FINAL
DRAFT

INTERNATIONAL STANDARD

ISO/IEC FDIS 25001

ISO/IEC JTC **1**

Secretariat: **ANSI**

Voting begins on:
2006-08-30

Voting terminates on:
2006-10-30

Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Planning and management

Ingénierie du logiciel — Exigences de qualité et évaluation du produit logiciel (SQuaRE) — Planification et gestion

Please see the administrative notes on page iii

Reference number
ISO/IEC FDIS 25001:2006(E)

In accordance with the provisions of Council Resolution 21/1986, this document is **circulated in the English language only**.

Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

Attention is drawn to the possibility that some of the elements of ISO/IEC 25001 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 25001 makes a part of SQuaRE series of standards and was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information Technology*, Subcommittee SC 7, *Software and system engineering.*

SQuaRE series of standards consists of the following divisions under the general title *Software product Quality Requirements and Evaluation:*

— Quality Management Division,

— Quality Model Division,

— Quality Measurement Division,

— Quality Requirements Division, and

— Quality Evaluation Division.

Introduction

ISO/IEC 25001 provides details about the planning and management requirements associated with software product quality requirements and evaluation.
While this standard is mainly concerned with product quality requirements and evaluation, wherever it is relevant the corresponding process requirements and evaluation activities are also discussed.

This standard aims to clarify the requirements which should be identified by the organization in order to ensure the success of specifying quality requirements and executing the evaluation.

This International Standard is intended to be used in conjunction with the other parts of the SQuaRE series (ISO/IEC 25000 – ISO/IEC 25051) of standards, and with ISO/IEC 14598 and ISO/IEC 9126-1 until superseded by the ISO/IEC 25000 series of standards.
This International Standard complies with the technical processes identified in ISO/IEC 15288 related to quality requirements definition and analysis.

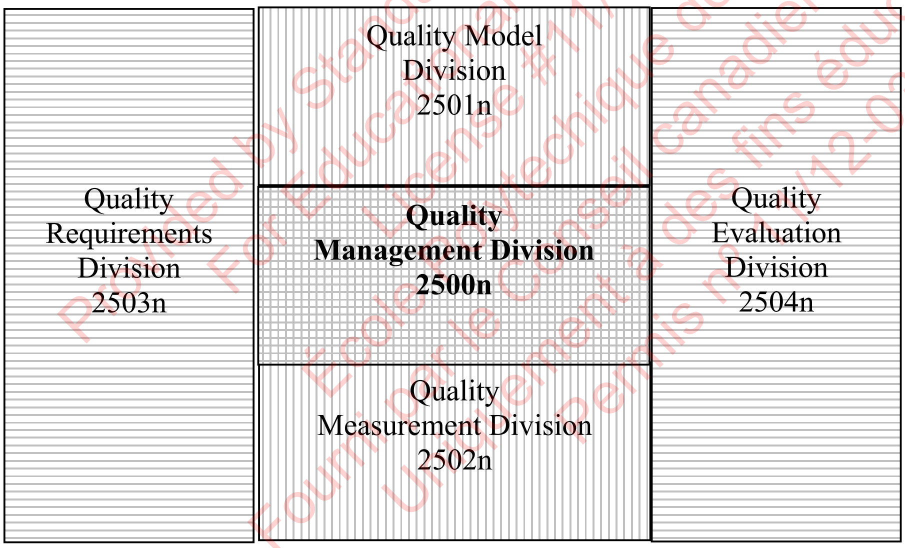

Figure 1 — Organization of SQuaRE series of standards

Figure 1 (quoted after ISO/IEC 25000) illustrates the organisation of the SQuaRE series representing families of standards, further called Divisions.

The Divisions within SQuaRE model are:

- **ISO/IEC 2500n — Quality Management Division.** The standards that form this division define all common models, terms and definitions referred further by all other standards from SQuaRE series. Referring paths (guidance through SQuaRE documents) and high level practical suggestions in applying proper standards to specific application cases offer help to all types of users. The division

also provides requirements and guidance for an evaluation group which is responsible for the management of software product quality requirements specification and quality evaluation.

- **ISO/IEC 2501n — Quality Model Division**. The standard that forms this division presents a detailed quality model including characteristics for internal, external and quality in use. Furthermore, the internal and external software quality characteristics are decomposed into subcharacteristics. Practical guidance on the use of the quality model is also provided.

- **ISO/IEC 2502n — Quality Measurement Division**. The standards that form this division include a software product quality measurement reference model, mathematical definitions of quality measures, and practical guidance for their application. Presented measures apply to internal software quality, external software quality and quality in use. Quality measure elements forming foundations for the latter measures are defined and presented,

- **ISO/IEC 2503n — Quality Requirements Division**. The standard that forms this division helps specifying quality requirements. These quality requirements can be used in the process of quality requirements elicitation for a software product to be developed or as input for an evaluation process. The requirements definition process is mapped to technical processes defined in ISO/IEC 15288,

- **ISO/IEC 2504n — Quality Evaluation Division**. The standards that form this division provide requirements, recommendations and guidelines for software product evaluation, whether performed by evaluators, acquirers or developers. The support for documenting a measure as an Evaluation Module is also presented.

Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Planning and management

1 Scope

This International Standard provides requirements and recommendations for an organization responsible for implementing and managing the software product quality requirements specification and software quality evaluation activities through the provision of technology, tools, experiences and management skills.

The role of the evaluation group includes motivating people and training them for the requirements specification activities and the evaluation activities, preparing appropriate documents, identification or development of required methods, and responding to queries on relevant technologies.

Technology management is related to the planning and management of a software quality requirements specification and evaluation process, measures and tools. This includes the management of development, acquisition, standardization, control, transfer and feedback of requirements specification and evaluation technology experiences within the organisation.

The intended users of ISO/IEC 25001 are those responsible for:

— managing technologies used for requirements specification and evaluation execution,
— specifying software product quality requirements,
— supporting software product quality evaluation,
— managing software development organisations,

as well as those in a quality assurance function. It is also applicable to managers involved in other software related activities.

2 Conformance

In order to conform to ISO/IEC 25001, an organization shall apply requirements from Clause 6 giving the reasons for any exclusion, or describe its own recommendations and provide a mapping to the original requirements.

3 Normative references

The following referenced documents are indispensable for the application 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.

ISO/IEC 25000, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

ISO/IEC 25020, *Software and System Engineering — Software Quality Requirements and Evaluation (SQuaRE) — Quality measurement — Measurement reference model and guide*

ISO/IEC 25030, *Software engineering — Software Quality Requirements and Evaluation (SQuaRE) — Quality requirements*

ISO/IEC 25051, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Requirements for quality of Commercial Off-The-Shelf (COTS) software product and instructions for testing*

ISO/IEC 15288, *Systems engineering — System life cycle processes*

4 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO/IEC 25000 and the following apply.

4.1
evaluation activity
assessment of a software product against identified and applicable quality characteristics performed using applicable techniques or methods

4.2
evaluation group
organization responsible for specifying the software quality requirements as well as managing and implementing the software quality evaluation activities through the provision of technology, tools, experiences, and management skills

4.3
evaluation technology (technology used for evaluation)
techniques, processes, tools, measures and relevant technical information used for evaluation

EXAMPLES These include internal, external or quality in use measures or specific evaluation processes designed for developers, acquirers or independent evaluators.

4.4
techniques
methods and skills required to carry out a specific activity

5 Evaluation management concepts

The ISO/IEC 25001 is applicable to the evaluation group, which provides the organisation-wide support to all projects in software development, software acquisition and third party evaluation organisations (see Table 1).

DEVELOPED SOFTWARE		ACQUIRED SOFTWARE	
Development Activities	Evaluation Activities	Acquisition Activities	Evaluation Activities
The "deliverables" are dependent upon the chosen life cycle (see ISO/IEC 15288) e.g. System Requirements Specification, Systems Design Specification	Evaluation of specific "deliverables" (output of the project) e.g. Review System Design	Purchase of the commercial-off-the-shelf (COTS) software products	Evaluate the product to be acquired applying appropriate ISO SQuaRE standards and technical reports

Table 1 - Software quality evaluation activities

The main responsibilities of the evaluation group are:

- leading and management of software quality evaluation related activities,
- leading the identification and definition of quality requirements,
- execution of quality requirements specification and quality evaluation projects,
- development of criteria for setting benchmarks for the evaluation,
- collection and analysis of evaluation group activities results,
- dissemination of results of evaluation group activities within the organisation,
- acquisition of relevant technical information,
- acquisition of evaluation technology,
- development of the proprietary (company-specific) standards and tools,
- evaluation of effectiveness and quality of software acquisition and development,
- facilitation of technology transfer.

NOTE The evaluation group can be external or internal with respect to the organisation which is evaluating the software.

6 Requirements and recommendations for software quality requirements specification and quality evaluation

6.1 General

The organisation shall develop policies and plans for quality requirements specification and quality evaluation activities, which also includes the roles of the evaluation group.

For the requirements specification purposes, ISO/IEC 25030 shall be applied. For the evaluation execution purposes, ISO/IEC 25040-44 shall be applied. Until this series of standards is published the ISO 14598 series is applicable.
For the requirements specification, quality measurement and evaluation execution purposes, ISO 25020 shall be applied. Until this series of standards is published the ISO 9126 series is applicable.

The Quality Evaluation Project Plan (template example: Annex A) for an evaluation project shall identify and describe activities applicable in the steps below:

- specifying software quality requirements,
- defining the objectives of the software quality evaluation,
- establishing evaluation requirements
- specifying the evaluation,
- designing the evaluation,
- executing the evaluation,
- analysing results.

The software quality evaluation shall satisfy pre-defined criteria, including the following:

- conformance to international, national or internal standards (if applicable),
- ability to quantify and clearly present traceable results,
- use of suitable and effective technology and best practices.

6.2 Organisation level activities

Any organisation that develops, acquires or evaluates software shall identify the associated software quality evaluation responsibilities and incorporate them into an organisation policy.

6.2.1 Organisation environment management

The organization shall implement the following in accordance with applicable organization policies and procedures:

- prepare software quality evaluation plan and procedures that are consistent with organisation strategic and organization quality policies,
- define the roles, responsibilities and authorities to facilitate strategic management of software quality,
- define target values for software quality evaluation,
- conduct periodic reviews of the software quality model applied in software quality requirements and evaluation projects.

NOTE The above requirements are based on clause 5.3 of ISO/IEC 15288.

6.2.2 Resources management

The organization shall implement the following in accordance with applicable organization policies and procedures:

- determine and provide the resource infrastructure support needed to execute software quality requirements specification and evaluation project,
- maintain and manage the pool of personnel necessary to staff ongoing projects,
- manage schedule conflicts that may result from executing multiple project in parallel.

6.2.3 Planning the use and improvement of the quality requirements specification and quality evaluation technology

An overall plan for improving the software quality evaluation, quality of software quality requirements and supporting technologies shall be made and implemented.

The plan should include the following:

a) Preparation of a policy

There should be a policy stating the organisation's approach to the introduction, maintenance and improvement of software quality requirements specification and quality evaluation.

b) Definition of the organisation’s objectives

The organisation's objectives, which are to be achieved by the introduction, maintenance and improvement of software quality requirements specification and evaluation technology, shall be defined.

c) Identification of the evaluation technology to be used

The software quality evaluation techniques and tools used in the organisation shall be assessed and identified in the policy. Any deviation from the stated objectives shall be either justified or corrected.

d) Assignment of responsibilities for the management of the quality requirements specification and evaluation process

Clearly stated responsibility shall be assigned for the introduction, maintenance and ongoing improvement of the quality requirements specification and quality evaluation process.

e) Identification of further improvements

Improvement of the quality requirements specification and quality evaluation processes and the use of new technology shall be planned and executed.

6.2.4 Implementation of the evaluation technology

The organisation shall:

- define the requirements for acquiring or developing the evaluation technology,
- assess the availability of quality evaluation technology,
- define the process for adopting and operating the acquired evaluation technology.

Any validated evaluation module should be maintained under configuration control, and documented as an Evaluation Module (see ISO/IEC 14598-6). Otherwise it should be put into trial use for assessment.

6.2.5 Transfer of the technology used for evaluation

In order to transfer the developed or acquired technology the organisation shall prepare training programs, tools and the appropriate environment for the introduction and adoption of new technology. These programs, tools and environment shall correspond to the technology applied in the evaluation group activities.

a) Preparation for technology transfer

The organisation shall consider the following for the purpose of technology transfer:

- prepare supporting training programs,
- prepare tools and environment,
- define how to collect data and assess the technology transfer,
- define how to collect experiences about technology transfer.

NOTE Quality Evaluation Project Plan targets, activities, schedules, project objectives and responsibilities should make a part of dedicated training program.

b) Implementation of technology transfer

The organisation shall implement the technology transfer and collect the data according to the defined plan.

c) Assessment of technology transfer

The organisation shall assess the technology transfer as follows:

- assess the effects of the introduced technology for all projects,
- evaluate the extent to which the technology is used within the organisation.

The organisation shall, if necessary, modify or prepare a new plan subject to the results of the assessment.

6.2.6 Assessment of technology for quality requirements specification and evaluation

In order to improve quality requirements specification and evaluation, the technology used shall be assessed. The data captured during the evaluation should be analysed applying the appropriate tools and methods (like for example economical or statistical analysis tools). This includes the following:

- effort spent on quality requirements specification
- effort spent on measurements and evaluation. This information shall be verified and maintained for future use by other projects and for the purpose of verifying the usefulness of the new technology,
- suitability and validity of measurements, evaluation criteria and the techniques used,
- effectiveness of quality requirements specification
- effectiveness of the overall software quality evaluation,
- standardisation. If the above proves satisfactory the proprietary standardisation (company-specific) of the evaluation technology shall be considered
- Suitability of rating levels.

6.2.7 Management of experiences

The responsibility for the effective use of the evaluation technology within the organisation shall be defined. This responsibility includes the maintenance of assessment results and experiences. These shall be used to improve the quality and the use of the evaluation technology.

The improvements can be achieved through modifications of the proprietary (company-specific) standards, such as:

- definition of quality requirements,
- measures selection,
- definition of rating level, and
- assessment criteria.

In order to achieve the above improvements the following approach shall be taken into consideration:

- carry out periodic related technology reviews,
- integrate new and existing relevant standards,
- integrate new and existing measures,
- provide feedback that should be used in revisions of these standards,
- provide feedback that should be used in revisions of the organisation's Quality Plan and/or Quality Manual,
- maintain records of the improvements and ensure the utilisation of "best practices" within the organisation.

6.3 Project Management level activities

The evaluation group assures the effective management of its activities. This includes software requirements specification and evaluation planning, the promotion of this plan and any necessary technology transfer.

For the management of an evaluation project there shall be an agreed Quality Evaluation Project Plan.

The evaluation shall be managed by an experienced project manager, and have:

- an approved budget,
- suitable resources,
- supporting tools, standards and procedures,
- clearly defined, documented and agreed Quality Evaluation Project Plan (Annex A).

6.3.1 Support for Evaluation Planning

In order to carry out software product evaluation successfully a Quality Evaluation Project Plan shall be developed at the start of a project. The aim of the plan is to assist the project manager in defining and monitoring quantitative quality objectives. It shall also assist all project staff in identifying their own quality objectives and in monitoring their progress continuously against those objectives.

The following shall be considered when such a plan is being prepared:

a) The purpose and use of the plan

All project members shall understand the importance of the proposed plan, its implementation details and its relevance to each individual project member. All this shall be clarified prior to any evaluation activity.

This plan shall be acknowledged and supported by all project personnel and management.

b) Validation of the plan

The plan shall be validated by the person responsible within an organisation. It shall be reviewed in order to ensure that it adequately covers the various evaluation requirements, which include the specification of the following:

- how the stated objectives will be achieved,

- how these objectives will be quantified and measured,
- how these measurements will support the evaluation process,
- how the quantitative management is to be carried out during software product evaluation,

NOTE Quantitative management uses data from statistical management in order to predict whether the project will be able to achieve its quality and process-performance objectives and identify what corrective action should be taken

- respective quality objectives,

NOTE These may be product, process or even size related

- clarification of the tasks, and assignment of corresponding responsibilities, (e.g. who is responsible for data collection, analysis and feedback to the project staff and to the management)
- definition of how data is to be collected, controlled and used.

c) Content of the plan

The content of this plan shall cover all measures applicable to the quality characteristics of the software product specified by software quality requirements.

The objectives stated in the plan shall be complemented by:

- the corresponding product quality characteristics,
- the adopted standards,
- methods,
- staff skills,
- tool and project management support.

A Quality Evaluation Project Plan template is shown in Annex A.

6.4 Analysis and use of evaluation results

The evaluation group shall collect the evaluation results at the end of each evaluation project. These results shall be then analysed and put in effective use. In order to achieve these objectives the following shall be considered:

- verification of the quality of collected data (e.g. meaningful, representative, correct and statistically valid)
- identification of appropriate methods of data aggregation and analysis,
- identification of appropriate methods of data interpretation,
- revision of targeted values for quality factors for each evaluation project,
- relevant training, if required.

In order to improve evaluation technology, the following shall be analysed and the findings recorded:

- evaluation results,
- evaluation methods,
- evaluation targeted values of quality factors for each evaluation project.

After the analysis process the obtained data shall be interpreted and presented to all involved parties. The collected data shall also be stored for reference purposes for future projects.

Annex A
(Informative)

Quality Evaluation Project Plan Template

The following Quality Evaluation Project Plan template makes an example of a document that should be used by the evaluation group when preparing and executing an evaluation project. If the preparation of an evaluation project requires more specific approach like for example applying the specific evaluation process the users of this International Standard may refer to the following parts of SQuaRE series, when published:

ISO/IEC 25040: Software engineering - Software product Quality Requirements and Evaluation (SQuaRE) – Evaluation reference model and guide

ISO/IEC 25041: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) - Evaluation modules,

ISO/IEC 25042: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Evaluation process for developers,

ISO/IEC 25043: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Evaluation process for acquirers,

ISO/IEC 25044: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Evaluation process for evaluators.

If the preparation of an evaluation project requires more specific approach to requirements definition process the users of this International Standard may refer to the following parts of SQuaRE series, when published:

ISO/IEC 25030: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Quality requirements

If the preparation of an evaluation project requires more specific approach to measurement process the users of this International Standard may refer to the following parts of SQuaRE series, when published:

ISO/IEC 25020: Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) - Measurement reference model and guide

ISO/IEC 25021 Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Quality measure elements

ISO/IEC 25022 Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Measurement of internal quality

ISO/IEC 25023 Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Measurement of external quality

ISO/IEC 25024 Software engineering: Software product Quality Requirements and Evaluation (SQuaRE) – Measurement of quality in use

A.1 Chapter 1 Introduction

The following should be described:

- the purpose of the plan
- the audience of the plan
- the intended use of the plan

A.2 Chapter 2 Evaluation objectives

This chapter should provide a clear statement about the objective(s) of the evaluation and the intended application of the software. This can be stated in terms of business needs. However, they should be useable for the purpose of specifying quality requirements and setting quality objectives and respective criteria.

A.3 Chapter 3 Software quality requirements and applicable quality characteristics

This chapter should provide statements of the quality characteristics resulting from the specification of software quality requirements, which support the objectives prescribed in A. 2.

NOTE The activity of quality requirements specification should be taken into consideration in chapters 6 and 9; however the process itself remains out of scope of Quality Evaluation Project Plan and would require a separate project effort.

The stated quality objectives may be both product and process oriented. The purpose of this plan is to address the product quality objectives only.

A.4 Chapter 4 List of priorities

This chapter should prioritize the above characteristics and should provide a supporting rationale for these priorities.

A.5 Chapter 5 Quality objectives

This chapter should provide quantifiable quality objectives (target values) which are verified against values measured at interim or final phases of the project development.

A.6 Chapter 6 Definition of responsibilities

This chapter should define all responsibilities associated with the implementation of the Plan. This includes software quality requirements specification, all data collection, analysis tasks, implementation of other supporting requirements, reporting, follow up and similar requirements.

A.7 Chapter 7 Evaluation design

This chapter should define the measurements which are planned to be carried out. It will only cover product quality measurements (e.g. performance, reliability or maintainability).

The chapter should indicate at what phase(s) of the development cycle these measurements are to be carried out, what evaluation process should be applied, how often they should be repeated, what techniques or tools should be used to aid data capture and analysis, and what actions should be undertaken if there are divergences from the stated objectives.

A.8 Chapter 8 Using and analysing data

This chapter should define how data is to be analysed, what, if any, statistical methods are to be employed and what presentation techniques are to be used.

It should make references to previously stated responsibilities, supporting tools and forms. It should also state how the information is to be integrated into the progress tracking process or into the product acceptance process.

A.9 Chapter 9 Evaluation planning and execution

This chapter should provide a clear plan of activities with milestones and stated deliverables.

A.10 Chapter 10 Reporting

This chapter should define all relevant reporting requirements.

A.11 Chapter 11 Other requirements

This chapter should include requirements not covered previously, e.g. it can include the following information:

a) Techniques and methods employed

Provide a full description (or references to other material) of the techniques and methods used, (e.g. method for sizing; development maturity assessment; inspection method for error detection; defect removal model for predicting error rates).

b) Supporting tools

Describe or provide requirements and references for the supporting tools. This can include guides for the use of databases, spreadsheet and statistical packages.

c) Relevant standards and guides

Refer to applicable standards and supporting guides. Describe their use and benefits relevant to the purchasing and acquisition processes (e.g. ISO/IEC 9126; ISO/IEC 9001; ISO/IEC 9000-3).

d) Suppliers' evaluation

Include evaluation and measurement procedures for the effective quantitative assessment of the software product suppliers.

This can cover the number of released copies, current error status, surveys about post installation support performance, statistics about past and current users' satisfaction, management performance and financial stability. Related parameters relevant to the application, which have been obtained from other suppliers, can be incorporated in the suppliers' evaluation plan.

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ICS 35.080

Price based on 15 pages