The Preparation, Presentation and use of Technical Documentation for Engineering Services within Buildings

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ABSTRACT

Technical documentation in the form of operating and maintenance manuals have long been an area of dissatisfaction in the UK building services industry in terms of the quality of the product and the data provided. To help guide the client in this area, BSRIA undertood a study of the information sources available at present to identify how satisfactory documentation can be specified and obtained. British Standard 4884 specification for technical manuals and draft British Standard 4899 guide to user requirements for technical manuals, were found to provide a useful framework and were developed by BSRIA into a specific format for the building services industry to provide a systematic approach when deciding what needs to be included and how the information could be presented. The results of the study have been published and this paper discusses the background. The publication identified the objectives of operating and maintenance manuals, the stages when information is produced, eight categories of information and four levels of documentation. It also developed two checklists to relate information categories to particular installations. It was prepared to establish how suitable operation and maintenance documentation could be achieved providing adequate planning is carried out and resources are available.

La conception, présentation et utilisation de la documentation technique de l'équipement technique du bâtiment

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MOTS-CLÉS

Documentation technique, manuel d'utilisation, document technique d'entretien

SOMMAIRE

Les manuels d'utilisation et les documents techniques d'entretien dans l'industrie de l'équipement technique du bâtiment au Royaume Uni sont critiqués depuis longtemps à cause de la qualité du produit et des dates de parution souvent tardives.
Pour aider les utilisateurs, BSRIA a étudié toutes les sources d'information afin d'identifier les moyens nécessaires pour définir et obtenir une documentation technique adéquate. Les normes britanniques BS 4884 Specification for technical manuals (spécification des manuels techniques) et BS 4899 (provisionelle) Guide to user requirements for technical manuals (guide de besoins des utilisateurs des manuels techniques) sont les fondations d'un format spécifique que BSRIA a développé pour permettre à l'industrie de l'équipement technique d'être plus systématique dans la choix d'informations incluses et de présentation. Cet article décrit le fond des résultats qui ont été publiés. Les objectifs des manuels d'utilisation et des documents techniques d'entretien, le calendrier de parution de l'information, huit catégories d'information et quatre niveaux de documentation ont pu être identifiés. Deux listes ont été développées pour contrôler la relation entre les catégories d'information et les installations spécifiques. BSRIA a cherché à démontrer comment, avec une planification et des ressources adéquates, une documentation correcte d'utilisation et d'entretien peut être rédigée.

1. BACKGROUND

Buildings and their associated engineering services are assets, the value of which needs to be protected. For the users of buildings they are a resource just as much as manpower or funding. The loss of a building's value can result from reduction of its capital value due to deterioration, loss of income arising from loss of rent or production capability, or loss of service being supplied such as health care. To ensure premature loss of a building's value is prevented it is essential to have the necessary information suitably presented and available at handover to allow proper operation and maintenance to be carried out.

Operating and maintenance manuals in the UK building services industry frequently leave much to be desired in content and presentation. Although they provide the basic reference for plant that may have to exist for many years, they often merit no more than a short paragraph in a consultant's specification outlining what is required and how it is to be presented.

Large industrial organisations, both public and private, have found it necessary to produce their own definitive specifications for technical documentation. While this has led to a satisfactory conclusion of the contract for those organisations with well defined relationships between all the parties, it is not generally the case in the building services industry where relationships can be fragmented. This had led to little direction or guidance in the provision of workable technical manuals and minimal standardisation in both the content and the manner in which the information is presented.

In addition, implementation of the Health and Safety at Work Act has imposed on the equipment supplier and user a joint responsibility for preparing adequate documentation to ensure a safe working environment for employees. To meet this responsibility, supplier and user should assist each other in determining what information, instructions and diagrams are required.

The British Standard specification for technical manuals is BS 4884. Part 1 (Content) specifies information to be given in technical manuals and other documents designed to facilitate the use, maintenance and repair of any material or product. Part 2 (Presentation) specifies requirements for the layout and preparation of technical manuals and other documentations which explain the use and maintenance of materials or products. Both these standards are written in general terms and relate to any item in any sector of industry. BS 4899 gives the same information, but is written from the user's point of view. Because both of these British Standards are written in general terms, it has been necessary to particularise the recommendations to make them of specific use in the building services sector of industry.

The Building Services Research and Information Association undertook a research project jointly sponsored by the UK Department of the Environment and the subscribing members of the research association

to interpret the requirements of the British Standards in terms of the specific needs of building services. The work concentrated on the 'content' aspect of technical manuals rather than their method of 'presentation'

2. CURRENT PRACTICE

A survey of available guidance, standard forms of specification and relevant sections of actual specifications highlighted the shortage of suitable information. Figure 1 is an analysis of actual specifications showing the various topics covered and the extent to which each are included. From this it can be seen that even subjects that might be expected to be covered in all such specifications such as spare parts lists or lubrication schedules were not necessarily included. Discussion took place with several building owners and operators and it became apparent that in many instances the contractor was expected to supply the technical manuals. These were often little more than manufacturers' data gathered together and bound. Little effort was thought to be put into their preparation and the contractor sometimes viewed them as something to be put together as quickly and cheaply as possible at the end of the project, with little thought about their subsequent importance or how they would be used.

3. PURPOSE OF THE PROJECT

It was realised that the client should expect clear, concise and satisfactorily presented documentation which described in detail how to operate and maintain each engineering service within a building. This was important if he was to avoid unnecessary and costly repairs, improper operation and general dissatisfaction with a project. This project was therefore intended to produce a guide for the client to enable him to obtain such documentation within a reasonable period of time after taking over an installation. This would be done by identifying

(a) the objectives of technical manuals

(b) the categories of information that should be included in them

(c) the responsibility for collecting, assembling and presenting this information

(d) the need for agreement on a time scale for preparation of the document.

4. OBJECTIVES OF O & M MANUALS

(a) To provide a comprehensive reference source for operating the installation both during commissioning and the subsequent service.

(b) To provide a basis for the correct and efficient operation of installed plant and systems.

(c) To serve as an information base and detailed guidance for the effective and efficient maintenance of the installation.

(d) To allow scheduled equipment re-conditioning or rectifying accidental breakdown to be done in the minimum time.

(e) To make the most economical use of energy.

(f) To provide maximum utilisation at minimum cost.

(g) To serve as a basis for staff training.

(h) To serve as a basis for safety awareness.

(i) To provide a basis for quoting for a maintenance contract.

(j) To provide a reference for identifying spare parts.

5. INFORMATION REQUIRED

Preparation of technical documentation should not be a collection of manufacturers' information, gathered in the last stages of a scheme. It is necessary at the start of the scheme to recognise the amount of information to be collected, and to identify, when, how and by whom the task is undertaken. Nine categories of information for technical manuals are identified in BS 4884 Part 1. Eight of these are considered to be relevant to the building services industry and are summarised in the following sections. The ninth category is "Handling, installation, storage and transit". It was decided that this category was not directly relevant to the operating and maintenance manuals of building services since in general the services would already be built and operating before the technical manuals were handed over. It is important to identify the relevant categories at the outset so that the process of collecting information and assembling it into a final document which meets the client's requirements can be fully appreciated and understood.

5.1 Purpose and Planning Information relates to the original design as determined in the brief and should include the parameters and conditions of operation including known hazards, details of each service needed to operate the installation, any spare capacity and the intended method of control.

5.2 Technical Documentation records all items of equipment in the installation. Detailed requirements need to be set out for mechanical and electrical services both in terms of methods of presentation (e.g. drawings and plant schedules) and the amount of information expected.

5.3 Equipment Schedules and Parts Lists identify replaceable items, options and accessories including replaceable assemblies. They need to contain

sufficient information to allow each item to be easily obtained.

5.4 Operating Information provides instructions for normal start up, operation and shutdown, emergency shutdown, methods of making safe any potentially dangerous plant, precautions against known hazards, operation of standby plant and control sequences.

5.5 Maintenance Instructions detail the methods of how maintenance tasks will be carried out including dismantling and re-assembly; replacement, adjustment and testing; parts lists; special tools and hazards.

5.6 Maintenance Schedules recommend the nature and frequency of inspection, examination, test and maintenance and should include the nature of deterioration and defects to be looked for.

5.7 Modification Instructions are authorised changes which may affect the reliability, safety, operation or maintenance of a system or component.

5.8 Disposal Instructions provide information on known dangers and recommended precautions; safe methods of disposal and sources of further advice.

6. THE INFORMATION SOURCES

Most of the information required in operating and maintenance manuals is obtained or developed during the design and installation stages of a scheme. During the former, the initial concepts are developed into working details. The operating philosophy of each service within the whole scheme has to be prepared and understood as designs are progressed. A detailed knowledge of each service within the scheme is developed at this stage, but since this is the earliest part of the design-install-handover process much of this detailed knowledge can become lost with the passing of time during installation. The installation stage extends from design to setting systems into use. Information at this stage will be obtained from both the design documentation and the details on installation, operation and maintenance of proprietary equipment supplied by manufacturers. Other information will become available about testing and commissioning of equipment and installed services during this stage. The value of this information can only be determined by reference to the original design concepts and strategy, particularly in relation to the eventual suitability of an installation to meet the system design proposals.

7. RESPONSIBILITY FOR PREPARING TECHNICAL MANUALS

The client needs a single, uniform reference document for the completed scheme, however, obtaining it may not be simple. The consultant/design stage covers the original concepts and operating procedures, but preparation of technical documentation may represent a significant work load at a late stage when the consultant may not wish to be so committed. The contractor/installation stage produces much information on proprietary equipment, but can mean access to the original concepts for systems is very limited. Reliance on the contractor may not be satisfactory if he cannot obtain sufficient information from the consultant designer,

particularly about operating concepts for complete service and installations. The cost of producing the documentation at the latest stages of an installation may be such a small part of the total contract value that a contractor has no incentive to undertake the work satisfactorily. Use of a third party specialising in preparation of this documentation can be advantageous. It allows an impartial assessment of the client's requirements by a party who is not involved in the design or installation procedures. It also can lead to a more uniform presentation of the information in line with the client's needs and based on the specialist knowledge of how it should be presented.

There is no simple answer to who should prepare the manual. Each scheme will need separate consideration, particularly of the skills, experience and previous records of all interested parties. It is recommended, however, that the client clearly places responsibility for obtaining the manual on one party only (e.g. consultant, contractor or specialist) together with clear guidance on what is expected and a time limit for delivery.

8. IDENTIFYING THE CLIENT'S NEEDS

Most references to technical manuals consulted during this project identified the importance of determing the client's requirements early in the project so that the necessary information could be collected as it became available. Included within the client's need was an assessment of the different categories and functions of the personnel who would use the documentation.

9. DOCUMENTATION APPROVAL

Approval of documentation is an important and necessary step before it is produced in its final form. The responsibility for this process was often not clearly defined in the references, being divided between the client and the consultant. To overcome this anomaly, it is recommended that at the design brief stage it should be decided who is responsible for approving and accepting the documentation on behalf of the client and the name of this person be recorded. He should then be made responsible to ensuring he obtains a draft copy of the manual at an agreed time before handover, when he will comment on the draft and return it to the originator so that the final document is available to the client at the date of formal handover.

10. COSTS

The cost of preparing an operating and maintenance manual needs to be agreed by the client at the earliest stages of a scheme to ensure that a realistic sum is allowed and to identify it separately. The cost will be related to the size and complexity of the installation, whether there are several repetitive systems or if each system in the installation is unique. From discussion with organisations involved in this work it was found that for larger work (e.g. a large building with many engineering services possibly repeated over several floors) manual costs could range from 0.3% to 0.5% of the total contract value. For smaller schemes

where there are neither repetitive systems nor opportunities for economies of scale, the cost could be 1.5% to 2.0% of the total contract price.

11. CONCLUSION

This project was carried out to determine how the client could obtain satisfactory and useful operating and maintenance manuals. It identified eight different categories of information required in such documents, the source of this information and the parties involved in preparing and presenting it. It also showed the need to differentiate between the systems involved in an installation (e.g. heating,lighting and power) and the proprietary plant and equipment included in each system. Because of the range of information required and the numbers of parties involved in preparing it, many errors could arise when producing the documentation.

Guidance is therefore very important so that the client can identify his particular needs by selecting, from the various options identified, those most relevant to his requirements. It is intended next to take the project report on which this presentation is based and develop it into an Application Guide for the UK building services industry to give the client a clear and simple method of specifying his particular needs for technical documentation.

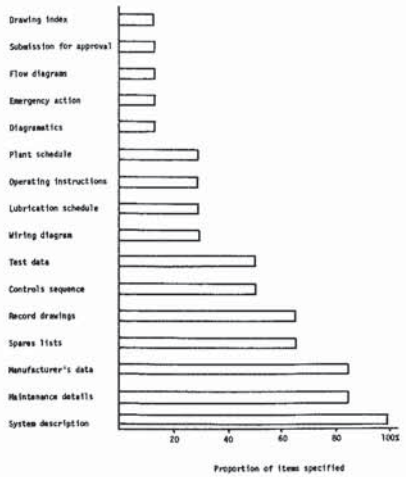

FIGURE 1. Analysis of topics in actual specifications

Scheme _____ Prepared by _____

Date _____

System	Purpose & planning information			Technical documentation (drawings)			Equipment schedules				Operating information				Test results	Commission results
	Design intent	Control intent	Spare capacity	General arrangement	Detail	Diagramatic	Mechanical	Electrical	Electronic	Pneumatic	Normal routines	Emergency procedures	Standby equipment	Fault finding		

FIGURE 2. Operating and maintenance information requirements for systems within a scheme

Scheme _____ Table prepared by _____

Service or system _____ Date _____

Plant items	Purpose	Technical documentation			Parts lists	Spares schedules	Operating information					Maintenance instructions	Maintenance schedules	Modification instructions	Disposal instructions
		Manuf. details	Drawings	Location			Operating routines	Emergency procedures	Standby equipment	Fault finding	Lubrication procedures				

FIGURE 3. Operating and maintenance information requirements for plant within a system