INTERNATIONAL STANDARD

ISO/IEC 29110-4-1

Second edition
2018-04

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 4-1: Software engineering - Profile specifications: Generic profile group

Ingénierie des systèmes et du logiciel — Profils de cycle de vie pour très petits organismes (TPO) —

Partie 4-1: Ingénierie du logiciel - Spécification de profil: Groupe de profil générique

Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This second edition cancels and replaces the first edition (ISO/IEC 29110-4-1:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

— the title of Clause 6 was changed from “Description of Basic VSE profiles” to “Profile Specification and its conformance with base Standards;

— Clause 8 was replaced by Annex A “Basic profile base document references”;

— Basic profile specifications (Clause 7) have been changed to requirements;

— mapping tables to “task requirements” of ISO/IEC 12207 have been included; and

— informative Annex B “Base profile Process Reference Model” was added.

A list of all parts in the ISO/IEC 29110 series is available on the ISO and IEC websites.

Introduction

Very Small Entities (VSEs) around the world are creating valuable products and services. For the purpose of ISO/IEC 29110, a VSE is an enterprise, an organization, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system and software components used in systems, either as independent products or incorporated in larger systems, a recognition of VSEs as suppliers of high quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2005) 'Small and Medium Enterprises (SMEs) constitute the dominant form of business organization in all countries world-wide, accounting for over 95 % and up to 99 % of the business population depending on country'. The challenge facing governments and economies is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformance with these standards is difficult, if not impossible. Consequently, VSEs have no, or very limited, means to be recognized as entities that produce quality systems/system elements including software in their domain. Therefore, VSEs are excluded from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the effort required to apply standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, expertise, budget and time, nor do they see a net benefit in establishing over-complex systems or software life cycle processes. To address some of these difficulties, a set of guidelines have been developed based on a set of VSE characteristics. The guidelines are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSE context; for example, processes, activities, tasks, and outcomes of ISO/IEC/IEEE 12207 for software; and processes, activities, tasks, and outcomes of ISO/IEC/IEEE 15288 for systems; and information products (documentation) of ISO/IEC/IEEE 15289 for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against ISO/IEC 29110 standards.

The ISO/IEC 29110 series of International Standards and Technical Reports can be applied at any phase of system or software development within a life cycle. This series of International Standards and Technical Reports is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 standards to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 are encouraged to use those International Standards instead of the ISO/IEC 29110 series.

ISO/IEC 29110 is intended to be used with any lifecycle such as: waterfall, iterative, incremental, evolutionary or agile.

Systems, in the context of ISO/IEC 29110, are typically composed of hardware and software components.

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality, and process performance. See Table 1.

Table 1 — ISO/IEC 29110 target audience

ISO/IEC 29110	Title	Target audience
Part 1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.
Part 2	Framework for profile preparation	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
Part 3	Certification and Assessment guidance	VSEs and their customers, assessors, accreditation bodies.
Part 4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
Part 5	Management, engineering and service delivery guidelines	VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4 and ISO/IEC TR 29110-5 can be developed with minimal impact to existing documents.

ISO/IEC TR 29110-1 defines the terms common to the set of the ISO/IEC 29110 series. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and needs of a VSE, and clarifies the rationale for specific profiles, documents, standards and guidelines.

ISO/IEC 29110-2-1 introduces the concepts for systems and software engineering profiles for VSEs. It establishes the logic behind the definition and application of profiles. For standardized profiles, it specifies the elements common to all profiles (structure, requirements, conformance, assessment). For domain-specific profiles (profiles that are not standardized and developed outside of the ISO process), it provides general guidance adapted from the definition of standardized profiles.

ISO/IEC 29110-3 defines certification schemes, assessment guidelines and compliance requirements for process capability assessment, conformity assessments, and self-assessments for process improvements. ISO/IEC 29110-3 also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC 29110-3 is addressed to people who have direct involvement with the assessment process, e.g. the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met.

ISO/IEC 29110-4-m provides the specification for all profiles in one profile group (a profile group may contain a single profile or multiple profiles). A profile is specified in terms of requirements imported from appropriate base standards.

ISO/IEC/TR 29110-5-m-n provides management, engineering and service delivery guidelines for the profiles in a profile group.

This document provides the specification for the Basic profile in the profile group of Software Engineering. It is based on subsets of appropriate standards elements.

Figure 1 describes the ISO/IEC 29110 series of International Standards (IS) and Technical Reports (TR) and positions the parts within the framework of reference. Overview, assessment guidelines, management and engineering guidelines are available from ISO as freely available Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

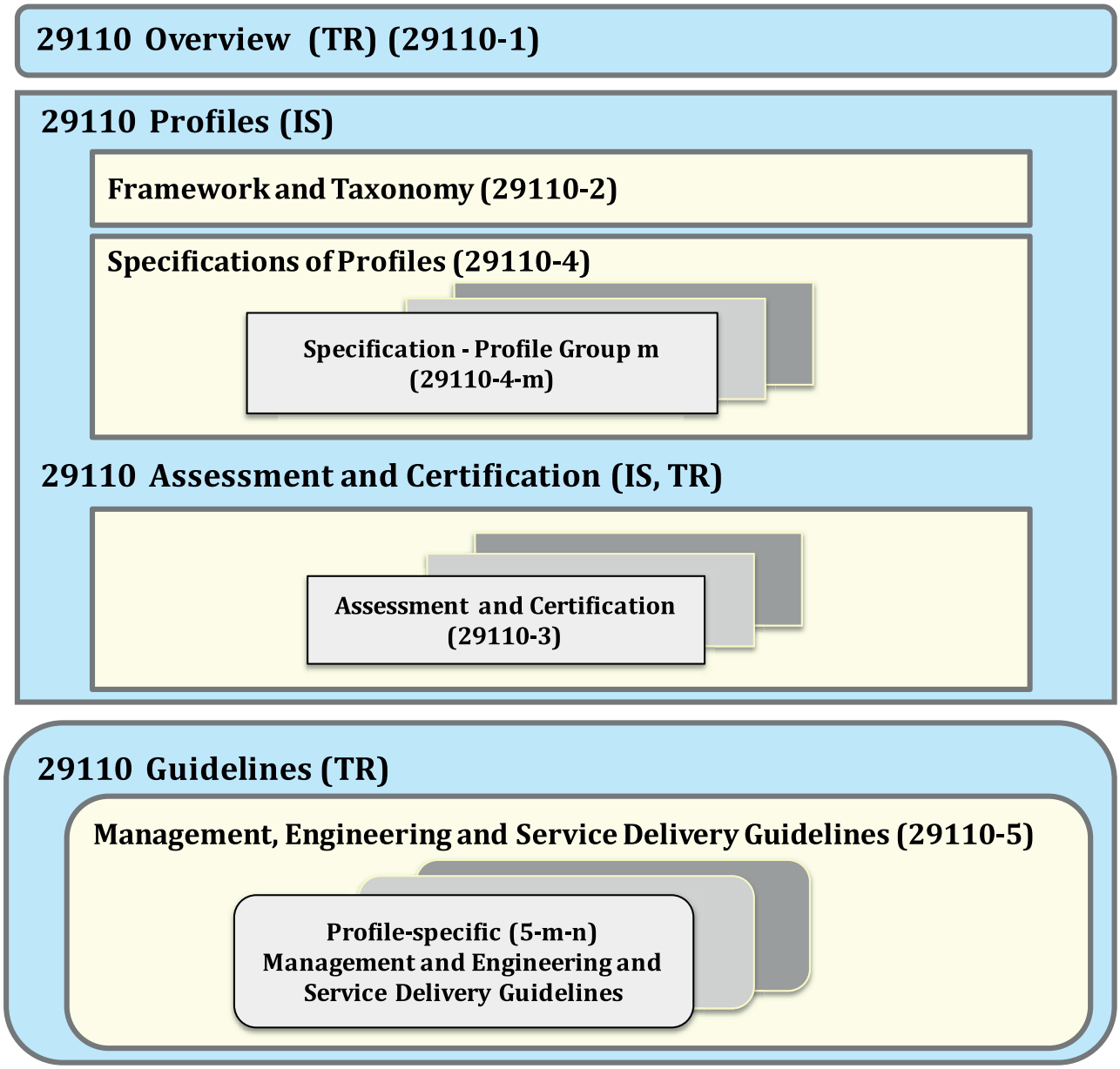

Figure 1 — ISO/IEC 29110 Series

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 4-1:
Software engineering - Profile specifications: Generic profile group

1 Scope

The ISO/IEC 29110 series is applicable to Very Small Entities (VSEs). VSEs are enterprises, organizations, departments or projects having up to 25 people. The lifecycle processes described in the ISO/IEC 29110 series are not intended to preclude or discourage their use by larger organizations than VSEs.

The lifecycle processes defined in the ISO/IEC 29110 series can be used by VSEs when using, as well as when creating and supplying, a software system. They can be applied at any level in a software system's structure and at any stage in the lifecycle. The processes described in the ISO/IEC 29110 series are not intended to preclude or discourage the use of additional processes that VSEs find useful. This document is not intended to preclude the use of different life cycles such as: waterfall, iterative, incremental, evolutionary or agile.

This document provides a profile specification for the Basic profile. The Basic profile applies to VSEs involved in software development. It selects ISO/IEC/IEEE 12207 project management and software implementation process elements from the single project perspective.

This document provides the normative and informative links to the subset of ISO/IEC/IEEE 12207.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 29110-2-1, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 2-1: Framework and taxonomy*

ISO/IEEE 12207:2008, *Systems and software engineering — Software life cycle processes*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29110-2-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

PAM Process Assessment Model

PM Project Management

PRM Process Reference Model

SI Software Implementation

VSE Very Small Entity

4 Conformance

4.1 Conformance situations

This document can be implemented by organizations or projects implementing and using the processes required by this document. Therefore, organizations can claim conformance to this document.

This document does not contain any requirements applicable to products that facilitate its implementation and its use within organizations. Therefore, conformance cannot be claimed by developers of products.

NOTE Examples of such products are methods, courses, teaching aids, tools, and forms.

This document can be attested by a third party. It can be mandated as part of procurement and contractual processes.

4.2 Conformance to this document

A VSE that claims conformance to the profile specified in this document shall identify the Software Engineering Basic Profile as the profile it has implemented.

It can claim conformance to the process part of the profile if it meets all the mandatory profile process requirements as identified in its specification Clause 7, and the associated properties and requirements as described in the base standards when applicable.

NOTE Requirements of this document are mandatory and use the word "shall".

5 Naming, diagramming and definition conventions

Conventions for naming, diagramming, describing and defining VSE Profiles are defined in ISO/IEC 29110-2-1.

6 Profile specification and its conformance with base standards

6.1 Minimal conditions for Basic profile use

To use the Basic profile, it is assumed that the VSE already fulfils the following conditions:

a) There is a project contract or agreement with scope.

b) The cost, technical and schedule feasibility was performed before the project start.

c) The project working team, including project manager, is assigned and trained.

d) Goods, services and infrastructure are available.

7 Basic profile specifications

7.1 Introduction

This clause contains the specification of the standardized profile requirements. It contains the specification for the following profile elements:

— in 7.2, Project Management process; and

— in 7.3, Software Implementation process.

The requirements are expressed in the form of process descriptions following ISO/IEC 29110-2-1 and ISO/IEC 33004 requirements.

NOTE The process outcomes are not declared in present tense so they can be used for different conformity assessment schemas, e.g. auditing purposes or process capability and organizational maturity.

These requirements are the result of Project Management and Software Implementation purpose achievement.

Annex A specifies the references between the standardized profile elements and the source standards. Annex B gives additional information on the Process Reference Model for the VSE Basic Profile.

7.2 Project Management process specification

7.2.1 Project Management purpose

The purpose of the Project Management process is to establish and carry out in a systematic way the tasks of the software implementation project, which allows complying with the project's scope, in the expected quality, time and costs.

7.2.2 Project Management requirements

As a result of successful implementation of the Project Management process:

a) The scope of the work for the project, including deliverables, shall be defined.

b) Tasks and resources associated with scope of the work shall be defined.

c) The cost, technical and schedule feasibility shall be performed.

d) Schedule, effort, cost and duration of work shall be estimated. Other metrics should be estimated, if needed.

e) Allocation of human resources shall be planned.

f) Execution plan of the project shall be developed according to the scope of work, planned human resources and tasks defined.

g) The execution plan shall be agreed by the Customer.

h) Risks shall be identified and monitored during the execution of the project.

i) A software version control strategy shall be developed and implemented, including back-up and restoring definition.

j) Relevant items of software configuration shall be identified and controlled, including their storage, baseline, handling, and modifications.

k) Progress of the project against the planning shall be monitored and reported.

l) Actions to adjust and correct execution plan deviations shall be taken.

m) Work team and customer review activities shall be held to assure that the work has been done complies with the software requirements and execution plan.

n) Agreements resulting from revision activities shall be registered and tracked.

o) Project closure shall be performed after Customer acceptance.

7.3 Software implementation process specification

7.3.1 Software implementation purpose

The purpose of the software implementation process is the systematic performance of the analysis, design, construction, integration and test activities for new or modified software products according to the specified requirements and execution plan.

7.3.2 Software implementation requirements

As a result of successful implementation of the basic software implementation process:

a) The execution plan and software requirements shall be reviewed and understood by the work team.

b) Software requirements shall be defined.

c) Software requirements shall be analysed for correctness and testability.

d) Software requirements shall be agreed by the Customer or project sponsor.

e) Software requirements' baseline shall be established and communicated to affected parties.

f) Changes to the software requirements shall be evaluated for cost, schedule and technical impact.

g) Software architectural and detailed design shall be developed and a baseline shall be established and communicated to affected parties.

h) Software architectural and detailed design shall have been prepared to describe the software components and their relevant internal and external interfaces.

i) Consistency and traceability between software requirements, software architectural and software detailed design shall be established.

j) Software components defined by the detailed design shall be produced.

k) Releases of items shall be controlled and made available to relevant stakeholders.

l) Unit test shall be performed to verify the consistency with software requirements and detailed design.

m) Consistency and traceability shall be established between software components and requirements and design.

n) User documentation shall be developed.

o) Software shall be produced by integrating software components.

p) Software shall be tested and verified, the results shall be recorded and communicated to work team.

q) Defects identified in reviews, tests and verifications shall be corrected.

r) Software configuration shall be integrated and stored in the project repository. A final baseline shall be established and communicated to work team and the customer.

s) Product shall be completed and released for use after validation by the customer or project sponsor.

Annex A
(normative)

Basic profile base document references

A.1 Introduction

This annex establishes the reference between the standardized profile elements and the source standards, in Tables A.1 and A.2. The explanation of the column names and contents is stated in ISO/IEC 29110-2-1:2015, Clauses 6 and 7.

Some profile elements are not included in the tables. Although explicit reference is not made in the body of this document to activities, tasks and work products, more information can be found in ISO/IEC TR 29110-5-1-2.

A.2 Profile requirements definition and composition references

A.2.1 PM Process — Project Management

Table A.1 — PM Process — Profile requirements mapping to base standards

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
a)	The scope of the work for the project, including deliverables, shall be defined.	ISO/IEC 12207:2008	6.1.1.3.1.10	b) Scope statement. d) List of software products.
b)	Tasks and resources associated with scope of the work shall be defined.	ISO/IEC 12207:2008	6.3.1.3.2.1	c) Adequate resources needed to execute the tasks. d) Allocation of tasks. i) Provision of environment and infrastructure.
c)	The cost, technical and schedule feasibility shall be performed.	ISO/IEC 12207:2008	6.3.1.3.1.2	Once the project requirements are established, the manager shall establish the feasibility of the project by checking that the resources (personnel, materials, technology, and environment) required to execute and manage the project are available, adequate, and appropriate and that the timescales to completion are achievable.
d)	Schedule, effort, cost and duration of work shall be estimated. Other metrics should be estimated, if needed.	ISO/IEC 12207:2008	6.3.1.3.2.1	a) Schedules for the timely completion of tasks. b) Estimation of effort. c) Adequate resources needed to execute the tasks. d) Allocation of tasks. e) Assignment of responsibilities.

Table A.1 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
e)	Allocation of human resources shall be planned.	ISO/IEC 12207:2008	6.3.1.3.2.1	c) Adequate resources needed to execute the tasks. d) Allocation of tasks. e) Assignment of responsibilities.
f)	Execution plan of the project shall be developed according to the scope of work, planned human resources and tasks defined.	ISO/IEC 12207:2008	6.3.1.3.2.1	a) Schedules for the timely completion of tasks. b) Estimation of effort. c) Adequate resources needed to execute the tasks. d) Allocation of tasks. e) Assignment of responsibilities. f) Quantification of risks associated with the tasks or the process itself. g) Quality assurance measures to be employed throughout the project. h) Costs associated with the process execution. i) Provision of environment and infrastructure.
g)	The execution plan shall be agreed by the Customer.	ISO/IEC 12207:2008	6.3.1.3.3.1	The manager shall obtain authorization for the project.
h)	Risks shall be identified and monitored during the execution of the project.	ISO/IEC 12207:2008	6.3.1.3.2.1	f) Quantification of risks associated with the tasks or the process itself.
		ISO/IEC 12207:2008	6.3.4.3.3.1	Risks shall be identified in the categories described in the risk management context.
i)	A software version control strategy shall be developed and implemented, including back-up and restoring definition.	ISO/IEC 12207:2008	7.2.2.3.2.1	A scheme shall be established for identification of software items and their versions to be controlled for the project. For each software item and its versions, the following shall be identified: the documentation that establishes the baseline; the version references; and other identification details.

Table A.1 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
j)	Relevant items of software configuration shall be identified and controlled, including their storage, baseline, handling, and modifications.	ISO/IEC 12207:2008	7.2.2.3.2.1	A scheme shall be established for identification of software items and their versions to be controlled for the project. For each software item and its versions, the following shall be identified: the documentation that establishes the baseline; the version references; and other identification details.
		ISO/IEC 12207:2008	7.2.2.3.3.1	The following shall be performed: identification and recording of change requests; analysis and evaluation of the changes; approval or disapproval of the request; and implementation, verification, and release of the modified software item. An audit trail shall exist, whereby each modification, the reason for the modification, and authorization of the modification can be traced. Control and audit of all accesses to the controlled software items that handle safety or security critical functions shall be performed
k)	Progress of the project against the planning shall be monitored and reported.	ISO/IEC 12207:2008	6.3.2.3.1.1	The manager shall monitor the overall execution of the project, providing both internal reporting of the project progress and external reporting to the acquirer as defined in the contract.
l)	Actions to adjust and correct execution plan deviations shall be take.	ISO/IEC 12207:2008	6.3.2.3.2.1	The manager shall investigate, analyse, and resolve the problems discovered during the execution of the project. The resolution of problems may result in changes to plans. It is the manager's responsibility to ensure the impact of any changes is determined, controlled, and monitored. Problems and their resolution shall be documented.
m)	Work team and customer review activities shall be held to assure that the work has been done complies with the software requirements and execution plan.	ISO/IEC 12207:2008	6.3.2.3.3.1	The manager shall ensure that the software products and plans are evaluated for satisfaction of requirements.
		ISO/IEC 12207:2008	7.2.6.3.1.1	Periodic reviews shall be held at predetermined milestones as specified in the project plan(s). Stakeholders should determine the need for any ad hoc reviews in which agreeing parties may participate.
n)	Agreements resulting from revision activities shall be registered and tracked.	ISO/IEC 12207:2008	7.2.6.3.1.5	The review results shall be documented and distributed. This communication includes adequacy of review (for example, approval, disapproval, or contingent approval) of the review results

Table A.1 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
o)	Project closure shall be performed after Customer acceptance.	ISO/IEC 12207:2008	6.3.2.3.4.1	When all software products, activities, and tasks are completed, the manager shall determine whether the project is complete, taking into account the criteria as specified in the contract or as part of organization's procedure.
		ISO/IEC 12207:2008	6.4.8.3.1.2	The developer shall complete and deliver the software product as specified in the contract.
		ISO/IEC 12207:2008	7.2.2.3.6.1	The release and delivery of software products and documentation shall be formally controlled. Master copies of code and documentation shall be maintained for the life of the software product. The code and documentation that contain safety or security critical functions shall be handled, stored, packaged, and delivered in accordance with the policies of the organizations involved

A.2.2 SI process — Software implementation

Table A.2 — SI Process — Profile requirements mapping to base standards

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
a)	The execution plan and software requirements shall be reviewed and understood by the work team.	ISO/IEC 12207:2008	7.2.6.3.1.1	Periodic reviews shall be held at predetermined milestones as specified in the project plan(s). Stakeholders should determine the need for any ad hoc reviews in which agreeing parties may participate.
b)	Software requirements shall be defined.	ISO/IEC 12207:2008	6.3.1.3.1.1	The manager shall establish the requirements of the project to be undertaken.
c)	Software requirements shall be analysed for correctness and testability.	ISO/IEC 12207:2008	7.1.2.3.1.2	The implementer shall evaluate the software requirements considering the criteria listed below. The results of the evaluations shall be documented a) Traceability to system requirements and system design. b) External consistency with system requirements. c) Internal consistency. d) Testability. e) Feasibility of software design. f) Feasibility of operation and maintenance.

Table A.2 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
d)	Software requirements shall be agreed by the Customer or project sponsor.	ISO/IEC 12207:2008	7.1.2.3.1.3	The implementer shall conduct review(s). NOTE 1 Following a successful evaluation and review, the software requirements should be approved, baselined and communicated to all affected parties. Subsequent changes to the software requirements baseline should be evaluated for cost, schedule and technical impact.
e)	Software requirements' baseline shall be established and communicated to affected parties.	ISO/IEC 12207:2008	6.4.1.3.5.1	The project shall record the stakeholder requirements in a form suitable for requirements management through the life cycle and beyond. NOTE 2 These records establish the stakeholder requirements baseline, and retain changes of need and their origin throughout the system life cycle. They are the basis for traceability to the system requirements and form a source of knowledge for requirements for subsequent systems and communications with stakeholders on requirements status.
		ISO/IEC 12207:2008	7.1.2.3.1.3	The implementer shall conduct review(s) NOTE 3 Following a successful evaluation and review, the software requirements should be approved, baselined and communicated to all affected parties. Subsequent changes to the software requirements baseline should be evaluated for cost, schedule and technical impact.
f)	Changes to the software requirements shall be evaluated for cost, schedule and technical impact.	ISO/IEC 12207:2008	7.1.2.3.1.3	The implementer shall conduct review(s) NOTE 4 Following a successful evaluation and review, the software requirements should be approved, baselined and communicated to all affected parties. Subsequent changes to the software requirements baseline should be evaluated for cost, schedule and technical impact.

Table A.2 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
g)	Software architectural and detailed design shall be developed and a baseline shall be established and communicated to affected parties.	ISO/IEC 12207:2008	7.1.3.3.1.1	The implementer shall transform the requirements for the software item into an architecture that describes its top-level structure and identifies the software components. It shall be ensured that all the requirements for the software item are allocated to its software components and further refined to facilitate detailed design. The architecture of the software item shall be documented.
		ISO/IEC 12207:2008	7.1.3.3.1.2	The implementer shall develop and document a top-level design for the interfaces external to the software item and between the software components of the software item.
h)	Software architectural and detailed design shall have been prepared to describe the software components and their relevant internal and external interfaces	ISO/IEC 12207:2008	7.1.3.3.1.2	The implementer shall develop and document a top-level design for the interfaces external to the software item and between the software components of the software item.
i)	Consistency and traceability between software requirements, software architectural and software detailed design shall be established.	ISO/IEC 12207:2008	7.1.3.3.1.6	The implementer shall evaluate the architecture of the software item and the interface and database designs considering the criteria listed below. The results of the evaluations shall be documented. a) Traceability to the requirements of the software item. b) External consistency with the requirements of the software item. c) Internal consistency between the software components. d) Appropriateness of design methods and standards used. e) Feasibility of detailed design. f) Feasibility of operation and maintenance.
j)	Software components defined by the detailed design shall be produced.	ISO/IEC 12207:2008	7.1.5.3.1.1	The implementer shall develop and document the following: a) Each software unit and database. b) Test procedures and data for testing each software unit and database

Table A.2 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
k)	Releases of items shall be controlled and made available to relevant stakeholders.	ISO/IEC 12207:2008	7.2.2.3.6.1	The release and delivery of software products and documentation shall be formally controlled. Master copies of code and documentation shall be maintained for the life of the software product. The code and documentation that contain safety or security critical functions shall be handled, stored, packaged, and delivered in accordance with the policies of the organizations involved
l)	Unit test shall be performed to verify the consistency with software requirements and detailed design.	ISO/IEC 12207:2008	7.1.5.3.1.2	The implementer shall test each software unit and database ensuring that it satisfies its requirements. The test results shall be documented.
m)	Consistency and traceability shall be established between software components and requirements and design.	ISO/IEC 12207:2008	7.1.5.3.1.5	The implementer shall evaluate software code and test results considering the criteria listed below. The results of the evaluations shall be documented. a) Traceability to the requirements and design of the software item. b) External consistency with the requirements and design of the software item.
n)	User documentation shall be developed.	ISO/IEC 12207:2008	7.1.4.3.1.4	The implementer shall update user documentation as necessary.
o)	Software shall be produced by integrating software components.	ISO/IEC 12207:2008	7.2.4.3.2.4	a) The software components and units of each software item have been completely and correctly integrated into the software item.
		ISO/IEC 12207:2008	7.1.6.3.1.2	The implementer shall integrate the software units and software components and test as the aggregates are developed in accordance with the integration plan. It shall be ensured that each aggregate satisfies the requirements of the software item and that the software item is integrated at the conclusion of the integration activity. The integration and test results shall be documented.
p)	Software shall be tested and verified, the results shall be recorded and communicated to work team	ISO/IEC 12207:2008	7.1.7.3.1.1	The implementer shall conduct qualification testing in accordance with the qualification requirements for the software item. It shall be ensured that the implementation of each software requirement is tested for compliance. The qualification testing results shall be documented.

Table A.2 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
q)	Defects identified in reviews, tests and verifications shall be corrected.	ISO/IEC 12207:2008	7.2.4.3.2.3	The code shall be verified considering the criteria listed below: a) The code is traceable to design and requirements, testable, correct, and compliant with requirements and coding standards. b) The code implements proper event sequence, consistent interfaces, correct data and control flow, completeness, appropriate allocation timing and sizing budgets, and error definition, isolation, and recovery. c) Selected code can be derived from design or requirements. d) The code implements safety, security, and other critical requirements correctly as shown by suitably rigorous methods.
		ISO/IEC 12207:2008	7.2.5.3.2.4	Validate that the software product satisfies its intended use.
		ISO/IEC 12207:2008	7.2.6.3.1.4	Problems detected during the reviews shall be recorded.
		ISO/IEC 12207:2008	7.2.8.3.2.1	When problems (including non-conformances) have been detected in a software product or an activity, a problem report shall be prepared to describe each problem detected. The problem report shall be used as part of the closed-loop process described above: from detection of the problem, through investigation, analysis and resolution of the problem and its cause, and onto trend detection across problems. NOTE 5 Other means besides testing (such as, analysis, modelling, simulation, etc.) may be employed for validation.
		ISO/IEC 12207:2008	7.2.5.3.2.1	Prepare selected test requirements, test cases, and test specifications for analysing test results.

Table A.2 *(continued)*

Profile requirement ID	Profile requirement	Source doc. ID	Base standard ID	Base standard name
r)	Software configuration shall be integrated and stored in the project repository. A final baseline shall be established and communicated to work team and the customer.	ISO/IEC 12207:2008	7.2.2.3.6.1	The release and delivery of software products and documentation shall be formally controlled. Master copies of code and documentation shall be maintained for the life of the software product. The code and documentation that contain safety or security critical functions shall be handled, stored, packaged, and delivered in accordance with the policies of the organizations involved.
s)	Product shall be completed and released for use after validation by the customer or project sponsor.	ISO/IEC 12207:2008	7.2.2.3.6.1	The release and delivery of software products and documentation shall be formally controlled. Master copies of code and documentation shall be maintained for the life of the software product. The code and documentation that contain safety or security critical functions shall be handled, stored, packaged, and delivered in accordance with the policies of the organizations involved
		ISO/IEC 12207:2008	7.2.5.3.2.4	Validate that the software product satisfies its intended use.

Annex B
(informative)

VSE Basic profile PRM

B.1 Introduction

VSEs are enterprises, organizations, departments or projects up to 25 people. The software life cycle processes described in this set of ISO/IEC 29110 International Standards (IS) Profiles and Technical Reports (TR) are not intended to preclude or discourage their use by organizations bigger than VSEs.

It has been found that VSEs find it difficult to relate ISO/IEC software related standards to their business needs and to justify the application of the standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, budget and time, nor do they see a net benefit in establishing software life cycle processes. To rectify some of these difficulties, a set of guidelines and standards have been developed according to a set of VSE characteristics. The 29110 series of guidelines and standards are based on subsets of appropriate standards elements, referred to as VSE Profiles. The purpose of a VSE profile is to define a subset of ISO/IEC software related standards relevant to the VSE context, i.e., software processes and outcomes of ISO/IEC 12207.

This Annex presents the Process Reference Model for the VSE Basic Profile for software development.

This Process Reference Model describes the software processes implied by this document at an abstract level. Each process of this process reference model is described in terms of a purpose and outcomes. It does not attempt to place the processes in any specific environment nor does it pre-determine any level of process capability required to achieve the requirements of this document. ISO/IEC TR 29110-3-1 describes the how conducting an assessment and the MF with the measurement scale for assessing process capability.

B.2 Overview

The VSE Management and Engineering Basic Profile applies to a Very Small Entity (VSE) (enterprise, organisation, department or project up to 25 people) dedicated to software development. It is intended to address the projects within these small organizations that may fulfil an external or internal contract. The internal contract between the project team and its customer need not be explicit.

This PRM provides Project Management (PM) and Software Implementation (SI) processes which integrate practices based on the selection of ISO/IEC 12207:2008 detailed in ISO/IEC TR 29110-5-2.

Using the PRM, VSE can obtain benefits in the following aspects:

— An agreed set of project requirements and expected products is delivered to the customer.

— A disciplined management process, that provides project visibility and corrective actions of project problems and deviations, is performed.

— A systematic software implementation process, that satisfies customer needs and ensures quality products, is followed.

To use the PRM, the VSE needs to fulfil the following minimal conditions:

a) There is a project contract or agreement with scope.

b) The cost, technical, and schedule feasibility was performed before the project start.

c) The project working team, including project manager, is assigned and trained.

d) Goods, services and infrastructure are available.

The customer provides a statement of work as an input to Project Management process and receives a software configuration as a result of Software Implementation process execution.

The PM process starts by using the customer's statement of work to perform the basic project planning process. The PM project assessment and control tasks, compare the project progress against the project plan and actions are taken to eliminate deviations or incorporate changes to the project plan. Then, the PM project closure delivers the software configuration, produced by the SI process, and gets the customer's acceptance to formalize the end of the project. A project repository is established to save the work products and to control its versions during the project.

The execution of the SI process is driven by the PM process. The SI process starts with an initiation activity of the project plan revision. The PM process will guide the execution of the software requirements analysis, software architectural and detailed design, software construction, software integration and test, and product delivery activities. To remove product's defects, verification, validation and test tasks are included in the SI process activities workflow.

This VSE Basic Profile PRM is used in conjunction with the VSE Basic Profile Process Assessment Model (PAM) when performing an assessment.

The VSE Basic Profile PAM (in ISO/IEC TR 29110-3-1) provides additional indicators of process performance and process capability tailored to the needs of performing assessments of the Basic Profile of VSE suppliers.

In this Annex, the processes are arranged in a sequence suitable for exposition. This positional sequence does not prescribe or dictate any time-dependent sequence. The user of this standard may select and order the processes, activities, and tasks as appropriate and effective. This standard encourages iteration among the process. The users of this standard are responsible for selecting a life cycle model for the project and mapping the processes onto that model.

The purposes and outcomes of the processes constitute a Process Reference Model.

B.3 Project Management (PM) process

B.3.1 Project Management purpose

Refer to 7.2.1.

B.3.2 Project Management process outcomes

As a result of successful implementation of the Software Project Management Process the outcomes achieved are detailed in 7.2.2.

B.4 Software Implementation (SI) process

B.4.1 Software Implementation purpose

Refer to 7.3.1.

B.4.2 Software Implementation outcomes

As a result of successful implementation of the Basic Software Implementation Process the outcomes achieved are detailed in above 7.3.2.

B.5 Statement of conformity

B.5.1 General

The Process Reference Model included in this Annex of this document is suitable for use in process assessment performed in accordance with ISO/IEC 33002.

ISO/IEC 33002:2015, Clause 5 places requirements on process reference models suitable for assessment by that standard. The following sections quote the requirements for process reference models and describe how this Annex meets these. In each of the following clauses the text in a box quotes the requirements from the text of ISO/IEC 33002 and the next text describes the manner in which the requirements are satisfied in this Annex.

B.5.2 Requirements for process reference models

ISO/IEC 33004, *Information technology — Process assessment — Requirements for process reference, process assessment and maturity models*

5.3 Requirements for process reference models

5.3.1 A process reference model shall contain:

a) a declaration of the domain of the process reference model;

b) a description of the relationship between the process reference model and its intended context of use;

c) descriptions, meeting the requirements of 5.4, of the processes within the scope of the process reference model;

d) a description of the relationship between the processes defined within the process reference model

The declaration of the domain is for software related processes relevant to the basic profile within the VSE context, i.e., some software processes and outcomes of ISO/IEC 12207.

The description of the processes is provided in B.3 and B.4 of this Annex.

This process reference model is intended to be used as described in this document containing the Description of the Basic VSE Profile.

5.3.2 The process reference model shall document the community of interest of the model and the actions taken to achieve consensus within that community of interest:

a) the relevant community of interest shall be characterized or specified;

b) the extent of achievement of consensus shall be documented;

c) if no actions are taken to achieve consensus, a statement to this effect shall be documented.

The relevant communities of interest and their mode of use are described in the Introduction of this document.

This document is an International Standard satisfying the consensus requirements of ISO/IEC JTC 1.

No actions required because consensus has been achieved.

5.3.3 The processes defined within a process reference model shall have unique process descriptions and identification.

In above clauses B.3 and B.4 of this Annex, each process is having unique process descriptions and identification.

5.4 Process descriptions

The fundamental elements of a process reference model are the descriptions of the processes within the scope of the model.

The process descriptions in the process reference model incorporate a statement of the purpose of the process which describes at a high level the overall objectives of performing the process, together with the set of outcomes which demonstrate successful achievement of the process purpose.

A process description shall meet the following requirements:

a) a process shall be described in terms of its purpose and process outcomes;

b) the set of process outcomes shall be necessary and sufficient to achieve the purpose of the process;

c) process descriptions shall not contain or imply aspects of the process quality characteristic beyond the basic level of any relevant process measurement framework conformant with ISO/IEC 33003.

These requirements are met by the process descriptions in this Annex B.

A process outcome describes one of the following:

— production of an artefact;

— a significant change of state;

— meeting of specified constraints, e.g. requirements, goals etc...

These requirements are met by the process descriptions in this Annex.

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