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Information technology — Process assessment —

Part 6:
An exemplar system life cycle process assessment model

Technologies de l'information — Évaluation des procédés —

Partie 6: Un exemple de modèle d'évaluation des procédés du cycle de vie d'un système

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.

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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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.

ISO/IEC TR 15504-6, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems enginering*.

ISO/IEC TR 15504 consists of the following parts, under the general title *Information technology — Process assessment*:

— *Part 1: Concepts and vocabulary*

— *Part 2: Performing an assessment*

— *Part 3: Guidance on performing an assessment*

— *Part 4: Guidance on use for process improvement and process capability determination*

— *Part 5: An exemplar Process Assessment Model*

— *Part 6: An exemplar system life cycle process assessment model* [Technical Report]

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Introduction

This part of ISO/IEC 15504 provides an example of a System Life Cycle Process Assessment Model for use in performing a conformant assessment in accordance with the requirements of ISO/IEC 15504-2.

An integral part of conducting an assessment is to use a process assessment model that is constructed for that purpose, is related to a process reference model and is conformant with ISO/IEC 15504-2, which sets out the minimum requirements for performing an assessment in order to ensure consistency and repeatability of the ratings.

A process reference model cannot be used alone as the basis for conducting consistent and reliable assessments of process capability because it requires greater detail to indicate process performance and capability. Therefore,

— the descriptions of process purpose and process outcomes provided by a process reference model need to be supported with a comprehensive set of indicators of process performance; and

— the capability levels and process attributes defined in ISO/IEC 15504-2 and its associated rating scale need to be supported with a set of indicators of process capability.

This additional detail describes a process reference model in terms of a process assessment model that can enable the assessment of consistent and repeatable ratings of process capability.

This Process Assessment Model contains a set of indicators to be considered when interpreting the intent of its Process Reference Model. These indicators may also be used when implementing a process improvement program or to help evaluate and select an assessment model, method, methodology or tools.

The Process Reference Model defined in ISO/IEC 15288:2002 has been used as the basis for the Process Assessment Model in this part of ISO/IEC 15504. Relevant material from ISO/IEC 15288:2002 is included in this Technical Report, and it is not necessary to refer to ISO/IEC 15288 in order to use this Technical Report. After evaluation of this Technical Report in use, it will be amended to reflect the current version of ISO/IEC 15288.

As an exemplar, this Process Assessment Model embodies the core characteristics that could be expected of any Process Assessment Model consistent with ISO/IEC 15504-2. Nevertheless, use of this Process Assessment Model is not required to meet the requirements of ISO/IEC 15504; any other process assessment models meeting the requirements of ISO/IEC 15504-2 may be used in a conformant assessment.

This part of ISO/IEC 15504 has a similar structure to ISO/IEC 15504-5. It may be used in conjunction with ISO/IEC 15504-5 for joint assessment of system life cycle processes and software life cycle processes.

This part of ISO/IEC 15504 uses the classification structure of the information work products used in ISO/IEC 15289:2006, *Systems and software engineering — Content of systems and software life cycle process information products (Documentation)* as the basis for the Generic Work Products.

This part of ISO/IEC 15504 is structured as follows.

— Clause 4 provides a detailed description of the structure and key components of a process assessment model, which includes two dimensions: a process dimension and a capability dimension. Assessment indicators are introduced in this clause.

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— Clause 5 addresses the process dimension. It uses process definitions from ISO/IEC 15288 to designate the Process Reference Model. The processes of the Process Reference Model are described in the Process Assessment Model in terms of purpose and outcomes and are grouped in four process categories. The Process Assessment Model expands the Process Reference Model process definitions by including a set of process performance indicators called Base Practices for each process. The Process Assessment Model also defines a second set of indicators of process performance by associating Work Products with each process. Clause 5 is also linked directly to Annex B, which defines the Work Product characteristics.

— Clause 6 addresses the capability dimension. It duplicates the definitions of the capability levels and process attributes from ISO/IEC 15504-2, and expands each of the nine attributes through the inclusion of a set of Generic Practices. These Generic Practices belong to a set of indicators of process capability, in association with Generic Resource indicators and Generic Work Product indicators. Annex B is also linked directly to Clause 6 as it defines the Work Product characteristics.

— Annex A provides a statement of conformance of the Process Assessment Model to the requirements defined in ISO/IEC 15504-2.

— Annex B provides selected characteristics for typical Work Products to assist the assessor in evaluating the capability level of processes.

— Annex C contains style guides for defining Base Practices, Work Products and Generic Practices for adjusting the Process Assessment Model, and guidance explaining how to expand or adapt the model.

— The bibliography contains a list of informative references.

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Information technology — Process assessment —

Part 6:
An exemplar system life cycle process assessment model

1 Scope

This part of ISO/IEC 15504

— defines an exemplar Process Assessment Model that meets the requirements of ISO/IEC 15504-2 and that supports the performance of an assessment by providing indicators for guidance on the interpretation of the process purposes and outcomes as defined in ISO/IEC 15288 and the process attributes as defined in ISO/IEC 15504-2;

— provides guidance, by example, on the definition, selection and use of assessment indicators.

A process assessment model comprises a set of indicators of process performance and process capability. The indicators are used as a basis for collecting the objective evidence that enables an assessor to assign ratings. The set of indicators included in this part of ISO/IEC 15504 is not intended to be an all-inclusive set nor is it intended to be applicable in its entirety. Subsets that are appropriate to the context and scope of the assessment should be selected, and possibly augmented with additional indicators (see Annex C).

The Process Assessment Model in this part of ISO/IEC 15504 is directed at assessment sponsors and competent assessors who wish to select a model, and associated documented process method, for assessment (for either capability determination or process improvement). Additionally it may be of use to developers of assessment models in the construction of their own model, by providing examples of good systems engineering and management practices.

Any process assessment model meeting the requirements defined in ISO/IEC 15504-2 concerning models for process assessment may be used for assessment. Different models and methods may be needed to address differing business needs. The assessment model in this part of ISO/IEC 15504 is provided as an exemplar of a model meeting all the requirements expressed in ISO/IEC 15504-2.

The scope of this part of ISO/IEC 15504 is consistent with the scope of ISO/IEC 15504-5 in order to assist in situations where assessment is being made of both system and software life cycle processes.

NOTE: **Copyright release for the Exemplar Process Assessment Model:** Users of this part of ISO/IEC 15504 may freely reproduce the detailed descriptions contained in the exemplar assessment model as part of any tool or other material to support the performance of process assessments, so that it can be used for its intended purpose.

2 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 15504-1:2004, *Information technology — Process assessment — Part 1: Concepts and vocabulary*

ISO/IEC 15504-2:2003, *Information technology — Process assessment — Part 2: Performing an assessment*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15504-1 apply.

4 Overview of the exemplar Process Assessment Model

4.1 Introduction to Overview

This part of ISO/IEC 15504 provides an exemplar Process Assessment Model that includes examples of assessment indicators.

The Process Reference Model defined in ISO/IEC 15288, associated with the process attributes defined in ISO/IEC 15504-2, establish a Process Assessment Model used as a common basis for performing assessments of systems engineering process capability, allowing for the reporting of results using a common rating scale.

The Process Assessment Model is a two-dimensional model of process capability. In one dimension, the process dimension, the processes are defined and classified into process categories. In the other dimension, the capability dimension, a set of process attributes grouped into capability levels is defined. The process attributes provide the measurable characteristics of process capability.

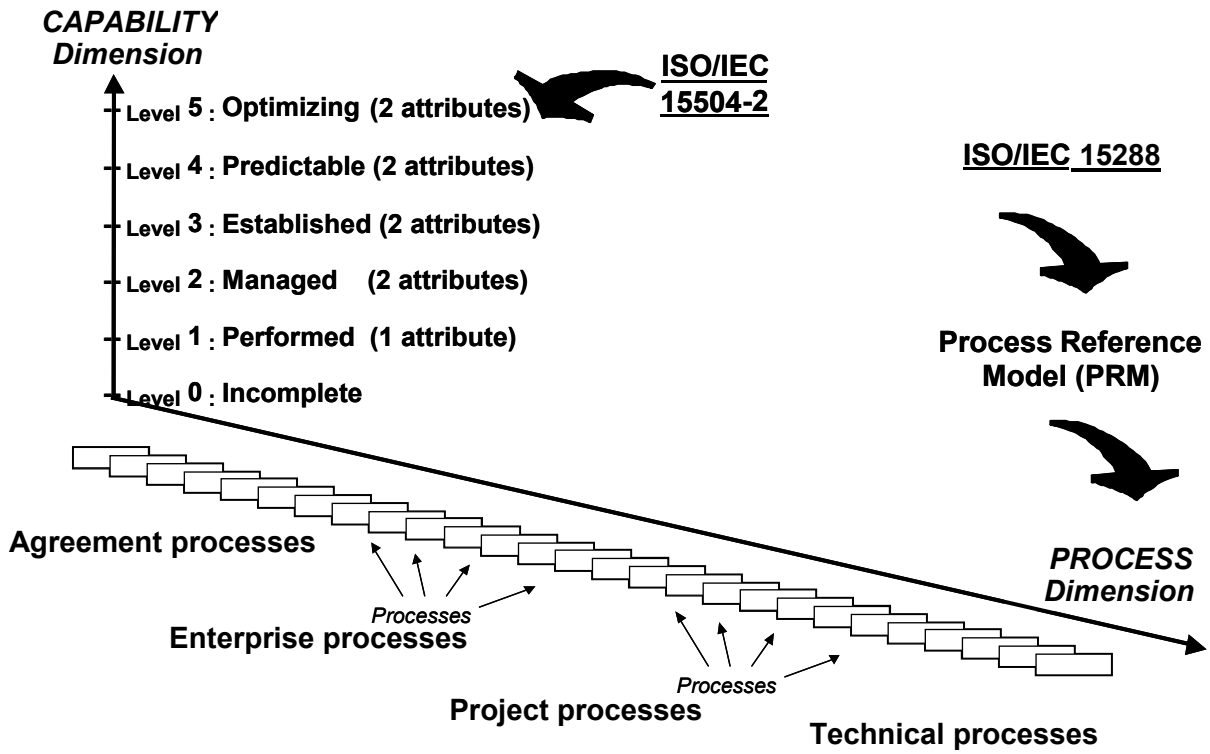

Figure 1 — Relationship between the Process Assessment Model and its inputs

Figure 1 shows the relationship between the general structure of the Process Assessment Model, ISO/IEC 15504-2 and ISO/IEC 15288.

A process reference model and a capability dimension defined in ISO/IEC 15504-2 cannot be used alone as the basis for conducting reliable and consistent assessments of process capability since the level of detail provided is not sufficient. The descriptions of process purpose and outcomes in a process reference model,

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and the process attribute definitions in ISO/IEC 15504-2, need to be supported with a comprehensive set of indicators of process performance and process capability that are used for assessment performance.

The exemplar Process Assessment Model defined in this part of ISO/IEC 15504 is conformant with the ISO/IEC 15504-2 requirements for a Process Assessment Model, and can be used as the basis for conducting an assessment of systems engineering process capability.

In order to meet the process assessment model requirements of ISO/IEC 15504-2, a documented process supporting other requirements of ISO/IEC 15504-2 is also required. This need may be met, for example, by the adoption of a supporting method for conducting assessments.

4.2 Structure of the exemplar Process Assessment Model

This clause describes the detailed structure of the Process Assessment Model and its key components.

This Process Assessment Model expands upon the Process Reference Model by including a defined set of assessment indicators. Assessment indicators comprise indicators of process performance and process capability and are defined to support an assessor's judgment of the performance and capability of an implemented process.

Clause 5, together with its associated Annex B, describes the components of the process dimension, and Clause 6 describes the components of the capability dimension. Annex A provides a statement of conformance of the Process Assessment Model to the requirements defined in ISO/IEC 15504-2.

ISO/IEC 15504-2 requires that processes included in a process reference model satisfy the following:

"The fundamental elements of a Process Reference Model are the set of descriptions of the processes within the scope of the model. These process descriptions shall meet the following requirements:

a) A process shall be described in terms of its Purpose and Outcomes.

b) In any description the set of process outcomes shall be necessary and sufficient to achieve the purpose of the process.

c) Process descriptions shall be such that no aspects of the measurement framework as described in Clause 5 of this International Standard beyond level 1 are contained or implied."

As processes are derived directly from ISO/IEC 15288, these requirements are satisfied.

The Process Assessment Model includes processes, which are grouped in four process groups identical to the process groups in ISO/IEC 15288. The four process groups are:

— the Agreement system life cycle processes group;

— the Enterprise system life cycle processes group;

— the Project system life cycle processes group;

— the Technical system life cycle processes group.

In addition, the Tailoring Process is included since this is defined in a normative Annex of ISO/IEC 15288. The Tailoring Process is presented before the four process groups in order to align subsequent clause numbering of processes in this document with equivalent processes in ISO/IEC 15288.

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4.2.1 Processes

Figure 2 lists the processes from ISO/IEC 15288, which are included in the process dimension of the exemplar System Life Cycle Process Assessment Model.

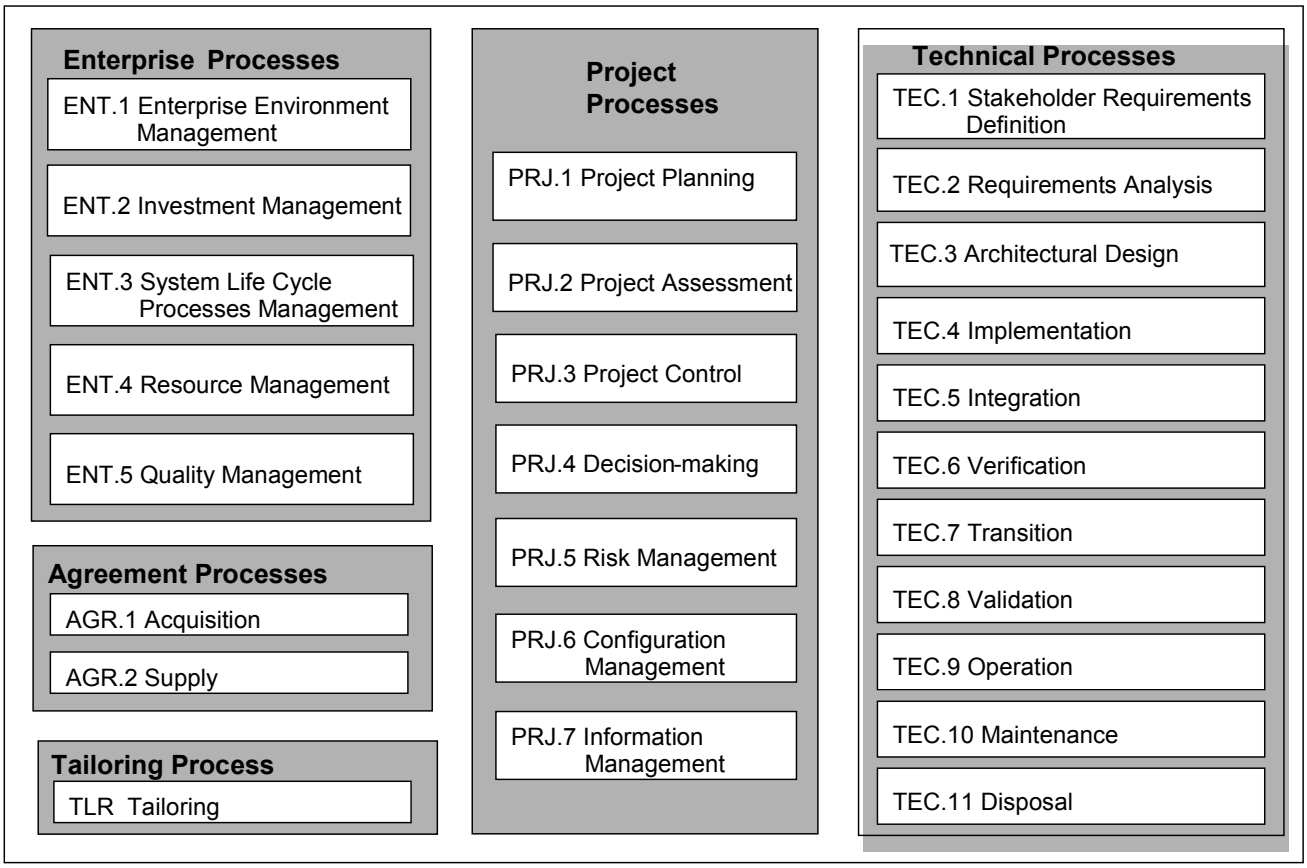

Figure 2 — Process Grouping

Each Process Group includes a list of the processes it contains. Each process is identified with a Process Identifier [ID] consisting of the Group abbreviated name and a sequential number of the process in that Group.

The Process Groups are described in more detail below.

4.2.1.1 Tailoring Process

The Tailoring Process is performed in order to adapt the system life cycle processes of ISO/IEC 15288 and to define the life cycle stages that describe a life cycle model appropriate to particular circumstances of an organization. This process is derived from the requirements of the System Life Cycle Processes Management Process.

4.2.1.2 Agreement System Life Cycle Process Group

The Agreement process group consists of processes performed in order to establish agreements with organizational entities external and internal to the organization. These processes define the activities necessary to establish an agreement between two organizations. Invocation of the Acquisition Process provides the means for conducting business with a supplier of products that are supplied for use as an operational system, of services in support of an operational system, or of elements of a system being developed by a project. Invocation of the Supply Process provides the means for conducting a project in which the result is a product or service that is delivered to the acquirer.

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This group includes the processes listed in Table 1.

Table 1 — Agreement System Life Cycle Process Group

Process Identification	Process name
AGR.1	Acquisition Process
AGR.2	Supply Process

4.2.1.3 Enterprise System Life Cycle Process Group

The Enterprise process group consists of processes performed in order to manage the organization's capability to acquire and supply products or services through the initiation, support and control of projects. They provide resources and infrastructure necessary to support projects and ensure the satisfaction of organizational objectives and established agreements. They are not intended to be a comprehensive set of business processes that enable strategic management of the organization's business.

This group includes the processes listed in Table 2.

Table 2 — Enterprise System Life Cycle Process Group

Process Identification	Process name
ENT.1	Enterprise Environment Management Process
ENT.2	Investment Management Process
ENT.3	Systems Life Cycle Process Management Process
ENT.4	Resource Management Process
ENT.5	Quality Management Process

4.2.1.4 Project System Life Cycle Process Group

The Project process group consists of processes performed in order to establish and evolve project plans, to assess actual achievement and progress against the plans and to control execution of the project through to fulfilment. Individual Project Processes may be invoked at any time in the life cycle and at any level in a hierarchy of projects, as required by project plans or unforeseen events. The Project Processes are applied with a level of rigour and formality that depends on the risk and complexity of the project.

This group includes the processes listed in Table 3.

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Table 3 — Project System Life Cycle Process Group

Process Identification	Process name
PRJ.1	Project Planning Process
PRJ.2	Project Assessment Process
PRJ.3	Project Control Process
PRJ.4	Decision-making Process
PRJ.5	Risk Management Process
PRJ.6	Configuration Management Process
PRJ.7	Information Management Process

4.2.1.5 Technical System Life Cycle Process Group

The Technical process group consists of processes performed in order to define the requirements for a system; to transform the requirements into an effective product; to permit consistent reproduction of the product where necessary; to use a product to provide the required services; to sustain the provision of those services; and to dispose of the product when it is retired from service.

The Technical Processes define the activities that enable enterprise and project functions to optimize the benefits and reduce the risks that arise from technical decisions and actions. These activities enable products and services to possess the timeliness and availability, the cost effectiveness, and the functionality, reliability, maintainability, producibility, usability and other qualities required by acquiring and supplying organizations. They also enable products and services to conform to the expectations or legislated requirements of society, including health, safety, security and environmental factors.

This group includes the processes listed in Table 4.

Table 4 —Technical System Life Cycle Process Group

Process Identification	Process name
TEC.1	Stakeholder Requirements Management Process
TEC.2	Requirements Analysis Process
TEC.3	Architectural Design Process
TEC.4	Implementation Process
TEC.5	Integration Process
TEC.6	Verification Process
TEC.7	Transition Process
TEC.8	Validation Process
TEC.9	Operation Process
TEC.10	Maintenance Process
TEC.11	Disposal Process

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4.2.2 Process dimension

The process dimension of the Process Assessment Model includes all processes listed in Figure 2. The processes are classified into 5 Process Groups. Each process in the Process Assessment Model is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when performed in a particular environment. A list of specific outcomes is associated with each of the process purpose statements, as a list of expected positive results of the processes' performance.

Satisfying the purpose statements of a process represents the first step in building a level 1 process capability where the expected outcomes are observable. The Process Groups and their associated processes are described in Clause 5.

4.2.3 Capability dimension

For the capability dimension, the process capability levels and process attributes are identical to those defined in ISO/IEC 15504-2.

Evolving process capability is expressed in the Process Assessment Model in terms of process attributes grouped into capability levels. Process attributes are features of a process that can be evaluated on a scale of achievement, providing a measure of the capability of the process. They are applicable to all processes. Each process attribute describes a facet of the overall capability of managing and improving the effectiveness of a process in achieving its purpose and contributing to the business goals of the organization.

A capability level is a set of process attribute(s) that work together to provide a major enhancement in the capability to perform a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in ISO/IEC 15504-2.

There are six capability levels, incorporating nine process attributes.

Level 0: Incomplete process

The process is not implemented, or fails to achieve its process purpose.

At this level, there is little or no evidence of any systematic achievement of the process purpose.

Level 1: Performed process

The implemented process achieves its process purpose.

Level 2: Managed process

The previously described Performed process is now implemented in a managed fashion (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.

Level 3: Established process

The previously described Managed process is now implemented using a defined process that is capable of achieving its process outcomes.

Level 4: Predictable process

The previously described Established process now operates within defined limits to achieve its process outcomes.

Level 5: Optimizing process

The previously described Predictable process is continuously improved to meet relevant current and projected business goals.

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Within the Process Assessment Model, the measure of capability is based upon the nine process attributes (PA) defined in ISO/IEC 15504-2. Process attributes are used to determine whether a process has reached a given capability. Each attribute measures a particular aspect of the process capability.

At each level there is no ordering between the process attributes; each attribute addresses a specific aspect of the capability level. The list of process attributes is shown in Table 5.

Table 5 — Capability levels and process attributes

Process Attribute ID	Capability Levels and Process Attributes
	Level 0: Incomplete process
	Level 1: Performed process
PA 1.1	Process performance
	Level 2: Managed process
PA 2.1	Performance management
PA 2.2	Work product management
	Level 3: Established process
PA 3.1	Process definition
PA 3.2	Process deployment
	Level 4: Predictable process
PA 4.1	Process measurement
PA 4.2	Process control
	Level 5: Optimizing process
PA 5.1	Process innovation
PA 5.2	Continuous optimization

The process attributes are evaluated on a four point ordinal scale of achievement, as defined in ISO/IEC 15504-2. They provide insight into the specific aspects of process capability required to support process improvement and capability determination.

4.3 Assessment Indicators

The Process Assessment Model is based on the principle that the capability of a process can be assessed by demonstrating the achievement of process attributes on the basis of evidence related to assessment indicators.

There are two types of assessment indicators: process capability indicators, which apply to capability levels 1 to 5 and process performance indicators, which apply exclusively to capability level 1. These indicators are defined in Clause 4.3.2.

The process attributes in the capability dimension have a set of process capability indicators that provide an indication of the extent of achievement of the attribute in the instantiated process. These indicators concern significant activities, resources or results associated with the achievement of the attribute purpose by a process.

The process capability indicators are:

— Generic Practice (GP);

— Generic Resource (GR);

— Generic Work Product (GWP).

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As additional indicators for supporting the assessment of a process at Level 1, each process in the process dimension has a set of process performance indicators which is used to measure the degree of achievement of the process performance attribute for the process assessed.

The process performance indicators are:

— Base Practice (BP);

— Work Product (WP).

The performance of Base Practices (BPs) provides an indication of the extent of achievement of the process purpose and process outcomes. Work Products (WPs) are either used or produced (or both), when performing the process.

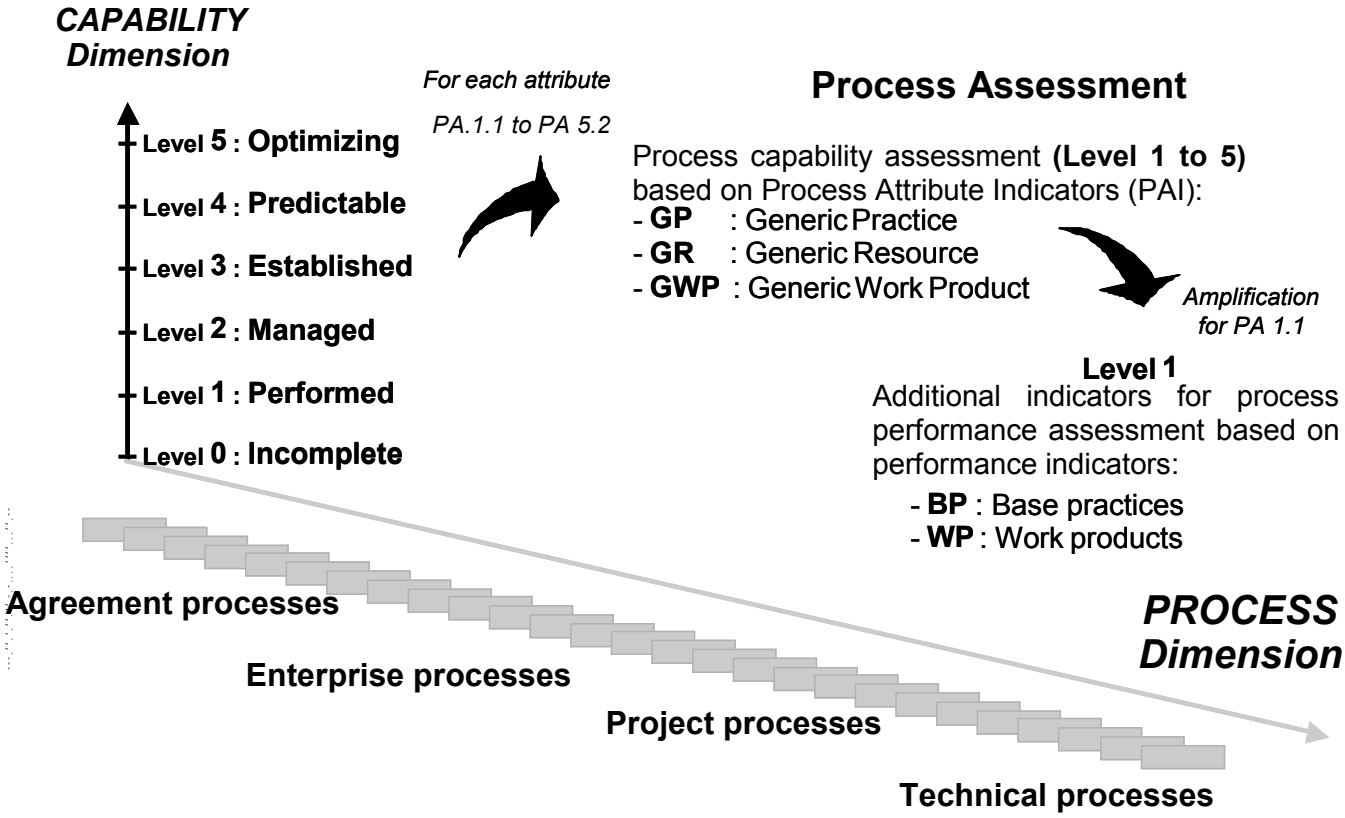

Figure 3 — Assessment indicators

The process performance and process capability indicators defined in the Process Assessment Model represent types of objective evidence that might be found in an instantiation of a process and therefore could be used to judge achievement of capability.

Figure 3 shows how the assessment indicators are related to process performance and process capability.

4.3.1 Process Capability Indicators

The three types of process capability indicators related to levels 1 to 5 are identified in Figure 4. They are intended to be applicable to all processes.

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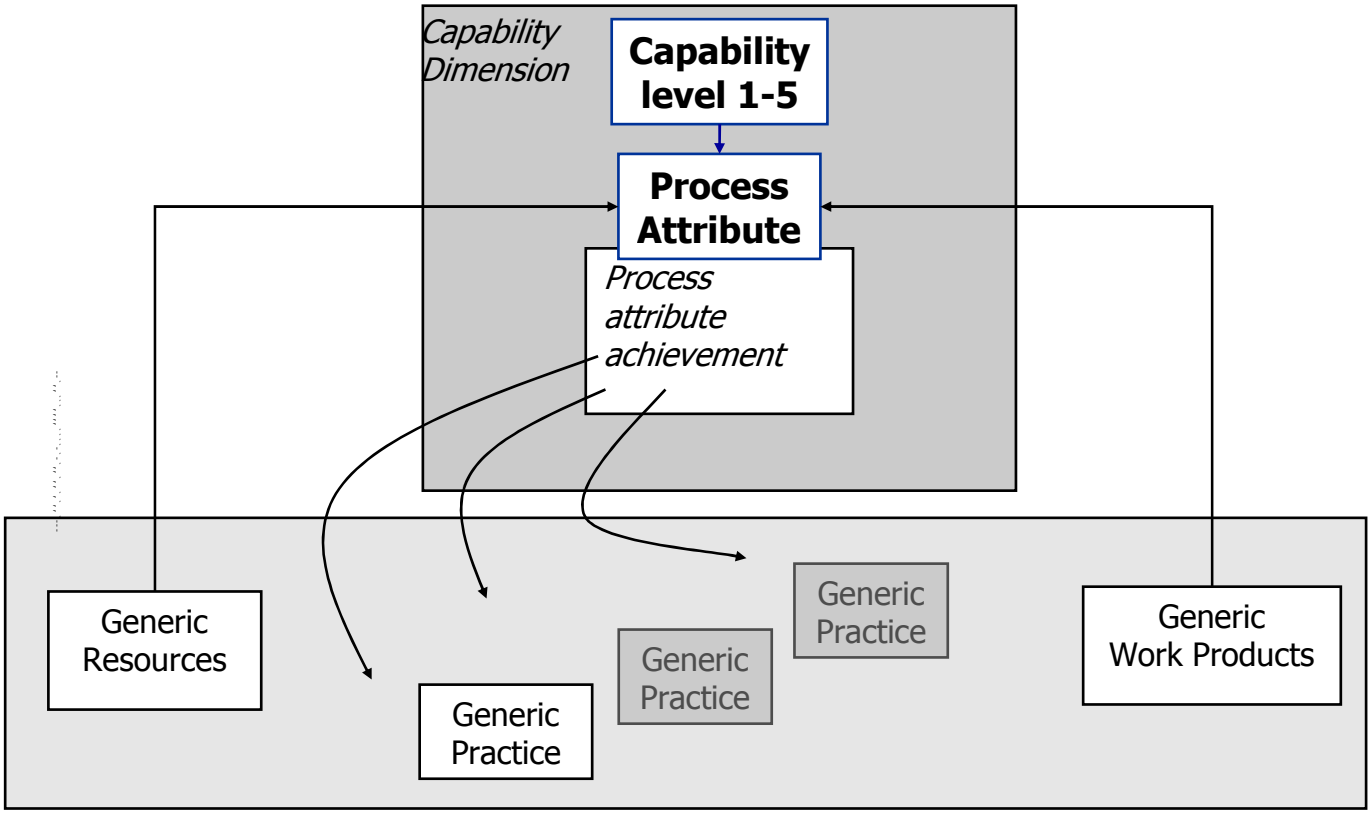

Figure 4 — Process capability indicators

All the process capability indicators relate to the process attributes defined in the capability dimension of the Process Assessment Model. They represent the type of evidence that would support judgments of the extent to which the attributes are achieved. Evidence of their effective performance or existence supports the judgment of the degree of achievement of the attribute. The Generic Practices are the principal indicators of process capability.

The **Generic Practice (GP)** indicators are activities of a generic type and provide guidance on the implementation of the attribute's characteristics. They support the achievement of the process attribute and many of them concern management practices, i.e. practices that are established to support the process performance as it is characterized at level 1. In general, performance of all Generic Practices is expected for full achievement of the process attribute.

The **Generic Resource (GR)** indicators are associated resources that may be used when performing the process in order to achieve the attribute. These resources may include human resources, tools, methods and infrastructure. The availability of a resource indicates the potential to fulfil the purpose of a specific attribute.

NOTE: The assessor should interpret the Generic Resources according to the process assessed; e.g. for PA2.1 resources (with identified objectives, responsibilities and authorities) an assessor would look for roles (with identified objectives, responsibilities and authorities) in project and technical processes, but for enterprise and agreement processes would look for governance structures, e.g. mandated committees, positions, (with identified objectives, responsibilities and authorities).

The **Generic Work Product (GWP)** indicators are sets of characteristics that would be expected to be evident in work products of generic types as a result of achievement of an attribute. The Generic Work Products form the basis for the classification of the Work Products defined as process performance indicators; they represent basic types of work products that may be inputs to or outputs from all types of process.

These three types of indicators help to establish objective evidence of the extent of achievement of the specified process attribute.

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Due to the fact that Level 1 capability of a process is only characterized by the measure of the extent to which the process purpose is achieved, the process performance attribute (PA.1.1) has a single Generic Practice indicator (GP.1.1.1). In order to support the assessment of PA.1.1 and to amplify the process performance achievement analysis, additional process performance indicators are defined in the Process Assessment Model.

4.3.2 Process Performance Indicators

There are two types of process performance indicators: **Base Practice (BP)** indicators and **Work Product (WP)** indicators. Process performance indicators relate to individual processes defined in the process dimension of the Process Assessment Model and are chosen to explicitly address the achievement of the defined process purpose.

Evidence of performance of the Base Practices, and the presence of Work Products with their expected Work Product characteristics, provide objective evidence of the achievement of the purpose of the process.

A Base Practice is an activity that addresses the purpose of a particular process. Consistently performing the Base Practices associated with a process will help the consistent achievement of its purpose. A coherent set of Base Practices is associated with each process in the process dimension. The Base Practices are described at an abstract level, identifying "what" should be done without specifying "how". Implementing the Base Practices of a process should achieve the basic outcomes that reflect the process purpose. Base practices represent only the first step in building process capability, but the Base Practices represent the unique, functional activities of the process, even if that performance is not systematic. The performance of a process produces work products that are identifiable and usable in achieving the purpose of the process. In this assessment model, each work product has a defined set of example work product characteristics that may be used when reviewing the work product to assess the effective performance of a process. Work product characteristics may be used to identify the corresponding work product produced/used by the assessed organization.

Clause 5 contains a complete description of the processes, including the Base Practices and the associated Work Products.

Annex B.1 contains a list of Generic Work Products together with the Work Product characteristics.

Annex B.2 contains a complete list of specific Work Products, with the Generic Work Products for completeness. Similar to the concept of modularity in object orientation, the shared characteristics of a group of Work Products have been extracted into a Generic Work Product. An assessor would refer to both the specific Work Product and the Generic Work Product in the context of the specific work product (e.g. 3.09 project management plan and 3.00 plan) when performing an assessment.

4.4 Measuring process capability

The process performance and process capability indicators in this model give examples of evidence that an assessor might obtain, or observe, in the performance of an assessment. The evidence obtained in the assessment, through observation of the implemented process, can be mapped onto the set of indicators to enable correlation between the implemented process and the processes defined in this assessment model. These indicators provide guidance for assessors in accumulating the necessary objective evidence to support judgments of capability. They are not mandatory.

An indicator is defined as an objective characteristic of a practice or work product that supports the judgment of the performance or capability of an implemented process. The assessment indicators, and their relationship to process performance and process capability, are shown in Figure 5.

Assessment indicators are used to confirm that certain practices were performed, as shown by observable evidence collected during an assessment. All such evidence comes either from the examination of work products of the processes assessed, or from statements made by the performers and managers of the processes.

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The existence of Base Practices, Work Products, and Work Product characteristics, provide evidence of the performance of the processes associated with them. Similarly, the existence of process capability indicators provides evidence of process capability.

The evidence obtained should be recorded in a form that clearly relates to an associated indicator, so that the support for the assessor's judgment can be readily confirmed or verified as required by ISO/IEC 15504-2.

The output from a process assessment is a set of process profiles, one for each process within the scope of the assessment. A typical process profile is illustrated in ISO/IEC 15504-4. Each process profile consists of a set of the process attribute ratings for an assessed process. Each attribute rating represents a judgment by the assessor of the extent to which the attribute is achieved. To improve the reliability and repeatability of the assessment, the judgments of the assessor are based on a coherent set of recorded objective evidences.

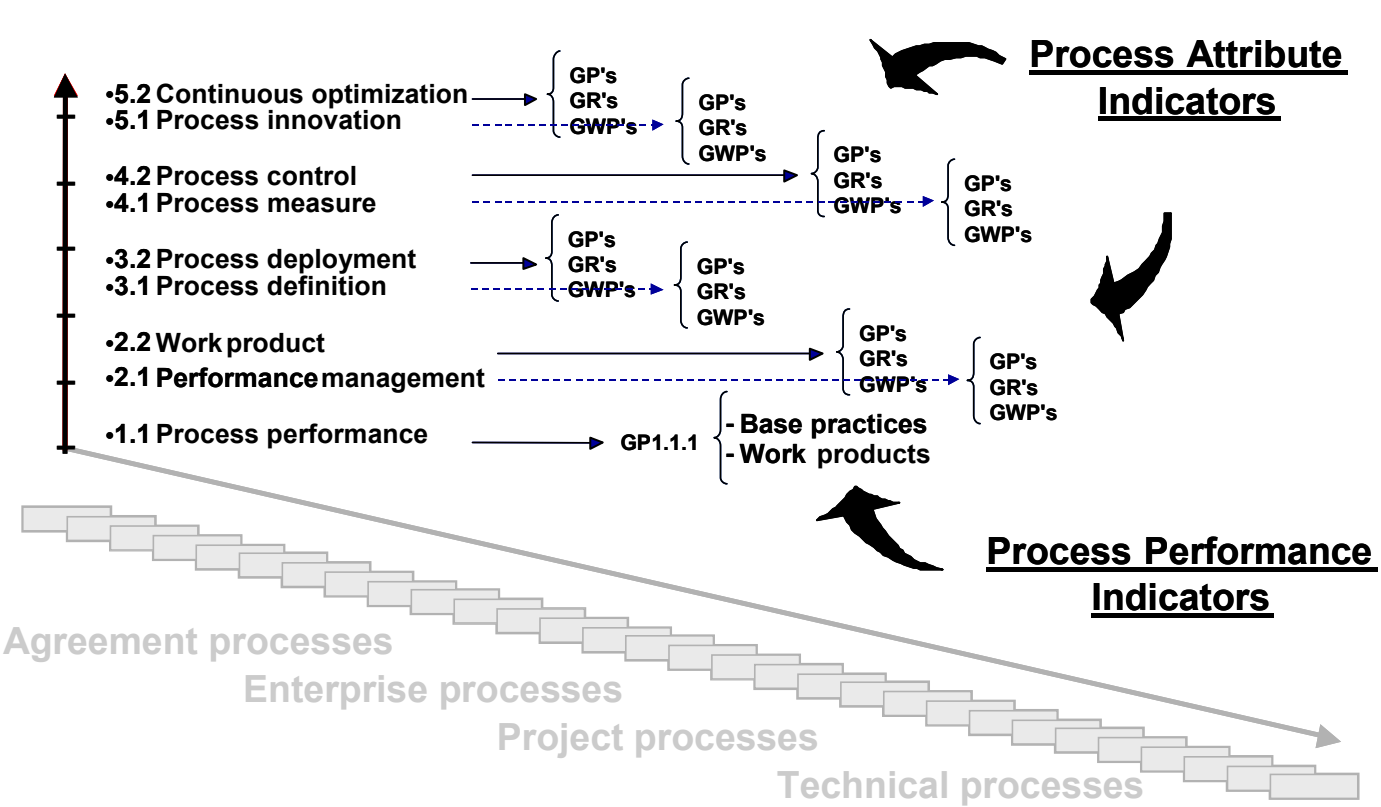

Figure 5 — Relationship between assessment indicators and process capability

5 The process dimension and process performance indicators (level 1)

This clause defines the processes and the process performance indicators, also known as the process dimension, of the Process Assessment Model. The processes in the process dimension can be directly mapped to the processes defined in the Process Reference Model.

The processes are classified (for the purpose of this Process Assessment Model) into Process Groups which are listed in Clause 4.

The individual processes are described in terms of Process Name, Process Purpose, and Process Outcomes as defined in ISO/IEC 15288.

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In addition, the process dimension of the Process Assessment Model provides information in the form of:

a set of Base Practices for the process providing a definition of the tasks and activities needed to accomplish the process purpose and fulfil the process outcomes; each Base Practice is explicitly associated to a process outcome;

a) a number of input and output work products associated with each process and related to one or more of its outcomes; and

b) characteristics associated with each work product.

The process purposes, outcomes, the Base Practices and the Work Products associated with the processes are included in this clause. An explanation of the table format is provided in Annex C. The Work Product characteristics are contained in Annex B. The Base Practices and Work Products constitute the set of indicators of process performance.

The associated Work Products listed in this clause may be used when reviewing potential inputs and outputs of an organization's process implementation.

The associated Work Products provide objective guidance for potential inputs and outputs to look for, and objective evidence supporting the assessment of a particular process. A documented assessment process and assessor judgment is needed to ensure that process context (application domain, business purpose, development methodology, size of the organization, etc.) is explicitly considered when using this information. This list should not be considered as a checklist of what each organization must have but rather as an example and starting point for considering whether, given the context, the work products are necessary and contributing to the intended purpose of the process.

These Work Products are identified with their Work Product identifier number as used in the Annex B.

5.1 Tailoring Process (TLR)

NOTE: The tailoring process is a normative Annex in ISO/IEC 15288:2002. It is thus presented after the provisions concerned with the four primary business process categories: Agreement Processes, Enterprise Processes, Project Processes and Technical Processes. In this Technical Report, the tailoring process is presented first so that the paragraph numbering of the four process categories is then identical to that used in ISO/IEC 15288:2002.

Process ID	TLR
Process Name	**Tailoring Process**
Process Purpose	The purpose of the Tailoring Process is to adapt the processes of this Technical Report to satisfy particular circumstances or factors that: a) surround an organization that is employing this Technical Report in an agreement; b) influence a project that is required to meet an agreement in which this Technical Report is referenced; c) reflect the needs of an organization in order to supply products or services.
Process Outcomes	As a result of the successful implementation of the Tailoring Process: a) A life cycle model is defined in terms of stages and the contributions they make to the system. b) Individual life cycle stages that influence the fulfilment of an agreement to supply a product or service are described. c) Modified or new system life cycle processes are defined.

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Base Practices	**TLR.BP.1: Identify tailoring influences.** [Outcome: b] Identify the circumstances that influence tailoring. These influences include, but are not limited to: 1) stability of, and variety in, operational environments; 2) risks, commercial or performance, to the concern of interested parties; 3) novelty, size and complexity; 4) starting date and duration of utilization; 5) integrity issues such as safety, security, privacy, usability, availability; 6) emerging technology opportunities; 7) profile of budget and organizational resources available; 8) availability of the services of enabling systems. **TLR.BP.2: Account for tailoring constraints related to critical properties.** [Outcome: a,b] In the case of properties critical to the system, take due account of the life cycle structures recommended or mandated by standards relevant to the dimension of the criticality. **TLR.BP.3: Account for the interests of parties affected by tailoring.** [Outcome: a,b,c] Obtain input from all parties affected by the tailoring decisions. This includes, but may not be limited to: 1) the system stakeholders; 2) the interested parties to an agreement made by the organization; 3) the contributing organizational functions. **TLR.BP.4: Tailor in accordance with Decision-making Process.** [Outcome: b,c] Make tailoring decisions in accordance with the Decision-making Process. **TLR.BP.5: Define life cycle model appropriate to system requirements.** [Outcome: a] Define a suitable system life cycle model that permits the system-of-interest to be created and utilized in a manner that conforms to the services needed or the product specified. **TLR.BP.6: Define the stages of the life cycle model.** [Outcome: a,b] Identify a life cycle model in terms of stages, their identities, their purposes and the outcomes they accomplish as a result of the application of the life cycle processes within each stage.

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	1) The exemplary stages described in ISO/IEC 15288 may be individually selected and used to define the identity, purposes, and outcomes of stages that form part of a selected life cycle model. 2) Alternatively, life cycle stages described in ISO/IEC 15288 may be individually selected, identified and modified or not applied, as necessary, to achieve changed purpose and outcomes. 3) Alternatively, define any new stage in terms of its identity, purpose and outcomes. Each new stage is assessed to confirm its contribution to a complete and consistent life cycle. **TLR.BP.7: Tailor or create processes required to achieve stage outcomes.** [Outcome: c] Select the life cycle processes that require tailoring in order to satisfy the life cycle stage outcomes. 1) The life cycle processes described in this Technical Report may be individually selected, identified and modified, as necessary, to achieve changed purpose and outcomes. 2) Alternatively, define any new Life Cycle Process in terms of its identity, purpose and outcomes. The contribution of each new Life Cycle Process is evaluated for its contribution to the system.

Work Products	
Inputs	Outputs
2.03 system life cycle stage model 2.04 system life cycle process model 3.04 system life cycle management policy 3.06 system life cycle process policy 3.09 project management plan 4.02 system life cycle management procedure	2.01 tailored system life cycle stage model [Outcome: a,b] 2.02 tailored system life cycle process model [Outcome: c]

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5.2 Agreement Processes (AGR)

5.2.1 Introduction

The Agreement Processes consist of the following:

a) Acquisition Process;

b) Supply Process.

5.2.2 AGR.1 Acquisition Process

Process ID	AGR.1
Process Name	**Acquisition Process**
Process Purpose	The purpose of the Acquisition Process is to obtain a product or service in accordance with the acquirer's requirements.
Process Outcomes	As a result of the successful implementation of the Acquisition Process: a) A strategy for the acquisition is established. b) A supplier is selected. c) Communication with the supplier is maintained. d) A justification for the selection is declared. e) An agreement to acquire a product or service according to defined acceptance criteria is established. f) A product or service complying with the agreement is accepted. g) Payment or other consideration is rendered.
Base Practices	**AGR.1.BP.1: Define acquisition strategy.** [Outcome: a] Establish a strategy for how the acquisition will be conducted. NOTE This strategy includes reference to the life cycle model, a schedule of milestones and selection criteria if the supplier is external to the acquiring organization. **AGR.1.BP.2: Prepare acquisition request.** [Outcome: b] Prepare a request for the supply of a product or service. NOTE Provide a definition of requirements to one or more suppliers. If a supplier is external to organization, then the request can include the business practices with which a supplier is expected to comply and the criteria for selecting a supplier. **AGR.1.BP.3: Communicate acquisition request.** [Outcome: b] Communicate the request for the supply of a product or service to identified suppliers. NOTE This may include supply chain management partnering which exchanges information with related suppliers and acquirers to achieve a harmonized or collective approach to common technical and commercial issues.

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	AGR.1.BP.4: Select supplier. [Outcome: b,d] Select a supplier. NOTE To obtain competitive solicitations, proposals to supply are evaluated and compared against the selection criteria. Where proposals include offerings that are not covered by the criteria, then the proposals are compared with each other to determine their order of suitability and thus supplier preference. The justification for rating each proposal is declared and suppliers may be informed why they were or were not selected. **AGR.1.BP.5: Negotiate agreement.** [Outcome: c,e] Negotiate an agreement with the supplier. NOTE This agreement may range in formality from a written contract to a verbal understanding. Appropriate to the level of formality, the agreement establishes requirements, development and delivery milestones, verification, validation and acceptance conditions, exception handling procedures, change control procedures and payment schedules, so that both parties of the agreement understand the basis for executing the agreement. Rights and restrictions associated with technical data and intellectual property are noted in the agreement. The negotiation is complete when the acquirer accepts the terms of an agreement offered by the supplier. **AGR.1.BP.6: Assess supplier performance.** [Outcome: c] Assess the execution of the agreement. NOTE This includes confirmation that both parties are meeting their responsibilities according to the agreement. Projected cost, performance and schedule risks are monitored, and the impact of undesirable outcomes on the organization is evaluated regularly. Variations to the terms of the agreement are negotiated as necessary. **AGR.1.BP.7: Confirm product or service compliance.** [Outcome: f] Confirm that the delivered product or service complies with the agreement. NOTE Exceptions that arise during the conduct of the agreement or with the delivered product or service are resolved according to the procedures established in the agreement. **AGR.1.BP.8: Pay supplier.** [Outcome: g] NOTE When the supplied product or service has satisfied the conditions of the agreement, the acquirer concludes the agreement by rendering payment or other agreed consideration.

Work Products	
Inputs	Outputs
2.07 stakeholders profile	1.14 supplier payment [Outcome: g]
3.02 supply strategy	3.01 acquisition strategy [Outcome: a]
3.03 business strategy	4.01 supplier selection procedure [Outcome: b]
3.10 project acquisition plan	5.01 supplier justification record [Outcome: d]
5.23 payment record	6.01 supplier assessment report [Outcome c]
6.03 supply performance report	6.02 delivery acceptance report [Outcome: f]
7.03 supply proposal	7.01 acquisition request [Outcome: b]
7.04 supply agreement change request	7.02 acquisition agreement change request

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7.06 supplier directive 8.03 supply agreement 8.21 implementation enabling system requirement 8.23 integration enabling system requirement 8.25 verification enabling system requirement 8.27 transition enabling system requirement 8.29 validation enabling system requirement 8.31 maintenance enabling system requirement 8.33 disposal enabling system requirement	[Outcome: e] 8.01 acquisition agreement [Outcome: e] 8.02 delivery acceptance criteria [Outcome: f]

5.2.3 AGR.2 Supply Process

Process ID	AGR.2
Process Name	**Supply Process**
Process Purpose	The purpose of the Supply Process is to provide an acquirer with a product or service that meets agreed requirements.
Process Outcomes	As a result of the successful implementation of the Supply Process: a) An acquirer for a product or service is identified. b) A response to the acquirer's request is made. c) An agreement to supply a product or service according to defined acceptance criteria is established. d) Communication with the acquirer is maintained. e) A product or service conforming to the agreement is supplied according to agreed delivery procedures and conditions. f) Responsibility for the acquired product or service, as directed by the agreement, is transferred. g) Payment or other agreed consideration is received.
Base Practices	**AGR.2.BP.1: Identify supply opportunity.** [Outcome: a] Determine the existence and identity of an acquirer who has, or who represents a party or parties having, a need for a product or service. NOTE For a product or service developed for consumers, an agent, e.g. a marketing function within the supplier organization, may represent the acquirer. **AGR.2.BP.2: Evaluate supply request.** [Outcome: a] Evaluate a request for the supply of a product or service to determine feasibility and how to respond. **AGR.2.BP.3: Prepare supply response.** [Outcome: b] Prepare a response that satisfies the solicitation.

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	AGR.2.BP.4: Negotiate agreement. [Outcome: c] Negotiate an agreement with the acquirer. NOTE This agreement may range in formality from a written contract to a verbal understanding. Negotiate the differences, where applicable, between the acquisition request or tasking statement and the capability expressed in the response. The Supplier confirms that the requirements, delivery milestones and acceptance conditions are achievable, that exception handling and change control procedures and payment schedules are acceptable, and that they establish a basis for executing the agreement without unnecessary risks. **AGR.2.BP.5: Execute supply agreement.** [Outcome: d,e] Execute the agreement according to the Supplier's established project plans and in accordance with the agreement. NOTE A supplier may adopt, or agree to use, acquirer processes. **AGR.2.BP.6: Assess supply performance.** [Outcome: d] Assess the execution of the agreement. NOTE Projected cost, performance and schedule risks are monitored and communicated to the acquirer as appropriate. The impact of undesirable outcomes on the organization is evaluated. **AGR.2.BP.7: Deliver product or service.** [Outcome: e] Deliver the product or service in accordance with the agreement criteria. **AGR.2.BP.8: Receive payment.** [Outcome: g] Accept and acknowledge payment or other agreed consideration. **AGR.2.BP.9: Transfer responsibility.** [Outcome: c,f] Transfer the responsibility for the product or service to the acquirer, or other party, as directed by the agreement.

Work Products	
Inputs	Outputs
1.10 validated system 1.14 supplier payment 2.07 stakeholders profile 3.01 acquisition strategy 3.03 business strategy 4.01 supplier selection procedure 5.01 supplier justification record 5.03 decision history record 5.05 risk history record 5.07 configuration history record 5.08 information history record 7.01 acquisition request 7.02 acquisition agreement change request 7.05 project control directive 7.07 supply agreement change directive 7.10 operation request	1.01 supplied system [Outcome: e] 3.02 supply strategy [Outcome: a] 5.23 payment record [Outcome: g] 6.03 supply performance report [Outcome: d] 7.03 supply proposal [Outcome: b] 7.04 supply agreement change request [Outcome: c,d] 8.03 supply agreement [Outcome: c,f]

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7.11 maintenance request 8.01 acquisition agreement 8.02 delivery acceptance criteria	

5.3 Enterprise Processes (ENT)

5.3.1 Introduction

The Enterprise Processes consist of the following:

a) Enterprise Environment Management Process;

b) Investment Management Process;

c) System Life Cycle Processes Management Process;

d) Resource Management Process;

e) Quality Management Process.

5.3.2 ENT.1 Enterprise Environment Management Process

Process ID	ENT.1
Process Name	**Enterprise Environment Management Process**
Process Purpose	The purpose of the Enterprise Environment Management Process is to define and maintain the policies and procedures needed for the organization's business with respect to the scope of ISO/IEC 15288.
Process Outcomes	As a result of the successful implementation of the Enterprise Environment Management Process: a) Policies and procedures for the strategic management of system life cycles are provided. b) Accountability and authority for system life cycle management are defined. c) A policy for the improvement of system life cycle processes is provided.
Base Practices	**ENT.1.BP.1: Establish business strategy.** [Outcome: a] Establish strategy for each business area. NOTE Identify the short-term objectives that contribute to achieving strategic objectives and the projects that will be undertaken to accomplish the strategic objectives. **ENT.1.BP.2: Define system life cycle policies and procedures.** [Outcome: a] Prepare system life cycle policies and procedures that implement the requirements of ISO/IEC 15288 and are consistent with enterprise strategic and business area plans. NOTE The actual range and detail of the system life cycle implementation within a project will be dependent upon the complexity of the work, the methods

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	used, and the skills and training of personnel involved in performing the work. A project tailors policies and procedures according to its requirements and needs. Relevant policies and procedures include risk management, quality management and resource management. **ENT.1.BP.3: Establish system life cycle roles and responsibilities.** [Outcome: b] Define, integrate, and communicate the roles, responsibilities and authorities to facilitate implementation of system life cycle processes and the strategic management of system life cycles. **ENT.1.BP.4: Define system life cycle progression criteria.** [Outcome: a,b] Define business criteria that control progression through the system life cycle. NOTE Establish the decision-making criteria regarding entering and exiting each life cycle stage, and for other key milestones. Express these in terms of business achievement. **ENT.1.BP.5: Review system life cycle model.** [Outcome: c] Conduct periodic reviews of the system life cycle model used by a project. NOTE Confirm the continuing suitability, adequacy and effectiveness of the life cycle models used by each project and make improvements as appropriate. This includes the stages, processes and achievement criteria that control progression through the life cycle. **ENT.1.BP.6: Communicate system life cycle management policies and procedures.** [Outcome: a,c] Communicate to projects the policies and procedures adopted by the enterprise in order to implement the requirements of this standard.

Work Products	
Inputs	Outputs
2.01 tailored system life cycle stage model 2.02 tailored system life cycle process model 3.01 acquisition strategy 3.02 supply strategy 3.14 decision-making strategy 3.15 risk management strategy 4.03 quality management system 6.07 system life cycle processes review 6.08 system life cycle improvement report 6.11 quality management report 8.08 quality management goals and objectives 8.09 quality measures	2.03 system life cycle stage model [Outcome: a,c] 3.03 business strategy [Outcome: a] 3.04 system life cycle management policy [Outcome: a,c] 4.02 system life cycle management procedure [Outcome: a] 6.04 system life cycle model review [Outcome: b,c]

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5.3.3 ENT.2 Investment Management Process

Process ID	ENT.2
Process Name	**Investment Management Process**
Process Purpose	The purpose of the Investment Management Process is to initiate and sustain sufficient and suitable projects in order to meet the objectives of the organization. This process commits the investment of adequate organization funding and resources, and sanctions the authorities needed to establish selected projects. It performs continued qualification of projects to confirm they justify, or can be redirected to justify, continued investment.
Process Outcomes	As a result of the successful implementation of the Investment Management Process: a) Investment opportunities or necessities are qualified and selected. b) Resources and budgets are identified and allocated. c) Project management accountability and authorities are defined. d) Projects meeting agreement, stakeholder and organization requirements are sustained. e) Projects not meeting agreement, stakeholder or organization requirements are redirected or terminated.
Base Practices	**ENT.2.BP.1: Establish business ventures.** [Outcome: a] Establish new business opportunities, ventures or undertakings consistent with the business strategy and action plans of the organization. NOTE Prioritize the projects to be started and establish thresholds to determine which projects will be executed. **ENT.2.BP.2: Establish projects.** [Outcome: b,c] Define projects, accountabilities and authorities. **ENT.2.BP.3: Define project outcomes.** [Outcome: b] Identify the expected outcomes of the projects. **ENT.2.BP.4: Allocate resources.** [Outcome: b] Allocate resources for the achievement of project objectives. **ENT.2.BP.5: Identify project interdependencies.** [Outcome: b,c] Identify any multi-project interfaces that must be managed or supported by the project. This includes the use of enabling systems used by more than one project and the use of common system elements by more than one project. **ENT.2.BP.6: Specify project reporting and reviews.** [Outcome: d,e]

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	Specify the project reporting requirements and review milestones that will govern the execution of the project. **ENT.2.BP.7: Authorize project execution.** [Outcome: b,d] Authorize the project to commence execution of approved project plans, including the technical plans. **ENT.2.BP.8: Evaluate projects.** [Outcome: d,e] Evaluate ongoing projects to confirm that: projects are making progress towards achieving established goals; projects are complying with project directives; projects are being conducted according to system life cycle plans and procedures; projects remain viable, as indicated by, for example, continuing need for the service, practicable product implementation, acceptable investment benefits. **ENT.2.BP.9: Authorize project progression.** [Outcome: d] Act to continue or redirect projects that are satisfactorily progressing or can be expected to progress satisfactorily by appropriate redirection. **ENT.2.BP.10: Close projects.** [Outcome: e] Act to cancel or suspend projects whose disadvantages or risks to the organization outweigh the benefits of continued investments, where agreements permit this.

Work Products	
Inputs	Outputs
1.02 enterprise resource assignment 3.01 acquisition strategy 3.02 supply strategy 3.03 business strategy 3.04 system life cycle management policy 3.14 decision-making strategy 3.15 risk management strategy 6.06 investment decision report 6.10 customer satisfaction report 6.12 project status report 6.18 risk management report 7.08 authorization to proceed request 8.07 enterprise resource requirement 8.10 project infrastructure and services requirements	3.05 resource allocation plan [Outcome: d] 6.05 resource commitment report [Outcome: b] 6.06 investment decision report [Outcome: d,e] 8.04 project requirements [Outcome: a,c] 8.05 project authorization [Outcome: c]

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5.3.4 ENT.3 System Life Cycle Processes Management Process

Process ID	ENT.3
Process Name	**System Life Cycle Processes Management Process**
Process Purpose	The purpose of the System Life Cycle Processes Management Process is to assure that effective system life cycle processes are available for use by the organization. This process provides system life cycle processes that are consistent with the organization's goals and policies, that are defined, adapted and maintained in a consistent way in order to meet the nature of individual projects, and that are capable of being applied using effective, proven methods and tools.
Process Outcomes	As a result of the successful implementation of the System Life Cycle Processes Management Process: a) System life cycle processes for use by the organization are defined. b) Policy to apply system life cycle processes is defined. c) Policy to adapt system life cycle processes to meet the needs of individual projects is defined. d) Measures are defined to evaluate the application of the system life cycle processes. e) Improvements to the definition and application of system life cycle processes are undertaken.
Base Practices	**ENT.3.BP.1: Define system life cycle processes.** [Outcome: a] Establish standard sets of system life cycle processes for applicable system life cycle stages. **ENT.3.BP.2: Define application and tailoring.** [Outcome: b,c] Establish acceptable tailoring and application policies and procedures, with approval requirements. **ENT.3.BP.3: Identify methods and tools.** [Outcome: b,d] Identify methods and tools that support system life cycle process execution. **ENT.3.BP.4: Establish measures.** [Outcome: d] Establish measures wherever possible that determine performance of the implemented standard processes. **ENT.3.BP.5: Assess process quality.** [Outcome: d] Monitor process execution, store and analyze process measures, and identify trends with respect to enterprise criteria. **ENT.3.BP.6: Identify improvement opportunities.** [Outcome: d,e]

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	Identify opportunities for improvement of standard system life cycle process implementation. **ENT.3.BP.7: Perform process improvement.** [Outcome: e] Improve processes, methods and tools as determined.

Work Products	
Inputs	Outputs
2.01 tailored system life cycle stage model 2.02 tailored system life cycle process model 2.03 system life cycle stage model 3.04 system life cycle management policy 4.02 system life cycle management procedure 6.04 system life cycle model review	2.04 system life cycle process model [Outcome:a] 3.06 system life cycle process policy [Outcome:b,c] 6.07 system life cycle processes review [Outcome: c,d] 6.08 system life cycle improvement report [Outcome: e] 8.06 system life cycle process measures [Outcome: d]

5.3.5 ENT.4 Resource Management Process

Process ID	ENT.4
Process Name	**Resource Management Process**
Process Purpose	The purpose of the Resource Management Process is to provide resources to projects. This process provides resources, materials and services to projects to support organization and project objectives throughout the life cycle. This includes a supply of educated, skilled and experienced personnel qualified to perform life cycle processes. This process assures that there is effective co-ordination and sharing of resources, information and technologies.
Process Outcomes	As a result of the successful implementation of the Resource Management Process: a) Necessary resources, materials and services are provided to projects. b) Skills of personnel are maintained or enhanced. c) Conflicts in multi-project resource demands are resolved.
Base Practices	**ENT.4.BP1: Provide resource infrastructure.** [Outcome: a] Determine and provide the resource infrastructure support needed to implement the requirements of this International Standard within the organization and provide project support. NOTE Project plans and future business needs contribute to the understanding of the resource infrastructure that is required. Physical factors, such as facilities, and human factors, such as ambient noise level, of the work environment are defined.

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	ENT.4.BP2: Obtain materiel resources. [Outcome: a] Obtain resources other than personnel that are needed to implement and support projects. NOTE Materiel resources are released by own organisation or acquired from other organization at an appropriate time **ENT.4.BP3: Manage personnel resource.** [Outcome: b] Maintain and manage the pool of personnel necessary to staff ongoing projects. NOTE This includes the recruitment, training and retention of personnel with experience levels and skills necessary to properly staff projects; managing the competency of personnel to perform life cycle processes; provision of training and education to improve their skill sets and support their career paths; staff assessment and review, e.g. their proficiency, motivation, ability to work in a team environment, as well as the need to be retrained, reassigned or reallocated. **ENT.4.BP4: Motivate personnel.** [Outcome: b] Motivate staff. NOTE This includes undertaking career development and defining reward mechanisms. **ENT.4.BP5: Manage resource conflicts.** [Outcome: c] Control multi-project management interfaces to resolve schedule conflicts: – of capacity in organizational infrastructure and supporting services and resources among ongoing projects; – from project personnel being over-committed.

Work Products	
Inputs	Outputs
3.05 resource allocation plan 3.09 project management plan 6.05 resource commitment report	1.02 enterprise resource assignment [Outcome:a,c] 1.03 competent operator [Outcome: b] 3.07 training strategy [Outcome: b] 6.09 training report [Outcome: b] 8.07 enterprise resource requirement [Outcome: a]

5.3.6 ENT.5 Quality Management Process

Process ID	ENT.5
Process Name	**Quality Management Process**
Process Purpose	The purpose of the Quality Management Process is to assure that products, services and implementations of life cycle processes meet enterprise quality goals and achieve customer satisfaction.

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Process Outcomes	As a result of the successful implementation of the Quality Management Process: a) Organization quality management policies and procedures are defined. b) Organization quality goals and objectives are defined. c) Accountability and authority for quality management are defined. d) The status of customer satisfaction is monitored. e) Appropriate action is taken when quality goals are not achieved.
Base Practices	**ENT.5.BP.1: Establish quality management system.** [Outcome: a] Establish quality management policies, standards and procedures. NOTE A process model for quality management system requirements can be found in ISO 9001:2000 with further guidance in ISO 9004:2000. **ENT.5.BP.2: Define quality management criteria.** [Outcome: b] Establish organization quality management goals and objectives based on business strategy for customer satisfaction. **ENT.5.BP.3: Define quality management responsibilities.** [Outcome: c] Define responsibilities and authority for implementation of quality management. **ENT.5.BP.4: Assess customer satisfaction.** [Outcome: d] Assess and report customer satisfaction. NOTE The implementation of ISO/IEC 15288 provides the organization with an approach to achieving customer satisfaction. **ENT.5.BP.5: Review project quality plans.** [Outcome: a,b] Conduct periodic reviews of project quality plans. NOTE Assure that quality objectives based on the stakeholder requirements are established for each project. **ENT.5.BP.6: Manage quality improvements.** [Outcome: e] The status of quality improvements on products and services is monitored and take appropriate corrective action.

Work Products	
Inputs	Outputs
3.13 project quality plan 6.14 project quality report	3.08 quality management policy [Outcome: a] 4.03 quality management system [Outcome: a,c] 6.10 customer satisfaction report [Outcome: d] 6.11 quality management report

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	[Outcome: d,e] 8.08 quality management goals and objectives [Outcome: b] 8.09 quality measures [Outcome: b,d]

5.4 Project Processes (PRJ)

5.4.1 Introduction

The Project Processes consist of the following processes:

a) Project Planning Process;

b) Project Assessment Process;

c) Project Control Process;

d) Decision-making Process;

e) Risk Management Process;

f) Configuration Management Process;

g) Information Management Process.

5.4.2 PRJ.1 Project Planning Process

Process ID	PRJ.1
Process Name	**Project Planning Process**
Process Purpose	The purpose of the Project Planning Process is to produce and communicate effective and workable project plans. This process determines the scope of the project management and technical activities, identifies process outputs, project tasks and deliverables, establishes schedules for project task conduct, including achievement criteria, and required resources to accomplish project tasks.
Process Outcomes	As a result of the successful implementation of the Project Planning Process: a) Project plans are available. b) Roles, responsibilities and authorities are defined. c) Resources and services necessary to achieve the project objectives are formally requested. d) Project performance measures are defined. e) Project staff are directed in accordance with the project plans.
Base Practices	**PRJ.1.BP.1: Identify project objectives.** [Outcome: a,d] Identify the project objectives and constraints. NOTE Objectives and constraints include performance and other quality aspects, cost, time and stakeholder satisfaction. Each objective is identified with a

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	level of detail that permits selection, tailoring and implementation of the appropriate processes and activities. **PRJ.1.BP.2: Define project scope.** [Outcome: a] Define the project scope as established in the agreement. NOTE The project includes all the relevant activities required to satisfy business decision criteria and complete the project successfully. A project can have responsibility for one or more stages in the complete system life cycle. Planning includes appropriate actions for maintaining project plans, performing assessments and controlling the project. **PRJ.1.BP.3: Establish work breakdown.** [Outcome: a,c] Establish a work breakdown structure based on the evolving system architecture. NOTE Each element of the system architecture, and appropriate processes and activities are described with a level of detail that is consistent with identified risks. Related tasks in the work breakdown structure are grouped into project tasks according to organizational responsibilities. Project tasks identify every work item being developed or produced and its associated tasks. **PRJ.1.BP.4: Define project schedule.** [Outcome: a] Define and maintain a project schedule based on project objectives and work estimates. NOTE This includes definition of the duration, relationship, dependencies and sequence of project activities, achievement milestones, resources employed and the reviews necessary to achieve timely completion of the project. **PRJ.1.BP.5: Define project achievement criteria.** [Outcome: d] Define project achievement criteria for the life cycle stage decision gates, delivery dates and major dependencies on external inputs or outputs. NOTE The time intervals between internal project reviews are defined in accordance with organizational policy on issues such as business and system criticality, schedule and technical risks. **PRJ.1.BP.6: Define project budget.** [Outcome: a,c] Define the project costs and plan a budget. NOTE Costs are based on, e.g. the project schedule, labour estimates, infrastructure costs, procurement items, acquired service and enabling system estimates, and budget reserves for risk management. **PRJ.1.BP.7: Allocate project responsibilities.** [Outcome: b, e] Establish the structure of authorities and responsibilities for project work. NOTE This includes defining the project organization, staff acquisitions, the development of staff skills and the methods of team working. They include the effective use of human resources and draw on organizational functions that contribute to all stages of the system life cycle. The structure of authority is designated, including, as appropriate, the legally responsible roles and individuals, e.g. design authorization, safety authorization, award of certification or accreditation. Direct project staff in accordance with project plans.

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	PRJ.1.BP.8: Define resource and service requirements. [Outcome: c] Define the infrastructure and services required by the project. NOTE This includes defining the capacity needed, its availability and its allocation to project tasks. Also included are facilities, tools, communications and information technology assets. The requirements for enabling systems for each life cycle stage within the scope of the project are also specified. **PRJ.1.BP.9: Plan resource and service acquisition.** [Outcome: a,c] Plan the acquisition of materials, goods and enabling system services supplied from outside the project. NOTE This includes, as necessary, plans for solicitation, supplier selection, acceptance, contract administration and contract closure. The agreement processes are used for the planned acquisitions. **PRJ.1.BP.10: Establish technical management plans.** [Outcome: a,b] Generate and communicate a plan for technical management of the project, including reviews. **PRJ.1.BP.11: Define project measures.** [Outcome: d] Define the project measures to be generated and the associated data to be collected, validated and analyzed. NOTE This includes identifying project data sources, recipients and timing. **PRJ.1.BP.12: Generate project quality plan.** [Outcome: a,d] Generate a project quality plan. NOTE This includes defining project quality objectives that assures that the enterprise quality goals and objectives and enterprise quality management policies and procedures are attained. Plan in accordance with ISO 9001:2000 or other quality standards.

Work Products	
Inputs	Outputs
1.02 enterprise resource assignment 1.03 competent operator 2.01 tailored system life cycle stage model 2.02 tailored system life cycle process model 2.03 system life cycle stage model 2.04 system life cycle process model 2.07 stakeholders profile 3.01 acquisition strategy 3.02 supply strategy 3.03 business strategy 3.04 system life cycle management policy 3.05 resource allocation plan 3.06 system life cycle process policy 3.07 training strategy 3.08 quality management policy 3.14 decision-making strategy 3.15 risk management strategy	3.09 project management plan [Outcome: a,b] 3.10 project acquisition plan [Outcome: c] 3.11 technical management plan [Outcome: a,b,e] 3.12 service management plan [Outcome: a,b,c] 3.13 project quality plan [Outcome: a,d] 8.10 project infrastructure and services requirements [Outcome: c] 8.11 project performance measures specification [Outcome: d]

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3.16 configuration management strategy 3.17 information management strategy 7.05 project control directive 7.06 supplier directive 7.07 supply agreement change directive 7.09 configuration baseline change request 8.01 acquisition agreement 8.03 supply agreement 8.04 project requirements 8.05 project authorization	

5.4.3 PRJ.2 Project Assessment Process

Process ID	PRJ.2
Process Name	**Project Assessment Process**
Process Purpose	The purpose of the Project Assessment Process is to determine the status of the project. This process evaluates, periodically and at major events, the progress and achievements against requirements, plans and overall business objectives. Information is communicated for management action when significant variances are detected.
Process Outcomes	As a result of the successful implementation of the Project Assessment Process: a) Project performance measures or assessment results are available. b) Adequacy of roles, responsibilities and authorities is assessed. c) Adequacy of resources and services necessary to achieve the project is assessed. d) Deviations in project performance indicators are analyzed. e) Concerned parties are informed of project status.
Base Practices	**PRJ.2.BP.1: Assess project status.** [Outcome: a] Assess project status against appropriate project plans to determine actual and projected cost, schedule and quality variations. **PRJ.2.BP.2: Assess project quality.** [Outcome: a,d] Perform quality assurance in accordance with project plans. **PRJ.2.BP.3: Assess team effectiveness.** [Outcome: a,b] Assess the effectiveness of project team structure, roles and responsibilities. NOTE This includes assessment of the adequacy of team member competencies to perform project roles and accomplish project tasks. Use objective measures wherever possible, e.g. efficiency of resource use, project achievement.

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	PRJ.2.BP.4: Assess project infrastructure. [Outcome: c] Assess the adequacy and availability of the project's supporting infrastructure. NOTE This includes confirming that intra-organizational commitments are satisfied. **PRJ.2.BP.5: Assess project progress.** [Outcome: a,d] Assess project progress using measured achievement and milestone completion. NOTE Collect and evaluate at planned times the actual or estimated labour, material and service costs. Compare against defined project measures of achievement. This includes conducting effectiveness assessments to determine the adequacy of the evolving system against requirements. It also includes the readiness of enabling systems to deliver their services when needed. **PRJ.2.BP.6: Conduct stage and milestone reviews.** [Outcome: b,c,d] Conduct required management and technical reviews, audits and inspections to determine readiness to proceed to the next stage of the system life cycle or project milestone. **PRJ.2.BP.7: Monitor critical project factors.** [Outcome: c] Monitor critical processes and new technologies. NOTE This includes identifying and evaluating technology insertion according to project plans. **PRJ.2.BP.8: Analyze project performance.** [Outcome: d] Analyze data and measures to identify deviations or variations from planned values or status and make appropriate recommendations for corrections. NOTE This includes, where appropriate, statistical analysis of measures that indicates trends, e.g. fault density to indicate quality of outputs, distribution of measured parameters that indicate process repeatability. **PRJ.2.BP.9: Report project status.** [Outcome: e] Provide periodic status reports and required deviation reports as designated in the agreement, policies and procedures.

Work Products	
Inputs	Outputs
1.03 competent operator 3.09 project management plan 3.10 project acquisition plan 3.11 technical management plan 3.12 service management plan 3.13 project quality plan 4.03 quality management system 5.02 decision register 5.04 risk register	6.12 project status report [Outcome: a] 6.13 project resources and services report [Outcome: b,c] 6.14 project quality report [Outcome: d] 6.15 project progress report [Outcome: a,e]

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5.06 configuration baseline 6.01 supplier assessment report 6.02 delivery acceptance report 6.05 resource commitment report 6.06 investment decision report 6.09 training report 6.11 quality management report 6.16 corrective action report 6.17 decision report 6.18 risk management report 6.19 configuration management report 6.20 information management report 6.21 stakeholder requirements report 6.22 system requirements report 6.23 system architectural design report 6.24 implementation report 6.25 integration report 6.26 verification report 6.27 transition report 6.28 validation report 6.29 operation report 6.30 maintenance report 6.31 disposal report 8.06 system life cycle process measures 8.08 quality management goals and objectives 8.09 quality measures 8.11 project performance measures specification 8.16 system performance measures specification	

5.4.4 PRJ.3 Project Control Process

Process ID	PRJ.3
Process Name	**Project Control Process**
Process Purpose	The purpose of the Project Control Process is to direct project plan execution and ensure that the project performs according to plans and schedules, within projected budgets and it satisfies technical objectives. This process includes redirecting the project activities, as appropriate, to correct identified deviations and variations from other project management or technical processes. Redirection may include replanning as appropriate.
Process Outcomes	As a result of the successful implementation of the Project Control Process: a) Corrective action is defined and directed, when project achievement is not meeting planned targets. b) Project re-planning is initiated when project objectives or constraints have changed, or when planning assumptions are shown to be invalid. c) Project action to progress (or not) from one scheduled milestone or event to the next is authorized.

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	d) Project objectives are achieved.
Base Practices	**PRJ.3.BP.1: Manage project requirements.** [Outcome: b,d] Manage project requirements and changes to requirements in accordance with the project plans. **PRJ.3.BP.2: Initiate corrective action.** [Outcome: a] Initiate the corrective actions needed to achieve the goals and outputs of project tasks that have deviated outside acceptable or defined limits. NOTE Corrective action may include re-deployment and re-assignment of personnel, tools and project infrastructure assets when inadequacy or unavailability has been detected. **PRJ.3.BP.3: Initiate preventive action.** [Outcome: d] Initiate preventive actions, as appropriate, to ensure achievement of the goals and outputs of the project. **PRJ.3.BP.4: Initiate problem resolution.** [Outcome: a] Initiate problem resolution actions to correct non-conformances. NOTE This includes performing corrective actions to the implementation and execution of the life cycle processes when non-conformances are traced to them. Actions are reviewed to confirm their adequacy and timeliness. **PRJ.3.BP.5: Progress corrective action.** [Outcome: a] Evolve with time the scope, definition and the related breakdown of the work to be carried out by the project in response to the corrective action decisions taken and the estimated changes they introduce. **PRJ.3.BP.6: Initiate project change actions.** [Outcome: b] Initiate change actions when there is a contractual change to cost, time or quality due to the impact of an acquirer or supplier request. **PRJ.3.BP.7: Remedy defective provisions.** [Outcome: d] Act to correct defective provision of acquired goods and services through constructive interaction with the supplier. NOTE This may include consideration of modified terms and conditions for supply or initiating new supplier selection. **PRJ.3.BP.8: Authorize project progression.** [Outcome: c] Authorize the project to proceed toward the next milestone or event if justified.

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Work Products	
Inputs	Outputs
3.09 project management plan 3.14 decision-making strategy 3.15 risk management strategy 6.12 project status report 6.13 project resources and services report 6.14 project quality report 6.15 project review report 6.17 decision report	6.16 corrective action report [Outcome: a] 7.05 project control directive [Outcome: a,d] 7.06 supplier directive [Outcome: a,d] 7.07 supply agreement change directive [Outcome: b] 7.08 authorization to proceed request [Outcome: c]

5.4.5 PRJ.4 Decision-making Process

Process ID	PRJ.4
Process Name	**Decision-making Process**
Process Purpose	The purpose of the Decision-making Process is to select the most beneficial course of project action where alternatives exist. This process responds to a request for a decision encountered during the system life cycle, whatever its nature or source, in order to reach specified, desirable or optimized outcomes. Alternative actions are analyzed and a course of action selected and directed. Decisions and their rationale are recorded to support future decision-making.
Process Outcomes	As a result of the successful implementation of the Decision-making Process: a) A decision-making strategy is defined. b) Alternative courses of action are defined. c) A preferred course of action is selected. d) The resolution, decision rationale and assumptions are captured and reported.
Base Practices	**PRJ.4.BP.1: Define decision-making strategy.** [Outcome: a] Define a decision-making strategy. NOTE This includes identifying decision categories and a prioritization scheme, and identifying responsible parties. The decision makers are identified and given the responsibility and authority to make decisions. Decisions may arise as a result of an effectiveness assessment, a technical trade-off, problem needing to be solved, action needed as a response to risk exceeding the acceptable threshold, a new opportunity or approval for project progression to the next life cycle stage. A decision-making strategy includes the identification and allocation of responsibility for, and authority to make, decisions. **PRJ.4.BP.2: Engage decision makers.** [Outcome: b,c] Involve relevant parties in the decision-making in order to draw on experience and knowledge. **PRJ.4.BP.3: Identify decision situations.** [Outcome: a]

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	Identify the circumstances and need for a decision. NOTE Record, categorize and promptly and objectively report problems or opportunities and the alternative courses of action that will resolve their outcome. **PRJ.4.BP.4: Select individual decision scheme.** [Outcome: a,b] Select and declare the decision-making strategy for each decision situation. Identify desired outcomes and measurable success criteria. **PRJ.4.BP.5: Evaluate alternative courses of action.** [Outcome: b,c] Evaluate the balance of consequences of alternative actions, using the defined decision-making strategy, to arrive at an optimization of, or an improvement in, an identified decision situation. **PRJ.4.BP.6: Progress selected action.** [Outcome: c,d] Record, track, evaluate and report decision outcomes to confirm that problems have been effectively resolved, adverse trends have been reversed and advantage has been taken of opportunities. **PRJ.4.BP.7: Maintain decision-making records.** [Outcome: d] Maintain records of problems and opportunities and their disposition, as stipulated in agreements or organizational procedures and in a manner that permits auditing and learning from experience.

Work Products	
Inputs	Outputs
3.09 project management plan 6.12 project status report	3.14 decision-making strategy [Outcome: a] 5.02 decision register [Outcome: b,d,c] 5.03 decision history record [Outcome: d] 6.17 decision report [Outcome: c,d]

5.4.6 PRJ.5 Risk Management Process

Process ID	PRJ.4
Process Name	**Risk Management Process**
Process Purpose	The purpose of the Risk Management Process is to reduce the effects of uncertain events that may result in changes to quality, cost, schedule or technical characteristics. This process identifies, assesses, treats and monitors risks during the entire life cycle, responding to each risk in terms of appropriate treatment or acceptance.
Process Outcomes	As a result of the successful implementation of the Risk Management Process: a) Risks are identified and categorized. b) The probabilities and consequence of risks are quantified.

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	c) A strategy to treat each risk is specified. d) Risk status is available and communicated. e) Risks that have become unacceptable are acted upon.
Base Practices	**PRJ.4.BP.1: Establish risk strategy.** [Outcome: a, c] Establish a systematic approach to risk identification, assessment and treatment. NOTE This includes determining events that would adversely affect the system, project or the organization. It also may include establishing risk categories. Within the quality, cost, schedule or technical characteristics, define the method for expressing risks in suitable terms, including measures wherever possible. **PRJ.4.BP.2: Identify risks.** [Outcome: a] Identify and define the risks. NOTE This includes identifying the initiating events associated with each risk in each risk category, and defining the interrelationships between sources of risk. Within these dimensions, the method for expressing risks in suitable terms, including measures wherever possible, is defined. **PRJ.4.BP.3: Determine risk occurrence probability.** [Outcome: b] Determine the probability associated with risk occurrence using the established risk criteria. NOTE The criteria can include associated cost, legal and statutory requirements, socio-economic and environmental aspects, the concerns of stakeholders, priorities and other inputs to the assessment. **PRJ.4.BP.4: Evaluate risk consequence.** [Outcome: b] Evaluate the risks in terms of their possible consequences using the established criteria. **PRJ.4.BP.5: Prioritize risks.** [Outcome: b] Prioritize the risks in terms of their probability and consequences. **PRJ.4.BP.6: Select risk treatment strategies.** [Outcome: c] Determine the risk treatment strategies. NOTE This includes: 1) Risk avoidance by either a decision not to become involved in, or an action to withdraw from, a risk situation; 2) Risk optimization, including mitigation, to reduce the negative consequences and respective probabilities. Risk optimization depends upon risk criteria, including costs and legal requirements; 3) Transfer of risk by sharing the responsibility with another party for the burden of loss;

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	4) Risk retention, which is the acceptance of the burden of loss from a particular risk. **PRJ.4.BP.7: Establish acceptable risk threshold.** [Outcome: c,e] Define a threshold of acceptability for each identified risk. **PRJ.4.BP.8: Identify risk treatment action.** [Outcome: c] Identify the risk treatment actions to follow if the threshold of acceptability is exceeded. NOTE For risks that have high consequences, establish contingency plans that will be initiated if mitigation actions are unsuccessful. **PRJ.4.BP.9: Report risk treatment action.** [Outcome: d] Communicate the risk treatment actions and their status in accordance with the agreement, policies and procedures. **PRJ.4.BP.10: Maintain risk register.** [Outcome: a,c,d,e] Maintain a register of risk throughout the life cycle. NOTE The register includes a definition of the current perception of risks, and the relationship to risk treatment actions and budgets. This register maintains the history of the risks in order to assist decisions and may become a reference for an evolving design for future, related systems.

Work Products	
Inputs	Outputs
3.09 project management plan	3.15 risk management strategy [Outcome: c] 5.04 risk register [Outcome: a,b,e] 5.05 risk history record [Outcome: d] 6.18 risk management report [Outcome: d]

5.4.7 PRJ.6 Configuration Management Process

Process ID	PRJ.6
Process Name	**Configuration Management Process**
Process Purpose	The purpose of the Configuration Management Process is to establish and maintain the integrity of all identified outputs of a project or process and make them available to concerned parties.
Process Outcomes	As a result of the successful implementation of the Configuration Management Process: a) A configuration management strategy is defined. b) Items requiring configuration management are defined. c) Configuration baselines are established.

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	d) Changes to items under configuration management are controlled. e) The configuration of released items is controlled. f) The status of items under configuration management is made available throughout the life cycle.
Base Practices	**PRJ.6.BP.1: Define configuration management strategy.** [Outcome: a] Define a configuration management strategy. NOTE This includes defining authorities for the deposition of, access to, release of and control of changes to configuration items; defining the locations and conditions of storage, their environment and, in the case of information, storage media, in accordance with designated levels of integrity, security and safety; defining the criteria or events for commencing configuration control and maintaining baselines of evolving configurations and defining the audit strategy and the responsibilities for ensuring continuous integrity and security of the configuration definition information. The configuration management activities should be compatible with the guidance provided in ISO 10007. **PRJ.6.BP.2: Identify configuration items.** [Outcome: b] Identify items that are subject to configuration control. NOTE Items are distinguished by unique, durable identifiers or markings, where appropriate. The identifiers are in accordance with relevant standards and product sector conventions, such that the items under configuration control are unambiguously traceable to their specifications. **PRJ.6.BP.3: Maintain configuration records.** [Outcome: c,d,f] Maintain information on configurations with an appropriate level of integrity and security. NOTE This includes taking into account the nature of the items under configuration control. Configuration descriptions conform, where possible, to product or technology standards. Ensure that configuration information permits forward and backward traceability to other baseline configuration states. Consolidate the evolving configuration states of configuration items to form baselines at designated times or under defined circumstances. Record the rationale for the baseline and associated authorizations in configuration baseline data. Maintain configuration records through the system life cycle and archive them according to agreements, relevant legislation or best industry practice. **PRJ.6.BP.4: Manage configuration baselines.** [Outcome: d,e,f] Ensure that changes to configuration baselines are properly identified, recorded, evaluated, approved, incorporated, and verified. NOTE Consolidate the evolving configuration states of configuration items to form documented baselines at designated times or under defined circumstances. Record the steps of configuration, the rationale for the baseline and associated authorizations in configuration baseline data. Maintain configuration records through the system life cycle and archive them according to agreements, relevant legislation or best industry practice. Manage the recording, retrieval and consolidation of the current configuration status and the status of all preceding configurations to confirm information correctness, timeliness, integrity and security. Perform audits to verify conformance of a baseline to drawings, interface control documents and other agreement requirements.

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Work Products	
Inputs	Outputs
2.09 architectural design description 3.09 project management plan	2.05 configuration item list [Outcome: b] 3.16 configuration management strategy [Outcome: a] 5.06 configuration baseline [Outcome: c] 5.07 configuration history record [Outcome: f] 6.19 configuration management report [Outcome: f] 7.09 configuration baseline change request [Outcome: d,e]

5.4.8 PRJ.7 Information Management Process

Process ID	PRJ.7
Process Name	**Information Management Process**
Process Purpose	The purpose of the Information Management Process is to provide relevant, timely, complete, valid and, if required, confidential information to designated parties during and, as appropriate, after the system life cycle. This process generates, collects, transforms, retains, retrieves, disseminates and disposes of information. It manages designated information, including technical, project, enterprise, agreement and user information.
Process Outcomes	As a result of the successful implementation of the Information Management Process: a) Information to be managed is identified. b) The forms of the information representations are defined. c) Information is transformed and disposed of as required. d) The status of information is recorded. e) Information is current, complete and valid. f) Information is made available to designated parties.
Base Practices	**PRJ.7.BP.1: Specify information items.** [Outcome: a] Define the items of information that will be managed during the system life cycle and, according to organizational policy or legislation, maintained for a defined period beyond. **PRJ.7.BP.2: Assign information item responsibilities.** [Outcome: a] Designate authorities and responsibilities regarding the origination, generation, capture, archiving and disposal of items of information. **PRJ.7.BP.3: Define information access rights.** [Outcome: e,f] Define the rights, obligations and commitments regarding the retention of, transmission of and access to information items.

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	NOTE Due regard is paid to information and data legislation, security and privacy, e.g. ownership, agreement restrictions, rights of access, intellectual property and patents. Where restrictions or constraints apply, information is identified accordingly. Staff having knowledge of such items of information are informed of their obligations and responsibilities. **PRJ.7.BP.4: Define information composition.** [Outcome: b] Define the content, semantics, formats and medium for the representation, retention, transmission and retrieval of information. NOTE The information may originate and may terminate in any form (e.g. verbal, textual, graphical, numerical) and may be stored, processed, replicated and transmitted using any medium (e.g. electronic, printed, magnetic, optical). Pay due regard to organization constraints, e.g. infrastructure, inter-organizational communications, distributed project working. Relevant information storage, transformation, transmission and presentation standards and conventions are used according to policy, agreements and legislation constraints. **PRJ.7.BP.5: Acquire information.** [Outcome: e] Obtain the identified items of information. NOTE This may include generating the information or collecting it from appropriate sources. **PRJ.7.BP.6: Manage information integrity.** [Outcome: c,e] Maintain information items and their storage records according to integrity, security and privacy requirements. NOTE Record the status of information items, e.g. version description, record of distribution, security classification. Information should be legible and stored and retained in such a way that it is readily retrievable in facilities that provide a suitable environment, and that prevent damage, deterioration and loss. **PRJ.7.BP.7: Maintain information dependability.** [Outcome: c,e] Define information maintenance actions. NOTE This includes status reviews of stored information for integrity, validity and availability and any needs for replication or transformation to an alternative medium. Consider the need to either retain infrastructure as technology changes so that archived media can be read or the need to re-record archived media using new technology. **PRJ.7.BP.8: Make information available.** [Outcome: d,f] Retrieve and distribute information to designated parties as required by agreed schedules or defined circumstances. NOTE Information is provided to designated parties in an appropriate form. **PRJ.7.BP.9: Provide authenticated information.** [Outcome: d,f] Provide official documentation as required. NOTE Examples of official documentation are certification, accreditation, pilot license and assessment ratings.

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	PRJ.7.BP.10: Archive designated information. [Outcome: c,d] Archive designated information, in accordance with the audit and knowledge retention purposes. NOTE Select the media, location and protection of the information in accordance with the specified storage and retrieval periods, and with organization policy, agreements and legislation. **PRJ.7.BP.11: Dispose of redundant information.** [Outcome: c] Dispose of unwanted, invalid or unverifiable information according to organization policy, and security and privacy requirements.

Work Products	
Inputs	Outputs
3.09 project management plan	1.04 information item [Outcome: a,b] 2.06 information item list [Outcome: a] 3.17 information management strategy [Outcome: a,b] 5.08 information history record [Outcome: d] 6.20 information management report [Outcome: d,f]

5.5 Technical Processes (TEC)

5.5.1 Introduction

The Technical Processes consist of the following processes:

a) Stakeholder Requirements Definition Process;

b) Requirements Analysis Process;

c) Architectural Design Process;

d) Implementation Process;

e) Integration Process;

f) Verification Process;

g) Transition Process;

h) Validation Process;

i) Operation Process;

j) Maintenance Process;

k) Disposal Process.

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5.5.2 TEC.1 Stakeholder Requirements Definition Process

Process ID	TEC.1
Process Name	**Stakeholder Requirements Definition Process**
Process Purpose	The purpose of the Stakeholder Requirements Definition Process is to define the requirements for a system that can provide the services needed by users and other stakeholders in a defined environment. It identifies stakeholders, or stakeholder classes, involved with the system throughout its life cycle, and their needs and desires. It analyzes and transforms these into a common set of stakeholder requirements that express the intended interaction the system will have with its operational environment and that are the reference against which each resulting operational service is validated in order to confirm that the system fulfils needs.
Process Outcomes	As a result of the successful implementation of the Stakeholder Requirements Definition Process: a) The required characteristics and context of use of services are specified. b) The constraints on a system solution are defined. c) Traceability of stakeholder requirements to stakeholders and their needs is achieved. d) The basis for defining the system requirements is described. e) The basis for validating the conformance of the services is defined. f) A basis for negotiating and agreeing to supply a service or product is provided.
Base Practices	**TEC.1.BP.1: Identify stakeholders.** [Outcome: c] Identify the individual stakeholders or stakeholder classes who have a legitimate interest in the system throughout its life cycle. NOTE This includes, but is not limited to, users, supporters, developers, producers, trainers, maintainers, disposers, acquirer and supplier organizations, regulatory bodies and members of society. Where direct communication is not practicable, e.g. consumer products and services, representatives or designated proxy stakeholders are selected, e.g. marketing. **TEC.1.BP.2: Elicit stakeholder requirements.** [Outcome: a,c] Elicit stakeholder requirements. NOTE Stakeholder requirements are expressed in terms of the needs, wants, desires, expectations and perceived constraints of identified stakeholders. They are expressed in terms of a model that may be textual or formal, that concentrates on system purpose and behaviour, and that is described in the context of the operational environment and conditions. A product quality model, such as found in ISO/IEC 9126, is useful for aiding this Base Practice. Stakeholder requirements include the needs and requirements imposed by society, the constraints imposed by an acquiring organization and the capabilities and limiting characteristics of operator staff. Exclude unjustified constraints on a solution. It is useful to cite sources, including solicitation documents or agreements, and, where possible,

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	their justification and rationale, and the assumptions of stakeholders and the value they place on the satisfaction of their requirements. For key stakeholder needs, the measures of effectiveness are defined so that operational performance can be measured and assessed. **TEC.1.BP.3: Define solution constraints.** [Outcome: b] Define the constraints on a system solution that are unavoidable consequences of existing agreements, management decisions and technical decisions. NOTE These may result from 1) instances or areas of stakeholder-defined solution 2) implementation decisions made at higher levels of system hierarchical structure 3) required use of defined enabling systems, resources and staff. **TEC.1.BP.4: Define service activity sequences.** [Outcome: d,e] Define a representative set of activity sequences to identify all required services that correspond to anticipated operational and support scenarios and environments. NOTE Scenarios are used to analyze the operation of the system in its intended environment in order and to identify requirements that may not have been formally specified by any of the stakeholders, e.g. legal, regulatory and social obligations. The context of use of the system is identified and analyzed. Include in the context analysis the activities that users perform to achieve system objectives, the relevant characteristics of the end-users of the system (e.g. expected training, degree of fatigue), the physical environment (e.g. available light, temperature) and any equipment to be used (e.g. protective or communication equipment). The social and organizational influences on users that could affect system use or constrain its design are analyzed when applicable. **TEC.1.BP.5: Identify user interactions.** [Outcome: d,e] Identify the interaction between users and the system. NOTE Usability requirements are determined, establishing, as a minimum, the most effective, efficient, and reliable human performance and human-system interaction. Where possible, applicable standards, e.g. ISO 9241, and accepted professional practices are used in order to define: Physical, mental, and learned capabilities; Work place, environment and facilities, including other equipment in the context of use; Normal, unusual, and emergency conditions; Operator and user recruitment, training and culture; **TEC.1.BP.6: Specify required critical qualities.** [Outcome: d,e] Specify health, safety, security, environment and other stakeholder requirements and functions that relate to critical qualities. NOTE Identify safety risk and, if warranted, specify requirements and functions to provide safety. This includes risks associated with methods of operations and support, health and safety, threats to property and environmental influences. Use applicable standards, e.g. IEC 61508, and accepted professional practices. Identify security risk and, if warranted, specify all applicable areas of system security, including physical, procedural, communications, computers, programs, data and emissions. Identify functions that could impact the security of

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	the system, including access and damage to protected personnel, properties and information, compromise of sensitive information, and denial of approved access to property and information. Specify the required security functions, including mitigation and containment, referencing applicable standards and accepted professional practices where mandatory or relevant. **TEC.1.BP.7: Analyze stakeholder requirements.** [Outcome: c,d,e] Analyze the complete set of elicited requirements. NOTE Analysis includes identifying and prioritizing the conflicting, missing, incomplete, ambiguous, inconsistent, incongruous or unverifiable requirements. **TEC.1.BP.8: Resolve contrary stakeholder requirements.** [Outcome: b,d] Resolve requirements problems. NOTE This includes requirements that cannot be realized or are impractical to achieve. **TEC.1.BP.9: Confirm adequacy of stakeholder requirements.** [Outcome: d,e] Feed back the analyzed requirements to applicable stakeholders to ensure that the needs and expectations have been adequately captured and expressed. NOTE Explain and obtain agreement to the proposals to resolve conflicting, impractical and unrealisable stakeholder requirements. **TEC.1.BP.10: Confirm accuracy of stakeholder requirements.** [Outcome: c,d] Establish with stakeholders that their requirements are expressed correctly. NOTE This includes confirming that stakeholder requirements are comprehensible to originators and that the resolution of conflict in the requirements has not corrupted or compromised stakeholder intentions. **TEC.1.BP.11: Establish stakeholder records.** [Outcome: d,f] Record the stakeholder requirements in a form suitable for requirements management through the life cycle and beyond. NOTE 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 system entities. **TEC.1.BP.12: Maintain stakeholder requirements traceability.** [Outcome: d,f] Maintain stakeholder requirements traceability to the sources of stakeholder need. NOTE The stakeholder requirements are reviewed at key decision times in the life cycle to ensure that account is taken of any changes of need.

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Work Products	
Inputs	Outputs
3.11 technical management plan 3.14 decision-making strategy 3.15 risk management strategy 5.11 system requirements traceability 5.13 system architectural design traceability 8.14 system requirements	2.07 stakeholders profile [Outcome: c] 5.09 stakeholder requirements traceability [Outcome: c] 5.10 stakeholder requirements record [Outcome: d, e] 6.21 stakeholder requirements report [Outcome: c,d,e] 8.12 stakeholder requirements [Outcome: a,b,c,d] 8.13 stakeholder requirements constraints on solution [Outcome: b]

5.5.3 TEC.2 Requirements Analysis Process

Process ID	TEC.2
Process Name	**Requirements Analysis Process**
Process Purpose	The purpose of the Requirements Analysis Process is to transform the stakeholder, requirement-driven view of desired services into a technical view of a required product that could deliver those services. This process builds a representation of a future system that will meet stakeholder requirements and that, as far as constraints permit, does not imply any specific implementation. It results in measurable system requirements that specify, from the developer's perspective, what characteristics it is to possess and with what magnitude in order to satisfy stakeholder requirements.
Process Outcomes	As a result of the successful implementation of the Requirements Analysis Process: a) The required characteristics, attributes, and functional and performance requirements for a product solution are specified. b) Constraints that will affect the architectural design of a system and the means to realize it are specified. c) The integrity and traceability of system requirements to stakeholder requirements is achieved. d) A basis for verifying that the system requirements are satisfied is defined.
Base Practices	**TEC.2.BP.1: Define system functional boundary.** [Outcome: a] Define the functional boundary of the system in terms of the behaviour and properties to be provided. NOTE This includes the system's stimuli and its responses to user and environment behaviour, and an analysis and description of the required interactions between the system and its environment in terms of interface constraints, such as mechanical, electrical, mass, thermal, data, and procedural flows. This establishes the expected system behaviour, expressed in quantitative terms, at its boundary.

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	TEC.2.BP.2: Define system functions. [Outcome: a] Define each function that the system is required to perform, how well the system, including its operators, is required to perform that function, the conditions under which the system is to be capable of performing the function, the conditions under which the system is to commence performing that function and the conditions under which the system is to cease performing that function. NOTE Conditions for the performance of functions may incorporate reference to states and required modes of operation of the system. System requirements depend heavily on abstract representations of proposed system characteristics and may employ multiple modelling techniques and perspectives to give a sufficiently complete description of the desired system requirements. **TEC.2.BP.3: Define implementation constraints.** [Outcome: b] Define necessary implementation constraints that are introduced by stakeholder requirements or are unavoidable solution limitations. NOTE This includes the implementation decisions that are allocated from design at higher levels in the structure of the system. **TEC.2.BP.4: Define technical performance measures.** [Outcome: a, d] Define technical and quality in use measures that enable the assessment of technical achievement. NOTE This includes defining critical performance parameters associated with each effectiveness measure identified in the stakeholder requirements. The critical performance measures are analyzed and reviewed to ensure stakeholder requirements are met and to ensure identification of project cost, schedule or performance risk associated with any non-compliance. ISO/IEC 15939 provides a process to identify, define and use appropriate measures. ISO/IEC 9126 may provide relevant quality measures. **TEC.2.BP.5: Specify system critical qualities.** [Outcome: a,b] Specify system requirements and functions, as justified by risk identification or criticality of the system, that relate to critical qualities, such as health, safety, security, reliability, availability and supportability. NOTE This includes analysis and definition of safety considerations, including those relating to methods of operation and maintenance, environmental influences and personnel injury. It also includes each safety related function and its associated safety integrity, expressed in terms of the necessary risk reduction, is specified and allocated to designated safety-related systems. Applicable standards are used concerning functional safety, e.g. IEC 61508, and environmental protection, e.g. ISO 14001. Analyze security considerations including those related to compromise and protection of sensitive information, data and material. The security-related risks are defined, including, but not limited to, administrative, personnel, physical, computer, communication, network, emission and environment factors using, as appropriate, applicable security standards. **TEC.2.BP.6: Analyze system requirements integrity.** [Outcome: c] Analyze the integrity of the system requirements to ensure that each requirement, pairs of requirements or sets of requirements possess overall integrity. NOTE Each system requirement statement is checked to establish that it is unique, complete, unambiguous, consistent with all other requirements,

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	implementable and verifiable. Deficiencies, conflicts and weaknesses are identified and resolved within the complete set of system requirements. The resulting system requirements are analyzed to confirm that they are complete, consistent, achievable (given current technologies or knowledge of technological advances) and expressed at an appropriate level of detail. Confirmation is made that they are a necessary and sufficient response to stakeholder requirements and a necessary and sufficient input to other processes, in particular architectural design. **TEC.2.BP.7: Demonstrate system requirements traceability.** [Outcome: c] Demonstrate traceability between the system requirements and the stakeholder requirements. NOTE Maintain mutual traceability between the system requirements and the stakeholder requirements, i.e. all achievable stakeholder requirements are met by one or more system requirements, and all system requirements meet or contribute to meeting at least one stakeholder requirement. The system requirements are held in an appropriate data repository that permits traceability to stakeholder needs and architectural design. **TEC.2.BP.8: Maintain system requirements records.** [Outcome: d] Maintain throughout the system life cycle the set of system requirements together with the associated rationale, decisions and assumptions.

Work Products	
Inputs	Outputs
2.07 stakeholders profile 2.09 architectural design description 3.11 technical management plan 3.14 decision-making strategy 3.15 risk management strategy 5.09 stakeholder requirements traceability 5.13 system architectural design traceability 8.12 stakeholder requirements 8.13 stakeholder requirements constraints on solution 8.17 system interface requirements 8.18 system element interface requirements 8.19 system element requirements 8.20 implementation constraints on solution 8.22 integration constraints on solution 8.24 verification constraints on solution 8.26 transition constraints on solution 8.28 validation constraints on solution 8.30 maintenance constraints on solution 8.32 disposa constraints on solution	2.08 system functional model [Outcome: a] 5.11 system requirements traceability [Outcome: c] 5.12 system requirements record [Outcome: f] 6.22 system requirements report [Outcome: d,e] 8.14 system requirements [Outcome: a,b,c,d] 8.15 system requirements constraints on solution [Outcome: b] 8.16 system performance measures specification [Outcome: e]

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5.5.4 TEC.3 Architectural Design Process

Process ID	TEC.3
Process Name	**Architectural Design Process**
Process Purpose	The purpose of the Architectural Design Process is to synthesize a solution that satisfies system requirements. This process encapsulates and defines areas of solution expressed as a set of separate problems of manageable, conceptual and, ultimately, realizable proportions. It identifies and explores one or more implementation strategies at a level of detail consistent with the system's technical and commercial requirements and risks. From this, an architectural design solution is defined in terms of the requirements for the set of system elements from which the system is configured. The specified requirements resulting from this process are the basis for verifying the realized system and for devising an assembly and verification strategy.
Process Outcomes	As a result of the successful implementation of the Architectural Design Process: a) An architectural design baseline is established. b) The implementable set of system element descriptions that satisfy the requirements for the system are specified. c) The interface requirements are incorporated into the architectural design solution. d) The traceability of architectural design to system requirements is established. e) A basis for verifying the system elements is defined. f) A basis for the integration of system elements is established.
Base Practices	**TEC.3.BP.1: Define logical architecture.** [Outcome: d] Define appropriate logical architectural designs. NOTE This includes identifying and defining derived requirements for describing functional and performance requirements, services and attributes, timeline requirements, data flow requirements, etc., as appropriate to a logical architecture. Prior to partitioning logical architecture to physical elements, conflicts among and between various logical descriptions are resolved and each logical architecture is shown to be complete and consistent by making mutual traceability checks with the defined system requirements. **TEC.3.BP.2: Associate system functions with system elements.** [Outcome: b] Partition the system functions identified in requirements analysis and allocate them to elements of system architecture. Generate derived requirements as needed for the allocations. **TEC.3.BP.3: Specify requirements for each system element.** [Outcome: b,c] Analyze the resulting architectural design to establish design criteria for each element.

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NOTE The design criteria include the physical, performance, behavioural, durability and sustainable service characteristics. Typically, Stakeholder Requirements Definition, Requirements Analysis and Architectural Design Processes are recursively applied to successive levels of detail in the system architecture until elements are capable of being, purchased, re-used or built using a development standard such as ISO/IEC 12207:1995/AMD.1:2002 for software.

TEC.3.BP.4: Determine operator requirements allocation. [Outcome: b,c]

Determine which system requirements are allocated to operators.

NOTE This determination takes account of the context of use factors and considers, as a minimum, the following factors for the most effective, efficient and reliable human-machine interaction.

1) Limitations of human capabilities;
2) Human actions critical to safety and how the consequences of error are addressed;
3) Integration of human performance into systems and their operation.

Guidance on user-centred design is given in ISO 13407.

TEC.3.BP.5: Determine off-the-shelf system element suitability. [Outcome: b,c]

Determine whether hardware and software elements that satisfy the design and interface criteria are available off-the-shelf.

NOTE This includes evaluation of design elements that are not readily available in order to determine if an element is to be developed, or if existing system elements will be re-used or adapted. Establish the costs, schedule, and technical risks associated with these make/modify/buy decisions.

TEC.3.BP.6: Evaluate alternative designs. [Outcome: b]

Evaluate alternative design solutions, modelling them to a level of detail that permits comparison against the specifications expressed in the system requirements and the performance, costs, time scales and risks expressed in the stakeholder requirements.

NOTE This includes:

1) assessing and communicating the emergence of adverse system properties resulting from the interaction of candidate system elements or from changes in a system element;
2) ensuring that the constraints of enabling system are taken account of in the design;
3) performing effectiveness assessments, trade-off analyses and risk analyses that lead toward realizing a feasible, effective, stable and optimized design.

TEC.3.BP.7: Define system element interfaces. [Outcome: c]

Define the interfaces between system elements and at the system boundary with external systems.

NOTE Definitions are made with a level of detail and control appropriate to the creation, use and evolution of the system entity and with interface documentation from parties responsible for external interfacing entities. Human-system and human-human interfaces are also defined and controlled. Interface definitions conform to recognized product sector or international standards where

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	these exist, e.g. ISO 9241 for human-computer interface or the Open System Interconnect seven layer model for data communications in ISO 7498. **TEC.3.BP.8: Specify architecture of design solution.** [Outcome:a,d,e,f] Specify the selected physical design solution as an architectural design baseline in terms of its functions, performance, behaviour, interfaces and unavoidable implementation constraints. NOTE These specifications are the basis of the system solution and an origin for system element acquisition agreements, including acceptance criteria. They may be in the form of sketches, drawings or other descriptions appropriate to the maturity of the development effort, e.g. feasibility design, conceptual design, pre-fabrication design. They are the basis for deciding whether to produce, re-use or acquire system elements, for verifying the system elements and for defining an integration strategy for the system. **TEC.3.BP.9: Record architectural design.** [Outcome: a] Record the architectural design information. NOTE This records the structural and functional partitioning, interface and control definitions and the design decisions and conclusions, with traceability to the requirements baseline. The architectural design baseline enables review in the event of change throughout the life cycle, as well as providing information for any subsequent re-use of the architecture. It is also the information source from which tests during integration are defined. **TEC.3.BP.10: Maintain architectural design traceability.** [Outcome: a,d] Maintain mutual traceability between architectural design and system requirements.

Work Products	
Inputs	Outputs
2.05 configuration item list 2.07 stakeholders profile 2.08 system functional model 3.11 technical management plan 3.14 decision-making strategy 3.15 risk management strategy 3.18 implementation strategy 5.09 stakeholder requirements traceability 5.11 system requirements traceability 8.13 stakeholder requirements constraints on solution 8.14 system requirements 8.15 system requirements constraints on solution 8.16 system performance measures specification 8.20 implémentation constraints on solution 8.22 integration constraints on solution 8.24 verification constraints on solution 8.26 transition constraints on solution 8.28 validation constraints on solution 8.30 maintenance constraints on solution 8.32 disposal constraints on solution	2.09 architectural design description [Outcome: a,b,c] 5.13 system architectural design traceability [Outcome: d] 5.14 system architectural design record [Outcome: e,f] 6.23 system architectural design report [Outcome: e,f] 8.17 system interface requirements [Outcome: c] 8.18 system element interface requirements [Outcome: c] 8.19 system element requirements [Outcome: d,e]

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5.5.5 TEC.4 Implementation Process

Process ID	TEC.4
Process Name	**Implementation Process**
Process Purpose	The purpose of the Implementation Process is to produce a specified system element. This process transforms specified behaviour, interfaces and implementation constraints into fabrication actions that create a system element according to the practices of the selected implementation technology. The system element is constructed or adapted by processing the materials and/or information appropriate to the selected implementation technology and by employing appropriate technical specialisms or disciplines. This process results in a system element that satisfies architectural design requirements through verification and stakeholder requirements through validation.
Process Outcomes	As a result of the successful implementation of the Implementation Process: a) An implementation strategy is defined. b) Implementation technology constraints on the design are identified. c) A system element is realized. d) A system element is packaged and stored in accordance with an agreement for its supply.
Base Practices	**TEC.4.BP.1: Define implementation strategy.** [Outcome: a] Generate an implementation strategy. NOTE This includes implementation procedures, fabrication processes, tools and equipment, implementation tolerances and verification uncertainties. In the case of repeated system element implementation, e.g. mass production, replacement system elements, the implementation procedures and fabrication processes are defined to achieve consistent and repeatable producibility. **TEC.4.BP.2: Identify implementation constraints on design.** [Outcome: b] Identify the constraints that the implementation strategy and implementation technology impose on the design solution. NOTE This includes current or anticipated limitations of the chosen implementation technology, acquirer furnished materials or system elements for adaptation and limitations resulting from the use of required implementation enabling systems. **TEC.4.BP.3: Realize system elements.** [Outcome: c] Realize or adapt system elements using the implementation enabling systems and specified materials according to the defined implementation procedures for hardware fabrication, software creation and/or operator training. NOTE Adaptation includes configuration of hardware and software element that are reused or acquired. Realization or adaptation is conducted with regard to

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	standards that govern applicable safety, security, privacy and environmental guidelines or legislation and the practices of the relevant implementation technology. 1) Hardware Fabrication Fabricate hardware elements using the conditioning, forming and fabrication techniques relevant to the physical implementation technology and materials selected. As appropriate, hardware elements are tested to confirm specified product quality characteristics. 2) Software Creation Code software elements and, as appropriate, compile, inspect and test to assure their conformance to the design criteria. ISO/IEC 12207:1995/AMD.1:2002 applies to system elements realized in software. 3) Operator Training Deliver appropriate training to prepare operators for performing tasks in accordance with required performance standards and operational procedures and, as appropriate, confirm that the specified range and level of competence has been attained. This may include awareness of the operational environment, including appropriate failure detection and isolation instruction. **TEC.4.BP.4: Record system element conformance information.** [Outcome: c] Record evidence that the system element meets supplier agreements, legislation and organizational policy. NOTE This provides objective evidence that the requirements from architectural design have been fulfilled by the implemented system element. Evidence is provided in accordance with supply agreements, legislation and organization policy, **TEC.4.BP.5: Contain system elements.** [Outcome: d] Package the system element and store as appropriate. NOTE Contain the system element in order to achieve continuance of its characteristics. Conveyance and storage media, and their durations, influence the specified containment.

Work Products	
Inputs	Outputs
2.05 configuration item list 2.08 system functional model 2.09 architectural design description 3.11 technical management plan 3.19 integration strategy 5.13 system architectural design traceability 5.14 system architectural design record 8.17 system interface requirements 8.18 system element interface requirements 8.19 system element requirements	1.05 system element [Outcome: c,d] 1.06 qualified operators [Outcome: c] 3.18 implementation strategy [Outcome: a] 4.04 implementation procedure [Outcome: c] 5.15 implementation record [Outcome: c,d] 6.24 implementation report [Outcome: c] 8.20 implementation constraints on solution [Outcome: b] 8.21 implementation enabling system requirement [Outcome: b,c]

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5.5.6 TEC.5 Integration Process

Process ID	TEC.5
Process Name	**Integration Process**
Process Purpose	The purpose of the Integration Process is to assemble a system that is consistent with the architectural design. This process combines system elements to form complete or partial system configurations in order to create a product specified in the system requirements.
Process Outcomes	As a result of the successful implementation of the Integration Process: a) A system integration strategy is defined. b) Unavoidable constraints of integration that influence requirements are defined. c) A system capable of being verified against the specified requirements from architectural design is assembled and integrated. d) Non-conformances due to integration actions are recorded.
Base Practices	**TEC.5.BP.1: Define integration strategy and procedure.** [Outcome: a] Define an assembly sequence and strategy that minimizes system integration risks. NOTE This strategy may permit verification against a sequence of progressively more complete system element configurations. It is dependent on system element availability and is consistent with a fault isolation and diagnosis strategy. Wherever possible an integrated configuration includes its human operators. Successive applications of the Integration Process and the Verification Process, and when required the Validation Process, are repeated for systems at successive levels until the system-of-interest has been realized. **TEC.5.BP.2: Identify integration constraints on design.** [Outcome:b] Identify the constraints on the design arising from the integration strategy. NOTE This includes factors such accessibility, integration enabling systems and required interfacing/interconnections for intermediate assembly configurations. **TEC.5.BP.3: Obtain integration resources.** [Outcome: c] Obtain integration enabling systems and specified materials according to the defined integration procedures. NOTE The enabling system for integration may include integration facilities, jigs, conditioning facilities and assembly equipment. Integration enabling system requirements, constraints and other limitations are defined. **TEC.5.BP.4: Obtain system elements.** [Outcome: c] Obtain system elements in accordance with agreed schedules. NOTE System elements can be received from suppliers or be withdrawn from storage. System elements are handled in accordance with relevant health, safety, security and privacy considerations.

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	TEC.5.BP.5: Assure system element conformance. [Outcome: c,d] Assure that the system elements have been verified against acceptance criteria specified in an agreement. NOTE System elements that do not pass verification are identified as such and handled in accordance with defined procedures. **TEC.5.BP.6: Integrate system elements.** [Outcome: c] Integrate system elements in accordance with applicable interface control descriptions and defined assembly procedures, using the specified integration facilities. **TEC.5.BP.7: Record integration information.** [Outcome: c,d] Record integration information in an appropriate database. NOTE This includes resolution of problems due to the integration strategy, the integration enabling systems or manual assembly errors. The data are analyzed to enable corrective or improvement actions to the integration strategy and its execution.

Work Products	
Inputs	Outputs
1.05 system element 2.05 configuration item list 3.11 technical management plan 3.20 verification strategy 4.04 implementation procedure 5.13 system architectural design traceability 5.15 implementation record 8.02 delivery acceptance criteria 8.17 system interface requirements 8.18 system element interface requirements 8.19 system element requirements	1.07 integrated system [Outcome: c] 3.19 integration strategy [Outcome: a] 4.05 integration procedure [Outcome: c] 5.16 integration record [Outcome: c,d] 6.25 integration report [Outcome: c,d] 8.22 integration constraints on solution [Outcome: b] 8.23 integration enabling system requirement [Outcome: c]

5.5.7 TEC.6 Verification Process

Process ID	TEC.6
Process Name	**Verification Process**
Process Purpose	The purpose of the Verification Process is to confirm that the specified design requirements are fulfilled by the system. This process provides the information required to effect the remedial actions that correct non-conformances in the realized system or the processes that act on it.
Process Outcomes	As a result of the successful implementation of the Verification Process: a) A verification strategy is defined. b) Verification constraints are provided as inputs to requirements.

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	c) Data providing information for corrective action is reported. d) Objective evidence that the realized product satisfies the system requirements and the architectural design is provided.
Base Practices	**TEC.6.BP.1: Define verification strategy.** [Outcome: a] Define the strategy for verifying the system entities throughout the life cycle. NOTE This strategy applies to the system and to its descriptions, e.g. requirements, design definitions. It includes the context and purpose for each instance of verification action, e.g. verifying the design, ability to build the design correctly, ability to reproduce the system, ability to correct a fault arising, ability to predict failures. Verification demonstrates, through assessment of the product, that the system is made 'right', i.e. fulfils the system requirements against which the product was realized. During verification, wherever possible, the system includes its human operators. The nature and scope of the verification action, e.g. review, inspection, audit, comparison, static test, dynamic test, demonstration (or a combination of these) depend on whether a model, prototype or actual product is being verified, and on the perceived risks, e.g. safety, commercial criticality. **TEC.6.BP.2: Define verification scheme.** [Outcome: b,c] Define a verification plan based on system requirements. NOTE The plans account for the sequence of configurations defined in the integration strategy and, where appropriate, take account of disassembly strategies for fault diagnosis. The schedule typically defines risk-managed verification steps that progressively build confidence in compliance of the fully configured product. **TEC.6.BP.3: Identify verification constaints on design.** [Outcome: b] Potential constraints on design decisions are identified and communicated. NOTE This includes practical limitations of accuracy, uncertainty, repeatability that are imposed by the verification enabling systems, the associated measurement methods, the need for system integration, and the availability, accessibility and interconnection with enabling systems. **TEC.6.BP.4: Confirm verification readiness.** [Outcome: d] Ensure that the enabling system for verification is available and associated facilities, equipment and operators are prepared to conduct the verification. **TEC.6.BP.5: Conduct verification.** [Outcome: c,d] Conduct verification to demonstrate compliance to the specified design requirements. NOTE Non-compliance identifies the existence of random faults and/or design errors, and corrective actions are initiated as appropriate. Verification is undertaken in a manner, consistent with organizational constraints, such that uncertainty in the replication of verification actions, conditions and outcomes is minimized. Approved records of verification actions and outcomes are made. **TEC.6.BP.6: Communicate verification data.** [Outcome: d]

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	Make available verification data on the system. NOTE This is conducted in accordance with agreements and legal, regulatory or product sector requirements. **TEC.6.BP.7: Report verification analysis.** [Outcome: c,d] Analyze, record and report verification, discrepancy and corrective action information. NOTE In accordance with agreement terms or organizational objectives, conduct verification to isolate that part of the system that is giving rise to a non-conformance. Fault diagnosis is conducted to a level of resolution consistent with cost effective remedial action, including re-verification following defect correction, and/or organizational quality improvement actions. Verification data is collected, classified and collated according to criteria defined in the verification strategy. This categorizes non-conformances according to their source and corrective action and owner. The verification data is analyzed to detect essential features such as trends and patterns of failure, evidence of design errors and emerging threats to services.

Work Products	
Inputs	Outputs
1.07 integrated system 3.11 technical management plan 3.21 transition strategy 4.05 integration procedure 5.11 system requirements traceability 5.12 system requirements record 5.16 integration record 8.14 system requirements	1.08 verified system [Outcome: d] 3.20 verification strategy [Outcome: a] 4.06 verification procedure [Outcome: c,d] 5.17 verification record [Outcome: c,d] 6.26 verification report [Outcome: c,d] 8.24 verification constraints on solution [Outcome: b] 8.25 verification enabling system requirement [Outcome: b,c,d]

5.5.8 TEC.7 Transition Process

Process ID	TEC.7
Process Name	**Transition Process**
Process Purpose	The purpose of the Transition Process is to establish a capability to provide services specified by stakeholder requirements in the operational environment. This process installs a verified system, together with relevant enabling systems, e.g. operating system, support system, operator training system, user training system, as defined in agreements.
Process Outcomes	As a result of the successful implementation of the Transition Process: a) A system transition strategy is defined. b) A system is installed in its operational location. c) A system, when operated, is capable of delivering services. d) The configuration as installed is recorded.

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	e) Corrective action reports are recorded. f) A service is sustainable by enabling systems.
Base Practices	**TEC.7.BP.1: Define transition strategy.** [Outcome: a] Prepare a transition strategy. NOTE The transition strategy includes installation and commissioning of the system in accordance with agreements. Wherever possible this includes human operators. **TEC.7.BP.2: Prepare operational site.** [Outcome: b] Prepare the site of operation in accordance with installation requirements. NOTE Site preparation is conducted in accordance with applicable health, safety, security and environmental regulations. **TEC.7.BP.3: Deliver system for installation.** [Outcome: b] Deliver the system for installation at the correct location and time. NOTE It may be necessary to account for intermediate storage prior to delivery. **TEC.7.BP.4: Install system.** [Outcome: b] Install the system in its operational location and interfaced to its environment according to its system specification. NOTE The system is configured with required operational data. **TEC.7.BP.5: Confirm installation conformance.** [Outcome: d] Demonstrate proper installation of the system. NOTE Acceptance tests defined in the agreement to deliver can demonstrate satisfactory installation. Where the exact location or environment of operation is not available, a representative example is selected. **TEC.7.BP.6: Activate system.** [Outcome: c] Activate the system in order to confirm capability readiness. **TEC.7.BP.7: Demonstrate system capability.** [Outcome: c,f] Demonstrate the installed system is capable of delivering its required services. NOTE Acceptance tests, as specified in agreements, can define the criteria that demonstrate that the system entity possesses the capability to deliver the required services when installed in its operational location and staffed by operators. **TEC.7.BP.8: Record installation information.** [Outcome: d,e] Record the installation data, including the operational configuration, anomalies detected, actions taken and lessons learned.

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	NOTE Post-implementation reporting includes flaws in the system requirements as well as technical features. Where inconsistencies exist at the interface between the system, its specified operational environment and any systems that enable the utilization stage, the deviations lead to corrective actions and/or requirement changes.

Work Products	
Inputs	Outputs
1.06 qualified operators 1.08 verified system 2.05 configuration item list 3.11 technical management plan 3.22 validation strategy 3.23 operation strategy 4.06 verification procedure 5.17 verification record	1.09 installed system [Outcome: d,f] 3.21 transition strategy [Outcome: a] 4.07 transition procedure [Outcome: b,c] 5.18 transition record [Outcome: d,e] 6.27 transition report [Outcome: c,e] 8.26 transition constraints on solution [Outcome: b] 8.27 transition enabling system requirement [Outcome: b,f]

5.5.9 TEC.8 Validation Process

Process ID	TEC.8
Process Name	**Validation Process**
Process Purpose	The purpose of the Validation Process is to provide objective evidence that the services provided by a system when in use comply with stakeholders' requirements. This process performs a comparative assessment and confirms that the stakeholders' requirements are correctly defined. Where variances are identified, these are recorded and guide corrective actions. System validation is ratified by stakeholders.
Process Outcomes	As a result of the successful implementation of the Validation Process: a) A validation strategy is defined. b) The availability of services required by stakeholders is confirmed. c) Validation data is provided. d) Data capable of providing information for corrective action is reported.
Base Practices	**TEC.8.BP.1: Define validation strategy.** [Outcome: a] Define the strategy for validating the services in the operational environment and achieving stakeholder satisfaction. NOTE Validation demonstrates, through assessment of the services presented to the stakeholders, that the 'right' system entity has been created, i.e., is fit for its purpose and satisfies the consumer. Validation takes place from the earliest stage of a life cycle. For example paper prototypes, simulations or mock-ups of the system under development in a corresponding representation of its environment may be used to validate at the Concept Stage. The nature and scope of the validation action depends on whether a model, prototype or actual system is being validated, on risks, (e.g. novelty, safety, technical and commercial criticality issues), on the agreement and organizational constraints, and on the stakeholder requirements. The supplier, the acquirer, or an agent of the acquirer may do

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validation of the realized product. The responsibility is designated in the agreement.

TEC.8.BP.2: Prepare validation scheme. [Outcome: b,d]

Prepare a validation plan.

NOTE Validation is based on the stakeholder requirements. Where appropriate, define validation steps, e.g. various operational states, scenarios and missions that progressively build confidence in conformance of the installed system and assist diagnosis of any discrepancies. Methods and techniques needed to implement the validation strategy are specified, as are the purpose, conditions and conformance criteria for each validation. Where stakeholder requirements cannot be specified comprehensively or change frequently, repeated validation of (often rapidly developed) increments in system evolution may be employed to refine stakeholder requirements and mitigate risks in the correct identification of need, e.g. ISO 13407 describes an iterative life cycle that involves users.

TEC.8.BP.3: Confirm validation readiness. [Outcome: b]

Ensure that any operators, enabling system for validation and associated facilities are ready in order to conduct validation.

TEC.8.BP.4: Conduct validation. [Outcome: b,c,d]

Conduct validation to demonstrate conformance of services to stakeholder requirements.

NOTE Validation is undertaken in a manner, consistent with organizational constraints, such that uncertainty in the replication of validation actions, conditions and outcomes is minimized. Objectively record and approve validation actions and results. Validation may also be conducted to confirm that the system not only satisfies all operational, functional and usability requirements, but also satisfies the often less formally expressed, but sometimes overriding, attitudes, experience and subjective tests that comprise customer satisfaction.

TEC.8.BP.5: Communicate validation data. [Outcome: c,d]

Make available validation data on the system according to legal, regulatory or product sector requirements.

TEC.8.BP.6: Isolate validation non-conformance. [Outcome: b,d]

As appropriate to agreement terms or organizational objectives, conduct validation to isolate that part of the system giving rise to a non-conformance.

NOTE Fault diagnosis is conducted to a level of resolution consistent with cost effective remedial action, including re-validation following defect correction and/or organizational quality improvement actions.

TEC.8.BP.7: Report validation analysis. [Outcome: c]

Analyze, record and report validation data according to criteria defined in the validation strategy.

NOTE This Base Practice categorizes non-conformances according to their source and corrective action owner. The validation data is analyzed to detect essential features such as trends and patterns of failure, evidence of design errors and emerging threats to services.

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Work Products	
Inputs	Outputs
1.06 qualified operators 1.09 installed system 3.11 technical management plan 3.23 operation strategy 4.07 transition procedure 5.09 stakeholder requirements traceability 5.10 stakeholder requirements record 5.18 transition record 8.12 stakeholder requirements	1.10 validated system [Outcome: b] 3.22 validation strategy [Outcome: a] 4.08 validation procedure [Outcome: b,c,d] 5.19 validation record [Outcome: c] 6.28 validation report [Outcome: c,d] 8.28 validation constraints on solution [Outcome: b] 8.29 validation enabling system requirement [Outcome: b]

5.5.10 TEC.9 Operation Process

Process ID	TEC.9
Process Name	**Operation Process**
Process Purpose	The purpose of the Operation Process is to use the system in order to deliver its services. This process assigns personnel to operate the system, and monitors the services and operator-system performance. In order to sustain services it identifies and analyzes operational problems in relation to agreements, stakeholder requirements and organizational constraints.
Process Outcomes	As a result of the successful implementation of the Operation Process: a) An operation strategy is defined. b) Services that meet stakeholder requirements are delivered. c) Approved corrective action requests are satisfactorily completed. d) Stakeholder satisfaction is maintained.
Base Practices	**TEC.9.BP.1: Define operation strategy.** [Outcome: a] Prepare a strategy for operation. NOTE This defines 1) The availability of services as they are introduced, routinely operated and withdrawn from service. Where appropriate, it includes co-ordination with pre-existing, concurrent or continuing services delivered by other systems that provide identical or similar services. 2) The staffing strategy and schedules for operators. 3) Where appropriate, the release and re-acceptance criteria and schedules of the system to permit modifications that sustain existing or enhanced services. **TEC.9.BP.2: Obtain operation services.** [Outcome: b] Obtain other services related to operation of the system. **TEC.9.BP.3: Assign operators.** [Outcome: b] Assign trained, qualified personnel to be operators. NOTE This may include awareness of the system in its operational environment and a defined program of familiarization, with appropriate failure detection and isolation instruction. Operator knowledge, skill and experience

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requirements guide the personnel selection criteria, and where relevant, their authorization to operate is confirmed. Selection and training of instructors to perform training that employs the operational system may be an aspect of staffing. A training mode of the operational system may impact service availability.

TEC.9.BP.4: Activate system service delivery. [Outcome: b]

Activate the system in its intended operational situation to deliver instances of service or continuous service according to its intended purpose.

NOTE Where agreed, maintain continuous service capacity and quality when the system replaces an existing system that is being retired. During a specified period of changeover or concurrent operation, manage the transfer of services so that continuing conformance to persistent stakeholder needs is achieved.

TEC.9.BP.5: Provide consumable materials. [Outcome: b]

Consume materials, as required, to sustain the services.

NOTE This includes energy sources for hardware and provisions for operators.

TEC.9.BP.6: Monitor system operation. [Outcome: b]

Monitor operation to ensure that the system is operated in accordance with the operations plans, in a safe manner and compliant with legislated guidelines concerning occupational safety and environmental protection.

TEC.9.BP.7: Monitor system service performance. [Outcome: d]

Monitor the system operation to confirm that service performance is within acceptable parameters.

NOTE The system may exhibit unacceptable performance when system elements implemented in hardware have exceeded their useful life or the system's operational environment affects the operating and maintenance personnel (including staff turnover, operator stress and fatigue).

TEC.9.BP.8: Perform service corrective action. [Outcome: c,d]

Perform failure identification actions when a non-compliance has occurred in the delivered services.

TEC.9.BP.9: Determine action when needs change.
[Outcome: c,d]

Determine the appropriate course of action when corrective action is required to remedy failings due to changed need.

NOTE The appropriate course of action may include, but not be limited to, introducing minor hardware or software adaptations or modified operator action, changes to the stakeholder requirements, changes to the design and/or implementation of the system, or tolerating diminished services.

TEC.9.BP.10: Remedy operator-related service failings. [Outcome: c]

Introduce remedial changes to operating procedures, the operator environment, human-machine interfaces and operator training as appropriate when human error contributed to failure.

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	TEC.9.BP.11: Determine service satisfaction. [Outcome: d] Continuously or routinely communicate with users to determine the degree to which delivered services satisfy their needs. NOTE The results are analysed and required action to restore or amend services in order to provide continued stakeholder satisfaction is identified. Wherever possible the benefit of such action is agreed with stakeholders or their representatives.

Work Products	
Inputs	Outputs
1.06 qualified operators 1.10 validated system 3.12 service management plan 3.24 maintenance strategy 3.25 disposal strategy 4.08 validation procedure 5.07 configuration history record 5.08 information history record 5.19 validation record	1.11 operational system [Outcome: b] 1.12 waste products [Outcome: b] 3.23 operation strategy [Outcome: a] 4.09 operation procedure [Outcome: b,c,d] 5.20 operation record [Outcome: b,c] 6.29 operation report [Outcome: c,d] 7.10 operation request [Outcome: b, d]

5.5.11 TEC.10 Maintenance Process

Process ID	TEC.10
Process Name	**Maintenance Process**
Process Purpose	The purpose of the Maintenance Process is to sustain the capability of the system to provide a service. This process monitors the system's capability to deliver services, records problems for analysis, takes corrective, adaptive, perfective and preventive actions and confirms restored capability.
Process Outcomes	As a result of the successful implementation of the Maintenance Process: a) A maintenance strategy is developed. b) Maintenance constraints are provided as inputs to requirements. c) Replacement system elements are made available. d) Services meeting stakeholder requirements are sustained. e) The need for corrective design changes is reported. f) Failure and lifetime data is recorded.
Base Practices	**TEC.10.BP.1: Define maintenance strategy.** [Outcome: a] Prepare a maintenance strategy. NOTE This defines schedules and resources required to perform corrective and preventive maintenance in conformance with operational availability requirements. It should include:

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1) The corrective and preventive maintenance strategy to sustain service in the operational environment in order to achieve customer satisfaction;

2) The scheduled preventive maintenance actions that reduce the likelihood of system failure without undue loss of services, e.g. suspension or restriction of the services;

3) The number and type of replacement system elements to be stored, their storage locations and conditions, their anticipated replacement rate, their storage life and renewal frequency;

4) The skill and personnel levels required to effect repairs and replacements, accounting for maintenance staff requirements and any relevant legislation regarding health and safety, security and the environment. These procedures include disassembly strategy, fault diagnosis techniques, re-assembly and testing sequences.

TEC.10.BP.2: Define maintenance constraints on system.
[Outcome: b]

Define the constraints on system requirements that are unavoidable consequences of the maintenance strategy.

NOTE These may result from the need to 1) re-use existing maintenance enabling systems, 2) re-use existing holdings of replaceable system element and accommodate re-supply limitations, 3) conduct maintenance in specific locations or environments.

TEC.10.BP.3: Obtain maintenance resources. [Outcome: c,d]

Obtain the enabling systems, system elements and services to be used during maintenance of the system.

TEC.10.BP.4: Establish problem reporting. [Outcome: d,e,f]

Implement problem reporting and incident recording to guide diagnosis of individual events and histories to support future corrective, adaptive, perfective and preventive maintenance.

TEC.10.BP.5: Conduct corrective maintenance actions. [Outcome: c,d,f]

Implement the procedures for correction of random faults and/or scheduled replacement of system elements.

NOTE For random system failures, the fault is isolated down to the planned level of system element replacement, the system element is replaced and correct system performance is verified. Actions are recorded in order to estimate the useful life of degradable system elements.

TEC.10.BP.6: Initiate design error corrective action. [Outcome: e]

Initiate corrective action to remedy previously undetected design errors.

NOTE Record and communicate to relevant parties the need for potential corrective action to development, e.g. software defect, and/or to production actions. This can have consequences on relevant enabling systems.

TEC.10.BP.7: Confirm logistics conformance. [Outcome: c,f]

Confirm that logistics actions satisfy the required replenishment levels so that stored system elements meet repair rates and planned schedules.

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	NOTE Monitor the quality and availability of spares, their transportation and their continued integrity during storage. Acquire, train and accredit, as necessary, personnel to maintain operator numbers and skills. **TEC.10.BP.8: Conduct preventative maintenance schedules.** [Outcome: c,d,f] Perform preventive maintenance by replacing or servicing system elements prior to failure, according to planned schedules and maintenance procedures. **TEC.10.BP.9: Identify causes of system failure.** [Outcome: e,f] Perform failure identification actions when a non-compliance has occurred in the system. **TEC.10.BP.10: Maintain maintenance records.** [Outcome: d,e,f] Maintain a history of problem reports, corrective actions and trends to inform operations and maintenance personnel, and other projects that are creating or utilizing similar system entities.

Work Products	
Inputs	Outputs
1.11 operational system 3.12 service management plan 3.25 disposal strategy 4.09 operation procedure 5.07 configuration history record 5.08 information history record 5.20 operation record	3.24 maintenance strategy [Outcome: a] 4.10 maintenance procedure [Outcome: c,d,e,f] 5.21 maintenance record [Outcome: d,e,f] 6.30 maintenance report [Outcome: e,f] 7.11 maintenance request [Outcome: d,e] 8.30 maintenance constraints on solution [Outcome: b] 8.31 maintenance enabling system requirement [Outcome: d]

5.5.12 TEC.11 Disposal Process

Process ID	TEC.11
Process Name	**Disposal Process**
Process Purpose	The purpose of the Disposal Process is to end the existence of a system entity. This process deactivates, disassembles and removes the system and any waste products, consigning them to a final condition and returning the environment to its original or an acceptable condition. This process destroys, stores or reclaims system entities and waste products in an environmentally sound manner, in accordance with legislation, agreements, organizational constraints and stakeholder requirements. Where required, it maintains records in order that the health of operators and users, and the safety of the environment, can be monitored.
Process Outcomes	As a result of the successful implementation of the Disposal Process: a) A system disposal strategy is defined.

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	b) Disposal constraints are provided as inputs to requirements. c) The system elements are destroyed, stored, reclaimed or recycled. d) The environment is returned to its original or an agreed state. e) Records allowing knowledge retention of disposal actions and the analysis of long-term hazards are available.
Base Practices	**TEC.11.BP.1: Define disposal strategy.** [Outcome: a] Define a disposal strategy for the system, to include each system element and any resulting waste products. NOTE This defines schedules, actions and resources that: 1) permanently terminate the system's delivery of services, 2) transform the system into, or retain it in, a socially and physically acceptable state, thereby avoiding subsequent adverse effects on stakeholders, society and the environment, 3) take account of the health, safety, security and privacy applicable to disposal actions and to the long term condition of resulting physical material and information. **TEC.11.BP.2: Define disposal constraints on design.** [Outcome: b] Communicate unavoidable constraints on the system design arising from the disposal strategy. NOTE This includes issues of disassembly, including their associated enabling systems, access to and availability of storage locations and available skill levels. **TEC.11.BP.3: Confirm disposal resources readiness.** [Outcome: c] Establish the readiness of enabling systems or services to be used during disposal of a system. **TEC.11.BP.4: Deactive system.** [Outcome: c] Deactivate the system to prepare it for removal from operation. NOTE Interfaces to other systems are considered, e.g. power, fuel, are disconnected in accordance with disassembly instructions and relevant health, safety, security and privacy legislation. **TEC.11.BP.5: Withdraw operating staff.** [Outcome: c,d] Withdraw operating staff from the system and record relevant operating knowledge. NOTE This is conducted in accordance with relevant safety, security, privacy and environmental standards, directives and laws. **TEC.11.BP.6: Disassemble system.** [Outcome: c,d] Disassemble the system into manageable elements to facilitate its removal for reuse, recycling, reconditioning, overhaul, archiving or destruction. **TEC.11.BP.7: Dispose of system elements.** [Outcome: c,d]

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	Remove the system from the operational environment for reuse, recycling, reconditioning, overhaul or destruction. NOTE This is conducted in accordance with relevant safety, security, privacy and environmental standards, directives and laws. Elements of the system that have useful life remaining, either in their current condition or following overhaul, are transferred to other systems-of-interest or organizations. Where appropriate, recondition system elements to extend their useful life. Reallocate, redeploy or retire operators. **TEC.11.BP.8: Specify storage conditions.** [Outcome: c,d] Specify containment facilities, storage locations, inspection criteria and storage periods if the system is to be stored. **TEC.11.BP.9: Treat disposable material.** [Outcome: c,d,e] Conduct destruction of the system, as necessary, to reduce the amount of waste treatment or to make the waste easier to handle. NOTE This Base Practice includes obtaining the destruction services required in order to melt, crush, incinerate or demolish the system or its elements as necessary. Act to safeguard and secure knowledge and skills possessed by operators. **TEC.11.BP.10: Confirm disposal compliance.** [Outcome: d,e] Confirm that no detrimental health, safety, security and environmental factors exist following disposal. **TEC11.BP.11: Record expected effects of disposed system.** [Outcome: e] Archive information gathered through the lifetime of the system to permit audits and reviews in the event of long-term hazards to health, safety, security and the environment, and to permit future system creators and users to build a knowledge base from past experiences.

Work Products	
Inputs	Outputs
1.11 operational system 3.12 service management plan 4.10 maintenance procedure 5.07 configuration history record 5.08 information history record 5.21 maintenance record	1.13 disposed system [Outcome: c] 3.25 disposal strategy [Outcome: a] 4.11 disposal procedure [Outcome: c,d,e] 5.22 disposal record [Outcome: e] 6.31 disposal report [Outcome: c,e] 8.32 disposal constraints on solution [Outcome: b] 8.33 disposal enabling system requirement [Outcome: c]

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6 Process capability indicators (level 1 to 5)

This clause presents the process capability indicators related to the process attributes associated with capability levels 1 to 5 defined in the capability dimension of the Process Assessment Model. Process capability indicators are the means of achieving the capabilities addressed by the considered process attributes. Evidence of process capability indicators support the judgment of the degree of achievement of the process attribute.

The capability dimension of the Process Assessment Model consists of six capability levels matching the capability levels defined in Part 2 of this International Standard. This clause describes the process capability indicators for the nine process attributes included in the capability dimension for levels 1 to 5. Clause 5 describes the assessment indicators for process performance which is characterized by Level 1 process capability.

Level 0 does not include any type of indicators. Level 0 reflects a non-implemented process or a process which fails to partially achieve its outcomes.

NOTE 1 In the next paragraphs, ISO/IEC 15504-2 process attribute definitions and attribute achievements are identified with italic font.

NOTE 2 Following each Generic Resource and Generic Work Product is '[PA x.y Achievement 1]'. This refers to process attribute x.y achievement 1 which is satisfied by this indicator.

6.1 Level 1: Performed process

6.1.1 PA 1.1 Process performance attribute.

The process performance attribute is a measure of the extent to which the process purpose is achieved. As a result of full achievement of this attribute:

- the process achieves its defined outcomes.

6.1.1.1 Generic Practices for PA 1.1

GP 1.1.1 Achieve the process outcomes
Perform the intent of the Base Practices.
Produce work products that evidence the process outcomes.

NOTE: The assessment of a performed process is based on process performance indicators, which are defined in Clause 5 of this document.

6.1.1.2 Generic Resources for PA 1.1

Resources are used to perform the intent of process specific Base Practices. [PA 1.1 Achievement a]

6.1.1.3 Generic Work Products for PA 1.1

1-00 Object [PA 1.1 Achievement a]

— Work products exist that provide evidence of the achievement of the process outcomes.

6.2 Level 2: Managed process

The previously described *Performed process* is now implemented in a managed fashion (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.

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The following attributes of the process demonstrate the achievement of this level:

6.2.1 PA 2.1 Performance management attribute

The performance management attribute is a measure of the extent to which the performance of the process is managed. As a result of full achievement of this attribute:

a) objectives for the performance of the process are identified;

b) performance of the process is planned and monitored;

c) performance of the process is adjusted to meet plans;

d) responsibilities and authorities for performing the process are defined, assigned and communicated;

e) resources and information necessary for performing the process are identified, made available, allocated and used;

f) interfaces between the involved parties are managed to ensure both effective communication and also clear assignment of responsibility.

6.2.1.1 Generic Practices for PA 2.1

GP 2.1.1 Identify the objectives for the performance of the process. NOTE: Performance objectives may include – (1) quality of the artefacts produced, (2) process cycle time or frequency, (3) resource usage and (4) boundaries of the process. Performance objectives are identified based on process requirements and customer requirements. The scope of the process performance is defined. Assumptions and constraints are considered when identifying the performance objectives.
GP 2.1.2 Plan and monitor the performance of the process to fulfil the identified objectives. Plan(s) for the performance of the process are developed. The process performance cycle is defined. Key milestones for the performance of the process are established. Estimates for process performance attributes are determined and maintained. Process activities and tasks are defined. Schedule is defined and aligned with the approach to performing the process. Process work product reviews are planned. The process is performed according to the plan(s). Process performance is monitored to ensure planned results are achieved.
GP 2.1.3 Adjust the performance of the process. Process performance issues are identified. Appropriate actions are taken when planned results and objectives are not achieved. The plan(s) are adjusted, as necessary. Rescheduling is performed as necessary.

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GP 2.1.4 Define responsibilities and authorities for performing the process. Responsibilities, commitments and authorities to perform the process are defined, assigned and communicated. Responsibilities and authorities to verify process work products are defined and assigned. The needs for process performance experience, knowledge and skills are defined.
GP 2.1.5 Identify and make available resources to perform the process according to plan. The human and infrastructure resources necessary for performing the process are identified, made available, allocated and used. The information necessary to perform the process is identified and made available.
GP 2.1.6 Manage the interfaces between involved parties. The individuals and groups involved in the process performance are determined. Responsibilities of the involved parties are assigned. Interfaces between the involved parties are managed. Communication is assured between the involved parties. Communication between the involved parties is effective.

6.2.1.2 Generic Resources for PA 2.1

Human resources with identified objectives, responsibilities and authorities; [PA 2.1 Achievement a, d, e, f]

Facilities and infrastructure resources; [PA 2.1 Achievement a, d, e, f]

- Project planning, management and control tools, including time and cost reporting; [PA 2.1 Achievement b, c]
- Workflow management system; [PA 2.1 Achievement d, f]
- Email and/or other communication mechanisms; [PA 2.1 Achievement d, f]
- Information and/or experience repository; [PA 2.1 Achievement b, e]
- Problem and issue management mechanisms. [PA 2.1 Achievement c]

6.2.1.3 Generic Work Products for PA 2.1

3-00 Plan [PA 2.1 Achievement a, b, c, d, e, f]

- Defines objectives to perform the process.
- Describes assumptions and constraints considered in defining the objectives.
- Includes milestones and timetable to produce the work products of the process.
- Identifies tasks, resources, responsibilities and infrastructure needed to perform the process.
- Considers risks related to fulfil defined objectives.
- Identifies stakeholders and communication mechanisms to be used.

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— Describes how the plan is controlled and adjusted when needed.

5-00 Record [PA 2.1 Achievement c, d, e, f]

— States results achieved or provides evidence of activities performed in a process.

— Provides evidence of communication, meetings, reviews and corrective actions.

— Contains status information about corrective actions; schedule and work breakdown structure.

— Monitors identified risks.

6-00 Report [PA 2.1 Achievement b, c]

— Monitors process performance against defined objectives and plans.

— Identifies deviations in process performance.

— Describes results and status of the process.

— Provides evidence of management activities.

6.2.2 PA 2.2 Work product management attribute

The work product management attribute is a measure of the extent to which the work products produced by the process are appropriately managed. As a result of full achievement of this attribute:

a) requirements for the work products of the process are defined;

b) requirements for documentation and control of the work products are defined;

c) work products are appropriately identified, documented, and controlled;

d) work products are reviewed in accordance with planned arrangements and adjusted as necessary to meet requirements.

NOTE 1: Requirements for documentation and control of work products may include requirements for the identification of changes and revision status, approval and re-approval of work products, and the creation of relevant versions of applicable work products available at points of use.

NOTE 2: The work products referred to in this clause are those that result from the achievement of the process outcomes.

6.2.2.1 Generic Practices for PA 2.2

GP 2.2.1 Define the requirements for the work products.

The requirements for the work products to be produced are defined. Requirements may include defining contents and structure.

Quality criteria of the work products are identified.

Appropriate review and approval criteria for the work products are defined.

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GP 2.2.2 Define the requirements for documentation and control of the work products. Requirements for the documentation and control of the work products are defined. Such requirements may include requirements for (1) distribution, (2) identification of work products and their components (3) traceability Dependencies between work products are identified and understood. Requirements for the approval of work products to be controlled are defined.
GP 2.2.3 Identify, document and control the work products. The work products to be controlled are identified. Change control is established for work products. The work products are documented and controlled in accordance with requirements. Versions of work products are assigned to product configurations as applicable. The work products are made available through appropriate access mechanisms. The revision status of the work products may readily be ascertained.
GP 2.2.4 Review and adjust work products to meet the defined requirements. Work products are reviewed against the defined requirements in accordance with planned arrangements. Issues arising from work product reviews are resolved.

6.2.2.2 Generic Resources for PA 2.2

- Requirement management method / toolset; [PA 2.2 Achievement a, b, c]
- Configuration management system; [PA 2.2 Achievement b, c]
- Documentation elaboration and support tool; [PA 2.2 Achievement b, c]
- Document identification and control procedure; [PA 2.2 Achievement b, c]
- Work product review methods and experiences; [PA 2.2 Achievement d]
- Review management method / toolset; [PA 2.2 Achievement d]
- Intranets, extranets and/or other communication mechanisms; [PA 2.2 Achievement b, c]
- Problem and issue management mechanisms. [PA 2.2 Achievement d]

6.2.2.3 Generic Work Products for PA 2.2

1-00 Object [PA2.2 Achievement a,b,c,d)

- Demonstrates process specific work products to be managed.

3-00 Plan [PA 2.2 Achievement b]

- Expresses selected policy or strategy to manage work products.
- Describes requirements to develop, distribute, and maintain the work products.
- Defines quality control actions needed to manage the quality of the work product.

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5-00 Record [PA 2.2 Achievement b,c,d]

- Demonstrates work product reviews and contributes to traceability.
- Records the status of documentation or work product.
- Contains and makes available work products and/or configuration items.
- Supports monitoring of changes to work products.
- Provides evidence that the changes are under control.
- Contains and makes available work products and/or configuration items.
- Supports monitoring of changes to work products.

8-00 Specification [PA 2.2 Achievement a,b]

- Defines the functional and non-functional requirements for work products.
- Identifies work product dependencies.
- Identifies approval criteria for documents.
- Defines the attributes associated with a work product to be created.

6.3 Level 3: Established process

The previously described *Managed process* is now implemented using a defined process capable of achieving its process outcomes.

The following attributes of the process demonstrate the achievement of this level:

6.3.1 PA 3.1 Process definition attribute

The process definition attribute is a measure of the extent to which a standard process is maintained to support the deployment of the defined process. As a result of full achievement of this attribute:

a) a standard process, including appropriate tailoring guidelines, is defined that describes the fundamental elements that must be incorporated into a defined process;

b) the sequence and interaction of the standard process with other processes are determined;

c) required competencies and roles for performing a process are identified as part of the standard process;

d) required infrastructure and work environment for performing a process are identified as part of the standard process;

e) suitable methods for monitoring the effectiveness and suitability of the process are determined.

NOTE: A standard process may be used as-is when deploying a defined process, in which case tailoring guidelines would not be necessary.

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6.3.1.1 Generic Practices for PA 3.1

GP 3.1.1 Define the standard process that will support the deployment of the defined process. A standard process is developed that includes the fundamental process elements. The standard process identifies the deployment needs and deployment context. Guidance and/or procedures are provided to support implementation of the process as needed. Appropriate tailoring guideline(s) are available as needed.
GP 3.1.2 Determine the sequence and interaction between processes so that they work as an integrated system of processes. The standard process's sequence and interaction with other processes are determined. Deployment of the standard process as a defined process maintains integrity of processes.
GP 3.1.3 Identify the roles and competencies for performing the standard process. Process performance roles are identified. Competencies for performing the process are identified.
GP 3.1.4 Identify the required infrastructure and work environment for performing the standard process. Process infrastructure components are identified (facilities, tools, networks, methods, etc). Work environment requirements are identified.
GP 3.1.5 Determine suitable methods to monitor the effectiveness and suitability of the standard process. Methods for monitoring the effectiveness and suitability of the process are determined. Appropriate criteria and data needed to monitor the effectiveness and suitability of the process are defined. The need to establish the characteristics of the process is considered. The need to conduct internal audit and management review is established. Process changes are implemented to maintain the standard process.

6.3.1.2 Generic Resources for PA 3.1

- Process modelling methods / tools; [PA 3.1 Achievement a, b, c, d]
- Training material and courses; [PA 3.1 Achievement a, b, c]
- Resource management system; [PA 3.1 Achievement b, c]
- Process infrastructure; [PA 3.1 Achievement a, b]
- Audit and trend analysis tools; [PA 3.1 Achievement e]
- Process monitoring method. [PA 3.1 Achievement e]

6.3.1.3 Generic Work Products for PA 3.1

2-00 Description [PA 3.1 Achievement a, b, c, e]

- Describes the standard process, including the fundamental process elements, interactions with other processes and appropriate tailoring guidelines.
- Addresses the performance, management and deployment of the process, as described by capability levels 1 and 2 and the PA 3.2 Process deployment attribute.

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— Addresses methods to monitor process effectiveness and suitability.

— Identifies data and records to be collected when performing the defined process, in order to improve the standard process.

— Identifies and communicates the personnel competencies, roles and responsibilities for the standard and defined process.

— Identifies the personnel performance criteria for the standard and defined process.

— Identifies the tailoring guidelines for the standard process.

3-00 Plan [PA 3.1 Achievement c, d]

— Identifies approaches for defining, maintaining and supporting a standard process, including infrastructure, work environment, training, internal audit and management review.

4-00 Procedure [PA 3.1 Achievement a, b, c, d, e]

— Provides evidence of organizational commitment to maintain a standard process to support the deployment of the defined process.

5-00 Record [PA 3.1 Achievement d]

— Is used to support and maintain the standard process assets.

8-00 Specification [PA 3.1 Achievement a]

— Provides reference for the standards used by the standard process and identification about how they are used.

6.3.2 PA 3.2 Process deployment attribute

The process deployment attribute is a measure of the extent to which the standard process is effectively deployed as a defined process to achieve its process outcomes. As a result of full achievement of this attribute:

b) a defined process is deployed based upon an appropriately selected and/or tailored standard process;

c) required roles, responsibilities and authorities for performing the defined process are assigned and communicated;

d) personnel performing the defined process are competent on the basis of appropriate education, training, and experience;

e) required resources and information necessary for performing the defined process are made available, allocated and used;

f) required infrastructure and work environment for performing the defined process are made available, managed and maintained;

g) appropriate data are collected and analyzed as a basis for understanding the behaviour of, and to demonstrate the suitability and effectiveness of the process, and to evaluate where continuous improvement of the process can be made.

NOTE: Competency results from a combination of knowledge, skills and personal attributes that are gained through education, training and experience.

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6.3.2.1 Generic Practices for PA 3.2

GP 3.2.1 Deploy a defined process that satisfies the context specific requirements of the use of the standard process. The defined process is appropriately selected and/or tailored from the standard process. Conformance of defined process with standard process requirements is verified.
GP 3.2.2 Assign and communicate roles, responsibilities and authorities for performing the defined process. The roles for performing the defined process are assigned and communicated. The responsibilities and authorities for performing the defined process are assigned and communicated.
GP 3.2.3 Ensure necessary competencies for performing the defined process. Appropriate competencies for assigned personnel are identified. Suitable training is available for those deploying the defined process.
GP 3.2.4 Provide resources and information to support the performance of the defined process. Required human resources are made available, allocated and used. Required information to perform the process is made available, allocated and used.
GP 3.2.5 Provide adequate process infrastructure to support the performance of the defined process. Required infrastructure and work environment is available. Organizational support to effectively manage and maintain the infrastructure and work environment is available. Infrastructure and work environment is used and maintained.
GP 3.2.6 Collect and analyze data about performance of the process to demonstrate its suitability and effectiveness. Data required to understand the behaviour, suitability and effectiveness of the defined process are identified. Data are collected and analyzed to understand the behaviour, suitability and effectiveness of the defined process. Results of the analysis are used to identify where continual improvement of the standard and/or defined process can be made.

6.3.2.2 Generic Resources for PA 3.2

- Feedback mechanisms (customer, staff, other stakeholders); [PA 3.2 Achievement f]
- Process repository; [PA 3.2 Achievement a, b]
- Resource management system; [PA 3.2 Achievement b, c, d]
- Knowledge management system; [PA 3.2 Achievement d]
- Problem and change management system; [PA 3.2 Achievement f]
- Working environment and infrastructure; [PA 3.2 Achievement e]
- Data collection analysis system: [PA 3.2 Achievement f]
- Process assessment framework; [PA 4.1 Achievement f]

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— Audit / review system. [PA 3.2 Achievement f]

6.3.2.3 Generic Work Products for PA 3.2

2-00 Description [PA 3.2 Achievement a]

— Describes the defined process for use by the project.

— Describes the verification activities needed to ensure the conformance of the project's defined process with the organization's standard process.

— Represents the interactions of the project's defined process with other processes.

3-00 Plan [PA 3.2 Achievement a, b, f]

— Expresses the strategy for the organizational support, allocation and use of the process infrastructure.

— Describes the project's resources and the elements of the infrastructure needed to deploy the defined process.

— Expresses the strategy to satisfy the project's training needs.

— Identifies process improvement proposal(s) based on analysis of suitability and effectiveness.

5-00 Record [PA 3.2 Achievement f]

— Provides evidence that the project's defined process performance data was collected.

— Provides evidence that the project personnel possess the required authorities, skills, experience and knowledge.

— Provides evidence that project personnel have received the required training to satisfy the needs of the project.

— Provides evidence that project infrastructure and working environment are made available and maintained for performing the defined process.

— Records the status of required corrective actions.

— Captures the project's work breakdown structure needed to define the tasks and their dependencies.

— Provides evidence that information is made available for performing the defined process.

6-00 Report [PA 3.2 Achievement f]

— Provides results of the analysis, recommended corrective action, feedback to the process owner and to the organization's standard process.

— Identifies improvement opportunities of the defined process.

— Provides evidence on the suitability and effectiveness of the defined process.

8-00 Specification [PA 3.2 Achievement f]

— Provides a basis to analyze data associated with the performance of the defined process.

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6.4 Level 4: Predictable process

The previously described *Established process* now operates within defined limits to achieve its process outcomes.

The following attributes of the process demonstrate the achievement of this level:

6.4.1 PA 4.1 Process measurement attribute

The process measurement attribute is a measure of the extent to which measurement results are used to ensure that performance of the process supports the achievement of relevant process performance objectives in support of defined business goals. As a result of full achievement of this attribute:

process information needs in support of relevant business goals are established;

process measurement objectives are derived from identified process information needs;

quantitative objectives for process performance in support of relevant business goals are established;

measures and frequency of measurement are identified and defined in line with process measurement objectives and quantitative objectives for process performance;

results of measurement are collected, analyzed and reported in order to monitor the extent to which the quantitative objectives for process performance are met;

measurement results are used to characterize process performance.

NOTE 1: Information needs may typically reflect management, technical, project, process or product needs.

NOTE 2: Measures may be either process measures or product measures or both.

6.4.1.1 Generic Practices for PA 4.1

GP 4.1.1 Identify process information needs, in relation with business goals. Business goals relevant to establishing quantitative process measurement objectives for the process are identified. Process stakeholders are identified and their information needs are defined. Information needs support the relevant business goals.
GP 4.1.2 Derive process measurement objectives from process information needs. Process measurement objectives to satisfy defined process information needs are defined.
GP 4.1.3 Establish quantitative objectives for the performance of the defined process, according to the alignment of the process with the business goals. Process performance objectives are defined to explicitly reflect the business goals. Process performance objectives are verified with organizational management and process owner(s) to be realistic and useful.

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GP 4.1.4 Identify product and process measures that support the achievement of the quantitative objectives for process performance. Detailed measures are defined to support monitoring, analysis and verification needs of process and product goals. Measures to satisfy process measurement and performance objectives are defined. Frequency of data collection is defined. Algorithms and methods to create derived measurement results from base measures are defined, as appropriate. Verification mechanism for base and derived measures is defined.
GP 4.1.5 Collect product and process measurement results through performing the defined process. Data collection mechanism is created for all identified measures. Required data is collected in an effective and reliable manner. Measurement results are created from the collected data within defined frequency. Analysis of measurement results is performed within defined frequency. Analysis results including assumptions are reported to those responsible for monitoring the extent to which qualitative objectives are met.
GP 4.1.6 Use the results of the defined measurement to monitor and verify the achievement of the process performance objectives. Statistical or other techniques are used to quantitatively understand process performance and capability within defined control limits. Trends of process behaviour are identified.

6.4.1.2 Generic Resources for PA 4.1

- Management information (cost, time, reliability, profitability, customer benefits, risks etc.); [PA 4.1 Achievement a, c, d, e, f]
- Applicable measurement techniques; [PA 4.1 Achievement d]
- Product and process measurement tools and results databases; [PA 4.1 Achievement d, e, f]
- Process measurement framework; [PA 4.1 Achievement d, e, f]
- Tools for data analysis and measurement. [PA 4.1 Achievement b, c, d, e]

6.4.1.3 Generic Work Products for PA 4.1

2-00 Description [PA 4.1 Achievement a, d]

- Defines information needs for the process.
- Specifies candidate measures.

3-00 Plan [PA 4.1 Achievement b, c]

- Defines quantitative objectives for process performance.

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— Specifies measures for the process.

— Defines tasks and schedules to collect and analyze data.

— Allocates responsibilities and resources for measurement.

5-00 Record [PA 4.1 Achievement e]

— Defines data to be collected as specified in plans and measures.

6-00 Report [PA 4.1 Achievement e, f]

— Provides results of process data analysis to identify process performance parameters.

— Monitors process performance based on results of measurement.

8-00 Specified [PA 4.1 Achievement a, b, d]

— Describes information needs and performance objectives.

— Provides a basis for analyzing process performance.

— Defines explicit criteria for data validation.

— Defines frequency of data collection.

6.4.2 PA 4.2 Process control attribute

The process control attribute is a measure of the extent to which the process is quantitatively managed to produce a process that is stable, capable, and predictable within defined limits. As a result of full achievement of this attribute:

a) suitable analysis and control techniques where applicable, are determined and applied;

b) control limits of variation are established for normal process performance;

c) measurement data are analyzed for special causes of variation;

d) corrective actions are taken to address special causes of variation;

e) control limits are re-established (as necessary) following corrective action.

6.4.2.1 Generic Practices for PA 4.2

GP 4.2.1 Determine analysis and control techniques, appropriate to control the process performance. Process control analysis techniques are defined. Selected techniques are validated against process control objectives.
GP 4.2.2 Define parameters suitable to control the process performance. Standard process definition is modified to include selection of parameters for process control. Control limits for selected base and derived measurement results are defined.

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GP 4.2.3 Analyze process and product measurement results to identify variations in process performance. Measures are used to analyze process performance. All situations are recorded when defined control limits are exceeded. Each out-of-control case is analyzed to identify potential cause(s) of variation. Assignable causes of variation in performance are determined. Results are provided to those responsible for taking action.
GP 4.2.4 Identify and implement corrective actions to address assignable causes. Corrective actions are determined to address each assignable cause. Corrective actions are implemented to address assignable causes of variation. Corrective action results are monitored. Corrective actions are evaluated to determine their effectiveness.
GP 4.2.5 Re-establish control limits following corrective action. Process control limits are re-calculated (as necessary) to reflect process changes and corrective actions.

6.4.2.2 Generic Resources for PA 4.2

- Process control and analysis techniques; [PA 4.2 Achievement a, c]
- Statistical analysis tools; [PA 4.2 Achievement b, c, e]
- Process control tools. [PA 4.2 Achievement d, e]

6.4.2.3 Generic Work Products for PA 4.2

2-00 Description [PA 4.2 Achievement b, e]

- Defines parameters for process control.
- Defines and maintains control limits for selected base and derived measurement results.

3-00 Plan [PA 4.2 Achievement a]

- Defines analysis methods and techniques at detailed level.

5-00 Record [PA 4.2 Achievement a, b, c, d, e]

- Provides measurement data to identify special causes of variation.
- Provides information on defects and problems.
- Records the changes.
- Documents corrective actions to be implemented.
- Monitors the status of corrective actions.
- Collects the data and provides the basis for analysis, corrective actions and results reporting.

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6-00 Report [PA 4.2 Achievement a, c, d, e]

- Provides analyzed measurement results of process performance.
- Identifies corrective actions to address assignable causes of variation.
- Ensures that selected techniques are effective and measures are validated.

6.5 Level 5: Optimizing process

The previously described *Predictable process* is continuously improved to meet relevant current and projected business goals.

The following attributes of the process demonstrate the achievement of this level:

6.5.1 PA 5.1 Process innovation attribute

The process innovation attribute is a measure of the extent to which changes to the process are identified from analysis of common causes of variation in performance, and from investigations of innovative approaches to the definition and deployment of the process. As a result of full achievement of this attribute:

a) process improvement objectives for the process are defined that support the relevant business goals;

b) appropriate data are analyzed to identify common causes of variations in process performance;

c) appropriate data are analyzed to identify opportunities for best practice and innovation;

d) improvement opportunities derived from new technologies and process concepts are identified;

e) an implementation strategy is established to achieve the process improvement objectives.

6.5.1.1 Generic Practices for PA 5.1

GP 5.1.1 Define the process improvement objectives for the process that support the relevant business goals. Directions to process innovation are set. New business visions and goals are analyzed to give guidance for new process objectives and potential areas of process change. Quantitative and qualitative process improvement objectives are defined and documented.
GP 5.1.2 Analyze measurement data of the process to identify real and potential variations in the process performance. Measurement data are analyzed and made available. Causes of variation in process performance are identified and classified. Common causes of variation are analyzed to get quantitative understanding of their impact.
GP 5.1.3 Identify improvement opportunities of the process based on innovation and best practices. Industry best practices are identified and evaluated. Feedback on opportunities for improvement is actively sought. Improvement opportunities are identified.

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GP 5.1.4 Derive improvement opportunities of the process from new technologies and process concepts. Impact of new technologies on process performance is identified and evaluated. Impact of new process concepts are identified and evaluated. Improvement opportunities are identified, Emergent risks are considered in identifying improvement opportunities
GP 5.1.5 Define an implementation strategy based on long-term improvement vision and objectives. Commitment to improvement is demonstrated by organizational management and process owner(s). Proposed process changes are evaluated and piloted to determine their benefits and expected impact on defined business objectives. Changes are classified and prioritized based on their impact on defined improvement objectives**.** Measures that validate the results of process changes are defined to determine expected effectiveness of the process change. Implementation of the approved change(s) is planned as an integrated program or project. Implementation plan and impact on business goals are discussed and reviewed by organizational management.

6.5.1.2 Generic Resources for PA 5.1

- Process improvement framework; [PA 5.1 Achievement a, d, e]
- Process feedback and analysis system (measurement data, causal analysis results etc.); [PA 5.1 Achievement b, c]
- Piloting and trialing mechanism. [PA 5.1 Achievement c, d]

6.5.1.3 Generic Work Products for PA 5.1

2-00 Description [PA 5.1 Achievement c, d]

- Identifies potential areas of innovation and new technology.
- Incorporates approaches to root cause analysis.

3-00 Plan [PA 5.1 Achievement a, e]

- Defines improvement objectives for the process
- Allocates resources for improvement activities.
- Schedules activities for root cause analysis.
- Defines an approach to implementing selected improvements.
- Identifies scope of pilot improvement activities.

4-00 Procedure [PA 5.2 Achievement a]

- Establishes expectations for conduct and evaluation of pilot improvements.

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5-00 Record [PA 5.1 Achievement b,c,d]

- Provides analytical data to identify common causes of variation.
- Provides analytical data to identify opportunities for best practice and innovation.
- Records data relevant to root cause analysis.
- Identifies potential improvement opportunities.
- Records information on new technology and techniques.

6-00 Report [PA 5.1 Achievement b, d]

- Identifies potential innovations and process changes.
- Provides information for an analysis to identify common causes of variation in performance.
- Identifies common causes of defects and appropriate corrective actions.

8-00 Specification [PA 5.1 Achievement a]

- Define and maintain business goals.
- Provides evidence of management commitment.

6.5.2 PA 5.2 Process optimization attribute

The process optimization attribute is a measure of the extent to which changes to the definition, management and performance of the process result in effective impact that achieves the relevant process improvement objectives. As a result of full achievement of this attribute:

a) impact of all proposed changes is assessed against the objectives of the defined process and standard process;

b) implementation of all agreed changes is managed to ensure that any disruption to the process performance is understood and acted upon;

c) effectiveness of process change on the basis of actual performance is evaluated against the defined product requirements and process objectives to determine whether results are due to common or special causes.

6.5.2.1 Generic Practices of PA 5.2

GP 5.2.1 Assess the impact of each proposed change against the objectives of the defined and standard process.
Objective priorities for process improvement are established.
Specified changes are assessed against product quality and process performance requirements and goals.
Impact of changes to other defined and standard processes is considered.

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GP 5.2.2. **Manage the implementation of agreed changes** to selected areas of the defined and standard process according to the implementation strategy. A mechanism is established for incorporating accepted changes into the defined and standard process (es) effectively and completely. The factors that impact the effectiveness and full deployment of the process change are identified and managed, such as: • Economic factors (productivity, profit, growth, efficiency, quality, competition, resources, and capacity); • Human factors (job satisfaction, motivation, morale, conflict / cohesion, goal consensus, participation, training, span of control); • Management factors (skills, commitment, leadership, knowledge, ability, organizational culture and risks); • Technology factors (sophistication of system, technical expertise, development methodology, need of new technologies). Training is provided to users of the process. Process changes are effectively communicated to all affected parties**.** Records of the change implementation are maintained.
GP 5.2.3 Evaluate the effectiveness of process change on the basis of actual performance against process performance and capability objectives and business goals. Performance and capability of the changed process are measured and compared with historical data. A mechanism is available for documenting and reporting analysis results to management and owners of standard and defined process. Measures are analyzed to determine whether results are due to common or special causes. Other feedback is recorded, such as opportunities for further improvement of the standard process.

6.5.2.2 Generic Resources for PA 5.2

— Change management system; [PA 5.2 Achievement a, b, c]

— Process evaluation system (impact analysis, etc.). [PA 5.2 Achievement a, c]

6.5.2.3 Generic Work Products for PA 5.2

2-00 Description [PA 5.2 Achievement b]

— Documents changes as a result of process improvement actions.

3-00 Plan [PA 5.2 Achievement a, b]

— Defines activities and schedule for pilot change implementation.

— Allocates resources for pilot implementation.

— Assigns responsibility for pilot implementation.

— Defines activities and schedule for organizational implementation of process change.

— Allocates resources and responsibilities for organizational implementation.

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— Specifies scope of pilot implementation of proposed change.

5-00 Record [PA 5.2 Achievement b]

— Contains records of all completed and in-progress pilot implementations.

— Records history of and justification for changes.

6-00 Report [PA 5.2 Achievement a, b, c]

— Describes results of pilot implementation of process change.

— Evaluates effectiveness of process compared to process improvement objectives.

— Provides details on implementation of organizational changes.

— Describes proposed changes to standard and defined process.

8-00 Specification [PA 5.2 Achievement c]

— Specifies measures derived from process improvement objectives.

6.6 Processes Supporting Process Attributes

Certain processes support achievement of the capabilities addressed by a process attribute. Table 6 lists those processes and indicates the processes that contribute to each Process Attribute (PA). This information can be used in planning process assessments and in analysis and validation of the assessment results.

Table 6 — Processes Supporting Process Attributes

	Process attributes							
Process	PA 2.1	PA 2.2	PA 3.1	PA 3.2	PA 4.1	PA 4.2	PA 5.1	PA 5.2
TEC.6 Verification		◆						
PRJ.6 Configuration management		◆						
PRJ.4 Decision-making	◆	◆						
PRJ.7 Information management		◆	◆					
PRJ.1 Project planning	◆			◆				
PRJ.3 Project control	◆	◆		◆				
ENT.1 Enterprise environment management			◆	◆				
PRJ.5 Risk management	◆				◆			
ENT.4 Resource management	◆		◆	◆		◆		
ENT.5 Quality management	◆	◆		◆	◆	◆		
PRJ.2 Project assessment			◆	◆	◆	◆	◆	
ENT.2 Investment management			◆					◆
TLR Tailoring				◆			◆	◆
ENT.3 System life cycle process management				◆	◆	◆	◆	◆

7 Bibliography

ISO/IEC 15288:2002, *Systems engineering — System life cycle process*

ISO/IEC 15289:2006, *Systems and software engineering — Content of systems and software life cycle process information products (Documentation)*

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Annex A
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Conformity of the exemplar Process Assessment Model

A.1 Introduction

This part of ISO/IEC 15504 sets out a Process Assessment Model that meets the requirements for conformance defined in ISO/IEC 15504-2. This Process Assessment Model can be used in the performance of assessments that meet the requirements of ISO/IEC 15504. It may also be used as an example for a process assessment model developer.

This clause serves as the statement of conformance of the Process Assessment Model to the requirements defined in ISO/IEC 15504-2. For ease of reference, the requirements from Clause 6.3 of ISO/IEC 15504-2:2003 are embedded verbatim in the text of this clause. They should not be construed as normative elements of this part of ISO/IEC 15504.

Since this Process Assessment Model has been explicitly constructed to be an elaboration of the Process Reference Model defined in ISO/IEC 15288, the conformance claim is relatively simple. For other models, particularly ones with a different architecture, the demonstration of conformance may be more difficult requiring more detail in the mapping.

A.2 Requirements for Process Assessment Models (from ISO/IEC 15504-2)

A.2.1 Introduction

In order to assure that assessment results are translatable into an ISO/IEC 15504 process profile in a repeatable and reliable manner, Process Assessment Models shall adhere to certain requirements. A Process Assessment Model shall contain a definition of its purpose, scope and elements; its mapping to the Measurement Framework and specified Process Reference Model(s); and a mechanism for consistent expression of results.

A Process Assessment Model is considered suitable for the purpose of assessing process capability by conforming to 6.3.2, 6.3.3, and 6.3.4.

[ISO/IEC 15504-2:2003, 6.3.1]

The purpose of this Process Assessment Model is to support assessment of process capability in accordance with the requirements of ISO/IEC 15504-2 (Refer Clause 1).

A.2.2 Process Assessment Model scope

6.3.2.1 *A Process Assessment Model shall relate to at least one process from the specified Process Reference Model(s).*

6.3.2.2 *A Process Assessment Model shall address, for a given process, all, or a continuous subset, of the levels (starting at level 1) of the Measurement Framework for process capability for each of the processes within its scope.*

NOTE: It would be permissible for a model, for example, to address solely level 1, or to address levels 1, 2 and 3, but it would not be permissible to address levels 2 and 3 without level 1.

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6.3.2.3 *A Process Assessment Model shall declare its scope of coverage in the terms of:*

a) the selected Process Reference Model(s);

b) the selected processes taken from the Process Reference Model(s);

c) the capability levels selected from the Measurement Framework.

[ISO/IEC 15504-2:2003, 6.3.2]

This Process Assessment Model is based upon the Process Reference Model defined in ISO/IEC 15288.

In the capability dimension of this Process Assessment Model, the model addresses all of the capability levels defined in the Measurement Framework in ISO/IEC 15504-2:2003, Clause 5.

A.2.3 Process Assessment Model elements and indicators

A Process Assessment Model shall be based on a set of indicators that explicitly addresses the purposes and outcomes, as defined in the selected Process Reference Model, of all the processes within the scope of the Process Assessment Model; and that demonstrates the achievement of the process attributes within the capability level scope of the Process Assessment Model. The indicators focus attention on the implementation of the processes in the scope of the model.

[ISO/IEC 15504-2:2003, 6.3.3]

The Process Assessment Model provides a two-dimensional view of process capability for the processes in the Process Reference Model, through the inclusion of assessment indicators as shown in Figure 3. The Assessment Indicators used are:

— Base Practices and Work Products; and

— Generic Practices, Generic Resources and Generic Work Products

as shown in Figure 3. They support the judgment of the performance and capability of an implemented process.

A.2.4 Mapping Process Assessment Models to Process Reference Models

A Process Assessment Model shall provide an explicit mapping from the relevant elements of the model to the processes of the selected Process Reference Model and to the relevant process attributes of the Measurement Framework.

The mapping shall be complete, clear and unambiguous. The mapping of the indicators within the Process Assessment Model shall be to:

a) the purposes and outcomes of the processes in the specified Process Reference Model;

b) the process attributes (including all of the results of achievements listed for each process attribute) in the Measurement Framework.

This enables Process Assessment Models that are structurally different to be related to the same Process Reference Model.

[ISO/IEC 15504-2:2003, 6.3.4]

Each of the Processes in this Process Assessment Model is identical in scope to the Process defined in the Process Reference Model. Each Base Practice and Work Product is cross-referenced to the Process

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Outcomes it addresses. All Work Products relate as Inputs or Outputs to the Process as a whole - see mappings in Clause 5 of this document.

Each of the Process Attributes in this Process Assessment Model is identical to the Process Attribute defined in the Measurement Framework. The Generic Practices address the characteristics from each Process Attribute. The Generic Resources and Generic Work Products relate to the Process Attribute as a whole.

Table A.1 lists the mappings of the GPs to the achievements associated with each Process Attribute.

Table A.1 — Mapping of Generic Practices

GP	Practice Name	Maps To
PA 1.1: Process performance attribute		
GP 1.1.1	Achieve the process outcomes.	PA.1.1.a
PA 2.1: Performance management attribute		
GP 2.1.1	Identify the objectives for the performance of the process.	PA.2.1.a
GP 2.1.2	Plan and monitor the performance of the process to fulfil the identified objectives.	PA.2.1.b
GP 2.1.3	Control the performance of the process.	PA.2.1.c
GP 2.1.4	Define responsibilities and authorities for performing the process.	PA.2.1.d
GP 2.1.5	Identify and make available resources to perform the process according to plan.	PA.2.1.e
GP 2.1.6	Manage the interfaces between involved parties.	PA.2.1.f
PA 2.2: Work product management attribute		
GP 2.2.1	Define the requirements for the work products.	PA.2.2.a
GP 2.2.2	Define the requirements for documentation and control of the work products.	PA.2.2.b
GP 2.2.3	Identify, document and control the work products.	PA.2.2.c
GP 2.2.4	Review and adjust work products to meet the defined requirements.	PA.2.2.d
PA 3.1: Process definition attribute		
GP 3.1.1	Define the standard process that will support the deployment of the defined process.	PA.3.1.a
GP 3.1.2	Determine the sequence and interaction between processes so that they work as an integrated system of processes.	PA.3.1.b
GP 3.1.3	Identify the roles and competencies for performing the process.	PA.3.1.c
GP 3.1.4	Identify the required infrastructure and work environment for performing the process.	PA.3.1.d
GP 3.1.5	Determine suitable methods to monitor the effectiveness and suitability of the process.	PA.3.1.e
PA 3.2: Process deployment attribute		
GP 3.2.1	Deploy a defined process that satisfies the context specific requirements of the use of the standard process.	PA.3.2.a
GP 3.2.2	Assign and communicate roles, responsibilities and authorities for performing the defined process.	PA.3.2.b
GP 3.2.3	Ensure necessary competencies for performing the defined process.	PA.3.2.c

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GP	Practice Name	Maps To
GP.3.2.4	Provide resources and information to support the performance of the defined process.	PA.3.2.d
GP 3.2.5	Provide process infrastructure to support the performance of the defined process.	PA.3.2.e
GP 3.2.6	Collect and analyze data about performance of the process to demonstrate its suitability and effectiveness.	PA.3.2.f
PA 4.1 Process measurement attribute		
GP 4.1.1	Identify process information needs, in relation with business goals.	PA.4.1.a
GP.4.1.2	Derive process measurement objectives from process information needs.	PA.4.1.b
GP 4.1.3	Establish quantitative objectives for the performance of the defined process, according to the alignment of the process with the business goals.	PA.4.1.c
GP 4.1.4	Identify product and process measures that support the achievement of the quantitative objectives for process performance.	PA.4.1.d
GP 4.1.5	Collect product and process measurement results through performing the defined process.	PA.4.1.e
GP 4.1.6	Use the results of the defined measurement to monitor and verify the achievement of the process performance objectives.	PA.4.1.f
PA 4.2 Process control attribute		
GP 4.2.1	Determine analysis and control techniques, appropriate to control the process performance.	PA.4.2.a
GP 4.2.2	Define parameters suitable to control the process performance.	PA.4.2.b
GP 4.2.3	Analyze process and product measurement results to identify variations in process performance.	PA.4.2.c
GP 4.2.4	Identify and implement corrective actions to address assignable causes.	PA.4.2.d
GP.4.2.5	Re-establish control limits following corrective action.	PA.4.2.e
PA 5.1 Process innovation attribute		
GP 5.1.1	Define the process improvement objectives for the process that support the relevant business goals.	PA.5.1.a
GP 5.1.2	Analyze measurement data of the process to identify real and potential variations in the process performance.	PA.5.1.b
GP 5.1.3	Identify improvement opportunities of the process based on innovation and best practices.	PA.5.1.c
GP.5.1.4	Derive improvement opportunities from new technologies and process concepts.	PA.5.1.d
GP 5.1.5	Define an implementation strategy based on long-term improvement vision and objectives.	PA.5.1.e
PA 5.2 Process optimization attribute		
GP 5.2.1	Assess the impact of each proposed change against the objectives of the defined and standard process.	PA.5.2.a
GP 5.2.2	Manage the implementation of agreed changes according to the implementation strategy.	PA.5.2.b
GP 5.2.3	Evaluate the effectiveness of process change on the basis of actual performance against process objectives and business goals.	PA.5.2.c

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A.2.5 Expression of assessment results

A Process Assessment Model shall provide a formal and verifiable mechanism for representing the results of an assessment as a set of process attribute ratings for each process selected from the specified Process Reference Model(s).

NOTE: The expression of results may involve a direct translation of Process Assessment Model ratings into a process profile as defined in this international standard, or the conversion of the data collected during the assessment (with the possible inclusion of additional information) through further judgment on the part of the assessor.

[ISO/IEC 15504-2:2003, 6.3.5]

The processes in this Process Assessment Model are identical to those defined in the Process Reference Model. The Process Attributes and the Process Attributes Rating in this Process Assessment Model are identical to those defined in the Measurement Framework. As a consequence, results of Assessments based upon this Process Assessment Model are expressed directly as a set of process attribute ratings for each process within the scope of the assessment. No form of translation or conversion is required.

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Annex B
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Work Product Characteristics

Work Product characteristics listed in this Annex can be used when reviewing potential inputs and outputs of process implementation. The characteristics are provided as guidance for the attributes to look for, in a particular sample work product, to provide objective evidence supporting the assessment of a particular process. A documented process and assessor judgment is needed to ensure that the process context (application domain, business purpose, development methodology, size of the organization, etc.) is considered when using this information. Work Products are defined using the schema in Table B.1. Work Products and their characteristics should be considered as a starting point for considering whether, given the context, they are contributing to the intended purpose of the process, not as a check-list of what every organization must have.

Table B.1 — Work product identification

Work product identifier #	An identifier number for the Work Product which is used to reference the Work Product.
Work product name	Provides an example of a typical name associated with the Work Product characteristics. This name is provided as an identifier of the type of work product the practice or process might produce. Organizations may call these work products by different names. The name of the work product in the organization is not significant. Similarly, organizations may have several equivalent work products which contain the characteristics defined in one Work Product type. The formats for the work products can vary. It is up to the assessor and the organizational unit coordinator to map the actual work products produced in their organization to the examples given here.
Work product characteristics	Provides examples of the potential characteristics associated with the Work Product types. The assessor may look for these in the samples provided by the organizational unit.

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B.1 Generic Work Products

The Generic Work Product Indicators are sets of characteristics that would be expected to be evident in work products of a generic type as a result of achievement of an attribute. The Generic Work Products form the class structure of the Work Products defined as process performance indicators. These work product types are basic input types to process owners of all types of processes.

WP ID	Generic Work Product Class	Generic Work Product Description	Generic Work Product Typical Characteristics
1.00	object	An entity created to serve a purpose, or created in the course of serving that purpose. Its existence is observable and rationalised by its material or behavioural characteristics. It may exist as a complete, partial or exemplifying realization of a product, be a subordinate part of a product, be a by-product or be a part of an enabling system	– identity, name of object – purpose, value that caused its creation – ownership and responsibility for object – status, state and classification of object – distinguishing observable qualities and properties – functional and behavioural characteristics – dimensional and parametric characteristics – relationship with and dependencies on surroundings – observable interactions or effects on other objects – interfaces, connections to surroundings – location, position in surroundings – safety, security, privacy and environmental regulations
2.00	description	An account or representation of a proposed or actual object or concept. It may be a textual, pictorial, graphical or mathematical representation. It may be in a standardised form for human or machine interpretation. It may be a static or dynamic model or a simulation representing reality. It may establish order, structure, grouping or classification.	– object, subject or class represented – purpose and applicability of description – concerned parties, viewpoints, views – range of use, and validity of description – accuracy, detail and abstraction level – model dimensions, degrees of freedom – description language, notation, nomenclature – applicable standards, formats and styles – representations of function, attributes, properties – descriptions of architecture, arrangement, interfaces – depiction of composition or form – definition of classification, category, ranking, type
3.00	plan	A proposed scheme or systematic course of action for achieving a declared purpose. It predicts how to successfully accomplish objectives in terms of specific actions, undertaken at defined times and employing defined resources. It may apply to technical, project or enterprise actions. At a high level of abstraction it may be a policy or, with	– definition of undertaking, purpose and objectives of plan – strategy and policy guiding plan – plan owner, stakeholders, responsible parties and their authorities – plan status, version, reviews and modifications – proposed events, actions and tasks – predicted timescales, durations, dates of actions – assumed dependencies, conditions,

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		reference to assets and their disposition, a strategy.	constraints, risks – allocated resources, labour, facilities, materials – planned budget, cost, expenditures – defined milestones, results and progress targets – decision points and authorization gates – options and contingency actions
4.00	procedure	A declared way of formally conducting a customary course of action. It defines an established and approved way or mode of conducting business in an organization. It may detail permissible or recommended method in order to achieve technical or managerial goals or outcomes.	– purpose, outcomes and results of performing actions – issuing authority and controls – roles, responsibilities and duties – actors, their competence and proficiency – dependency on requirements, standards and directives – achievement, goals, completion criteria – definition of transformations and their products – work definitions, instructions to act – progression and dependencies of action – guiding method and practices – enabling tools and infrastructure
5.00	record	A permanent, readable form of data, information or knowledge. Accessible and maintained evidence of the existence or occurrence of facts, events or transactions. It may take the form of a journal chronicle, register or archive. It may contain the information to confirm achievement of performance, fiscal or legal conditions or obligations.	– record identity or title – content, description and reason for record – ownership, origin and authorship – practices, agreements, commitments and regulations applying to record – authorities and condition of storage, retrieval, replication and deletion – medium and format of record – location, conditions and periods of storage – applicable information privacy, security and integrity – declaration of status, configuration and baseline information – information on audit, validity and history
6.00	report	An account prepared for interested parties in order to communicate status, results or outcomes. It is a result of information gathering, observation, investigation or assessments, and it may impart situation, affects, progress or achievement. It serves to inform so that decisions or subsequent actions can be taken.	– purpose or benefit of report – source, author and authority to report – interested parties, recipients, distribution – knowledge, understanding communicated – information, data, facts and evidence contained – analysis, inspections and audits employed – timing, validity, condition of information use – dependence on circumstances, constraints and assumptions – reported status, results, achievements, conformance, compliance or outcomes – identified faults, failings or errors – inferred patterns, trends or predications – conclusions, recommendations, rationale
7.00	request	A communication that initiates a defined course of action or	– objective, purpose or outcome of request – expression of a demand, need or desire

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		change in order to fulfil a need. This may originate or control on-going action based on an agreed plan or procedure. It may result in a proposal or plan of action. It may take the form of a solicitation, requisition, instruction or demand for a resource, product, service or an approval to act.	– communication of enquiry, solicitation or an order to provide – initiation of supply, provision or support – definition of action, change or exchange – identification of required products, services, capability or resources – authorisation of tasking or commitments – specified terms, conditions to act, agreement conveyed – required availability of requested provision communicated
8.00	specification	Criteria or conditions that place limits or restrictions on actions, attributes or qualities. It establishes measures or qualities for determining acceptability, conformance or merit. It may be required as part of an agreement or contract.	– definition of needs, wishes and circumstances – statement of requirements – definition of constraints and conditions – standards and regulations invoked – dimensions of achievement and outcome – criteria of conformance, correctness and compliance – definition of measures, indicators, limitations, values, and thresholds – statements of action and conduct – required functions, performance, behaviour or service levels – definitions of interfaces, interaction, location and connection – conditions of acceptance, permissible exceptions and deviations – conditions of change and variation

B.2 Generic Work Products and specific Work Products

Specific Work Product types are typically created by process owners and applied by process deployers in order to satisfy an outcome of a particular process purpose.

NOTE: Generic Work Product types are included in the list for completeness.

WP ID	Work Product Name	Work Product Typical Characteristics
1.00	object	refer to B.1 for Generic Work Product typical characteristics
1.01	supplied system	– agreement – stakeholder requirements – delivery conditions – acceptance criteria – compliance deviations – handling and storage – safety and security conditions – transfer of ownership
1.02	enterprise resource assignment	– project personnel profile – working environment – projects materials – projects services – resource capacity – resource needs profile – multi-project resource conflicts

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1.03	competent personnel	– staff experience, skills and knowledge – competence to perform life cycle processes – team working ability – staff assessments – training and education needs – retraining, reassignment or reallocation plans – recruitment criteria
1.04	information item	– storage medium – security classification – privacy requirements – access rights – storage environment – information legislation – currency and validity
1.05	system element	– delivery schedule – acquisition agreement – architecture design – interface control descriptions – implementation technology – acceptance criteria – compliance deviation – useful life – handling instructions – storage and release conditions
1.06	qualified operators	– operator competence definition – operator selection criteria – training criteria – qualifications – operating instructions – failure detection instructions – authorization to operate – training resources – system training mode – service availability
1.07	integrated system	– architectural design – assembly sequence – integration non-conformances – configuration status – verification readiness
1.08	verified system	– conformance evidence – configuration status – deviations – corrective actions
1.09	installed system	– delivery schedule – intermediate storage – installation location – operational location – operational readiness – operational data
1.10	validated system	– service requirements – operational site – qualified operators – service non-conformances – operational status – acceptance condition

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1.11	operational system	– service requirements – service availability – service life – service non-conformances – maintenance conditions – operators
1.12	waste products	– waste disposal conditions – waste disposal equipment – system destruction procedure – treaded waste – waste handling procedure – melted, crushed, incinerated or demolished system elements – knowledge safeguards – operator skills safeguards
1.13	disposed system	– current condition – disassembled elements – useful remaining life – reuse conditions – operator redeployed/retirement – reconditioning actions – value to other systems – storage conditions
1.14	supplier payment	– contract conditions – work offset – acceptance confirmation
2.00	description	refer to B.1 for Generic Work Product typical characteristics
2.01	tailored system life cycle stage model	– stage purpose – stage outcomes – enabling system services – succeeding stage criteria – stage exit criteria – approval to proceed
2.02	tailored system life cycle process model	– process purpose – process outcome – activity identity and detail – output work products – input work products
2.03	system life cycle stage model	– business strategy – business area strategy – stages – gates – gate review achievement criteria – gate review authorities – system life cycle management policy and procedures – system life cycle performance measures – risk management policies and procedures
2.04	system life cycle process model	– policy to adapt system life cycle processes – life cycle process performance/trends – project requirements and needs – quality management policies and procedures
2.05	configuration item list	– identifiers or markings – relevant standards – product sector conventions – specification or description identity – configuration baseline descriptions

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		– released item configuration – baseline timing and conditions – authorizations
2.06	information item list	– identifier – security classification – privacy requirements – access rights – storage environment – distribution schedules
2.07	stakeholders profile	– stakeholder classes – stakeholder identity – acquirer organizations – supplier organizations – regulatory bodies – members of society – stakeholder representatives
2.08	system functional model	– product function – performance parameters – data flows – quality in use measures – functional views and viewpoints – modelling notation
2.09	architectural design description	– system elements – structure views and viewpoints – non-functional views and viewpoints – design rationale – interface requirements – implementation technology – planned evolution – technology upgrades
3.00	plan	refer to B.1 for Generic Work Product typical characteristics
3.01	acquisition strategy	– acquisition plan – life cycle model – make/buy/reuse policy – supply chain relationships – market influences – technology investment strategy
3.02	supply strategy	– enterprise objectives – business area objectives – asset base – resource availability – service offerings – product families
3.03	business strategy	– new business opportunities – business areas – opportunity viability – risks to organization – projects prioritisation – current product/service portfolio – current assets – resource availability – investment strategy
3.04	system life cycle management policy	– business achievement criteria – life cycle reference models – stage gate/milestones approval criteria – system life cycle processes improvement policy

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3.05	resource allocation plan	– project resource needs – multi-project interfaces – resource capacities – common enabling systems – common system elements
3.06	system life cycle process policy	– system life cycle process definitions – life cycle reference models – process application policy – tailoring/adaptation policy
3.07	training strategy	– competence profiles – knowledge – skills – experience – aptitude – recruitment – re-assignment
3.08	quality management policy	– business strategy – organization quality goals and objectives – quality management standards
3.09	project management plan	– work breakdown structure – task relationships/external dependencies – achievement milestones – organizational infrastructure – procured items and services – project review times/events – reserves for risk management
3.10	project acquisition plan	– staff recruitment – acquired materials and goods – acquired services – solicitation plans – supplier selection – contract monitoring schedule
3.11	technical management plan	– technical achievement criteria – technical roles and responsibilities – technical resources – selected methods and tools – supporting technical services – technology readiness – technical risks – technical review schedule
3.12	service management plan	– agreement – service levels – service conditions – operational location – service non-conformances – maintenance – operator training
3.13	project quality plan	– project quality objectives – enterprise quality goals and objectives – enterprise quality management policies and procedures – quality standards – infrastructure assets and capability – enabling systems – infrastructure capacity – service availability – allocation to tasks

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		– project performance criteria – stakeholder satisfaction criteria – project status reporting schedule – enterprise reporting schedule
3.14	decision-making strategy	– decision categories – prioritisation scheme – effectiveness assessment – project initiation or progression approvals – decision-making parties
3.15	risk treatment strategy	– risk avoidance actions and rationale – risk mitigation actions and rationale – risk transfer actions and rationale – risk retention actions rationale
3.16	configuration management strategy	– levels of system integrity, security, safety – configuration baseline criteria, events and timing – release authorities – conditions of release and storage – audit conditions
3.17	information management strategy	– business policy – knowledge base – security requirements – privacy legislation – information audit
3.18	implementation strategy	– implementation procedures – fabrication processes – enabling tools and equipment – fabrication constraints – verification conditions
3.19	integration strategy	– assembly sequence and configurations – verification information – fault isolation and diagnosis constraints – operator integration
3.20	verification strategy	– product requirements – verification methods and techniques – configuration sequences – disassembly strategies – fault diagnosis steps – inspections and comparisons – static and dynamic tests – demonstrations and acceptance criteria – regression criteria – verification enabling systems requirements – non-conformance handling – reviews and audits
3.21	transition strategy	– installation constraints – operating environment dependencies – commissioning instructions – operator incorporation – acceptance conditions
3.22	validation strategy	– stakeholder requirements/acquirer agreements – safety, technical and commercial criticality constraints – validation enabling system requirements – non-conformance handling – validation limitations and deferred actions – service conformance recording – validation steps,

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		– operational states, scenarios and missions – conformance confidence, diagnosis, discrepancies – validation methods and techniques – purpose, conditions and conformance criteria
3.23	operation strategy	– service availability schedule – introduction to service conditions – operator capacity and renewal – system modification schedules – release and re-acceptance criteria – service withdrawal circumstances – service migration and concurrent services – customer satisfaction criteria
3.24	maintenance strategy	– operational availability requirements – corrective and preventative maintenance policy – maintenance capabilities and locations – maintenance enabling system requirements – maintenance staff competence – maintenance schedules – service restrictions and suspensions – replacement system element logistics – health, safety, security and environment legislation
3.25	disposal strategy	– waste product handling – system element recycling options – disposal enabling system requirements – disposal constraints, regulations and directives – disposed material handling – audits and inspections – health, safety, security and environment legislation
4.00	procedure	refer to B.1 for Generic Work Product typical characteristics
4.01	supplier selection procedure	– business policy – supply chain circumstances – technical and commercial issues – selection rating criteria – negotiation schedules – decision and rationale feedback
4.02	system life cycles management procedure	– enterprise strategic plans – business area plans – risk management policy – quality management policies – stage entry and exit criteria – project tailoring policy – key milestones definition – reporting events
4.03	quality management system	– quality policy – access mechanism – information medium – standards – customer satisfaction – project quality plans – quality assessments – quality improvements
4.04	implementation procedure	– selected implementation technology – implementation enabling systems – fabrication safety, security and environmental standards and legislation – physical fabrication and conditioning techniques

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		– software generation and coding – operator task training – system element verification actions – conformance and quality reporting
4.05	integration procedure	– system elements – interface control descriptions – configuration baselines – diagnostic and regression tests – integration enabling systems
4.06	verification procedure	– verification methods – verification enabling system – assembly sequence – fault diagnosis sequence – non-conformance handling
4.07	transition procedure	– installation location preparation – transition enabling system – operator induction – activation conditions – transition non-conformances – operational readiness criteria – acceptance requirements
4.08	validation procedure	– agreement – acceptance conditions – service requirements – operational states, scenarios and missions – validation enabling system
4.09	operation procedure	– service availability requirements – service non-conformance reports – corrective action request – maintenance requirements
4.10	maintenance procedure	– servicing skills – preventative maintenance schedules – system element failure rates – spares holdings – maintenance enabling systems – random faults detection – systematic fault detection – replacement schedules – level of system element replacement – useful life of degradable system elements – corrective design/implementation actions
4.11	disposal procedure	– service withdrawal/transfer sequences – power/fuel termination – systems interfaces – disassembly sequences – intermediate/long term storage/archive conditions – operating knowledge recording – health, safety, security and environmental legislation
5.00	record	refer to B.1 for Generic Work Product typical characteristics
5.01	supplier justification record	– supply chain – technical and commercial issues – competitive solicitations – selection criteria – offerings – rating

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5.02	decision register	– problem/opportunity circumstances – decision-making authority – decision-maker identity – concerned parties – subject matter experience – subject matter knowledge – courses of action open – actions taken – problem/opportunity resolution outcome – audits
5.03	decision history record	– problem/opportunity circumstances – actions taken – problem/opportunity resolution outcome – learning from experience
5.04	risk register	– risk categories and responsibilities – risk sources and relationships – initiating events and occurrence probability – risk consequences – threshold of acceptability – risk ranking
5.05	risk history record	– history of risks – risk treatment actions – risk budget – risk treatment outcomes
5.06	configuration baseline	– composition – configuration – levels of system integrity, security, safety – release events and timing – release authorities – conditions of release and storage
5.07	configuration history record	– baselines – releases – authorisations – change rationale
5.08	information history record	– agreement constraints – organizational information policy or legislation – information currency and validity – medium longevity – data security and privacy legislation – intellectual property – information audits
5.09	stakeholder requirements traceability	– agreement – stakeholder class – service requirement – validation – acceptance conditions
5.10	stakeholder requirements record	– stakeholder requirements baselines – changes of need and origin – persistent needs – agreements
5.11	systems requirements traceability	– stakeholder requirement – system functional model – architectural design – agreement
5.12	system requirements record	– system requirements baselines – design rationale

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		– modelling conventions
5.13	system architectural design traceability	– system product requirements – architectural design – agreements – regulatory requirements – product sector requirements
5.14	system architectural design record	– architectural design baseline – structural and functional partitioning – interface and control definitions – design decisions – traceability to requirements
5.15	implementation record	– architectural design specification – system element specification – supplier agreements – legislation – organizational policy
5.16	integration record	– integration baselines – integration strategy – integration enabling systems – non-conformances and errors – corrective or improvement outcomes
5.17	verification record	– compliance deviations – verification data – authentications – corrective actions
5.18	transition record	– installation baseline – installation test – operator training/certification – acceptance authorisation – user training – corrective actions
5.19	validation record	– stakeholder requirements – legal and regulatory requirements – operator qualification – service levels – non-conformances and deviations – corrective actions
5.20	operation record	– operational configuration – modification information – operation non-conformances – service levels – service period
5.21	maintenance record	– operational information – maintenance information – product/service non-conformance – trends and failure patterns – detected design errors – services threats and failures
5.22	disposal record	– disposed material – storage locations and conditions – anticipated storage effects – recycled material – re-used system elements
5.23	payment record	– contract conditions – acquirer information – quality measures

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6.00	report	refer to B.1 Generic Work Product typical characteristics
6.01	supplier assessment report	– supplier offerings – proposal rating justification – supplier preference – selected supplier
6.02	delivery acceptance report	– delivered product/service – product/service requirements – agreement – compliance confirmation method – compliance tools
6.03	supply performance report	– cost – performance – schedule – risks – execution of agreement assessment – undesirable outcome evaluation – corrective action recommendations
6.04	system life cycle model review	– life cycle models – stages – life cycle processes – achievement criteria – life cycle model improvements
6.05	resource commitment report	– resource allocation – project interdependencies – project plans – project reviews – project authorisation – recruitment – training
6.06	investment decision report	– business strategy – new business opportunities – cost and delivery projections – viability assessment – risks to organization – projects prioritisation – current product/service portfolio – current assets
6.07	system life cycle process review	– enterprise goals and policies – quality audits – method and tool support – project review – tailoring policy
6.08	system life cycle improvement report	– system life cycle performance measures – process execution performance/trends – process improvement opportunities – processes improvement actions
6.09	training report	– competence profile – knowledge – skill – recruitment – re-assignment
6.10	customer satisfaction assessment	– customer satisfaction definition – information sources and schedule – customer satisfaction status
6.11	quality management report	– quality objectives – non-conformance information

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		– project performance trends – product/service quality improvements
6.12	project status report	– planned cost, resources, schedule – actual cost against project plan – actual or estimated labour costs – actual or estimated material costs – actual or estimated service costs – actual measured achievement – milestone completion
6.13	project resources and services report	– project structure and responsibilities – team competencies – adequacy and availability supporting infrastructure – readiness of enabling systems – technology readiness – technology insertion plans
6.14	project quality report	– performance measures – business audit results – technical results – project self-assessment results – quality deviations or variations – corrective actions
6.15	project progress report	– project status – risk profile – stage progression criteria – milestone achievements – projected performance against plans – business and technical risks – replanning needs – resource authorisation – project readiness to proceed
6.16	corrective action report	– non-compliance – agreement – stakeholder requirements – systems requirements – service requirements – diagnosed faults – design change
6.17	decision report	– problem or opportunity – assumptions – resolution status – outcomes – trends
6.18	risk management report	– identified risk – risk treatment actions – impact on plans – risk status – project risk reserves
6.19	configuration management report	– configuration item audit – baselines – release time – approvals – change history
6.20	Information management report	– information item audit – integrity, validity and availability status – replication requirements – transformation requirements

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		– technology infrastructure retention
6.21	stakeholder requirements report	– integrity analysis – conflicting requirements – missing requirements – incomplete requirements – ambiguous requirements – unverifiable requirements – requirements integrity resolution strategy
6.22	system requirement report	– requirements uniqueness – requirements completeness – requirements non-ambiguity – requirements consistency – requirements implementability – requirements verifiability – requirements integrity resolution strategy – traceability – derived requirements
6.23	system architectural design report	– feasibility – effectiveness – design stability – enabling system constraints
6.24	implementation report	– suppliers – implementation technology – verification data – acceptance – handling and storage
6.25	integration report	– integration data – system element delivery – assembly sequence – integration faults – maintenance
6.26	verification report	– verification data – verification non-conformances – corrective action information – diagnosed faults – trends and patterns of failure – evidence of design or implementation errors
6.27	transition report	– capability readiness – installed system – operational location and environment – operator readiness – acceptance criteria – support enabling system readiness – corrective action reports
6.28	validation report	– validation data – user communication – stakeholder satisfaction – service restoration – service amendment actions
6.29	operation report	– delivered services – service levels – service satisfaction – performance parameters – acceptable/revised service parameters – operational situation – service non-compliances

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		– operating personnel performance – operations plans – system activation actions – operator training and accreditation – usability review – occupational safety – environmental protection
6.30	maintenance report	– logistics analysis – replenishment levels – replacement schedules – repair rates – spares availability, spares integrity – failure data – events and histories – lifetime data – preventive and corrective maintenance – adaptive and perfective maintenance operator replenishment – maintenance personnel performance
6.31	disposal report	– disposal confirmation – health factors – safety factors – security factors – environmental factors
7.00	request	refer to B.1 Generic Work Product typical characteristics
7.01	acquisition request	– supply solicitation – requirements – tasking statement – acquirer processes
7.02	acquisition agreement change request	– needs – stakeholder requirements – agreement terms and conditions – delivery schedule – acceptance criteria
7.03	supply proposal	– supply request response – supplier's project plans – proposed cost, schedule and system performance – anticipated risks – supply terms and conditions
7.04	supply agreement change request	– acquirer requests – supplier requests – contract variation – acceptance concessions – terms and conditions – re-plan criteria
7.05	project control directive	– project objectives – project plans – risk response directives – personnel deployment and re-assignments – infrastructure deployment and re-assignments – corrective actions – preventive actions
7.06	supplier directive	– acceptance criteria – product/service defects – instructions to rectify – supplier monitoring

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		– modified terms and conditions
7.07	supply change directive	– change actions – stakeholder requirements – operational constraints – delivery requirements – project plan changes
7.08	authorization to proceed request	– stage gate review – project review – project report
7.09	configuration baseline change request	– design release – corrective maintenance – technology upgrade – obsolescence – in-service modification
7.10	operation request	– change of need – context of use – service level – service non-compliance – maintenance schedule – modifications and upgrades – operator assignment – consumable materials
7.11	maintenance request	– acquired maintenance services – consumable materials – energy sources – operator provisions
8.00	specification	refer to B.1 for Generic Work Product typical characteristics
8.01	acquisition agreement	– supplier – product or service need – achievement milestones – reporting milestones – completion conditions – exception handling procedures – change control procedures – acceptance criteria – delivery conditions – payment schedules – intellectual property rights – acquirer terms and conditions
8.02	delivery acceptance criteria	– agreement criteria – product/service compliance criteria – delivery procedures and conditions – verification procedure – validation procedure
8.03	supply agreement	– acquirer – product or service offered – supplier terms and conditions – acceptance information/demonstration – deviation handling – delivery procedures – intellectual property rights – responsibility transfer definition – completion conditions – liabilities
8.04	project requirements	– enterprise objectives – requirements/review milestones

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		– acquirer/supplier agreement – project objectives – projects accountabilities and authorities – project achievement criteria – project life cycle stage responsibility – project completion criteria – project constraints – scope of technical activities – life cycle process tailoring – project assessment and control plans
8.05	project authorization	– project initiation directives – project re-direction directive – reporting to enterprise management – stage gate approval criteria – project termination criteria
8.06	system life cycle process measures	– business strategy – quality policy – customer satisfaction – project reviews – non-conformances
8.07	enterprise resource requirement	– project plans – resource allocation – project interdependencies – recruitment – training – enabling systems
8.08	quality management goals	– business strategy – quality policy – customer satisfaction
8.09	quality measures	– customer satisfaction – non-compliances – project reviews
8.10	project infrastructure and services requirements	– project organization – project roles and responsibilities – definition of role competence – staff appointments – designation of legally responsible roles and individuals – methods of team working
8.11	project performance measures specification	– defined project measures of achievement – enterprise quality metrics – schedule of measures collection – measures analysis procedure – project performance deviation indicators
8.12	stakeholder requirements	– system purpose – stakeholder concerns – operational scenarios – context of use – user culture and social profile – measures of effectiveness – service validation conditions – service requirements to stakeholder needs traceability
8.13	stakeholder requirements constraints on solution	– stakeholders' assumptions and rationale – stakeholder perceived constraints – previous implementation decisions – operator staff capabilities and competence – agreements

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		– acquiring organization constraints – health and safety – security standards – reliability and availability – supportability – environmental protection
8.14	system requirements	– functional boundary definition – critical performance parameters – behaviour and properties required – system stimuli and responses – interface constraints – user and environment behaviour – quality in use measures – implementation constraints
8.15	system requirements constraints on solution	– performance requirements – product sector standards – interface requirements – verification enabling system – agreement
8.16	system verification performance measures	– performance parameters – critical performance measures – quality in use – non-compliance criteria – verification enabling system
8.17	system interface requirements	– system boundary definition – external systems – external interface specifications – human-system interfaces – product sector interface standards
8.18	human-equipment interface requirements	– operator competence and capabilities – usability requirements and standards – operator and user recruitment – operator training needs – operator certification requirements
8.19	system element requirements	– system architecture definition – system element design constraints – performance attributes – physical attributes – interface definitions – system element storage – containment criteria – conveyance constraints – storage conditions
8.20	implementation constraints on solution	– implementation technology selected implementation technology – implementation technology constraints and limitations – acquirer furnished materials – system elements for adaptation – implementation enabling systems limitations
8.21	implementation enabling system requirements	– agreement – verification results – non-conformance handling procedures – packaging and storage conditions
8.22	integration constraints on solution	– architectural design – interface requirements – diagnosis/rectification accessibility

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		– integration enabling systems
8.23	integration enabling system requirements	– integration enabling system facilities – integration procedures – intermediate assembly configurations – assembly equipment and jigs – integration constraints and limitations
8.24	verification constraints on solution	– measurement methods – verification enabling systems – availability – interconnection – accuracy, uncertainty, repeatability
8.25	verification enabling system requirement	– verification facilities – system requirements – integration strategy – non-conformance diagnosis – acceptance criteria – interfaces – availability
8.26	transition constraints on solution	– operational site conditions – operating environment dependencies – commissioning instructions – acceptance conditions – operator induction – activation conditions – acceptance requirements
8.27	transition enabling system requirements	– operational location – installation skills – fault identification
8.28	validation constraints of solution	– operational location access – operator availability – renewable materials – acceptance criteria – validation enabling system
8.29	validation enabling system requirements	– verification facilities – system requirements – installation strategy – non-conformance diagnosis – acceptance criteria – operators competence – interfaces
8.30	maintenance constraints on solution	– maintenance enabling systems – re-use strategy – logistics strategy – system element holdings – re-supply limitations – maintenance scenarios – maintenance locations – maintenance environments – maintenance staff competence – maintenance enabling systems
8.31	maintenance enabling system requirements	– service level agreement – operational situation – activation procedure – required instances/continuous service – service conformance audits – transfer/changeover of services

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8.32	disposal constraints on solution	– disassembly location and access – disposal enabling systems – availability of storage locations – disposal skill levels
8.33	disposal enabling systems requirement	– disposal support services – disposal location – environmental legislation

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Annex C
(informative)

Adaptation of the assessment model

This Annex gives recommendations for developing assessment indicators and adjusting the assessment model, such as:

— expanding a process into multiple processes; and

— introducing a new process with associated assessment indicators.

It contains a style guide for identifying and defining Base Practices and Generic Practices.

C.1 Assessment indicators identification

A nomenclature for assessment indicators is defined in order to identify them unambiguously and relate them to the architecture of the model. The nomenclature for Base Practices facilitates the identification of process groups, the processes that belong to each process group, and the Base Practices that belong to each process. For Generic Practices, the nomenclature facilitates the identification of capability levels, the process attributes that belong to each capability level, and the Generic Practices that belong to each process attribute. In process assessments using the assessment model, the nomenclature and identifiers contained in this model should be used to identify practices referenced as evidence justifying the rating of a process attribute.

Each practice is linked to its parent entity, whether a process or a process attribute, through a numbering scheme, based upon the identifiers for processes and process attributes in the assessment model.

Each practice is assigned an identifier consisting of a multi-part alphanumeric code.

C.1.1 Base practices

This clause gives guidelines for defining Base Practices. Base practices used in this exemplar assessment model provide a definition of the tasks and activities needed to accomplish the process purpose and fulfil the process outcomes.

A **Base Practice** is identified in the following sequence: PG.PR.**BP**.PN.

Where the codes are

PG process group identifier (3 letters),

PR process number (within the process group),

BP the text "BP" used to signify Base Practice,

PN practice number (within the process).

Templates for constructing definitions of new Base Practices are given in Table C.1. A Base Practice description consists of the following components:

— practice identifier;

— practice name;

— practice description;

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— list of outcomes addressed;

— optionally, additional notes on the practice.

Table C.1 — Guidelines for describing Base Practices

Component	Guideline
Practice identifier	PG.PR.**BP**.PN
Practice name	1. The name of the Base Practice should identify what the practice does in summary form. 2. In general, the name should be an action-oriented phrase, beginning with a verb which summarizes the action (e.g. "Plan", "Establish", "Build"), and followed by a word or phrase that describes what is to be accomplished (e.g. "Identify the need"). 3. The practice name appears on the same line as and immediately after the practice identifier.
Outcomes addressed	The list of outcomes addressed, in the form: [Outcomes: <outcome letter>, …, <outcome letter>]. When only one outcome is addressed, the form [Outcome: <outcome letter>] is used.
Practice description	One or more sentences that describe the practice.
Informative notes	Optionally, notes may be appended to the Base Practice to further describe the practice, to give examples, or to provide cross-references to other practices, in the form: NOTE: <text> Where there is more than one note for several Base Practices related to a process (PR) then these should be numerically sequenced.

Example of Base Practice description with note:

TEC.1.BP.1: Identify stakeholders. [Outcome: c]

Identify the individual stakeholders or stakeholder classes who have a legitimate interest in the system throughout its life cycle.

NOTE This includes, but is not limited to, users, supporters, developers, producers, trainers, maintainers, disposers, acquirer and supplier organizations, regulatory bodies and members of society. Where direct communication is not practicable, e.g. consumer products and services, representatives or designated proxy stakeholders are selected, e.g. marketing.

C.1.2 Generic practices

A **Generic Practice** is identified with the following sequence: **GP** CL.PAN.PN.

Where the codes are

GP the text "GP" used to signify Generic Practice,

CL capability level number,

PAN process attribute number (within the capability level),

PN practice number (within the process attribute).

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Templates for constructing definition of new Generic Practices are given in Table C.2. A Generic Practice description consists of the following components:

Table C.2 — Guide-lines for describing Generic Practices

Component	Guideline
Practice identifier	**GP** CL.PAN.PN
Practice name	1. The name of the Generic Practice should identify what the practice does in summary form. 2. In general, the name should be an action-oriented phrase, beginning with a verb which summarizes the action (e.g., "Plan", "Establish", "Build"), and followed by a word or phrase that describes what is to be accomplished (e.g. "Identify the need") followed by the purpose of performing this practice (e.g., “perform this practice” to “achieve this attribute”). 3. The practice name appears on the same line as and immediately after the practice identifier, with the first significant phrase in bold style.
Outcomes addressed	The list of outcomes addressed, in the form: [Outcomes: <outcome letter>, …, <outcome letter>]. When only one outcome is addressed, the form [Outcome: <outcome letter>] is used.
Practice description	A list of sentences detailing the practice.
Informative notes	Optionally, notes may be appended to the Generic Practice to further describe the practice, to give examples, or to provide cross-references to other practices, in the form: NOTE: <text>. Where there is more than one note for several Base Practices related to a process (PR) then these should be numerically sequenced.

Example of Generic Practice description:

GP 2.1.5 Identify and make available resources to perform the process according to plan.

The human and infrastructure resources necessary for performing the process are identified, made available, allocated and used.

The information necessary to perform the process is identified and made available.

The necessary infrastructure and facilities are identified and made available.

C.2 Adaptation of the exemplar Process Assessment Model

C.2.1 Adding to or removing processes from the process dimension

The Process Reference Model used to define the Process Assessment Model described in this standard is derived from the ISO/IEC 15288, which complies with ISO/IEC 15504-2 requirements, as demonstrated in Annex A.

Adaptation in the process dimension (e.g. to add or remove processes) according to the assessment context must not impact the compliance with the ISO/IEC 15504-2 requirements.

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C.2.2 Identifying process performance indicators for a new process

C.2.2.1 Base practices

The set of Base Practices, when performed, provides an indication of the extent of achievement of the process purpose.

As for each process of this exemplar model, the set of Base Practices for a new process should cover the achievement of the whole set of process outcomes of the process.

When defining a new Base Practice, the following should be considered.

A Base Practice is:

- Understandable, clear, unambiguous;
- Applicable to the technical area or domain of the Process Assessment Model;
- Has an adequate granularity and is homogenous; and
- described in simple terms, ideally in no more than 2 to 3 sentences.

Evaluating the performance of a Base Practice during an assessment should:

- Ideally take no more than 10 to 20 minutes to cover its scope, and
- Provide evidence associated with the performance of the Base Practice.

C.2.2.2 Work products

Work products are useful for the assessor when identifying whether the process is being performed. For instance, at the beginning of an assessment, identifying the set of work products produced by the organizational unit is an objective way to map the organization specific set of processes to the Process Assessment Model set of processes.

If a new process is outside of the domain of this Process Assessment Model, new input and output Work Products should be identified together with their characteristics. This should facilitate the mapping between the new process and any specific organization processes.

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Bibliography

NOTE The following documents contain definitions and may provide general guidance to terms in the indicator set.

[1] ISO/IEC 2382-1:1993, *Information technology — Vocabulary — Part 1: Fundamental terms*

[2] ISO/IEC 2382-20:1990, *Information technology — Vocabulary — Part 20: System development*

[3] ISO 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

[4] ISO 9001:2000, *Quality management systems — Requirements*

[5] ISO 9004:2000, *Quality management systems — Guidelines for performance improvements*

[6] ISO 9126-1:2001, *Software engineering — Product quality — Part 1: Quality model*

[7] ISO 9241-400:2007, *Ergonomics of human-system interaction — Part 400: Principles and requirements for physical input devices*

[8] ISO/IEC TR 9294:2005, *Information technology — Guidelines for the management of software documentation*

[9] ISO 10007:2003, *Quality management systems — Guidelines for configuration management*

[10] ISO/IEC 12207:2008, *Systems and software engineering — Software life cycle processes*

[11] ISO 13407:1999, *Human-centred design processes for interactive systems*

[12] ISO 14001:2004, *Environmental management systems — Requirements with guidance for use*

[13] ISO/IEC 15288:2002, *Systems engineering — System life cycle processes*[1)]

[14] ISO/IEC 15289:2006, *Systems and software engineering — Content of systems and software life cycle process information products (Documentation)*

[15] ISO/IEC 15504-5:2006, *Information technology — Process assessment — Part 5: An exemplar Process Assessment Model*

[16] ISO/IEC 15939:2007, *Systems and software engineering — Measurement process*

[17] ISO/TR 18529:2000, *Ergonomics — Ergonomics of human-system interaction — Human-centred lifecycle process descriptions*

[18] ISO/IEC 25000:2005, *Software Engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Guide to SquaRE*

[19] IEEE Std 1517-1999, *IEEE Standard for Information Technology — Software Life Cycle Processes — Reuse Processes*

1) ISO/IEC 15288:2002 has been cancelled and replaced by ISO/IEC 15288:2008.

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