This brochure celebrating the 75th Anniversary of the founding of the HVCA was published in 1979.
Three pioneers of the heating industry

Charles Sylvester
1774-1828

George Hadwen
1788-1856

David Nesbit
1855-1929

founded the association in 1904

Presidents
1904/05 D. M. Nesbit, Ashwells & Nesbit, London
1911/12 C. G. Hadwen, G. N. Hadwen, Trowbridge
1912/13 J. G. Walker, Henry Walker, Newcastle
1914/15 Chees, R. Horndale, C. R. Horndale, Liverpool
1915/16 Ernest Griffiths, Ernest Griffiths, Liverpool
1918/19 Frank Legg, Brighton, Sheffield
1918/19 W. Nelson Hadwen, G. N. Hadwen, London
1920/21 Stanley J. Benham, Benham & Sons, London
1922/23 Ernest S. Deed, Deed & Bell, London
1925/27 P. M. B. Grenville, J. Jeffreys, London
1927/29 James Elliott, Elliott, Ebb, Manchester
1929/30 F. A. Norris, Norris, Warings, London
1932/33 R. C. Ching, Ching, Ching, London
1934/35 Henry Walker, Henry Walker, Newcombe upon Tyne
1939/41 Walter Charles, Ashwells & Nesbit, Leicester
1941/42 C. W. Johnson, C. W. Johnson, London
1942/43 J. Eric Street, S. E. Engineering, Sunderland
1943/44 W. L. Swain, Young, Aukin & Young, London
1944/45 A. Anthony Scull, Arthur Scull, Bristol
1945/46 D. P. How, Brighton, Birmingham
1946/47 J. W. Boyd, James, Boyd & Sons, Paisley
1949/50 W. E. Otter, J. S. Wright, Birmingham
1950/51 Colin S. R. Benham, Benham & Sons, London
1951/52 J. M. Parkinson, Parkinson, London
1952/53 J. N. Saunders, Saunders & Taylor, Manchester
1954/55 G. W. Mackenzie, Mackenzie & Moncur, Edinburgh
1956/57 William R. Mee, Mee & Son, London
1958/59 J. H. Richardson, J. H. Richardson, London
1959/60 W. S. Richards, Brightside, Sheffield
1962/63 W. D. Cook, Godber & Godber, London
1963/64 F. R. Collins, J. S. Wright, Birmingham
1964/65 Brian Hinch, Atkinson, Warings, London
1967/68 Sir Alan Pullinger, G. N. Hadwen, London
1968/69 W. H. Evans, F. Evans & Sons, Birmingham
1970/71 M. H. A. Axtell, Young, Aukin & Young, Manchester
1971/72 Geoffrey Stringer, G. S. Stringer, Huddersfield
1973/74 H. Norman Ludlow, Thomas A. B. J. Birmingham
1974/75 E. Neumann, Andrew Weatherell, Slough
1975/76 Peter How, How Group, Coventry
1976/77 Derek Kyri, Hadwen, London
1979/80 N. S. Pettitt, Marriott & Jackson Norris, Bristol
1979/80 S. Wright, Barrie & Wright, London
1979/80 S. Wright, Barrie & Wright, London
1979/80 S. Wright, Barrie & Wright, London
1979/80 S. Wright, Barrie & Wright, London
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The Heating and Ventilating Contractors' Association was founded in 1904. Some 85 years earlier one of the industry's pioneers, Charles Sylvester, in his treatise "The Philosophy of Domestic Economy as Exemplified in the Mode of Warming, Ventilating, Washing, Drying, and Cooking" was proclaiming that science should direct its resources to increasing domestic comfort and happiness.

But it was not to the home that the early arts of heating and ventilating were applied. Rather it was to an incongruous admixture of buildings ranging from prisons, poor law institutions and lunatic asylums, to museums, schools and churches.

Only in the past thirty years has the real potential of the industry begun to blossom. And today the compelling need for energy conservation adds a new dimension to its multifarious and often intriguing role.

This booklet traces the story of the development and diversification of the industry and the part played by its Association over the past 75 years.

Alfred Manly, President
1 July 1979

HEATING AND VENTILATING CONTRACTORS' ASSOCIATION
Meeting of the Council with Past Presidents. April 1979

Memorandum the 3rd day of Feb'y 1869
between John Lee Bonham of 25 Wigmore
Street Cavendish Square Stowe Square
Manufacturer of the one part and William
Williams of York Square Regents Park Esquire
MF one of the Wardens of the Committee of the
Reform Club of the other part

The said John Lee Bonham agreed with the
said William Williams to erect a stove in the
Smoking Room of the Reform Club House
similar to that represented in the attached plan
for the sum of thirty five pounds and the present
stove which is to be removed.

And the further agreed that in case the stove to
be erected under this agreement shall be found to
smoke and that smoke be approved of
by the Committee for the time being of the
Reform Club within three calendar months from the
time it shall have been completed, i.e., this
said John Lee Bonham agree to replace the
present stove in its present condition at his own
expense and bring it to the said William
Williams the said sum of thirty five pounds or any
part of the sum previously paid to him under
this agreement.

J. L. Bonham
Witness D. J. Simpson
W. Williams

William Williams

WHEN CENTRAL HEATING WAS A
(RARE) LUXURY
It is as well to start at the beginning. And the conventional beginning is always the warm baths and floor heating of the Romans.

But the industry of to-day was conceived in the early 1700's and was fostered by the boilers and steam of the industrial revolution. The early pioneers were men of inventive mind and enterprise. Essentially they were engineers and iron founders who branched out as 'heating apparatus manufacturers'.

The key to initial success was the development of a good patented warm air heating stove. Travelling on horseback or by stage coach, the principals of the early firms of heating engineers marketed their products all over the country, quoting minimized competitive prices for the design and installation of their systems.

In retrospect it may seem ironic that religion, learning, poverty, misfortune and crime should lie behind the stock of public buildings that awaited the attentions of the heating engineer. He applied himself to the earnest task of heating churches, schools, museums, poor law institutions, lunatic asylums and prisons.

Literally thousands of churches were heated and many of the original warm air systems operate to the present day. Heating standards were low and inside temperatures of 52°-57°F (11°-14°C) were regarded as luxury.

It is a reflection on Victorian times that when coal fired heated water began to replace steam heated air as the heating medium, one heating engineer demonstrated that hot water could be pumped round a prison by the prisoners and he designed and supplied a hand crank and treadle mill for the purpose.

There was no central heating in the home. The British stuck obstinately to their inefficient open fires. Cheap coal burned in the grate, smogging the atmosphere from myriad chimneys. Stately homes were the exception. Indeed the Royal apartments at Windsor Castle were fitted with a warm air stove installation in 1820.

By this time steam engines were taking over from water power to drive the machinery in the then thriving textile industry. It was a short step to convy the steam to other parts of the mill, not only for space heating, but also to heat the process water and dry the cloth. This must be one of the first examples of the application of the arts of heating to industrial processes. But apart from a minor boom in greenhouse heating, industrial applications (which now account for a sizeable slice of the industry's output) remained rare.

Shipwork was another 'late developer'. But a heating engineer's scientifically planned system of heating, cooking and ventilation made a notable contribution to the discovery of the North West Passage in 1819 by helping the crew to live healthily in Arctic waters for two years.

In many respects progress was slow. It was not until 1910 that a British hotel could boast of being the first in the world to have private bathrooms with central heating in every room.

Moreover, the scientific principles of heating took time to develop. There was no formalised training and few textbooks. Apprentices learned their trade from their masters. Standards depended upon the empirical understanding and initiative of the individual engineer. Some were very good but others were very bad. Poor design produced ineffective systems and stoves were known to explode with catastrophic effect.

One important trend began to emerge in the 19th century, namely the separation of manufacture from installation. The early heating engineers frequently used local labour to install their equipment and later started to sub-contract the work. Then some firms began to reorganise manufacture to specialise in contracting. There thus emerged the specialist heating and ventilating contractor offering a design and erection service to the client and purchasing his equipment from manufacturers.

Later as we shall see, a further separation took place when specialist designers established themselves although to-day about half of the industry's work is still contractor-designed.

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1. This private cast iron radiator was typical of those used for low pressure steam at the turn of the 19th century.
2. Sir A. M. Perkins of London patented his high pressure hot water heating system in 1831. Today's systems for domestic heating are designed on the same principle.
3. St. Pancras Station and Hotel (seen in the distance) were completed in the 1860s at a cost of £1 million and £300,000 respectively. The ornate nature of the heating and ventilation (steam air) can be judged by the successful traders of £140,000 and £80,000 respectively.
DIVERSIFICATION AND GROWTH
The increase in the membership of the HVCA and in the industry's professional body (the Chartered Institution of Building Services) provides a simplistic yardstick of the expansion of the industry. The actual story of its diversification and growth is much more fascinating. It is an amalgam of advancing technology, rising living standards and changing and growing demands from buildings, building owners and industrial and commercial processes.

Fundamental to all developments has been the perfection of methods of creating and holding internal environments to fine limits of temperature, humidity and purity. Whereas central heating was a rare (and often cruel) luxury in 19th century buildings, environmental control is a vital necessity in many 20th century buildings.

It was perhaps significant that the world's first scientifically designed air conditioning system was installed in a printing works in Brooklyn, New York, in 1922. Today, there are many industrial processes and much industrial equipment for which strict environmental control is essential.

Examples range from pharmaceutical manufacture and assembly of electronic equipment to computer installations, microtechnology and sophisticated telephone exchanges. The frozen food industry relies uniquely on refrigeration for its success. Materials like paper, textile fibres and tobacco are hygroscopic, adjusting their moisture content to the relative humidity of the surrounding air and their manufacture demands humidity control. High-speed printing machinery will not print or register properly unless the paper is in controlled room conditions.

In operating theatres air conditioning provides the clinical conditions that reduce the risk of cross-infection. Indeed, the whole complex of engineering services which support a modern hospital can account for half the building cost compared with less than a fifth in the 1920s.

Of course, human comfort is still the mainspring of much of the demand for the industry's services. But comfort is by no means the sole consideration. There is ample proof that productivity, health and temperament all improve with good environmental conditions. It is indeed surprising that the House of Commons, at times that most Intemperate debating chamber, was not fully air conditioned "to encourage" the reverse of hot heads and cool feet until it was rebuilt in 1950.

Even in Britain's reasonably temperate climate, buildings with a high occupancy rate such as department stores, assembly halls
and theatres need air conditioning or at least mechanical ventilation. In the 19th century, inadequate natural ventilation systems were compounded by the gas lighting, each jet 'exhaling' as much carbon dioxide as ten or more people. Going to the theatre was more of an ordeal than a pleasure when the house was full.

Just as television (with its air conditioned studios) has dominated the entertainment industry after the second world war, so the motion picture industry was in the position of dominance after the first world war. Cinemas had to have extract ventilation (signified by a 'fan working' sign) but the money invested in artistic interiors could have been better applied to environmental control. Later standards did improve and the super-cinemas were air conditioned. The market was, however, speculative and bankruptcies among cinema proprietors confirmed the industry's opposition to 'pay when paid' clauses under which the building contractor undertakes to pay the subcontractor and the client.

Defence works and munition factory building for two world wars had their impact on the industry. In the 1914-18 war one heating contractor was designing and commissioning shell filling machines. In the Second World War the industry converted oil fired furnaces to burn creosote pitch and improved the ventilation of many a passenger and merchant vessel to make it suitable for use as a troop ship.

Vulnerability to air attack gave a significant impetus to air conditioning. Strategic operations rooms and defence works were housed underground and air conditioning or forced ventilation was imperative.

Much of the building programme since 1945 has been concentrated on projects containing a large element of engineering services such as hospitals, laboratories, universities, hotels, shopping centres, places of entertainment and high rise buildings of various kinds.

An important stimulus came in the 1960s with the boom in domestic work. With central heating then in less than 5 per cent of homes the vast potential of this market had long been recognised. The industry had failed to tap it because it could not gather together the necessary marketing resources. The competing fuel interests, anxious to off-load their surplus capacities, could, and did. Unfortunately, they generated the market beyond the capacity of competent installers. Cowboy firms sprang up lacking both experience and financial integrity. The position has now greatly improved and the Association played a prominent part in raising standards.

Legislation passed in the 1960s laying down minimum standards of heating to be provided in offices, shops and factories provided yet a further stimulus. In contrast to the 52°F-57°F (11-14°C) once regarded as luxury a minimum of 60°F (16°C) was made the requirement after the first hour for work not requiring serious physical effort. In practice higher temperatures are usually provided and in the home acceptable standards are higher still. When relating, people have come to expect around 70°F (21°C) although the tendency is to notch the thermostat a few degrees lower since the rapid rise in fuel prices in the 1970s.
1 Improved ventilation can be provided unobtrusively. In the case of a new control structure, the ceiling can be left as it is.

2 Domestic control heating has been extended on the outside of the building.

3 Swimming pools are now heated to significantly higher standards. The new system provides ventilation, humidity control, water treatment and filtration.

4 Receiving cool returns: Evaporative cooling units immediately lower the temperature of air brought in through the adjustable slides.

5 Modern airports make heavy demands upon the industry's skills.

6-9 Designing theatres and launchers demands careful planning.
SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT
The relative simplicity of many engineering objectives is usually in sharp contrast with the complexities of the engineering itself. Few concepts are more basic than those of the generation, transfer, and distribution of heat. It has been in the ways of realizing these concepts, refining them, and adding to them, that the scientific and technological advancements have been made.

As we have seen, the early warm air systems were quickly followed by steam systems, James Watt installed one in 1784. Even when coal was a few shillings a ton, it made economic sense to utilise the heat in the exhaust steam from machine-driven engines. Indeed, steam was to retain its popularity as a means of heating industrial buildings until the 1940s.

By the early 19th century all three main transfer media—air, steam, and water—were well established. Nor was it long before a high-pressure system utilising a closed circuit (known as the Perkins system) offered higher operating temperatures than conventional low pressure hot water. But both systems relied on gravity with its endemic idiosyncrasies for circulation.

Circulation problems urgently applied the mind of the heating engineer. In steam systems, practical experience dictated that the water line of the boiler should be at least four feet below the lowest heating surface in order to return the condensate water; later this was aided by the vacuum ingeniously induced into the steam pipe to reduce the operating temperature.

Equipment was both bulky and crude. Pipe stacks provided the heating surface for hot water systems. The joints in the cast iron mains were sometimes a fruitful source of leakage while the wrought iron welded boilers were relatively inefficient.

Heating practice was empirical rather than scientific. Heat requirements were calculated by the engineer applying his discretion and experience to schedules listing the average footage of 4 inch pipe required for each thousand cubic feet of air space in different buildings.

The Perkins system was designed to use a loop of small diameter pipe, fitted to 3000 lbs per sq in, and cooled to form the heating surfaces and the boiler element. In the more commonly used low pressure hot water system, pipe sizing took little account of the distance from the heat source and prudence often led to over-sizing of the already large diameter pipes to ensure circulation. Today system design and calculation is a highly sophisticated operation in which computer programmes are often used.

A major landmark in the development of the scientific approach was the formation in 1897 of the...
Institution of Heating and Ventilating Engineers (now the Chartered Institute of Building Services). Engineers from all sides of the industry have participated in the Institution's work and its Guide is the industry's standard work of reference.

Advances proceeded apace in the present century. The general availability of electric power provided the means of 'forcing' the circulation of air or water by fan or pump. It also stimulated development in automatic controls. These not only regulate internal temperatures by the time of the day but by sensing external temperatures can anticipate internal environmental requirements and transfer unwanted heat from the sunny sides of a building to the cooler shady side.

Innovation by contractors has continued from the earliest times. A significant development adapted throughout the world was the use of low temperature radiation from heating elements embedded in the ceilings, floors or walls. This system necessitated welded pipework and from it grew many forms of medium and high temperature radiant heating.

A variety of factors have influenced the choice and development of new systems and techniques. For example, the heavily constructed buildings that dominated the architectural scene for the first half of the 20th century have slow thermal response and lent themselves to continuous hot water heating, often by radiant floor or ceiling panels.

Lighter, high rise buildings produce natural ventilation and their quick thermal response is best served by air-conditioning designed where necessary for intermittent operation.

The high premium on building space...
fostered the development of forced circulation through small pipes and finned tube convectors to provide a concentrated source of heat which can be accelerated by fan assistance.

Pipe joints are often welded rather than screwed and prefabrication under factory controlled conditions is practised on an ever-widening scale. Ductwork, once a heavy craft operation is now manufactured from light gauge material using a production line basis.

Hand in hand with improvements in design and erection techniques have come an ever-widening range of equipment from the manufacturing side of the industry. A relatively modest heating system can require the assembly of 1000 separate components and as many as 50,000 in a complex multi-purpose installation. Needless to say, changes in the relative price and availability of fuels have had significant impact upon the industry. In the 1930s oil began a supplant coal and coal manufactured gas as the preferred fuel. Today, natural gas is the market leader, following the fivefold increase in the price of oil and concern about its longer term availability, notwithstanding the discoveries in the North Sea. But all these major fuels hold rightful, if changing, places in the task of heating the nation's buildings. Electricity is confined mainly to home heating where its convenience can outweigh its cost.

The demand for energy conservation makes organised research even more vital for future progress. With foresight the industry in 1955 established its own research body — now the Building Services Research and Information Association.

1. Plant formerly accommodated in the basement can now be located on the roof thanks to new technology and pipe fuels.
2. One form of ceiling heating — low temperature water circulated through these copper heating pipes is embedded in the church of St. John's, Hammersmith.
3. A modern coil line duct forming unit.
4. Centrifugal chiller unit: They can extract the heat equivalent of 2200 kilowatts.
5. Testing for leakage from steam and water points in the vicinity of the building by the Building Service Research and Information Association.
6. Low temperature ceiling heating developed by Britain contractors between the wars. The webs of pipes were protected against leakage.
The work of the early heating engineers had two distinguishing features. It was associated with existing buildings and the systems were contractor-designed.

Much of the industry's work has been on these same features today; indeed, escalating fuel prices and the damaging effect on the economy have given new impetus to the rehabilitation and retrofitting of systems in both commercial and industrial premises. Routine repairs and maintenance - badly neglected by some building owners - represents another self-contained market.

For the rest - some 80 per cent of turnover - the industry works as part of the building team. Its role has become not only immensely complicated but also highly sensitive to the critical path along which building operations should proceed but from which they sometimes stray.

There were but four main parties to building operations right up to the 1920s. First, the client. Second, the architect who was also both the designer and the co-ordinator and often ruled the site with a rod of iron. Third, the main contractor who deployed most of the craft skills. Fourth, a few selected specialists like the heating engineer.

The heating engineer usually had a contract direct with the client who both appointed him and paid him. Site co-ordination was not a problem and it was largely for reasons of convenience that clients began, on the basis of guaranteed payment, to nominate the heating engineer (chosen after competition) to the main contractor as a nominated sub-contractor. Things have changed fundamentally in the last sixty years. The public sector is a major client, often a multi-headed client. Public accountability usually requires independence in all aspects of building design. So the architect has joined in the professional team not only by the structural engineer and the quantity surveyor but also by the services engineer. Main contractors cannot deploy the vast range of skills and expertise now required by building operations so sub-contracting has become the rule rather than the exception.

The nomination system, a unique British development, gives the specialist sub-contractor confidence to tender in the knowledge that the competition will be fair - no multiple tendering or Dutch auctioning - and that the contract conditions will be equitable. The system provides a practical means of harnessing the design capabilities of the specialists. It also recognises the complexities of 20th century building by reserving to the client the competitive selection of the specialists while leaving the site co-ordination role in the hands of the main contractor.

Considerable problems are involved in co-ordinating and controlling the many specialists engaged in the construction of a sizable building. Careful and detailed programming is required to ensure an orderly sequence of operations and to prevent disturbance getting beyond the point when costs begin to escalate.

Engineering services are a critical part of the programme. They have to be co-ordinated through the structure and their installation has to be co-ordinated with the work of other trades. Most of the spatial and material issues on building operations arise because one service is in conflict with another or with the basic structure. When engineering services are subject to variations (the American expression "change orders" is more explanatory) it often means back to the drawing board because of design considerations.

Despite the inherent problems, many large and complex building projects proceed without undue delay or hindrance. Others, however, suffer inordinate disturbance and interruption.

At too frequently the nomination system gets paraded as the root cause of delays. It is true that nominated sub-contractors sometimes cause delay as do all members of the building team. But the nomination system, as such, is not the culprit provided it is managed properly. To prove this it is only necessary to point to the many jobs both large and small that go through smoothly without the nomination system.

The root causes of delays are incomplete design and lack of co-ordinating at the tender stage, indecision or changes of mind by the client and poor programming, co-ordination and control during construction.

The real need is to create a building team which works with mutual trust and cooperation with the object of integrating all aspects of design and achieving the vital pre-planning and programming on which good site co-ordination and control can proceed. In such a world of change the central heating industry will be a willing partner.
ROLE OF THE HVCA
Most national employers' organisations were established around the turn of the century and usually they were built upon the already established local associations. As regards timing, the Heating and Ventilating Contractors' Association was no exception because it was founded 75 years ago in 1934. But as regards structure, it was different because it started with just 14 founder members on a national basis and then set about establishing a regional structure, largely by embracing the local associations. Mergers with the associations in Scotland in 1940 and in Northern Ireland in 1974 set the seal on the present Association with over 1,000 members spread among 18 branches, three specialist groups and a National Contractors' Group.

Ancillary to the Association is an organisation in Penrith, Cumbria, which administers the industry's scheme covering payment for annual holidays and welfare benefits. Every employee is entitled to a card to which the employer affixes a weekly stamp, the cost of which provides a credit for annual holidays and a premium for welfare benefits. About one million stamps are sold each year.

In the construction industry the major motives for the formation of national associations were two-fold:
1. to secure a national agreement on wages
2. to secure equitable conditions of contract

In the case of the HVCA, there was a further reason—demarcation problems with plumbers. Happily demarcation problems have not arisen today. But the scope of the rest of the Association's work has extended greatly with the growth and diversification of the industry, the intuitions of Government, the complexities of legislation and the new horizons presented by the Common Market and the potential for exports on a world-wide basis.

The Association's headquarters are located at Baywater, London. In a building shared jointly with a sister association, namely the Electrical Contractors' Association, Scotland has its own full-time Regional Officer through which the other branches are served by part-time secretaries. Thus staff resources are concentrated at headquarters and are deployed as follows:

Executive Staff
4 General service to members
3 Specialist Groups
4 Industrial Relations—Operatives and Staff
5 Commercial and Legal
3 Education and Training: Safety
3 Technical and Productivity

Much of this industry's identifiable record in the field of industrial relations is due to the mutual respect and trust that has been built up between the Union and the Association—the Union being the National Union of Sheet Metal Workers, Coppersmiths, Heating and Domestic Engineers. In 1972 the Association became a signatory to an agreement for environmental engineering staff in the heating, plumbing and electrical contracting industries negotiated with the staff sides of the Engineering, Electronic, Telecommunications and Plumbing Union (EEPTU). This agreement prescribes minimum salaries for various grades of staff and staff members are graded under a jointly agreed job evaluation scheme.

The Association's commercial and legal work has the object of creating a framework within which the industry can operate efficiently, responsibly and profitably. It often involves long and patient negotiations over such matters as tendering procedures, contract conditions or conditions for the supply of materials.

Fundamental to the structure of the Association are the three specialist groups. They allow members operating in specific fields to meet, discuss and act together. The Duct Work Group was founded in 1945 and its specifications for the manufacture and erection of ductwork have been adopted by the Government and by some countries overseas.

The main work of the Home Heating Group, founded in 1964, has been to raise standards by establishing good practices for home heating work. Sales of the Group's specifications exceed 80,000 and its double guarantee system (approved by the Office of Fair Trading) gives the household equitable conditions of trading and the double guarantee that should a member default, the Association will step in and put the matter right. Refrigeration and unit air conditioning are fast developing specialties. The Group founded in 1971 has produced the only UK specification in Britain and is conducting a vigorous education drive to ensure that sufficient mechanics are available for future expansion.
TRAINING THE ENGINEERS AND CRAFTSMEN
The industry is people intensive rather than capital intensive. There is relatively little plant and machinery. In the last analysis what it "sells" is a trained and organised workforce.

Training is the touchstone of the industry. With a smallish but national workforce there were many problems to overcome before the present sophisticated pattern of training was developed.

The very first organised courses of technical training date back to the beginning of the century. They were conducted by the late Professor A.H. Barker at London University, and required a student to attend three days a week for three years to qualify for the University College diploma in heating and ventilating. Only a handful of students took the course each year.

The second seat of learning was designed to become the industry's main centre for technical training. This was the old Borough Polytechnic which began a pilot series of lectures in 1921. Later in 1948 the industry established its own National College in a purpose-designed building adjacent to the Borough Poly and the whole complex is now absorbed into the Polytechnic of the South Bank.

Meanwhile, in 1919 the industry set up its joint body responsible for the promotion and regulation of craft apprenticeship training, namely the Heating, Ventilating and Domestic Engineers National Joint Industrial Council. Craft courses were slowly established in the major conurbations.

A Technical Education Committee was formed in 1923 leading to the organisation of draughtsmen's courses and day release was instituted for both craft and student apprentices.

Today the usual training pattern is block release for craft apprentices and sandwich courses for technical training. Degree courses in environmental engineering are offered at eight universities and polytechnics.

Few industries have such an outstanding record of care and attention to education and training. The NJIC has established a network of 28 regional committees which liaise with their local technical colleges and oversees the training of craft apprentices in their area.

A separate body now deals with technical training, yet a third body organises and provides mid-career training.

Although contract values often run into six or seven figures, system design and erection is still done by small teams. The work provides considerable job satisfaction to those concerned who enjoy working in a friendly industry with good communications between employer and employee. By national standards, local firms in the industry are small with less than 20 employees. The typical provincial contractor employs perhaps 20-50 people. The largest firms may employ 1000 or more spread among several regional offices.

Training courses are available at all levels of ability and in all the specialisations of what is a diverse and demanding industry. They lead to careers which offer absorbing interest and a real challenge to anyone who enjoys working in an engineering industry whose workshops are a building site or an existing building and whose unfailing characteristics is to present new problems and new interests everday. The three main patterns of training are shown in the next two pages. There are other schemes covering, for example, the training of refrigeration and air conditioning mechanics, ductwork fitters and domestic heating fitters.
Craft Apprenticeships

Craft apprenticeships are usually 16-17 year old school leavers although you can be up to 23. You must be physically fit, have good eyesight and an aptitude for working with your hands. Your workplace is going to be a building site or an existing building so you must be prepared to work in outdoor conditions which are sometimes rough and ready, wet and muddy. Personal qualities and aptitudes count most but it is a great advantage to have GCSEs in maths and English language.

Training
Your four-year paid apprenticeship will make you an excellent heating fitter or fitter welder. College training continues throughout but is concentrated in the early years. You spend about 50 per cent of your time at college in the first year, 25 per cent in the second year and 20 per cent in the third and fourth years. Back with your employer, you put into practice what you learn.

Your training covers:
- basic workshop — measuring, setting out, bending, jutting and welding
- assembly, erection and connection of boilers, radiators, fans and other plant
- commissioning, testing, operation and maintenance of systems fault finding
- reading and interpreting drawings
- basic theory of heating, ventilating and air conditioning systems

Qualifications on passing your examinations
You will receive a certificate from the City and Guilds of London Institute; your indentures are endorsed, and after six months site welding experience you receive your certificate(s) of competency in welding.

Career Opportunities
You acquire skills which will always be in demand. The industry's on-site professionals have a fascinating and rewarding job. There is every opportunity for promotion to chargehand and foreman and if you have the will and ability you can progress to top positions in the industry.

Student Apprenticeships

There are excellent student apprenticeships for 16-18 year old school leavers.

You must be a practical person who is detail oriented and can work scientifically. The ability to get on with people and overcome difficulties is important.

There are two levels of student apprenticeship. If you show the necessary attitude and ability you can always move from Student Apprentice to Student Technician Engineer.

To be indentured as a Technician you must:
- as a minimum, have maths, English language and a science subject (preferably physics) at Grade C GCSE or in Scotland at SCE O grade.

To be indentured as a Technician Engineer you must have grades A and B or C in maths, English language, physics and a drawing subject at GCE O level, or in Scotland the equivalent SCE O and H grades.

Training
Your four to five year paid apprenticeship will teach you all the basic techniques of a fascinating branch of engineering. You spend 10-15 weeks each year at college which are coupled with on-the-job training, covers:
- technical drawing and draughtsmanship
- heating and hot water services
- refrigeration and air conditioning

There are a number of optional studies including fire protection, contract management, services surveying and multi-service contracting.

Qualifications on passing your examinations
You not only qualify under TEC or SCOTEC but are also eligible for an appropriate grade of membership of the Chartered Institution of Building Services (CIBS), The Higher Education Examinations and Credit Grading Council and the Scottish Gauged and Entered Education in the UK.

The industry is one where responsibility comes early and there are many opportunities for promotion to the top. At the start there are three main choices:
- contract management — for the practical person with a flair for organisation and management of people
- work on the drawing board — for the person who likes applying his engineering knowledge to conceptual and detailed design
- services surveying — for the person with a commercial outlook who likes working with the more contractual, legal and financial aspects of design and installation.

Degree Courses

There are well established routes to a degree in building services engineering.

One way is to do a general degree in mechanical or electrical engineering or in physics or chemistry and then take a specialist postgraduate course.

The more usual way is to take a specialist degree course. For this the usual age of entry is 19-19 years and as a minimum you must have maths and physics at GCE A level with at least three other subjects at GCE D level or the equivalent SCE grades in Scotland.

Some courses are full-time while others are on a sandwich basis with industrial experience for which a special technologist training register has been set up.

Training
You will get sound training in engineering and its applications to the various branches of engineering services. It is important for example to gain an understanding of the need to integrate building design and services design and to co-ordinate the work of construction.

During a sandwich course or on-the-job training, you will have opportunities for both site and office experience. There you will learn drawing office practice, estimating, tendering and contract procedures, contract management and organisation including the commissioning and testing of systems and their planned maintenance.

Qualifications on passing your examinations
As well as getting your degree, you will become eligible for appropriate membership of the Chartered Institution of Building Services (CIBS). Career Opportunities
Opportunities abound for the degree building services engineer. His career is in touch with the forefront of technology and he has a key role to play in energy conservation.
"Dentistry in action" housing.

An apprentice practices brazing.

A pleasant drawing office.

Students cross-check the fan efficiency testing on a demonstration unit (right) against that of an industry reference unit (left).

An example of career progression:

1961 graduated in mechanical engineering
1962 success in postgraduate course
1963 completion of office and site experience; appointed team leader on design and contract work
1968 appointed drawing office manager of a subsidiary company
1970 appointed manager of Leeds Branch
1977 appointed managing director of Australian subsidiary

Undergraduates carry out an acoustics and vibration experiment.
EXPORTING ENVIRONMENTAL SKILLS
The industry in common with the British construction industry has a long tradition of working abroad. It certainly dates back to the 19th century for in 1894 an order was obtained for heating and other engineering services in the administration building of the Delte Publique Ottomans in Constantinople. Indeed, both the Middle and Far East were to prove useful markets for the industry's services up to 1939.

Today perhaps a score of engineering services contractors operate in as many countries all over the world. It is their talent for engineering design as much as their skill in installation that enables them to compete for international contracts.

In recent years it has been the oil-rich states of the Middle East that have provided the major market for multi-million jumbo contracts. British engineering systems will be found not only there and in South Africa and South America but also in such less likely places as Poland, Spain, Liberia and Mauritius.

To encourage exports, the Association published a booklet entitled "Thinking of Working Abroad?" and members can obtain intelligence and advice on overseas markets through the affiliation arrangement established with the Export Group for the Constructional Industries.

Pitfalls abound. Different rules apply. An overseas contract may be held in the balance because of the country's political uncertainty, financial instability or seemingly insurmountable transport problems.

Yet the engineers, supervisors and craftsmen sent on overseas projects seem to thrive on adversity. The pay is good and the experience unrivalled.

Opposite Page: Construction of a new sports and leisure centre at Abu Dhabi. The engineering services contract covers air conditioning, plumbing, solar panels, electrical services, communication and audio systems, control and even a sophisticated electronic score board.

1. The world is your oyster as a trained heating engineer
2. Ventilation system for a large textile mill in Khartoum
3 & 4. Unique shape of the Sydney Opera House project problems for installing the engineering services.
We have sketched the establishment of an elementary heating industry by the original 'Heating Appliances Manufacturers' and its subsequent diversification into all aspects of environmental and process engineering. The industry's fortunes will always, to some extent, be bound up with those of the construction industry.

But it has a resilience and creativity of its own, the more so since energy conservation has become of such compelling importance. One of the leading trends over the past century is for engineering services to account for a steadily increasing proportion of building content and cost. Another trend, except in times of war or economic crisis, is for construction output to equal or overtake the growth in national output.

So the market for engineering services usually enjoys the double stimulus of a rising content within a rising building programme. However, the economic crisis of 1973/74 led to savage and many would say disproportionate cuts in capital expenditure and plunged the construction industry into serious recession. Output fell by 25 per cent and as much as 40 per cent in certain trades. In the special case of the engineering services trades, the impact was much less severe and output declined only by some 10.15 per cent.

Today the industry is once again on the upturn. It faces an exciting future which is likely to involve—

- an increasing demand for its services ever widening diversity and new applications of its skills
- higher standards of engineering for maximum energy conservation
- closer integration of building design and engineering services design
- application of the micro-chip to design, co-ordination and contract control

Advances in automatic controls also using the micro-chip revamping and retrofitting of systems in existing buildings to save energy and costs.

Alternative sources of energy

The industry itself is changing and responding to these new demands. Contractors are increasingly developing a multi-service capability under which they assume responsibility for the integrated design, provision and maintenance of all the vital services that make a modern building tick ranging from heating, electrics, lighting and plumbing to fire protection, telephones and piped services.

To meet tomorrow's challenges the industry must recruit top quality people today. Indeed, the only serious cloud upon its future is the shortage of skilled manpower of all kinds. A variety of absorbing and satisfying careers awaits men and women of energy and enterprise at all levels of ability.
1. Osmosis plant for a gas installation
2. Part of a total energy system for a hospital
3. The building has an advanced heat recovery system which optimizes the use of the heat produced by computers, lights, generators, and people.
4. Seven inch diameter electrically heated pipes keep the gas at temperatures ranging from plus 120°F to minus 20°F.
5. Opposite page: A motorcycle enthusiast's dream, this facility includes accommodation and recreational facilities, complete with a first-class hotel. The mechanical services work includes provision of containment areas to prevent the ingress of combustible gases which could cause an explosion.
Mechanical Services in Buildings
heating — air, water, steam
air conditioning
refrigeration, cooling, humidification
mechanical ventilation
dust and fume removal
hot and cold water
filtration
water treatment and sterilisation
fire protection, sprinklers, alarms
piped fluids and gases
process plant
cooking and laundry facilities

Related Engineering Services
plumbing
sanitation
electrical lighting and power
lifts, escalators
conveyor systems
communication systems
lighting protection systems

Text by Geoffrey Cutting.
Design/treatment by Harold Auvergne.

Published by the Heating and Ventilating
Contractors Association,
ESCA House, 34 Palace Court, Battersea,
London SW11 3JG.
Telephone 01-222 2458. Telex 27929.

The Association wishes to thank the many people
and organisations from all sides of the industry who
helped with information, advice or photographs for
the publication of this booklet, including:

Building Services Research and Information Association
Chartered Institution of Building Services
HMSO Association
Department of the Environment
Department of Health and Social Security
Fieldcall of the South Bank, London
Syracuse College of Engineering, Syracuse
Australian Information Services
British Broadcasting Corporation
Building Services Publications Ltd
Imperial Chemical Industries Ltd
Museum of London
Smithers Photographic Services
Donald Smith Seymour & Rosley
Dawson, Price & Partners
DW/141
Specification for sheet metal ductwork

Low and high velocity/pressure air systems

HEATING AND VENTILATING CONTRACTORS’ ASSOCIATION 1977

1977
A practical guide to
DUCTWORK LEAKAGE TESTING
Based on the requirements of DW/142 specification for sheet metal ductwork

HEATING AND VENTILATING CONTRACTORS’ ASSOCIATION
Second Edition 1986
ENERGY EFFICIENCY HANDBOOK

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1999