

Estates Development & Projects

Production Guidelines for the Operating & Maintenance Manuals (Mechanical & Electrical Services)

Guidance for the Technical Author


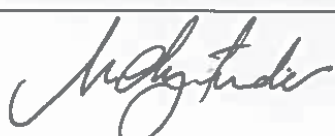
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Document History

Revision History

Revision Number	Revision Date	Summary of Changes
Rev 10	February 2016	
Rev 10.1	February 2017	<ul style="list-style-type: none">• Updated 5.0 Draft Manuals review process• Updated 8.0 Manual format• Removed Appendix (ii) Asset Schedule – superseded by appendix iv in document RM09• Changed all references of Supervisor to Compliance Monitor

Approvals

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Contents

Part 1: Production Guidance

- 1.0 [Introduction](#)
- 2.0 [Purpose of the Operating & Maintenance Manuals](#)
- 3.0 [Health & Safety Pro Forma](#)
- 4.0 [Design Criteria Requirement pro forma](#)
- 5.0 [Draft manuals review process](#)
- 6.0 [Asset Registers](#)
- 7.0 [Specialist Stand-alone Manuals](#)
- 8.0 [Manual Format](#)
- 9.0 [Cover and Spine format](#)
- 10.0 [Production of As-Built Drawings](#)
- 11.0 [Production and Distribution of Manuals and Drawings](#)

Part 2: O&M Manual Standard Contents

Standard Index of Contents

- 1.00 [General Description of the Installation](#)
- 2.00 [Specific Health & Safety Issues](#)
- 3.00 [Plant Data Information](#)
- 4.00 [Test Certificates and Commissioning Data](#)
- 5.00 [Manufacturers' Literature](#)
- 6.00 [Record Drawings](#)
- 7.00 [Specialist Services](#)
- 8.00 [Building Management System / Controls](#)

Appendices

[Appendix \(i\)](#) Example Manual cover, spine and CD labels

[Appendix \(ii\)](#) Table of M&E Record requirements.

Part 1: Production Guidance

1.0 Introduction

This document provides guidance for the production of the Mechanical and Electrical Services' Operating & Maintenance Manuals (O&Ms) for Imperial College London construction projects. The contents of this document are aimed at the Technical Author appointed to produce the manuals.

This should be read in conjunction with *Record Document Process Guidelines (RM09 rev 1.1)* the *Production Guidelines for Building Fabric Manual (including Health & Safety File) (RM07 Rev10)* and the Technical Author's Scope of Services.

It is the responsibility of the Contractor to deliver all O&Ms and associated Record Drawings as a required deliverable of the works carried out. To enable the manuals to be produced to the standard required by the College, they are to appoint a Technical Author from the College's approved list.

Refer to the *Record Document Process Guidelines (RM09 rev 1.1)* for an outline of individual responsibilities and record document production process.

The intention is to provide a document that meets statutory and operational requirements, whilst being user friendly and compatible with the College's document management system

2.0 Purpose of the Operating & Maintenance Manuals

These guidelines are for the specific use on projects where separate mechanical and electrical Operating and Maintenance manuals are required.¹

The O&Ms offer the personnel concerned with the operation and maintenance of College infrastructure and services the necessary knowledge and skills to perform their duties.

Specific health and safety information, relating to the mechanical and electrical services is included in [Section 2.00](#) of the O&Ms for the installations involved. These are to be read in conjunction with the full Health and Safety information on the project included within the Building Fabric manual.

The format and style in which the O&Ms are produced is designed to:

- Minimise repeated information from one project to another
- Minimise the space needed for archiving
- Ease of referencing of information
- Allow improved use of the manuals
- Enables electronic access via Imperial College's Pythagoras Space Management database
- Act as an aide memoir to the project team
- Develop the use of barcode plant labelling
- Provide an authentic, archival, record of the works carried out.

¹ On projects with minimal mechanical and electrical works, there may be no requirement for a separate set of O&Ms and this information will instead be included in Section 10 of the Building Fabric Manual. Refer to guideline document RM07 for further information on the production of Building Fabric manuals.

3.0 Health & Safety Pro forma

This information is specific to the maintenance requirements covered in the O&Ms and not a repeat of general information included in the Building Fabric Manual /Health & Safety File.

The form is issued by the Technical Author for completion by all parties and collated by the Principal Designer. This is then returned to the Technical Author for inclusion in Section 2 of the O&Ms.

Specific Health and Safety Pro Forma

Building Name		
Level(s) and Project Name		
Imperial College London Project Number		
Imperial College London Document Ref. Number		
Information Compiled by	Company Name	Individual's Name
Special Access		
Residual Risks		
Special Maintenance		

The information on this form is a summary of the unusual issues relating specifically to the building services for this project. For full Health and Safety information reference should be made to the Health and Safety File for the project

4.0 Design Criteria Requirement Pro-forma

This form is issued by the Technical author for completion by the designers. It is to be returned to the Technical Author for inclusion within Section 1 of the O&M's

Design Criteria Pro Forma

Building Name		
Level(s) and Project Name		
Imperial College London Project Number		
Imperial College London Document Ref. Number		
Information Compiled by	Company Name	Individual's Name
External Conditions	Summer Temperature Winter Temperature Noise Criteria	
Internal Conditions	Name of Space Summer Temperature Winter Temperature Ventilation Rate Noise Criteria Lighting Level Occupants	
	Name of Space Summer Temperature Winter Temperature Ventilation Rate Noise Criteria Lighting Level Occupants	
	Name of Space Summer Temperature Winter Temperature Ventilation Rate Noise Criteria Lighting Level Occupants	

5.0 Draft manuals review process

Drafts of the O&Ms will be issued for review in accordance with the Project Handover Plan and in sufficient time to allow for the final copies to be issued at completion. Format of draft versions to be decided at the Record Document Strategy Meeting, however in most instances electronic format would be the preferred review format.

The initial document for early stage review will contain only certain project information compiled at this stage, which should include items such as:

- Scope and location of works
- Project Directory
- Schedules of literature and certificates
- Schedules of drawings (drawing registers)

Items such as literature, drawings or certificates themselves may not yet be available or to be issued for comment under separate cover.

The purpose of the draft at this stage is to ensure that the manual is being set out correctly, that key project information is correct and evidences that information for the other sections is in the process of compilation.

This draft should be reviewed by the Project Manager, Contractor and Compliance Monitors to ensure the documentation accurately reflects the works carried out.

The first complete draft will be issued by the Technical Author to the reviewers agreed at the Record Document Strategy Meeting at the agreed date prior to completion. This draft should include finalised literature and drawings, with notification of any commissioning certificates for insertion at completion. This review must also ensure any changes made to the scope of works since the first draft have been updated and incorporated.

Any comments on missing, incomplete or inaccurate information should be addressed to the Technical Author to report back to the Contractor. The Technical Author is to compile a tracker of comments, which will be updated when comments are addressed. A copy of the tracker, when completed, should be issued with the completed manuals as a record that the content has been reviewed to the satisfaction of all parties concerned.

Following any final corrections and all parties are satisfied with the content, the Project Manager should carry out a final technical review.

After the final technical reviews are completed and approved, a fully hyperlinked final draft (electronic format) should be sent to the Records & Archives Officer (Projects) to carry out the Composition Review. The purpose of this review is to ensure the format meets with the College requirements and any specific items agreed in the Strategy Meeting have been addressed.

The Technical Author is to escalate failure of timely submission of literature from contractors along with delays in the review or collation process to the Project Manager, for addressing at the next project team meeting.

Refer also to *RM09 Record Document Process Guidelines* – Section 3: Responsibilities, for an outline of responsibilities within the project team.

6.0 Asset Registers

The Contractor is responsible for producing an Asset Register spreadsheet as part of the project process. Once completed, this will be included on the final O&M CDs as a record of the assets removed or installed as part of these works.

A draft version should be requested from the Contractor for the purpose of collating the manual and distributing the draft O&Ms for comment. This must then be replaced by the final completed version during the commissioning stage of the works, in time for the completed issue of the record documents at completion.

Refer to document *Record Document Process Guidelines (RM09 rev 1.1)* for full details on this process including the schedule of Asset information requirements.

7.0 Specialist Stand-alone Manuals

Some specialist services will require the production of a self-contained manual. The requirement for this would be determined at the Record Document Strategy Meeting. Examples where this may be required include:

- New Fire Alarm installations
- Lifts
- Catering Equipment
- BMS – **only** if agreed at the Record Document Strategy meeting that this should be produced as a separate file.

These manuals must, as far as practical, be produced to the same format as the O&M manuals.

Any drawings produced for Specialist Manuals must also be checked by the CAD Manager to confirm whether compliance to the College CAD Strategy is required.

Delivery of any separate specialist manuals must be included with the O&Ms for completion to be given to the project.

8.0 Manual Format

The contents of the O&M manuals will consist of 7 sections (8 Sections for the Mechanical Services Manual) with information arranged as described in Part 2 of these guidelines.

Paper and Electronic copies are required, refer to [Part 1 Section 11](#) for quantities

The typeface to be used is Arial. Other fonts should only be used in specific applications where the use of Arial is not possible or appropriate (e.g. mathematical formulas).² When using the Imperial College logo, always use the original artwork and completely unaltered. The logo is available upon request from Imperial College Communications Division: <http://www.imperial.ac.uk/graphicidentity/applyingthegraphicidentity/usingthelogo>

Hard copy format

The hard copy manuals are to be issued in hard cover A4 4-ring binders in the following colours:

- Mechanical – blue
- Electrical – green

² Refer to Imperial College's Graphic Identity webpages for further information, including the "house style": <http://www3.imperial.ac.uk/graphicidentity>

- Fire Alarm – red

Where coloured ring binders cannot be obtained, use of the appropriate coloured card for the spine and front cover labels will clearly denote the type of manual. Ensure the coloured card is pale enough for the labelling to be clearly read.

Sections should be clearly denoted through the use of wide subject dividing cards. Refer to the next section for labelling details.

Electronic format

The electronic manual is to be issued on CD as a single pdf file (excluding drawings, which are to be issued in a separate sub-folder). The document must be fully hyperlinked and not link to files or documents contained in external folders on the CD or other source. The hyperlinks must link to/from the following:

- Contents page to each section of the manual
- Each section's index page to each item
- Plant names in the description of the plant data
- Manufacturers' names in the plant data to their contact details
- Model numbers in the plant data to their literature.
- Any reference to an item found elsewhere in the manual.

The document needs to be user friendly, enabling the user to review all sections independently via the hyperlinks and without having to scroll through the entire document.

The CD should contain only the following items:

- One version of the manual in an editable pdf format, enabling the information to be extracted or updated
- One version of the manual saved in PDF/A format, to provide an authentic record suitable for long term preservation.³
- An asset register in excel format.
- A folder of as-built drawings in pdf and dwg format (meeting the College CAD strategy). These are to be fully itemised in the schedule of drawings in Section 6 of the manual.

Zip files are not to be used. Should the quantity of records be too large to fit onto a single disc, contact the Archives Officer (Projects) to agree on an alternative.

No other documents should be issued as a separate file unless agreed in the Record Document Strategy meeting and included on the Tracker (for example a complex specialist contractor manual, as outlined in Section 7 of these guidelines).

Unless this has been agreed, all sub-contractor literature needs to be incorporated within the manual's pdf document.

Literature which has been issued as a separate file or incorporated within another manual should be cross-referenced in the appropriate section, to aid the user in locating the information.

9.0 Cover and Spine format

The front cover and the spine of the hard copy manual must provide easy reference to relevant project information so that the user can source the appropriate information from the correct manual.

³ The 'A' in PDF/A stands for 'Archive' and signifies that the format has been confined to basic PDF features to simplify its long term preservation. Its adoption assists in the preservation of PDF files by preventing encryption, digital rights mechanisms and other features which impede preservation. PDF/A was ISO-approved in 2005 (as ISO 19005-1).

- Operating & Maintenance manuals front cover and spine text are to be produced on white card to ensure text is readable against the coloured files.*
- Text must include the project number, document reference number, project title, building, date of issue, type of manual, contractor's details. Contact the Archives Officer (Projects) to obtain the agreed project name and reference numbers.
- Where more than one volume is required, the spine label must also include a schedule of information contained within that specific volume ie Section number and headings.
- CDs must also be labelled with the same project information (excluding schedule)

Refer to [Appendix \(i\)](#) for sample cover, spine and CD templates. Editable versions of these templates can be obtained from the Archives Officer (Projects) upon request.

* refer to exception in Section 8 where coloured ring binders cannot be obtained.

10.0 Production of As-Built Drawings

The O&Ms require all Mechanical, Electrical and Public Health drawings produced as an outcome of the completed works.

These drawings must be issued as final As-built/As-installed status and produced to the College CAD Strategy.

Refer to: <http://www.imperial.ac.uk/estates-projects/space-management/cad-strategy/>

Details of the drawing approval process are outlined in the *Record Document Process Guidelines (RM09 rev 1.1)* as this will have commenced at Stage 2 Design.

By construction stage, drawings are expected to be produced to the CAD strategy, however final sample drawings should be resubmitted at Stage 5 (Construction) to cadcompliance@imperial.ac.uk to confirm that this has been followed and the room numbering is correct.

A full set of hard copy drawings must be included in the hard copy manual, printed to the size specified on the drawing scale and folded down to A4 for insertion into the file. An additional set, as noted in the table, is to be delivered in A4 4-ring binders titled Record Drawings (refer also [to Appendix \(i\)](#) for required project information on cover label)

For large quantities of drawings, which may not be practical to deliver in binders, alternative storage is to be agreed with the Archives Officer Projects; to ensure they are stored in a manner suitable for long term preservation whilst meeting storage and access requirements

Electronic format drawings are to be issued in dwg and pdf formats as per the quantity specified in the table in the next section.

11.0 Distribution of Manuals and Drawings

Unless otherwise agreed at the Record Document Strategy meeting the standard quantity is

- 1x hard copy manual including drawings
- 2x CD copy manual including drawings
- 1x additional set of hard copy drawings (folded to A4 and inserted in a labelled, coloured lever arch file, as per the hard copy Manual format)

Mechanical and Electrical manuals are to be produced as two separate sets of record documents, unless otherwise agreed in the Record Document Strategy meeting (for example where one element is minor and would make more sense to include in a single manual)

The table in [Appendix \(iii\)](#) details the production and distribution of Mechanical & Electrical record documents required by the College. This includes complete sets of as-built drawings produced in line with the College CAD Strategy.

All hard copy and CD copies of the drawings and manuals are to be issued to the Archives Officer (Projects) in Estates Projects Division without exception. Anything issued directly to any other department cannot be guaranteed as the final issued Record Documents.

Part 2: O&M Manual Standard Contents

The following is the standard index of contents for the Mechanical and Electrical Services O&M manuals. Should any section not be applicable to the nature of the works, do not omit the section, instead it should be noted that the section is “not applicable” Any specialist services stand-alone manuals should also follow this layout as far as is practical.

- 1.00 [General Description of the Installation](#)
- 2.00 [Specific Health & Safety Issues](#)
- 3.00 [Plant Data Information](#)
- 4.00 [Test Certificates and Commissioning Data](#)
- 5.00 [Manufacturers' Literature](#)
- 6.00 [Record Drawings](#)
- 7.00 [Specialist Services](#)
- 8.00 [Building Management System and Controls](#)

Detailed Description of Contents:

Refer to the following pages for further details of what is to be included in each section.

1.00 General Description of the Installation

This section provides an overview of the document, file holders responsibility, project and location details. This section should commence with a Document Revision Record

1.1 Introduction

A brief outline of the regulatory responsibilities that require the production of this file. Reference to any other records which should be viewed in conjunction with this file. Users' responsibilities on acceptance and use of the records.

1.2 Incoming Services Location

Details of incoming services to the project area – for example, mains water, gas, electricity

1.3 Directory of Project Team Members

A schedule of names and contact details of key personnel involved in the Mechanical and Electrical aspects of the project.

1.4 Brief Description of Installation

This section consists of a summary description of the Mechanical, electrical and public health services installed. The section should commence with a basic description of the scope of works that this file covers, including a summary of all rooms/areas affected by the works.

Related services referred to in this manual but produced in a stand alone manual (for example a Fire Alarm Manual or BMS/Controls system) should be cross-referenced in this section, so that users know where to refer to for the information.

1.5 Design Criteria

The Design Criteria Pro-formas detailed in [Part 1 Section 4](#) of this guideline document are to be included in this section.

2.00 Specific Health & Safety Issues

This section is for the Principal Designer's H&S Pro-forma detailed in [Part 1 Section 3](#) of this guideline document. This should only include information specific to the maintenance requirements covered in this O&M.

3.00 Plant Data Information

This section provides information on the plant detailed in the Asset Register (which is to be issued as a separate excel document on the CD copy of the manual).

Information in this section is to include (but not limited to):

- Equipment Data
- Directory of Manufacturers
- Directory of Specialist Sub-contractors
- Recommended Stocked Spares
- Lubricants
- Tools and Equipment

Plant data must be linked, via internal hyperlinks, to/from relevant literature, certificates, drawing schedules etc located elsewhere within the manual.

4.00 Test Certificates and Commissioning Data

For ease of reference, this section is to commence with an index/table of certificates and commissioning data for each system, hyperlinked to each applicable document(s) which follow within the section.

5.00 Manufacturers Literature

This must include all plant and systems which require maintenance or for which the manufacturer produces an O&M leaflet – e.g. Boilers, Pumps, Chillers etc. This should be information specific to the project and not a bulk of generic manufacturer's brochures.

Refer to the Asset Information Requirements in Appendix iv of RM09 Record Document Process Guidelines for an outline of the types of equipment which require literature, drawings and certificates.

Equipment information must be linked, via internal hyperlinks, to any test certificates and commissioning data included in Section 4.

6.00 Record Drawings

This section is for the respective mechanical/electrical drawings produced for the works and includes:

- Schedules of the drawings included in this manual
- Hard copy drawings
- Electronic format drawings in a sub-folder on the same CD as the respective manual.

It is essential that these are the final As-built/As-installed drawings issued by the M&E Contractor and must be produced to the College CAD strategy, approved by the College CAD Manager.

This must include all relevant schematic drawings and the Metering Strategy.

Refer to:

- [CAD Strategy](#). (external link to College website)
- [Technical Policy Statement EN7b Metering of M&E Systems](#) (external link to College website)

7.00 Specialist Services

This section is specifically designed for maintenance instructions which are not detailed in the College generic maintenance and fault finding documentation issued to all Maintenance Managers.

This includes those services for which a specialist maintenance contract may be required e.g. Structured Cabling system, CCTV, Access Control, updates to the Fire Alarm system (note that a new Fire Alarm installation **must** have its own separate manual), Fume Cupboards, Laboratory Gases, Lightning Protection, Lifts etc.

8.00 Building Management system and Controls (Mechanical O&M only)

This will include a general description, control drawings, strategy diagrams etc so that it can be read as a standalone document.

This must be the final document, produced after commissioning.

In the majority of cases, BMS will be included in the Mechanical Services O&M, however some circumstances may permit this to be produced as a standalone file. For example if commissioning was scheduled for a later date or for larger projects, to reduce the bulk of the manual. This will be decided at the Record Document Strategy Meeting or final pre-handover meeting should the scope of works change.

Appendix (i) Manual and CD labelling

The front cover and the spine of the manuals must provide easy reference to relevant project information so that the end user can source appropriate information from the correct manual.

All copies of CDs issued must also have this information labelled on the spine (excluding schedule of information)

Key information for the labels consists of:

- Project Number
- Document Reference Number
- Project Title
- Building Name
- Type of Manual
- Contractor details
- Date of Issue
- Schedule of information contained within that specific volume ie Section Number and Headings.

The front cover and spine text are to be produced on white card to ensure text is readable. Refer overleaf in Figures 1.1, 1.2, 1.3 for sample cover, spine and CD labels

An editable version of the templates in Word format is available upon request from the Archives Officer (Projects)

Figure 1.1: Sample Cover

Operation and Maintenance Manual

**Imperial College
London**

**Advanced Manufacturing Facility
Levels L & LG Mezzanine, Royal School of Mines
South Kensington Campus**

Electrical Services Manual

Practical Completion	:	December 2009
Project Number	:	RSM0704
Document Reference	:	B/RSM/018
Volume	:	One of Two

M&E Contractor

Company Name
Address line 1
Address line 2
Address line 3

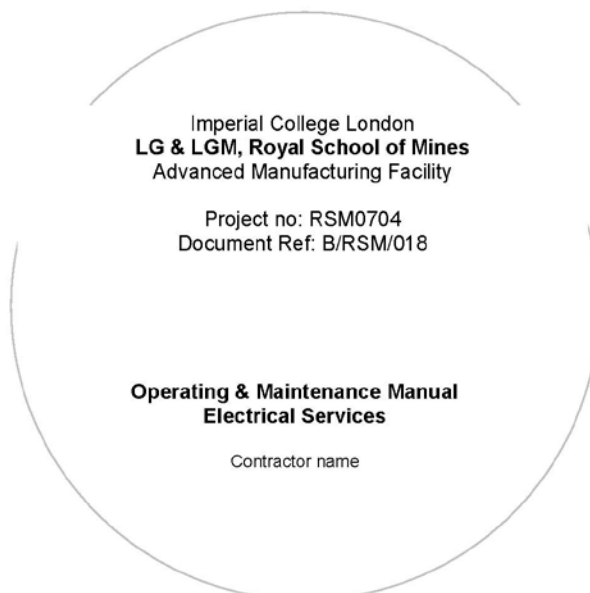
Tel: (...)

Figure 1.2 Spine Template

Imperial College London	Levels LG & LG Mezzanine, Royal School of Mines Advanced Manufacturing Facility	Section 1: General Description of Installation Section 2: Health and Safety Information Section 3: Plant Data Schedules Section 4: Test Certificates & Commissioning Data Section 5: Manufacturer's Literature	Volume 1 of 2
	Operation and Maintenance Manual Electrical Services Manual	<i>[complete this section for manuals consisting of more than a single volume: to be edited as applicable to the volume contents]</i>	
	Project Number: RSM0704	Document Reference: B/RSM/018	

O&M Manual Spine template

Figure 1.2 CD Template



Appendix (ii) Table of M&E Record requirements.

This table summarises in detail the record types and quantities required for issue as part of the O&M Manuals package.

Electronic format drawings are to be saved in a sub-folder on the respective manual's CD, with the schedules included in Section 6.

	Estates Projects Archive	Estates Facilities	Other	Total
MANUALS				
Electrical Services Hard copy	1			1
Electrical Services CD copy	1	1		2
Mechanical services Hard copy	1			1
Mechanical Services CD Copy	1	1		1
Fire Alarm (new system install) Hard copy	1			1
Fire Alarm (new system install) CD copy	1	1	1	3
Specialist O&M (if applicable) Hard copy	1		Additional copies where agreed at strategy meeting	1*
Specialist O&M (if applicable) CD copy	1	1	Additional copies where agreed at strategy meeting	2*
DRAWINGS				
Electrical Drawings Hard Copy	1	1		2
Electrical Drawings dwg + pdf	1	1		2
Mechanical Drawings Hard copy	1	1		2
Mechanical Drawings dwg + pdf	1	1		2
Fire Alarm drawings (new system install) Hard copy	1	1		2
Fire Alarm drawings (new system install) dwg + pdf	1	1	1	3
Specialist services Hard copy	1	1		2
Specialist services CD copy	1	1		2

*total quantity of Specialist Manuals may vary in accordance with requirements agreed at strategy meeting. For example, the master copy may be incorporated within the O&M and additional stand-alone copies produced for distribution as required.