.

Heat Recovery Coils

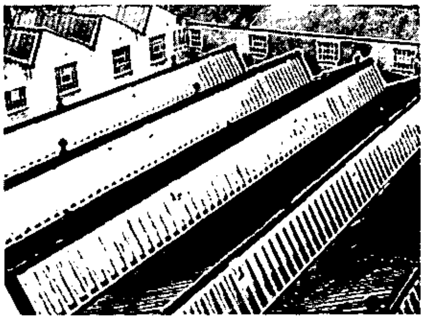
Run-Around Coil systems from F H. Biddle Limited provide the means for heat recovery in situations where space may be short, as for example when adapting existing installations.

For further details contact: F. H. Biddle Ltd, Newtown Road, Nuneaton, Warwickshire CV11 4HP. Tel: Nuneaton (0682) 384233.

Rooflight Insulation

Northlite Insulation Services Ltd, introduced their I.V.40/60 unit for application to north-facing rooflights, in January and have recently completed the first major project. The module, which is formed in PVC, is fitted by means of an aggressive adhesive to the exterior of the glass and reduces the 'U' value, in normal conditions, from 6.34 to 2.79 W/M^2O^C and saves up to 60% of the heat previously lost through the rooflights.

Northlite guarantee the installation for a period of five years.



Northlite, Webner Industrial Estate, Ettingshall Road, Wolverhampton WV2 2LD. Tel: Bilston (0902) 49400.

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