BRITISH STANDARD

BS EN
12170:2002

Heating systems in buildings — Procedure for the preparation of documents for operation, maintenance and use — Heating systems requiring a trained operator

The European Standard EN 12170:2002 has the status of a British Standard

ICS 91.140.10

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 12170:2002.

The UK participation in its preparation was entrusted to Technical Committee RHE/24, Central heating installations, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 33 and a back cover.

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EUROPEAN STANDARD

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English version

Heating systems in buildings - Procedure for the preparation of documents for operation, maintenance and use - Heating systems requiring a trained operator

Systèmes de chauffage dans les bâtiments - Instructions de conduite, maintenance et utilisation - Systèmes de chauffage exigeant un opérateur professionnel

Heizungsanlagen in Gebäuden - Betriebs-, Wartungs- und Bedienungsanleitungen - Heizungsanlagen, die qualifiziertes Bedienungspersonal erfordern

This European Standard was approved by CEN on 11 April 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This document EN 12170:2002 has been prepared by Technical Committee CEN/TC 228 “Heating systems in buildings”, the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

This document includes two informative annexes A and B, and no normative annexes.

The subjects covered by CEN/TC 228 are the following:

- design of heating systems (water based, electrical, etc.);
- installation of heating systems;
- commissioning of heating systems;
- instructions for operation, maintenance and use of heating systems;
- methods for calculation of the design heat loss and heat loads;
- methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are system standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other CEN or ISO standards, a.o. product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

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Introduction

This European Standard is intended to be used in the preparation of documents for operation, maintenance and use of heating systems for new projects and renovation projects as well as in the updating of existing such documents. Documents for operation, maintenance and use are hereafter termed OM&U documents.

The objective of this standard is to ensure that the OM&U documents contain essential information to a minimum standardised level.

The intention of the OM&U documents is to provide a durable record of the system design and the set of instructions and requirements for operation, maintenance and use of the heating system. Relevant instructions and requirements for operation, maintenance and use are necessary in order to ensure safety, rational use of energy and environmental quality management.

Heating systems requiring a trained operator are those systems, designed for operation by persons having specific technical training, knowledge or skill in respect of these systems.

Users of this standard may be:

technical authors of OM&U documents;

system designers (as guidance when preparing their part of the OM&U documents);

manufacturers (as guidance when establishing the OM&U instructions and requirements for the equipment);

installers and commissioning personnel (as guidance when preparing their part of the OM&U documents and submitting the documents to those persons responsible for compiling the OM&U documents);

commissioning engineers (as guidance when verifying conformity with OM&U instructions and requirements and examining the OM&U documents);

owners (as guidance when specifying the requirements for the OM&U documents for their projects).

1 Scope

This European Standard specifies requirements for providing documents for the operation, maintenance and use of heating systems in buildings requiring a trained operator.

Parts of heating systems covered by this standard are:

boilers or heat supply equipment, including control;

safety arrangements, including air supply;

district heating heat exchangers, heat meters and primary domestic hot water production facilities;

energy sources, storage and supply;

flue gas systems, including condensate treatment and disposal;

heat distribution network, including associated components;

heat emitters, including accessories;

systems for control and supervision;

water treatments and procedures (e.g. chemical and physical, including antifreeze).

2 Terms, definitions and abbreviations

For the purposes of this European Standard, the following terms and definitions apply.

2.1
operation
those actions necessary to make available the services, which the system has been designed to provide

2.2
maintenance
combination of all technical, administrative and managing actions necessary to retain an item in, or restore it to, a state in which it can perform an intended function

2.3
use
action of receiving the services, which the system has been designed to provide

2.4
item
any part, component, device, sub-system, functional unit, equipment or system that can be individually considered

NOTE 1 Any item may consist of hardware, software or both, and may also in particular cases include people.

NOTE 2 A number of items (e.g. a population of items or a sample) may itself be considered as an item.

2.5
maintenance plan
description of the methods, procedures and resources required for the sustaining support of an item throughout its life cycle

2.6
preventive maintenance
maintenance carried out at predetermined intervals or according to prescribed criteria, which is intended to reduce the probability of failure or degradation of the functioning of an item

2.7
corrective maintenance
maintenance carried out after fault recognition, which is intended to restore an item into a state in which it can perform an intended function

NOTE In French, the term “dépannage” sometimes implies a provisional restoration.

2.8
inspection
procedure or action to check whether or not maintenance is required

2.9
repair
part of corrective maintenance which is comprised of actions performed on an item

2.10
design parameters
system operating requirements as specified by the system designer

2.11
OM&U
operation, maintenance and use

3 General requirements for the OM&U documents

3.1 Extent

OM&U documents shall be compiled and provided with any installed heating system of the type covered by this standard.

3.2 OM&U instructions

A set of OM&U instructions shall be prepared and form part of the OM&U documents. The OM&U instructions shall be prepared in the official language of the country where the system is installed.

The OM&U instructions shall include a record of the design operating and maintenance requirements for the system, as specified by the system designer[1)].

3.3 Manufacturers' instructions

The OM&U documents shall incorporate the manufacturers' instructions for the appliances and components of the heating system. The system designer's specification for the heating system shall be paramount to the manufacturers' instructions. Whenever the system designer utilises any component in a manner not specified in the manufacturer's instructions for that component, this shall be explained and highlighted in the OM&U documents.

3.4 Form and format

The OM&U documents shall be produced in a clearly legible and lasting form. The printing shall be indelible and the material shall be appropriate for normal expected usage.

The format, style and number of copies of the OM&U documents shall be agreed with the system designer and the owner of the heating system. A list of contents[2)] for the OM&U documents shall be provided in front.

A copy of the OM&U documents shall be prepared in a form appropriate for the use by those persons concerned in the operation, maintenance and use of the heating system.

The International System of Units (SI) shall be applied in the OM&U documents. The definitions given in this standard shall be applied when preparing the OM&U documents[3)].

[1)] These instructions may form part of a set of comprehensive instructions for the entire building.

[2)] Alphanumeric sequence should be adopted.

[3)] Alternative terms should be avoided.

3.5 Availability

The OM&U documents shall be prepared and compiled prior to the conclusion of contractual obligations. The OM&U documents shall be available at hand-over of the heating system.

3.6 Revision

The OM&U documents shall include provision for updating the documents following any alteration in the specification for the heating system (i.e. the design) and the specifications for appliances, components, operation, maintenance and use of the heating system.

4 Contents of the OM&U documents

4.1 General information

The OM&U documents shall contain the following general information about the heating system, as specified by the system designer:

a general description of the system. The description shall give information about the purpose and the services for which the system has been designed and intended. It shall include advice on interfaces with all attached systems and associated sub-systems;

the following statement: “These OM&U documents have been compiled according to EN 12170.”;

plans showing layout of building, appliances and components, as guidance to those concerned with the operation, maintenance, servicing and repair of the system;

schematic plant or system drawings;

a full description or other information about concealed piping and appliances and components, which are considered free of maintenance;

make, type, duty and data on appliances and components of the system;

commissioning information and data;

commissioning and balancing report;

operation, servicing, maintenance and repair history of the system and sub-systems;

an address list;

references to applicable health and safety regulations, including risk assessment;

documents from manufacturers of appliances and components of the system (e.g. manufacturers’ data sheets);

cost control schedules for operation, maintenance and repair;

the name of the author(s) [4)] of the OM&U documents, the date of preparation and any date of revision [5)]. Any change in authorship shall be clearly indicated;

any warranty conditions;

any specific literature on appliances and components of the system (e.g. from manufacturers) to which cross-

[4)] Individual(s) or organisation(s) responsible for the preparation and compilation of the OM&U documents.

[5)] A numerical sequence should be adopted.

references are given in the OM&U documents [6];

updates (amendments);

information on the location of available OM&U documents, including archive.

An example extracted from particular sets of OM&U documents is given in annex A (informative). An example of an address list is given in annex B (informative).

4.2 Instructions for operation

4.2.1 Operation schedule

The operation schedule shall include the design specifications for operation. A schedule of operating times and temperatures, together with other operating parameters, as applicable during different operational states and seasons and for individual zones and sub-systems, shall be provided.

4.2.2 Operation procedures

Procedure for start-up and shut-down of the heating system shall be included. Daily or routine start-up and shut-down procedures shall be separately described and detailed.

The recommended methods for isolation of components, zones or sub-systems, for operational purposes, shall be included.

4.2.3 Operation of individual zones or sub-systems

A separate operational description for the operation of facilities in individual zones or sub-systems shall be provided, unless there is no control option for the zone or sub-system. This part of the instructions shall be prepared according to the requirements of the system designer and shall include additional advice to the persons operating individual zones or sub-systems. The risks in connection with improper operation of individual zones or sub-systems shall be described.

This part of the instructions shall, as necessary, include information and advice such as:

a general description of the sub-system installed in the individual zone;

the exact location of control devices (e.g thermostats);

an outline of the methods for bringing an individual zone or sub-system into operation and for taking it out of operation;

operational relationships between the heating system, attached systems (e.g. air conditioning system, swimming pool) and other building systems (e.g. boiler room ventilation system, independent solar system).

4.2.4 Economical operation

The instructions shall include the system designer's recommendations for meeting the design comfort parameters through an ecological, economical and energy conscious operation of the heating system.

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[6] This can be done by including only relevant parts or sections of such literature.

4.2.5 Controls and safety systems

Instructions for the operation of controls and safety systems of the heating system shall be included.

4.2.6 Operational record

Provision shall be made for recording operational events. The record shall contain fields for description of the event, identification of the person recording the event and the date of the event.

Record of fuel deliveries and consumption should be prescribed as specified.

A separate record shall be kept for individual zones and sub-systems, as specified by the system designer.

4.2.7 Routine inspections

Any requirements or instructions for routine inspections and actions, given by the system designer or by the manufacturers of appliances and components of the system, shall be included.

4.2.8 Malfunction

The instructions should include information on actions to be taken in the event of a system or equipment malfunction.

Where required and specified by the owner of the system, a check list for fault diagnosis shall be provided.

4.2.9 Safety

Safety procedures shall be included. Matters related to fuel, chimney, water treatment and electrical isolation shall be described.

Procedures for emergency shut-down shall be included (such procedures should include situations of fire, fuel or water leakage and other foreseeable emergency situations).

4.3 Instructions for maintenance

4.3.1 General

The instructions shall include a maintenance plan, as specified by the system designer. Particular reference shall be made to regular assessment of system safety, performance and fulfilment of statutory requirements.

The methods for isolation of the system or sub-systems, for maintenance and repair purposes, shall be included.

4.3.2 Product maintenance

Instructions for the inspection and maintenance of appliances and components of the system shall be in accordance with the manufacturers' requirements and the system designer's specifications. Any statutory requirements shall be included in the instructions.

4.3.3 Inspection

The instructions shall include provision for inspection schedules and records, as specified by the system designer.

4.3.4 Preventive maintenance

The instructions shall include provision for preventive maintenance schedules and records, as specified by the system designer.

4.3.5 Corrective maintenance

The instructions shall include provision for repair and replacement records.

4.4 Instructions for use

The OM&U documents shall comprise instructions for use of the heating system.

4.4.1 General

A separate operational description for use of the heating system in individually controlled zones shall be included.

4.4.2 Instructions for the user

The instructions shall include the system designer's recommendations for operating the controls of each individual zone and for conserving energy while maintaining the specified internal design conditions.

User instructions provided by manufacturers of appliances and components shall be included.

4.4.3 Content of the instructions for the user

The instructions shall include information and the system designer's advice and recommendations as follows:

a general description of the system installed in the individual zone;

depiction of the exact location of control devices available to the user (e.g. thermostats, temperature controls);

an outline of the methods for bringing the system of the zone into use and for taking it out of use;

the methods for meeting the design comfort parameters through an ecological, economical and energy conscious use of the heating system;

procedures for reporting defects;

depiction of the location of individual heat meters, where applicable, and user guidance on performing readings thereof;

the effects of using other systems and facilities on the operation of the heating system.

4.4.4 Safety

The risks in connection with improper use of the systems installed in the individual zones shall be described.

The actions to be taken by the user in emergency situations shall be described.

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Annex A
(informative)

Example extracted from an OM&U Instruction Manual

A.1 General

The purpose of this annex A is to provide guidance to the author(s) of OM&U documents on a possible structure for the documents and form of presentation (refer to 4.1).

This informative annex A (except for the present clause) consists of sample text, extracted from more than two actual OM&U Instruction Manuals, which have been prepared for different specific buildings. The numbering of clauses and sub-clauses has been adapted to the format of an annex to a standard.

For the purpose of making the sample text anonymous and limiting the extent of this annex A, the following legend is applied:

- XXXXXXXX – is used in place of specific data such as names, dates, parts of and locations in buildings, etc.;
- Etc. or etc. – is used to indicate that a list can be extended;
- Etc., etc. or etc., etc. – is used to indicate that a text can be extended.

The sample text of this annex A does not cover all requirements given in the standard.

EXAMPLE: User instructions are not covered by the sample text.

Any part of the sample text of this annex A can or can not be relevant for any particular set of OM&U documents.

A.2 Title and contents list of the manual

A.2.1 Title

OPERATING AND MAINTENANCE INSTRUCTION MANUAL FOR ADMINISTRATION AND AMENITY BUILDING XXXXXXXX

Client: XXXXXXXX

Mechanical and Electrical Services Designed and Installed By: XXXXXXXX

Technical Author: XXXXXXXX
Date of original issue: XXXXXXXX

Revised by: XXXXXXXX
Date and number of revision: XXXXXXXX

A.2.2 Foreword

A.2.2.1 Purpose of the manual

This manual has been prepared to assist the plant operators and maintenance engineers in familiarising themselves with

the mechanical and electrical plant and systems installed by XXXXXXXX in the XXXXXXXX Building

A.2.2.2 Structure of the manual

The Mechanical and Electrical Services Operating and Maintenance Manual is contained in ten binders and each binder is given a unique volume number, i.e. 1 to 10. Within the ten volumes, the manual is divided into two main sections, the Mechanical Services (volumes 1 to 4) and the Electrical Services (volumes 5 to 8). Volumes 9 and 10 contain the record drawings for both the mechanical services and the electrical services. Each main section is sub-divided into 13 parts as follows in A.2.3.

A.2.3 List of contents of the manual

- PART 1 - INTRODUCTION (see A.3)
  General introduction to the building and its use, design and performance data, general abbreviations, plant abbreviations (including plant labelling information), list of record drawings, list of plant items and suppliers and the major plant identification schedule.
- PART 2 - DESCRIPTION OF SERVICES (see A.4)
  General description of the installed systems and plant
- PART 3 - OPERATING PROCEDURES (see A.5)
  Details on the operation of the main plant items and systems, including preliminary checks, start-up, day-to-day operating checks, shut-down and emergency procedures
- PART 4 - EQUIPMENT SCHEDULES (see A.6)
  Technical details of all plant items and equipment, including manufacturer, type, duty, etc.
- PART 5 - MAINTENANCE PROCEDURES AND SCHEDULES (see A.7)
  Procedures and schedules for maintenance of the plant and equipment
- PART 6 - CONTROLS (see A.8)
  Brief description with cross-references to a separate specialist manual on controls
- PART 7 - SAFETY AND FAULT FINDING PROCEDURES (see A.9)
  General notes on health and safety at work and general safety procedures
  Details on fault tracing
- PART 8 - RECOMMENDED SPARES (see A.10)
  Recommendations for the minimum requirement of spare parts to be held in stock
- PART 9 – MANUFACTURERS' CERTIFICATES (not further detailed in this annex A)
  Test certificates for individual manufacturers' equipment
- PART 10 - COMMISSIONING AND TEST DATA (not further detailed in this annex A)
  Commissioning reports and test data for the installed plant and systems
- PART 11 – MANUFACTURERS' LITERATURE (not further detailed in this annex A)
  Individual manufacturers' technical literature collated into alphabetical order with divider cards
- PART 12 - A3 RECORD DRAWINGS (not further detailed in this annex A)
  A3 size record drawings
- PART 13 - OPERATION AND MAINTENANCE RECORD (not further detailed in this annex A)
  Sample schedules for the recording of operation and maintenance

Each part is provided, where applicable, with its own list of contents which details the information headings within that part.

A.3 Part 1 - Introduction

A.3.1 List of contents

Part 1 - Introduction - includes the following:

- General Description of the Building (see A.3.2)
- The Services (see A.3.3)
- Basis of Design (see A.3.4)
- Abbreviations (see A.3.5)
  - General Abbreviations
  - Plant and Equipment Abbreviations
    - Plant
    - Pipe Line Valves and Equipment
    - Etc.
- List of Record Drawings (see A.3.6)
  - Comfort Cooling and Ventilation Services
  - Hot and Cold Water Services
  - HVAC Controls Schematics
  - Etc.
- List of Plant Items and Suppliers
- Major Plant Identification Schedule
- Plant Labelling
  - Introduction
  - Plant Label
  - Equipment Label
  - Valve Label
  - Etc.
- Etc.

A.3.2 General description of the building

The building is a three-level structure comprising an XXXXXXXX area and the ground and first floors. Entrance pavilions, located on the north and west aspects, are joined to the main body of the building by ground floor link bridges.
The ground floor of the building comprises etc., etc.

A.3.3 The services

The mechanical services installation covered by this manual comprises the following:

- a LPHW heating system incorporating boiler plant, fill and pressurisation unit, circulating pumps, etc.;
- the domestic hot water services;
- a chilled water cooling system incorporating chiller units, fill and pressurisation unit, circulating pumps, etc.;
- comfort cooling and ventilation systems;
- the cold water services distribution system including a water softening facility;
- the fire protection services;
- plumbing services.

Specialist manuals have been prepared for the sprinkler system and the control system. These manuals are contained in Part 11 - Manufacturers' Literature.

Major plant items are situated in the West Pavilion XXXXXXXX boilerhouse, the chiller plantroom in the West Pavilion first floor plantroom and the North Pavilion first floor plantroom.

A.3.4 Basis of design

The mechanical services Systems have been designed to satisfy the following criteria:

- External Conditions
  - Summer 24 °C db / 19 °C wb
  - Winter -5 °C db 100% RH (-12 °C frost protection)
- Internal Conditions - Comfort Cooled Areas
  - First Floor Offices, XXXXXXX Offices and Business Centre
    - Summer 22 °C ± 1 °C db
    - Winter 20 °C ± 1 °C db
  - Staff Facilities and Medical Centre
    - Summer 22 °C ± 1 °C db
    - Winter 20 °C ± 1 °C db
- Internal Conditions - Heating Only Areas
  - Etc.
- Ventilation
  - Etc.
- Noise Ratings
  - Etc.
- Media Conditions
  - LPHW Heating 85 °C flow / 70 °C return
  - Chilled Water 6 °C flow / 12 °C return
  - HWS 65 °C flow
  - Etc.

A.3.5 Abbreviations

For the purpose of this manual, the following definitions apply:

- db Dry Bulb
- wb Wet bulb
- LPHW Low Pressure Hot Water
- LTHW Low Temperature Hot Water
- Etc.

A.3.6 List of record drawings

Dwg.No.	Title
7410	Plan - Chiller Area
7411	Boiler House
etc.	
7414	Plan - Zone 2
etc.	
7441	Heating Pipework Schematic
etc.	

A.4 Part 2 - Description of services

A.4.1 List of contents

Part 2 - Description of services - includes the following:

- Heating System (see A.4.2)
  - General Description (see A.4.2.1)
  - Constant Temperature Heating Circuit (see A.4.2.2)
  - Variable Temperature Heating Circuit
  - Boiler Plant (see A.4.2.3)
  - Fill and pressurisation Unit
  - Water Treatment
  - Trace Heating
  - Heating Plant Controls (see A.4.2.4)
    - General Note (see A.4.2.4.1)
    - Constant Temperature Pumps (see A.4.2.4.2)
    - Variable Temperature Pumps (see A.4.2.4.3)
    - Variable Temperature Heating Circuit
    - Boilers
    - Gas Safety Circuit
    - Frost Protection
    - Alarms
    - Fire Alarm Interlock
    - Load Shedding
    - Etc.
  - Etc.
- Domestic Hot Water Services
- Chilled Water System
  - General Description
  - Chilled Water Distribution Circuit
  - Etc.
- Comfort Cooling and Ventilation Systems
  - First Floor Offices Comfort Cooling System
  - North Pavilion Concourse Ventilation System
  - Etc.
- Cold Water Services
- Etc.

A.4.2 Heating system

A.4.2.1 General description

Low pressure hot water (LPHW) for the heating of the building and to provide the primary heat source for the HWS calorifiers is generated by three gas-fired boilers and is pump-circulated through two distribution pipework systems namely:

- the constant temperature heating circuit;
- the variable temperature heating circuit.

The system is of the closed, pressurised design incorporating a fill and pressurisation unit. The unit is arranged to accommodate the system's thermal expansion and to introduce a softened water make-up supply at a constant cold-fill pressure.

A.4.2.2 Constant temperature heating circuit

This circuit provides LPHW circulation at a constant temperature of 85°C to the air handling units' heating coils, duct mounted reheater coils, the fan coil units' heating coils, the fan convector heater, the high level atrium pipe coil and the primary heating circuits serving the KWS storage calorifiers.

Circulation is maintained by duplicate, duty/standby, variable speed pumps named HCP1 and HCP2 and located in the West Pavilion boilerhouse. The pumps are connected into the system via suction and delivery isolating valves, a suction strainer, a delivery non-return valve and suction and delivery flexible pipe couplings; pressure gauges are mounted in the suction and delivery pipework to allow the duty pump head to be monitored. Ground floor radiators are served by flow and return dropper circuits taken from the ring main.
The circuit flow temperature is controlled via a 3-port motorised mixing valve connected across the system flow and return mains on the pump suction side. The method of control is described later in section XXXXXXXX.
The variable temperature circuit pumps are controlled from individual HAND/OFF/AUTO switches located on boilerhouse panel MCC2, These pumps are arranged to operate as described later in section XXXXXXXX.
Etc., etc.

A.4.2.3 Boiler plant

The LPHW heating system is served by three packaged, gas-fired sectional boiler units named CHB1, CHB2 and CHB3 and located in the West Pavilion XXXXXXXX boilerhouse. Each boiler has a rated output of XXXXXXXX kW and is fitted with a set of mountings comprising a safety valve, a T-port escape valve, a pressure gauge, a temperature gauge and a hose union drain cock. The boilers are connected, via isolating valves, into common flow and return headers from which the heating distribution pipework circuits are taken. Each boiler unit is fitted with a 3-port motorised valve mounted in the flow pipeline and a primary circulating pump mounted in the return connection. The primary pumps are named HCP5, HCP6 and HCP7.
The gas supply for the boiler plant is run to the boilerhouse from a valved takeoff point on the below-ground site main service. Within the boilerhouse, branch supplies are taken from the main and are connected to the boiler units' gas booster/burner assemblies via isolating gas cocks. At its point of entry into the boilerhouse the gas main is fitted with a solenoid maintained emergency shut-off valve.
Etc., etc.

A.4.2.4 Heating plant controls

A.4.2.4.1 General note

The LPHW heating plant is controlled from boilerhouse panel MCC2 and the associated panel mounted DDC outstation. Control panel details are provided on circuit diagrams XXXXXXXX (Sheets 1 to NN).

A.4.2.4.2 Constant temperature pumps (HCP1 and HCP2)

The constant temperature pumps are selected via their associated HAND/OFF/AUTO switches mounted on the panel front. When selected to AUTO the pumps are controlled via the outstation.
Each pump is variable speed controlled via a panel mounted inverter. The pump speed is varied (via a 1-10 signal from the outstation to the inverter) operating on five DP/XL differential pressure sensors (B/DPS1-B/DPS5), located at designated points within the heating system. From each sensor a signal is sent to the outstation indicating whether the actual flow is above or lower than a minimum flow.
The pumps are duty/standby, the duty pump being changed on a weekly basis via the outstation. Should the duty pump fail as sensed by a differential pressure water flow switch (B/DPS6) located across the pumps, the standby pump is automatically started.

A.4.2.4.3 Variable temperature pumps (HCP3 and HCP4)

The variable temperature pumps are selected via their associated HAND/OFF/AUTO switches mounted on the panel front.
Etc., etc.

A.5 Part 3 - Operating procedures

A.5.1 List of contents

Part 3 - Operating procedures - includes the following:

- General Notes
  - Introduction
  - Operating Notes
- Preparation (see A.5.2)
  - General Checks (see A.5.2.1)
  - Electrical Services and Controls
  - Heating System (see A.5.2.2)
  - Domestic Hot Water Services
  - Etc.
- Operation (see A.5.3)
  - State of Plant (Check List)
  - Direct Control System (DDC)
  - Heating System (see A.5.3.1)
  - Domestic Hot Water Services
  - Chilled Water System
  - Comfort Cooling and Ventilation Systems
- General procedures (day-to-day operation) (see A.5.4)
- Shut-down (see A.5.5)
  - Introduction (see A.5.5.1)
  - Heating System Plant (see A.5.5.2)
  - Domestic Hot Water Services Plant
  - Etc.
- Emergency Procedures (see A.5.6)
  - Introduction (see A.5.6.1)
  - Fire (see A.5.6.2)
  - Gas Leaks
  - LPHW Leakage
  - Refrigerant Leaks
  - Water Services Leakage
- Etc.

A.5.2 Preparation

A.5.2.1 General checks

Before starting operation:

a) check that all plant areas are clean and that there is unimpeded access to all items of equipment;
b) check that all control and electrical cubicle doors are closed and secured;
c) check that all plant and ductwork access panels are in place and secured;
d) check that all machine guards are in place and firmly mounted;
e) check that all electric motors are clean and serviceable and that their ventilation ports are unobstructed;
f) check that the main services are available to the plant and systems at which they are required;
g) etc.

A.5.2.2 Heating system

Before starting operation of the heating system:
a) check that all system drain cocks are closed;
b) check that all pipeline strainers are clean and serviceable;
c) check that all distribution circuit and plant isolating valves are open;
d) check that a softened cold water supply is available to the system's fill and pressurisation unit, that the unit's suction break tank is filled and that its inlet ball float valve operates correctly;
e) fill and vent the system utilising the quick-fill connection;
f) introduce the water treatment chemical via system dosing pot and check the system water quality instructions;
g) energise the power supply to the fill and pressurisation unit and check that the unit functions correctly to pressurise the system;
h) etc.

A.5.3 Operation

A.5.3.1 Heating system

To start operation of the heating system:
a) check that the fill and pressurisation unit is operating within its designated parameters;
b) select AUTO for the constant temperature circuit pumps HCP1 and HCP2 at the HAND/OFF/AUTO control switches;
c) select AUTO for the boiler primary pumps at the HAND/OFF/AUTO control switches;
d) etc.

A.5.4. General procedures (day-to-day operation)

To ensure proper operation of the system:
a) make a regular check on the LPHW and the chilled water systems' flow and return temperatures;
b) ensure that the distribution circuits are kept vented of air;
c) regularly check the contents temperature in the HWS storage calorifiers;
d) maintain a regular check on the LPHW and the chilled water systems' water quality to ensure that the required condition is being maintained;
e) make a regular tour of the comfort cooled and heated areas to ensure that the design comfort conditions are being achieved;
f) make a daily check on the pressure drop across all supply plant air filters;
g) maintain a fixed operating cycle for plant items provided with duty/standby or lead/lag facilities to ensure that duty time is evenly shared;
h) etc.

A.5.5 Shut-down

A.5.5.1 Introduction

The following instructions refer to the procedures required to shut down selected items of the plant for maintenance or inspection purposes.

A.5.5.2 Heating system plant

To shut down a duty circulating pump and activate the related standby pump:
a) check that the standby pump isolating valves are open;
b) check that the standby pump control MCC2 switch is set to AUTO;

c) select OFF for the duty pump. The standby pump will now be activated automatically via the DDC software;
d) check the new duty pump suction and delivery pressures;
e) isolate hydraulically and electrically the out-of-service pump.

To shut down a boiler unit:
a) etc.

A.5.6 Emergency procedures

A.5.6.1 Introduction

An emergency is a situation which causes personnel to be at risk of injury or the building and plant to be at risk of damage.
Most plant equipment is protected by electrical and/or mechanical interlocks, which are activated automatically in case of emergency situations. The emergency procedures that the operator needs to follow are therefore very few.
Equipment duplicated in lead/lag or duty/standby arrangements will switch to the secondary unit if the duty unit fails. Thus, failure of a duty unit is not considered as an emergency situation, but the faulty equipment should be repaired as soon as possible to prevent a more serious situation to develop.

A.5.6.2 Fire

A fire in the boiler room will eventually melt the electro-thermal links above each boiler burner, which will release the gas safety shut-off valve automatically. If a fire is detected before the links fuse, release the valve by operating the manual emergency release button mounted adjacent to the plantroom door.
DO NOT use water on a plantroom fire with the electrical supply switched on.
During a fire the extract fans can be operated for smoke clearance by the Fireman's Switch in the reception area. This facility is provided for use by trained fire fighting services.
Etc., etc.

A.6 Part 4 - Equipment schedules

A.6.1 List of contents

Part 4 - Equipment schedules - includes the following:

- Heating System (see A.6.2)
  - Boiler Plant (see A.6.2.1)
  - Etc.
- Heating Circulation Pumps
  - Constant Temperature Circuit Pumps (HCP1 and HCP2)
  - Variable Temperature Circuit Pumps (HCP3 and HCP4)
- Domestic Hot Water Services
  - Storage Calorifiers (HWC1 and HWC2)
  - Etc.
- Etc.

A.6.2 Heating system

A.6.2.1 Boiler plant (CHB1, CHB2 and CHB3)

Manufacturer	XXXXXXXX
Type	XXXXXXXX
Model	XXXXXXXX
Number Installed	XXXXXXXX
Serial Numbers	XXXXXXXX
Location	XXXXXXXX
Rated Output (each)	XXXXXXXX
Heat Input	XXXXXXXX
Water Temperatures	XXXXXXXX
Water Pressure	XXXXXXXX
LPHW Flow Rate	XXXXXXXX
Fuel Type	XXXXXXXX
Gas Burner Type	XXXXXXXX

Etc.

A.7 Part 5 - Maintenance procedures and schedules

A.7.1 List of contents

Part 5 - Maintenance procedures and schedules - includes the following:

- Introduction (see A.7.2)
- General Maintenance Procedures (see A.7.3)
  - Electric Motors
  - Pumps (see A.7.3.1)
  - Valves
  - Safety Valves (see A.7.3.2)
  - Etc.
- Maintenance Schedules (see A.7.4)
  - Boiler Plant (see A.7.4.1)
  - Etc.

A.7.2 Introduction

The maintenance instructions comprise, generally, recommendations related to the scheduling of maintenance tasks, designed to ensure that the various maintenance procedures required for each of the individual services and systems are carried out at the correct intervals. The objective of which is to maintain all plant equipment at the best level of efficiency and to prevent, in so far as possible, any breakdown that could result in interruption of services.
The maintenance instructions in the following section XXXXXXXX give certain recommendations related to the general maintenance procedures to be adopted in respect of non-specialist maintenance. The specialist maintenance is detailed in the separate instruction manuals provided by the equipment suppliers. Non-specialist preventive maintenance procedures are presented in the form of schedules in the following section XXXXXXXX.
All required manufacturers' literature is supplied in collated form in Part 11 of this manual.
Etc., etc.

A.7.3 General Maintenance Procedures

A.7.3.1 Pumps

Gland leakage rates should be regularly checked and particular attention paid to any signs of overheating or abnormal operating noise.
Pump suction and discharge pressures should be regularly checked to ensure that they are maintained at the system requirement.
Where pump gland lubricators are fitted, the manufacturers' instructions with regard to the operation of the lubricators and recharging with the correct grade of lubricant should be carefully observed.
Gland nuts should be screwed down, just sufficiently to prevent leakage, always noting that the gland face is maintained square with the pump shaft.
Where mechanical or carbon ring seals are fitted, careful attention shall be given to the manufacturers' instructions with regard to adjustment.
Where pumps are protected by suction strainers, these should be regularly cleansed and strainer elements and seals inspected for damage or wear. A damaged strainer element or worn seal should be renewed at the time of inspection.

A.7.3.2 Safety valves

SAFETY VALVES ARE INSTALLED PRIMARILY TO PREVENT EXPLOSIONS AND MUST NOT BE IGNORED. THEY SHOULD BE REGULARLY INSPECTED AND TESTED TO ENSURE THAT THEY WILL FUNCTION IF AND WHEN REQUIRED. THE DISCHARGE PIPES FROM SAFETY VALVES MUST BE KEPT CLEAR AND FREE FROM ANY OBSTRUCTION.
A safety valve head should be periodically rotated approximately $45°$ on its seat by means of its test lever and then returned to its original position. With good water and normal operating conditions this should be done at intervals of three months. More frequent rotating will be necessary in hard water areas. Such testing should be done immediately prior to the commencement of the heating season and at regular intervals thereafter.
The rotating of the valve on its seat during service is possible only on those safety valves fitted with test levers. This is the most suitable type of valve but care shall be taken because on some valves the test lever turns only the spindle - not the valve head. It is necessary, therefore, to ensure that the valve head is pinned to the spindle, thus turning with it.
Where the valve head cannot be turned, or where doubt exists, the valve shall be either lifted by means of the test lever, or tested under hydraulic pressure.
Etc., etc.

A.7.4 Maintenance Schedules

A.7.4.1 Boiler Plant

Table A.1 - Sample boiler plant maintenance schedule

Frequency	Activity
Daily	Check that the boilers are operating satisfactorily Check the LPHW flow and return temperatures Etc.
Weekly	Check the operation of the boiler burners and controls. Ensure that the burner combustion air intake is clean and unobstructed Clean the boilers' casework and check for signs of damage and corrosion Check the operation of the boiler safety valves Vary the boiler firing sequence Etc.
Monthly	Check the operation of the burner safety interlocks Inspect the gas supply pipelines to the burner assemblies and check for any signs of damage and/or leakage Etc.
3-monthly	Carry out combustion efficiency checks Etc.
6-monthly	Inspect all wiring termination to the boilers and burners and check that they are secure. Check for any signs of overheating and arcing Inspect and test the boiler safety valves Etc.
Yearly	Inspect, clean and service the boilers and burners in accordance with the manufacturers' instructions Etc.

A.8 Part 6 - Controls

A.8.1 General description

The mechanical services installation is provided with an electric/electronic direct digital control (DDC) control and monitoring system. The system incorporates five floor-standing, cabinet style control panels named and located as follows:

- MCC1 - Chiller Plantroom
- MCC2 - West Pavilion Boilerhouse
- Etc.

The MCC panels each incorporate a door interlocked mains isolator, selector switches, status indication lamps, motor starters, control relays, the electrical supply and control circuit fuses and a dedicated compartment which houses the outstation control and monitoring equipment for the associated plant and systems. The control section incorporates a front mounted display panel complete with keypad. The control panels are networked so that information relating to any plant item or system can be relayed to any one of the display panels.
Panel control switches are of the HAND/OFF/AUTO or AUTO/OFF rotary type. The switches should normally be set to AUTO thus enabling the plant and systems to be controlled via the associated DDC software. The HAND control setting allows the related plant to be operated independently and is primarily intended for test purposes.
In the event of a plant fault condition developing, a visual alarm signal will be initiated on the appropriate control panel. The signal will be relayed to the remote alarm panel located in the first floor (East) reception area and will initiate an audio/visual PANEL ALARM signal. The audible signal may be silenced by pressing the MUTE button, but the visual signal will remain illuminated until the fault is rectified. The remote alarm panel additionally incorporates OPEN/ AUTO/CLOSED Fireman's Override Switches associated with the atrium louvres installation.
Full details of the control system are provided in the specialist documentation and circuit diagrams prepared and issued by XXXXXXXX and contained in Part 11 - Manufacturers' Literature.

A.9 Part 7 - Safety and fault finding procedures

A.9.1 List of contents

Part 7 - Safety and fault finding procedures - includes the following.

- Introduction (see A.9.2)
- Health and Safety - General Instructions (see A.9.3)
  - General Note (see A.9.3.1)
  - Working Conditions
  - Safe Way to Work
  - Personal Safety
  - Permit to Work
  - Notes on Permit to Work
  - Replacement Parts
  - Warning and Safety Notices
  - Fire Precautions
  - Fire Extinguishers (Types and Uses)
  - Escape Routes
  - Acids and Chemicals
  - General Items
  - Etc.
- Safety Procedures (see A.9.4)
  - Introduction (see A.9.4.1)
  - General

Fire
Safety Valves
Refrigeration
LPHW Systems (see A.9.4.2)
Electrical Systems
Tools and Equipment
Etc.

- Fault Finding Procedures (see A.9.5)
  Control Equipment
  LPHW Heating System
  Domestic Water Services
  Chilled Water System
  Comfort Cooling and Ventilation Systems
  Etc.

A.9.2 Introduction

This section comprises general instructions relating to health and safety, recommended safety procedures for maintenance personnel and recommended fault finding procedures designed to assist the personnel in diagnosing the various faults which may develop during the normal operation of the plant and systems.
It is stressed that prior to working on, operating or maintaining the plant and systems, the maintenance staff should familiarise themselves with and fully understand the provisions of etc., etc.

A.9.3 Health and safety - General instructions

A.9.3.1 General note

When maintenance tasks are being carried out precautions should be taken by both the management and the maintenance staff to ensure the health and safety of all other staff and occupants of the building. It is recommended that at least one copy of the XXXXXXXX is kept on the premises and that it has been read and understood by all maintenance staff and general personnel. Maintenance staff members shall also be aware of any in-house-rules and regulations formulated by the Plant Superintendent and incorporated into the safety procedures to satisfy specific local conditions.

A.9.4 Safety procedures

A.9.4.1 Introduction

The purpose of this section is to provide a general guide to safety procedures that should be observed in order to provide the highest measure of safety to personnel and equipment. The procedures are designed to protect plant operators, service technicians and the occupants of the building which this installation serves.
The information is intended to supplement the instructions contained in the technical manuals, which have been provided for the mechanical and electrical services. Recommendations contained herein should not be adopted in preference to the specialist instructions detailed in the technical manuals.
Etc., etc.

A.9.4.2 LPHW Systems

Always treat LPHW systems with care. Although they do not operate at a high enough temperature to generate steam, serious scalding can result from contact with the flow or return water.
To ensure the safe operation of an installation remember:

a) test safety valves regularly, following the manufacturer's recommendations;
b) perform regular checks on operating temperatures and pressures. Take remedial action if they exceed the design limits;
c) ensure that all boiler equipment is serviced regularly by professional engineers;
d) etc.

A.9.5 Fault finding procedures

The fault finding procedures given in this section serve as guidance to the possible causes of plant or system malfunction or failure and to the simple remedies of these faults.
The procedures constitute a general outline guidance and do not replace specific instructions which are given by the individual manufacturers. The appropriate Manufacturers' Literature is contained in Part 11 of this manual.

Table A.2 - Sample fault finding check-list

Fault	Possible cause	Action
Boiler shuts down	Over-temperature has activated the high limit thermostat	Reset the high limit thermostat
	Pressurisation unit, pressure failure	Check pressurisation unit status Switch operated interlocks
	Boiler burner failure	Check burner in accordance with manufacturer's instructions
	Loss of gas supply to burner	Check that gas supply safety fire valve is still OPEN - reset if necessary Check that manual isolating cocks are OPEN
	Etc.	Etc.
LPHW pump high suction pressure	Closed or partially closed suction valve	Open suction valve
LPHW pump high discharge pressure	Closed or partially closed discharge valve	Open discharge valve
LPHW pump excessive gland leakage	Worn mechanical seal	Renew seal
LPHW pump unusual noise or vibration	Closed valve or bearing failure, or loose mountings and securing bolts	Check valves are open, check pump bearings, check alignment
Etc.	Etc.	Etc.

A.10 Part 8 - Recommended spares

When ordering spare parts please specify the details on the plant nameplate including model number and serial number.

Table A.3 - Sample list of recommended spares

Part Description	Part No.	Number of recommended spares
1.5 HP 3 phase motor	XXXXXXXX	1
Fan Impeller	XXXXXXXX	1
Electrode	XXXXXXXX	2
Mounting Gasket	XXXXXXXX	2
Etc.	Etc.	Etc.

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Annex B
(informative)

Example of an address list

B.1 General

The purpose of this annex B is to provide guidance to the author(s) of OM&U documents on the possible contents of an address list (refer to 4.1).

For any particular set of OM&U documents, any part of the example of this annex B can be relevant or not relevant.

B.2 Designer and installer of the plant

B.2.1 Plant designer

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.2.2 Installer of the plant

Headquarters: Branch office:
Service department:

B.3 Operation and maintenance companies

B.3.1 Contract operation and maintenance company / emergency service

Headquarters: Branch office:
Service department:

B.3.2 Burner emergency service

Headquarters: Branch office:
Service department:

B.4 Authorities/public utility company

B.4.1 Fire brigade

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.4.2 Police

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.4.3 First aid/Hospital

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5 Fuel and energy suppliers

B.5.1 Oil supplier/gas supply company

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5.2 Emergency service of the gas supply company

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5.3 District heating supply companies

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5.4 Electricity supply company

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5.5 Electrical contractor

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:
Accommodation address:

B.5.6 Chimney sweep

Name: Street/post office: Postal code/place:
Telephone: Fax: Telex:

Accommodation address:

B.6 Manufacturer/supplier of plant components

B.6.1 Gas train

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.2 Fuel storage plant and system

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.3 Safety devices for tank systems

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.4 District heating transmitter station

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.5 Heat generator

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.6 Burner

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.7 Flue gas plant/components

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.8 Domestic hot water plant

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.9 Circulating pump

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.10 Automatic control system/ control fittings/control system

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.11 Safety devices for heat generators

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.12 Measuring systems, calorimeter

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.13 Heating surfaces

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.6.14 Floor-heating system

Manufacturer: Supplier:
Sales agency: Service department of the company:

B.7 Suppliers of incidentals

B.7.1 Chemicals for corrosion prevention

Headquarters: Branch office:

B.7.2 Water treatment etc. (like inhibitors - salt)

Headquarters: Branch office:

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