Facilities maintenance management – Code of practice
Contents

1 Scope 5
2 Normative references 5
3 Terms, definitions and abbreviations 6
4 Facilities maintenance 8
5 Facilities maintenance planning 11
6 Maintenance approach 20
7 Factors affecting maintenance 23
8 Performance management 30
9 Facilities information management 34

Summary of pages

This document comprises a front cover, an inside front cover, pages i to x, pages 1 to x, an inside back cover and a back cover.
Foreword

Publishing information
This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on XX Month 201X. It was prepared by Technical Committee FMW/1, Facilities management. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession
This British Standard supersedes BS 8210:2012, which is withdrawn.

Information about this document
This British Standard does not prescribe “how to do maintenance” but acts as the basis of an approach for achieving successful maintenance outcomes for a range of facilities. It is intended to assist facility owners and operators, or those acting on their behalf, in regard to facilities maintenance management in aligning the formulation and implementation of maintenance strategies and policies to the core objectives of the organization in the most efficient and effective way.

This is a full revision of the standard, and introduces the following principal changes:

- the incorporation of practices based upon a business-focused or risk-based process for determining maintenance recommendations, changing this British Standard from a Guide to a Code of Practice;
- greater consideration of environmental factors and how these might impact maintenance strategies, policies and plans;
- further guidance arising from developments in technology affecting the nature of facility assets and the maintenance management process, in particular the use of information and communications technology (ICT) and smart systems, have been taken into account.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document
As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions
The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).
Contractual and legal considerations
This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.
1 Scope
This British Standard gives recommendations for the maintenance management of facilities by:

a) outlining a business-focused or risk-based process approach to maintenance management at the strategic and tactical levels, with links to operational activities;

b) assisting organizations and individuals to formulate strategies and policies for maintenance management;

c) assisting those responsible for ensuring that facility assets continue to perform as intended, retaining their asset value at minimum cost;

d) highlighting the importance of regular and planned maintenance as a value-adding activity; and

e) highlighting relevant areas of importance with regard to occupational health and safety and information management.

NOTE It might be necessary and economically desirable to carry out maintenance at the same time as improvements, additions or alterations.

This British Standard applies to most types of building-related facilities, for example, those for health care, education, housing, manufacturing and distribution, commerce, retailing, utilities, communication and transportation.

The term “organization” is used throughout this document to refer to the entity with responsibility for facilities management, including facilities maintenance management. The term “user” has been adopted to refer collectively to occupants, service personnel and occasional visitors to a facility.

This British Standard does not give recommendations on:

1) the procurement of services for maintenance (see BS 8572);

2) how to carry out different types of maintenance;

3) any improvements, additions or alterations to a facility that would make it suitable for a purpose other than that for which it was designed (see BS 8536-1);

4) cleaning facilities (see BS 6270-3); and

5) maintenance of engineering infrastructure.

2 Normative references
The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7671, Requirements for Electrical Installations – IET Wiring Regulations

BS 8536-1, Briefing for design and construction – Part 1: Code of practice for facilities management (Buildings infrastructure)

BS 8572, Procurement of facility-related services – Code of Practice

BS EN ISO 22301, Security and resilience – Business continuity management systems – Requirements

BS EN ISO 41012, Facility management – Guidance on strategic sourcing and the development of agreements
3 Terms, definitions and abbreviations

3.1 Terms
For the purposes of this British Standard, the following terms and definitions apply.

3.1.1 asset register
collection of records holding information about facility assets in terms of their manufacturer, vendor, make, model, specifications, date of acquisition, initial cost, maintenance costs and requirements, accumulated depreciation and written-down value

[SOURCE: BS 8587:2012, 3.1.3]

3.1.2 balanced scorecard
performance measurement tool

3.1.3 building fabric
elements and components of a building other than furniture and engineering installations

3.1.4 building information modelling (BIM)
use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions

[SOURCE: BS EN ISO 19650-1:2018, 3.3.14]

3.1.5 building management system (BMS)
computer-aided control systems, including hardware and software, to collect and monitor parameters and performance data of plant, equipment, systems and elements either at source or remotely and to enable corrective action to be initiated

3.1.6 building physicist
person with knowledge and experience of the behaviour and performance of buildings and their components under the influence of physical, chemical and biological phenomena

3.1.7 computer-aided facilities management system (CAFM)
systems, applications and tools that automate functions needed to support the core business in its efficient and effective use of facilities

3.1.8 computer-aided maintenance management system (CMMS)
system specifically designed to enable planning, organizing, directing and controlling maintenance programmes and to collect and collate historical data on the performance of assets so the most effective maintenance is selected under actual performance and environmental conditions
3.1.9 condition monitoring
act of measuring and recording data from operating parameters, using either human senses or instrumentation, to verify plant and equipment condition and trends

3.1.10 corrective maintenance
maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function

[SOURCE: BS EN 13306:2010, 7.5]

3.1.11 critical environment
area or location that, in the event of its non-availability, would have a significant negative impact upon business processes and activities

3.1.12 element
functional part of a building or other facility

3.1.13 facilities maintenance
work needed to maintain the performance of the building structure, fabric and components, and engineering installations

3.1.14 facility
collection of assets which is built, installed or established to serve an entity’s needs

[SOURCE: ISO 41011:2017, 3.2.3.2]

3.1.15 facility asset performance
requirements in terms of measurable outcomes to meeting organizational goals

3.1.16 facility management strategy (facilities management strategy)
statement expressing the analysed needs of the demand organization, proposed facility management (FM) solution(s) and outline plan for implementation

3.1.17 integrated workplace management system (IWMS)
software platform for optimizing the use of workplace resources

3.1.18 maintenance management
process of ensuring that the most effective and efficient maintenance programme is formulated and delivered to ensure that assets continue to perform their intended function

3.1.19 maintenance manual
technical instructions intended to preserve an item in, or restore it to, a state in which it can perform a required function

[SOURCE: BS EN 13460:2009, 5.3]

3.1.20 maintenance plan
structured and documented set of tasks that include the activities, procedures, resources and the time scale required to carry out maintenance

[SOURCE: BS EN 13306:2010, 2.5]

3.1.21 maintenance policy
scope and course of action taken to achieve an organization’s objectives

NOTE This can include requirements related to regulations and standards to be observed during maintenance.
3.1.22 maintenance programme
arrangement of maintenance tasks in terms of their sequence, durations and resource requirements

3.1.23 maintenance strategy
statement of organizational approach to maintenance management

3.1.24 operational plan
organization’s statement of actions intended to achieve a specific business goal(s)

3.1.25 planned preventive maintenance
maintenance organized and carried out with forethought, control and the use of records to a plan based on the results of condition surveys

3.1.26 reliability centred maintenance (RCM)
systems-based methodology used to determine maintenance tasks required to ensure that a facility asset or system continues to function in order to fulfil its purpose as designed in its present operating context

3.2 Abbreviated terms
For the purposes of this British Standard, the following abbreviations apply.
- CAFM computer-aided facilities management system
- CMMS computer-aided maintenance management system
- IWMS integrated workplace management system

4 Facilities maintenance

4.1 General

COMMENTARY ON 4.1
A well-defined facilities maintenance strategy supports an organization’s goals, whereas a poorly defined or absent strategy can have significant adverse safety and commercial consequences for the organization. The effectiveness of an organization to fulfil its environmental and social responsibility commitments and targets is also dependent upon an effective maintenance strategy. Since targets are subject to revision and are progressive, a static maintenance arrangement is unlikely to meet the developing needs of the organization. A review process is particularly important as changes, for example, to health, safety, security and the environment can impact the way in which maintenance is undertaken.

The organization should formulate a facilities maintenance strategy and policy that meets its current and likely future needs, including those relating to any new or refurbished facilities, in accordance with BS 8536-1. The strategy and policy should be reviewed, at least annually, to ensure that it continues to be aligned to the organization’s core business and primary processes. The organization should ensure that the needs of its stakeholders are identified and the impact of those needs is assessed and taken into account when formulating the strategy and policy. A communication plan to disseminate the strategy and policy, as well as tactical and operational actions, to stakeholders should be prepared by the organization. Details of annual, or more frequent, reviews to check on the alignment between actions and the organization’s facilities maintenance strategy should be included in the plan.

NOTE 1 BS ISO 55001 gives guidance on the high-level approach to the management and maintenance of physical assets, including those related to constructed facilities. BS 8544 provides detailed guidance on the life-cycle costing of maintenance and BS ISO 15686-5 provides guidance on the wider context for the life-cycle costing of facilities.

Where a new facility is being procured, the organization should ensure that operational requirements, including those concerning maintenance, are taken into account during briefing and design.
NOTE 2 BS 8536-1 gives recommendations on an appropriate approach for organizations and their design and construction (or delivery) teams.

The organization should be mindful of the restrictions or constraints that additional requirements imposed by non-governmental organizations might have on its obligations and duties with respect to maintenance of its facilities.

NOTE 3 “Blue tape” refers to the extra burdens placed on organizations by other organizations or their representative industry or professional bodies, often encouraged by government or its agencies in line with prevailing policy. In simple terms, it can be seen as additional administration and is in contrast to “red tape” which stems directly from government or its agencies. The organization needs to be aware of the time and cost involved in complying with “blue tape”, including any additional requirements placed on a service provider and the basis for recompensing the latter.

4.2 Maintenance strategy

NOTE Facilities maintenance strategies can embody different methods of maintenance, e.g. scheduled preventive, condition-based, corrective or a combination of these and other methods (see Clause 6). Attention is drawn to “CIBSE Guide M: Maintenance engineering and management” [1], which includes guidance on maintenance strategy, business risk assessments, maintenance contracts, condition surveys and maintenance audits.

The facilities maintenance strategy should define the criteria by which an appropriate method or combination of methods of maintenance can be assessed (see Clause 6). This strategy should form an integral part of the organization’s facilities management strategy. Where no facilities management strategy exists, such a strategy should be prepared to support the organization’s core business and primary processes (see BS EN ISO 41014).

The supply chain below the principle service provider, especially specialist providers, should be included in any briefing on the facilities maintenance strategy.

4.3 Maintenance policy

4.3.1 General

COMMENTARY ON 4.3.1

Facility assets need to be maintained to ensure that:

a) they are suitable for their intended purpose;

b) they continue to perform their function throughout their useful life in a safe and efficient way; and

c) their value is protected.

Ignoring maintenance risks the failure of systems and components and incurs needless additional cost, as well as threatening business continuity. Lack of maintenance can arise, in part, from a belief that a facility is a long-lived asset that deteriorates gradually. Even so, failure to maintain the structure and fabric can affect its function and presents safety risks in addition to reducing the value of the facility as an asset.

Requirements for the health, safety and security of persons in and around a facility, coupled with the need to discharge the responsibilities of ownership, mean that an organization would benefit from adopting a proactive approach to its facilities maintenance management. The maintenance requirements of a facility are, to a large extent, a consequence of its original design and construction. Inefficient design, inappropriate specifications and poor-quality work can result in faults that are subsequently difficult and expensive to diagnose and remedy. Inappropriate maintenance and repairs amount to unnecessary cost and inconvenience, which can be compounded by further attempts to remedy faults.

A policy should be developed to support the preparation of operational plans in accordance with the maintenance strategy. The policy should outline the scope (see 4.3.2) and course(s) of action that should be taken to achieve the organization’s goals (see 4.1). Organizations should ensure that suitable expertise is available for maintenance and its management at all levels within the organization. Where this expertise is not available in the organization, external resources should be employed. Persons responsible for managing the maintenance of facilities, including engineering installations, should possess appropriate management ability and technical competence.

1 In preparation.
**4.3.2 Scope of policy**

The maintenance policy should reflect the principle of best value for money (see BS 8572) to protect both the asset value and the resource value of the facility. The policy should cover:

a) the organization’s anticipated future requirements for the facility, taking into account the facility’s physical performance, functional suitability and energy performance, for example:

1) the use of the facility, i.e. anticipating likely upgrades and the effect on the life cycles of existing materials, components and engineering installations including energy performance (see 7.2);

2) progressive reduction in energy consumption to achieve a zero-carbon footprint for the facility;

3) a change of use for the facility and the effect of any conversion work on the life cycles of existing materials, components and engineering installations including energy performance (see 7.2); and

4) the anticipated date of conversion, renovation or refurbishment work;

b) any cycles of maintenance determined in accordance with 4.3.2 a);

c) the method of maintenance, taking account of cycles of maintenance [see 4.3.2 b)] together with the requirements of the organization with respect to the use of the facility and any special requirements to which this might give rise;

d) holding spare parts and other items to replace those that are beyond repair or which have exceeded their useful life (see 9.9.6); and

e) the means for reporting on performance achieved.

**4.4 Risk management**

Risks that could affect the performance of the facility should be systematically assessed to identify any condition or event that could impact negatively or positively on its operation or affect the asset value and resource value of the facility. The assessment should include identification and analysis of downside risk events and upside opportunities and their proposed treatment. Details of such events and the actions arising should be recorded in a risk register.

**NOTE 1** Downside risks are factors that can have a potentially negative impact (i.e. threats) on the facility (e.g. unusual hazards faced in certain maintenance work and inability to obtain spare parts in the future). Upside risks are factors that can enhance or add value to the outcome and are more commonly referred to as opportunities. The latter might arise from a re-examination of the scope of maintenance work (e.g. changes to take advantage of more energy-efficient technology).

For downside risks (i.e. threats), actions should be explored to reduce or avoid their potential impact. For upside risks (i.e. opportunities), actions should be explored to realize or enhance the improvement. The risk register should be kept up to date so that it reflects the current status and condition of the facility and its assets.

A business-focused or risk-based model of facilities management should be adopted by the organization, which should first review its business objectives and needs to ascertain the consequences of the failure of any aspect of the facilities on its primary activities and process. The organization should have a strong understanding of the resilience of its facilities especially the engineering installations. An independent assessment of the condition of the engineering installations should be sought to support information available on the facilities’ history.

Wherever possible, information and data on the condition of the facilities should be converted to numerical values that can then be used objectively to support review of the
frequency of maintenance and to provide a level of risk that is acceptable to the organization.

**NOTE 2** BG 53/2016 [2] on Business-focused maintenance (BFM) provides guidance concerning risk-based maintenance management. It details the six steps to take when following BFM, including calculations and considerations to be made to review scheduled preventive maintenance (see 6.2.1).

The organization should establish its level of appetite in respect of maintenance activities and articulate this clearly in the form of a risk policy. Risk management should include robust risk monitoring, utilizing a risk register, which should be regularly reviewed and updated as necessary to reflect the control measures that are in place, residual risks and to ensure alignment with the organization’s business objectives. The organization should, as far as practicable, align its risk management policy and processes (see BS ISO 31000).

### 4.5 Permits and approvals

The organization should determine the extent to which permits and approvals apply to maintenance work. A risk assessment should be carried out to determine the need for a safe system of work or permit-to-work. Safety should be checked at each stage.

**NOTE** A permit-to-work is a formal system that states, in precise terms, the work to be done and when, and which parts of it are safe. A permit-to-work is a means of communication between site management, plant supervisors and operators, and those carrying out the work. It helps in coordinating different work activities to avoid conflicts. Guidance is given in HSE “Guidance on permit-to-work systems” [3]; while focusing on the petroleum, chemical and allied industries, it is nonetheless applicable to the built environment. The organization needs to be aware of the time and cost involved in establishing a permit-to-work, not least where the burden falls on a service provider and the basis for recompensing the latter.

### 4.6 Procurement of maintenance-related services

**COMMENTARY ON 4.6**

One of the functions of maintenance management is to determine which procurement option, or combination of options, for the delivery of maintenance-related services best fits the core business and primary processes of an organization. It is essential for organizations to understand the full extent of maintenance requirements and the capability and capacity required of service providers to deliver these services for a price that is economically viable.

The organization should define its procedures on the procurement of maintenance-related services in accordance with BS 8572, collaborative business arrangements (see BS ISO 44001) and the preparation of facility management agreements (see BS EN ISO 41012).

### 5 Facilities maintenance planning

#### 5.1 General

Maintenance plans should be driven by, and support, the intended outcomes stated in the facilities maintenance strategy and should be fully aligned with them.

Maintenance plans should be prepared in consultation with stakeholders, taking account of the following as a minimum:

- a) the organization’s requirements for production and operational demands and constraints;
- b) the organization’s financial circumstances and/or taxation position; and
- c) feedback data on maintenance outcomes, including associated costs.

**NOTE** The organization might find it beneficial to implement an annual programme of maintenance that takes into account climate, seasonal changes and conditions, physical environment, business continuity and user requirements.

Multi-year programmes of maintenance should be put in place where appropriate, i.e. for long-term planning, finance or other expediency. Programmes should state a review date for assessing progress and performance (see Clause 8).
When formulating maintenance plans, a number of maintenance methods should be evaluated (see Clause 6). The links between the selected maintenance method(s), maintenance performance, facility asset performance and service delivery (see Clause 8) should be established through metrics, e.g. key performance indicators (KPIs), based on a practical and effective maintenance process.

5.2 Roles and responsibilities

The organization should ensure clarity on the party responsible (e.g. general contractor, subcontractor or equipment vendor) for each asset in the facility (e.g. building element, system or component). An asset register should be maintained (see 9.9.4) with the name of the responsible party assigned to each asset and the means for that party to signify acceptance of its responsibility. Each asset should be cross-referenced to any related or connected asset to ensure integrity of the asset(s).

NOTE A hardwired item of equipment maintained by a manufacturer or vendor needs to “handshake” with the fixed wiring system maintained and be inspected by the party responsible for electrical installations with the rules and associated responsibilities clearly noted in the asset register. Effective integration of systems is vital for seamless operation of the whole facility, not just the individual assets.

5.3 Supporting documentation

5.3.1 General

Success in planning maintenance depends on the quality of information available for this purpose, therefore records and documents relating to the maintenance of the facility should be organized, kept up-to-date and stored in a secure environment.

NOTE 1 BS 8587 provides comprehensive guidance on the management of facility-related information and data. See Clause 9 for detailed guidance on further aspects of facilities information management.

The following general information should be recorded:

a) classification: the facility and its sub-divisions (i.e. rooms and other spaces) should be assigned codes according to type or use to support the management of information and data;

NOTE 2 Uniclass Table D (Facilities) [4] provides a classification that covers most types of facility. Close alignment with the Uniclass system in general offers benefits in areas such as maintenance, repair work, cost accounting and benchmarking. While intended for new facilities, adoption of the system can prepare the organization for those occasions where alteration or extension of the facility is necessary.

b) obligations under conditions of lease or occupancy (e.g. frequency of repainting);

c) statutory and insurance inspections;

d) estate terrier (records of property holdings with legal status);

e) ownership of and/or maintenance obligations of parties, separating and boundary walls;

f) rights of way, easements and wayleaves (particularly with respect to buried utilities); and

g) requirements and restrictions laid down by planning, building regulation control and fire authorities including, in the case of the latter, fire risk assessments.

Elements/sub-elements of the facility should be labelled or marked, as far as is practicable, so that the materials, components, systems, plant, equipment and parts can be easily identified.

Where information is limited or lacking, records should be compiled during maintenance. Alternative (or additional) surveys or investigations should be initiated to accelerate the gathering of information for record purposes; high-resolution photographic records can be of assistance in this respect.

All personnel involved in the maintenance of the facility should be made aware of the existence of records containing information about it. Hazardous areas should be marked on
the records as well as marked in their physical location and should be made known to maintenance personnel, together with any system of work adopted for use in these areas.

5.3.2 Facility handbook

A facility handbook should be prepared, which can be stored and retrieved electronically, as well as being reproduced on paper wherever necessary. The form of the handbook should be such that content can be easily updated and for versions of it to be controlled. The handbook should include the records relating to the maintenance of the facility and the documents to support the wider needs of the organization in regard to its facilities management (see BS 8587).

Records should be broadly classified according to:

a) “as built” information, which should have been prepared before the handover of the facility, such as construction details, floor plans and other perspectives showing the location of engineering installations; and

b) “as subsequently altered”, which need to be kept during the operational life of the facility, such as details of defects, maintenance, alterations and redecoration work.

NOTE 1 The use of building information models and drawings allows plans to be regularly updated to reflect changes to layouts and enables them to be stored in an efficient and easy-to-access manner (see 9.2).

A record should be kept of all reported defects and the measures taken to rectify them. Details of maintenance should also be recorded and cross-referenced to the reported defect.

NOTE 2 Captioned and dated high-resolution photographs can be particularly useful when monitoring defects developing over time. It is helpful to include a means for indicating the scale of the defect in the photograph (e.g. a ruler or an object of known dimensions).

Periodic reviews of records should be made and where there are recurrences of the same defect, the causes should be investigated. There should be clearly defined and logical responsibilities for maintaining records.

NOTE 3 For example, the F-gas refrigerant gas register needs to be maintained such that changes of specialist service provider do not disrupt accurate record-keeping.

The organization should determine where responsibility rests for verifying the accuracy of records and documents, including those captured digitally, when transferred from the design and construction (or delivery) team prior to, and upon, the handover of a new or refurbished facility, where applicable.

5.3.3 Building log-book and building manual


Where a building log-book is available, it should be incorporated into the facility handbook. Where no building log-book is available, information and data on the operation and maintenance of the facility, including measures to conserve energy, should be incorporated into the facility handbook. The organization should ensure that the scope of a building log-book is satisfied by provisions made in the facility handbook.

NOTE 2 The building log-book was conceived as a single reference source for information needed to operate a building and for those with the responsibility for the building to be able to understand their obligations and duties. It summarizes design assumptions, describes engineering installations, including operational and maintenance requirements for the safe and correct use of the facility, in terms that non-specialists can follow. The intention is that the building log-book can be a dynamic document, recording the performance of the facility over time and that it covers energy performance as well as maintenance (see the Building log book toolkit [6]).

Where a building manual and/or building user guide has been prepared it/they should be incorporated in the facility handbook.

NOTE 3 The Building Manuals and Building User Guides [7] gives guidance to those responsible for creating documentation to satisfy requirements for the building log-book and building user information for the Building Research Establishment Environmental Assessment Method. Building manuals and building user guides are
intended to exceed the scope of building log-books. Similarly, the facility handbook is intended to extend the scope of building manuals by considering a broader base of information and data required to manage a facility.

NOTE 4  Attention is drawn to The Building Regulations 2013 (incorporating 2016 amendments), Approved document L2A [8] regarding the conservation of fuel and power in new buildings other than dwellings and building log-books [5].

5.3.4 Drawings
The records of the facility should include as-built and “as subsequently altered” drawings and contain, as a minimum, the following:

NOTE See BIP 2207 [9].

a) a neighbourhood plan, showing the position of the facility and the site where it is located, in relation to its surroundings;

b) the site plan, showing the facility and other structures forming the facility and external engineering installations, e.g. drainage runs and incoming public utilities;

c) general arrangement plans of each floor and the roof to a scale not normally greater than 1:50;

d) elevations and sections;

e) foundation plans and details, together with available soil investigation reports;

f) structural plans and sections, including information relating to design parameters, such as permissible superimposed loadings on floors;

g) structural details, such as structural steel connections and concrete reinforcement drawings and bending schedules; these are particularly important when prestressed or post-stressed forms of structure have been used;

h) details of the construction of external wall elements and roofs, including insulation materials and vapour barriers;

i) materials that might be injurious to health and safety;

j) location of public health (i.e. waste) systems; and

k) location of essential intake and shut-off of public utilities (water, electricity, gas and telecommunications).

All drawings, including those used in design and construction, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected drawing(s) should be labelled “as subsequently altered”.

5.3.5 Specifications and schedules
The records of the facility should include detailed specifications of:

a) all materials incorporated, e.g. name of facing brick, mix of concrete, species and grade of timber;

b) materials with properties that could prove injurious to health and safety;

c) all plant and machinery, including manufacturers’ trade literature, manuals and instructions for installation, operation and maintenance; and

d) methods of work used during construction, which are unusual or atypical such as assembly of purpose-made manufactured units.

All specifications and schedules, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected specification(s) and/or schedule(s) should be labelled “as subsequently altered”.
NOTE SFG20 [10] provides an impartial and consistent baseline for record-keeping but needs adjustment for manufacturer, model and organizational need or instruction.

5.4 Inspections

5.4.1 General

COMMENTARY ON 5.4.1

Maintenance is intended to ensure that the facility remains fit for purpose in terms of satisfying organizational goals. This requirement is met, in part, through an effective inspection regime and forward-looking maintenance reporting. The value of inspection and monitoring might take precedence over box-ticking KPIs.

The facility should be inspected to determine the quality of the internal environment and the condition and performance of the structure, fabric, engineering installations, fixtures and finishes. Inspection intervals should take into account the properties and anticipated service life of elements/sub-elements (see 7.2 and 7.3).

Inspections should be carried out carefully as unrecorded dangers might exist. If any area or task is suspected of being hazardous, suitable precautions should be taken (see 7.1.3).

NOTE Inspections might involve many types of operations and maintenance tasks, which are covered by legislation. The organization has a duty to identify a responsible person(s) for the work.

Inspections should be based on industry standards and methods that have been verified for their objectivity. The organization should require service providers to substantiate any proposed inspection and to report on any concerns they might have about the ability to carry out maintenance work in a manner that is safe and secure for maintenance personnel and which does not pose a threat to users of the facility.

5.4.2 Frequency of inspection

Inspection frequency should be a function of the chosen maintenance regime or monitoring and by the evaluation of risk with respect to health, safety, operations and the potential for damage resulting from neglect.

Inspections should be carried out as follows:

a) routine: consultation with users of the facility to determine the existence of any maintenance matters that might require action and, where such work has been undertaken, measurement of users’ satisfaction with the outcomes;

b) general: visual inspections of the main elements carried out on an annual basis that informs the organization’s budgets for maintenance programmes and other maintenance; and

c) detailed: a full inspection at intervals of not more than three years for the structure, fabric and fit-out of the facility and for engineering installations at intervals prescribed by competent authorities.

An inspection should be carried out by using a checklist made up of facility elements/sub-elements and arranged in way that supports safe working.

The organization should consider the overall value of inspection and monitoring, in addition to systematic working through checklists and performance indicators, to determine its requirement for maintenance.

5.4.3 Reporting

A maintenance report should be prepared. Information gained from inspections should be collated into two groups:

a) the degree of urgency needed to carry out repairs; and

b) a comparison of maintenance plans, including work of a planned preventive nature.
Attention should be paid to the requirements defined in the maintenance policy (see 4.3.2). Each item should be carefully assessed when postponing apparently non-urgent work so that it does not result in a major defect or failure over the longer term. The anticipated life of the facility, or any element of it, should be taken into account. The implications of a “do-nothing” decision should be evaluated.

Anticipated failures and defects expected to lead to failure should be highlighted in reports. The resulting information should be arranged into three categories: those matters requiring immediate attention, those that could be placed into a maintenance programme and those which could be postponed but which should continue to be monitored and reviewed.

The maintenance report should address all maintenance requirements not covered by scheduled preventive maintenance (see 6.2) for a period of five to ten years.

NOTE 1 Where contracts run over longer periods, maintenance plans may extend beyond this limit.

The following points should be included, as a minimum, in the maintenance report:

1) location;
2) name of element (e.g. roof);
3) name of sub-element (e.g. roof covering – sheeting);
4) existing condition (e.g. excellent, satisfactory, adequate, poor or unsafe);
5) prioritization of the element, (e.g. the redecoration of a customer-facing reception area would have a higher ranking than a storage room);
6) anticipated phasing of maintenance; and
7) cost of maintenance.

Inspections should clearly identify and describe faults and observations found along with consequences of inaction in order to inform maintenance priorities for the organization.

NOTE 2 Condition surveys can also indicate the expected life of elements, systems and components. Where the organization has an asset replacement formula based on age and maintenance expenditure, this can be considered in the wider context of a business-focused or risk-based process approach to maintenance (see 6.1) to enable evaluation and forecasting of replacements.

5.5 Assessment of maintenance planning

The organization should assess the benefits of maintenance planning, basing the assessment on the following:

a) contribution to the organization’s goals;
b) satisfaction of stakeholder interests;
c) effectiveness of the facility in supporting the organization’s operational plans;
d) availability and reliability of the facility at minimal cost;
e) capital expenditure, capital allowances and taxation;
f) asset management strategy;
g) protection of the value of facility assets;
h) provision of data on facility asset performance;
i) provision of data for maintenance benchmarking;
j) provision of data for continual process improvement;
k) provision of data on environmental performance;
l) basis for service life planning (see BS ISO 15686-1, BS ISO 15686-2 and BS ISO 15686-5);
m) contribution to energy management;

n) contribution to business continuity management (see BS EN ISO 22301);

o) basis for service level agreements;

p) transparency and sound governance in financial reporting;

q) identified security risks;

r) awareness environmental sustainability;

s) improvement of outsourcing and collaboration agreements;

t) contribution to the facilities management strategy;

u) contribution to total quality management; and

v) contribution to procurement and supply chain management.

Assessment of maintenance planning should be transparent and balance critical dependence, redundancy and/or speed of recovery with age and condition, not least with respect to health and safety implications. Wherever possible, predictive, monitored or usage-based systems should be implemented and used to determine frequency and scope of intervention (i.e. full, interim or safety check).

The organization should consider the following options for service delivery (see BS 8572):

1) in-house team;

2) total facilities management service provider; and

3) specialist service provider.

NOTE An in-house team might have sufficient competence and capacity to cope, unless the complexity and scale warrants specialist input. An in-house team can lack expertise in managing maintenance; whereas, a total facilities management service provider might be more familiar and competent in management, procurement and resourcing. Trained, experienced and well-resourced specialist service providers are unlikely to be kept fully occupied, unlike a total facilities management service provider which can be a flexible resource to be utilized as and when required.

5.6 Service life planning

Maintenance plans should be devised to ensure that the service life of facility assets matches or, where desirable, exceeds their design life.

NOTE Further guidance on service life planning is given in BS ISO 15686-1, BS ISO 15686-5 and BS ISO 15686-10.

5.7 Facility assets and maintenance resources

A facility, and the individual assets that it comprises, should be maintained to deliver the most effective outcomes in terms of minimal cost and risk. Assets should be classified into risk categories, e.g. small, medium, severe and critical, according to their potential impact on the core business of the organization in the event of failure in performance. The condition of assets should be determined and a decision made as to the most effective option for their maintenance (see Clause 6).

A maintenance resource plan should be prepared for assets operating under normal (operating) conditions. This plan should be modified, where necessary, to reflect operating conditions within the facility that fall outside specified design requirements and/or tolerances. The plan should be capable of aligning with changes in demand for, or modes of, service delivery. For an existing facility, a condition assessment of the assets should be undertaken before preparing the maintenance resource plan, wherever practicable. The cost of implementing the plan should be estimated and adequate provision made within budgets. Once implemented, the plan should be monitored for effectiveness and performance, with adjustments made where appropriate to ensure that the requirements as set out are met.
NOTE 1 Where the condition of the facility is unknown or incomplete, one option for the organization might be to implement condition-based maintenance (see 6.2).

The organization should align its service needs, including service dependency, utilization, location, capacity and functionality, and maintenance planning with the required level of facility asset performance. Where a new facility is being procured, the organization should ensure that adequate provision is made during the design and construction phases to incorporate these requirements.

NOTE 2 BS 8536-1 gives recommendations on an appropriate approach for organizations and their designers.

Maintenance should be planned to take account of the maintenance cycle of each element/sub-element and inspections should be made at regular intervals (as determined by the properties of each element/sub-element and its anticipated service life). The organization’s production and operational requirements should be integrated into the maintenance plan. Annual programmes of maintenance should take into account subsequent years’ programmes so that additional costs or abortive works are minimized. Decisions to replace or repair components should be taken after due consideration of life-cycle costs.

NOTE 3 BS 8544 provides detailed guidance on the life-cycle costing of maintenance and BS ISO 15686-5 provides guidance on the wider context for the life-cycle costing of facilities.

5.8 Maintenance planning process

Maintenance planning should be carried out as follows (see Figure 1):

a) the facility assets required to support the core business and the delivery of services should be defined;

b) the required level of facility asset performance, including performance indicators, should be agreed;

c) the condition and sufficiency of facility assets for their intended purpose should be audited;

d) the scope of the maintenance required should be identified through gap analysis;

e) an appropriate maintenance method from those available should be selected;

f) the resources required for the chosen maintenance method should be assessed;

g) maintenance plans and budgets should be prepared to cover the required scope of services over the short, medium and long term;

h) a tactical plan for delivery of maintenance should be formulated;

i) the resources to deliver the scope of maintenance should be provided;

j) maintenance plans and programmes of work should be implemented; and

k) performance monitoring, review and control of maintenance plans and programmes of work should be carried out.

Information and data gathered from this process should be used to re-inform the organization’s need for, and use of, facility assets during this, and any future iterations, of this process.

NOTE 1 A well-defined scope might reasonably be expected to produce compliant tenders; however, it does not follow that all prospective service providers fully recognize the meaning and extent of what is required.

The organization should ensure that prospective service providers have the processes, resources and competence to deliver the planned maintenance. Evidence of their understanding and experience in achieving the required performance should be provided before accepting any tender or proposal. There should be sufficient detailed breakdown of work items and their associated costs to allow close scrutiny for completeness and
comprehension of maintenance requirements. Quality assurance and control procedures should be defined and implemented for the purpose of ensuring that service delivery is as specified.

NOTE 2 BS 8572 provides detailed guidance on the procurement of facility-related services, including tendering procedures.

NOTE 3 Where services are bundled into inclusive or comprehensive contracts, there is a risk that insufficient detail is available for planning and implementation (see 5.5). This lack of transparency raises the likelihood of confusion and conflict, resulting in inadequate maintenance if not closely monitored and controlled.

Figure 1 – Maintenance planning process

NOTE The cycle that this figure represents could begin again at a time or at a frequency to be determined by the organization having regard to the extent, complexity and condition of facility assets.

5.9 Maintenance costs and financial control

COMMENTARY ON 5.9

Financial control is an important aspect of maintenance management; this ensures that maintenance proposals justify the funds requested and that organizations obtain best value for money.

A maintenance strategy, and its associated maintenance programme(s), should include estimates of the cost of known work and provision for work that might be required but where
the extent is unknown. These estimates should be used as the basis for preparing budgets for maintenance in line with the organization’s overall financial planning and management accounting requirements.

The organization should be clear about the relationship between capital expenditure (including capital allowances) and operational expenditure, as attempts to reduce one form of expenditure have the potential to increase the other. The organization should consider taking a view on total expenditure instead, as this is consistent with the practice of life-cycle costing.

NOTE 1 Aside from establishing a more balanced view of costs and budgets, it is likely to reduce conflict between personnel with responsibility for managing capital expenditure on the one hand and operational expenditure on the other hand.

Budgets should include, but are not limited to, repair/replace decisions, the optimization of scheduled preventive maintenance, surveying/inspection costs and life-cycle costs.

Budget proposals should be presented in a way that identifies:

a) the impact on capital value;

b) the costs and benefits that accrue from the funds required;

c) the risks and associated costs of not carrying out maintenance programmes in accordance with the maintenance strategy (i.e. the “do-nothing” decision); and

d) the costs and benefits of repair against refurbishment and against replacement and the basis of calculation, e.g. net present value (NPV).

NOTE 2 BS 8544 provides detailed guidance on the life-cycle costing of maintenance and BS ISO 15686-5 provides guidance on the wider context for the life-cycle costing of facilities.

Proposed budgets should align with any planned future facility and/or property portfolio decisions such as disposals and relocations.

NOTE 3 Financial considerations include decisions regarding optimal repair reaction times and the choice of the most appropriate source(s): in-house, outsourced or co-sourced. This leads to the need for budgetary control during the course of each financial year over which maintenance programmes extend.

In the case of outsourced contracts, the contract sums and the costs associated with the management of the contracts, should be prepared in accordance with BS 8572.

An audit should be carried out in each financial year to ascertain the extent to which best value for money has been obtained from the funds expended in the previous year on maintenance and to determine if any changes are needed to improve value for money. The extent to which maintenance has provided any operational benefits for the organization should also be determined. This information should be used to inform decisions on budgets for subsequent maintenance plans and programmes.

NOTE 4 BS 8572 provides guidance on the options for service delivery. In this regard, it is important to recognize that no option relieves the procurer (i.e. the organization) of the need to manage the service provider and its performance (see Clause 8).

6 Maintenance approach

COMMENTARY ON CLAUSE 6

Maintenance approaches can be grouped into two broad categories: preventive and corrective maintenance. Preventive tasks manage risk prior to a failure event. Corrective tasks manage risk after a failure event or identification of the potential for such an event. Within each category are various types of maintenance task. Not all of them might be applicable or effective, although they can serve as the basis for exploring options.

6.1 General

Maintenance is founded on a set of principles which should directly influence the intent, design for, and delivery of an organization’s maintenance activities for its facilities.
These principles should be as follows:

a) Maintenance tasks are inherent in a design solution and fulfil a role that might be either preventive or corrective in nature. This principle requires that all maintenance tasks should:
   1) be determined using risk-based techniques;
   2) be aligned with their intent; and
   3) demonstrate achievement of value.

b) Maintenance tasks and their delivery should be determined in a structured manner. All maintenance tasks exist to achieve value as identified by a risk-based process. This principle requires that all maintenance tasks:
   1) are determined using a defensible process;
   2) demonstrably achieve value;
   3) account for human capability covering physical, mental and behavioural demands;
   4) are designed for efficient and effective delivery; and
   5) account for their impact on functional requirements.

The organization should determine which method or combination of methods (see 6.2 and 6.3) best satisfies (or does not satisfy) the criteria defined as part of the facilities maintenance strategy (see 4.2). When taking into account asset criticality and monitoring capacity within the facility, the benefit of combining methods should be evaluated.

In order to achieve an effective maintenance programme, the principles and methods associated with reliability centred maintenance (RCM) should be considered when maintenance is being identified (for new facilities) or reviewed (for existing facilities).

**NOTE 1** The RCM method is not a maintenance strategy or task as such but describes a structured and defensible process for the identification of applicable and effective maintenance tasks. This process identifies both applicable task types and the most effective task interval based on cost and risk assessment as defined by the maintenance policy.

**NOTE 2** Reliability centred maintenance is a systems-based method used to determine maintenance tasks needed to ensure that a facility asset or system continues to function in order to fulfil its purpose as designed in its present operating context. The method can involve the implementation of asset condition monitoring based on an asset register which is kept up to date, including records of failures and breakdowns, repairs undertaken, a forward maintenance register and life-cycle reporting against each asset to identify critical factors such as age, condition, standby facilities and, ultimately, the reliability of facility assets. Further details on RCM can be found in BS EN 60300-3-11.

### 6.2 Preventive

#### 6.2.1 Scheduled preventive

**NOTE 1** Scheduled preventive tasks normally address failures due to wear-out or ageing of assets. Task intervals are thus determined by the known life of the asset and risk associated with continued use close to that limit. Critical assets might require some additional condition-based tasks (see 6.2.3) as an additional protective measure.

Adoption of this approach should be subject to risk-based assessment before proceeding.

**NOTE 2** Scheduled preventive maintenance often follows a defined specification (e.g. SFG20 [10]) that identifies maintenance tasks and their respective maintenance frequencies for the facility assets. In the absence of a risk-based process, SFG20 can be a useful source of guidance for considering maintenance frequencies. Business-focused maintenance (BG 53/2016) [2]) describes a form of RCM applied to existing facilities.

#### 6.2.2 Condition based

**NOTE 1** Condition-based maintenance is based on the results of condition monitoring of plant, equipment, systems and elements to avoid loss of function or mitigate consequences failure. It is performed by selecting and monitoring a parameter which, for example, indicates plant condition. Data are collected and analyzed and the required corrective action planned accordingly.
This work should be carried out periodically or in real time and make use of instrumentation, local and remote monitoring systems, plantroom walkarounds by a competent person through visible and audible methods. Special equipment, such as thermographic cameras may be used to monitor plant condition, hot spots in electrical wiring systems and switchboards and cold spots within the building fabric.

NOTE 2 Condition monitoring tasks are most appropriate for equipment with a constant failure rate which, as such, exhibit no consistent age-related failure characteristics (i.e. do not wear out). This approach is applicable only if the monitored parameter(s) give sufficient warning of potential failure for mitigating action to be taken. If the consequences of allowing the failure to occur and planned shutdown for repair of an identified potential failure are the same, there is unlikely to be any benefit in performing monitoring.

NOTE 3 An evaluation of engineering installations, including an introduction into its use as a facility maintenance strategy and details of the main parameters used in monitoring the condition of installations, is covered by BSRIA's *Condition Based Maintenance* [11].

6.2.3 Opportunity maintenance

NOTE Opportunity maintenance (or shutdown maintenance) is normally used in continuous production and manufacturing facilities, where planned maintenance is not possible due to the assets being in almost continuous use and/or where supplies of feedstock are required to enable continuous production and manufacturing.

A detailed plan should be produced and agreed with those responsible for production or manufacturing to enable planned maintenance to be carried out for the affected assets during a pre-agreed shutdown period. This can be for specific production or manufacturing areas within a facility or can involve a total shutdown of the facility. In this case, the tasks to be performed and their intervals should be determined in the same manner as other planned maintenance activities (i.e. the task should only be performed if the opportunity is within the identified task interval range). A planned task which has been found to be effective when performed at a defined interval (e.g. every 3 years ±3 months) should not be performed opportunistically (e.g. at shutdown or when intervening opportunities arise) unless that opportunity falls within the defined interval.

6.3 Corrective

6.3.1 Planned or unplanned

Corrective maintenance initiated as a result of the observed or measured condition of plant, equipment, systems and elements before or after a functional failure may be used to restore the asset to its desired functional state. This work can be planned or unplanned; however, pre-planned responses together with the required resources for dealing with failures, which might be reasonably anticipated, can reduce system downtime and costs and should be actively considered.

6.3.2 Run to failure

NOTE When performing the analysis of maintenance requirements, it is sometimes concluded that the cost of performing preventive tasks exceeds the cost of allowing a failure to occur. This is often called "run to failure" or "breakdown maintenance". This method might result in high replacement costs over the lifetime of the asset but has a low initial maintenance resource requirement. It is sometimes used for simple facilities that have few operatives and no critical environments to support.

The selection of this strategy should be a deliberate decision by the organization based on cost and risk assessment.

6.4 Other maintenance considerations

6.4.1 Levels of maintenance

A policy on maintenance levels should be established based on an analysis of the maintenance resource requirements and organizational objectives.

NOTE An optimal maintenance strategy for an organization is likely to be reflected in different levels of maintenance across the assets depending on matters of compliance, sector- or organization-specific requirements, function criticality and use of space.
6.4.2 Statutory (or compliance)

The organization should be aware of testing and certifying all assets that will be subject to statutory compliance against the defined frequencies as stated within the respective regulation or approved code of practice. Certificates should be stored in an accessible location.

Assets that fail the required tests should be subject to corrective maintenance, pending evaluation of the severity of the failure and the asset. The asset should then be re-tested and certified accordingly, subject to a successful test and/or inspection. The organization should determine the appropriateness and extent to which this maintenance option applies.

6.4.3 Mandatory – sector- or organization-specific

NOTE   Mandatory maintenance is either an industry sector or an organizational requirement to carry out maintenance against specific standards and frequencies in order to limit risk and maintain safe working. Mandatory maintenance usually represents good practice within the sector or within the organization’s policies and practices.

The organization should determine the appropriateness and extent to which this maintenance option applies.

6.4.4 Discretionary maintenance

NOTE   Discretionary maintenance is usually applied to maintenance tasks for systems and services that can add some value to the business being supported (e.g. meeting sustainability requirements).

The selection of tasks and task intervals should use defensible risk or financial criteria.

6.4.5 Unoccupied – vacated space maintenance

NOTE   This applies to unoccupied buildings or spaces where it becomes uneconomical to carry out other forms of maintenance. Statutory compliance maintenance might still be required but other forms of maintenance may be replaced by general inspections by maintenance personnel to ensure that the overall integrity of the assets is maintained.

The selection of tasks and task interval should use the same approach as for facilities in use, but criteria for selection require consideration of different stakeholder requirements. The organization should determine the appropriateness and extent to which this maintenance option applies.

7 Factors affecting maintenance

7.1 Health, safety, security and environment

7.1.1 General

COMMENTARY ON 7.1.1

The information given in this clause is intended as guidance for those who need to incorporate occupational health and safety (OH&S) management within their facilities maintenance management. For a more comprehensive overview, see BS ISO 45001, BS 45002-1 and BS 45002-3. BS 45002-1 has been used as the primary basis for the occupational health and safety guidance provided in this British Standard.

The management of occupational health and safety should be viewed as an integral component of facilities maintenance management and not as a separate function or as an add-on.

The organization should assess risks and other hazards at all stages in a facility’s life cycle. Identified risks should be monitored and, wherever possible, their potential impacts should be mitigated. The organization should implement a formal system of risk management, including establishing and maintaining a risk register. Periodic reassessment of risks should be undertaken to update the risk register and associated risk treatment (see BS ISO 31000).

NOTE   Attention is drawn to legislation affecting health and safety in the workplace, in particular the need for risk assessment, which includes but is not limited to the following:
7.1.2 Initial review

An initial review should be undertaken to provide information on the appropriateness, efficiency and effectiveness of existing occupational health and safety management systems. Where no formal, or a minimal, occupational health and safety management system exists (such as when an organization is newly established or when carrying out new activities), the initial review should be used as a base from which to develop the new system.

7.1.3 Risk control and corrective actions

The organization should implement risk control, as an integral part of its risk management, to ensure that control measures remain in place and that they remain efficient and effective. The risk management system (see 4.4) should allow, as a minimum, for the following:

a) identification of health and safety hazards arising from maintenance and other work determined by workplace inspections, behavioural observations, safety tours, and formal and informal discussions with the workforce;

b) identification of people who might be at risk from maintenance (e.g. maintenance personnel, users, visitors, passers-by and trespassers);

c) evaluation of the risks to which individuals and/or the organization might be exposed;

d) devising ways to eliminate, reduce and/or control risks (e.g. guarding and fencing, method statements, safe systems of work, permit-to-work, training and supervision);

e) monitoring and recording the effectiveness of risk control measures and systems (e.g. inspections, observations, safety tours and checklists);

f) taking coordinated corrective action;

g) providing feedback to the workforce and other stakeholders;

h) training, together with health and safety checks, of operatives; and

i) auditing and reviewing the system and, therefore, health and safety performance.

The use of access equipment should be assessed to maximize the benefits of its use and to optimize the overall cost of maintenance. This should take into account future requirements for access that might arise on multi-year programmes of maintenance. The longer-term implications of providing access, particularly the equipment required for this purpose, should be evaluated and permanent means of access should be used where possible.

NOTE 1 Some maintenance can require access to be provided over and above that needed for the day-to-day operation of the facility. Repeated cycles of equipment erection and dismantling can add to the risks faced by maintenance personnel as well as adding needlessly to maintenance costs.

The organization should determine its responsibilities and appropriate actions to ensure the quality of the working environment.

NOTE 2 Maintenance teams have a crucial role to play in maintain the working environment and are not to be forgotten when it comes to their own spaces: neglected basement plant rooms are not conducive to performance or retention of personnel.
The organization should ensure the integration of any contract personnel into their core team to establish a positive working environment. All parties should be reviewed regularly to ensure a unified team across the supply chain.

The organization should recognize its responsibilities concerning the mental health and wellbeing of users of the facilities including those conducting maintenance work. Maintenance teams are as vulnerable as others in the workplace and prescribed and reviewed actions should be in place to manage stress and mental health pro-actively as well as reactively. Plans and evidence of implemented activities and actions should be regularly reviewed by the organization.

NOTE 3 A primary responsibility of any organization with responsibility for maintaining facilities, over and above operational needs, is the inherent safety of users of the facilities and the facilities themselves.

The organization should ensure that it has the competence to minimize risk to acceptable and agreed levels as well as a robust and visible monitoring and reporting system. The organization should be structured as to be practicable, with consideration given to the balance of operational efficiency (including the supply chain) against over-detailed or prescribed systems. Where there is any shortfall in competence, the organization should consider training, re-training or the recruitment of suitably qualified personnel.

NOTE 4 A typical suite of safety processes might include the requirement for a method statement in advance of the work to allow local arrangements or comment/alternation, approved generic risk assessments covering regular tasks along with a dynamic risk assessment process, visible and approved in advance of activity by the authorizing party.

Wherever possible, maintenance risks should be engineered out of the maintenance management process. Where the facilities involve vehicle movements, whether materials or personnel in the course of maintenance activities, consideration should be given to ensuring that such activities are properly monitored with attention given to alignment with best practice in fleet management. Where national defence or commercial sensitivity requires security of access, attention should be given to the fullest implications of such requirements in terms of their impact on the facilities, its users and the cost involved.

7.2 Environmental factors

7.2.1 General

7.2.1.1 Energy performance

The organization should at all times be aware of the energy performance of its facilities. Service providers should monitor and report to the organization the principal impacts of their work where this might give rise to energy consumption in excess of, or significantly below, previously agreed level(s). Discussion and agreement should take place to minimize the negative impacts or to explore the benefits from savings in energy consumption in line with the organization's business strategy.

NOTE 1 Verified self-reporting with plans to minimize and monitor consumption are essential.

NOTE 2 User behaviour is a determinant of energy consumption. It is important that energy consumption data are available in a form that is easy for users to understand. This can then be used to drive changes in behaviour to reduce energy consumption and improve energy efficiency.

The organization should implement an arrangement to manage its energy performance. The following outlines an approach with typical measures that can be taken by the organization and adapted to suit the characteristics and requirements of the facility:

a) assessment of annual energy use with regard to individual energy sources;

b) analysis of hourly energy demand profiles;

c) cross-references to any post-occupancy evaluation survey, where applicable, in regard to internal environment, performance and engineering;

d) investigation of issues leading to unusually good, poor or variable performance;
e) spot checks and recording measurements as necessary;

f) technical review of building fabric, component and equipment performance;

g) review of the energy management system (EMS), where applicable, and metering;

h) reliability, maintenance and maintainability of energy-using systems and components;

i) structured reviews with the operator, operations team or facility manager, as appropriate, and the representative(s) of users;

j) review of how the owner’s facilities management strategy, leadership and user behaviour impact upon energy use;

k) suggestions for improvement; and

l) comparison with results from other facilities within a portfolio programme, where applicable.

NOTE 3 BS 8536-1 provides further recommendations and guidance on environmental performance requirements.

NOTE 4 A metering strategy sets out the spaces to be metered and to what level. Any area larger than 250 m² or occupied by a tenant should be sub-metered. This provides more reliable recording of energy consumption and accurate billing for individual tenants. It also establishes a baseline for measurement that assists in determining the impact of specific equipment and/or energy-saving initiatives as well as an opportunity for benchmarking.

The organization should aim to reduce energy consumption by direct means such as the replacement of energy-inefficient components (e.g. replacing inefficient illuminants with LEDs, installing variable-speed drives on electric motors and ensuring that equipment and appliances have an energy rating of at least A+).

7.2.1.2 Carbon emissions

The organization should be aware of any process or activity in its facilities that leads to, or could lead to, polluting carbon substances, primarily but not exclusively CO₂, being released into the atmosphere. Steps should be taken to minimize such emissions with consideration given to offsetting the impact of those emissions.

NOTE Offsetting is an action that compensates for an organization’s emissions by financing a reduction in emissions elsewhere. Carbon markets based on offsetting have existed in some regions of the world for many years. CO₂ reductions can be achieved in several ways and used as offsets; for example, wind-generated energy, methane capture and emission-avoidance projects.

7.2.1.3 Carbon footprint

The organization’s carbon footprint represents the total emissions caused by its processes and activities, expressed as carbon dioxide equivalent; the organization should measure its carbon footprint periodical and be able to explain the steps it has taken and continues to take to minimize its carbon footprint.

NOTE Carbon footprint is a measure of the weight of carbon dioxide equivalent (CO₂-eq) emitted per square metre per annum (based on greenhouse gas emissions over a 100-year period), expressed as kgCO₂-eq/m²/annum per building type.

7.2.2 External

COMMENTARY ON 7.2.2

Air is liable to various forms of contamination. Near the coast, it can contain significant salt-bearing water vapour with consequential corrosion for iron and steel and deleterious effects on other materials. The effects of industrial pollution can cause carbonation of mortar, which can have an adverse impact on embedded metals, even in rural areas.

The main structures of facilities are normally unaffected by wind; however, damage to external cladding can sometimes occur. This can vary from displaced roofing to more extensive damage caused by freak weather conditions. Tall structures and those in exposed positions are more at risk, but there are places where unexpected wind conditions exist in otherwise sheltered locations. In cases where damage to fabric is not caused, excessive air infiltration can affect the interior environment and impair control of engineering installations.
Wind conditions, for example near tall structures or groups of buildings, could result in precautions becoming necessary to prevent rain penetration and resultant damage.

Different forms of precipitation influence the maintenance needs of a facility. Rain by itself normally has no deleterious effect but when combined with wind can cause problems (see An index of exposure to driving rain [20] for further guidance, including a driving rain index). Additionally, rain can saturate part of the fabric causing, for example, sulphate attack or frost damage following a sharp drop in temperature.

Snow usually causes problems by blocking drainage channels, leading to water penetration in unexpected places. In the UK, hailstones rarely achieve a size that can cause actual damage, but it is not unknown. Extreme temperatures can also cause problems; the effect of thermal expansion on roofs and parapets is possible. Some external cladding can be subject to frost attack.

All of the above factors can act both singly and in combination, e.g. rain penetration can be more severe when wind driven.

### 7.2.2.1 General

The organization should assess the extent to which external environmental factors could influence the condition of the structure, fabric, engineering installations, fixtures and external finishes, and take such factors into account when drawing up maintenance plans. This should also include control of moisture.

### 7.2.2.2 Adaptation to climate change

The organization should determine how it intends to moderate, avoid harm or exploit opportunities arising from climate change for its own benefit and those of its stakeholders in the context of its facilities maintenance strategy.

**NOTE** Climate change adaptation is the process of adjustment to actual or expected climate and its effects.

### 7.2.2.3 Biodiversity and green infrastructure

The organization should be aware of how its facilities can support biodiversity whilst contributing to any action on green infrastructure initiated by it or any of its stakeholders. The link between biodiversity, green infrastructure and climate change should be investigated to provide support for the organization's facilities maintenance strategy.

### 7.2.3 Internal

#### 7.2.3.1 General

*COMMENTARY ON 7.2.3.1*

Humidity, temperature and pollution are factors that can adversely affect the condition of the structure, fabric, engineering installations, fixtures and internal finishes. The effects of intermittent heating and condensation can cause particular problems.

Industrial facilities can be subject to many different factors depending on the processes carried out within them. Other facilities can be affected by particular conditions; swimming pool structures, for example, are vulnerable to the effects of the chlorine used in the water. The maintenance requirements of facilities and their various parts are directly related to the type and intensity of use they attract; for example, a school would necessitate robust doors and door fittings in excess of the requirements for housing. Facilities that accommodate animals or vehicles need provision for potential failure in controls. Some facilities might suffer from deliberate misuse and vandalism. An important factor when considering such behaviour is that lack of repair tends to encourage further damage.

The organization should assess the extent to which internal environmental factors, as well as the performance of maintenance (see Clause 8), influences the condition of the structure, fabric, engineering installations, fixtures and internal finishes. These factors should be taken into account when maintenance plans are drawn up. Factors that have a damaging effect on physical conditions, e.g. control of moisture and static electricity, as well as any unintended consequences for maintenance personnel, users of the facility, should also be taken into account.

**NOTE** It might be necessary to seek the assistance of a building physicist (see 3.1.6) or other appropriate specialists to determine the root cause of a defect or failure where this cannot be readily or reliably diagnosed. The decision depends on the particular circumstances of each case and rests with the individual or firm.
responsible for inspection. Some matters, such as accurate assessment of slip resistance of floors and paving, require appropriate apparatus and experienced operators.

### 7.2.3.2 Health, safety and operational security

The organization should monitor and control the internal environment for users to ensure that it is, at all times, as healthy, safe and secure as possible, as well as supportive of their needs in terms of the activities in which they are engaged. Attention should be given to any activities that could create stressful situations for users of the facility; for example, physical disturbance, visual distraction and noise from maintenance-related tasks. Control over the movement of people should be taken into account where security is a concern.

**NOTE**  This is especially important in facilities where the public has a major interest, such as in retail outlets, sports venues and entertainment centres. Unauthorized access poses not only risk for the organization but for the individuals who might be unaware of the dangers they face.

### 7.2.3.3 Air quality

Indoor air quality can be affected negatively and positively by many factors; the organization should ensure that it has an adequate indoor air quality programme in place that involves testing of air quality on a regular basis.

**NOTE**  An objective of any indoor air quality programme is to minimize the exposure of users of the facility to pollutants (see 7.2.3.5) and other factors (e.g. fluctuating ambient air temperature, excessive or insufficient humidity and poor air movement) that can impair well-being.

### 7.2.3.4 Water management

The organization should implement an arrangement to manage its water consumption. The following outlines an approach with typical measures that should be taken by the organization and adapted to suit the characteristics and requirements of the facility:

a) assessment of annual water use;
b) analysis of water demand profiles;
c) cross-references to the post-occupancy evaluation survey in regard to internal environment, engineering and performance;
d) investigation of issues arising, especially where there is unusually good, poor or variable performance;
e) spot checks and recording measurements as necessary;
f) technical review of component and equipment performance;
g) review of the performance and usability of controls, the building management system (BMS), where applicable, and metering;
h) reliability, maintenance and maintainability of water systems;
i) review of water-saving devices or appliances;
j) structured reviews with the operator, operations team or facility manager, as appropriate, and the representative(s) of users;
k) review of how the owner’s management strategy and leadership, facilities management and user behaviour impact upon water use;
l) suggestions for improvement; and
m) comparison with results from other facilities within a portfolio programme, where applicable.

### 7.2.3.5 Pollutants

**NOTE 1**  Pollutants are generated by outdoor or indoor processes, including maintenance activities, pest control, housekeeping, refurbishment, new furnishings or finishes and users’ activities and can impact indoor air quality and health. Classification is as follows:
a) biological contaminants;
b) chemical pollutants; and
c) particles.

NOTE 2 Indoor air pollutants can impact users in many ways. All pollutants, to varying extents, impact negatively on users' health, ranging from minor irritations to life-threatening diseases.

The organization should take steps to minimize users' exposure to all pollutants. This should include actions to encourage users to report all incidents where pollutants might be experienced or suspected.

Badly maintained ventilation and air conditioning equipment and exhaust systems can be potential causes of pollutant infiltration; regular inspection and adjustment of equipment and systems should be carried out to guard against the threat of pollutants entering or remaining in the facility.

7.3 Materials, components and systems

7.3.1 Physical characteristics and behaviour

When drawing up maintenance programmes and plans, including inspection schedules, the specification of materials, components and systems and the requirements for their maintenance, as outlined in their manufacturers’ recommendations where available, should be made known. These requirements should include the expected maintenance cycle of each element/sub-element, degree of resilience, durability and design life.

NOTE BS EN 45552 defines parameters and methods as a framework in order to assess the durability of energy-related products for use in preparation of product-specific standardization deliverables on durability assessment.

7.3.2 Special requirements

NOTE 1 The age of some facilities can mean that they are likely to incorporate materials or components that are no longer acceptable in use or which, in extreme cases, pose an immediate and unacceptable threat to health and safety.

Attention should be drawn to any special requirements such as the following:

a) potentially hazardous materials and components, for example:
   1) those containing asbestos;
   2) lead, which might be present in some paint or be used for pipes carrying potable water;
   3) materials that are either highly combustible or give off large quantities of smoke and toxic chemicals (see 8.11) when involved in a fire or in confined spaces (e.g. electrical risers);
   4) areas that should operate under a permit-to-work system;

b) types or methods of construction that, under certain circumstances, might become dangerous; and

c) finishes and decorations, including their protection and treatment, where required.

NOTE 2 Cleaning facilities fall within the scope of maintenance. Cleaning and good housekeeping before, during and after maintenance is a large part of achieving satisfactory performance. Poor cleaning or the use of inappropriate cleaning methods or materials can have a significant, adverse effect on the design life and/or durability of materials, components and systems.

The person responsible for maintenance should coordinate closely with those responsible for cleaning.

NOTE 3 For further guidance on cleaning see BS 6270-3. Attention is drawn to The Provision and Use of Work Equipment Regulations 1998 [21].
7.4 Life-cycle performance

7.4.1 Life-cycle assessment

NOTE  Life-cycle assessment (LCA) is a methodology used to assess the environmental, operational and disposal impacts, and the costs associated with, all the stages of a product’s life from raw material extraction through material’s processing, manufacture, distribution, use, repair, maintenance and disposal or recycling. Accelerating social trends (fashion) and technological impacts which result in a rapidly evolving work and leisure environment reinforce the need for realistic asset-life evaluation.

The organization should consider how a life-cycle assessment can help avoid a narrow outlook on environmental concerns by broadening consideration to include financial aspects as well as the following specific actions:

a) compiling an inventory of relevant energy and material inputs and environmental releases;

b) evaluating the impacts associated with identified inputs and releases; and

c) interpreting the results to help make a more informed decision, i.e. by calculating the life-cycle costs of an element.

The evaluation of future requirements based on risk assessment should be considered and might include, for example, shorter asset-life expectancy and its associated financial implications.

7.4.2 Total life-cycle cost

COMMENTARY ON 7.4.2

Life-cycle costing is a decision-driven process that measures the development of the service life of a component or facility asset. Its approach is to ensure that the anticipated design life is based upon a structured approach for establishing its service life, typically derived from a reference or anticipated service life. This leads to a life-cycle cost profile that acknowledges factors such as life-cycle assessment and end-of-life considerations, including obsolescence and embodied-energy recovery.

The objective of service life planning is to provide assurance that the estimated service life of a new facility on a specific site, with planned maintenance, will be at least as long as the design life. Service life planning facilitates the making of well-informed decisions regarding cost and maintenance planning as well as environmental impact. As service life cannot be estimated precisely, the objective is to produce an appropriately reliable estimate of the service life of the facility using available data relating to the service life of each material, component, assembly and system that is to be used in the facility.

If the estimated service life of any of the above is likely to be less than the design life of the facility, a decision can be made as to whether maintenance, repair or replacement could ensure that its essential functions are likely to be maintained. To assist with specification and design, and avoidance of obsolescence and waste, service life planning can include projections of the need for, and timing of, replacement and end-of-life recovery.

The organization should adopt a total life-cycle cost perspective for the purpose of facilities maintenance.

NOTE  BS 8544 provides detailed guidance on the life-cycle costing of maintenance and BS ISO 15686-5 provides guidance on the wider context for the life-cycle costing of facilities.

8 Performance management

8.1 General

COMMENTARY ON 8.1

Performance management involves monitoring, controlling and improving the efficiency and effectiveness of facilities maintenance management and applies to both internal and outsourced arrangements. Various models, methods and tools are available to assist in the measurement of performance and in indicating where improvement is required; examples include, but are not limited to, value management, the EFQM Excellence Mode2), balanced scorecards and benchmarking (see BS EN 15221-7).

Performance management can be used to foster efficient and effective working relationships between the parties of a contract or agreement relating to maintenance and/or its management, with the aim of achieving continual improvement in performance. It is not intended to be used as the basis for penalizing contractors or service providers, but instead to encourage better performance.

Recommendations for performance management should be formulated as part of the facilities maintenance strategy (see 4.2) and policy (see 4.3) and communicated to all affected stakeholders (see 4.1).

The organization should establish a performance management system based upon service level agreements as part of its facility management system (see BS EN ISO 41001). Where a facility management system has not been implemented and, instead, a quality management system or other management system exists in its place, the relationship between that and the performance management system should be made clear. In such cases, information and data should be capable of being entered once into either system and should be accessible from both.

NOTE BS EN ISO 41001 specifies the requirements for a facility management system.

A means for measuring performance over time to indicate progress towards meeting defined objectives should be incorporated in the performance management system. This should report current and past performances to highlight where improvement has been achieved and where it has not. Performance indicators should be defined for the purpose of measuring and reporting achievement and those performance indicators that are regarded as significant among them should be defined as key performance indicators (KPIs). A process for reviewing and, where appropriate, updating performance indicators should be established as part of a process of continual improvement.

NOTE KPIs are those that measure progress towards achieving objectives or other factors that are critical to success. For further information see BS EN ISO 9004.

8.2 Performance measurement

Compliant and successful maintenance services depend on performance that achieves predefined service levels and does so consistently. Measuring performance also supports a process of continual improvement. The organization should measure maintenance services to confirm priorities, check position, communicate position and ensure that appropriate progress is being made.

8.3 Process and approach

The organization should identify its objectives, the factors that are necessary for achieving those objectives and its operational requirements. Once the organization’s objectives and critical success factors are known, effective metrics should be established in the form of KPIs to measure several service perspectives and, ultimately, to identify compliance against agreed or set limits to ensure continual improvement. It is usual for metrics to be based on a balanced scorecard. This offers a holistic approach to performance measurement.

8.4 Developing appropriate and relevant metrics

KPIs should be reported in simple, direct terms that allow progress towards achieving outcomes and targets to be easily understood. The organization should ensure that the measurement process is appropriate and not a management or administrative burden.

KPIs should be:

a) derived from the maintenance strategy and based on critical success factors;

b) clearly defined and simple to understand;

c) providing timely and accurate feedback;

d) based on quantities that can be influenced or controlled;

e) related to specific goals and targets;
f) relevant and reflect the specification intent;
g) forming part of a closed-loop process;
h) representing both lead and lag measures; and
i) focused on improvement.

Responsibility for verifying work performed by service providers should rest with the organization which should have the right under the agreement or contract to require evidence before authorizing payment. Details of performance measurement and reporting should be included in the respective service contract between the organization and the maintenance organization or service level agreement between two internal bodies.

### 8.5 Performance metrics

KPIs derive from strategy, tactical and operational requirements and should be based on a balanced scorecard.

**NOTE 1** This approach involves direct and indirect measures to provide a holistic review of compliance, performance and progress.

The scorecard should include metrics identified for the following perspectives:

a) strategy, systems and processes;
b) compliance and risk management;
c) management and administration;
d) cost and financial management;
e) delivery performance;
f) resources, including in-house resources and supply chain;
g) user satisfaction;
h) environmental performance; and
i) innovation and continual improvement.

Each KPI should be supported by individual performance indicators whose scores are aggregated to provide an overall KPI score; this is achieved by applying a weighting to each performance indicator according to its relative importance to establish the overall KPI score. The weights of individual performance indicators should summate to 100%.

**NOTE 2** An example performance indicator for compliance might be percentage of statutory requirements compliant in the reporting period such as one month or, simply, % requirements compliant in month. Another example, where risk assessments are concerned, might be risk assessments completed as a percentage of those required in the reporting period or, simply, % risk assessments complete in month. A further example might be number of corrective maintenance tasks completed against those tasks logged in the reporting period or, simply, % backlog of corrective maintenance tasks in month.

**NOTE 3** Individual performance indicators and KPIs developed as part of performance measurement effectively measure the organization’s objectives and targets and represent the most important aspects of the specification as set out in the service level agreement or contract.

There should be alignment between individual performance indicators, KPIs and organizational objectives and targets.

**NOTE 4** A scoring matrix may be established to enable the level of compliance or non-compliance to be determined.

### 8.6 Performance review

Performance reviews should be convened periodically between the organization and providers of maintenance, as reviews offer both parties the opportunity to examine performance and compliance, to understand if targets are being met and to determine if performance is following a trend.
The performance review process enables the organization to manage maintenance by exception via the KPIs. Meetings should be held between the parties to identify and focus on those KPIs and individual performance indicators that have not met the agreed targets as set for each area of service. The reasons for targets not being met should be determined. In those cases where performance is below the set targets, performance improvement initiatives should be established and agreed between the parties. Review meetings should provide the forum for considering changes that might be necessary, including corrective actions (see 8.7), to raise performance, realize targets and agree incentives.

**NOTE**  Monthly meetings are likely to be appropriate in most cases.

### 8.7 Corrective actions

Where performance has fallen below the set targets, corrective actions should be taken.

**NOTE**  The steps necessary to be implemented as part of corrective action are likely to vary pending the nature and severity of the failure.

Agreement between the parties on where and how improvement can be achieved should be reached in the performance review meeting. The organization should consider fully the implications of any incentives or penalties with respect to performance so that unintended consequences are avoided.

### 8.8 Performance management and design

In cases where a new or refurbished facility is involved, the organization should ensure that sufficient attention is given to operational performance requirements prior to concept design as a part of briefing and that requirements are monitored throughout the subsequent work stages up to and including operation and use.

**NOTE**  BS 8536-1 provides detailed guidance on performance design.

### 8.9 Continual improvement

The organization should ensure that a systematic review of service delivery and maintenance performance takes place to understand the extent to which operational outcomes and targets have been met and where improvement is necessary. The review should cover the impact of service delivery upon compliance, risk exposure, the organization’s business activities, user experience and opportunities for innovation. Lessons learnt from this review should be recorded and used to inform the strategy and brief work stages (see BS 8536-1) for future new or refurbished facilities, contributing directly to a culture of continual improvement.

### 8.10 Quality control

Maintenance should ideally be inspected while it is being undertaken and immediately after completion to ensure that it complies with requirements. Records and accounts rendered for maintenance work carried out should be checked for completeness and accuracy.

**NOTE**  Quality control is part of a much larger consideration of quality (see BS EN 15221-3 for further details).

The organization should establish an audit regime covering all aspects of maintenance and, in particular, the quality of maintenance provision whether preventive or corrective. If there is insufficient competence for audit within the organization, external auditors should be considered for reviewing compliance with contract terms and conditions.

### 8.11 Fire protection

The organization should ensure that it understands the potential behaviour of materials, components and furnishings in the facilities in the event of a fire and the extent to which fire-retardant substances have been used either in their manufacture or applied subsequently.

**NOTE**  Fire-retardant substances can pose additional hazards and risks to health for users of the facility and firefighters, in the event of a fire, from the release of toxic chemicals.
8.12 Fire safety

The organization should recognize its responsibilities for the health, safety and security of people in its facilities and ensure that a responsible person is designated to act upon any matter that might be potentially hazardous or pose some other threat to users.

9 Facilities information management

9.1 General

COMMENTARY ON 9.1

The efficient and effective management of facility-related information is necessary for the organization to comply with its obligations and duties, as well as being able to derive optimal use and benefit from the facilities. The breadth of information to be managed can be substantial and demands a structured approach to its collection, analysis, updating, communication, storage and destruction.

The organization should determine the extent and nature of its process for managing facility-related information and, in particular, the relationship with existing processes including those for facilities maintenance management. Where facilities information management does not form an explicit part of the organization’s facilities management strategy or its facilities maintenance strategy, the organization should consider making allowance for it at the next available opportunity, for example when updating either strategy. The organization should incorporate its facilities information management with the facilities management system (see BS EN ISO 41001), where this has been implemented.

NOTE 1 Facilities information management can offer benefits beyond the collection, analysis, updating, communication and control of information and data. It can provide an important element in the basic infrastructure for facilities maintenance management. The efficient and effective use of information is the cornerstone of successful facilities management, including facilities maintenance management, enabling the organization to plan ahead by proactively supporting its core business.

NOTE 2 BS 8587 provides detailed guidance on facilities information management. BS EN ISO 41001 includes the requirement to manage documented information.

A plan for facilities information management should be prepared and kept up-to-date. This plan should include a definition of the information management process, the functions or activities within it, the information flows between functions or activities and the controls that need to be applied. Consideration should be given to the use of a digitally-based methodology and appropriate tools and systems.

9.2 Building information modelling

COMMENTARY ON 9.2

Building information modelling (BIM) is a method of designing, constructing, operating and maintaining a facility as a collaborative process using a single, integrated, up-to-date system of computer models, rather than several sets of different tools and documents.

Where the facilities have been designed, constructed and handed over as a building information model, the organization should make arrangements for maintaining and updating the model during its operational life. If an asset is replaced or modified, the relevant records should be updated utilizing COBie or another appropriate protocol. Attention should be given to any terms and conditions that should be in place to ensure compliance, monitoring and corrective action when data are not updated.

NOTE BS EN ISO 19650-3 provides guidance on the organization and digitization of information about buildings during the operational life of a facility. BS 8536-1 provides guidance on embedding BIM in a digital plan of work for a new or refurbished facility and the necessary considerations when managing the organization’s information requirements, asset information requirements and exchange information requirements.

3) In preparation.
9.3 Mechanical installations

Records should be kept of the following as installed:

a) the location, including level if buried, of all external connections (e.g. gas and cold water supplies) together with the points of origin and termination, size and materials of pipes, line pressure and other relevant information;

b) the layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes as well as the results of all balancing, testing and commissioning;

c) the location, identity, size and details of all apparatus and control equipment served by, or associated with, each of the various piped services together with copies of any test certificates for such apparatus where appropriate;

   NOTE 1  The information for size and details can be presented in schedule form.

d) the layout, location and extent of all air ducts showing dampers and other equipment, acoustic silencers, grilles, diffusers or other terminal components. Each duct and each terminal component should be marked with its size, the air quantity flowing and other relevant balancing data; and

e) the location and identity of each room or space housing plant, machinery or apparatus.

Drawings should record the following as installed:

1) detailed general arrangements of boiler houses, machinery spaces, air handling plants, tank rooms and other plant or apparatus, including the location, identity, size and rating of each apparatus;

   NOTE 2  The information for the size and rating can be presented in schedule form.

2) isometric or diagrammatic views of boiler houses, plant rooms, tank rooms and similar rooms or spaces housing plant, machinery or apparatus, including valve identification charts. A copy of such drawings should be framed and mounted on the wall of the appropriate room or space; and

3) comprehensive diagrams that show power wiring and control wiring and/or pneumatic or other control piping, including size, type or conductor or piping used, identifying the terminal points of each.

All records and drawings, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected records(s) and/or drawing(s) should be labelled “as subsequently altered”.

9.4 Electrical installations

Records should be kept of the following as installed:

a) main and sub-main cables, showing origin, route, termination, size and type of each cable. Cables providing supplies to specialist equipment, for example data centre equipment, should be identified separately;

b) lighting conduits and final sub-circuit cables, showing origin, route, termination and size of each, together with the number and size of cables within each conduit. The drawings should indicate, for each conduit or cable, whether it is run on the surface or concealed, for example in a wall chase, in a floor screed, cast in situ or above a false ceiling. These drawings should also indicate the locations of lighting fittings, distribution boards, switches, draw-in-boxes and point boxes, and should indicate circuitry;

c) details of secondary power sources for inclusion in a safe systems of work regime;
d) location and purpose of each emergency lighting fitting, including an indication of the circuit to which it is connected;

e) single and three-phase power conduits and final sub-circuit cables showing locations of power distribution boards, motors, isolators, starters, remote control units, socket outlets and other associated equipment;

f) other miscellaneous equipment, conduits and cables;

g) lightning conductor air terminals, conductors, earth electrodes and test clamps; and

h) location of earth tapes, earth electrodes and test points other than those in 9.4 g), cables providing earth circuits for specialist equipment should be identified separately.

Records should also include, where applicable:

1) distribution diagrams or schedules to show size, type and length (to within 1 m) of each main and sub-main cable, together with the measured earth continuity resistance of each;

2) schedule of lighting fittings installed stating location, manufacturer and type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed;

3) schedule of escape and emergency lighting fittings installed stating location, manufacturer, type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed. For battery systems, the position of the battery, its ampere-hour rating and battery system rated endurance in hours should be stated;

4) records of smoke detectors, sprinklers and fire protection generally (see 9.5), as well as security protection;

5) incoming supply details including the type of system, voltage, phases, frequency, rated current and short circuit level, with the details of the supply protection and time of operation as appropriate;

6) main switchgear details which, for purpose-made equipment, should include a set of manufacturers’ drawings and the site layout;

7) transformer, capacitor and power plant details. e.g. in the case of transformers, the volt-ampere rating, voltages and type of cooling; and

8) completion certificate in accordance with BS 7671.

All records and drawings, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected record(s) and/or drawing(s) should be labelled “as subsequently altered”.

9.5 Fire protection systems

Records should be kept of the following:

a) description of fire detection and fire alarm system;

b) details of any fire suppression systems, e.g. sprinkler, inert gas or chemical agent installations;

c) location and servicing arrangements of all fire alarm and call points;

d) location and servicing arrangements of all risers, hose reels, extinguishers and any other fire-fighting equipment;

e) location of all fire compartment walls, doors, floors and screens;
f) location of all areas of exceptional fire hazard;

g) fire escape routes;

h) details of the application of any fire protection treatment, for example the use of intumescent materials and applied fire retardants;

i) location, details and description of any installation for smoke control or protection of escape routes, e.g. pressurization of lobbies and staircases;

j) details of any master key system; and

k) names, home addresses and telephone numbers of key holders, which should be kept up-to-date and should be lodged with the fire and police authorities.

All records, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected record(s) should be labelled “as subsequently altered”.

NOTE Attention is drawn to The Regulatory Reform (Fire Safety) Order 2005 [19] relating to fire risk reduction and fire prevention and to BS 5839-1. Under The Regulatory Reform (Fire Safety) Order 2005 [19] and The Fire (Scotland) Act 2005 [22], those who have a degree of control over the premises (or certain areas on the premises) might be designated as the “responsible person”, for example, the owner, an agent, an employee or the occupier.

9.6 Building management system (BMS)

Where a BMS or equivalent arrangement exists for monitoring and controlling mechanical, electrical or other engineering installations, the organization should ensure that the requirements for the maintenance of the BMS are fully incorporated into maintenance programmes. In the event of actuator failures or other faults, corrective actions should be initiated with minimal delay.

NOTE The Effective BMS – A guide to improving system performance [23] provides guidance on improving the effectiveness of a BMS. A BMS can help to reduce energy consumption and CO₂ emissions, improve user comfort, operate engineering installations more efficiently and transfer data to other systems such as those for maintenance management (see 9.11).

9.7 Energy management system (EMS)

Where an EMS or equivalent arrangement exists for monitoring and controlling energy use, the organization should ensure that the requirements for the maintenance of the EMS are fully incorporated into maintenance programmes.

9.8 Smart buildings and intelligent systems

COMMENTARY ON 9.8

A smart building is a facility that uses sensor and control systems to obtain and analyze data points and automatically utilize these data, which could be used to:

a) control the facility’s operations, including heating, ventilation, air conditioning, lighting and security;

b) issue warning or alarms if setpoints or operating parameters are exceeded;

c) support user wellness by continuously assessing air quality and temperature;

d) support facility environmental impact by assessing energy and emissions in use;

e) assist in wayfinding around the building;

f) determine space utilization; and

g) link with the building information model to assist maintenance.

A smart building uses sensors, gateways, actuators and other networked devices. These can form part of the building management system, a local area network or a dedicated network. An intelligent system is any connected system, be it a sub-system or whole system, that generates data, has a communication protocol enabling data to be sent to either a database or a cloud platform, where analytics are utilized to deliver insight into the performance and functionality of the parameters or facility assets being monitoring.
The organization should ensure that correct and appropriate security controls are embedded into a smart building or intelligent system to prevent unapproved access to the system or the wider network infrastructure of the facilities or the organization.

9.9 Manuals, registers and inventories

9.9.1 General

COMMENTARY ON 9.9.1

Whether an organization is responsible for the maintenance of a number of facilities or a single facility, the preparation of a manual tailored to suit each facility can offer significant advantages in terms of providing a clear statement of intentions and required actions.

The organization’s procedures for undertaking maintenance should be formalized in a maintenance manual or manuals. The manual might form part of wider documentation covering operational plans and arrangements; where this is the case, all such documentation should be incorporated in the facility handbook (see 5.3.2).

In the event of a change of organization or maintenance advisor, an up-to-date manual and/or facility handbook should ensure continuity of maintenance. Copies of maintenance manuals should be held by the organization and any maintenance advisor if appointed.

9.9.2 Structure of maintenance manual

9.9.2.1 General

The maintenance manual should be prepared in two parts: the first part should be addressed to the organization; and the second part should be addressed to those responsible for inspecting the facility and reporting to and advising the organization.

9.9.2.2 Guidance

The first part of the manual should:

a) recommend intervals between:
   1) routine, general and detailed inspections (see 5.4);
   2) inspection and maintenance of each engineering installation and items of special equipment;
   3) maintenance of items which, as recommended by their manufacturers, require regular attention to preserve satisfactory performance, e.g. the lubrication and adjustment of moving parts in component assemblies and systems; and
   4) other periodic work as experience in use shows to be necessary, e.g. the clearing of gutters, downpipes or surface water gullies;

b) draw attention to the need to ensure that a facility’s provisions for means of escape in the event of fire, i.e. fire resisting self-closing doors and exit hatches, are in satisfactory working order at all times, including those periods during which any maintenance is being undertaken;

c) draw attention to critical environments, including special arrangements for gaining access for the purpose of inspections or when undertaking maintenance;

d) specify proprietary maintenance materials, e.g. floor sealers and polishes likely to offer acceptable service and slip resistance;

e) set out the names, addresses and other contact details of firms responsible for the following:
   1) inspecting, reporting and advising on the condition of the building fabric;
   2) emergency repairs to the building fabric; and
3) servicing and emergency repairs for each engineering installation and items of special equipment.

The second part of the manual should:

a) consist mainly of selected, concise information, abstracted from the facility handbook, and likely to be needed during inspections; this information should be ordered in the sequence in which examination is likely to be carried out; and

b) schedule those materials and components that experience shows to be prone to failure and/or to require special attention.

NOTE Advice on the preparation of manuals can be found in BS 4884-2, BS 8587 (especially in regard to the facility handbook) and BS EN 15331.

9.9.3 Updating of manual

The maintenance manual should be reviewed annually and updated where necessary to reflect changes in legislation as well as current circumstances and arrangements. When changes occur to facilities, or where new information becomes available, all copies of the maintenance manual should be revised accordingly, irrespective of whether it is self-standing or forms an integral part of the facility handbook.

9.9.4 Asset register

The organization should include other information and data as might be necessary in the form of a register of its facility assets, for example:

a) identification number or unique reference for the asset;

b) make and/or model;

c) manufacturer;

d) vendor, if different to manufacturer;

e) date of manufacture;

f) date of acquisition, installation or completion of construction;

g) location of asset;

h) whether or not access equipment is required;

i) whether or not the asset is subject to a permit-to-work requirement;

j) initial cost;

k) predicted lifetime;

l) specification;

m) replacement cycle;

n) cost breakdown;

o) servicing requirements, including type and frequency of service;

p) other maintenance required;

q) maintenance costs;

r) accumulated depreciation;

s) written-down value;

t) source of components and spare parts, where applicable (see 9.9.6);

u) energy consumption and, where applicable, energy-efficiency rating; and

v) identification of hazardous or other risks to people or property.
9.9.5 Engineering installations

Information describing the facility’s engineering installations should be recorded. Details should include points of entry, or termination, of public utilities.

The organization should stipulate the maintenance requirements for its mechanical and electrical installations and fire protection systems (see 9.3, 9.4 and 9.5 respectively); the tasks to be carried out and their frequency should be included. The following attributes of major components should be taken into account:

a) current condition;
b) current utilization or output;
c) maintenance tasks to be performed;
d) frequency of maintenance; and
e) estimated cost of maintenance.

NOTE SFG20 [10] covers the management, specification and delivery of engineering maintenance. This standard is useful when framing tendering requirements and, later, during operation and use when benchmarking the costs of service provision. The standard specifies tasks that need to be performed and the frequency of those tasks to keep engineering installations in the best operational condition. It can be a useful source of guidance in the absence of a business-focused or risk-based process for determining maintenance frequencies (see 6.1).

9.9.6 Warranties, repairs and spare parts

Details of warranties relating to plant, equipment, components and systems should be recorded and cross-referenced to those operational and maintenance requirements that affect them. Details of repairs should be recorded against the respective item. A list of spare parts should be kept up-to-date. Details should include the following as a minimum:

a) description of part;
b) identification number or unique reference for the part;
c) original manufacturer of part;
d) contact details of current manufacturer and/or distributor;
e) predicted lifetime of part;
f) operational parameters affecting lifetime of part;
g) minimum number of parts to be held in stock (within or near to the facility);
h) where permissible, details of any alternative part and its source;
i) availability and minimum delivery period;
j) warranty period;
k) estimated cost of part;
l) transportation and logistical considerations;
m) details of other parts potentially affected by failure and/or replacement;
n) specialist equipment or tools required;
o) specific competence required; and
p) details of special conditions or arrangements when installing.

The details given in a) to p) are, in effect, an inventory that should be kept up-to-date if the organization is to minimize disruption and/or loss of business continuity in the event of a breakdown or failure.

The organization should determine its policy on the holding of spare parts (see 4.3.2).
9.10 Storage and security of records

9.10.1 General

The organization should keep records in a safe and secure location and arrange them in such a way as to enable their rapid retrieval. Records of personnel permitted to access the records and any requirements or conditions attaching thereto should be defined. Duplicate records should be kept in a physically separate and secure environment.

NOTE Attention is drawn to The Data Protection Act 2018 [24].

9.10.2 Storage

The place for storage of records should take into account the form of the records, the media used and the conditions necessary to keep them from damage of any kind; they should also be readily accessible. Backup or duplicate records (electronic and paper-based) should be kept in a secure place in a location other than the facility to which they relate. Both sets should be kept up-to-date.

9.10.3 Security

Measures taken to ensure security should be recorded and a copy should be held in a secure location away from the facility to which they relate. The following records should be kept up-to-date and be readily accessible to authorized personnel when required, which might be at short notice and outside normal working hours:

a) names, home addresses and telephone numbers of key holders;

b) details of master key system; and

c) details of intruder alarms and other security systems.

NOTE Attention is drawn to BS ISO/IEC 17799 and BS 5839-1.

9.11 Maintenance management system

The organization should review its requirements for data systems, basic ICT facilities and extended services necessary to support its maintenance management. An IWMS, CAFM, CMMS or equivalent system, as a means for managing facilities maintenance information, should be utilized. The following features are likely to provide a suitable basis and should be considered:

a) budgetary and other financial controls;

b) cost accounting;

c) asset register;

d) condition-based monitoring of assets;

e) early detection of problems and rapid fault reporting;

f) operational plans, including frequency of functions or activities performed;

g) risk and hazard assessment;

h) permits-to-work;

i) personal protective equipment issued and returned;

j) planned and scheduled preventive maintenance;

k) reactive maintenance;

l) change management;

m) job orders and other requisitions for goods and services;

n) job logging, prioritization and tracking, including details of backlogs;
o) energy use and carbon dioxide equivalent (CO$_2$-eq) emitted per annum;

p) resource consumption and productivity measures;

q) analysis of work undertaken to identify trends;

r) space planning and space utilization;

s) workstation location and furniture management;

t) performance indicators for the delivery of services;

u) user experiences of services delivered;

v) audit trail of system transactions; and

w) exception reporting for management purposes.
Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4884-2, Technical manuals – Part 2: Guide to content
BS 5839-1, Fire detection and fire alarm systems for buildings – Part 1: Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises
BS 6270-3, Code of practice for cleaning and surface repair of buildings – Part 3: Metals (cleaning only)
BS 8544, Guide for life-cycle costing of maintenance during the in-use phases of buildings
BS 8587, Guide to facility information management
BS 18004, Guide to achieving effective occupational health and safety performance
BS 45002-1, Occupational health and safety management systems – General guidelines for the application of ISO 45001 – Part 1: Guidance on managing occupational health
BS 45002-3, Occupational health and safety management systems. General guidelines for the application of ISO 45001 – Part 3: Guidance on incident investigation
BS EN 13306, Maintenance – Maintenance terminology
BS EN 13460, Maintenance – Documentation for maintenance
BS EN 15221-1, Facility management – Part 1: Terms and definitions
BS EN 15221-2, Facility management – Part 2: Guidance on how to prepare facility management agreements
BS EN 15221-3, Facility management – Part 3: Guidance on quality in facility management
BS EN 15221-5, Facility management – Part 5: Guidance on facility management processes
BS EN 15221-7, Facility management – Part 7: Guidelines for performance benchmarking
BS EN 15331, Criteria for design, management and control of maintenance services for buildings
BS EN 45552, General method for the assessment of the durability of energy-related products
BS EN 60300-3-11, Dependability management – Part 3-11: Application guide – Reliability centred maintenance
BS EN ISO 9004, Quality management – Quality of an organization – Guidance to achieve sustained success
BS EN ISO 19650-1, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 1: Concepts and principles
BS EN ISO 19650-3, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 3: Operational phase of assets
BS EN ISO 41001, Facility management – Management systems – Requirements with guidance for use

4 In preparation
BS ISO 15686-10, Buildings and constructed assets – Service life planning – Part 10: When to assess functional performance

BS ISO 41014, Facility management – Development of facility management strategy 5)

BS ISO 45001, Occupational health and safety management systems – Requirements with guidance for use

BS ISO 55001, Asset management – Management systems – Requirements

BS ISO/IEC 17799, Information technology – Code of practice for information security management

ISO 41011:2017, Facility management – Vocabulary

Other publications


5) In preparation


