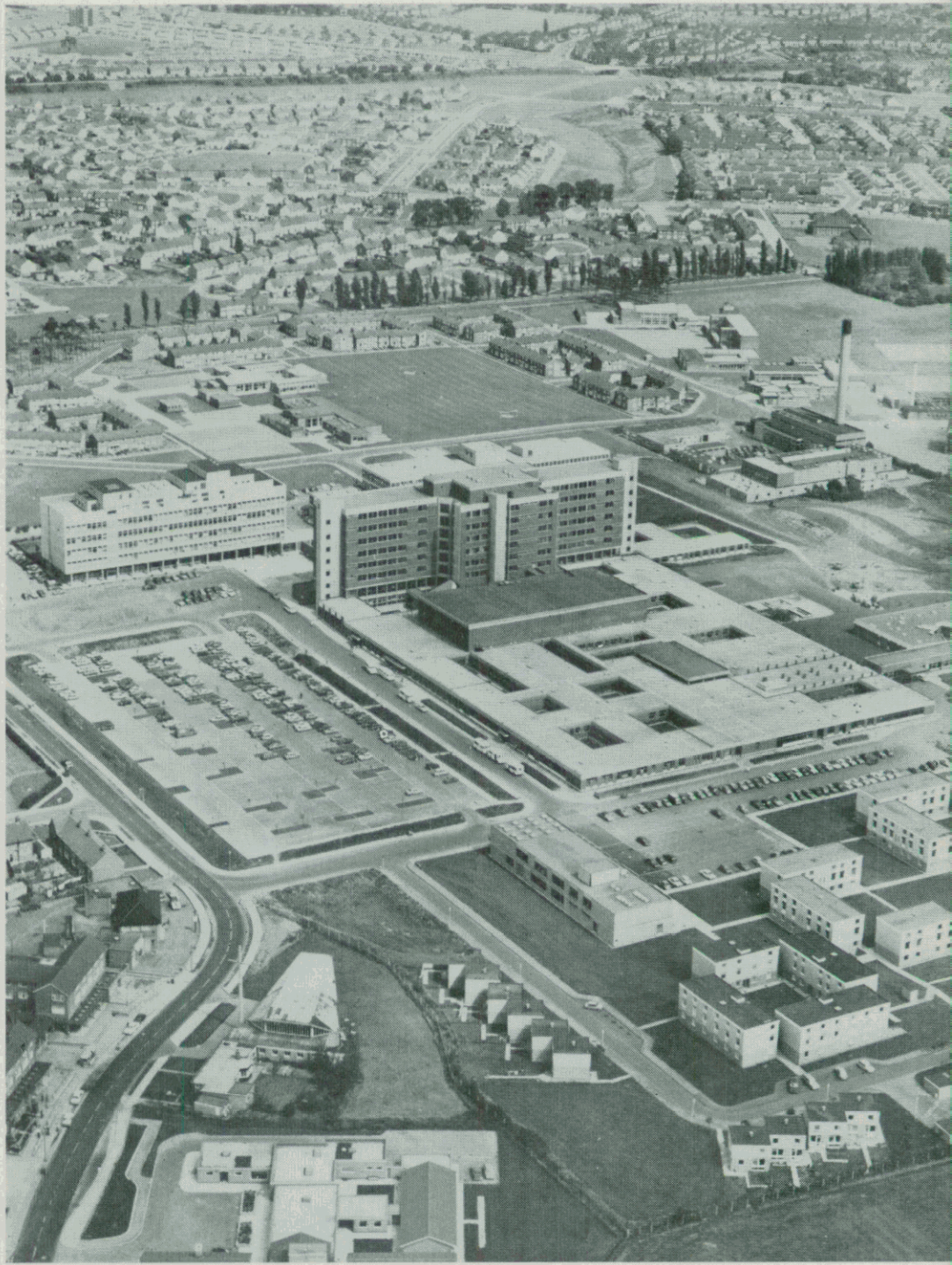


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## Hospital Engineering

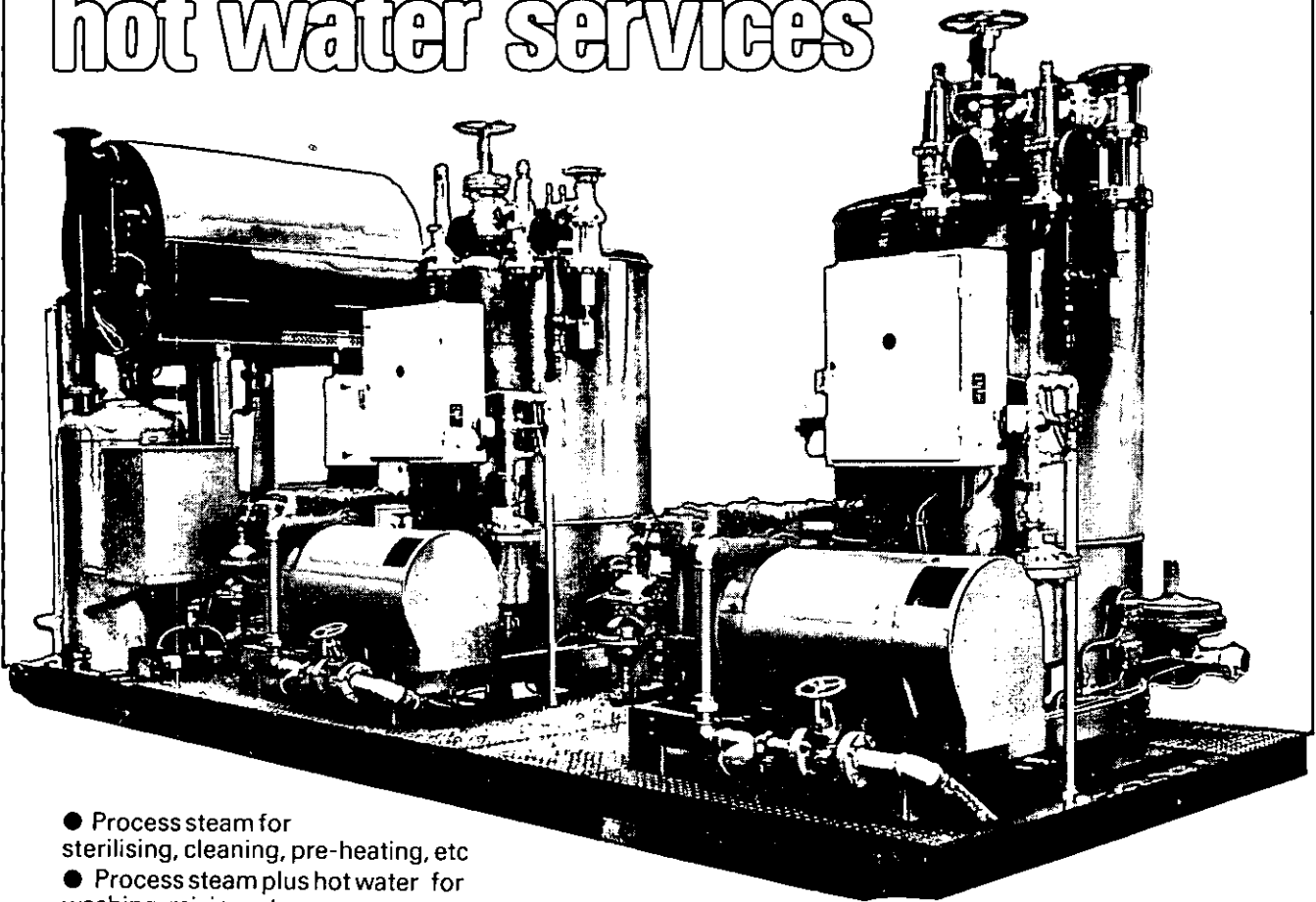
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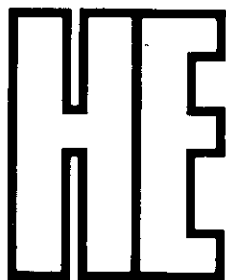
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# Hospital Engineering

Incorporating 'The Hospital Engineer'

**Vol. 30  
April 1976**

The Journal of The Institute of Hospital Engineering

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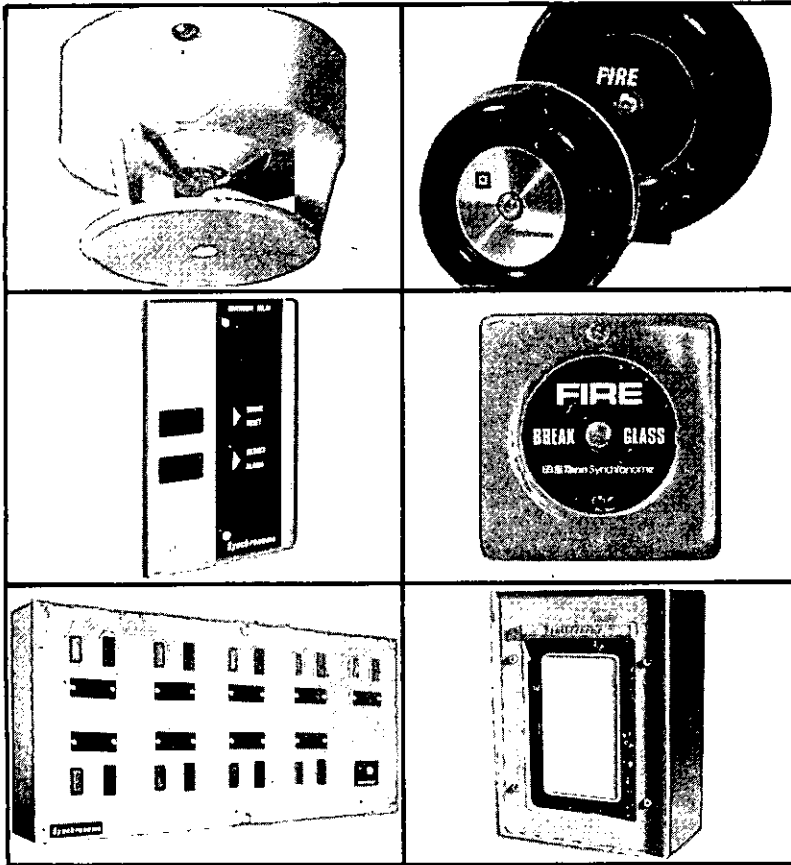
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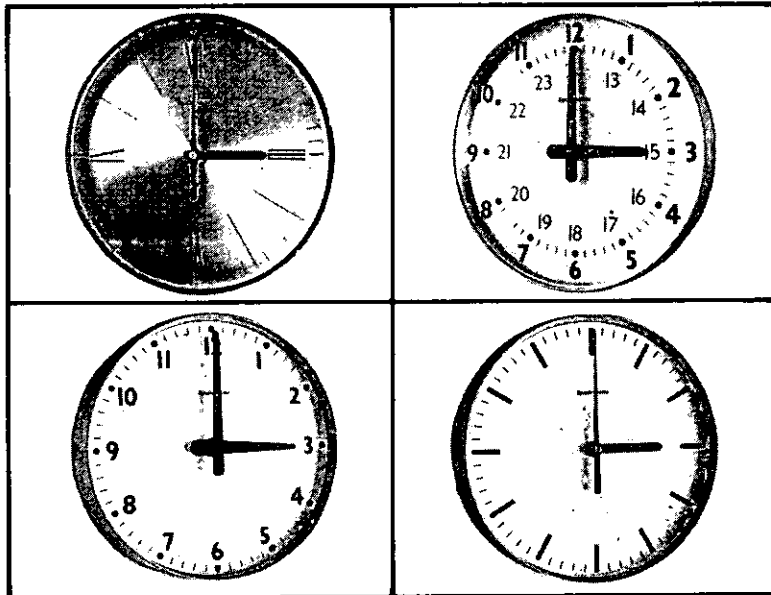
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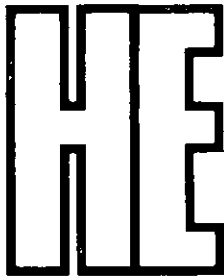
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**Hospital  
Engineering**

Vol 30  
April 1976

# The rôle of the consulting engineer in the building-services industry

by K. G. HANLON, B.Sc., F.I.Hosp.E., C.Eng., F.I.Mech.E., M.I.E.E.

The profession of building-services consultant has come into being in the past 50 or so years in response to the increasing complexity of equipment and public demand for improved environmental standards. The increasing involvement of this new type of engineer in design teams would seem likely to lead to the further divergence at the fields of consulting and contracting; but what will happen? Will they grow further apart, or will they merge?

## Introduction

In tracing the growth of building services, it becomes evident that the profession of building-services consultant is still very young, in contradistinction to those of architect and civil engineer.

The origins of the building-services engineer are those of the contractor unsupported by erudition; it is not surprising that until perhaps 20 years ago, he was treated as a 2nd-rate member of the building team, waiting to be informed of the precise limits of his job of work.

The attitude of limited involvement is gradually being dispelled, especially under the powerful influence of integrated design and the urgent need to fill the post of the building scientist in the design team.

Gradually emerging is a new type of engineer, qualified, responsible yet imaginative and, above all, intent upon improving the reputation of the profession. Thus, it seems almost axiomatic that the fields of consulting and contracting will continue to diverge, and certainly there are many arguments for the retention of the independent rôle of the consulting engineer.

In the very long term, however, the need to employ a contractor in the design team, coupled with the inadequacies of the present tendering system and other inefficiencies, lead me to believe that eventually contractor and consultant will join.

## The growth of building services

Unlike the architect, whose ancestry is lost in the mists of antiquity, or the civil engineer who commenced as a military engineer in the 1700s, or the quantity surveyor whose beginning originated in the mid-1880s, the building services consultant has really only had the last 50 years on which to hang his hat.

Indeed, this is not surprising since building-services systems were relatively simple and often were incorporated as part of another trade.

When a building was designed by an architect (and most public buildings were) then in company with Italian marble layers and french polishers, etc., the embryo heating-and-ventilation man was content to take his instructions direct from the autocratic master both of his subject and of the project.

It is said the society is divided into two classes—the divergent and the convergent—and when Galsworthy's

Phillip Bossinni said to his client Mr. Forsyte 'don't bother me with your problems of money, I am building you a house not acting as your book-keeper' he epitomised the former state.

What Bossinni was really saying was that he didn't like the science of *numbers* and over the years the architectural profession has gradually discarded responsibility for those elements of the construction industry demanding quantitative analysis. Thus the primary opportunity for the formation of quantity surveyors and structural engineers, and later the electrical- and mechanical-services consultants was made.

Building-services consultants, with one or two exceptions (one firm traces its history back over 100 years), arose from the coincidence of several factors of which the two most important were:

- (a) the increasing complexity of equipment
- (b) public demand for improved environmental standards.

In addition, however, was the innate desire to offer a personal technical service, perhaps as a means of raising standards, but more particularly as a means of obtaining satisfaction within one's work.

I suggest that this last motivating factor remains the principal *raison d'être* of all reputable consultants' offices and is probably the point of departure from contractors, who, responsible to investing shareholders, must necessarily place profitability ahead of reputation.

### Organisation of a building-services office

#### *Objectives*

Although the principal concern of the consulting engineer is client satisfaction by means of a personal tailored service, he is also motivated, as mentioned previously, by personal satisfaction in the advancing technology of the work.

Combining these two prime requirements enables us to set reputation as the first of three basic objectives of the organisation, with profitability and growth for the other two. In fact, as will be readily appreciated, these objectives are interrelated.

It is a truism that a firm must remain profitable if it is to continue in business, while a firm that is not expanding is decaying. Nevertheless, these home truths will become lost without frequent reinforcement.

#### *Reputation*

Although a practice is firstly judged on its technical competence, a close second criterion (since this is something that every client understands) is that of administrative ability.

Wrapping both requirements with the ethereal quality that surrounds all commercial relationships, but particularly those of a professional person, is that of ethics.

*Technical ability:* It is as well to reflect on the very fundamental task of the consultant which is the production of ideas, arranged as a design philosophy to give the optimum solution (from the clients' viewpoint), of a functional problem.

Having thus established the outline design brief, the consultant's secondary rôle is to translate this into information sufficient to enable construction of the

design to proceed without (if justified) further advice.

Usually a watching brief is held over the installation work, although the RIBA contract effectively excludes active participation with the contractor.

In practice, the fundamental task is met by allocating this element of the work to a conceptual study group, mainly consisting of free thinkers (but constrained by the practical anchor men), who, under the guidance of a leader, produce a series of brochures, e.g.

Conceptual stage

Outline design

Design brief

This is the most attractive period of any project.

The design brief (fully approved by the client) is used as the reference manual by the production group of staff who employ engineering ingenuity and expertise coupled with a knowledge of logistics and contract law to provide the tender drawings and specification.

The entire scheme passes into the hands of the contracts engineers at the date of contract signing, but prior to that the contracts section has accepted the design as a workable proposition.

There are, of course, some jobs which go wrong or have some shortcomings, and the contracts engineers are employed in commissioning and trouble-shooting.

There are strong grounds for accepting the suggestion that the responsibility for final commissioning be transferred from contractor to consultant, since systems are becoming more complex and there is a dearth of commissioning engineers who have both the enthusiasm and an enquiring and analytical mind to make a success of each installation. Good design involves commissioning, which for maximum efficacy should remain 'in house'.

Trouble shooting on projects other than a consultant's own design is not very welcome, but one is on occasions required to provide formal reports. Here the consultant's reputation must stand the test of legal and ethical examination.

The three stages of project development are technically assisted by a close support development section (computing, testing, planning, etc.) with large-scale centralised backup resources.

*Administrative ability:* Besides obeying the normal business rules such as early, courteous and informed replies to all bona-fide letters, it is essential to have a well-oiled administrative machine which presents an image of office efficiency.

In addition, should a client make inquiries, it must be shown that certain procedures were available, or in use, dealing with his particular project. Thus in the matter of security, who does one allow into a consultant's offices? What control is exercised over incoming tenders. How is the correspondence filed?

The impression that one must give to all and sundry is that you care, for the good name of the project and those associated with it. It is extremely easy to lose one's technical reputation for excellence through poor administration.

*Ethics:* Ethics are defined as a system of principles and rules of conduct. The ACE Rules, Terms of Agreement and Scale of Fees provide the foundation for the brief and without them; jungle law would surely be inevitable.

Unfortunately, the rules can rarely be given the

precision desired so that a degree of subjectiveness is injected into every practice. It is this ethos which essentially distinguishes consultants' offices of similar size, ability and speciality from each other.

In the past (and indeed up to the present) on large highly specialised projects, of which most civil work would be typical, consultants have left clients to beat a pathway to their door.

The evident trends of the package deal, the design ability of major contractors and the consortium of consultant and contractor, all of which have been extensively employed by the building-services industry are not adequately reflected in the ACE Rules. Professional etiquette prohibits unsolicited approach to any person or organisation. How does the consultant therefore obtain new work?

It would be nice to say by reputation and recommendation, but while this has some bearing, the major pathway is of confidence through personal relationships, where invariably every senior member of the staff is but a microcosm of the parent organisation.

The professions do not allow limited liability, a relic of the days of the personal nature of a partnership venture. It must be asked, however, whether this attitude remains correct, since a single failure, despite insurance cover, could, by cascade action, affect many other clients' projects as well as the welfare of large numbers of staff.

The integrity of a firm of consultants directly affects, of course, the activities of the contractors with whom it comes in contact. Personal prejudices favouring and against individual contractors will inevitably exist.

How much longer competitive tendering will be the norm is not clear, but the present rules, which, amongst others, favour the acceptance of the lowest tender can be regarded as having disadvantages.

There seems to be no reason why three or four of the most carefully matched tenderers should not satisfy the principles of selective tendering irrespective of the size of the project.

If one assumes that there is a balance of firms and jobs available, the reduction in tendering exercises must bring an increase in quality and profits.

### Consultant and contractor (should they consort?)

Is it possible that the present marriages of convenience between contractor and consultant will extend beyond that of the package job? I think not. The main problem is one of distrust. The Building services subcontract historically embodies an element of detail design or judgement which, until the contract is signed, cannot be finalised by drawing or specification. The subcontractor's task of removing this degree of uncertainty in the final interpretation of the engineering design, via his working drawings, can be difficult at times and often he sees himself doing work for which he did not price at the tender stage. Moreover his practical advice, whenever asked for, is rarely altruistic.

The consequence of all this is that the consultant is presented at a very late stage with a carefully nurtured claim, which often adversely reflects upon him in the eyes of the client.

Meanwhile, the consultant is beginning to be accorded a new respect as, over the last five years, sophisticated heat-reclaim and total energy systems have become

fairly well known. The image of a 2nd-eleven team is fast receding and the BSE is taking on an authority unthought of 20 years ago. As such he must inevitably break the intangible links with the industry which, rightly or wrongly, he is considered to have such close associations. However, history being what it is, I believe that in due course the wheel must turn full circle and consultant and contractor will emerge perhaps as 'constructants' (the word consultants is rapidly becoming a misnomer, and may have to be discarded during the next decade).

Currently assisting in this metamorphosis is the advent of truly integrated design which would be impossible under a select tendering procedure. It is a sad reflection that the contractors' expertise and ingenuity cannot yet be adequately included at the design stage.

Integrated design in which the contractor participates is thought by many to be a novel approach, but really it is a return to commonsense principles of jointly examining, solving and sharing the functional problems between all members of a properly convened team. Only when this is an everyday event, can the unease between consultant and contractor be reduced!

The parochial attitudes of designers are fast disappearing and it is hazarded that this must shortly apply to contractors' staff who can adequately span the various disciplines with experience and design.

At least one consultancy office has embarked upon a programme of retraining young people, aged 23 to 28, taken from other industries. The major attributes expected of them are a minimum qualification of HNC, enthusiasm, dedication and an enquiring mind. We do not have electrical or mechanical engineers *per se* but all are grouped as designers—trainee, assistant, project or senior.

### Consultant and contractor (should they diverge?)

The corollary of the title to this article is 'Are consultants really necessary?'

Well, first someone has to conceive the design philosophy and carry out all the work attendant upon taking it to the tender or equivalent stage. The question then is would quality improve or costs be reduced if done by the contractor?

We would argue against the event of any of these two possibilities since, despite many allegations, I have never known of the lure of increased fees with increased plant costs being exploited—in fact, quite the contrary. The simple satisfaction of obtaining two functions for the price of one continues to motivate staff. Thus the consultant may be truthfully stated to have free-ranging design opportunity often denied in part to the contractor.

Secondly, no-one can level the accusation at building-service consultants that they are taking gross profits out of the industry (at the expense of the contractor?). Profit margins are absurdly low and perhaps it is a good thing that consultants are not shareholder controlled since no-one would buy the shares for dividend purposes, and morale would consequently slump.

It is extremely doubtful if any other type of organisation or system could offer the same intellectual and practical facility so cheaply. Many building-service departments of large multidisciplinary practices are supported by the group profits and it is noteworthy that

relate the present-day profitability table of the construction-industry consultants in descending order: quantity surveyor, civil engineer, structural engineer, architect, electrical engineer, mechanical engineer.

Only when the building-services consultants are paid considerably more than present levels (for which in return they must strive to raise the design standards by an order of magnitude), will building-services engineers establish their true identity as the construction scientist and building users spokesman—again a position that might be found incompatible with the declared interest of the contractor.

The fourth argument cites the extremely advanced work that is being done by several large practices in concert with the building science groups of several universities. Research and development is renowned for running away with the profits and, generally, contractors are not geared towards this type of activity (although it is true there are one or two exceptions).

Finally, I think the break between contractor and consultant will be confirmed when the interchange of potential executive staff ceases.

The present efforts by responsible authorities such as the DoE and particularly the work of the IHVE will have the effect not only of improving the academic standard of entrants to this industry, but also—contrary to present practice—allow them a much greater freedom of choice.

All other things being equal, it seems that the new intake will opt for consultancy, thereby reinforcing what now might be described as the inexorable trend towards more academically inclined, reputation-conscious building-service consultancies.

### The future

The biggest advance in building-services since the war is probably the public demand for improved internal environment, and the associated solution—central heating.

It is difficult to recapture the prewar cave-age spirit when it was considered by most eminent authorities (in answer to severely shaken and frozen American tourists) that universal central heating in Britain was utterly impracticable!

Until the impending energy crisis was noticed, the public was set to launch itself into the air-conditioned age, with an industry doubling time of five years.

Today, the economic crisis will undoubtedly retard this development, but it is extremely unlikely that it will turn down for any significant period. People who have tasted comfort rapidly convert this to the norm and rarely will suffer discomfort unheard.

Fuel-conservation schemes will tend to dominate electrical and mechanical services and, over the next five years, innovations concerning the design of buildings will multiply.

If the standards of living in this country continues to rise at 2% or more, then the building-services industry will grow at a rate faster than any other element of the construction industry and probably comparable with any other similar sized national undertaking.

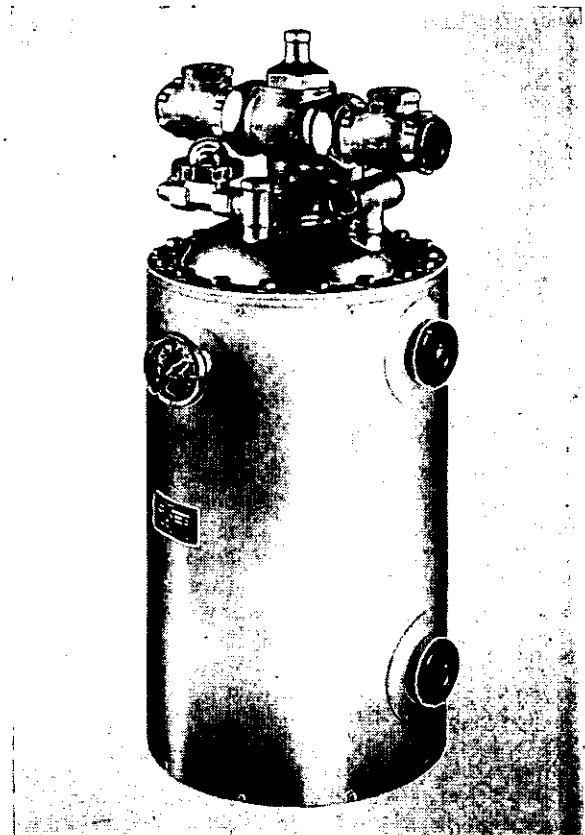
The need to improve the efficiency of the building industry and the standards of building design is seen by many to be best undertaken by an integrated team approach which includes both the contractor and the consultant in his uniquely qualified role of building-services designer, scientist and environmentalist.

## Warm-water supply

Co-operation between industry and two hospital boards has resulted in a new approach to water-temperature control for warm-water supplies to paediatric, geriatric and psychiatric wards. The Horne Engineering Co. Ltd., after discussions with the Sheffield Regional Hospital Board (now the Trent Regional Health Authority) and the Western Regional Hospital Board in Glasgow, has developed an alternative to the usual methods of either installing a high-capacity storage calorifier or fitting individual thermostatic mixing valves at each tap or shower.

The new unit consists of a hot-water blender with nonreturn valves, a copper cylinder, a heating coil and a thermostatic valve. The blender mixes hot and cold water to the desired temperature, the water then flows through the cylinder, which is fitted with the heating coil and the valve, before entering the pipework leading to the outlets. When there is no demand for warm water, heat losses in the pipework are made-up and the temperature maintained by the heating coil. Water to heat the coil is taken from the hot supply and the temperature of the warm water is controlled by the thermostatic valve.

The system was developed as a result of trials in a Dumbarton hospital and is being marketed as the *Tepidstat*. Further details from The Horne Engineering Co. Ltd., PO Box 7, Rankine Street, Johnstone, Scotland PA5 8BD.





# Hevac 76

**The 9th International  
Heating, Ventilating  
and Air Conditioning  
Exhibition  
5 - 9 April 1976**

**NATIONAL EXHIBITION CENTRE,  
BIRMINGHAM**

The International Heating, Ventilating & Air Conditioning Exhibition will be held this year at the National Exhibition Centre, Birmingham, from the 5th-9th April. Hevac 76, as the exhibition is known is the ninth, and largest yet, of these exhibitions covering the increasingly important field of environmental engineering.

Among the exhibitors will be companies from Belgium, Denmark, Sweden, India, USA, Canada, France, East Germany, West Germany, Holland, Finland and, of course, the UK. To date, 260 exhibitors have booked space—and the stand space is all but sold out. Besides the more conventional exhibitions, there will also be substantial outdoor sites showing solar-energy equipment—a facility possible only at the NEC.

Some of the exhibitors' stands are outlined below:

Developed, manufactured, marketed and installed by the *ICI Flexel Group*, the Flexel system consists of a membrane of conducting silicone rubber which is laid between the joists in a ceiling and covered with thermal insulation. It is an electrical system which maximises the efficiency of radiant heat.

A new company *Celsius Ltd.* was formed last year to act as the UK sales office for Marlo S.p.A. of Milan, already known here for its range of fan-coil and induction units. Hevac '76 will see the first showing of the new Marlo central-station air-handling units and the Dialatemp air-conditioning units. Marlo central-station units are of modular design and features the matching of the fan section to unit performance for efficiency.

photo: Birmingham Post

Another new name at Hevac, although not a new company, is *PP Controls Ltd.*, which recently changed its title from *Perfection Parts Ltd.* In addition to its existing range of heating, refrigeration and air-conditioning controls, the company will give a UK premiere to a selective range of Centratherm automatic controls, sensors and control valves manufactured by Centra KG of Stuttgart, West Germany.

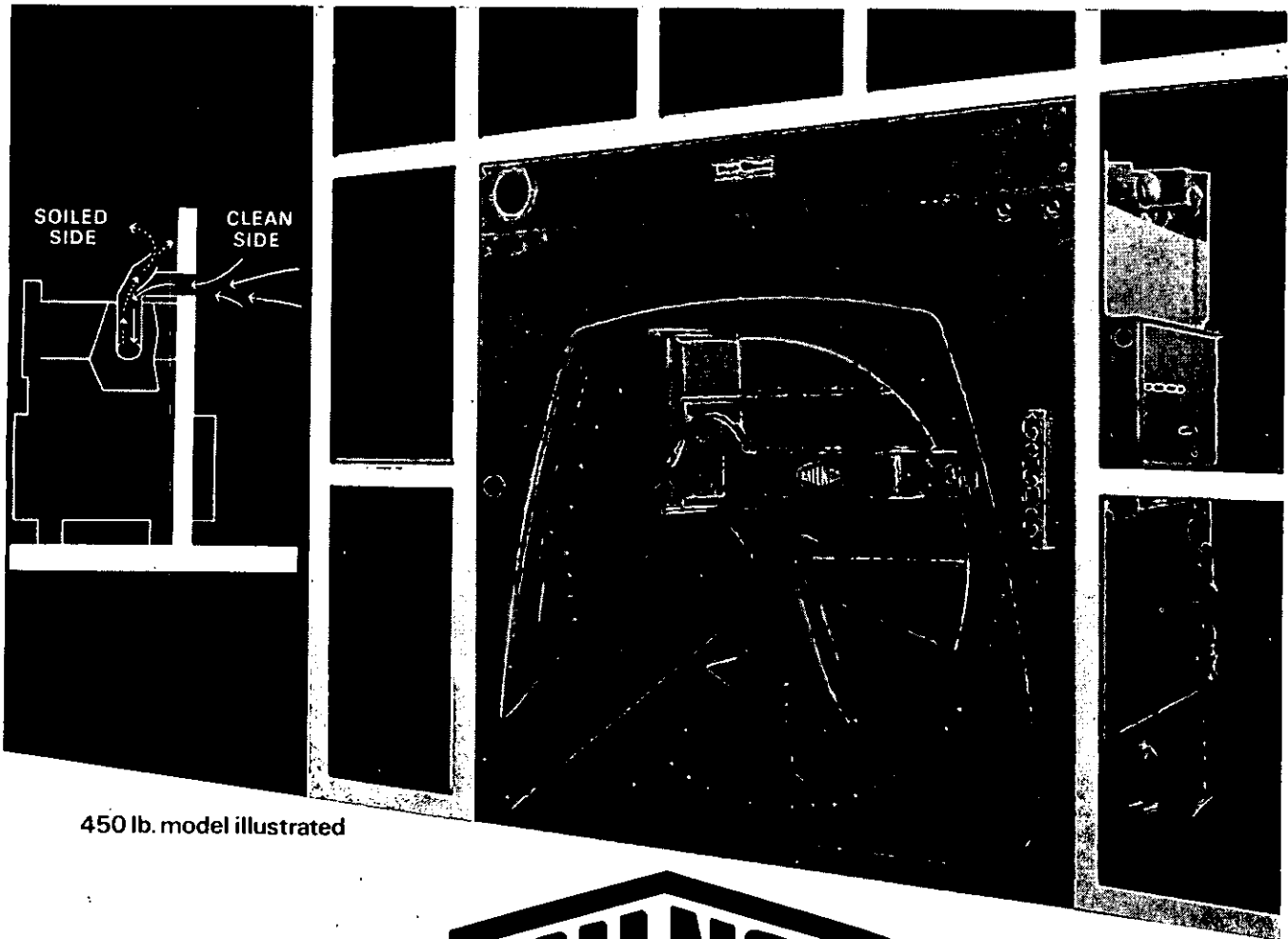
**New Magnetic Devices control valves on show at Hevac (Stand 2100)**

A newcomer to Hevac, *Magnetic Devices Ltd.*, will be showing its range of flow-control valves, including the company's latest 2- and 3-way aluminium-body directly operated solenoid valves. Also on show will be a 2-way directly operated reverse-acting solenoid valve which is designed for vertical mounting in air, water, gas and moderate-viscosity fluid systems. This valve, like others in the range, can be supplied with Buxton-certified enclosures for Group-II and III gases. Other valves on show include directly operated, servo-operated, and electrohydraulically operated devices designed for a wide range of applications.

Highlights of the stand of *Allen Ygnis Boilers Ltd.*, will be a steam boiler fired by a Nu-Way dual-fuel burner. It will be shown in boilerhouse form, complete with ladder and gantry, and equipped with a water-sample cooler and dual feed pumps. Boilers from the H and HC hot-water range will also be shown. Another

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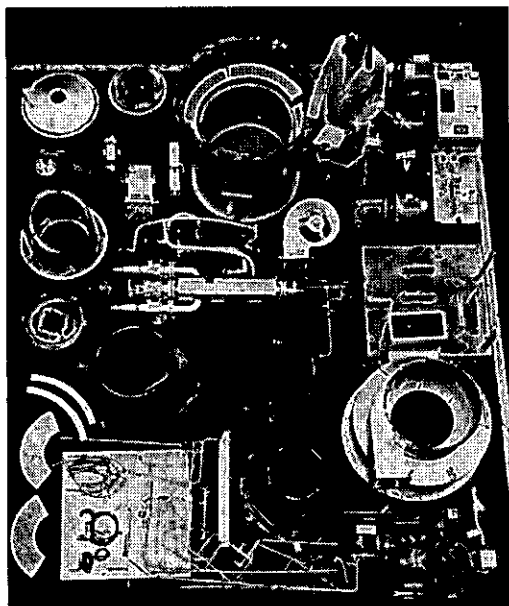
feature of this stand will be a small wall-mounted boilerhouse control panel containing such controls as optimum start, sequence cascade control, pump starters and isolators.

One of the last companies to book space was *Hoval Boilers Ltd.*, who plans to show four boilers from its range, extending from the GS 440 atmospheric boiler up to the ST 3200 oil- or gas-fired unit. *Hoval* will also feature one of the company's combination boilers, energy-saving designs which combine boiler and calorifier in one integral unit.

One firm with a good reason for taking part in the first Hevac to be held on this site is *Hartley & Sudgen Ltd.*; the company's SCP steel hot-water boilers are installed in the exhibition complex, and some of its cast-iron boilers serve the new railway station—

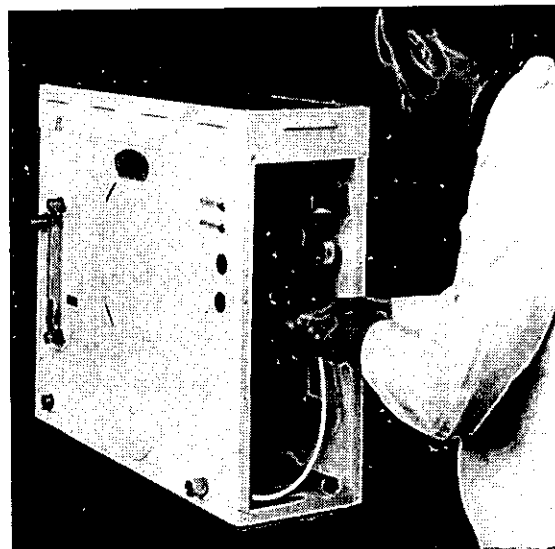
One of the dual fired Stone-Vapor coiled-tube boilers to be shown by *Stone-Platt Crawley Ltd.* at Hevac will be the new 7211D. This is believed to be the smallest dual-fired fully modulating coiled-tube boiler on the UK market. This boiler has been designed for the many processes requiring relatively small amounts of steam instantly. Visitors to the stand will be able to see some of the more complex components dismantled, such as the patented servo mechanism. Another area will be devoted to waste-heat technology, for which *Stone-Platt Crawley* has recently acquired marketing rights in Europe from *Conseco Inc* in the USA.

A Stone-Vapor 7245 dismantled for installation recently in a London Hospital where access was difficult.



Birmingham International. Examples from these ranges will be on show on the *Hartley & Sudgen* stand, together with its Junior combination boiler and calorifier.

A new range of humidifiers will be shown by *Calomex* consisting of 12 electrically operated models for sterile steam humidification. Ratings are from 2.00 to 29.30 kW, with outputs from 2.0 to 39.0 Kg/h.



Calomex humidifier

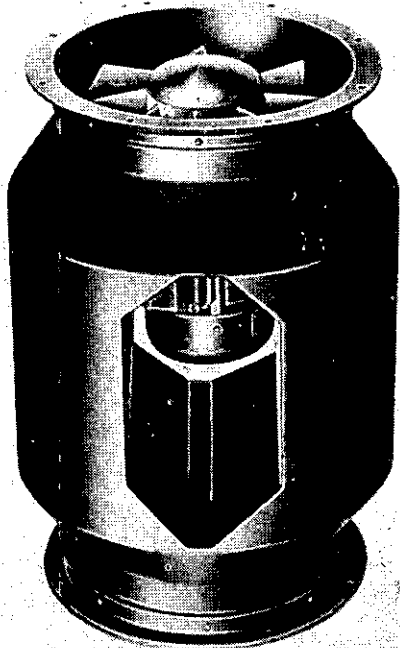
Heating equipment manufactured in W. Germany by *Buderus*, and marketed by *Clyde Combustions* will be exhibited along with the company's ranges of gas- and oil-fired boilers, a horizontal calorifier and an atmospheric gas-air heater complete with stand. A technical service will be available to advise on chimney and pipework problems.

Making its first appearance at a major exhibition will be the recently introduced series of Firepack nozzle-mix-blown packaged gas burners, on the *Stordy Combustion Engineering Ltd.* stand. Available in seven models with firing rates up to 2520 kW, the burners are suitable for natural, manufactured or low-pressure gases. Gas and oil burners made under licence from the *Hauck Manufacturing Co. Ltd.* will also be shown. These can be switched instantly from oil to gas or vice versa, burning either simultaneously or independently.

Many exhibitors will be emphasising the continuing need for economy in the use of energy. Among these is *GEC Boilers Ltd.*, who will give the first showing to a waste heat boiler. It forms part of a complete range for industrial use, utilising exhaust gases, and covering outputs from 585 to 2930 kW.

One of the biggest items on show at Hevac '76 will be the *Marshall-Cleaver Brooks CB 500* steam boiler on the stand of *Thos. W. Ward Ltd.* This is a 4-pass boiler, fired by an oil-gas dual-fuel burner and with a change-over time of 60 s. The boiler on show comes from the range of 19 *Cleaver Brooks* boilers, all of which are built in the UK.

A range of fans new to this country will be shown by *Electric Fans & Controls Ltd.* Manufactured by the Palau company in Spain, the products include a line of roof fans, axial flow fans and a novel window fan. The company also represents the Matsushita Seiko Co. and will show their range of table and pedestal fans.



Palau bifurcated fan

In addition to representing these two fan-engineering companies, *EFC Ltd.* produce fans in their own factory which are used by the Royal Navy as well as in many hospitals.

The largest manufacturer of air-side air-conditioning and refrigeration products in the UK, the *Searle Manufacturing Co. Ltd.*, will be showing a variety of equipment including air-handling units, spray-coil and fan-coil units, plus the DWM Copeland semi-pneumatic compressors and condensing units for which *Searle* is the distributor in the UK. One of the highlights, however, will be the new DD3-LN range of quiet-running air-cooled condensers for use in situations where noise is a prime consideration. Also of interest will be the company's 1976 range of heavy-duty coolers and other refrigeration equipment.

Four divisions of *Servotomic Ltd.* will be exhibiting, Simplicity is showing the Saxon boiler and a range of flexible stainless-steel linings, along with the company's valve and fire-resistant ducting. The Servowarm division will be selling its standard system contract package and the relatively new Servocool division its packaged air-conditioning. The Energy Conservation division completes the *Servotomic* line-up.

Fans and blowers with outputs from 0.5 to 850 m<sup>3</sup>/min will be available for inspection on the *Motor & Fan Co. Ltd.* stand. All fans are based on 'inside-out' motor technology for compact design, mechanical stability, reliability and low noise levels.

The Profil radiator for indirect central-heating system will be shown for the first time in the UK by *Hudevad Britain*. The Profil differs from the standard Hudevad radiator in having a fluted front but is otherwise the same. Of special interest will be the Module hot-water

Fifteen years ago, a group of British manufacturers of heating and ventilating plant met in London to discuss an important proposal at a time when the trade was on the threshold of technical revolution. The plan—placed before them by an experienced exhibition organiser—was for a major trade fair for their products and services to win them new customers at home and especially abroad. The snag which the delegates quickly appreciated was the multiplicity of their various highly specialised sectors of operation.

The immediate solution was the setting up of an exhibition advisory committee, still running today as a joint body bringing together organisers and exhibitors. This was to lead to the welding together of all the main interests into one body for the whole industry—sowing the seed of what was soon to emerge as the Heating, Ventilating & Air Conditioning Manufacturers Association.

The first Hevac was held a year later in 1961, occupying nearly 7000 m<sup>2</sup> of stand space, far beyond the expectations of the committee and almost beyond the capacity of the hall at Olympia. In 1962 the same success was repeated, and settling down to a 2-yearly cycle the show moved in 1964 to the largest halls of Olympia.

The presentation of the exhibition through the years since has reflected the changing pattern of the industry. The early Hevac exhibitions showed an emphasis on

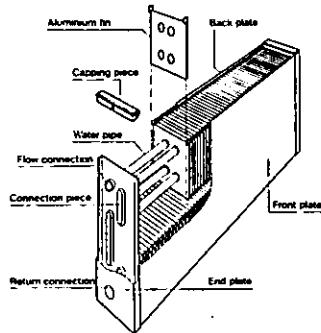
fans and boilers, the present day exhibits indicate the more sophisticated nature of the equipment and techniques being employed both for the human environment and for process requirements.

The exhibiting companies have also evolved. European manufacturers appearing fifteen years ago under the parent name have now formed British subsidiaries—in many cases because of the exhibition. Mergers and other changes in the industry have reflected in the exhibitor list.

Two important new factors will also contribute to Hevac 1976. The exhibition has recently been elected a member of the Union des Foires Internationales (UFI), and now is one of a handful of British exhibitions to be so honoured. This is indicative of the international standing of Hevac and the UFI award will help to attract even more overseas exhibitors and visitors.

But in many ways what is even more important is that the 1976 exhibition will be held at the National Exhibition Centre at Birmingham and will take full advantage of this complex of exhibition halls, conference facilities and hotels. The single-level halls are ideal for the needs of the Hevac industries and the whole centre, with its railway station, international airport and being at the crossroads of the Midlands motorway network will offer visitor facilities far surpassing those of the old London halls.

neutral convector which is constructed with finned water pipes protected by 0.75 mm steel plate. As the convectors are modular, they can be banked vertically and/or horizontally to fit available space and meet the heat output required.



Hudevad Profil

Among the overseas companies will be *Techno-commerz GmbH*, the DDR's foreign-trade company

for all imports and of exports air-conditioning equipment. All the company's products are new to the UK and will include water chillers and compressors. A model of a test chamber will also be featured on their stand.

The UK subsidiary of *Max Weishaupt GmbH* of West Germany will be exhibiting examples of its range of gas, oil and duct-fuel 1- and 2-stage burners, including a new emulsion burner which runs on a mixture of heavy fuel oil and water to give clean combustion characteristics. Also on show will be a new type of sound absorber for use with the company's range of Monarch burners.

Hevac '76 is sponsored by the Heating Ventilating & Air Conditioning Manufacturers' Association and supported by The British Combustion Equipment Manufacturers' Association, The British Refrigeration & Air Conditioning Association and the Boiler & Radiator Manufacturers' Association.

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- 10.00 a.m. Coffee
- 10.30 a.m. OFFICIAL OPENING by F. H. HOWORTH  
President, The Institute of Hospital Engineering
- 10.45 a.m. 'CLEAN AIR, LESS INFECTION?'  
Speaker: Dr. O. M. LIDWELL,  
Central Public Health Laboratory  
Chairman: Prof. JOHN CHARNLEY
- 11.30 a.m. 'BACTERIAL ASPECTS OF ULTRA-CLEAN  
OPERATING ROOMS'  
Speaker: W. WHYTE  
Bacteriologist, Building Services  
Research Unit, University of  
Glasgow.  
Chairman: Prof. JOHN CHARNLEY
- 12.15 p.m. LUNCH
- 2 p.m. 'CONTAMINATION CONTROL IN THE  
HOSPITAL ENVIRONMENT'  
Speaker: F. H. HOWORTH  
Chairman: Dr. O. M. LIDWELL
- 2.45 p.m. 'THE WAY AHEAD'  
Speaker: R. MANSER  
Assistant Chief Engineer,  
Department of Health & Social  
Security  
Chairman: Dr. O. M. LIDWELL
- 3.30 p.m. OPEN FORUM—Questions and Discussion  
Chairman: Dr. O. M. LIDWELL

4.30 p.m. CLOSURE

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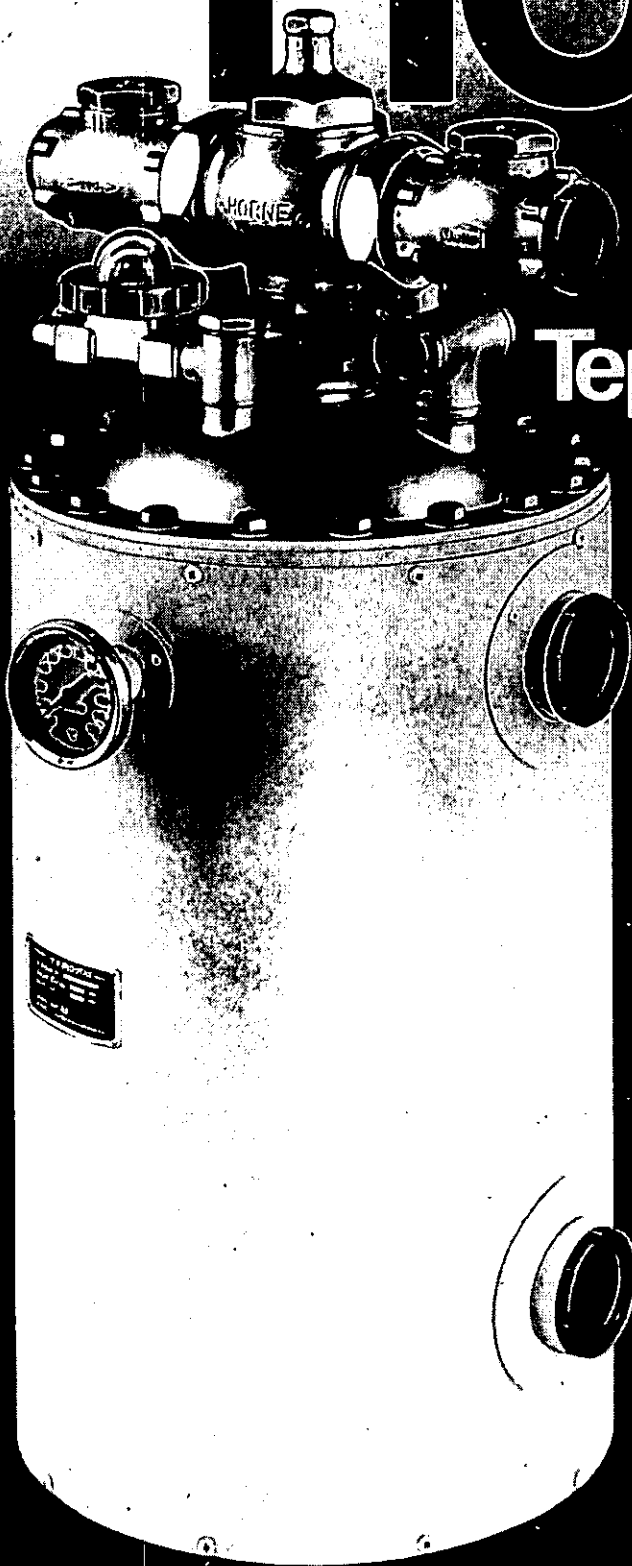
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# The Employment Protection Act 1975

by JOHN RITSON LL.B., Barrister-at-Law, A.M.B.I.M.



The Employment Protection Act as a whole is a far reaching and important piece of legislation. It is generally felt that there is little in its contents to which one could take exception and many of the rights are already provided for employees by more sensitive and progressive employers. Employers should however beware of treating the provisions of the act as a ceiling to be achieved through negotiation. They are in

fact a minimum, a basis from which collective bargaining will begin. It is likely to be about 18 months or two years before the act is fully operational but this in no way obviates the need for immediate management action to monitor the act, consider its impact upon the systems, policies and procedures of the firm and implement the necessary changes at the appropriate time.

The Employment Protection Act is the second instalment of the Government's legislative programme to replace the Industrial Relations Act. As such the act does not introduce any alien rules into industrial relations as did its predecessor. What it does do is to assemble the best industrial-relations practices adopted by various companies and insist that all employers, with few exceptions, afford them as minimum employment rights to their employees. The two basic objectives of the legislation are to defuse the whole collective-bargaining process, and to provide some industrial-relations machinery to act as a fire-fighting operation should any industrial trouble occur. The objectives are achieved, first by the provision of a series of rights for employees, and secondly by establishing the Advisory, Conciliation & Arbitration Service on a statutory footing. By virtue of the act building upon accepted practices in UK industry, it is perhaps unlikely that another government will repeal the measure, whose pedigree renders it much more acceptable to industry as a whole than the Industrial Relations Act, which introduced legal principles from foreign countries that eventually proved unacceptable. However, the new act should not lead to anyone thinking that it is such a dramatic legislative step that will put the United Kingdom in front of the world in industrial legislation. It will, in fact, merely give to employees in British

industry the type of protection that has been enjoyed by workers in other countries for a number of years. In other countries these rights are obtained for employees by law, whereas in the United Kingdom, they are often obtained by collective bargaining. It now seems, however, that pressures will be applied to British management by both trade unions and the law, by virtue of the 1975 act. Many large companies, local and central government and the nationalised industries all have well established practices which afford to their employees many of the rights contained in this act.

## Advisory, Conciliation & Arbitration Service

The ACAS is a new name for well established industrial-relations functions designed to improve industrial relations in general and to assist in the resolution of any conflict. Thus the functions given by the act to ACAS of advising, conciliating and arbitrating were formerly performed either by the Department of Employment or the Commission on Industrial Relations. There are some additional specific tasks which the 'service' is required to undertake in relation to disputes over recognition of trade unions and disclosure of information to trade unions in claims for improved terms and conditions of employment. There is provision for individual employers as well as industries, trade unions, employers' associations and employees to use

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the facilities of ACAS. No employer therefore should fail to seek the assistance and guidance of the service when faced with problems. It is there, like the fire service, to be used, not only when there is an outbreak of trouble, but to give the necessary help to prevent trouble. Employers with industrial-relations difficulties will ignore ACAS at their disadvantage. This is reinforced by a consideration of the general duty imposed upon the service, of 'promoting the improvement of industrial relations, and in particular of encouraging the extension of collective bargaining and the development and, where necessary, reform of collective bargaining machinery'. It must also provide and publish advice to employers, employers' associations, workers and trade unions on industrial relations and employment policies.

### Right to earnings

The act provides a number of important rights to protect an employee's loss of earnings from his job. This is achieved by the provision of separate entitlements which will need to be considered separately since each right has its own special conditions to be fulfilled before the full entitlement can be claimed.

### Guarantee payments

With the increasing interdependency of one employer on another for supplies of raw materials, components, fuel and power etc., an employee's earnings can be jeopardised through neither fault of themselves nor their employer. Accordingly the 1975 act seeks to prevent earnings from falling below a minimum level in the event of there being no work, or insufficient work for employees to do. Thus, where there is any layoff or short-time working the employees concerned become entitled to guarantee payments, provided that they have at least four weeks' continuous service with their employer. If an employee is not provided with work on a normal working day, which then becomes in the language of the act, a workless day, he is entitled to a guarantee payment of a maximum of £6 per day for a maximum of five days in any calendar quarter. The calendar quarters run from the 1st February until the 1st May, from the 1st May until the 1st August, from the 1st August until the 1st November, and from the 1st November until the 1st February. If an employee is not provided with work on more than five days in any calendar quarter, then he will only be entitled to a guarantee payment in respect of the first five days. Once the full guarantee payment has been received then an employee must requalify for his next quarterly entitlement by working another four weeks continuously for his employer.

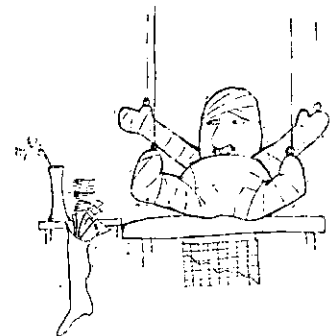
An employee will never be entitled to a guarantee payment in respect of a workless day if he refuses to do some suitable alternative task allotted to him by his employer or there is no work for him because of an industrial dispute either at his own place of work or at any other establishment operated by his employer. Thus an employee working at an assembly factory would not be entitled to a guarantee payment if he had no work to do because another of his employer's factories was on strike thereby interrupting the supply of components to the assembly factory. It is interesting to note that employers could overcome their liability to make guarantee payments by 'locking out' employees

thus initiating a dispute in which case the Act does not require payment to be made. There is of course no liability to make a payment if the employer is deprived of power, heat or light for his business. Thus, during a power crisis employers would not have to make a guarantee payment.

It will be useful if employers contemplating their employees' entitlement to guarantee payment remember the four conditions which must be fulfilled before entitlement arises:

- (a) The employee must have had four weeks' continuous service ending with the last complete week before the day in respect of which he is claiming payment.
- (b) No entitlement arises when a workless day arises due to a trade dispute as previously explained.
- (c) The employee must not have unreasonably refused any suitable alternative work on the workless day.
- (d) No entitlement arises once the employee has exhausted his 5-day entitlement during the 3-month calendar period.

If there is any dispute as to an employee's entitlement to guarantee payment, the matter will be dealt with by an industrial tribunal to whom complaint can be made. It may be, however, that employers and employees have, in advance of the act, 'concluded' an agreement providing 'laid-off' employees with guarantee payments. If this is so, then there is provision for both parties to the agreement to apply to the Secretary of State for Employment for exemption from compliance with the 1975 Act. Such exemption, however, will only be granted where the agreement is superior in every way to the legislative provisions.



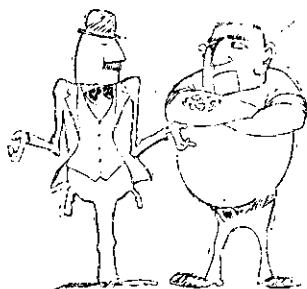
### Medical-suspension payments

Employees with four weeks' continuous service with their employer will be entitled to receive payment from him when they are suspended from work for specified medical reasons. The medical reasons referred to in the Employment Protection Act, comprise a statutory requirement of which there are at present 15, compelling employers to suspend employees from work when occupational factors cause ill health, or a recommendation contained in a code of practice issued under the Health & Safety at Work etc. Act 1974, by the Health & Safety Commission. This latter reason makes it very important for employers to monitor the issuing of the codes of practice under the Health & Safety at Work Act to be sure of the possible existence of circumstances in which they may have to pay employees whom they have been recommended to suspend from work, due to occupational health. If an employee is entitled to payment for medical suspension he will be paid his full wages for every week of absence up to a maximum of twenty-six weeks.

However, this entitlement may be lost if one of three conditions prevail:

- (a) The employee unreasonably refuses to do an alternative job assigned to him by his employer.
- (b) The employee refuses to comply with reasonable requirements as to his availability for work.
- (c) The employee must not be incapable of work due to sickness or injury.

It is of course likely to cause hardship to an employer who may be deprived of his employee's valuable services during the suspension period. Accordingly, an employer may engage a temporary replacement for the suspended employee and may dismiss him to relocate the 'regular' employee when his suspension ends. The employer in these circumstances will not be liable for unfairly dismissing the temporary replacement provided that it is made clear to the employee concerned the basis for his employment in the first place.



### Insolvency of an employer

The act provides that, where an employer becomes insolvent, monetary entitlements of employees are protected. This situation is achieved by allowing employees who have lost their jobs due to their employer's insolvency to claim their monetary entitlements from the Redundancy Fund. The fund then reclaims the money paid out to employees from the insolvent employer in the winding-up process. Moneys to which an employee becomes thus entitled comprise: arrears of pay, holiday pay, unfair-dismissal compensation, guarantee payments, medical-suspension payments, maternity pay, payments for time off work, protective awards, employer's contributions to an occupational pension fund, and pay in lieu of notice. Where the amount of money due relates to a period of time, a maximum of eight weeks pay only is payable (six weeks in the case of holiday pay) and in these circumstances there is a maximum limit of £80 per week payable.

### Maternity pay

One of the most interesting features of the act is the series of benefits given to employees in connection with maternity. One of those rights, to maternity pay, protects, in a limited way, the earnings of a pregnant employee. A female employee, whether married or not, who has worked continuously for her employer for at least two years up to the end of the tenth week before the week when the baby is due, and who in fact works up until this moment of time will be entitled to receive maternity pay. The amount of maternity pay involved is the difference between the social-security maternity benefits received and nine-tenths of the employee's normal week's pay. This payment will in fact come from a central fund established by the act into which employers will contribute and then receive a rebate

when payments are made to employees. Once again, any complaints about an employer's failure to make a maternity payment will go to the industrial tribunals which have the power to order the full payments to be made when they are legally due.

### Paid time off work

Employers will be required to protect their employees' earnings in circumstances defined in the act when employees are entitled to time off work. In such situations the employer will have to make payments to employees, thus protecting their earnings. There are three circumstances mentioned in which payment must be made for time off work. The first is to officials of an independent trade union recognised for collective-bargaining purposes. Paid time off work must be allowed to such officials, including shop stewards so that they can carry out their industrial-relations functions within the firm. This involves time spent on consultations, negotiations, dealing with members' grievances, excluding of course industrial action. Additionally employers must pay for time spent in training for these duties whether the training is carried out by the employer, trade union, or independent training organisation. Such time off is to be paid for on the basis of the official's average hourly earnings. The second example of the right to paid time off work covers members of an independent trade union recognised by the employer who have the right to take part in union activities, excluding again, industrial action. In this example, the act does not stipulate the amount of payment which is to be made. The act deliberately leaves these matters couched in rather vague phraseology and requires the ACAS to provide codes of practice giving guidance to employers and trade unionists. The third instance of paid time off work occurs in circumstances where employees are made redundant and entitled to a redundancy payment. In these cases employees are entitled to reasonable time off work with pay to look for new employment or to arrange for training for future employment.

There are a number of other rights contained in the act which give to employees what might be described as a measure of job security. These rights basically add to those already existing relating to unfair dismissal and redundancy, and build upon those rights. Loopholes and deficiencies have been found in these existing basic rights in the light of experience and it is this experience upon which the act draws heavily in developing them.



### Maternity leave

A woman who is pregnant is entitled under the act to 'enjoy' a period of maternity leave and to return to her

original job or to another job whose terms and conditions must be not substantially less favourable to her than the corresponding provisions of her previous job. In order to be entitled to the maternity leave detailed in the act a woman must fulfil four conditions:

- (a) She must have worked continuously for her employer for at least two years before the beginning of the eleventh week before the expected week of confinement.
- (b) She must have continued to work up to the beginning of the eleventh week before the expected week of confinement.
- (c) She informs her employer that she will be absent from work because of pregnancy and that she intends to return to work within twenty-nine weeks of giving birth, and
- (d) She produces a medical certificate stating the expected week of her confinement should her employer so request it.

The effect of this right is that a woman has an opportunity to return to work at any time within twenty nine weeks of the birth of her child, provided that she notifies her employer a week before she proposes to return to work, of her intention to do so. The employer may then, postpone the return to work for a maximum of four weeks if it is administratively inconvenient to accommodate the returning employee. Similarly the woman herself, may postpone her return to work for up to four weeks even after the twenty nine weeks has expired, for medical reasons. It is clear that any woman taking her maternity leave will cause severe administrative and economic problems to her employer. In these circumstances, therefore, the act specifically allows employers to engage a temporary replacement for the pregnant absentee and he can then dismiss the replacement 'fairly' when the woman returns to work after her maternity leave. Such a 'fair dismissal', however, can only be accomplished by an employer where he has made it clear to the temporary employee at the start of the employment that the job will only last until the pregnant woman returns. If an employer refuses to allow an employee to return to work after maternity leave this entitles her to complain to an industrial tribunal and the complaint will be treated as one for unfair dismissal. If an employer cannot re-employ her because of redundancy, then the woman will be entitled to claim compensation under the Redundancy Payments Act, 1965, as from the day on which she proposed to return to work and of which she had notified her employer.

### Unfair dismissal

The act adds an additional ground upon which to base a claim for unfair dismissal to those already contained in Schedule I Trade Union & Labour Relations Act 1974. This is the ground of pregnancy. Henceforth, therefore, the dismissal of an employee on the grounds of her pregnancy alone, will rank as an unfair dismissal. If, however, a woman's pregnancy, renders her incapable of work, or there are some legal restrictions upon her continuing to work at her job and the employer cannot offer her suitably alternative work she can then be fairly dismissed. Her dismissal then would not be for reasons of pregnancy but for reasons of incapability which are 'fair reasons', justifying a dismissal under the

Trade Union & Labour Relations Act 1974. In these cases a woman will retain her right to both maternity pay and maternity leave plus re-instatement if otherwise she is eligible.

### Written statement of reasons for dismissal

Apart from dismissals on the grounds solely of pregnancy being rendered unfair, the act requires employers to give to employees with at least 26 weeks' continuous service a written statement of the reasons for his dismissal. Such a statement will be required from the employer only where the employee requests it and it must be furnished to the employee within 14 days of the request. Once provided, that statement will be admissible as evidence in any industrial-tribunal proceedings where it may be used by both employer and employee to justify their respective positions. A refusal by an employer to provide such a statement or provide reasons therein which appear to be untrue, justifies a complaint to an industrial tribunal by the aggrieved employee. If the complaint is found to be justified in the tribunal proceedings then the employee will be entitled to compensation of the equivalent of two weeks' pay, irrespective of whether the dismissal is fair or unfair. This legal requirement does in fact do no more than emphasise the need for a sound dismissals procedure as is mentioned in paragraphs 130-133 Code of Industrial Relations Practice 1974.

This particular provision of the act could in practice turn out to be of minimal advantage to employees. Continental experience with similar requirements tends to indicate that the reasons given tend to be expressed in such general terms as to be meaningless, and therefore have minimal effect. Where written statements are given under the act, employers will presumably have researched their reasons thoroughly and they are likely to find the statement of more help to them than their employees.

### Complaints to tribunals

Once the act has come into force a further degree of protection in relation to unfair dismissal will be afforded. This relates to the timing of complaints to industrial tribunals by employees who consider themselves to have been unfairly dismissed. In future, an employee will be able to initiate a complaint immediately he receives notice from his employer instead of having to wait until that notice expires. This will allow an opportunity for conciliation before the employee leaves his job and his chances of getting the employer's decision rescinded are greater if that decision had not taken effect.

### Re-engagement and re-instatement

Where employees are found, by industrial tribunals, to have been unfairly dismissed the act gives new protections to them in the form of a right to re-engagement or re-instatement. In future, when an employee has been found to have been unfairly dismissed by the tribunal, he must be asked by them whether he wishes to be re-engaged or re-instated. If it is desired by the employee and if it is practicable then the employee will be entitled to an order from the tribunal re-instating him in his old job or re-engaging him in a comparable job with the same or an associated employer. Such

orders can contain the terms on which the re-instatement or re-engagement must take place. Only, in future, if this is not possible will tribunals consider compensation to be awarded to the employee. If an employer refuses to comply with an order for re-instatement or re-engagement when it is practicable for him to do so, the industrial tribunal will award an additional sum of between 13 and 26 weeks' pay, in addition to the compensation awarded for unfair dismissal.

### Amount of compensation

These rights to get the job back, are significant in themselves, but are given added strength by the increases in the amount of compensation awarded to the unfairly dismissed employee. In future, compensation will be based upon a basic award, and a compensatory award. The basic award is related to length of service, a week's pay, and age, and is calculated in the same way and on the same basis as redundancy pay. It will always comprise a minimum of two weeks' pay subject to the Redundancy Act limit of £80 per week. The compensatory award on the other hand will be based upon any loss sustained by the employee as a result of his dismissal as is the case at present. Such loss includes expenses incurred by the employee in making his complaint to the industrial tribunal and may in fact be reduced if the employee has in any way contributed to his own dismissal by his misconduct etc.

Since it came into being in 1963 the Contracts of Employment Act has been the cornerstone of employee's rights in relation to notice and written particulars of employment. Although amended in 1972, the act is being amended again by the Employment Protection Act. There are three ways in which these amendments take place; in relation to periods of notice, the written statement, and part-time employees.

### Notice periods

In future the act provides that employees will be entitled to minimum periods of notice from their employer to terminate their employment.

This notice will be one week, after four weeks' employment, two weeks' notice after two years' employment and thereafter a further week's notice up to a maximum of 12 for every year of continuous employment.

### Written statement

The written statement of main terms and conditions of employment has to be expanded in several ways to include a new series of particulars contained in the 1975 act. This will require employers to rewrite their contractual statements for existing and future employees. Four new details must be inserted therein according to the 1975 act.

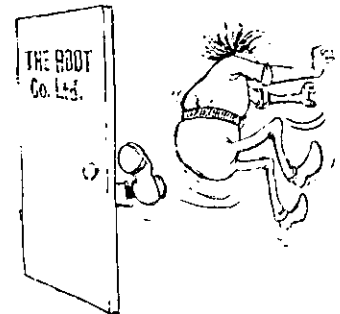
- (a) Reference to any previous employment which can be counted as continuous with the current employment and the date when that employment began.
- (b) The job description by reference to title which the employee is to do.
- (c) Specify any disciplinary rules applicable to the employee or refer to any document which contains those rules.
- (d) Specify a person to whom the employee can apply

if he is dissatisfied with any disciplinary decision made concerning him.

If, of course there are no disciplinary rules affecting the employee then this fact should be stated, thereby giving any dismissed employee a flying start when complaining about his allegedly unfair dismissal to an industrial tribunal. This provision clearly indicates the importance employers should attach to having a proper disciplinary procedure operating in their company. This statement in future, will have to be issued within twelve weeks of the employee starting work.

### Part-time employees

The Employment Protection Act brings many employees under both its own scope and that of the Contracts of Employment Act. Thus, many employees who are at the moment considered to be part-time because they work less than 21 hours per week, will be entitled to enjoy many of the rights conferred by the 1975 Act. The position is that all employees who work a minimum of 16 hours per week will be henceforth classed as full-time employees. So will those whose hours of work fall to a minimum of eight per week, provided that they only do so for 26 weeks or less. Employees who have worked continuously for the employer for five years or more for a minimum of eight hours per week will also be entitled to the new employee rights provided they fulfil the appropriate conditions for benefit.



### Redundancy

After what has just been said about part-time employees being given more status and more rights, it is perhaps hardly surprising that such workers are now brought into the redundancy-payments fold. Thus many more workers will enjoy the protection of the 1965 act.

A problem which has been found in the working of the act has been the situation of employees who have been made redundant and offered an alternative job by their employers. In the past employees have been uncertain whether to take the alternative job, since their right to redundancy pay could often be adversely prejudiced by them doing so. Accordingly, The Employment Protection Act allows employees to give the new job a trial of up to four weeks, or longer if agreed with the employer. If the job is still found to be unsatisfactory at the end of the trial period, then the employee can claim his entitlements to redundancy pay, asserting that he has been made redundant as from the time the original job ended. The act further extends a protecting hand to the redundant by permitting an industrial tribunal to allow an employee a further period of six months after the initial six has passed, in which to present his claim to the tribunal alleging his redundancy.

Thus it is feasible for a claim to be presented up to 12 months after the redundancy has occurred. If an employer makes a voluntary payment of redundancy money to an employee, during the second period of six months, then he will be entitled to a rebate from the redundancy fund in the normal way if there was no fault on his part occasioning the delay.

An employer who is faced with a redundancy situation has a new duty imposed upon him by the legislation. This is the duty to notify and consult with the Secretary of State for Employment and the representatives of an independent trade union he recognises for the purposes of collective bargaining. This consultation and notification should always take place regardless of how many people are made redundant, and should begin as early as possible. However, where ten or more redundancies are proposed within a 30-day period then such consultation and notification must take place, at least 60 days before the first redundancy is proposed, and if 100 or more are proposed within a 90-day period, then there must be 90 days of advanced warning. The purpose of these consultations is to require the employer to disclose basic information relating to the redundancies such as the reasons themselves for the redundancy situation occurring, the number of employees affected, the unit of employment from which the redundancies must come, and the proposed method of selecting them. The idea behind these requirements is to insist that proper industrial-relations practices and procedures are followed in such a sensitive area as loss of jobs through redundancies. It is hoped that proper consultations will obviate the need for any industrial action in these circumstances, directed against either the redundancies themselves or the way in which particular persons have been selected.

The act itself is fairly vague about what is meant by consultations and notification. Employers would therefore, in the absence of more specific information, be well advised to take note of the Code of Industrial Relations Practice paragraphs 65 and 68 in relation to this problem. They state:

Consultation means jointly examining and discussing problems of concern to both management and employees. It involves seeking mutually acceptable solutions through a genuine exchange of views and information. In setting up consultative arrangements management should ensure that:

- (i) The arrangements provide opportunities for employees to express their views on proposed changes which affect them and encourage discussion, at whatever level is most appropriate, of matters closely connected with the work situation;
- (ii) Employee representatives have all the information they require to enable them to participate effectively in discussions;
- (iii) Senior managers take an active part in consultation;
- (iv) The arrangements include effective means of reporting back to employees.

Of further guidance to employers is Section II of the EEC Directive on Collective Dismissals, dealing specifically with consultations about proposed redundancies. It provides that:

- 1 Where an employer is contemplating collective

redundancies, he shall begin consultations with the workers representatives with a view to reaching agreement.

- 2 These consultations shall at least cover ways and means of avoiding collective redundancies or reducing their number and mitigating their consequences.
- 3 To that end, the employer shall supply the workers' representatives with all relevant information and shall in any event give in writing the reasons for the redundancies, the number of workers to be redundant, the number of workers normally employed, and the period over which the dismissals are to be effected in order that the workers' representatives may make constructive proposals.

The employer shall forward to the competent public authority a copy of all the written communications referred to in the preceding subparagraph. This period shall be used by the competent public authority to seek solutions to the problems raised by the proposed collective redundancies.

If an employer fails to undertake the required consultations, then either an employee or a trade union could apply to an industrial tribunal asking for a 'protective award' to be made. This would entitle employees concerned with the redundancy to remuneration during the period in which consultations should have taken place. This protective period of course cannot exceed 90 days, which is the longest period during which consultations is required. If there is a failure to notify the Secretary of State about proposed redundancies then the employers' redundancy rebate from the central redundancy fund can be reduced by one-half or the employer will be liable to a fine of up to a maximum of £400.

A number of other rights are entrenched in the act, allowing employees, for example, to have unpaid time off work to carry out public duties. The duties referred to are those of justice of the peace, membership of local authorities, statutory tribunals, health authorities, local-education authorities and water authorities. No pay is due in respect of this 'civic' work though many employers will probably wish to pay their employees as many do at present, regarding themselves as under a social obligation in this matter. The other right referred to above, is the right to receive at or before payment of wages or salary is due, an itemised pay statement. This statement should show:

- (a) the gross amount of wages or salary;
- (b) the amounts of any fixed and variable deductions and the purposes for which they are made;
- (c) the net amount of wages or salary payable;
- (d) where different parts of the net amount are paid in different ways, the amount and method of payment of each part.

Instead of giving a weekly statement, employers can provide an annual statement in which the separate particulars of fixed deductions will have to be aggregated. Once again, as in other matters, there is provision for disputes about the statement to be referred to an industrial tribunal.

Quite apart from providing the series of rights referred to, for employees, the Employment Protection Act deals with some of the problems of collective bargaining. The two most significant aspects of the

act's provisions in this respect relate to the recognition of trade unions by employers and the disclosure of information by employers to recognised trade unions.

### Recognition of trade unions

Either an employer or an independent trade union can refer a recognition issue to the ACAS which has an initial duty to consult all the parties involved with a view to achieving a voluntary settlement of the problem, by conciliation. If no agreement is reached then the ACAS will proceed to recommend in writing a solution, suggesting either recognition or not. These recommendations take effect immediately they are notified to the parties involved, though as and when circumstances change the parties may apply to the ACAS for a revocation or variation of the recommendation. If an employer fails to comply with a recommendation for recognition, the trade union aggrieved will be able to lodge a further complaint with ACAS which has a duty to try further conciliation to achieve a settlement. If this is unsuccessful the trade union can ask for unilateral arbitration by the central arbitration committee (also established by the act). The committee can then make an award detailing the terms and conditions of employment which employees should enjoy. It is interesting to note that the act in this context merely requires employers to recognise unions not negotiate with them.

### Disclosure of information

Employers who recognise trade unions are under an obligation to disclose information to trade-union representatives, such as full-time officials or shop stewards which will assist collective bargaining. Exactly what should be disclosed by employers will appear later in a code of practice to be issued by the ACAS. However, there will be no obligation to disclose information which may be detrimental to the interests of the employer's business, or information which may prejudice either the national interest or individuals, and employers are not requested to produce actual documents or spend an unreasonable amount of time or money in preparing the information. If an employer fails to disclose information as required, then a trade union will be able to complain to the central arbitration committee. The complaint will then be referred to the ACAS with a view to conciliation. If this approach is unsuccessful the committee can eventually make a declaration as to the relevant information and the date by which the employer must make the disclosure. Should there then be continued refusal to disclose by the employer, the trade union can present a claim asking for certain terms and conditions to be afforded to employees and the committee is empowered to make an appropriate award. Much of the work on disclosure will have to be done later by ACAS and at the moment no-one knows what that development will be. However, it is worthy of note that the comparable provisions in the industry bill are much more significant.

In its requirements about disclosure the act draws heavily upon the experience on the USA of the National Labor Relations Act. Under the latter act employers are required to bargain in good faith which has been interpreted by the national labor relations board and the courts to include the duty to supply to a recognised trade union sufficient information to allow the union to

understand and discuss intelligently the issues raised. Employers thus have been required in various circumstances to disclose information on wages and other conditions of employment including job grading, pensions, insurance, and other benefits, pay of employees other than those requiring disclosure as well as wage rates at the employer's other factories, wage surveys conducted by the employer, time study and other data used in setting wage rates or incentive pay schemes, and information on job seniority and ages of employees, profits and other financial arrangements where relevant. Whether the central arbitration committee will adopt the same attitude as the national labor relations board remains to be seen.

Of great importance to the provisions relating both to recognition of trade unions and disclosure of information, is the basic right given to employees not to be prevented or deterred by their employer from membership of an independent trade union or from taking part in its activities at any 'appropriate time'. Appropriate time refers to any time outside the employee's working hours which the employer agrees can be used for trade-union activities. Should there be a closed shop in existence, the right to take part in union activities is limited to those unions who are party to the closed shop. Infringement of this right justifies a complaint to an industrial tribunal by an employee.

Should an employee present a complaint of unfair dismissal which relates to his membership or proposed membership of a trade union, or to taking part in its activities an industrial tribunal can require the employer to keep the employee in employment until the full issue can be heard. The complaint itself in these circumstances must be presented within seven days of the termination of the contract and has to be supported by a written certificate from an authorised trade-union official of the union concerned. Such protection will only be afforded by the industrial tribunals if it appears to them on receipt of the complaint that the tribunal hearing will eventually find the complainant to have been unfairly dismissed.

Apart from creating new rights and a new framework within which collective bargaining can take place, the act substantially alters a number of existing pieces of legislation. The nature and type of each of these amendments are too far reaching to be dealt with in detail in this article. However, some of these are of considerable significance such as the one which removes the disqualification from unemployment from those who are held to be financing a strike merely because they are a member of the same union as the strikers. For employers and employees in wages council industries there are some considerable changes in the operation of wages councils which are worthy of note. They will in future be able to fix any terms and conditions of employment not just pay and holidays, and be able to make orders themselves and specify the date on which they will become effective. There is also the facility in the act to convert wages councils into joint industrial councils which will not have independent members as do the present councils with the result that in cases of deadlock between the trade union and employer representatives, they can impose a settlement. The joint industrial councils thus are midway between a wages council and free collective bargaining which they are designed to encourage eventually.

## Product news

### Heat exchanger

This unit has been designed to recover most of the energy normally lost through mechanical exhaust systems and, depending upon the velocity of the air streams through the unit, efficiencies in excess of 80% are claimed. The construction involves a closely spaced series of thin corrugated aluminium plates through which the exhaust air is continually exposed to the make-up air in alternate slots. At each end the plates are securely sealed, allowing no chance for intermixing or contamination of exhaust and make-up air.

*F. H. Biddle Ltd., 16 Upper Grosvenor Street, London W1X 0BQ.*

### Thermal deaerator

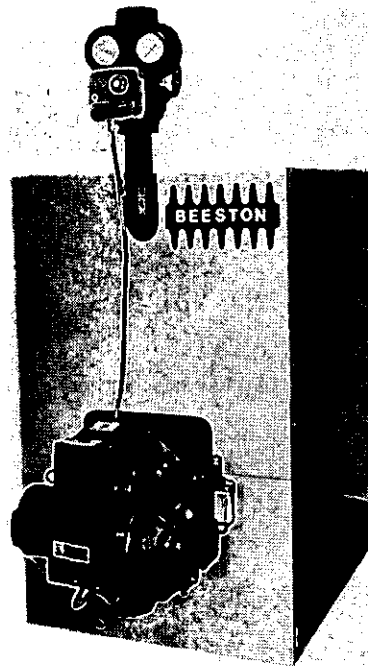
This thermal deaerator effectively reduces both oxygen and free-carbon dioxide to a minimum to provide the best possible protection to the entire steam system. It is available in a standardised modular range of internally lined units with outputs from 2 m<sup>3</sup>/h (1500 l) to 15 m<sup>3</sup>/h (9750 l). Operating temperature is 104°C (i.e. 2 MWC). Normal working differential is 10 min full flow with a further 5 min to emergency low level. Normal residual oxygen level in output is 0.02 parts in 10<sup>6</sup>. An important feature of the deaerator is the nozzle system which incorporates a jet which simplifies the forced circulation process, creates increased circulation, immediate boiling and more even distribution of turbulence and a reduction in noise. The self-contained deaerator also serves as a feedwater storage tank, and for this purpose it is equipped with flanged sockets for the feed pumps.

*Advanced Water Services Ltd., Church Road, Penn, Bucks.*

### Boilers

This modular boiler is available in fourteen arrangements covering outputs of 198 to 880 kW (675 000 to 3 × 10<sup>6</sup> Btu/h). The Moduline consists of selected sizes of cast iron sectional boiler from the com-

pany's Blythe and Trent ranges which are gas-fired via atmospheric burners; in each modular set the number of individual boiler units has been limited to four, except for



the largest Moduline which has five. The majority of Moduline sets employ dissimilar sized units and thereby achieve good load matching. *The Beeston Boiler Co. Ltd., PO Box No 2, Beeston, Nottingham NG9 2DN.*

### Enclosures

The T range of enclosures is designed to house electrical and other control gear. The design is double folded at the front with seam-welded corners. Lift-off, fully gasketed doors are also double-folded and surface mounted to open 180°. The unit is finished in 2-tone stoved enamel. Top and bottom gland plates, chrome barrel locks and bolt-on component panels are provided along with earthing facility on the panel and the door. The T range consists of six metric sizes ranging from 450 × 375 × 254cm to 1200 × 750 × 329cm. They are suitable for mounting either side-by-side or one above the other.

*Tegrel Engineering Ltd., Blaydon on Tyne, Tyne & Wear NE21 4SL.*

### Emergency lights

Nine emergency lighting units, in-

cluding both nonmaintained and sustained fluorescent models, are available in this range which has been designed and tested by an independent laboratory to GLC specifications. Features available include dryfit or nickel-cadmium sealed battery, automatic charger, solid-state switch and mains healthy neon indicator. Circular, rectangular and decorative fittings are also available.

*Patrick Roberts Lighting Ltd., 18 Queens Road, Brighton.*

### Nonslip finish

Industrial Safety Tread is a slip-retardent finish for concrete floors. It is applied as a liquid, the inert filler providing a safe slip-retardent surface even under damp conditions. Concrete floors are extremely prone to dusting and Industrial Safety Tread also acts as a seal, binding the surface of the concrete together and preventing it from dusting. It will withstand attack by petrol, oil, grease and a wide range of industrial chemicals. It will also resist alkali present in concrete. Two coats of Industrial Safety Tread, preceded by primer, are recommended for most applications. Each coat will dry hard, in approximately two hours.

*Russell Kirby Ltd., Kirby Industrial Estate, Liverpool L33 7TF.*

### Lightweight generators

This 7-model range of lightweight petrol generating sets incorporates dual voltage selection, includes a 500 W, 12/24 V battery charging set and extends to 5 kVA, 115/230V a.c. machines. The sets are powered by the Briggs & Stratton petrol engine coupled to a range of self-regulating self-exciting alternators, thus minimising the overall size of the units. The battery-charging set has anticreep feet and is fitted with a tubular steel carrying handle. The 1.2 and 2 kW, and 3.5 and 5 kVA a.c. sets are mounted on steel base-plates with a wrap-round protective frame. A trolley-mounted version is available for the 3.5 and 5 kVA sets, which can also be supplied with 415/240 V 3-phase supply.

*Erskine Systems Ltd., Lee De Forest House, Eastfield, Scarborough, Yorks. YO11 3DU.*

# Design notes on sanitary plumbing

by JOHN T. WOJCIK

These notes collate up-to-date information in the latest code of practice, building regulations and BRS digests to enable engineers engaged in the design of sanitary installations to rationalise design methods and apply these directly and easily to any problems that may arise.

## Introduction

The purpose of these notes is to summarise information on the design and installations of sanitary plumbing systems that will efficiently discharge waste materials without blockages, leakages of foul air, and excessive pressure fluctuations.

In the past, sanitary plumbing has been designed

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in an ad-hoc manner, i.e. vertical and horizontal pipes take a tortuous path through the building, with short-radius bends, unnecessary offsets, lack of access to the pipework, knuckle bends, lack of co-ordinations with other services, access points within the clinical areas etc., and the fact that this installed system is operating well is usually more by chance than intention.

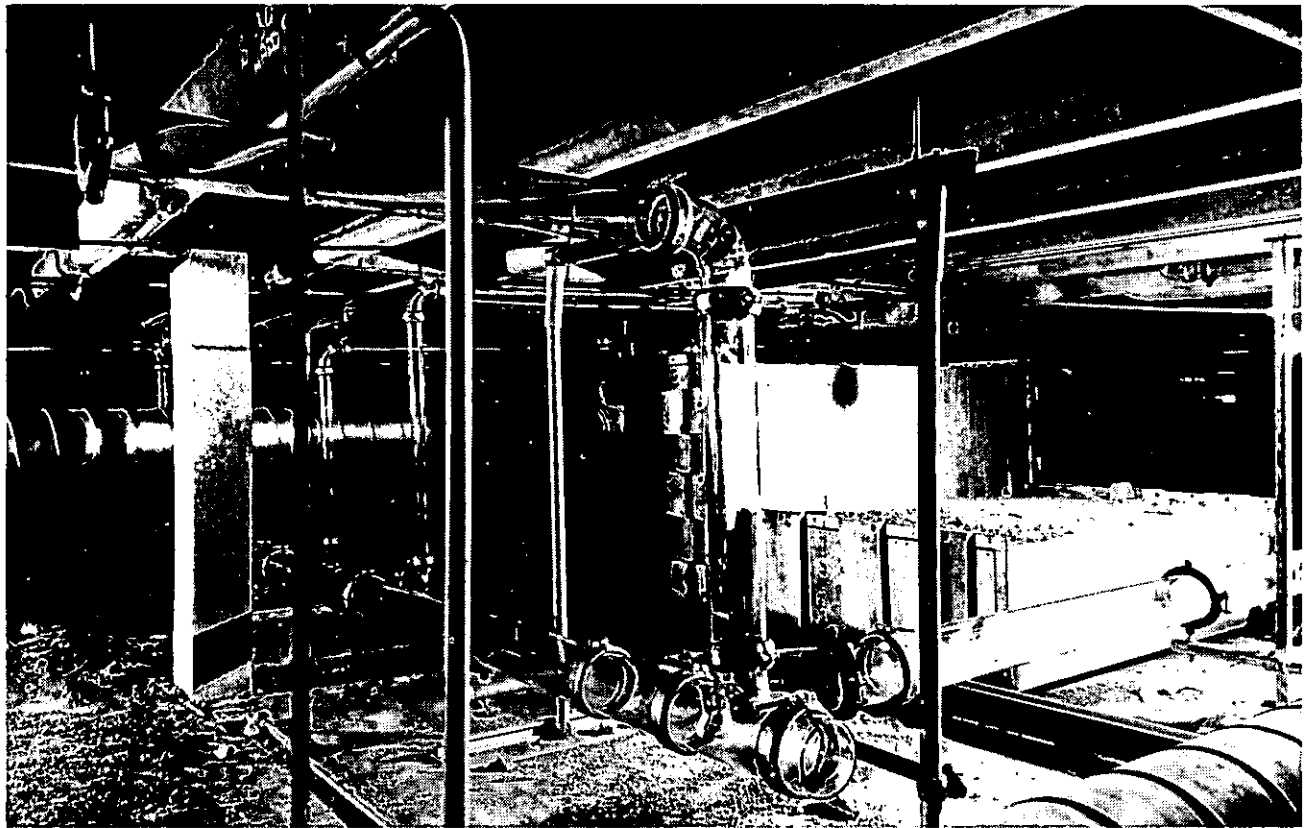
CP304 code deals with the design, installation, testing and maintenance of discharges and vent pipes for buildings. It does not cover all design considerations affecting other than domestic installations. For hospital and office buildings it is also advisable to follow the latest recommendations of the Building Research Establishment.

While the Public Health Act of 1936 exempts certain buildings, including hospitals, from building-regulation requirements, this should not be used as an excuse to design sanitary plumbing to lower standards. The whole of hospital sanitary plumbing design and installations should comply with the relevant BSS Codes of Practice, local by-laws and building regulations.

## Drawings

The following information should be included in all drawings:

- (a) a plan of each floor showing the position of sanitary appliances
- (b) the size and position of stacks
- (c) the routes of branches to fittings
- (d) the gradients and levels of all pipework



QVF glass Drainline at Nottingham University Hospital & Medical School

photo: Jobling Limited

- (e) the size of branch, soil and waste pipes
- (f) the type of traps
- (g) the access points
- (h) a plan of the roof, showing vent stacks
- (i) isometric details of each complete stack, showing connections of branch and soil-waste stack
- (j) 1:50 scale details showing co-ordination with other services in areas where these are considered congested
- (k) enlarged details of critical areas.

#### *Designs to avoid*

The following are considered as bad design:

- (a) installing access on the bottom of branch soil pipes
- (b) installing p.v.c. pipes close to heating pipes
- (c) installing a line which is inaccessible
- (d) installing unnecessary bends and offsets
- (e) installing branch soil pipes at flat gradients
- (f) installing branch soil and waste pipes over 6 m in length unless these are vented
- (g) installing specialist equipment without finding quantity or the material discharged
- (h) installing shallow seal traps
- (i) a specification without a test programme.

### **General**

#### *Layout of pipework*

The layout of plumbing pipework should at all times aim at a system where pipelines are as straight as possible. The effect of an offset in other services creates little difficulty, whereas an offset in a discharge pipe can be a frequent source of blockages following completion of the installation. Straighter pipes require fewer access points.

#### *Sizing of pipework*

Care must be taken in sizing a plumbing installation, especially in systems such as the single-stack system, if the installation is to function effectively without the aid of vent pipes.

#### *Blockages*

Experience has shown that blockages occur most frequently on horizontal pipework, and for this reason long horizontal runs exceeding 6 m should be avoided by using more vertical stacks. Better grouping of sanitary fittings can often assist in this problem. All bends, branches and offsets if unavoidable should be of large radius and there should be no restriction to the bore of the pipe.

#### *Access*

Access, when provided, should, wherever possible, be located in 'dirty' areas. The access cover should be located in a negative-pressure ventilation area. This limits the spread of foul air to one room. In positive-pressure areas there is a risk of spreading foul air to other rooms. The provision of access for rodding within false ceilings is to be avoided wherever possible. Access should preferably be from the floor above the pipe to prevent spillage into false ceilings. Access should be provided at the end of all branch runs, with access plates installed above flood level.

#### *Performance of installation*

For better performance and ease of installation, it is best to have the vent stack behind the w.c. pan next to the basin. The advantage of having the basin close to the stack cannot be overemphasised.

#### *Flooding and prevention*

The risk of flooding can be greatly reduced with little increase in initial cost and through measures simple enough to apply. Plumbing systems should be designed so that the first three or four floors are on a separate stack, letting the waste from the upper floors drop down without any connections to the lower floor stacks.

#### *Waste-disposal units*

The discharge pipes from waste-disposal units should continue directly to the main discharge pipe without intermediate connection to any other discharge pipe, and the fall should be not less than 15° to the horizontal. Tubular traps should always be used. The discharge pipe taking the waste from such units must connect directly to the drain without an intervening gulley trap. Waste-disposal units should always be flushed with cold water to solidify grease before it enters the drainage system.

#### *Ground-floor appliances*

To avoid back pressure at the base of the stack, the ground-floor appliance should be connected directly to the drain or manhole, or a bend used at the base of the stack which is larger than the stack itself. It is considered good practice to connect all ground-floor fittings direct to the manhole to prevent flooding.

#### *Grouping of sanitary appliances*

A basic principle in the siting of appliances is that a number of appliances on one floor should be closely grouped together and groups or isolated appliances on different floors should be sited one above the other. Keeping branches down in length by close grouping will make it easier to design efficient disposal plumbing and also make it easier to provide concealment for branch pipes, particularly the larger diameter soil and waste pipes. Also, close grouping and a similar arrangement of sanitary appliances on each floor will minimise the number of ducts required to conceal vertical runs of pipes and the number of drain connections.

#### *Back-flow*

Back-flow is caused by the main flow backing up into branches; 135° fittings prevent this occurring as does bringing side branches into the main drain at an angle to the horizontal. Double branch junctions should be avoided as back up can occur more readily.

#### *Flexible connections*

Flexible connections should be used between sanitary appliances and drains to allow an appliance to be easily removed for replacement or to enable a blockage to be cleared.

#### *Kitchen*

In view of the fact that crossinfection can rapidly spread throughout a hospital via the kitchen, this should have its own discharge stack quite separate from pipework serving the remainder of the accommodation around the kitchen.

*Effects of discharge on the seals*

Self siphonage is the action by which the wastes from individual appliances suck out their own seals at the end of their discharge. This can occur with any appliance but is important only with washbasins, and small sinks. Such appliances may lose a proportion of or all their seals after discharge, depending on conditions of installation. It is necessary to fix the maximum reduction of seal that can be permitted after individual discharge.

Induced siphonage is the action of single or combined discharges on the seals of appliances not in use at the same time. The loss of seals depends on the magnitude or pressure change caused by the discharge, and on the dimensions of the trap. When discharge through the pipework induces a steady suction less than or equal to the trap depth, the loss of seal is equivalent to about half the suction. A fall in pressure greater than the trap depth generally gives a much bigger loss whatever the trap shape, because air is sucked from the room through the seal and pumps out the water.

Back pressure is the rise in pressure in the pipework above atmospheric; when the pressure is removed the water falls back into the trap and a little water may be lost by momentum. When the pressure appreciably exceeds the trap depth, air from the pipework is forced back through the tap seal into the room without necessarily causing loss of water from the traps.

*Evaporation of the seal*

Evaporation was one reason why the seal has increased to 75 mm for the 1-pipe system. Tests have shown that a figure for rate of evaporation under conditions in the United Kingdom is 2.5 mm per week. A retention of 25 mm of seal is, therefore, a generous allowance for evaporation during periods of disuse, and provides a margin of safety.

**Soil stacks and vents***Offsets*

An offset in the stack above the topmost connection to the stack has little effect on the performance of the system. Offsets below the topmost connection should be avoided and every effort should be made to establish straight drops through the building, or extra ventilation pipes may be required to prevent large pressure fluctuation in the stack.

Investigations show that a 300 mm offset built into a drainage stack at ground level could possibly cause excess pressure. A small vent above the offset would have kept the positive pressure within the limit of 375N/m<sup>2</sup> from atmospheric pressure.

Bends and offsets (below the topmost connection) in the vertical stacks give rise to pressure fluctuations in the stack and should be avoided. If this is not possible then short projections should be used, an overall length of 914 mm being suitable. Longer offsets should be made up with two 135° bends with short lengths of connecting line to make up the required projection.

*Separate venting*

With a vertical stack serving tiers of appliances and an underground drain receiving the discharges from

the stack, the problem is not the self-siphonage effect of individual appliances but the overall effect throughout the pipework of simultaneous discharge from serving appliances in various parts of the building. Under certain conditions, the discharge may combine to cause a suction in the space when water will be drawn from the traps; sometimes pressure may rise above atmospheric, when foul air may be forced back through the seals into the building. As a basis for design it is necessary to fix a limit to the pressure variations. A seal is retained if the pressure is not allowed to depart from atmospheric by more than 25 mm water gauge. With a small number of appliances and with correct design the main disposal pipes open at the top provide ventilation sufficient to maintain this standard without the need for separate vent stacks. With greater loading of the main stacks, separate venting is required but it is sufficient to have one vent connection to each group of appliances instead of a separate vent pipe to each trap.

*Synthetic detergents*

The use of synthetic detergents creates a problem, as most of these detergents possess high foaming power and large quantities of foam are formed when waste water containing detergent is discharged into the stack. Stacks and drains must be large enough to cope with the foam, which otherwise may be forced out from the pipework into lower floors and flooding can be reduced by designing plumbing systems so that the first three or four floors are on a separate stack, letting the waste from the upper floors drop down without any connections to lower floor fixture areas (applicable to multistorey building).

*Vent near bottom of stack*

Single-stack installations require a vent near the bottom of the stack when conditions are such that the air drawn down with the discharge may not be able to escape freely into the drains. Individual stacks do not work as independent units but may be affected by discharge from other parts of the building.

*Stacks taking waste only*

The use of waste stacks for one, two or three appliances on each floor (for a maximum of five floors), without separate venting has been practised for some years in a limited way. The minimum sizes to be used are 65 mm for basins, 75 mm for sinks, on their own or with basins, 75 mm for baths and 90 mm for sinks, basins and baths together. It is advisable to use 75 mm seal traps. Special provision may be necessary if a sink waste stack is to be connected to a gully with sealed cover or directly to a heavily loaded drain. Where sinks are connected to a separate stack, the stack should be a minimum 90 mm for buildings over five storeys and connected directly to the drain.

*Base of stack*

The bend at the foot of stack should be of large radius. For a 100 mm stack it should not be less than 150 mm radius to the inside of the bend, corresponding to large radius in BS 1130 and 'long' in BS 65.

When practicable, two 135° large-radius bends should be used, and, in addition, the lowest branch con-

nection to combined soil and waste stacks should not be less than 914 mm above the invert of the drain.

#### *Access*

Access plates should be installed above flood level or 400 mm above floor level at the base of the stack.

#### *Relief vent for tall stack*

Soil and waste stacks more than ten storeys high should be provided with a relief vent at every tenth floor downwards from the top floor. This relief should be the same size as the vent stack to which it connects. Connection to the soil stack should be made below the lowest branch serving this floor and the upper end should join the vent stack not less than 914 mm above floor level.

#### *Offsets below the topmost connection*

The design of offsets in large buildings has been given a good deal of attention, and in a booklet interpreting the US code, emphasis is laid on the fact that the critical points in a tall stack are at the base where an offset occurs. Ample relief vents should be provided at these points. The US code gives the following instruction of sizing offsets and their relief vents:

##### *Offsets of 45° or less*

An offset with a change of direction of 45° or less from the vertical may be sized as a straight vertical stack. When a horizontal branch connects within 60 cm above or below the offset, a relief vent should be installed.

##### *Offsets of more than 45°*

A stack with an offset of more than 45° should be sized as follows. The portion of the stack above the offset should be sized as for normal stack based on the total number of fixture units above the offset.

The offset should be sized as for a drain. The portion of the stack below the offset should be sized as for the offset, or for the total number of fixture units on the entire stack. Whichever gives the larger diameter, a relief vent should be installed, and in no case should branch pipes be connected to the stack within 600 mm above or below the offset.

#### *Venting of offsets*

Stacks with offsets may be vented:

- (a) As two separate stacks, one above and one below the offset
- (b) By installing a relief vent as a vertical continuation of the lower section of the stack, or as a side vent just below the offset and above the next lower branch connections. This upper section of the offset should be provided with a yoke vent. The diameter of the vent should be not less than the diameter of the main vent or of the soil and waste stack, whichever is the smaller.

#### *Hydraulics of stacks*

Laboratory study has shown that the pressure of suction developing at any point in vertical pipes is affected by a variety of factors. These include the height and diameter of the stack, the elevation and diameter of branches, the dimensions of bends and junctions,

bases of flow and also the capacity of the underground drainage.

#### *Flow down vertical pipe*

It has often been thought that discharges pass down the stack as a solid plug of water, but this is not usually the case. Most of the water flows down as an annular sheet round the inside wall, the remainder of the stack being occupied by a core of air drawn down by the discharge, the air entering the stack through the top of stack vent.

Solids and paper with some water fall down the centre of the pipe occupied by the air. At the bottom of the stack the water falls to the outside of the bend and then flows along the invert of the drain with the air moving along above the water. The air and water discharge together into the main drain or sewer and the air exhausts through the stacks adjacent to the one discharging.

#### *Velocities in high stacks*

Many designers are concerned that the flow in high waste and soil stacks may reach excessive velocities with consequent damage to the pipework and unsealing traps. In some buildings stacks have been offset every five floors to prevent an uninterrupted drop. In fact, the forces of gravity and friction soon balance when the flow takes place. Offsets should be avoided, whether or not separate vents are provided, since they encourage pressure fluctuations and add to the expense of the installation and to the risk of blockages.

#### *Backpressure and detergent foam*

A sharp bend at the base of the stack can cause backpressure to affect the seals of the longest branch connection. It can also cause buildup of detergent foam. These difficulties can best be avoided by ensuring that this bend is of large radius.

#### *Venting and induced siphonage*

Induced siphonage can be prevented by providing a crossvent connection between the soil and vent stacks, either at every floor or at alternative floors. To prevent crossflow, the vent connection should slope upwards from the drainage stack at an angle not less than 45° to the horizontal.

#### *Wind effects*

Suction caused by wind blowing across the tops of stacks on tall buildings has been known to result in loss of water from seals. Normal trap venting is no remedy but a protective cowl at the top of the stack is of some help. Suction is greatest nearer the corners of roofs and the edges of parapets and, if possible, the top of stacks should be sited away from these positions.

### **Lavatory basins—75mm seal trap**

#### *Long branches*

For lengths greater than 1675 mm the slopes required are hardly suitable for practical purposes and vent pipes or resealing traps are necessary. If a vent pipe is used, it should be fixed between 75 mm and 300 mm from the trap.

*Allowable length of 1675 mm*

For waste branches under 1675 mm using a 75 mm seal P-trap a fall of 35 mm from the trap to the stack will ensure a satisfactory operation for any length of waste branch.

*Increased wastepipe diameter*

As an alternative to venting the trap when the waste pipe is longer than 1675 mm, it is sometimes possible to use a waste larger than 32 mm diameter, set at a gradual slope using large radius bends. This is not economical for normal practice.

*Inlet into stack*

Waste branches may be connected to the stack either by means of the trap spigot and socket junction, or by a screwed or compression-type fitting incorporated in the wall of the stack. With either method the last few centimetres of the waste pipe remains straight, a feature which is important in limiting self siphonage. Branch discharge pipes should have a uniform shallow fall and the inlet to the stack should, if swept, have a sweep of not more than 25 mm radius. Any bends on plan should be of large radius.

*Bath and basin waste combined*

Both self-siphonage and induced siphonage may occur when the combined waste is installed without air inlet: it is necessary to include at least one vent-pipe installation. To prevent water from the basin flowing into the bath, the following additional precautions should be taken.

- (a) The bath and basin waste should join at an angle of 45° on plan and the length of waste between the bath trap and tee should be given a definite fall, using preferably a bath trap with 5° rake of outlet. The length of waste between the tee and stack should, if possible, be straight. If a horizontal bend is necessary into the stack it should be of large radius. In bending 40 mm copper pipe the radius is approximately 150 mm and the whole length of waste from basin to stack should have a continuous fall of 2.5°.

*1065 mm waste*

With 1065 mm waste it is sufficient to ensure that the difference in level between the outlet and stack connection does not exceed 50 mm, which may be given as a working rule for the fixer.

*Union connection*

It is an advantage to provide traps with union connections at each end to permit removal for rodding.

*Character of flow and basin overflow*

The basin waste pipe normally flows full, with the waste carrying some air in the form of bubbles. Most of the air present has been sucked into the discharge through the basin overflow, a little air being entrained by the vortex. Blocking the overflow eliminates the air, except for the small volume sucked down the vortex. To eliminate hydraulic jump, avoid sharp bends.

With lavatory basins, the amount of refill (water trickling into the trap through the appliance itself and refilling the seal) is small and the possibility of suction is increased.

*S trap*

With an S trap fitted to a basin there can be refill neither from the appliance, nor from the waste pipe. Hence the final seal loss is usually greater than with a P trap. S traps produce severe self-siphonage conditions and venting is needed.

*Length/slope of waste pipe*

The length and slope of waste branches play an important part in the problem of self siphonage. Laboratory work has shown that the plug causing siphonage travels further from the trap the longer the pipe and the steeper its slope, and this usually increases the suction effect and reduces the amount of water reaching the trap in the release movement. To retain a proper seal it is necessary to limit the length of branch and it is sometimes necessary also to restrict the slope of waste-pipe branches.

*Self siphonage*

With P traps, the maximum fall of waste pipe should be determined from the graph in CP304 according to the length of the waste. Any bends on plan should be not less than 75 mm radius to the centre line. Waste pipes longer than the recommended maximum length should be vented (see resealing traps). As an alternative, 38 mm-diameter waste pipes to a maximum length of 3m could be used.

The introduction of water from basins into traps and wastepipes at a sharp angle results in fullbore flow at reduced velocity and the system operates as a siphon.

*Grouping of branches*

If large pressure fluctuations are to be avoided, the groupings of branches must be controlled.

*Unvented branches*

Laboratory tests have shown that four lavatory basins with P traps may be discharged into a common 50 mm waste without vents.

*Minimum gradient*

The minimum gradient for basin branches is 1:48.

*Vented branches*

The complicated pipework is unsightly and expensive. Trap venting should therefore be avoided whenever possible. All bends, branches and offsets should be radiused in such a way that there is no restriction to the bore of the pipe.

*Vent requirements*

Generally vents are required because of vertical drops and excessive horizontal run and because of the configuration of fittings. Unvented vertical drops almost inevitably lead to destruction of the seal trap by self-siphonage.

*Resealing traps*

The biggest offending appliance in a hospital on water-seal retention is the wash basin. It is often isolated from other fittings, making it difficult to drain without special precautions for retaining water seal. Where possible, single-stack principles of design should be used and normal P traps fitted. As it is often impossible

to vent or conform to single-stack principles a re-sealing trap should be used (maximum length 6 m). This resealing trap should receive regular maintenance. The trap should not be used for exceptionally foul or greasy discharge, as the topping up process is non-existent. The use of properly maintained resealing traps on basins reduces the venting requirements.

#### *Running and spray traps*

Full bore is unlikely if washing is done under a running tap. Spray taps do not normally run full even when the branch is only 30 mm in diameter. Tests show that up to eight basins may be connected to this size of pipe without venting. Spray taps are likely to become blocked by sedimentation and need regular cleaning.

#### *Running traps*

Where basin ranges are considered, a running trap is sometimes accepted and there is no venting problem.

#### *Branch pipes to lavatory basins*

For lavatory basins, the risk of self siphonage is more closely dependent on the design of the branch connection to the stack than for other appliances. Research has shown that the bore, length and fall of the waste pipe are all important factors. Basin branches of 30 mm diameter normally run full and so cause suction on the trap at the end of the discharge. One remedy is to limit the length and slope.

#### *Long branches*

When a basin is more than 1.68 m from the stack a 30 mm diameter trap with a short 30 mm diameter tail pipe can be arranged to discharge into 40 mm or 50 mm wastepipes. This method prevents the wastepipe from running full and, therefore, reduces the suction on the trap. Any bends in the wastepipe should be of large radius.

#### *Extra-long branches*

Very long basin wastes may become blocked by sediment from the wastewater and may be noisy when running full. A range of lavatory basins may discharge into an open channel without individual traps, provided the channel discharges at its outlet into a suitable trap. Similarly a range of basins may discharge into a common waste (not exceeding 4570 mm in length) without individual traps, provided that the waste is trapped at its outlet and has suitable means of access for cleaning.

### **Sinks**

#### *Branch inlet to stack*

Waste branches may be connected to the stack either by means of the traditional spigot and socket junction, or by a screwed or compression type fitting incorporated in the wall of the stack. With either method the last few centimetres of the wastepipe remains straight, a feature which is important in limiting self siphonage.

#### *Resealing traps*

The trap should not be used for exceptionally foul or greasy discharge as the topping-up process is non-existent.

#### *Self siphonage*

P traps should be used. Owing to the flat bottom of a sink the trailing discharge normally refills the trap and the risk of self siphonage is much reduced. Falls should be not greater than 5° for lengths of up to 685 mm, for longer lengths up to a maximum of 2285 mm the fall should be not greater than 2.5°. Where the length of slope is greater than 2285 mm the branch should be vented or a larger diameter discharge pipe could be used, with a maximum length of about 3000 mm.

#### *Minimum gradients for long wastepipes and access*

With minimum gradients for sink branches of 1:48 a self-siphonage problem is unlikely. The length and slope of waste branch not critical, but sediment may accumulate in a long wastepipe and access for cleaning should be provided.

#### *'S' traps*

Where sinks are installed with an S trap, each trap should have a vent connection. With an S trap fitted to a small sink there can be refill neither from the appliance, nor from the waste pipe. Hence the final seal loss is usually greater than with a P trap.

### **Baths**

#### *Branches and self siphonage*

Bath wastes may exceed 2 m but this figure can be taken as a reasonable maximum for normal installation with slopes between 1.25° and 5°. Outside these limits an individual vent is usually necessary to prevent self siphonage.

#### *Two bath wastes combined and branch inlet to stack*

The main problem is that, on discharge, water from one bath may flow into the other. The wastepipe should join as far from the trap as possible and have a good fall of 2.5–5°. With internal stacks the problem of combining bath and w.c. connections is complicated by the fact that the centre line of w.c. branches at a normal slope of 104° intersects the stack several inches above floor, and the bath waste reaches the stack below this level. Unless it is fixed almost horizontally this poses a problem because if the bath base is sited 5 or 10 centimetres below the w.c. branch there is danger of solids and paper from the w.c. crossing the stack and entering the bath waste. It is good practice to have the bath connection level with, or above, the central line of w.c. branch, or well below it as provided by the separate parallel junction. Alternatively, the w.c. branch connection may be modified by the use of an S-trap w.c. pan.

#### *Self siphonage*

P or S traps may be used. Owing to the flat bottom of a bath the trailing discharge normally refills the trap and the risk of self siphonage is much reduced. Wastepipes 2285 mm long at a fall of 1.25–5° have been used successfully. The position of entry of bath waste into the stack is important. With baths, self siphonage is important only with the very long wastes, say 6 m, when the plug movement and hence the suction may continue long enough for a large proportion of the water entering the trap from the appliance to be siphoned out.

### *Vents*

Generally, vents are required for bath wastes because of vertical drop. An unvented drop to the drain below the floor would almost inevitably lead to destruction of the trap seal by self siphonage.

### *Long branches*

Sediment may accumulate in long branches and access for cleaning should be provided.

## **Urinals**

### *Range of urinals*

On flow considerations alone, venting is normally necessary for a branch pipe to a range of urinal stalls. Information is lacking on the way in which venting may affect the build up of deposits in urinal branches. As with wastes for spray-tap installations, regular cleaning of urinal branches may be necessary, especially in hard water areas where scaling may be severe.

### *Eliminating vents*

To eliminate the need for individual vent pipes for urinals, a range of appliances may be discharged through a common running trap. This trap may need to be vented, but a single vent trap will be both nearer and cheaper than a range of individually vented traps, particularly if it can be located near the stack. Alternatively, a range of appliances may be discharged into an open floor channel connected to the stack via a trap (which may need to be vented).

### *Urinals to drain*

Urinals can be directly connected to the drain if the drain is properly vented. (An unvented branch should not exceed 6 m in length.)

### *Urinals to gully*

Waste appliances, bowl urinals and bidets present a different problem, as the small-diameter outgoing pipe often operates a full bore, and an unvented drop from the appliance to drain below the floor would almost inevitably lead to destruction of the trap seal by self siphonage. This type of appliance must discharge to a gully above water level, or to a vented stack.

## **Water closets**

### *W.C. branches*

There is no danger of self siphonage with the w.c. in any normal position in relation to the soil stack. With P-trap w.c.s branches up to 6 m long have been used successfully without vents. Branches from S-trap w.c.s contained within the floor are normally quite short. Self siphonage does not normally occur under these conditions. The BS angle of 104° intersects the centre line of the stack at between 75 mm and 125 mm above the floor. In some cases the w.c. branch is vented, but this has nothing to do with self siphonage.

### *Induced siphonage*

In the largest buildings a vent is necessary at each floor to limit induced siphonage, and it happens to be convenient to connect it to the w.c. branch. Possible

trouble to be guarded against is the induced siphonage lower in the stack when the w.c. is discharged.

### *Branch inlet to stack*

W.C. branches should be curved into the stack in the direction of flow, but this is to limit induced siphonage and has nothing to do with self siphonage.

Where w.c. branch inlets do not have a sweep in the direction of flow, a supplementary ventilating pipe may be required.

### *Access*

With a w.c., access into the branch and into the stack opposite the branch is necessary.

### *Gradient*

Gradients of w.c. branches are approximately 1:35. The washdown type of pan gives very little trouble, although the performance of this unit would be improved by using a high-level cistern. The syphonic type of pan generally is of double-trap type, and a big disadvantage is that the materials can be retained in the second trap which are not visible from the bowl and, therefore the next discharge tends to build up into a plug when combined with the first, causing a lower velocity owing to a reduction in quantity of water to paper. Dual-flush cisterns are not recommended.

### *Ranges of w.c.s*

Branch pipes serving ranges of w.c.s are normally 100 mm in diameter and do not run full. Hence, there is usually no need for branch venting. These have been checked in the laboratory for up to eight w.c.s in range with a straight branch at an angle of 2.5°. It is unlikely that this number of w.c.s could be exceeded (in practice, four w.c.s on a branch of unvented maximum length 6 m. 5 w.c.s on a branch of maximum length 6 m vented at one end).

Field studies have shown that the angle is not critical. Where there are bends in the pipe it may be necessary to fit a vent to the appliance furthest from the stack. From a general performance standpoint, it is an advantage for w.c. connections to the common branch to be swept in the direction of flow (BS416 fitting).

### *Branch pipe to w.c.*

Water-closet branches do not run full and so there is no risk of self siphonage whatever their length. However, the shape of the w.c. branch connection to the stack is important because it influences the amount of induced siphonage actions upon branches to other appliances lower in the stack. If straight-inlet w.c. branches are used, more venting or a larger diameter stack may be necessary. With straight inlet branches, a 100 mm stack with no vents has been found satisfactory up to four storeys, and a 150 mm stack with no vents has been found satisfactory up to 15 storeys.

### *Suction*

The appliance producing by far the greatest suction is the w.c. The effect of the remaining appliances is normally small.

### *Cistern overflows*

Overflows should not be less than 20 mm in diameter.

The overflow must discharge at a point where it creates a deliberate nuisance so that the waste of water cannot continue unheeded.

Prior to installation of the cistern overflow the requirements of the local waterboard should be sought.

### Laboratory plumbing

#### Hazardous areas

Contaminated waste from the hazardous areas should be separately conveyed to the external drainage system.

#### Laboratories on upper floors

Where laboratories are located on an upper floor the waste should be conveyed separately to the soil stack.

#### Corrosive waste

It is recommended that borosilicate glass be used for the conveyance of wastes of corrosive nature.

#### Dilution of waste

Dilution of laboratory wastes may be achieved in a variety of ways: by individual catch pots beneath each appliance, by similar fitting serving a group of appliances, or by dilution chambers constructed below ground level as part of the drainage system. The greater dilution obtained, the better, so as to minimise any damage to final drains.

#### Access

It is not good practice to bury pipes in a structure without providing means of access. For concealment of pipes, ducts and chases with access covers should be used.

#### Traps

It is preferable to avoid the use of traps in the waste pipes to obtain maximum corrosion resistance, since some substances, such as mercury, can be particularly corrosive when they are retained in a trap. One commonly used arrangement for laboratory plumbing is for a sink waste (without trap) to be connected to a main waste which discharges into fireclay receiver (catch pot). The laboratory waste system is then connected to the drain with a sealed back inlet gully. (A gully with more than one waste connection should be vented.)

#### Floor gullies

The use of floor gullies in the laboratories should be avoided.

#### Connection into main stack

Where vertical distribution of services is adopted as a basic principle of laboratory design, it is also preferable for individual wastes, even within one laboratory, to be connected direct into the main stack to improve dilution.

## Capital Allocations

Mrs. Castle, Secretary of State for Social Services, has announced the capital and revenue allocations for the financial year 1976/77. In reply to a question in the Commons, Mrs. Castle said that the allocations are based on the White Paper on Public Expenditure to

1979/80 and on the recommendations of the Resource Allocation Working Party.

Table 1 below shows the allocations by Regions and Table 2 shows the growth rate allocated to each region.

Table 1 Cash figures

Regional health authority	Capital*	Revenue*
	£m	£m (to nearest million)
Northern	17.6	214
Yorkshire	18.5	248
Trent	25.0	281
East Anglia	10.6	119
North-West Thames	14.5	300
North-East Thames	15.2	328
South-East Thames	18.5	308
South-West Thames	18.7	243
Wessex	16.1	174
Oxford	12.2	146
South-Western	16.8	214
West Midlands	20.2	339
Mersey	16.5	189
North Western	22.0	292

\*The capital figure is the main programme allocation at projected out-turn prices. For revenue, cash limit figures are introduced for the first time this year and are on a different basis from the figures for previous years. They represent actual limits on spending and have been calculated to take account of known and projected cost inflation up to the end of the financial year 1976/77. This means that this year's figures are not comparable with allocations for previous years.

Table 2 Percentage progress towards target

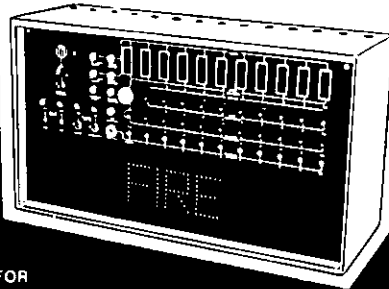
Region	End 75/6 1976/77			Growth rate as % of (2)
	At end 1975/6	Plus RCCS for 76/77	1976/77 with 4% ceiling	
	(1)	(2)	(3)	(4)
Wessex	87.34	87.92	91.44	4.00
Trent	88.46	90.26	93.87	4.00
E. Anglia	89.85	91.52	95.18	4.00
Yorkshire	92.84	93.52	96.75	3.45
S. Western	92.85	93.46	96.75	3.52
N. Western	93.18	93.43	96.75	3.56
W. Midlands	93.49	94.85	96.75	2.00
Oxford	94.24	96.34	96.75	0.39
Northern	95.56	96.60	96.75	0.16
S.W. Thames	103.23	103.57	103.57	0
S.E. Thames	104.12	106.08	106.08	0
Mersey	104.86	105.13	105.13	0
N.W. Thames	107.85	108.96	108.96	0
N.E. Thames	110.02	111.05	111.05	0

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**2.11.1 General** Any control and indicating equipment should comply with the requirements of BS 3116 Part 4 \*



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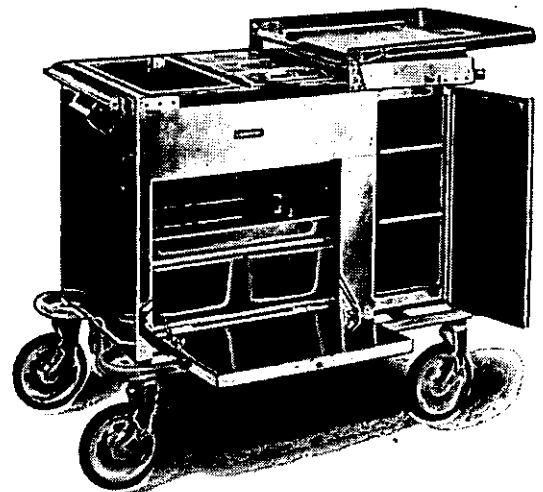
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