Heating & Ventilating Scheme, Birmingham Council House 1875

A CIBSE Heritage Group Electronic Publication
Sketch by W W Phipson for service ducts at Halifax Baths 1891
Records and Documentation

Scheme drawing by W W Phipson for the heating at Castell Coch, near Cardiff, c. 1880
Specification of Engineers Work.
G. N. Haden and Son.
TROWBRIDGE.
London, Manchester and Birmingham.

Specification of 1910 by G. N. Haden & Sons for the heating of St. Thomas' Church, Salisbury [Wiltshire REI]
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Introduction

Building engineering services fall into two categories. Environmental services contribute directly to the comfort of the occupied space and are heating, ventilation, air conditioning (which includes refrigeration) and lighting. Utility services contribute to human well-being, health and safety, and an easier way of life. They include plumbing (domestic hot & cold water services, and drainage), electricity generation and distribution, sanitation, fire detection and fire fighting, controls, communications, lifts, escalators and moving platforms. In heritage terms there are further subdivisions. For example, lighting may cover illumination by oil, gas, acetylene and electricity. Specialist areas include street lighting, lighthouses, floodlighting and theatre lighting.

The investigation of historical building engineering services generally starts on site when the building itself is being demolished, altered or restored. A major problem is often identifying the importance, in heritage terms, of the sometimes incomplete services systems and equipment. One aim of this book is to raise awareness of the importance of historic services, understand what survives, assess its significance, and make informed decisions about what to do next. Options range from re-use, retention in-situ, to removal to a safer site or, regretfully in some circumstances, to thoroughly record and destroy.

The investigators may include the property owner or occupier, architect, builder, services consultant and contractor, local government officers (especially conservation officers), and English Heritage inspectors. None of these may have the necessary expertise to evaluate a particular building engineering services item. One solution is to seek advice from someone knowledgeable in this field, where such a person can be found. The other approach, often overlooked due to commercial and time constraints, is to search for all related records and documentation. Information may be available locally, regionally or at national level—in libraries, record offices or specialist collections.

This book gives examples of the type of records and documentation which may be available, the information it may contain and how it may assist in identifying the age, type, manufacturer and importance of building engineering service equipment and components.
Records may span the complete life of a particular building, but those relating to its construction generally produce the most detailed information. Documentation on the building itself and the architect is more commonly found than papers relating to the services and the engineer. But research on the former often leads to details on the latter.

From the engineering services viewpoint, records and documentation may span from inception to handover, operation and maintenance. There are numerous steps in between—some commercial, some technical. The examples on the following pages cover securing the order, design and drawings, sending out enquiries, obtaining estimates, preparing specifications, calculating costs, going to tender, reporting to the client, through to commissioning & testing, and operation & maintenance.

Many of the documents shown in this book are taken from the Archives of the CIBSE Heritage Group and, in particular from the Phipson Collection.

Wilson Weatherley Phipson, MICE (1838-91) was a Victorian civil engineer who specialised in heating and ventilating. Born near Birmingham he spent his later childhood in Brussels and then became a pupil of Dr Van Hecke, a heating and ventilating engineer. Returning to London, Phipson established his own business in about 1862. He acted as a building services consultant (rare in those times), installer and entrepreneur. Some fifty of his works have been identified, including such notable buildings as the Royal Albert Hall, Natural History Museum, Glasgow University, the second Alexandra Palace and the Prudential Assurance offices in High Holborn. One of his major competitors was the firm of Haden (established in Trowbridge in 1816) and a comprehensive archive on their activities is held at the Wiltshire Record Office. These are just examples of what may be discovered by diligent research.
Another extract from the Phipson proposal for St. Thomas’s Hospital. The complete document describes the steam engine-driven fans, the “warming apparatus,” and the proposed methods of air distribution and temperature regulation. The proposal indicates that 5 drawings were also submitted, but these have not been found. This particular page estimates the annual cost of maintenance (£439) and the capital cost of the system (£1928), the latter including Phipson’s fee but excluding builders’ work.

**Securing Orders**

Work could be obtained by competitive tender, through nomination and negotiation, by collaboration in architectural competitions, aided by records of past works and client testimonials.

Old documents indicate there was another way. This was to identify a project of interest and then put an unsolicited proposal to the architect, or directly to the client, in the hope of being considered for the work.
Harrogate Baths, Yorkshire (Proposal) 1890. Building plan from the printed booklet "FINAL COMPETITION, BOROUGH OF HARROGATE 1890: DESCRIPTION OF DESIGN FOR NEW BATHS, COLONNADE &C., ON THE MONTPELLIER ESTATE" [PC375].

The design was by W.W. Phipson. His memo and a draft specification for services covers steam, heating & ventilation, sanitary, plumbing and water supply to Air Douches, Vapours and Turkish Baths and the like [PC378].
The First Prize in the South Kensington Museum (now the Victoria & Albert) architectural competition of 1891 was awarded to Aston Webb for this plan and elevation. [The Builder, LI, 124]

Report dated 8 June 1891 by W W Phipson to Aston Webb on proposed heating & ventilating and lighting plans for the SKM project. [PC/44]  

Architectural Competitions  
The 19th century was regarded by the Victorians as the Golden Age of Competition and the selection of the architect to carry out major public works was often determined in this way. One judge suggested that the object of the exercise was to select the best man rather than actually to select the design to be carried out.

Many competition drawings and reports still exist and can provide a fascinating insight to the then ‘state of the art’ building engineering services. Most designs were altered prior to building and the services amended to suit. In many cases it was not even the prizewinner’s design that was used.

The SKM design was modified in 1899 and Phipson never developed his services scheme to the working stage. He died in 1891.
Extract from letter of 12 November 1869 to Phipson (who had sought a testimonial regarding his heating and ventilating of the ICE Theatre) from the Secretary of the Institution of Civil Engineers in which he says “I beg to inform you that I think it succeeds very well. I cannot speak for the Members...” [PC/21]

Testimonials

It appears that a common practice among professionals and practitioners in the Victorian construction industry was to seek to acquire written testimonials from clients for whom they had recently carried out work. They would then show these hopefully glowing references to potential clients and their architects to try and obtain further work, either a professional appointment, or an order for goods and services. It is a practice that Phipson used regularly and apparently to good effect. The firm of Haden did likewise. Testimonials tell something of the success of early building services installations but, of course, there are no testimonials for those which were not satisfactory.
Testimonial letter dated 22 February 1865 from Mr Syers, Director of The Strand Music Hall Company Limited, to Wilson W Phipson Esq CE in which he states: “The power of regulating the heat without interference with the ventilation is in our opinion a great feature of the application, and however crowded the hall may have been, perfect ventilation and general warmth have always been secured.” [PC24]

External elevation and interior view of The Strand Music Hall by Enoch Duston Keeling, (Building News, 1864)

However, “this veritable Maddox’s cave of entertainment” failed as a business, was reconstructed by C J Phipps, and reopened in 1868 as the famous Gaiety Theatre. The building was demolished in 1903.
COPY OF TESTIMONIALS

REFFERING PARTICULARLY TO THE

VENTILATION AND WARMING OF PRISONS.

Extracts from 3rd and 4th Reports of the Inspectors of Prisons for the Home District, presented to Parliament in the years 1838, and 1839.

VENTILATION OF CELLS.

The objects to be attained under this head are,

1st. The supply of a sufficient quantity of fresh air and when necessary, of tempered air, into each cell without subjecting the occupier of it to any inconvenience from the draft.

2nd. The withdrawal of a like quantity of foul air.

3rd. That no additional facilities of communication between prisoners in adjoining Cells should be afforded by the means made use of.

In the consideration of the means by which these objects could be secured, we have had the advantage of the practical experience of those eminent Engineers, Messrs. HADEN, of TROWBRIDGE, who on being placed in possession of our views and principles have devoted much time to the details of a system which has been adopted in order to secure the conditions proposed.

Their Report on the subject is annexed in the Appendix of 3rd. Report, November, 1837.

(Signed)

W.M. CRAWFORD
WHITWORTH RUSSELL
J. JEBB, Captain Royal Engineers.

Extract from Reports of The Inspectors of Prisons, 1835-9, confirming the assistance received from “those eminent Engineers, Messrs. HADEN, of TROWBRIDGE,” in connection with the Ventilation and Warming of Prisons.

[Wiltsire Record Office 1525-127]
Copy of a Letter from Major Jebb, Royal Engineers.

45, Parliament Street, 
17th February, 1843.

Messrs. G. AND J. Haden,

Gentlemen,

I have now had sufficient experience of the new hot water Apparatus you have designed and applied in warming three wings of Pentonville Prison, to be enabled to state to you that it fulfils all the conditions to which I directed your attention. An equable temperature of from 52° to 58° has been maintained in all the Cells under circumstances of great variation in external temperature. The consumption of fuel has not exceeded from 2 to 2½ cwt of coal for sixty-six Cells, and the Ventilation or quantity of fresh air introduced into each Cell has been from 30 to 45 cubic feet per minute. The cost of maintaining this temperature and ventilation has been about ½d. per cell for 24 hours.

You have now completed your contract with the Commissioners of Her Majesty's Woods and Forests, for works at Pentonville; and I only do you justice in stating that every thing you have undertaken has been executed in a manner which has proved your practical skill and ability and that all your engagements have been fulfilled with straightforward integrity.

I am, Gentlemen,
Your Obedt. Servt.

(Signed) J. Jebb.
TABLE No. 3.
Length of 4-inch Pipe Required for every 1,000 Cubic Feet.

<table>
<thead>
<tr>
<th>Description of Building</th>
<th>Temperature Required</th>
<th>4-inch Pipes Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public buildings</td>
<td>Degrees</td>
<td>Feet</td>
</tr>
<tr>
<td>Workshops, warehouses, &amp;c.</td>
<td>65</td>
<td>6 to 7</td>
</tr>
<tr>
<td>Schools, churches, offices, bedrooms, &amp;c.</td>
<td>65</td>
<td>6</td>
</tr>
<tr>
<td>Shops, waiting-rooms, &amp;c.</td>
<td>60</td>
<td>7</td>
</tr>
<tr>
<td>Living-rooms</td>
<td>60</td>
<td>10 to 11</td>
</tr>
<tr>
<td>Drying Stoves (closed-in rooms)</td>
<td>65</td>
<td>10 to 11</td>
</tr>
<tr>
<td>&quot;</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>&quot;</td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>&quot;</td>
<td>120</td>
<td>170</td>
</tr>
<tr>
<td>Conservatories, greenhouses, &amp;c.</td>
<td>130</td>
<td>240</td>
</tr>
<tr>
<td>Ferneries, &amp;c.</td>
<td>45 to 50</td>
<td>35</td>
</tr>
<tr>
<td>Vineries, stoves</td>
<td>50 and 55</td>
<td>40</td>
</tr>
<tr>
<td>&quot;</td>
<td>60 and 65</td>
<td>45</td>
</tr>
<tr>
<td>Stoves, orchids</td>
<td>65 and 70</td>
<td>55</td>
</tr>
<tr>
<td>&quot;</td>
<td>70 and 75</td>
<td>60</td>
</tr>
<tr>
<td>Pineries, forcing-houses</td>
<td>75 and 80</td>
<td>70</td>
</tr>
</tbody>
</table>

Note.—A laundry or other drying-stove giving 120° to 130° when goods are dried, will register only 90° to 100° whilst they are saturated with moisture.

Heating design table from "Heating by Hot Water," Walter Jones, 1890, p.65

Design Calculations
Written design calculations of building engineering systems from the 19th century seem to be virtually non-existent. There are some installation drawings, manufacturers’ catalogues and plant operating instructions which may give a guide to system design. A few papers and discussions on design are available in the Proceedings of the Institution of Civil Engineers. It seems designers relied on their own acquired knowledge and experience (and were possibly secretive because of its commercial value). There were a number of published textbooks with guide tables, but these are extremely primitive by today's standards. It seems rule of thumb was often employed and as a result systems were either undersized or grossly oversized. This background should be borne in mind when researching installations of historical interest.
Ventilation design recommendations from "On Warming & Ventilating," Neil Arnott, 1838, p.85

Right
Design table showing length of heating pipe required under various conditions, from "A Practical Treatise on Warming Buildings", Charles Hood, 1879.
Enquiries & Estimates

Enquiries, especially if accompanied by drawings and sketches, help reveal how the design was put together.

Where the estimate relating to a particular enquiry is available, the two may be compared and any differences noted. The costs of equipment dating back perhaps a hundred years or more ago are especially interesting, particularly when total system and building costs are also known.

Two estimates from Fraser & Fraser, both dated 4 May 1882 in response to Phipson's enquiry of only two days earlier (opposite page).

Above
Estimate for cylinder £77-10s

Right
Estimate for expansion joints ranging from £2-10s to £6-10s according to size.
Enquiry letter with sketch dated 2 May 1882 from Wilson W. Phipson to Messrs. Fraser & Fraser in connection with Dillionary College asking for the prices of 2" to 6" expansion joints and a 6' 6" long x 4' 6" diameter cylinder with various mountings. (16/58)
Brooklyn Box
London, 26 April 1882

To Mr. Phipson, Esq.
1, Litchfield Great Street

December 26 last I was happy formally to deliver at Chesham one of our high-pressure double-acting superheated boilers of our special construction to your Boiler Co., No. 5, found in working order and in perfect condition. Having been made of Ramna Brass, with additional supports fitted at the bottom and top to prevent excessive vibration. It is estimated with 50% to 100% of the power.

Estimating at 500 per cent, this boiler, if so many boilers were made, will be found the most economical in the world for the power. The boiler is to be placed with reduced steam temperatures in mind, so as to prevent the formation of steam in the pipes, thus concentrating the energy in the boiler, giving a perfectly safe and efficient boiler.

From the boiler, 1,000 pounds per square inch, we estimate the boiler to be exactly as we described it. The boiler is made of Ramna Brass, and when fully tested, it will be found exactly as we stated.

Yours ever more faithfully,

Joseph Phipson

Drawing of Fraser's Special Compound Boiler accompanying estimate. [PC/10]

Estimate of 20 April 1882 from Fraser & Fraser to W W Phipson Esq. for the supply of high pressure steam boilers to Holloway College at a price of £325 each, plus boiler fittings at £25 per set. [PC/17]
Estimate dated 17 April 1882 from Fart, Son, Peard & Co to W W Phipson Esq for ornamental heating coils for Holloway College, Egham, the cost being £3-3 shillings for the small size and £0 for the large. [PC:8]

Memorandum (estimate) dated 7 June 1882, from Lewis & Clift to Mr Phipson for hedges from Egham Station to the Holloway College site at the rate of 2 shillings and 6 pence per ton. [PC:13]

Memorandum from LEWIS & CLIFT,
PROPRIETORS OF TRACTION ENGINES WITH THRASHING MACHINES,
BRIMPTON, READING.

To MR. Phipson

June 1st 1882

Sir, In answer to your request of yesterday, we suppose your land is about 1800 yards long, if so, we should be pleased to draw them up for you at the rate of 2 shillings and six pence per ton, if they are much heavier we could not agree to that price as we need yet no special hedges.

We are yours truly,
Lewis & Clift
Specifications

It was necessary for the designer of the building engineering services to prepare a report, generally handwritten, but sometimes printed, to advise his client and the architect of the details of the systems and equipment and their probable cost. It was usual for this to include details of the requirements for plant chambers, tunnels, shafts, chimneys and other builder’s work, since in Victorian schemes the space needed and the costs were likely to be considerable. Often this was the point where the client asked for savings.

The specification, with drawings, was used to obtain competitive tenders.

A complete description of the services for the Holloway College (later Royal) is given in Phipson’s report dated 28 August 1887 to his client Thomas Holloway (an entrepreneur and philanthropist who made his fortune from patent pills for medicinal purposes).

The 11-page specification [PC/34] covers steam boilers and heating, hot and cold water supply, fire appliances and kitchen equipment, the latter largely copied from a very detailed estimate from Benson & Sons dated 26 April 1882 [PC/39].
Cost Sheets & Tenders

Before going to tender a sheet calculating the anticipated cost of the building engineering services was prepared. The sums involved seem small by today's standard but many were considerable in their day. For example, Phipson's tender for the heating & ventilation at the Natural History Museum, South Kensington was £5115-12s while that of his competitor, Haden, was £5242 [PRO Kew, Works 18-18/3 p151f].

Then the project was sent out to tender and the resultant bids were analysed. In the case of Holloway College a tender comparison shows:

1st Estimate: £10416 13s 0d
2nd Estimate: £9744 9s 6d
  Extra: 470 16s 0d
3rd Estimate: £10537 6s 4d
  Extra: 267 10s 0d

Above: Extract from Phipson's estimate dated 26 April 1887 for the services at Holloway College. He adds 7.5% to the costs for contingencies and allows 30% for the contractor's overhead and profit [PC/31]

Right: Part of Phipson's comparison of tenders showing section totals to arrive at the lump sum totals [PC/33]
Commissioning & Testing Records

If these can be located such information can be extremely valuable in understanding the designer's intentions and whether the system was a success or not.

Above and opposite

Extract from the Report of 2 March 1867 by a Committee of Officers signed by Colonel Commandment Connolly, on the heating & ventilating at the Royal Marine Barracks, Woolwich. It concludes that the alterations by Mr. Phepson (the introduction of "the Fan") are perfect and show considerable improvements, increasing the supply air from 280 to 1020 cubic feet per hour, per inmate. [PC.28a & b]
Holborn Bars 1872 Phipson's Operating Instructions for the Empire Theatre, Leicester Square