INTERNATIONAL STANDARD

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Buildings and constructed assets — Service life planning —

Part 3: Performance audits and reviews

Bâtiments et biens immobiliers construits — Prévision de la durée de vie — Partie 3: Audits et revues des performances

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15686 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15686-3 was prepared by Technical Committee ISO/TC 59, *Building construction*, Subcommittee SC 14, *Design life*.

ISO 15686 consists of the following parts, under the general title *Buildings and constructed assets — Service life planning*:

— *Part 1: General principles*

— *Part 2: Service life prediction procedures*

— *Part 3: Performance audits and reviews*

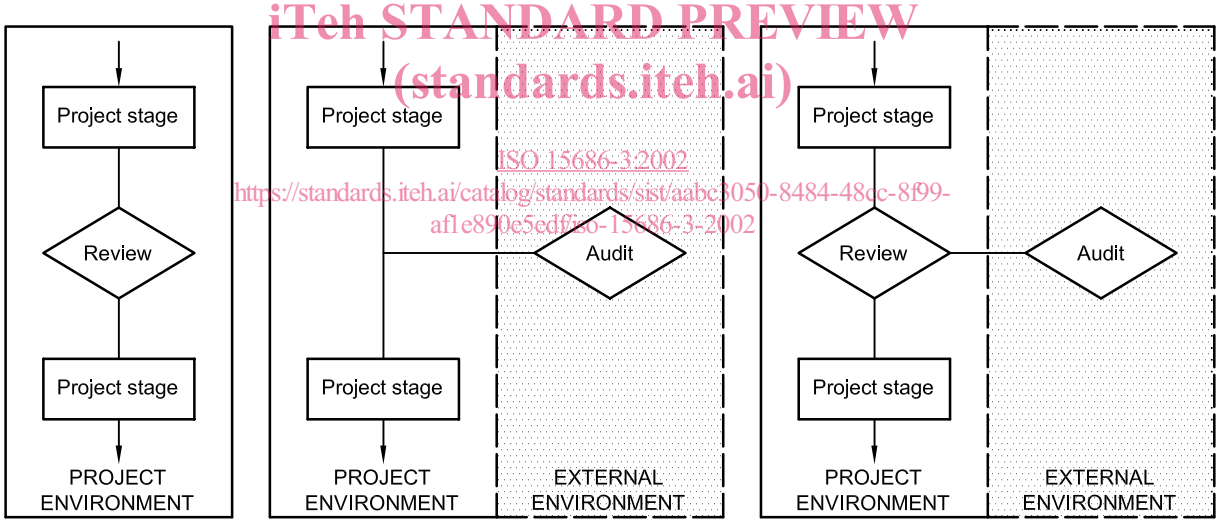
Annexes A, B and C of this part of ISO 15686 are for information only.

Introduction

Buildings and constructed assets require care from the initial proposals through to design, construction, operation, maintenance and disposal, to ensure they meet the required level of performance. ISO 15686-1 and ISO 15686-2 explain the principles of designing an appropriate service life for different types of constructed assets, components and assemblies. This part of ISO 15686 deals with measures to ensure that the life care of a constructed asset is considered through each stage of decision making from project conception and initial briefing, through design and construction, to occupancy and eventual disposal and reinstatement of the site.

This part of ISO 15686 provides a choice between formal independent audits carried out at key project stages (clauses 5 and 6); and service life performance reviews carried out alongside existing internal project review procedures (clause 7). The advantages of formal external audits can include greater independence and objectivity as well as access to wider experience of auditing procedures. Service life performance reviews benefit from greater familiarity with the specific project and the potential to integrate certain review procedures with other project validation procedures such as designers' quality management system checks.

NOTE There is also scope for integrating service life performance audit and review procedures within a project, such that the documented outcomes of the review process form the inputs into the audit process at a given project stage. The review then becomes the primary means of ensuring effective service life planning and the audit function is limited to that of verifying the outcomes of the review process (see Figure 1).



a) Reviews only **b) Audits only** **c) Reviews and audits**

Figure 1 — Three models for integrating performance audits and reviews into the procurement process

Both service life performance audits and reviews emphasize the pre-briefing, briefing and design stages of a construction project. It is the far-reaching decisions made at these early stages that affect what is built, the way it is constructed, its commissioning and operation, how it should be maintained and the options for dealing with the structure at the end of its life cycle. It has been found that more than 50 % of building failures can be traced back to the brief and to information passed on in, or missing from, the design and specification details that the constructor receives. Other failures can result from poor construction, inadequate commissioning, unsuitable use of the building, and inadequate life care. The service life performance audit and review process includes a means of checking back in these later stages to ensure that the original intentions are followed.

Auditing is a key management tool for ensuring that stated objectives are met. Procedures have been established for auditing quality management systems (ISO 19011) and for environmental auditing (ISO 14010, ISO 14011 and ISO 14012). Many of the techniques described here are similar to those used for quality and environmental auditing and there is an opportunity in service life performance audits and reviews to combine procedures in specific circumstances.

A service life performance audit or review of the pre-briefing stage and of the project brief should reveal where client requirements for service life are missing or inadequately defined. The requirements can then be defined before work starts on the detailed design. An audit or review of the detailed design will report on nonconformities, i.e. where the design does not meet the requirements of the brief. The design can then be amended, or the requirements redefined, before construction.

Further audits or reviews of the construction, commissioning, and future operation, refurbishment, adaptation and disposal of the constructed asset can be undertaken to ensure that the required service life performance is not compromised by such activities.

Figure 2 summarizes the main topics covered in this part of ISO 15686.

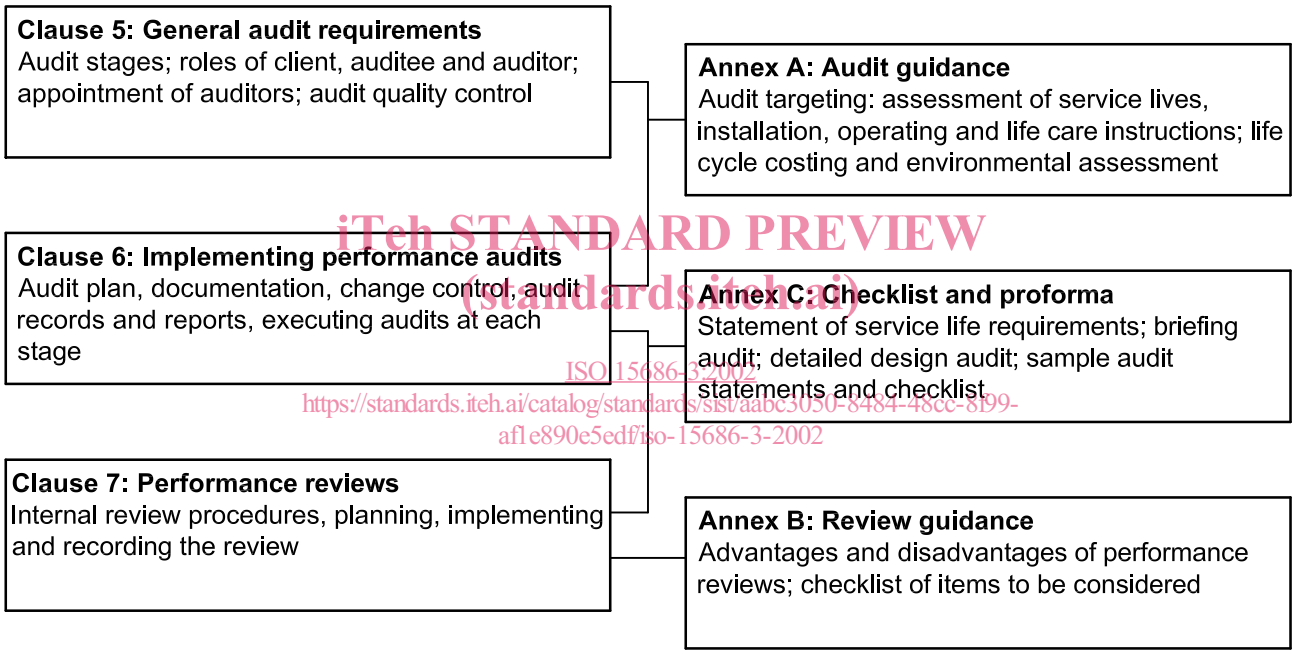


Figure 2 — Overview of this part of ISO 15686

The provisions of this part of ISO 15686 are intended primarily for

— construction clients,

— persons appointed to carry out service life performance audits (auditors),

— designers, and

— operational and maintenance personnel.

They are also relevant to the work of constructors, project managers, inspectors, asset and facilities managers, insurers and valuers.

In addition to this part of ISO 15686, six other parts are published or are in the course of preparation, as follows.

— Part 1 deals with general principles, issues and data needed to forecast service lives and provides a method for estimating the service lives of components and assemblies.

— Part 2 describes generic procedures for testing the performance of components, materials and assemblies to provide service life predictions.

— Part 4 will provide guidance on methods of presenting data and evidence to support forecasts and predictions.

— Part 5 will provide guidance on assessment of whole life costing.

— Part 6 will provide a procedure for considering environmental impacts.

— Part 7 will provide guidance on the performance evaluation and feedback of service life data from existing construction works.

— Part 8 will provide guidance on the provision of reference service life for use in the application of ISO 15686-1.

A major impetus for the production of ISO 15686 has been concern over the construction industry's need to control the cost of ownership of constructed assets, since a high proportion of the life cycle cost may be set by the time the facility is complete. In addition to reducing unnecessary expenditure, the use of ISO 15686 can contribute to the aim of "sustainable" development by promoting a less wasteful use of natural resources and to consequential protection of the environment.

Buildings and constructed assets — Service life planning —

Part 3: Performance audits and reviews

1 Scope

This part of ISO 15686 is concerned with ensuring the effective implementation of service life planning. It describes the approach and procedures to be applied to pre-briefing, briefing, design, construction and, where required, the life care management and disposal of buildings and constructed assets to provide a reasonable assurance that measures necessary to achieve a satisfactory performance over time will be implemented.

The cost implications of service life planning and the broader issues of sustainability (e.g. embodied energy, land use) are not developed in this part of ISO 15686.

NOTE Throughout this part of ISO 15686 the term “constructed asset” is used to include buildings; infrastructure works such as roads, bridges and pipelines; structural works such as communications masts; and other engineering works such as power stations and chemical plants.

2 Conformance

Conformance with this part of ISO 15686 requires service life performance audits to be undertaken in accordance with clauses 5 and 6 and/or reviews to be carried out in accordance with clause 7. It shall be stated in all relevant documentation which of these clauses applies. Audits or reviews of the pre-briefing, briefing and detailed design stages of a project are the minimum “core” activities that shall be carried out whenever compliance with this part of ISO 15686 is required prior to construction. Further audits or reviews of the initial design, construction, commissioning, operation, alteration and/or disposal of the facility are discretionary but, where carried out, shall conform with this part of ISO 15686.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15686. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15686 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*

ISO 15686-1:2000, *Buildings and constructed assets — Service life planning — Part 1: General principles*

ISO 19011, *Guidelines for quality and/or environmental management systems auditing*

4 Terms and definitions

For the purposes of this part of ISO 15686, the terms and definitions given in ISO 6707-1, ISO 15686-1, ISO 19011 and the following apply.

4.1
service life performance audit
systematic examination by an independent party of requirements, initial and detailed design proposals, and instructions for installation, commissioning and life care, to determine their adequacy in relation to service life performance

NOTE 1 In this context, an “independent party” is an individual or organization that is not directly accountable or responsible for the project activities being audited.

NOTE 2 A service life performance audit is not concerned with early failures (within the normal contractual warranty period) that are caused by faulty design, manufacture, handling or installation.

4.2
service life performance review
systematic second-party examination of requirements, initial and detailed design proposals, and instructions for installation, commissioning and life care, to determine their adequacy in relation to service life performance

4.3
pre-briefing
earliest stage in the consideration of a construction project when the need for constructed works is assessed and the suitability of sites is assessed

4.4
initial design
early stage in the development of a design before many of the materials, components or assemblies have been selected

4.5
detailed design
drawings, data, calculations and specifications from which constructed works, components and assemblies can be constructed

4.6
life care
measures that promote achievement of the design life, including cleaning, maintenance, servicing, repair, refurbishment, protection, control of use and avoidance of neglect

4.7
recovery management
planning and control procedures designed to maximize the economic reuse of resources committed to a constructed works project

4.8
reference document
project document and other supporting evidence, provided for auditing and/or review purposes, that demonstrate the project team’s response to the service life performance requirements in the project brief

4.9
reliability
probability that a component, assembly or system will perform its intended function under stated conditions for a stated period of time

4.10
serviceability
ability to meet or exceed relevant performance requirements

4.11
availability
periods during which a facility or service is serviceable

4.12
nonconformity
non-fulfilment of specified requirements

4.13
observation
statement of fact made during an audit or review and substantiated by objective evidence

5 General audit requirements and responsibilities

5.1 General

Service life performance audits are undertaken to ensure that performance over time has been adequately considered in the pre-briefing, briefing, design, construction, life care management (including refurbishment, alteration) and disposal of a constructed asset, and to provide a reasonable assurance that the required service life performance will be achieved. To ensure objectivity, consistency and reliability, service life performance audits are distinct activities carried out by qualified auditors that are independent of the project activities being audited.

Service life performance audits shall be conducted in accordance with clauses 5 and 6 of this part of ISO 15686. Audits shall be conducted according to documented and well-defined methodologies and systematic procedures. For any type of service life performance audit, the methodologies and procedures adopted shall be consistent and shall aim to ensure comparability and repeatability. Where possible, standard audit checklists, statements and proformas shall be used as a means of ensuring consistency and reliability in the audit process. Guidance and examples are provided in informative annexes A and C.

The scope and purpose of each audit shall be clearly defined before work on that audit starts. The detail and extent of the audit and its documentation shall reflect the specific context (e.g. legal, financial, environmental, health and safety) within which the findings are likely to be used. Where a particularly onerous reliance is likely to be placed on audit findings, the audit and its documentation shall be subject to an enhanced level of robustness and details. Records shall be kept of all reference documents and other documentation used in arriving at the audit findings. Following examination of the reference documents by the auditor, the output from the audit is a report to the client and/or auditee. The auditor may later be asked to assess the adequacy of corrective action taken to redress the nonconformities listed in the audit report.

The specific purpose of the audit will depend upon the stage in the asset life cycle at which it is undertaken and on the audit scope and extent as defined by the project client. Table 1 provides an overview of the service life performance auditing process related to specific stages in the asset life cycle.

Table 1 — Service life performance auditing related to asset life cycle

Stage in asset life cycle	Audit type/stage	Audit status[a]	Purpose of audit
Project initiation	Pre-briefing audit (6.6.1)	Core	To ensure that service life has been adequately considered in decisions on the need to build and the choice of site.
Project definition	Briefing audit (6.6.2)	Core	To ensure that there is an adequate basis for service life planning at the initial and detailed design stages.
Initial design	Initial design audit (6.6.3)	Secondary	To assess the service life implications of initial concept designs.
Detailed design	Detailed design audit (6.6.4)	Core	To ensure that the design conforms to the service life performance requirements of the brief; to ensure that adequate information on installation and commissioning is provided for those involved in the construction stage.
Construction	Construction audit (6.6.5)	Secondary	To assess whether correct or intended materials/ components have been used and installation instructions have been properly implemented.
Commissioning and handover	Commissioning and handover audit (6.6.6)	Secondary	To assess whether the commissioning instructions have been properly implemented; to ensure that adequate information on the operation and life care of the facility is provided.
Operation	Operation and life care audit (6.6.7)	Secondary	To assess whether the life care instructions have been properly implemented; to review the adequacy of the life care regime.
Refurbishment/ adaptation/ alteration/change of use	Refurbishment/adaptation/ alteration/change of use audits (6.6.8)	Secondary	To assess whether proposals/instructions for refurbishment/adaptation/alteration/change of use conform to the service life performance requirements of the brief for such works; to ensure that adequate instructions are provided for those involved in implementing the works. To assess whether the instructions have been properly implemented.
Disposal/ decommissioning/ deconstruction/ recovery/site reinstatement	Disposal/ decommissioning/ deconstruction/recovery/ site reinstatement audits (6.6.9)	Secondary	To assess whether proposals or instructions for disposal, decommissioning, deconstruction, material recovery, site reinstatement, etc. conform to the requirements of the disposal brief and/or the original project brief and detailed design. To assess whether disposal work, etc. carried out complies with those instructions.

[a] See 5.2.

5.2 Audit stages

Table 1 relates the audit types to stages in the asset life cycle. It also defines the purpose of the audit at each stage and distinguishes between core and secondary audits. Core audits are the minimum audits that shall be carried out in order to comply with the auditing clauses (clauses 5 and 6) of this part of ISO 15686. Further "secondary" audits may be carried out at the discretion of the client and/or project team. In deciding the quantity and types of audit to be carried out on a given project, due regard shall be given to the project size and complexity and to the perceived level of risk in relation to service life performance.

NOTE The distinction between core and secondary audits defined above is not intended to be definitive or prescriptive, but merely to define the minimum level of auditing required to comply with this part of ISO 15686. For certain types of project with known high risks, it is likely that the list of core audit activities will be extended to include other audits. For example, with complex mechanical or electrical plant, the assessment of commissioning and handover activities is of key importance and is likely to form a core audit activity.

In practice the detailed design audit is generally more onerous than other audits, and is not likely to be fully effective unless preceded by pre-briefing and briefing audits. Similarly if no detailed design audit has been prepared, the completeness of audits of construction, commissioning, operation, refurbishment and disposal may be limited because relevant information from the design stage has not been made available. Therefore the following requirements apply:

— pre-briefing and briefing audits shall always precede detailed design audits (see 5.4.1 on the timing of audits);

— a detailed design audit shall be carried out whenever conformance with this part of ISO 5686 is required prior to construction;

— when construction, commissioning, operation and life care, refurbishment or disposal audits are carried out without a preceding detailed design audit, this shall be stated in the audit report.

5.3 Roles

5.3.1 Introduction to the parties

The audit process described in this part of ISO 15686 involves three principal parties: the client, the auditor and the auditee. The client could be the occupier, or could have a financial interest in the constructed asset (e.g. as owner, leaseholder, lender or insurer), and is responsible for initiating the audit. The auditor shall be an individual or organization that is independent of the specific project activities being audited, and is responsible for carrying out the audit activities and reporting the findings. The auditee is generally the designer but may also be the project manager, constructor or supplier, and is responsible for providing the auditor with the necessary project information and, in conjunction with the client, for addressing any nonconformities identified in the audit process.

NOTE In practice the audit can be carried out as a second- or third-party function. A second-party audit is carried out by a person from within the same organization or within the project team, but independent of the activity being audited. A third-party audit is carried out by a person or organization wholly independent of the activity being audited.

5.3.2 Client

The client's (or client's nominated project manager or agents) responsibilities and tasks are

— to determine the need for the audit,

— to contact the auditee to obtain its full cooperation and to initiate the process,

— to appoint the auditor and, if applicable, approve the composition of the audit team,

— to consult with the auditor and define the scope, extent and objectives of the audit, including which of the audit stages listed in Table 1 shall be carried out and which parts of the project shall be included or excluded from the audits,

— to identify the anticipated uses(s) to which the audit will be put, including any specific legal, insurance or other requirements,

— to provide appropriate authority and resources to enable the audit to be carried out,

— to approve the audit plan,

— to provide information on pre-briefing decisions and the design brief that are relevant to service life,

— to receive the audit reports and determine their distribution, and

— to determine/initiate the audit response (in conjunction with the auditee), including any corrective action arising from nonconformities raised.