The Procurement Forum

SPICE

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Part 5: An exemplar Process Assessment Model

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Document History

Version:	Date:	By:	Notes:
2.0	2005-05-04	AD	DRAFT RELEASE pending final editorial review
2.1	2005-06-24	AD	Editorial review comments implemented Updated to reflect changes in FDIS 15504-5
2.2	2005-08-21	AD	Final checks implemented FORMAL RELEASE
2.3	2007-05-05	AD	Revision following CCB FORMAL RELEASE
2.4	2008-08-01	AD	Revision following CCB FORMAL RELEASE
2.5	2010-05-10	AD	Revision following CCB FORMAL RELEASE

Release Notes

Version 2.5 of the Process Assessment Model incorporates changes regarding

- application parameter management (ENG processes, SUP.8 and work product 01-51)
- extending storage beyond lifetime guarantee of media (SUP.8.BP11)
- project attributes and project performance clarifying the need for schedule and effort as a primary focus (MAN.3.BP10 & PA2.1)
- emphasising the use of this document in conjunction with the terminology in ISO/IEC 15504-1
- unit testing and significant editorial changes to the Software construction process (ENG.6)
- test output work products to align with updated IEEE-829 :2008 (08-50, 08-52, 13-50)
- registered trademark notice.

Version 2.5 of the Process Assessment replaces Version 2.4 of the Process Assessment Model with immediate effect.

Version 4.5 of the Process Reference Model has been released at the same time and is aligned to version 2.5 of the Process Assessment Model.

Any problems or change requests should be reported through the defined mechanism at the www.automotivespice.com web site. These will be addressed by the Change Control Board which meets every 6 months.

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1 Scope

1.1 Introduction

Process assessment is a disciplined evaluation of an organizational unit's processes against a Process Assessment Model (PAM).

The Automotive SPICE® Process Assessment Model (PAM) has been developed by consensus of the car manufacturers within the Automotive Special Interest Group (SIG) of the joint Procurement Forum/SPICE User Group under the Automotive SPICE® initiative.

The Automotive SPICE® Process Assessment Model (PAM) is available for use when performing conformant assessments of the software process capability of automotive suppliers in accordance with the requirements of ISO/IEC 15504-2.

The Automotive SPICE® Process Reference Model (PRM) is used in conjunction with the Automotive SPICE® Process Assessment Model (PAM) when performing an assessment.

The Automotive SPICE® Process Reference Model (PRM), which is defined in a separate document, is derived from Annex F and H of ISO/IEC 12207 AMD1: 2002 and ISO/IEC 12207 AMD2: 2004. It contains a sub set of the processes with minor editorial changes together with a number of other changes to reflect consistency in use of terminology and application in the automotive sector.

The FULL scope of Automotive SPICE® contains ALL the processes from the ISO/IEC 15504 Process Reference Model (PRM). The fact that some processes have not been included within the Automotive SPICE® PRM does not mean that they are not valid.

Supplier organisations should address all processes relevant to their business needs within their organisation. Where a process is not included within the Automotive SPICE® Process Reference Model (PRM) then the relevant process should be included from the ISO/IEC 15504 exemplar Process Assessment Model. The manufacturers will however focus on the set of process defined within the Automotive SPICE® PRM when performing supplier capability assessments.

This Automotive SPICE® Process Assessment Model contains a set of indicators to be considered when interpreting the intent of the Automotive SPICE® Process Reference Model. These indicators may also be used when implementing a process improvement program following an assessment.

1.2 Definitions

PAM	Process Assessment Model
PRM	Process Reference Model
SIG	Special Interest Group
SPICE	Software Process Improvement and Capability dEtermination

1.3 Terminology

Automotive SPICE® follows the following precedence for use of terminology:

a. English dictionary for common terms
b. ISO/IEC 15504-1 :2004 for assessment related terminology
c. IEEE 630 and BS 7925-1 terminology (as contained in Annex C)

This document should be read in conjunction with ISO/IEC 15504-1 :2004. Many terms from ISO/IEC 15504-1 :2004 are used throughout the document.

Other terminology used is defined below

Application parameter	An application parameter is a parameter containing indispensable/essential data applied to the system affecting overall system functions, behaviour or properties. The notion of application parameter is expressed in two ways: firstly, the logical specification (including name, description, unit, value domain or threshold values or characteristic curves, respectively), and, secondly, the actual quantitative data value it receives by means of data application.
Element	One of the parts that makes up a system. An element may comprise hardware, software, mechanical or manual operations.
Integrated software item	A set of components that are integrated into a larger assembly for the purpose of integration testing.
Process Reference Model	A model comprising definitions of processes in a life cycle described in terms of process purpose and outcomes, together with an architecture describing the relationships between the processes

Annex D provides a schematic of key concepts used in the terminology.

1.4 Applicable Documents

a. ISO/IEC 12207 AMD 1: 2002, Software Engineering - Software life cycle processes.
b. ISO/IEC 12207 AMD 2: 2004, Information Technology - Software life cycle processes.
c. ISO/IEC 15504-1: 2004, Software Engineering - Process assessment – Part 1: Concepts and Vocabulary
d. ISO/IEC 15504-2: 2003, Information Technology - Process assessment – Part 2: Performing an Assessment
e. ISO/IEC 15504-5: 2006, Information Technology - Process assessment – Part 5: An Exemplar Process Assessment Model
f. IEEE 610.12-1990, IEEE Standard Glossary of Software Engineering Terminology
g. BS 7925-1, Glossary of Terms used in Software Testing
h. Automotive SPICE® Process Reference Model

1.5 Warning

This document is subject to revision.

2 Statement of compliance

The Automotive SPICE® Process Assessment Model 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 process capability

A statement of compliance of the Process Assessment Model with the requirements of ISO/IEC 15504-2: 2003 can be found in Annex A.

3 Process Assessment Model

3.1 Introduction

The Automotive SPICE® Process Assessment Model (PAM) comprises a set of assessment 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 Automotive SPICE® Process Reference Model with the associated process attributes defined in ISO/IEC 15504-2 provides a common basis for performing assessments process capability, allowing for the reporting of results using a common rating scale.

The Process Assessment Model defines a two-dimensional model of process capability. In one dimension, the process dimension, the processes are defined and classified into process categories. Within a process category, processes are grouped into process groups at a second level according to the type of activity they address.

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.

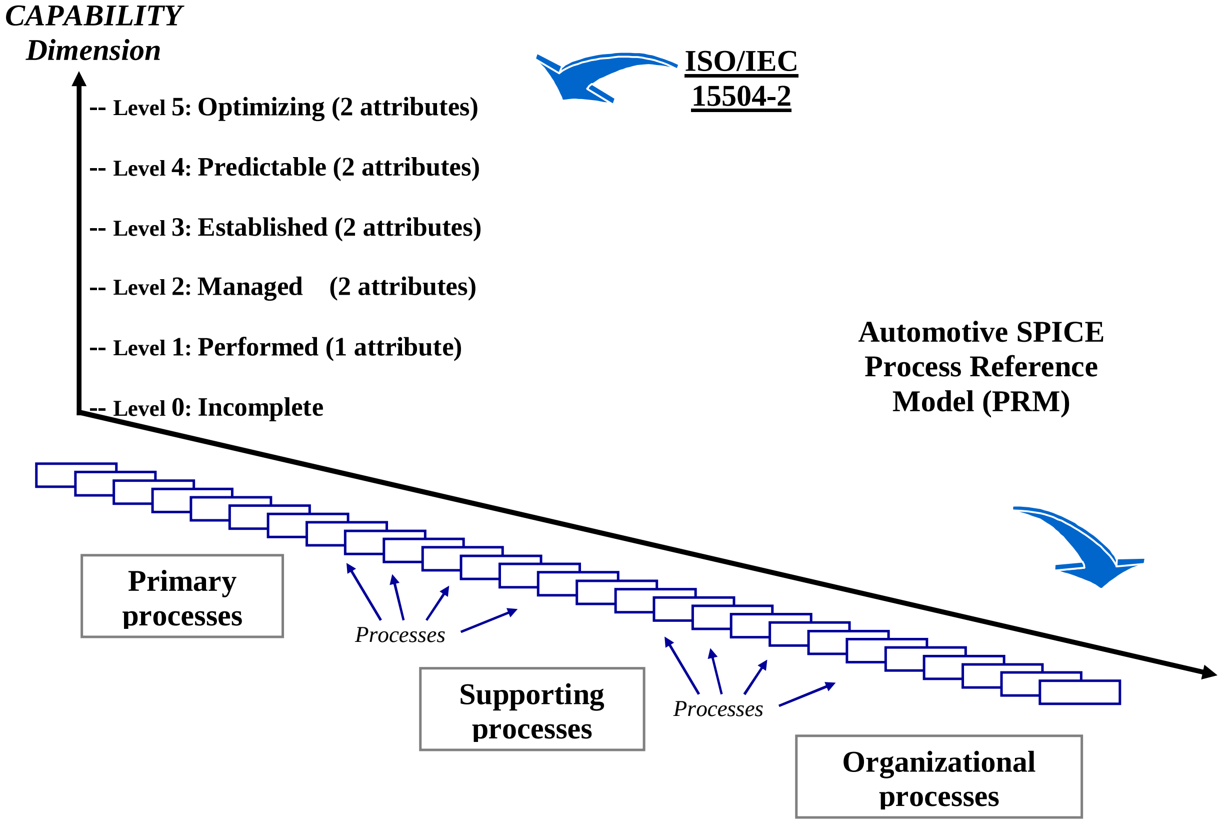
CAPABILITY
Dimension
ISO/IEC
15504-2
-- Level 5: Optimizing (2 attributes)
-- Level 4: Predictable (2 attributes)
-- Level 3: Established (2 attributes)
-- Level 2: Managed (2 attributes)
-- Level 1: Performed (1 attribute)
-- Level 0: Incomplete
Automotive SPICE
Process Reference
Model (PRM)
Primary
processes
Processes
Supporting
processes
Processes
Organizational
processes

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 the Automotive SPICE® Process Reference Model.

3.2 Process Dimension

For the process dimension, the Automotive SPICE® Process Reference Model (PRM) provides the set of processes.

The processes are classified into Process Categories and Process Groups. There are 3 Process Categories: Primary Life Cycle Processes, Organizational Life Cycle Processes and Supporting Life Cycle Processes. Each process 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 process performance.

The Process Categories and Process Groups are described below.

3.2.1 Primary Life Cycle Processes Category

The Primary life cycle processes category consists of processes that may be used by the customer when acquiring products from a supplier, and by supplier when responding and delivering products to the customer including the engineering processes needed for specification, design, development, integration and testing.

The primary life cycle processes category consists of the following groups:

- the Acquisition process group;
- the Supply process group;
- the Engineering process group;

The **Acquisition** process group (ACQ) consists of processes that are performed by the customer, or by the supplier when acting as a customer for its own suppliers, in order to acquire a product and/or service.

Any contract performed will be managed by processes in the **Management** process group (MAN) and executed by the processes in the **Engineering** process group (ENG).

Table 1 — Primary Life Cycle Processes – ACQ process group

Process Identification	PRM Process name
ACQ.3	Contract agreement
ACQ.4	Supplier monitoring
ACQ.11	Technical requirements
ACQ.12	Legal and administrative requirements
ACQ.13	Project requirements
ACQ.14	Request for proposals
ACQ.15	Supplier qualification

The **Supply** process group (SPL) consists of processes performed by the supplier in order to supply a product and/or a service.

Table 2 — Primary Life Cycle Processes – SPL process group

Process Identification	Process name
SPL.1	Supplier tendering
SPL.2	Product release

The **Engineering** process group (ENG) consists of processes that directly elicit and manage the customer's requirements, specify, implement, or maintain the software product, its relation to the system.

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Table 3 — Primary Life Cycle Processes – ENG process group

Process Identification	Process name
ENG.1	Requirements elicitation
ENG.2	System requirements analysis
ENG.3	System architectural design
ENG.4	Software requirements analysis
ENG.5	Software design
ENG.6	Software construction
ENG.7	Software integration test
ENG.8	Software testing
ENG.9	System integration test
ENG.10	System testing

3.2.2 Supporting Life Cycle Processes Category

The Supporting life cycle processes category consists of processes that may be employed by any of the other processes at various points in the life cycle.

Table 4 — Supporting Life Cycle Processes - SUP process group

Process Identification	Process name
SUP.1	Quality assurance
SUP.2	Verification
SUP.4	Joint review
SUP.7	Documentation
SUP.8	Configuration management
SUP.9	Problem resolution management
SUP.10	Change request management

3.2.3 Organizational Life Cycle Processes Category

The Organizational life cycle processes category consists of processes that establish the business goals of the organization and develop process,

product, and resource assets which, when used by projects in the organization, will help the organization achieve its business goals.
The organizational life cycle processes category consists of the following groups:

- the Management process group;
- the Process Improvement process group;
- the Reuse process group.

The **Management** process group (MAN) consists of processes that contain practices that may be used by anyone who manages any type of project or process within the life cycle.

Table 5 — Organizational Life Cycle Processes - MAN process group

Process Identification	Process name
MAN.3	Project management
MAN.5	Risk management
MAN.6	Measurement

The **Process Improvement** process group (PIM) consists of processes performed in order to define, deploy and improve the processes performed in the organizational unit.

Table 6 — Organizational Life Cycle Processes - PIM process group

Process Identification	Process name
PIM.3	Process improvement

The **Reuse** process group (REU) consists of processes performed in order to systematically exploit reuse opportunities in organization's reuse programs.

Table 7 — Organizational Life Cycle Processes - REU process group

Process Identification	Process name
REU.2	Reuse program management

3.3 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. Each level provides a major enhancement of capability in the performance of 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.

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 10.

Table 10 — 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.

3.4 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 evidences 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.

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 set of process capability indicators are:

- Generic Practice (GP);
- Generic Resource (GR);

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, produced or both, when performing the process.

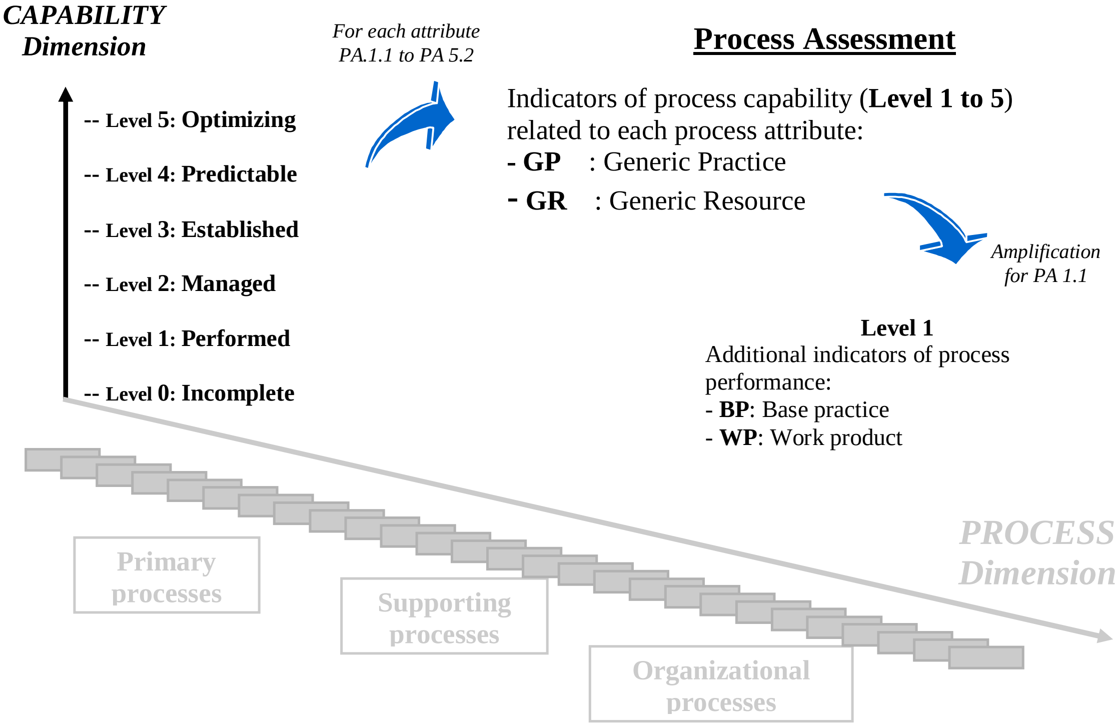


Figure 3 — Assessment indicators

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.

3.5 Process Capability Indicators

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

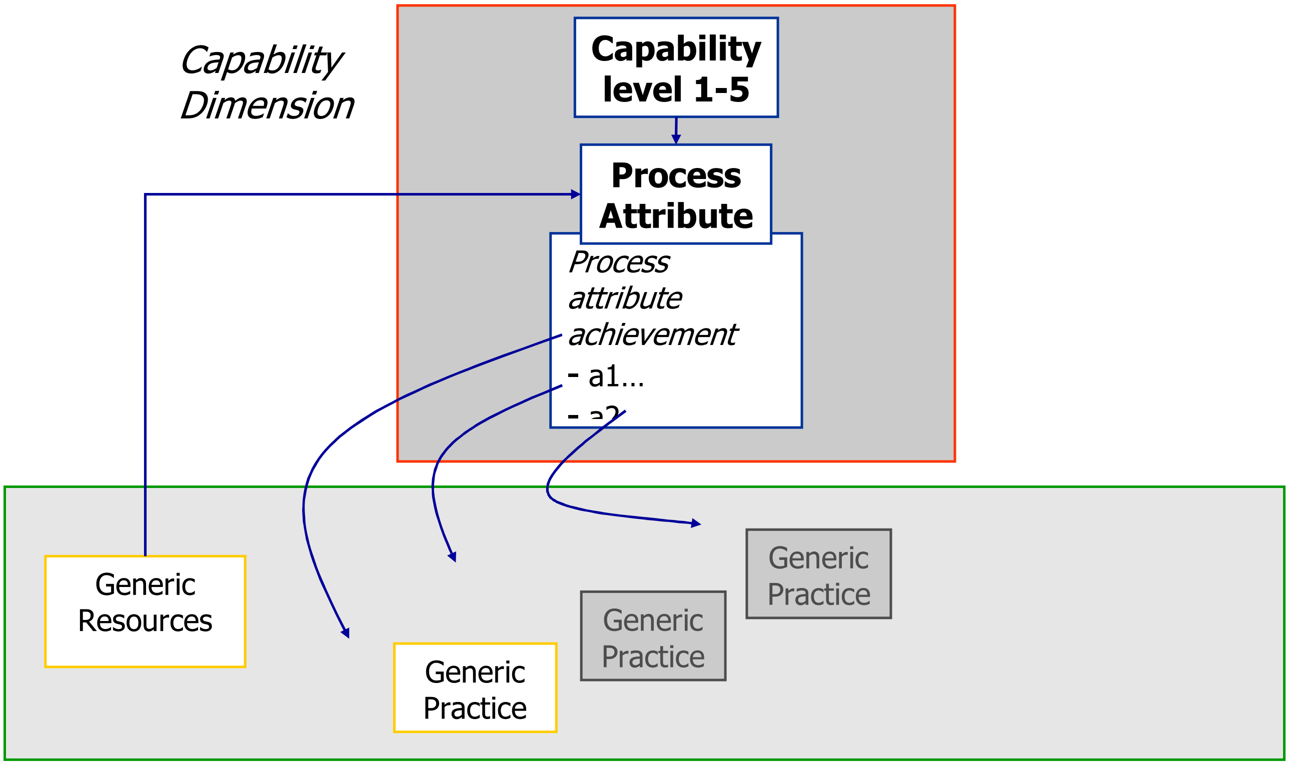


Figure 4 — Process capability indicators

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 substantiate 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.

Generic Practices (GP) are activities of a generic type and provide guidance on the implementation of the attribute's characteristics. They are designed around 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.

During the evaluation of process capability, the primary focus is on the instantiation of the generic practices. In general, performance of all generic practices is expected for full achievement of the process attribute

Generic Resources (GR) 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 fulfill the purpose of a specific attribute.

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.

3.6 Process Performance Indicators

There are two types of process performance indicators; **Base Practices (BP)** and **Work Products (WP)**. 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.

3.7 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 intended to be regarded as a mandatory set of checklists to be followed.

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.

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. 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.

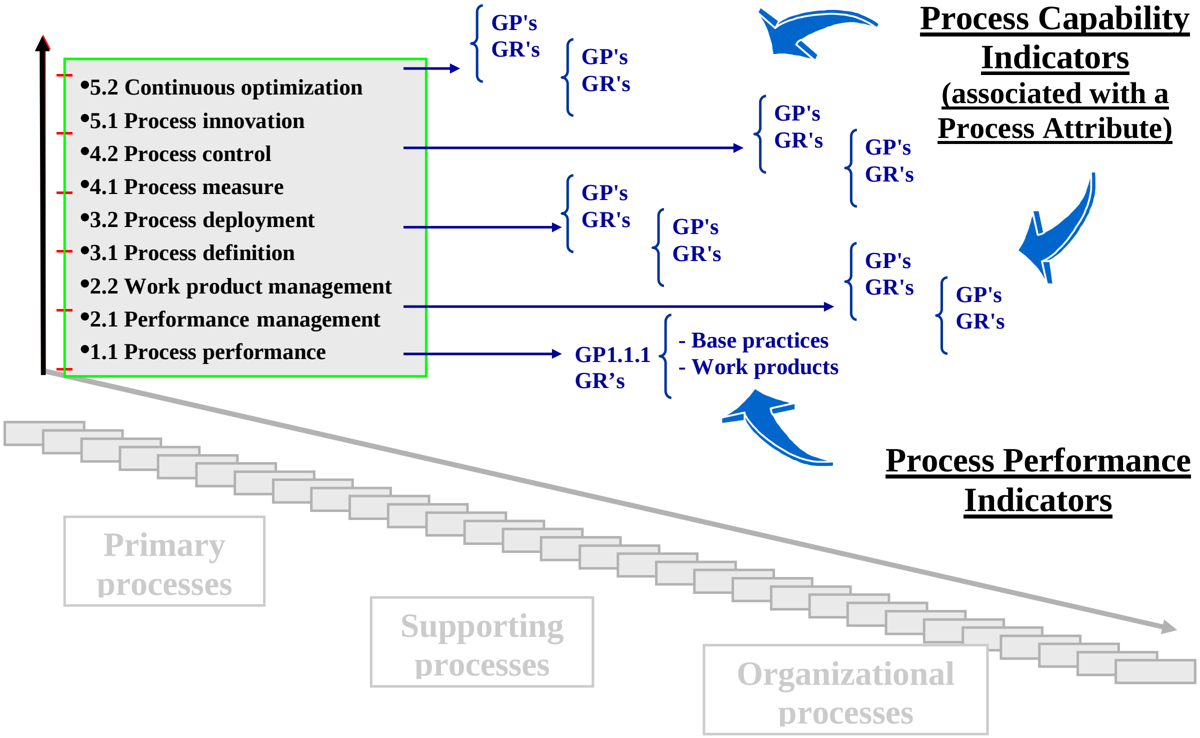


Figure 5 — Relationship between assessment indicators and process capability

4 Process Performance Indicators (level 1)

The processes in the process dimension can be directly mapped to the processes defined in the Automotive SPICE® Process Reference Model.

The individual processes are described in terms of Process Name, Process Purpose, and Process Outcomes as defined in the Automotive SPICE® Process Reference Model. Additional components are Process Identifier, and Process Notes, when needed. 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 fulfill the process outcomes;
- a number of output work products associated with each process; and
- characteristics associated with each work product.

4.1 Acquisition Process Group (ACQ)

4.1.1 ACQ.3 Contract agreement

Process ID	ACQ.3
Process Name	Contract agreement
Process Purpose	The purpose of Contract agreement process is to negotiate and approve a contract/agreement with the supplier.
Process Outcomes	As a result of successful implementation of this process: 1) a contract/agreement is negotiated, reviewed, approved and awarded to the supplier(s); 2) the contract/agreement clearly and unambiguously specifies the expectations, responsibilities, work products/deliverables and liabilities of both the supplier(s) and the acquirer; 3) mechanisms for monitoring the capability and performance of the supplier(s) and for mitigation of identified risks are reviewed and considered for inclusion in the contract conditions; and 4) proposers/tenderers are notified of the result of proposal/tender selection.
Base Practices	**ACQ.3.BP1: Negotiate the contract/agreement.** Negotiate all relevant aspects of the contract/agreement with the supplier. [Outcome 1] NOTE 1: Relevant aspects of the procurement may include • system requirements • acceptance criteria and evaluation criteria

	• linkage between payment and successful completion of acceptance testing • process requirements, process interfaces and joint processes. **ACQ.3.BP2: Specify rights and duties.** Unambiguously specify the expectations, responsibilities, work products/deliverables and liabilities of the parties in the contract/agreement. [Outcome 2] **ACQ.3.BP3: Review contract/agreement for supplier capability monitoring.** Review and consider a mechanism for monitoring the capability and performance of the supplier for inclusion in the contract/agreement conditions. [Outcome 3] **ACQ.3.BP4: Review contract/agreement for risk mitigation actions.** Review and consider a mechanism for the mitigation of identified risk for inclusion in the contract/agreement conditions. [Outcome 3] **ACQ.3.BP5: Approve contract/agreement.** The contract/agreement is approved by relevant stakeholders. [Outcome 1] **ACQ.3.BP6: Award contract/agreement.** The contract/agreement is awarded to the successful proposer/tenderer. [Outcome 1] **ACQ.3.BP7: Communicate result to tenderers.** Notify the result of the proposal/tender selection to proposers/tenders. After contract award inform all tenderers of the decision. [Outcome 4]

Output Work Products
13-09 Meeting support record [Outcome 1]
02-01 Commitment/agreement [Outcome 1]
02-00 Contract [Outcomes 1, 2, 3]
13-05 Contract review record [Outcome 1]
13-04 Communication record [Outcome 4]

4.1.2 ACQ.4 Supplier monitoring

Process ID	ACQ.4
Process Name	Supplier monitoring
Process Purpose	The purpose of the Supplier monitoring process is to monitor the performance of the supplier against agreed requirements.
Process Outcomes	As a result of successful implementation of this process: 1) joint activities between the customer and the supplier are performed as needed; 2) all information, agreed upon for exchange, is transferred between the supplier and the customer; 3) information on progress is exchanged regularly with the supplier; 4) performance of the supplier is monitored against the agreed requirements; and 5) changes to the agreement, if needed, are negotiated between the customer and the supplier and documented with the agreement. NOTE 1: Joint activities to be performed should be mutually agreed

	between the cutomer and the supplier.
Base Practices	**ACQ.4.BP1: Agree on joint processes and joint interfaces.** Establish an agreement on joint processes and joint interfaces, responsibilities, type and frequency of joint activities, communications, meetings, status reports and reviews. Agree on processes and interfaces at least for change management, problem management, quality assurance and customer acceptance. [Outcomes 1,2] NOTE 1 : The term customer in this process refers to the assessed party. The term supplier refers to the supplier of the assessed party. **ACQ.4.BP2: Exchange all relevant information.** Establish and maintain communications between customer and supplier for all agreed information, processes and interfaces. [Outcome 2] **ACQ.4.BP3: Review technical development with the supplier.** Review development with the supplier on the agreed regular basis, covering technical aspects, problems and risks. [Outcomes 3,4] **ACQ.4.BP4: Review progress of the supplier.** Review progress of the supplier regarding schedule, quality and cost on the agreed regular basis, also tracking problems to successful completion and performing risk mitigation activities. [Outcome 3, 4] **ACQ.4.BP5: Track open items.** Record open items found, pass them to the supplier and track them to closure. [Outcome 4] **ACQ.4. BP6: Act to correct deviations.** Take action when agreed targets are not achieved, to correct deviations from the agreed project plans and to prevent reoccurrence of problems identified. [Outcome 4] **ACQ.4.BP7: Agree on changes.** Changes on agreed activities proposed by either party are negotiated and the results are documented in the agreement. [Outcome 5]

Output Work Products
02-01 Commitment/agreement [Outcome 5]
13-01 Acceptance record [Outcome 4]
13-04 Communication record [Outcome 1, 2]
13-09 Meeting support record [Outcome 1]
13-14 Progress status record [Outcome 3]
13-16 Change request [Outcome 5]
13-17 Customer request [Outcome 4]
13-19 Review record [Outcome 3]
15-01 Analysis report [Outcome 4]

4.1.3 ACQ.11 Technical requirements

Process ID	ACQ.11
Process Name	Technical Requirements
Process Purpose	The purpose of the Technical requirements process is to establish the technical requirements of the acquisition. This involves the elicitation of functional and non-functional requirements that consider the

	deployment life cycle of the products so as to establish a technical requirement baseline.
Process Outcomes	As a result of successful implementation of this process: 1) the technical requirements, including environment effect evaluation, safety and security requirements where appropriate, are defined and developed to match needs and expectations; 2) the current and evolving acquisition needs are gathered and defined; 3) the requirements and potential solutions are communicated to all affected groups; 4) a mechanism is established to incorporate changed or new requirements into the established baseline; 5) a mechanism for identifying and managing the impact of changing technology to the technical requirements is defined; and 6) the requirements include compliance with relevant standards, including environment effect evaluation, safety and security standards where appropriate. NOTE 1: ISO/IEC 9126 may be a useful model to elicit technical requirements.
Base Practices	**ACQ.11.BP1: Elicitate needs.** Elicitate the needs of all relevant user groups. [Outcome 1] **ACQ.11.BP2: Define technical requirements.** Define and develop the technical requirements and potential solutions (where relevant), including environment effect evaluation, safety and security, performance, supportability requirements to match the needs and expectations of the relevant user groups. [Outcome 1] NOTE 1: This may include • the categorization, prioritization and indication of requirements • the indication of mandatory requirements classification of requirements into functional areas • using defined End User types to describe the functional requirements within an organization. **ACQ.11.BP3: Identify acquisition needs.** Gather and define the current and evolving acquisition needs. [Outcome 2] **ACQ.11.BP4: Ensure consistency.** Ensure consistency of the technical requirements with the defined acquisition needs. [Outcome 2] **ACQ.11.BP5: Identify affected groups**. Identify all groups to which the technical requirements and potential solutions should be communicated. [Outcome 3] **ACQ.11.BP6: Communicate to affected groups.** Communicate the technical requirements and potential solutions to all affected groups. [Outcome 3] NOTE 2: To ensure a better understanding • the requirements might be specified in business terms • simulation and exploratory prototyping techniques might be used. **ACQ.11.BP7: Establish a change mechanism.** Establish a mechanism to incorporate changed or new technical requirements into the established baseline. [Outcome 4]

	NOTE 3: This may include analyzing, structuring and prioritizing technical requirements according to their importance to the business. **ACQ.11.BP8: Track impact of changing technology.** Define a mechanism for identifying and managing the impact of changing technology to the technical requirements and integrate the resulting consequences into the technical requirements. [Outcome 5] **ACQ.11.BP9: Identify constraints and standards.** Identify constraints and standards applicable to the technical requirements (e.g. Open Systems standards). [Outcome 6] **ACQ.11.BP10: Ensure compliance of stated requirements.** Ensure that the technical requirements include compliance with identified relevant standards, including environment effect evaluation, safety and security standards where appropriate. [Outcome 6]

Output Work Products
13-17 Customer request [Outcome 1]
14-50 Stakeholder groups list [Outcome 1]
08-28 Change management plan [Outcome 4]
08-51 Technology monitoring plan [Outcome 5]
13-04 Communication record [Outcome 3]
17-00 Requirement specification [Outcome 6]
17-03 Customer requirements [Outcome 6]
13-24 Validation results [Outcome 6]
13-21 Change control record [Outcome 2]
14-01 Change history [Outcome 2]
14-02 Corrective action register [Outcome 2]

4.1.4 ACQ.12 Legal and administrative requirements

Process ID	ACQ.12
Process Name	Legal and administrative requirements
Process Purpose	The purpose of the Legal and administrative requirements process is to define the awarding aspects – expectations, liabilities, legal and other issues and which comply with national and international laws of contract.
Process Outcomes	As a result of successful implementation of this process: 1) a contractual approach is defined which is compliant with relevant national, international and regulatory laws, guidance and policies; 2) an agreement (contractual) terms and conditions is defined to describe how the supplier will meet the needs and expectations; 3) acceptance criteria and mechanisms for handling of breaches to the fulfillment of contract are established; 4) the rights of the acquirer to assume, modify or evaluate, directly or indirectly Intellectual Property Rights are established;

	5) warranties and service level agreements are provided for where applicable; 6) provision for the suppliers to deliver other requirements (e.g. quality plan, escrow arrangements etc.) is defined; and 7) recognized criteria for proprietary, regulatory and other product liabilities issues are established.
Base Practices	**ACQ.12.BP1: Identify relevant regulations.** Identify relevant national, international and regulatory laws, guidance and policies. [Outcome 1] **ACQ.12.BP2: Consider relevant regulations.** Consider identified relevant laws, guidance and policy when defining a contractual approach. [Outcome 2] **ACQ.12.BP3: Agree on (contractual) terms and conditions.** [Outcome 2] NOTE 1: This may include • responsibilities of the purchaser and supplier; and the basis for payments • responsibility for maintenance and upgrades. • a separate maintenance or support agreement • kind of payment, when both parties are sure in the amount of work **ACQ.12.BP4: Ensure usage of agreed terms and conditions.** Ensure the usage of agreed terms and conditions when describing how the supplier will meet the needs and expectations. [Outcome 2] **ACQ.12.BP5: Establish acceptance criteria.** [Outcome 3] **ACQ.12.BP6: Establish escalation mechanisms.** Establish mechanisms for handling of breaches to the fulfilment of contract. [Outcome 3] NOTE 2: This may include the planning the control of contract changes. **ACQ.12.BP7: Establish management of intellectual property rights.** Establish the rights of the acquirer to assume, modify or evaluate, directly or indirectly, Intellectual Property Rights. [Outcome 4] **ACQ.12.BP8: Provide for warranties and service level agreements.** Provide for warranties and service level agreements where applicable. [Outcome 5] **ACQ.12.BP9: Define provision for the suppliers.** Define provision for the suppliers to deliver other requirements like e.g. quality plan or escrow arrangements. [Outcome 6] **ACQ.12.BP10: Establish criteria for liability issues.** Establish recognized criteria for proprietary, regulatory and other product liabilities issues. [Outcome 7]

Output Work Products
10-00 Process Description [Outcome 1, 3]
02-01 Commitment/agreement [Outcome 2, 4, 5, 6, 7]
18-01 Acceptance criteria [Outcome 3]
14-02 Corrective action register [Outcome 3]

Output Work Products
02-00 Contract [Outcome 1-7]
17-00 Requirement specification [Outcome 1-7]

4.1.5 ACQ.13 Project requirements

Process ID	ACQ.13
Process Name	Project requirements
Process Purpose	The purpose of the Project requirements process is to specify the requirements to ensure the acquisition project is performed with adequate planning, staffing, directing, organizing and control over project tasks and activities.
Process Outcomes	As a result of successful implementation of this process: 1) consistency between financial, technical, contract and project requirements is established; 2) requirements for the organisational, management, controlling, and reporting aspects of a project are defined; 3) requirements for adequate staffing of projects by a competent team (e.g. legal, contractual, technical, project competent resources) with clear responsibilities and goals are defined; 4) the needs for exchanging information between all affected parties are established; 5) requirements for the completion and acceptance of interim work products and release of payments are established; 6) potential risks are identified; 7) requirements for ownership of interactions and relationships with suppliers are defined; 8) rights for use and distribution of the product by the customer and supplier are defined; and 9) support and maintenance requirements are established.
Base Practices	**ACQ.13.BP1: Identify relevant groups.** Identify relevant parties/stakeholders and experts for financial, technical, contract and project issues. [Outcome 1] **ACQ.13.BP2: Communicate with relevant groups.** Communicate with the relevant parties regarding the specification of financial, technical, contract and project requirements. [Outcome 1] **ACQ.13.BP3: Define organizational requirements.** Define requirements for the organizational aspect of the project. [Outcome 2] NOTE 1: Requirements for the organizational refer to the organization of the people on the project e.g. who is responsible etc. at different levels. **ACQ.13.BP4: Define management requirements.** Define requirements for the management, controlling and reporting aspect of the project. [Outcome 2] NOTE 2: Requirements for the management, controlling and reporting aspect of the project may be • the necessity to structure the acquisition process in logical

	phases • the use of experiences and skills of third parties • the sketch of a work breakdown structure • that all documentation conforms to appropriate standards, and should be contractually agreed with the suppliers • requirements to supplier’s processes, process interfaces and joint processes. **ACQ.13.BP5: Identify required competencies.** Identify required competencies (e.g. legal, contractual, technical and project competencies) for key resources. [Outcome 3] **ACQ.13.BP6: Define responsibilities and goals.** Define responsibilities and goals of the team members. [Outcome 3] **ACQ.13.BP7: Identify information needs.** Identify information needs of the relevant parties. [Outcome 4] **ACQ.13.BP8: Define exchange of information.** Consider how exchange of information may be effected. [Outcome 4] NOTE 3: Techniques for supporting the exchange of information may include electronic solutions, face-to-face interactions and decisions about the frequency. **ACQ.13.BP9: Establish criteria for interim work products.** Establish requirements for the completion and acceptance of interim work products. [Outcome 5] **ACQ.13.BP10: Establish payment requirements.** Establish requirements for the release of payments. [Outcome 5] NOTE 4: This may include for example the decision to link the major proportion of the supplier’s payment to successful completion of the acceptance test, the definition of supplier performance criteria and ways to measure, test and link them to the payment schedule or the decision that payments be made on agreed results. **ACQ.13.BP11: Identify risks.** Identify risks associated with project life cycle and with suppliers. [Outcome 6] NOTE 5: Potential risk areas are for example stakeholder (customer, user, and sponsor), product (uncertainty, complexity), processes (acquisition, management, support, and organization), resources (human, financial, time, infrastructure), context (corporate context, project context, regulatory context, location) or supplier (process maturity, resources, experience). **ACQ.13.BP12: Communicate risks.** Assure that all identified risks are communicated to the relevant parties. [Outcome 6] **ACQ.13.BP13: Define ownership of relationships.** Define requirements for ownership of interactions and relationships with suppliers. [Outcome 7] NOTE 6: This may include for example who has the lead on which type of interaction, who maintains an open-issue-list, who are the contact persons for management, technical and contractual issues, the frequency and type of interaction, to whom the relevant information is distributed. **ACQ.13.BP14: Define rights for use and distribution.** Define rights for use and distribution of the product by the customer and supplier. [Outcome 8] NOTE 7: This may include unrestricted right of product use or delivery of source code trial installation for „sale or return“.

	ACQ.13.BP15: Establish support and maintenance requirements. [Outcome 9] NOTE 8: This may include for example training requirements, the decision if support and maintenance should be conducted in-house or by a third party or the establishment of service level agreements.

Output Work Products
17-00 Requirement specification [Outcome 1-9]
13-19 Review record [Outcome 1]
13-20 Risk action request [Outcome 6]
02-00 Contract [Outcome 1-9]

4.1.6 ACQ.14 Request for proposals

Process ID	ACQ.14
Process Name	Request for proposals
Process Purpose	The purpose of the Request for proposals process is to prepare and issue the necessary acquisition requirements. The documentation will include, but not be limited to, the contract, project, finance and technical requirements to be provided for use in the Call For Proposals (CFP)/Invitation To Tender (ITT).
Process Outcomes	As a result of successful implementation of this process: 1) rules are defined for proposal/tender invitation and evaluation which comply with the acquisition policy and strategy; 2) the baseline technical and non-technical requirements are assembled to accompany the CFP/ITT; 3) the agreement (contractual) terms of reference and conditions for CFP/ITT are established; 4) the financial terms of reference for costs and payments for CFP/ITT are defined; 5) the project terms of reference for CFP/ITT are defined; 6) the technical terms of reference for CFP/ITT are defined; and 7) a CFP/ITT is prepared and issued in accordance with acquisition policies and which complies with relevant national, international and regulatory laws, requirements, and policies.
Base Practices	**ACQ.14.BP1: Define rules for CFP/ITT.** Define rules for proposal/tender invitation and evaluation which comply with the acquisition policy and strategy. [Outcome 1] NOTE 1: Examples are: • a rule that a multiphase tendering process should be used (reasonable when uncertainty is high) • pre-planned interactions with suppliers • a rule that the supplier will be informed about the evaluation criteria • a rule that a timetable should be stipulated to allow suppliers specified times to respond to the call for tender

	• a rule prescribing to use a two stage evaluation process (reduce a long list of suppliers to a short list of suppliers who are invited to tender). **ACQ.14.BP2: Assemble requirements.** Assemble the baseline technical and non-technical requirements to accompany the CFP/ITT. [Outcome 2] NOTE 2: The goal is to provide the supplier with an in-depth understanding of your business to enable him to offer the specified solution. **ACQ.14.BP3: Establish terms and conditions for CFP/ITT.** Establish the agreement (contractual) terms of reference and conditions for CFP/ITT. [Outcome 3] **ACQ.14.BP4: Define financial terms.** Define the financial terms of reference for costs and payments for CFP/ITT. [Outcome 4] **ACQ.14.BP5: Define project terms.** Define the project terms of reference for CFP/ITT. [Outcome 5] NOTE 3: The overall purpose of this is to communicate the documented business requirements of the acquisition to the suppliers. **ACQ.14.BP6: Define technical terms.** Define the technical terms of reference for CFP/ITT. [Outcome 6] **ACQ.14.BP7: Identify relevant regulations.** Identify international and regulatory laws, requirements and policies which are relevant for CFP preparation. [Outcome 7] **ACQ.14.BP8: Prepare and Issue a CFP/ITT.** Prepare and Issue a CFP/ITT in accordance with acquisition policies and which complies with relevant national, international and regulatory laws, requirements, and policies. [Outcome 7]

Output Work Products
19-11 Validation strategy [Outcome 1]
17-00 Requirement specification [Outcome 2, 4, 5, 6]
02-01 Commitment/agreement [Outcome 3]
12-01 Request for proposal [Outcome 7]

4.1.7 ACQ.15 Supplier qualification

Process ID	ACQ.15
Process Name	Supplier qualification
Process Purpose	The purpose of the Supplier qualification process is to evaluate and determine if the potential supplier(s) have the required qualification for entering the proposal/tender evaluation process. In this process, the technical background, quality system, servicing, user support capabilities and etc. will be evaluated.
Process Outcomes	As a result of successful implementation of this process: 1) criteria are established for qualifying suppliers; 2) supplier capability determination is performed as necessary; 3) the suppliers which possess required qualification are short-listed

	for tender solution(s) evaluation; 4) any shortfalls in capability are identified and evaluated; and 5) any corrective action required by the acquirer is evaluated and performed.
Base Practices	**ACQ.15.BP1: Establish qualification criteria.** Establish criteria for qualifying suppliers. [Outcome 1] NOTE 1: This could include • technical background of the supplier • quality system on the supplier side • servicing • user support capabilities. **ACQ15.BP2: Evaluate supplier.** Perform supplier capability determination as necessary. [Outcome 2] NOTE 2: It is often required that the supplier should have an ISO 9001 and/or an ISO 16949 certificate. NOTE 3: Establish the specific target levels against which the supplier's capability will be measured. **ACQ.15.BP3: Short-list suppliers with required qualification.** Short-list the suppliers for tender solution(s) evaluation which possess required qualification. [Outcome 3] **ACQ.15.BP4: Evaluate any shortfalls.** Identify and evaluate any shortfalls. [Outcome 4] NOTE 4: This may include: developing a method for evaluating risk related to the supplier or the proposed solution. **ACQ.15.BP5: Perform corrective actions.** Evaluate and perform corrective action required by the acquirer. [Outcome 5]

Output Work Products
18-50 Supplier qualification criteria [Outcome 1]
15-21 Supplier evaluation report [Outcome 2]
14-05 Preferred suppliers register [Outcome 3]
15-16 Improvement opportunity [Outcome 4]
14-02 Corrective action register [Outcome 5]

4.2 Supply Process Group (SPL)

4.2.1 SPL.1 Supplier tendering

Process ID	SPL.1
Process Name	Supplier tendering
Process Purpose	The purpose of Supplier tendering process is to establish an interface to respond to customer inquiries and requests for proposal, prepare and submit proposals, and confirm assignments through the establishment of a relevant agreement/contract.

Process Outcomes	As a result of successful implementation of this process: 1) a communication interface is established and maintained in order to respond to customer inquiries and requests for proposal; 2) request for proposal are evaluated according to defined criteria to determine whether or not to submit a proposal; 3) the need to undertake preliminary surveys or feasibility studies is determined; 4) suitable staff are identified to performed the proposed work; 5) a supplier proposal is prepared in response to the customer request; and 6) formal confirmation of agreement is obtained.
Base Practices	**SPL.1.BP1: Establish communication interface.** A communication interface is established and maintained in order to respond to customer inquiries or requests for proposal. [Outcome 1] **SPL.1.BP2: Perform customer enquiry screening.** Perform customer enquiry screening to ensure validity of contract, ensuring the right person is quickly identified to process the lead. [Outcome 1] **SPL.1.BP3: Establish customer proposal evaluation criteria.** Establish evaluation criteria to determine whether or not to submit a proposal based on appropriate criteria. [Outcome 2] **SPL.1.BP4: Evaluate customer request for proposal.** Requests for proposal are evaluated according to appropriate criteria. [Outcome 2] **SPL.1.BP5: Determine need for preliminary pre-studies.** Determine need for preliminary pre-studies to ensure that a firm quotation can be made based on available requirements. [Outcome 3] **SPL.1.BP6: Identify and nominate staff.** Identify and nominate staff with appropriate competency for the assignment. [Outcome 4] **SPL.1.BP7: Prepare supplier proposal response.** A supplier proposal response is prepared in response to the customer request. [Outcome 5] **SPL.1.BP8: Establish confirmation of agreement.** Formally confirm the agreement to protect the interests of customer and supplier. [Outcome 6] NOTE.1: The nature of the commitment should be agreed and evidenced in writing. Only authorized signatories should be able to commit to a contract.

Output Work Products
02-01 Commitment/agreement [Outcome 6]
08-12 Project plan [Outcome 4]
12-04 Supplier proposal response [Outcome 5]
13-04 Communication record [Outcome 1, 6]
13-15 Proposal review record [Outcome 3, 4]
13-19 Review record [Outcome 2]

4.2.2 SPL.2 Product release

Process ID	SPL.2
Process Name	Product release
Process Purpose	The purpose of Product release process is to control the release of a product to the intended customer.
Process Outcomes	As a result of successful implementation of this process: 1) the contents of the product release are determined; 2) the release is assembled from configured items; 3) the release documentation is defined and produced; 4) the release delivery mechanism and media is determined; 5) release approval is effected against defined criteria; 6) the product release is made available to the intended customer; and 7) confirmation of release is obtained.
Base Practices	**SPL.2.BP1: Define the functional content of releases.** Establish a plan for releases that identify the functionality to be included in each release. [Outcomes 1, 3] NOTE 1: The plan should point out which application parameters influencing the identified functionality are effective for which release. **SPL.2.BP2: Define release products.** The products associated with the release are defined. [Outcome 1] NOTE 2 The release products may include programming tools where these are stated. In automotive terms a release may be associated with a sample e.g. A, B, C. **SPL.2.BP3: Establish a product release classification and numbering scheme.** A product release classification and numbering scheme is established based upon the intended purpose and expectations of the release(s). [Outcome 2] NOTE 3: A release numbering implementation may include • the major release number • the feature release number • the defect repair number • the alpha or beta release • the iteration within the alpha or beta release. **SPL.2.BP4: Define the build activities and build environment.** A consistent build process is established and maintained. [Outcome 2] NOTE 4: A specified and consistent build environment should be used by all parties. **SPL.2.BP5: Build the release from configured items.** The release is built from configured items to ensure integrity. [Outcome 2] NOTE 5: Where relevant the software release should be programmed onto the correct hardware revision before release. **SPL2.BP6: The type, service level and duration of support for a release are communicated.** The type, service level and duration of support for a release is identified and communicated. [Outcome 3] **SPL.2.BP7: Determine the delivery media type for the release.** The media type for product delivery is determined in accordance with the needs of the customer. [Outcome 4] NOTE 6: The media type for delivery may be intermediate (placed on an adequate media and delivered to customer), or direct (such as

	delivered in firmware as part of the package) or a mix of both. The release may be delivered electronically by placement on a server. The release may also need to be duplicated before delivery. **SPL.2.BP8: Identify the packaging for the release media.** The packaging for different types of media is identified. [Outcome 4] NOTE 7: The packaging for certain types of media may need physical or electronic protection for instance specific encryption techniques. **SPL.2.BP9: Define and produce the product release documentation/release notes.** Ensure that all documentation to support the release is produced, reviewed, approved and available. [Outcome 3] **SPL.2.BP10: Ensure product release approval before delivery.** Criteria for the product release are satisfied before release takes place. [Outcome 5] **SPL.2.BP11: Ensure consistency.** Ensure consistency between software release number, paper label and EPROM-Label (where relevant). [Outcome 5] **SPL.2.BP12: Provide a release note.** A release is supported by information detailing key characteristics of the release. [Outcome 6] NOTE 8: The release note may include an introduction, the environmental requirements, installation procedures, product invocation, new feature identification and a list of defect resolutions, known defects and workarounds. **SPL.2.BP13: Deliver the release to the intended customer.** The product is delivered to the intended customer with positive confirmation of receipt. [Outcomes 6, 7] NOTE 9: Confirmation of receipt may be achieved by hand, electronically, by post, by telephone or through a distribution service provider. NOTE 10: These practices are typically supported by the SUP.8 Configuration Management process. NOTE 11: Refer to ISO/IEC 9127: 1988 'User Documentation and Cover Information for Consumer Software Packages' for guidance on packaging aspects of software product supply.

Output Work Products
06-01 Customer manual [Outcome 3]
08-16 Release plan [Outcome 1, 3]
11-03 Product release information [Outcome 1, 3, 4, 6]
11-04 Product release package [Outcome 2, 3, 6]
11-07 Temporary solution [Outcome 6]
13-06 Delivery record [Outcome 6,7]
13-13 Product release approval record [Outcome 5]
15-03 Configuration status report [Outcome 2]
18-06 Product release criteria [Outcome 5, 7]

4.3 Engineering Process Group (ENG)

4.3.1 ENG.1 Requirements elicitation

Process ID	ENG.1
Process Name	Requirements elicitation
Process Purpose	The purpose of the Requirements elicitation process is to gather, process, and track evolving customer needs and requirements throughout the life of the product and/or service so as to establish a requirements baseline that serves as the basis for defining the needed work products.
Process Outcomes	As a result of successful implementation of this process: 1) continuing communication with the customer is established; 2) agreed customer requirements are defined and baselined; 3) a change mechanism is established to evaluate and incorporate changes to customer requirements into the baselined requirements based on changing customer needs; 4) a mechanism is established for continuous monitoring of customer needs; 5) a mechanism is established for ensuring that customers can easily determine the status and disposition of their requests; and 6) changes arising from changing technology and customer needs are identified, the associated risks assessed and their impact managed. NOTE 1: Requirements elicitation may involve the customer and the supplier. NOTE 2: The agreed customer requirements and evaluation of any changes may be based on feasibility studies and/or cost and time analyses. NOTE 3: An information management system may be needed to manage, store and reference any information gained and needed in defining agreed customer requirements. NOTE 4: Any changes should be communicated to the customer before implementation in order that the impact, in terms of time, cost and functionality can be evaluated. NOTE 5: Agreed customer requirements may result directly in the production of a system or software requirements specification.
Base Practices	**ENG.1.BP1: Obtain customer requirements and requests.** Obtain and define customer requirements and requests through direct solicitation of customer input and through review of customer business proposals (where relevant), target operating and hardware environment, and other documents bearing on customer requirements. [Outcomes 1, 4] NOTE 1: The information needed to keep traceability for each customer requirement has to be gathered and documented. **ENG.1.BP2: Understand customer expectations.** Ensure that both supplier and customer understand each requirement in the same way. [Outcome 2] NOTE 2: Review with customers their requirements and requests to better understand their needs and expectations. Refer to the process SUP.4 Joint Review.

	ENG.1.BP3: Agree on requirements. Obtain an explicit agreement from all relevant parties to work to these requirements. [Outcome 2] **ENG.1.BP4: Establish customer requirements baseline.** Formalize the customer's requirements and establish as a baseline for project use and monitoring against customer needs. The supplier should determine the requirements not stated by the customer but necessary for specified and intended use and include them in the baseline. [Outcomes 2, 3] **ENG.1.BP5: Manage customer requirements changes.** Manage all changes made to the customer requirements against the customer requirements baseline to ensure enhancements resulting from changing technology and customer needs are identified and that those who are affected by the changes are able to assess the impact and risks and initiate appropriate change control and mitigation actions. [Outcomes 3, 6] NOTE 3: Requirements change may arise from different sources as for instance changing technology and customer needs, legal constraints. **ENG.1.BP6: Establish customer-supplier query communication mechanism.** Provide a means by which the customer can be aware of the status and disposition of their requirements changes and the supplier can have the ability to communicate necessary information, including data, in a customer-specified language and format. [Outcome 5] NOTE 4: This may include joint meetings with the customer or formal communication to review the status for their requirements and requests; Refer to the process SUP.4 Joint Review. NOTE 5: The formats of the information communicated by the supplier may include computer-aided design data and electronic data exchange.

Output Work Products
13-00 Record [Outcomes: 4, 5]
13-04 Communication record [Outcomes: 1, 4]
13-21 Change control record [Outcomes: 3, 4]
15-01 Analysis report [Outcomes: 2, 3, 6]
08-19 Risk management plan [Outcome 6]
08-20 Risk mitigation plan [Outcome 6]
17-03 Customer Requirements [Outcomes: 1, 2]

4.3.2 ENG.2 System requirements analysis

Process ID	ENG.2
Process Name	System requirements analysis
Process Purpose	The purpose of the System requirements analysis process is to transform the defined customer requirements into a set of desired system technical requirements that will guide the design of the system.
Process Outcomes	As a result of successful implementation of this process:

	1) a defined set of system requirements is established; 2) system requirements are categorized and analyzed for correctness and testability; 3) the impact of the system requirements on the operating environment is evaluated; 4) prioritization for implementing the system requirements is defined**;** 5) the system requirements are approved and updated as needed; 6) consistency and bilateral traceability are established between customer requirements and system requirements; 7) changes to the customer's requirements baseline are evaluated for cost, schedule and technical impact; and 8) the system requirements are communicated to all affected parties and baselined. NOTE 1: System requirements may be categorized in terms of feasibility and risk. NOTE 2: System requirements may typically include functional, performance, interface, design requirements and verification criteria. Verification criteria define the qualitative and quantitative criteria for verification of a requirement. Verification criteria demonstrate that a requirement can be verified within agreed constraints. NOTE 3: Analysis of system requirements for testability includes development of verification criteria.
Base Practices	**ENG.2.BP1: Identify System Requirements.** Use the customer requirements as the basis for identifying the required functions and capabilities of the system and document the system requirements in a system requirements specification. [Outcome 1] NOTE 1: System requirements include: functions and capabilities of the system; business, organizational and user requirements; safety, security, human-factors, engineering (ergonomics), interface, operations, and maintenance requirements; design constraints and qualification requirements (ISO/IEC 12207) as well as application parameters influencing system functions and capabilities. **ENG.2.BP2: Analyze system requirements.** Analyze the identified system requirements in terms of technical feasibility, risks and testability. [Outcome 2] NOTE 2: Verification criteria for all system requirements should be defined for further development of system test cases. NOTE 3: The results of the analysis may be used for categorization of the requirements (see also ENG.2.BP.4). **ENG.2.BP3: Determine the impact on the operating environment.** Determine the interfaces between the system requirements and other components of the operating environment, and the impact that the requirements will have. [Outcome 3] **ENG.2.BP4: Prioritize and categorize system requirements.** Prioritize and categorize the identified and analyzed system requirements and map them to future releases of the system. [Outcomes 2, 4] NOTE 4: Refer to the process SPL.2 Product Release. **ENG.2.BP5: Evaluate and update system requirements.** Evaluate system requirements and changes to the customer's requirements baseline in terms of cost, schedule and technical impact. Approve the system requirements and all changes to them and update the system

	requirements specification. [Outcome 5, 7] **ENG.2.BP6: Ensure consistency and bilateral traceability of customer requirements to system requirements.** Ensure consistency of customer requirements to system requirements including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the customer's requirements and system requirements including verification criteria. [Outcome 6] **ENG.2.BP7: Communicate system requirements.** Establish communication mechanisms for dissemination of system requirements, and updates to requirements to all relevant parties. [Outcome 8]

Output Work Products
01-51 Application parameter [Outcome 1]
08-16 Release Plan [Outcome 4, 5]
13-04 Communication record [Outcome 8]
13-21 Change control record [Outcome 7]
13-22 Traceability record [Outcome 6]
15-01 Analysis report [Outcome 2, 3, 4, 7]
17-08 Interface requirements specification [Outcome 3]
17-12 System requirements specification [Outcome 1, 5]
17-50 Verification criteria [Outcome 2]

NOTE: For system requirements specifications, the IEEE-Standard 1233-1998, Guide for Developing System Requirements Specifications might be used.

4.3.3 ENG.3 System architectural design

Process ID	ENG.3
Process Name	System architectural design
Process Purpose	The purpose of the System architectural design process is to identify which system requirements are to be allocated to which elements of the system.
Process Outcomes	As a result of successful implementation of this process: 1) a system architectural design is defined that identifies the elements of the system and meets the defined systems requirements; 2) the system requirements are allocated to the elements of the system; 3) internal and external interfaces of each system element are defined; 4) verification between the system requirements and the system architectural design is performed; 5) consistency and bilateral traceability are established between

	system requirements and system architectural design; and 6) the system requirements, the system architectural design, and their relationships are baselined and communicated to all affected parties. NOTE : Definition of system architectural design includes development of verification criteria. Verification criteria define the qualitative and quantitative criteria for verification of a requirement. Verification criteria demonstrate that a requirement can be verified within agreed constraints.
Base Practices	**ENG.3.BP1: Define system architectural design.** Establish the system architectural design that identifies the elements of the system with respect to the functional and non-functional system requirements. [Outcome 1] NOTE 1: The system might be decomposed into several subsystems on different system levels, if necessary. **ENG.3.BP2: Allocate System Requirements.** Allocate all system requirements to the elements of the system architectural design. [Outcome 2] **ENG.3.BP3: Define Interfaces.** Identify, develop and document the internal and external interfaces of each system element. [Outcome 3] NOTE 2: Interfaces include specific interfaces required for application parameter usage. **ENG.3.BP4: Develop verification criteria.** Define the verification criteria for each element of the system concerning the functional and non-functional system requirements based on the system architectural design. [Outcome 1] **ENG.3.BP5: Verify System Architectural Design**. Ensure that the system architecture meets all system requirements. [Outcome 4] **ENG.3.BP6: Ensure consistency and bilateral traceability of system requirements to system architectural design.** Ensure consistency of system requirements including verification criteria to system architectural design including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the system requirements including verification criteria and system architectural design including verification criteria. [Outcome 5] **ENG.3.BP7: Communicate system architectural design.** Establish communication mechanisms for dissemination of the system architectural design to all relevant parties. [Outcome 6]

Output Work Products
01-00 Configuration item [Outcome 6]
04-06 System architectural design [Outcome 1, 2, 3, 4]
13-04 Communication record [Outcome 6]
13-22 Traceability record [Outcome 1, 5]
13-25 Verification results [Outcome 4]
17-50 Verification criteria [Outcome 1]

4.3.4 ENG.4 Software requirements analysis

Process ID	ENG.4
Process Name	Software requirements analysis
Process Purpose	The purpose of the Software requirements analysis process is to establish the software requirements for the system.
Process Outcomes	As a result of successful implementation of this process: 1) the software requirements to be allocated to the software elements of the system and their interfaces are defined; 2) software requirements are categorized and analyzed for correctness and testability; 3) the impact of software requirements on the operating environment is evaluated; 4) prioritization for implementing the software requirements is defined; 5) the software requirements are approved and updated as needed; 6) consistency and bilateral traceability are established between system requirements and software requirements; and consistency and bilateral traceability are established between system architectural design and software requirements; 7) changes to the software requirements are evaluated for cost, schedule and technical impact; and 8) the software requirements are baselined and communicated to all affected parties. NOTE 1: Requirements may be categorized in terms of feasibility and risk. NOTE 2: Requirements may typically include functional, performance, interface, design requirements and verification criteria. Verification criteria define the qualitative and quantitative criteria for verification of a requirement. Verification criteria demonstrate that a requirement can be verified within agreed constraints. NOTE 3: Where software is the only system element it is often referred to a software system. NOTE 4: Analysis of software requirements for testability includes development of verification criteria.
Base Practices	**ENG.4.BP1: Identify software requirements.** Use the system requirements and the system architectural design as the basis for identifying the functional and non-functional requirements of the software and document the software requirements in a software requirements specification. [Outcome 1] NOTE1: In case of software development only, the system requirements and the system architectural design refers to a given operating environment (see also NOTE 4). In that case, customer requirements should be used as the basis for identifying the required functions and capabilities of the software as well as for identifying application parameters influencing software functions and capabilities. **ENG.4.BP2: Analyze software requirements.** Analyze the identified software requirements in terms of technical feasibility, risks and testability. [Outcome 2] NOTE 2: Verification criteria for all software requirements should be defined for further development of software test cases. NOTE 3: The results of the analysis may be used for categorization of the requirements.

	ENG.4.BP3: Determine the impact on the operating environment. Determine the interfaces between the software requirements, system requirements and/or other components of the operating environment, and the impact that the requirements will have. [Outcome 3] NOTE 4: The operating environment is defined as the system that the software works in (e.g. hardware, operating system, etc.). **ENG.4.BP4: Prioritize and categorize software requirements.** Prioritize and categorize the identified and analyzed software requirements and map them to future releases. [Outcomes 2,4] NOTE 5: See also SPL.3 – Product Release Process. **ENG.4.BP5: Evaluate and update software requirements.** Evaluate software requirements and changes to the system requirements and/or system architectural design in terms of cost, schedule and technical impact. Approve the software requirements and update the software requirements specification. [Outcome 5**,** 7] **ENG.4.BP6: Ensure consistency and bilateral traceability of system requirements to software requirements.** Ensure consistency of system requirements including verification criteria to software requirements including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the system requirements including verification criteria and software requirements including verification criteria. [Outcome 6] NOTE 6: In case of software development only, the system requirements and system architectural design refer to a given operating environment (see also NOTE 4). In that case, consistency and bilateral traceability will be of customer requirements to software requirements. **ENG.4.BP7: Ensure consistency and bilateral traceability** of **system architectural design to software requirements.** Ensure consistency of system architectural design including verification criteria to software requirements including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the system architectural design including verification criteria and software requirements including verification criteria. [Outcome 6] NOTE 7: In case of software development only, there may not be a system architectural design (see also NOTE 6). **ENG.4.BP8: Communicate software requirements.** Establish communication mechanisms for dissemination of software requirements, and updates to requirements to all relevant parties. [Outcome 8]

Output Work Products
01-00 Configuration item [Outcome 8]
01-51 Application parameter [Outcome 1]
08-16 Release Plan [Outcome 4, 5]
13-04 Communication record [Outcome 8]
13-21 Change control record [Outcome 7]
13-22 Traceability record [Outcome 1, 6]
15-01 Analysis report [Outcome 2, 3, 7]
17-08 Interface requirements specification [Outcome

Output Work Products
1]
17-11 Software requirements specification [Outcome 1, 2, 4, 5, 6]
17-50 Verification criteria [Outcome 2]

NOTE: For software requirements specifications, the IEEE-Standard 830-1998, Recommended Practice for Software Requirements Specifications might be used.

4.3.5 ENG.5 Software design

Process ID	ENG.5
Process Name	Software design
Process Purpose	The purpose of the Software design process is to provide a design for the software that implements and can be verified against the software requirements.
Process Outcomes	As a result of successful implementation of this process: 1) a software architectural design is defined that identifies the components of the software and meets the defined software requirements; 2) the software requirements are allocated to the elements of the software; 3) internal and external interfaces of each software component are defined; 4) the dynamic behaviour and resource consumption objectives of the software components are defined; 5) a detailed design is developed that describes software units that can be implemented and tested; 6) consistency and bilateral traceability are established between software requirements and software architectural design; and 7) consistency and bilateral traceability are established between software architectural design and software detailed design. NOTE 1: The software design process should take into account all software components such as customer supplied software, third party software and sub-contractor software. NOTE 2: Definition of software architectural design and detailed design includes development of verification criteria.
Base Practices	**ENG.5.BP1: Develop software architectural design**. Use the functional and non-functional software requirements to develop a software architecture that describes the top-level structure and all the software components including software components available for reuse. [Outcome 1] NOTE 1: See also REU.2 – Reuse Program Management. **ENG.5.BP2: Allocate software requirements**. Allocate all software requirements to the components of the software architectural design. [Outcome 2]

	ENG.5.BP3: Define interfaces. Identify, develop and document the internal interfaces between the software components and external interfaces of the software components. [Outcome 3] NOTE 2: Interfaces include specific interfaces required for application parameter usage. **ENG.5.BP4: Describe dynamic behaviour**. Evaluate and document the dynamic behaviour of and interaction between software components. [Outcome 4] NOTE 3: Dynamic behaviour is determined by operating modes (e.g. start-up, shutdown, normal mode, calibration, diagnosis, etc.), processes and process intercommunication, tasks, threads, time slices, interrupts, etc. and shall be evaluated over the complete range of allowed application parameter combinations. NOTE 4: Task execution time is highly depended on target and loads on the target which should be considered and documented. **ENG.5.BP5: Define resource consumption objectives**. Determine and document the resource consumption objectives for all software components. [Outcome 4] NOTE 5: Resource consumption is typically determined for resources like Memory (ROM, RAM, external/internal EEPROM), CPU load, etc. and can vary over the complete range of allowed application parameter combinations. **ENG.5.BP6: Develop detailed design**. Decompose the software architectural design into a detailed design for each software component describing all software units and their interfaces. [Outcome 5] NOTE 6: Task execution time is highly depended on target and loads on the target which should be considered and documented **ENG.5.BP7: Develop Verification Criteria**. Define the verification criteria for each component concerning their dynamic behaviour, interfaces and resource consumption based on the software architectural design. [Outcome 5] NOTE 7: Verification criteria should be developed over the complete range of allowed application parameter combinations. **ENG.5.BP8: Verify Software Design.** Ensure that the software design meets all software requirements. [Outcomes 4, 5] NOTE 8: Software design should be verified over the complete range of allowed application parameter combinations. **ENG.5.BP9: Ensure consistency and bilateral traceability of software requirements to software architectural design.** Ensure consistency of software requirements including verification criteria to software architectural design including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the software requirements including verification criteria and software architectural design including verification criteria. [Outcome 6] **ENG.5.BP10: Ensure consistency and bilateral traceability of software architectural design to software detailed design.** Ensure consistency of software architectural design including verification criteria to software detailed design including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the software architectural design including verification criteria and software detailed design including verification criteria. [Outcome 7]

Output Work Products
04-04 Software architectural design [Outcome 1, 2, 3, 4, 6]
04-05 Software detailed design [Outcome 2, 3, 4, 5, 6]
13-22 Traceability record [Outcome 2, 6, 7]
13-25 Verification results [Outcome 4, 5]
17-50 Verification criteria [Outcome 5]

4.3.6 ENG.6 Software construction

Process ID	ENG.6
Process Name	Software construction
Process Purpose	The purpose of the Software construction process is to produce verified software units that properly reflect the software design.
Process Outcomes	As a result of successful implementation of this process: 1) a unit verification strategy is developed for software units consistent with the software design; 2) software units defined by the software design are analyzed for correctness and testability; 3) software units defined by the software design are produced; 4) software units are verified according to the unit verification strategy; 5) results of unit verification are recorded; and 6) consistency and bilateral traceability are established between software detailed design and software units; NOTE 1: Analysis of software units will include prioritization and categorization of software units. NOTE 2: Unit verification will include unit testing and may include static analysis, code inspection/reviews, checks against coding standards and guidelines, and other techniques.
Base Practices	**ENG.6.BP1: Define a unit verification strategy**. Develop a strategy for verification and re-verifying the software units. The strategy should define how to achieve the desired quality with the available and suitable techniques over the complete range of allowed application parameter combinations. [Outcome 1] NOTE 1: Possible techniques are static/dynamic analysis, code inspection/review, white/black box testing, code coverage, etc.. NOTE 2: The unit verification strategy must include a unit test strategy if unit testing is stipulated by contract. **ENG.6.BP2: Analyze software units.** Analyze the defined software units in terms of interoperability, interaction, criticality, technical complexity, risks and testability. [Outcome 2] NOTE 3: The results of the analysis may be used for categorization of software units. **ENG.6.BP3: Prioritize and categorize software units.** Prioritize and categorize the identified and analyzed software units and map them to

	future releases. [Outcome 2] **ENG.6.BP4: Develop software units**. Develop and document the executable representations of each software unit. [Outcome 3] NOTE 4: In the development of software units code generation tools can be used to reduce the manual coding effort. **ENG.6.BP5: Develop unit verification criteria**. Develop and document verification criteria to verify that each software unit satisfies its design, functional and non-functional requirements over the complete range of allowed application parameter combinations. [Outcome 3] NOTE 5: The verification criteria should include unit test cases, unit test data, coverage goals and coding standards that include the usage of MISRA rules and defined coding guidelines. NOTE 6: The verification criteria must include test specifications for software units including test cases if unit testing is stipulated by contract. **ENG.6.BP6: Verify software units**. Verify software units against the detailed design according to the verification strategy and the unit verification criteria. [Outcome 4] **ENG.6.BP7: Record the results of unit verification.** Document the results of unit verification and communicate to all relevant parties. [Outcome 5] **ENG.6.BP8: Ensure consistency and bilateral traceability of software detailed design to software units.** Ensure consistency of software detailed design including verification criteria to software units including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the software detailed design including verification criteria and software units including verification criteria. [Outcome 6] **ENG.6.BP9: Ensure consistency and bilateral traceability of software requirements to software units.** Ensure consistency of software requirements including verification criteria to software units including verification criteria. Consistency is supported by establishing and maintaining bilateral traceability between the software requirements including verification criteria and software units including verification criteria. [Outcome 6] NOTE 7: Consistency and bilateral traceability need only be established between software requirements and software units for requirements that cannot be addressed in software detailed design (e.g. non functional requirements, attributes etc.). **ENG.6.BP10: Ensure consistency and bilateral traceability of software units to test specification for software units.** Ensure consistency of software units including verification criteria to test specification for software units including test cases for software units. Consistency is supported by establishing and maintaining bilateral traceability between the software units including verification criteria and test specification for software units including test cases for software units. [Outcome 6]

Output Work Products
08-52 Test plan [Outcome 1]
08-50 Test Specification [Outcome 1, 4]

Output Work Products
13-50 Test Result [Outcome 4, 5]
11-05 Software unit [Outcome 3]
13-22 Traceability record [Outcome 6]
13-25 Verification results [Outcome 4, 5]
17-50 Verification criteria [Outcome 3]

NOTE: For software and system test documentation, the IEEE-Standard 829-2008 might be used.

4.3.7 ENG.7 Software integration test

Process ID	ENG.7
Process Name	Software integration test
Process Purpose	The purpose of the Software integration test process is to integrate the software units into larger assemblies, producing integrated software consistent with the software design and to test the interaction between the software items.
Process Outcomes	As a result of successful implementation of this process: 1) a software integration and integration test strategy is developed for software items consistent with the software design according to the priorities and categorization of the software requirements; 2) a test specification software integration is developed that ensures compliance with the software architectural design, software detailed design, allocated to the items; 3) software units and software items are integrated as defined by the integration strategy; 4) integrated software items are verified using the test cases; 5) results of software integration testing are recorded; 6) consistency and bilateral traceability are established between software architectural design and software detailed design to software integration test specification including test cases; and 7) a regression strategy is developed and applied for re-integrating and re-verifying software items when a change in software items (including associated requirements, design and code) occurs. NOTE 1: The test specification for software integration includes the test design specification, test procedure specification and test case specifications. NOTE 2: The test results for software integration include the test logs, test incident reports and test summary reports.
Base Practices	**ENG.7.BP1: Develop software integration strategy.** Develop the strategy for integrating software items consistent with the release strategy and an order for integrating them. [Outcome 1] **ENG.7.BP2: Develop software integration test strategy.** Develop the strategy for testing the integrated software items. Identify test steps according to the order of integration defined in the integration

	strategy. [Outcome 1] NOTE 1: The Software integration test will focus mainly on interfaces, data flow, functionality of the items etc.. NOTE 2: The Software integration test should verify that only allowed application parameter combinations can influence functionality and that wrong parameter or parameter combinations are failsafe. NOTE 3: The Software integration test process should start with the beginning of the software development process There is a close link from Software Requirements Analysis ENG.4, Software Design ENG.5 or Requirements Elicitation ENG.1 in developing test cases and testable requirements. NOTE 4: The software integration test strategy contains different approaches of integrating software items depending of the changes (e.g. new units, changed units). The integration strategy also includes the most suitable test methods to be used for each integration approach. NOTE 5: The identified items and the order of integration will have an influence on integration test strategy. **ENG.7.BP3: Develop test specification for software integration test.** Develop the test specification for software integration test including test cases, to be executed on each integrated software item. The test cases should demonstrate compliance to the software architectural design and software detailed design allocated to each software item. [Outcome 2] **ENG.7.BP4: Integrate software units and software items.** Integrate the software units to software items and software items to integrated software according to the software integration strategy. [Outcome 3] NOTE 6: Software units are integrated to software components and software components to integrated software. NOTE 7: The integration of the software units and software components also integrates their data. Data can be calibration data and variant coding data. **ENG.7.BP5: Verify the integrated software.** Verify each integrated software item against the test cases for software integration test according to the software integration test strategy. [Outcome 4] NOTE 8: Verification of the integrated software produces the test logs. **ENG.7.BP6: Record the results of software integration testing.** Document the results of software integration testing and communicate to all relevant parties. [Outcome 5] NOTE 9: The test incident reports and the test summary report are based on the test logs. **ENG.7.BP7: Ensure consistency and bilateral traceability of software architectural design and software detailed design to software integration test specification.** Ensure consistency of software architectural design and software detailed design to software integration test specification including test cases. Consistency is supported by establishing and maintaining bilateral traceability between software architectural design and software detailed design to software integration test specification including test cases. [Outcome 6] **ENG.7.BP8: Develop regression testing strategy and perform regression testing.** Develop the strategy for re-testing the software items if changed software items are integrated. Perform regression

	testing as defined in the regression test strategy and document the results. [Outcome 7]

Output Work Products
08-52 Test plan [Outcome 1, 2, 7]
08-50 Test specification [Outcome 2]
13-50 Test result [Outcome 4, 5]
13-22 Traceability record [Outcome 6]
17-02 Build list [Outcome 3, 6, 7]
01-03 Software item [Outcome 3]
01-50 Integrated software [Outcome 3]

NOTE: For software and system test documentation, the IEEE-Standard 829-2008 might be used.

4.3.8 ENG.8 Software testing

Process ID	ENG.8
Process Name	Software testing
Process Purpose	The purpose of the Software testing process is to confirm that the integrated software meets the defined software requirements.
Process Outcomes	As a result of successful implementation of this process: 1) a strategy is developed to test the integrated software according to the priorities and categorization of the software requirements; 2) a test specification for software test of the integrated software is developed that demonstrates compliance to the software requirements; 3) the integrated software is verified using the test cases; 4) results of software testing are recorded; 5) consistency and bilateral traceability are established between software requirements and software test specification including test cases; and 6) a regression test strategy is developed and applied for re-testing the integrated software when a change in software items occur. NOTE 1: The test specification for software testing includes the test design specification, test procedure specification and test case specifications. NOTE 2: The verification is performed according to the test cases NOTE 3: The test results for software testing include the test logs, test incident reports and test summary reports.
Base Practices	**ENG.8.BP1: Develop software test strategy.** Develop the strategy for software testing consistent with the release strategy. [Outcome 1] **ENG.8.BP2: Develop test specification for software test.** Develop the test specification for software test including test cases, to be executed on the integrated software. The test cases should

	demonstrate compliance to the software requirements. [Outcome 2] NOTE 1: The Software testing process should start early in the software development life cycle. There is a close link to Software Requirements Analysis ENG.4, Software Design ENG.5 and Requirements Elicitation ENG.1 in developing test cases and testable requirements. NOTE 2: The test cases should demonstrate compliance to the software requirements over the complete range of allowed application parameter combinations. **ENG.8.BP3: Verify integrated software.** Verify the integrated software against the test cases for software testing and according to the software test strategy. [Outcome 3] NOTE 3: Verification of the integrated software produces the test logs. NOTE 4: Tests should be automated as far as possible having regard to efficiency. **ENG.8.BP4: Record the results of software testing.** Document the results of software testing and communicate to all relevant parties. [Outcome 4] NOTE 5: The test incident reports and the test summary report are based on the test logs. **ENG.8.BP5: Ensure consistency and bilateral traceability of software requirements to software test specification.** Ensure consistency of software requirements to software test specification including test cases. Consistency is supported by establishing and maintaining bilateral traceability between the software requirements and software test specification including test cases. [Outcome 5]. NOTE 6: Consistency can be demonstrated by review records. **ENG.8.BP6: Develop regression test strategy and perform regression testing.** Develop the strategy for retesting the integrated software should a software item be changed. If changes are made to software items carry out regression testing as defined in the software regression test strategy, and record the results. [Outcome 6]

Output Work Products
08-52 Test plan [Outcome 1, 2, 6]
08-50 Test specification [Outcome 2]
13-50 Test result [Outcome 3, 4]
13-22 Traceability record [Outcome 5]

NOTE: For software and system test documentation, the IEEE-Standard 829-2008 might be used.

4.3.9 ENG.9 System integration test

Process ID	ENG.9
Process Name	System integration test
Process Purpose	The purpose of the System integration test process is to integrate the system elements to produce an integrated system that will satisfy the system architectural design and the customers' expectations

	expressed in the system requirements.
Process Outcomes	As a result of successful implementation of this process: 1) a system integration and system integration test strategy is developed for system elements consistent with the system architectural design according to the priorities and categorization of the system requirements; 2) a test specification for system integration test is developed to verify compliance with the system architectural design, including the interfaces between system elements; 3) an integrated system is integrated as defined by the integration strategy; 4) the integrated system elements are verified using the test cases; 5) results of system integration testing are recorded; 6) consistency and bilateral traceability are established between system architectural design and system integration test specification including test cases; and 7) a regression strategy is developed and applied for re-testing the system elements when changes are made. NOTE 1: The test specification for system integration includes the test design specification, test procedure specification and test case specifications. NOTE 2: The test results for system integration include the test logs, test incident reports and test summary reports.
Base Practices	**ENG.9.BP1: Develop system integration strategy.** Develop the strategy for integrating the hardware, mechanics and software consistent with the release strategy and the order for integrating them. [Outcome 1] **ENG.9.BP2: Develop system integration test strategy.** Develop the strategy for testing the integrated system. Identify test steps according to the order of integration defined in the integration strategy. [Outcome 1] NOTE 1: The System integration test will focus mainly on interfaces, data flow, functionality of the system elements etc.. NOTE 2: The System integration test should verify that only allowed application parameter combinations can influence system functionality and that wrong parameter or parameter combinations are failsafe. NOTE 2: The System integration test process should start with the beginning of the system development process. There is a close link from System Requirements Analysis ENG.2, System Architectural Design ENG.3, or Requirements Elicitation ENG.1 in developing test cases and testable requirements. NOTE 3: The system integration strategy contains different approaches of integrating system elements depending of the changes (e.g. changed hardware items, new integrated software). The integration strategy also includes the most suitable test methods to be used for each integration approach. NOTE 4: The identified system elements and the order of integration will have an influence on system integration test strategy. **ENG.9.BP3: Develop a test specification for system integration.** Develop the test specification system integration, including the test cases, to be executed on each integrated system element. The test cases should demonstrate compliance to the system architectural

	design. [Outcome 2] **ENG.9.BP4: Integrate system elements.** Integrate the system elements to an integrated system according to the system integration strategy. [Outcome 3] NOTE 5: The system integration can be performed step wise integrating the hardware elements as prototype hardware, peripherals (sensors and actuators), the mechanics and integrated software to produce a system consistent with the priorities and categorization of the system requirements. **ENG.9.BP5: Verify the integrated system.** Verify each integrated system element against the test cases for system integration according to the system integration test strategy. [Outcome 4] NOTE 6: Verification of the integrated system produces the test logs. NOTE 7: Verification of the integrated system can be supported using environment simulation methods (e.g. Hardware-in-the-Loop-Simulation, vehicle network simulations). **ENG.9.BP6: Record the results of system integration testing.** Document the results of system integration testing and communicate to all relevant parties. [Outcome 5] NOTE 8: The test incident reports and the test summary report are based on the test logs. **ENG.9.BP7: Ensure consistency and bilateral traceability of system architectural design to the system integration test specification.** Ensure consistency of system architectural design to the system integration test specification including test cases. Consistency is supported by establishing and maintaining bilateral traceability between the system architectural design and system integration test specification system including test cases. [Outcome 6] **ENG.9.BP8: Develop regression testing strategy and perform regression testing.** Develop the strategy for re-testing the system elements if changed hardware, mechanics or software are integrated. Perform regression testing as defined in the regression test strategy and document the results. [Outcome 7]

Output Work Products
08-52 Test plan [Outcome 1, 2, 7]
08-50 Test specification [Outcome 2]
13-50 Test result [Outcome 4, 5]
13-22 Traceability record [Outcome 6]
11-06 System [Outcome 3]

NOTE: For software and system test documentation, the IEEE-Standard 829-2008 might be used.

4.3.10 ENG.10 System testing

Process ID	ENG.10
Process Name	System testing

Process Purpose	The purpose of the Systems testing process is to ensure that the implementation of each system requirement is tested for compliance and that the system is ready for delivery.
Process Outcomes	As a result of successful implementation of this process : 1) a strategy is developed to test the system according to the priorities of and categorization the system requirements; 2) a test specification for system test of the integrated system is developed that demonstrates compliance with the system requirements; 3) the integrated system is verified using the test cases; 4) results of system testing are recorded; 5) consistency and bilateral traceability are established between system requirements and the system test specification including test cases; and 6) a regression test strategy is developed and applied for re-testing the integrated system when a change in system elements is made. NOTE 1: The test specification for system testing includes the test design specification, test procedure specification and test case specifications. NOTE 2: The test results for system testing include the test logs, test incident reports and test summary reports.
Base Practices	**ENG.10.BP1: Develop system test strategy.** Develop the strategy for system testing consistent with the release strategy. [Outcome 1] **ENG.10.BP2: Develop test specification for system test.** Develop the test specification for system test, including the test cases, to be executed on the integrated system. [Outcome 2] NOTE 1: The System testing process should start early in the system development life cycle. There is a close link to System Requirements Analysis ENG.2, System architectural design ENG.3, and Requirements Elicitation ENG.1 in developing test cases and testable requirements. NOTE 2: The test cases should demonstrate compliance to the system requirements over the complete range of allowed application parameter combinations. **ENG.10.BP3: Verify integrated system.** Verify the integrated system against the test cases for system testing and according to the system test strategy. [Outcome 3] NOTE 3: Verification of the integrated system produces the test logs. NOTE 4: Tests should be automated as far as possible having regard to efficiency. **ENG.10.BP4: Record the results of system testing.** Document the results of system testing and communicate to all relevant parties. [Outcome 4] NOTE 5: The test incident reports and the test summary report are based on the test logs. **ENG.10.BP5: Ensure consistency and bilateral traceability of system requirements to the systems test specification.** Ensure consistency of system requirements to the systems test specification including test cases. Consistency is supported by establishing and maintaining bilateral traceability between the system requirements and systems test specification including test cases. [Outcome 5]

	NOTE 6: Consistency can be demonstrated by review records. **ENG.10.BP6: Develop system regression test strategy and perform testing.** Develop the strategy for re-testing the integrated system if a system element is changed. If changes are made to system elements, carry out regression testing as defined in the system regression test strategy, and record the results. [Outcome 6]

Output Work Products
08-52 Test plan [Outcome 1, 2, 6]
08-50 Test specification [Outcome 2]
13-50 Test result [Outcome 3, 4]
13-22 Traceability record [Outcome 5]

NOTE: For software and system test documentation, the IEEE-Standard 829-2008 might be used.

4.4 Supporting Process Group (SUP)

4.4.1 SUP.1 Quality assurance

Process ID	SUP.1
Process Name	Quality assurance
Process Purpose	The purpose of the Quality assurance process is to provide independent assurance that work products and processes comply with predefined provisions and plans.
Process Outcomes	As a result of successful implementation of this process: 1) a strategy for conducting quality assurance is developed, implemented and maintained; 2) quality assurance is performed independent of the activity or project being performed; 3) evidence of quality assurance is produced and maintained; 4) adherence of products, processes and activities to agreed requirements are verified, documented, and communicated to the relevant parties; 5) problems and/or non-conformance with agreement requirements are identified, recorded, communicated to the relevant parties, tracked and resolved; and 6) quality assurance has the independence and authority to escalate problems to appropriate levels of management. NOTE 1: Quality assurance should be coordinated with, and make use of, the results of other supporting processes such as verification, validation, joint review, audit and problem management. NOTE 2: Verification and validation may be subject to quality assurance. NOTE 3: Independent quality assurance should be established as a separate functional role within an organization.

Base Practices	**SUP.1.BP1 : Develop project quality assurance strategy.** A project level strategy for conducting quality assurance is developed. This strategy is consistent with the organisational quality management strategy. [Outcome 1] NOTE 1: The quality assurance process may be co-ordinated with the related SUP.2 Verification, SUP.4 Joint Review, Validation and Audit processes. **SUP.1.BP2: Develop and maintain an organisation structure which ensures that quality assurance is carried out and report independentely.** Quality assurance team members are not directly responsible to the project organisation – they work independently from it. [Outcome 2] **SUP.1.BP3: Develop and implement a plan for project quality assurance based on a quality assurance strategy.** [Outcome 3] NOTE 2: Quality assurance plan may contain quality assurance activities, a schedule of activities, assigned responsibilities, resources required, guidelines and quality standards for requirement, design, coding and testing work products. **SUP.1.BP4: Maintain evidence of quality assurance.** Define and maintain the records that demonstrate that planned quality assurance activities have been implemented. [Outcome 3] **SUP.1.BP5: Assure quality of work products.** Carry out the activities according to the quality assurance plan to ensure that the work products meet the quality requirements. [Outcome 4] NOTE 3: Product quality assurance activities may include reviews, audits, problem analysis, reports and lessons learned that improve the work products for further use. NOTE 4: Non conformances detected in work products may be entered into the problem resolution management process (SUP.9) to document, analyze, resolve, track to closure and prevent the problems. **SUP.1.BP6: Assure quality of process activities.** Carry out the activities according to the quality assurance plan to ensure assurance that the processes meet the defined requirements of the project. [Outcome 4] NOTE 5: Problems detected in the process definition or implementation should be entered into the process improvement process (PIM.3) to describe, record, analyze, resolve, track to closure and prevent the problems. NOTE 6: Process quality assurance activities may include process assessments and audits, problem analysis, regular check of methods, tools, documents and the adherence to defined processes, reports and lessons learned that improve processes for future projects. NOTE 7: In case of supplier involvement, the quality assurance of the supplier should cooperate with the quality assurance of the customer and all other involved parties. **SUP.1.BP7: Track and record quality assurance activities.** Records of quality assurance activities are produced and retained. [Outcome 3, 4, 5] **SUP.1.BP8: Report quality assurance activities and results.** Regularly report performances, deviations, and trends of quality assurance activities to relevant parties for information and action. [Outcome 5]

	NOTE 8: The quality assurance may use an independent path to report regularly the results to the management and other relevant stakeholders. **SUP.1.BP9: Ensure resolution on non-conformances**. Deviations or non-conformance found in process and product quality assurance actitvities should be analyzed, corrected and further prevented. [Outcome 5] **SUP.1.BP10: Implement an escalation mechanism.** Develop and maintain the escalation mechanism that ensures that quality assurance may escalate problems to appropriate levels of management to resolve them. [Outcome 6]

Output Work Products
08-13 Quality plan [Outcome 1, 2, 3, 5, 6]
13-04 Communication Record [Outcome 5]
13-07 Problem record [Outcome 3, 4]
13-18 Quality Record [Outcome 3, 4]
13-19 Review Record [Outcome 2, 3, 4]
14-02 Corrective action plan [Outcome 3, 5]
18-07 Quality criteria [Outcome 4]

4.4.2 SUP.2 Verification

Process ID	SUP.2
Process Name	Verification
Process Purpose	The purpose of the Verification process is to confirm that each work product of a process or project properly reflects the specified requirements.
Process Outcomes	As a result of successful implementation of this process: 1) a verification strategy is developed, implemented and maintained; 2) criteria for verification of all required work products are identified; 3) required verification activities are performed; 4) defects are identified, recorded and tracked; and 5) results of the verification activities are made available to the customer and other involved parties.
Base Practices	**SUP.2.BP1: Develop a verification strategy.** Develop and implement a verification strategy, including verification activities with associated methods, techniques, and tools, work product or processes under verification, degrees of independence for verification and schedule for performing these acticvities. [Outcome 1] NOTE 1: Verification strategy is implemented through a plan. NOTE 2: Software and system verification may provide objective evidence that the outputs of a particular phase of the software development life cycle (e.g. requirements, design, implementation, testing) meet all of the specified requirements for that phase. NOTE 3: Verification methods and techniques may include

	inspections, peer reviews (see also SUP.4), audits, walkthroughs and analysis. **SUP.2.BP2: Develop criteria for verification.** Develop the criteria for verification of all required technical work products. [Outcome 2] **SUP.2.BP3: Conduct verification.** Verify identified work products according to the specified strategy and to the developed criteria to confirm that the work products meet their specified requirements. The results of verification activities are recorded. [Outcome 3] **SUP.2.BP4: Determine and track actions for verification results.** Problems identified by the verification should be entered into the problem resolution management process (SUP.9) to describe, record, analyze, resolve, track to closure and prevent the problems. [Outcome 4] **SUP.2.BP5: Report verification results.** Verification results should be reported to all affected parties. [Outcome 5]

Output Work Products
13-04 Communication record [Outcome 5]
13-07 Problem record [Outcome 3, 4, 5]
13-16 Change request [Outcome 3, 4]
13-18 Quality record [Outcome 4, 5]
13-25 Verification results [Outcome 2, 3, 4, 5]
14-02 Corrective action register [Outcome 4]
18-07 Quality criteria [Outcome 2]
19-10 Verification strategy [Outcome 1]

4.4.3 SUP.4 Joint review

Process ID	SUP.4
Process Name	Joint review
Process Purpose	The purpose of the Joint review process is to maintain a common understanding with the stakeholders of the progress against the objectives of the agreement and what should be done to help ensure development of a product that satisfies the stakeholders. Joint reviews are at both project management and technical levels and are held throughout the life of the project .
Process Outcomes	As a result of successful implementation of this process: 1) management and technical reviews are held based on the needs of the project; 2) the status and products of an activity of a process are evaluated through joint review activities between the stakeholders; 3) review results are made known to all affected parties; 4) action items resulting from reviews are tracked to closure; and 5) problems are identified and recorded. NOTE 1: Joint review should be performed at specific milestones during project/product development. The scope and the goals of joint

	review may be different dependent on project/product development phase (for example, in the early stage of a project joint review may be “conceptual” in order to analyse the customer requirements; in later stages joint review may be concerned with the implementation). NOTE 2: Joint review should be performed to verify different aspects (for example: hardware resources utilization; the introduction of new requirements and new technologies; modification to the working team structure; technology changes).
Base Practices	**SUP.4.BP1: Define review elements.** Based on the needs of the project, identify the schedule, scope and participants of management and technical reviews, agree all resources required to conduct the reviews (this includes personnel, location and facilities) and establish review criteria for problem identification, resolution and agreement. [Outcome 1] **SUP.4.BP2: Establish a mechanism to handle review outcomes.** Establish mechanisms to ensure that review results are made available to all affected parties that problems detected during the reviews are identified and recorded and that action items raised are recorded for action. [Outcome 3] **SUP.4.BP3: Prepare joint review.** Collect, plan, prepare and distribute review material as appropriate in preparation for the review. [Outcome 1] NOTE 1: The following items may be addressed: Scope and purpose of the review; Products and problems to be reviewed; Entry and exit criteria; Meeting agenda; Roles and participants; Distribution list; Responsibilities; Resource and facility requirements; Used tools (checklists, scenario for perspective based reviews etc.). **SUP.4.BP4: Conduct joint reviews.** Conduct joint management and technical reviews as planned. Record the review results. [Outcome 1, 2] **SUP.4.BP5: Distribute the results.** Document and distribute the review results to all the affected parties. [Outcome 3] **SUP.4.BP6: Determine actions for review results.** Analyze the review results, propose actions for resolution and determine the priority for actions. [Outcome 4] **SUP.4.BP7: Track actions for review results.** Track actions for resolution of identified problems in a review to closure. [Outcome 4] **SUP.4.BP8: Identify and record problems.** Identify and record the problems detected during the reviews according to the established mechanism. [Outcome 5]

Output Work Products
13-04 Communication record [Outcome 3]
13-05 Contract review record [Outcome 1, 2, 3]
13-07 Problem record [Outcome 3, 5]
13-09 Meeting support record [Outcome 1, 2]
13-19 Review record [Outcome All]
14-02 Corrective action register [Outcome 3, 4, 5]
14-08 Tracking system [Outcome 3, 4, 5]

Output Work Products
15-01 Analysis report [Outcome 3, 5]
15-13 Assessment/audit report [Outcome 1, 2]
15-16 Improvement opportunity [Outcome 3, 4]

4.4.4 SUP.7 Documentation

Process ID	SUP.7
Process Name	Documentation
Process Purpose	The purpose of the Documentation process is to develop and maintain the recorded information produced by a process.
Process Outcomes	As a result of successful implementation of this process: 1) a strategy identifying the documentation to be produced during the life cycle of the product or service is developed; 2) the standards to be applied for the development of the documentation are identified; 3) documentation to be produced by the process or project is identified; 4) the content and purpose of all documentation is specified, reviewed and approved; 5) documentation is developed and made available in accordance with identified standards; and 6) documentation is maintained in accordance with defined criteria. NOTE 1: Careful attention should be paid to the customer - supplier relationship and its documents.
Base Practices	**SUP.7.BP1: Develop a documentation management strategy.** Develop a documentation management strategy which addresses where, when and what should be documented during the life cycle of the product/service. [Outcome 1] NOTE 1 A documentation management strategy may define the controls needed to approve documentation for adequacy prior to issue; to review and update as necessary and re-approve documentation; to ensure that changes and the current revision status of documentation are identified; to ensure that relevant versions of documentation are available at points of issue; to ensure that documentation remain legible and readily identifiable; to ensure the controlled distribution of documentation; to prevent unintended use of obsolete documentation ; and may also specify the levels of confidentiality, copyright or disclaimers of liability for the documentation. **SUP.7.BP2: Establish standards for documentation.** Establish standards for developing, modifying and maintaining documentation. [Outcome 2] **SUP.7.BP3: Specify documentation requirements.** Specify requirements for documentation such as title, date, identifier, version history, author(s), reviewer, authorizer, outline of contents, purpose, and distribution list. [Outcome 2] **SUP.7.BP4: Identify the relevant documentation to be produced.** For any given development life cycle, identify the documentation to be

	produced. [Outcome 3] **SUP.7.BP5: Develop documentation.** Develop documentation at required process points according to established standards and policy, ensuring the content and purpose is reviewed and approved as appropriate. (Outcome 4, 5). **SUP.7.BP6: Check documentation.** Review documentation before distribution, and authorize documentation as appropriate before distribution or release. [Outcome 5] NOTE 2: The documentation intended for use by system and software users should accurately describe the system and software and how it is to be used in clear and useful manner for them. NOTE 3: Documentation should be checked through verification or validation process. **SUP.7.BP7: Distribute documentation.** Distribute documentation according to determined modes of distribution via appropriate media to all affected parties, confirming delivery of documentation, where necessary. [Outcome 5] **SUP.7.BP8: Maintain documentation.** Maintain documentation in accordance with the determined documentation strategy. [Outcome 6] NOTE 4: If the documentation is part of a product baseline or if its control and stability are important, it should be modified and distributed in accordance with process SUP.8 Configuration management.

Output Work Products
08-26 Documentation plan [Outcome 1, 2]
13-01 Acceptance record [Outcome 4, 5]
13-19 Review record [Outcome 4, 5]
14-01 Change history [Outcome 5, 6]
14-11 Work product list [Outcome 3]
17-05 Documentation requirements [Outcome 1, 2, 3]
20-00 Template [Outcome 2]
21-00 Work product [Outcome 5, 6]

4.4.5 SUP.8 Configuration management

Process ID	SUP.8
Process Name	Configuration management
Process Purpose	The purpose of the Configuration management process is to establish and maintain the integrity of all the work products of a process or project and make them available to concerned parties.
Process Outcomes	As a result of successful implementation of this process: 1) a configuration management strategy is developed; 2) all items generated by a process or project are identified, defined and baselined according to the Configuration management strategy; 3) modifications and releases of the items are controlled;

	4) modifications and releases are made available to affected parties; 5) the status of the items and modification requests are recorded and reported; 6) the completeness and consistency of the items is ensured; and 7) storage, handling and delivery of the items are controlled. NOTE 1: Items requiring configuration control may include modules, subsystems, libraries, test cases, compilers, data, documentation, physical media, and external interfaces.
Base Practices	**SUP.8.BP1: Develop a configuration management strategy.** Develop a configuration management strategy, including configuration management activities and a life cycle model, responsibilities and resources for performing these activities. [Outcome 1] NOTE 1: The configuration management strategy should be documented in a configuration management plan. NOTE 2: The configuration management strategy should also support the handling of product/software variants including application parameters used. **SUP.8.BP2: Identify configuration items.** Identify configuration items according to the Configuration management strategy that need to be stored, tested, reviewed, used, changed, delivered and/or maintained. [Outcome 2] NOTE 3: Items requiring configuration control should include the products that are delivered to the customer, designated internal work products, acquired products, tools and other items that are used in creating and describing these work products. NOTE 4: Software development configuration items typically are e.g.: • configuration management plan • requirements documents, architecture and design documents, • software development environment, • software development plan, • supplier agreements, • quality assurance plan, • software units (code) including documentation, • application parameters, • test cases and test results, review documentation, • build list, integration reports and • customer manuals. NOTE 5: Items requiring configuration control may also include work products of hardware (layouts, drawings, circuit boards, bills of material, etc.) and mechanical development. **SUP.8.BP3: Establish a configuration management system.** Establish a configuration management system, which provides an efficient means for handling the configuration items. [Outcomes 1, 2, 3, 4, 6, 7] NOTE 6: A configuration management system may include storage media, structures and hierarchies, procedures, access control and adequate tools for accessing the configuration items. **SUP.8.BP4: Establish branch management strategy.** Develop a branch management strategy where applicable for parallel

	development efforts that use the same source base. [Outcomes 1 , 3, 4, 6, 7] NOTE 7: A branch management strategy will include branch management, merging strategies, configuration item versioning in a branching system, branch parenting strategies and labeling strategies. NOTE 8: A branch management strategy will define why and when branches will be created, which activities will occur in the branches, and how the branches will complete and/or migrate into the main source base. **SUP.8.BP5: Establish baselines.** Establish the internal and external (delivery) baselines according to the configuration management strategy. [Outcome 3] NOTE 9: In complex software systems with many work products including application parameters, the preparation of external (delivery) baselines may be supported by the reasonable use of several intermediate internal baselines. NOTE 10: For baseline issues refer also to the product release process (SPL.2). **SUP.8.BP6: Maintain configuration item description.** Maintain an up-to-date description of each configuration item. [Outcomes 2, 3, 4] NOTE 11: The description should identify: • its decomposition into lower level configuration components; • who is responsible for each item; and • when it is placed under configuration management. **SUP.8.BP7: Control modifications and releases.** Establish mechanisms in order to determine configuration items to change, check in/out, configuration item access permissions, version identification and change, change commenting, configuration item locking/commit. [Outcome 3, 4 ,5] **SUP.8.BP8: Maintain configuration item history.** Maintain a history of each configuration item in sufficient detail to recover a previously baselined version when required. [Outcomes 3, 4] **SUP.8.BP9: Report configuration status.** Report status of each configuration item. [Outcome 5] NOTE 12: Regular reporting of the configuration status (e.g. how many configuration items are currently under work, checked in, tested, released, etc.) supports project management activities and dedicated project phases like software integration. **SUP.8.BP10: Verify the information about configured items.** Verify that the information about configured items, their structures and baselines, supplied through status accounting reporting is complete and ensure the consistency of the items and baselines. [Outcome 6] **SUP.8.BP11: Manage the backup, storage, archiving, handling and delivery of configuration items.** Ensure the integrity and consistency of configuration items through appropriate scheduling and resourcing of backup, storage and archiving. Control the handling and delivery of configuration items. [Outcomes 4, 5, 6, 7] NOTE 13: Backup, storage and archiving may need to extend beyond the guaranteed lifetime of available storage media. Relevant configuration items affected may include those referenced in NOTE 4 and NOTE 5. Availability may be specified by contract requirements.

Output Work Products
01-00 Configuration item [Outcome 2, 3, 7]
06-02 Handling and storage guide [Outcome 7]
08-04 Configuration management plan [Outcome 1, 2, 7]
08-14 Recovery plan [Outcome 4, 6]
13-00 Record [Outcome 5, 6]
13-06 Delivery record [Outcome 7]
13-10 Configuration management record [Outcome 5]
13-13 Product release approval record [Outcome 5, 7]
14-01 Change history [Outcome 3]
16-03 Configuration management library [Outcome 1, 3, 4]

4.4.6 SUP.9 Problem resolution management

Process ID	SUP.9
Process Name	Problem resolution management
Process Purpose	The purpose of the Problem resolution management process is to ensure that all discovered problems are identified, analyzed, managed and controlled to resolution.
Process Outcomes	As a result of successful implementation of this process: 1) a problem management strategy is developed; 2) problems are recorded, identified and classified; 3) problems are analysed and assessed to identify acceptable solution(s); 4) problem resolution is implemented; 5) problems are tracked to closure; and 6) the status of all problem reports is known.
Base Practices	**SUP.9.BP1: Develop a problem resolution management strategy**. Develop a problem resolution management strategy, including problem resolution management activities and a life cycle model, responsibilities and resources for performing these activities. [Outcome 1] **SUP.9.BP2: Establish a consistent problem resolution management proceeding.** A problem resolution management proceeding is established in order to ensure that problems are detected, described, recorded, analyzed, resolved and prevented in a consistent and traceable way based on the problem resolution management strategy. Interfaces to affected parties are defined and maintained. [Outcome 1] **SUP.9.BP3: Identify and record the problem.** Each problem is uniquely identified and recorded. [Outcome 2]

	NOTE 1: The necessary supporting information needs to be provided in order to support diagnosis of the problem. NOTE 2: Unique identification supports traceability to changes made. **SUP.9.BP4: Investigate and diagnose the cause and the impact of the problem.** Investigate and diagnose the cause and the impact of the problem in order to determine appropriate actions and provide classification. [Outcomes 2, 3] NOTE 3: Problem classification (e.g. A, B, C, light, medium, severe) may be based on severity, impact, criticality, urgency, relevance, etc.. **SUP.9.BP5: Execute urgent resolution action, where necessary.** If the problem warrants immediate resolution pending an actual change then obtain authorization for immediate fix. [Outcome 3] NOTE 4: Following urgent resolution action, a problem resolution management proceeding should be established according to BP2 and progressed according BP3, BP4, BP7 and BP8. **SUP.9.BP6: Raise alert notifications, where necessary.** If the problem is of high classification and impacts other systems or users an alert notification may need to be raised, pending a fix or change. [Outcome 4] NOTE 5: Following the raising of an alert notification, a problem resolution management proceeding should be established according to BP2 and progressed according BP3, BP4, BP7 and BP8. **SUP.9.BP7: Initiate change request.** Initiate a change request for diagnosed problems. [Outcome 4] NOTE 6: The implementation of the change request is done in the SUP.10 Change request management process. NOTE 7: The implementation of process improvements (to prevent problems) is done in the process improvement process (PIM.3). **SUP.9.BP8: Track problems to closure.** Track the status of all reported problems to closure. Before closure, a formal acceptance has to be authorized. [Outcomes 5, 6] **SUP.9.BP9: Analyze problem trends.** Collect and analyze data from the problem management system (occurrence, detection, affected range, etc.), identify trends and initiate actions, where necessary. [Outcome 6]

Output Work Products
08-27 Problem management plan [Outcome 1]
13-07 Problem record [Outcome 2, 3, 4, 5]
15-01 Analysis report [Outcome 3]
15-05 Evaluation report [Outcome 3]
15-12 Problem status report [Outcome 6]

4.4.7 SUP.10 Change request management

Process ID	SUP.10
Process Name	Change request management

Process Purpose	The purpose of the Change request management process is to ensure that change requests are managed, tracked and controlled.
Process Outcomes	As a result of successful implementation of this process: 1) a change management strategy is developed; 2) requests for changes are recorded and identified; 3) dependencies and relationships to other change requests are identified; 4) criteria for confirming implementation of the change request are defined; 5) requests for change are analysed, prioritized, and resource requirements estimated; 6) changes are approved on the basis of priority and availability of resources; 7) approved changes are implemented and tracked to closure; and 8) the status of all change requests is known. NOTE 1: Analysis should cover costs, risks, impact, urgency and resource requirements.
Base Practices	NOTE 1: This process has a close interaction with the problem resolution management process (SUP.9), which is one of the input providers for the change request management process. **SUP.10.BP1: Develop a change request management strategy.** Develop a change request management strategy, including change request management activities and a life cycle model, responsibilities and resources for performing these activities. [Outcome 1] **SUP.10.BP2: Establish a consistent change request management proceeding.** A change request management proceeding is established and implemented in order to ensure that changes are detected, described, recorded, analyzed and managed in a consistent and traceable way based on the change request management strategy. Interfaces to affected parties are defined and maintained. [Outcome 1] **SUP.10.BP3: Identify and record the change request.** Each change request is uniquely identified and recorded and the initiator of the change request is retained. [Outcomes 2, 3] NOTE 2: Provide traceability to originating problem or error reports. Change requests submitted as a resolution to a problem or error report should retain a link to the originating problem or error report. **SUP.10.BP4: Record the status of change requests.** Change Requests and changes are allocated a status indication to facilitate tracking. [Outcome 8] NOTE 3: Change request status is often denoted as open, under investigation, rejected, postponed, approved for implementation, allocated (i.e. allocated to a developer for implementation), implemented, fixed, closed, etc.. **SUP.10.BP5: Establish the dependencies and relationships to other change requests.** Identify the relationship of a change request to other change requests to establish dependencies, e.g. for all changes to a specific software component or all changes related to a specific software release. [Outcome 3] **SUP.10.BP6: Assess the impact of the change.** Assess the technical impact and potential benefits of the change request.

	[Outcomes 4, 5] NOTE 4: A Change Request Board (CRB) is a common mechanism used to assess change requests. **SUP.10.BP7: Analyze and prioritize change requests.** Change requests are analyzed in terms of resource requirements, scheduling issues, risks and benefits. For every change request a priority is specified that indicates the urgency of the change request to be considered. [Outcomes 4, 5] NOTE 5: For scheduling issues refer also to the product release process (SPL.2). **SUP.10.BP8: Approve change requests before implementation.** Change requests are approved on the basis of priority and availability of resources before implementation. [Outcome 6] **SUP.10.BP9: Identify and plan the verification and validation activities to be performed for implemented changes.** Before implementing a change the required verification and validation activities to be undertaken are identified and planned. [Outcomes 4, 5, 6] **SUP.10.BP10: Schedule and allocate the change request.** Approved change requests are scheduled to a particular delivery and are allocated to the resources responsible for implementation, verification and validation. [Outcomes 5, 7] **SUP.10.BP11: Review the implemented change.** Changes are reviewed after implementation, verification and validation and before closure to ensure that they have the desired effect and meet their objectives and respective verification criteria. [Outcomes 7, 8] **SUP.10.BP12: Change requests are tracked until closure.** Feedback to the initiator is provided. [Outcomes 7, 8]

Output Work Products
08-28 Change management plan [Outcome 1]
13-16 Change request [Outcome 2, 3, 4. 5, 6, 7]
13-21 Change control record [Outcome 8]
21-00 Work product [Outcome 7]

4.5 Management Process Group (MAN)

4.5.1 MAN.3 Project management

Process ID	MAN.3
Process Name	Project management
Process Purpose	The purpose of the Project management process is to identify, establish, plan, co-ordinate, and monitor the activities, tasks, and resources necessary for a project to produce a product and/or service, in the context of the project’s requirements and constraints.
Process Outcomes	As a result of successful implementation of this process: 1) the scope of the work for the project is defined;

	2) the feasibility of achieving the goals of the project with available resources and constraints is evaluated; 3) the tasks and resources necessary to complete the work are sized and estimated; 4) interfaces between elements in the project, and with other project and organizational units, are identified and monitored; 5) plans for the execution of the project are developed, implemented and maintained; 6) progress of the project is monitored and reported; and 7) actions to correct deviations from the plan and to prevent recurrence of problems identified in the project are taken when project goals are not achieved. NOTE 1: The necessary resources will include - people, development tools, hardware present in the ECU (CPU, RAM, Flash RAM, etc.), test equipment, methodologies. NOTE 2: The skills of the people and the technologies used to develop the project will need to be evaluated and if necessary, training courses, tool upgrades, introduction of new technologies, etc. need to be planned. NOTE 3: Plans for the execution of the project may contain among other elements, work break down structures, responsibilities, schedules, etc..
Base Practices	**MAN.3.BP1: Define the scope of work.** Define the work to be undertaken by the project, and confirm that the goals of the project are feasible with available resources and constraints. [Outcomes 1, 2] **MAN.3.BP2: Define project life cycle.** Define the life cycle for the project, which is appropriate to the scope, context, magnitude and complexity of the project. [Outcome 2] NOTE 1: The consistency between the project life cycle and the car development process should be verified. **MAN.3.BP3: Determine and maintain estimates for project attributes.** Define and maintain baselines for project attributes [Outcome 2]. NOTE 2: Project attributes may include 1) business and quality goals for the project, 2) resources for the project and 3) project effort, schedule and budget. NOTE 3 Appropriate estimation methods should be used. NOTE 4: A development strategy is determined and resources for the development life cycle to satisfy requirements are estimated. NOTE 5: Resources may include required infrastructure and communication mechanisms. NOTE 6: Project risks and quality criteria may be considered when estimating project attributes. **MAN.3.BP4: Define project activities.** Plan project activities according to defined project life cycle and estimations, define and monitor dependencies between activities. [Outcome 3, 5] NOTE 7: The activities and related work packages should be of manageable size to ensure that adequate progress monitoring is possible. **MAN.3.BP5: Define skill needs.** Identify required skills needed for the project and allocate them to individuals and teams. [Outcome 3]

	MAN.3.BP6: Define and maintain project schedule. Allocate resources to activities and determine schedule for each activity and for the whole project. [Outcome 3, 5] NOTE 8: This includes appropriate re-planning. NOTE 9: Project time schedule has to keep updated during lifetime of the project continuously. **MAN.3.BP7: Identify and monitor project interfaces.** Identify and agree interfaces of the project with other (sub-) projects, organizational units and other stakeholders and monitor agreed commitments. [Outcome 4] NOTE 10: The project planning and monitoring may include all involved parties like quality assurance, production, car integration, testing and prototype manufacturing. **MAN.3.BP8: Establish project plan.** Collect and maintain project master plan and other relevant plans to document the project scope and goals, resources, infrastructure, interfaces and communication mechanisms. [Outcome 5] **MAN.3.BP9: Implement the project plan.** Implement planning activities of the project. [Outcome 5] **MAN.3.BP10: Monitor project attributes.** Monitor the defined project attributes and document significant deviations of them against the project plan. [Outcome 6] NOTE 11: At minimum, project attributes of resources, effort and schedule (planned, actual and remaining) should be monitored by the project. **MAN.3.BP11: Review and report progress of the project.** Regularly report and review the status of the project against the project plans to all affected parties. This includes reports to the car producer. Regularly evaluate the performance of the project. [Outcome 6] NOTE 12: Project reviews may be executed at regular intervals by the management. At the end of a project, a project review will normally be held to identify best practices and lessons learned. **MAN.3.BP12: Act to correct deviations.** Take action when project goals are not achieved, correct deviations from plan and prevent recurrence of problems identified in the project. Update project plans accordingly. [Outcome 7]

Output Work Products
08-12 Project plan [Outcome 1, 2, 3, 4, 5]
08-19 Risk management plan [Outcome 5]
13-04 Communication record [Outcome 6]
13-14 Progress status record [Outcome 6]
13-16 Change request [Outcome 7]
13-19 Review record [Outcome 7]
14-02 Corrective action register [Outcome 7]
14-06 Schedule [Outcome 5]
14-09 Work breakdown structure [Outcome 3]
08-06 Project activity network [Outcome 4]

Output Work Products
15-06 Project status report [Outcome 4, 6]

4.5.2 MAN.5 Risk management

Process ID	MAN.5
Process Name	Risk management
Process Purpose	The purpose of the Risk management process is to identify, analyze, treat and monitor the risks continuously.
Process Outcomes	As a result of successful implementation of this process: 1) the scope of the risk management to be performed is determined; 2) appropriate risk management strategies are defined and implemented; 3) risks are identified as they develop during the conduct of the project; 4) risks are analyzed and the priority in which to apply resources to treatment of these risks is determined; 5) risk measures are defined, applied, and assessed to determine changes in the status of risk and the progress of the treatment activities; and 6) appropriate treatment is taken to correct or avoid the impact of risk based on its priority, probability, and consequence or other defined risk threshold. NOTE 1: Risks may include technical, economic and timing risks. NOTE 2: Risks are normally analysed to determine their probability, consequence and severity. NOTE 3: Major risks may need to be communicated to and monitored by higher levels of management. NOTE 4: Different techniques may be used to analyze a system in order to understand if risks exist, for example, functional analysis, simulation, FMEA, FTA etc..
Base Practices	**MAN.5.BP1: Establish risk management scope.** Determine the scope of risk management to be performed for the project, in accordance with organizational risk management policies. [Outcome 1] **MAN.5.BP2: Define risk management strategies.** Define appropriate strategies to identify risks, mitigate risks and set acceptability levels for each risk or set of risks, both at the project and organizational level. [Outcome 2] **MAN.5.BP3: Identify risks.** Identify risks to the project both initially within the project strategy and as they develop during the conduct of the project, continuously looking for risk factors at any occurrence of technical or managerial decisions. [Outcomes 2, 3] NOTE 1: Examples of risk areas, which should be analyzed for potential risk reasons or risks factors, include: cost, schedule, effort, resource, and technical. NOTE 2: Examples of risk factors include: unsolved and solved trade-offs, decisions of not implementing a project feature, design changes, lack of expected resource.

	MAN.5.BP4: Analyze risks. Analyze risks to determine the priority in which to apply resources to mitigate these risks. [Outcome 4] NOTE 3: Issues to be considered in risk analysis include the probability and impact of each identified risk. **MAN.5. BP5: Define risk treatment actions.** For each risk (or set of risks) define, perform and track the selected actions to keep/reduce the risks to acceptable level. [Outcomes 5, 6] **MAN5.BP6: Monitor risks.** For each risk (or set of risks) define measures (e.g. metrics) to determine changes in the status of a risk and to evaluate the progress of the of mitigation activities. Apply and assess these risk measures. [Outcomes 5, 6] **MAN.5.BP7: Take corrective action.** When expected progress in risk mitigation is not achieved, take appropriate corrective action to reduce or avoid the impact of risk. [Outcome 6] NOTE 4 Corrective actions may involve developing and implementing new mitigation strategies or adjusting the existing strategies.

Output Work Products
07-07 Risk measure [Outcome 5]
08-14 Recovery plan [Outcome 4, 6]
08-19 Risk management plan [Outcome All]
08-20 Risk mitigation plan [Outcome 3, 4, 5, 6]
13-20 Risk action request [Outcome 1, 2, 6]
14-02 Corrective action register [Outcome 6]
14-08 Tracking system [Outcome 5, 6]
15-08 Risk analysis report [Outcome 4]
15-09 Risk status report [Outcome 4, 5]

4.5.3 MAN.6 Measurement

Process ID	MAN.6
Process Name	Measurement
Process Purpose	The purpose of the Measurement process is to collect and analyze data relating to the products developed and processes implemented within the organization and its projects, to support effective management of the processes and to objectively demonstrate the quality of the products.
Process Outcomes	As a result of successful implementation of this process: 1) organizational commitment is established and sustained to implement the measurement process; 2) the measurement information needs of organizational and management processes are identified; 3) an appropriate set of measures, driven by the information needs are identified and/or developed; 4) measurement activities are identified and performed;

	5) the required data is collected, stored, analyzed, and the results interpreted; 6) information products are used to support decisions and provide an objective basis for communication; and 7) the measurement process and measures are evaluated and communicated to the process owner. NOTE 1: Information products are produced as a result analysis of data in order to summarise and communicate information.
Base Practices	**MAN.6.BP1: Establish organizational commitment for measurement.** A commitment of management and staff to measurement is established and communicated to the organizational unit. [Outcome 1] **MAN.6.BP2: Develop measurement strategy.** Define an appropriate measurement strategy to identify, perform and evaluate measurement activities and results, based on organizational and project needs. [Outcome 1] **MAN.6.BP3: Identify measurement information needs**. Identify the measurement information needs of organizational and management processes. [Outcome 2] **MAN.6.BP4: Specify measures.** Identify and develop an appropriate set of measures based on measurement information needs. [Outcome 3] **MAN.6.BP5 Perform measurement activities.** Identify and perform measurements activities. [Outcome 4] **MAN.6.BP6: Retrieve measurement data.** Collect and store data of both base and derived measures, including any context information necessary to verify, understand, or evaluate the data. [Outcome 5] **MAN.6.BP7: Analyze measures.** Analyze and interpret measurement data and develop information products. [Outcome 5] **MAN.6.BP8: Use measurement information for decision-making**. Make accurate and current measurement information accessible for any decision-making processes for which it is relevant. [Outcome 6] **MAN.6.BP9: Communicate measures**. Disseminate measurement information to all affected parties who will be using them and collect feedback to evaluate appropriateness for intended use. [Outcome 5, 6] **MAN.6.BP10: Evaluate information products and measurement activities.** Evaluate information products and measurement activities against the identified information needs and measurement strategy. Identify potential improvements. [Outcome 7] **MAN.6.BP11: Communicate potential improvements.** Communicate to the affected people the identified potential improvements concerning the processes they are involved in. [Outcome 7]

Output Work Products
02-01 Commitment/agreement [Outcome 1]
03-03 Benchmarking data [Outcome 5]
03-04 Customer satisfaction data [Outcome 5]
[deleted]
03-06 Process performance data [Outcome 6]

Output Work Products
07-01 Customer satisfaction survey [Outcome 3, 7]
07-02 Field measure [Outcome 3, 7]
07-03 Personnel performance measure [Outcome 3, 4, 7]
07-04 Process measure [Outcome 3, 4, 7]
07-05 Project measure [Outcome 3, 4, 7]
07-06 Quality measure [Outcome 3, 4, 7]
07-07 Risk measure [Outcome 3, 4, 7]
07-08 Service level measure [Outcome 3, 4, 7]
15-01 Analysis report [Outcome 2, 5]
15-05 Evaluation report [Outcome 5, 7]
15-18 Process performance report [Outcome 5, 7]

4.6 Process Improvement Process Group (PIM)

4.6.1 PIM.3 Process improvement

Process ID	PIM.3
Process Name	Process Improvement
Process Purpose	The purpose of the Process improvement process is to continually improve the organization's effectiveness and efficiency through the processes used and aligned with the business need.
Process Outcomes	As a result of successful implementation of this process: 1) commitment is established to provide resources to sustain improvement actions; 2) issues arising from the organization's internal/external environment are identified as improvement opportunities and justified as reasons for change; 3) analysis of the current status of the existing process is performed, focusing on those processes from which improvement stimuli arise; 4) improvement goals are identified and prioritized, and consequent changes to the process are defined, planned and implemented; 5) the effects of process implementation are monitored, measured and confirmed against the defined improvement goals; 6) knowledge gained from the improvement is communicated within the organization; and 7) the improvements made are evaluated and consideration given for using the solution elsewhere within the organisation. NOTE 1: information sources providing input for change may include: process assessment results, audits, customer's satisfaction reports, organizational effectiveness/efficiency, cost of quality. NOTE 2: the current status of processes may be determined by

	process assessment.
Base Practices	**PIM.3.BP1: Establish commitment.** Commitment is established to support the process group, to provide resources and further abilities (trainings, methods, infrastructure, etc.) to sustain improvement actions. [Outcome 1] NOTE 1: The process improvement process is a generic process, which can be used at all levels (e.g. organizational level, process level, project level, etc.) and which can be used to improve all other processes. NOTE 2: Commitment at all levels of management may support process improvement. Personal goals may be set for the relevant managers to enforce management commitment. **PIM.3.BP2: Identify issues.** Processes and interfaces are continuously analyzed to identify issues arising from the organization's internal/external environment as improvement opportunities, and with justified reasons for change. This includes issues and improvement suggestions addressed by the customer. [Outcome 2, 3] NOTE 3: Continuous analysis may include problem report trend analysis (see SUP.9), analysis from Quality Assurance and Verification results and records (see SUP.1 – SUP.2), validation results and records, and product quality measures like ppm and recalls. **PIM.3.BP3: Establish process improvement goals.** Analysis of the current status of the existing process is performed, focusing on those processes from which improvement stimuli arise, resulting in improvement objectives for the processes being established. [Outcome 3] **PIM.3.BP4: Prioritize improvements.** The improvement objectives and improvement activities are prioritized. [Outcome 4] **PIM.3.BP5: Plan process changes.** Consequent changes to the process are defined and planned. [Outcome 4] NOTE 4: Process changes may only be possible if the complete supply chain improves (all relevant parties). NOTE 5: Traditionally process changes are mostly applied to new projects. Within the automotive industry, changes could be implemented per project phase (e.g. product sample phases A, B, C), yielding to a higher improvement rate. Also, the principal of low hanging fruits (means implementing easy improvements first) may be considered when planning process changes. NOTE 6: Improvements may be planned in continuous incremental small steps. Also, improvements are usually piloted before roll out at the organization. **PIM.3.BP6: Implement process changes.** The improvements to the processes are implemented. Process documentation is updated and people are trained. [Outcome 4] NOTE 7: This practice includes defining the processes and making sure these processes are applied. Process application can be supported by establishing policies, adequate process infrastructure (tools, templates, example artefacts, etc.), process training, process coaching and tailoring processes to local needs. **PIM.3.BP7: Confirm process improvement.** The effects of process implementation are monitored, measured and confirmed against the

	defined improvement goals. [Outcome 5] NOTE 8: Examples of measures may be metrics for goal achievement, process definition and process adherence. **PIM.3.BP8: Communicate results of improvement.** Knowledge gained from the improvements and progress of the improvement implementation is communicated outside of the improvement project across relevant parts of the organization and to the customer (as appropriate). [Outcome 6] **PIM.3.BP9: Evaluate the results of the improvement project.** Evaluate the results of the improvement project to check whether the solution was successful and can be used elsewhere in the organization. [Outcome 7]

Output Work Products
02-01 Commitment/agreement [Outcome 1]
05-00 Goals [Outcome 4]
06-04 Training material [Outcome 4, 6]
07-04 Process measure [Outcome 6]
08-00 Plan [Outcome 2, 4, 7]
08-29 Improvement plan [Outcome 4]
10-00 Process description [Outcome 4]
13-04 Communication record [Outcome 6]
13-16 Change request [Outcome 2]
15-05 Evaluation report [Outcome 2, 3, 4, 5, 7]
15-13 Assessment/audit report [Outcome 3, 5]
15-16 Improvement opportunity [Outcome 2, 3, 4, 7]
16-06 Process repository [Outcome 4]

4.7 Reuse Process Group (REU)

4.7.1 REU.2 Reuse program management

Process ID	REU.2
Process Name	Reuse program management
Process Purpose	The purpose of the Reuse program management process is to plan, establish, manage, control, and monitor an organization's reuse program and to systematically exploit reuse opportunities.
Process Outcomes	As a result of successful implementation of this process: 1) the reuse strategy, including its purpose, scope, goals and objectives, is defined; 2) each domain is assessed to determine its reuse potential; 3) the domains in which to investigate reuse opportunities, or in which it is intended to practice reuse, are identified;

	4) the organization's systematic reuse capability is assessed; 5) reuse proposals are evaluated to ensure the reuse product is suitable for the proposed application; 6) reuse is implemented according to the reuse strategy ; 7) feedback, communication, and notification mechanisms are established, that operate between affected parties; and 8) the reuse program is monitored and evaluated. NOTE 1: Affected parties may include reuse program administrators, asset managers, domain engineers, developers, operators, and maintainance groups. NOTE 2: The quality requirements for re-use work products should be defined.
Base Practices	**REU.2.BP1: Define organizational reuse strategy.** Define the reuse program and necessary supporting infrastructure for the organization. [Outcome 1]. **REU.2.BP2: Identify domains for potential reuse.** Identify set(s) of systems and their components in terms of common properties that can be organized into a collection of reusable assets that may be used to construct systems in the domain. [Outcome 2] **REU.2.BP3: Assess domains for potential reuse.** Assess each domain to identify potential use and applications of reusable components and products. [Outcome 3] **REU.2.BP4: Assess reuse maturity.** Gain an understanding of the reuse readiness and maturity of the organization, to provide a baseline and success criteria for reuse program management. [Outcome 4] **REU.2.BP5: Evaluate reuse proposals.** Evaluate suitability of the provided reusable components and product(s) to proposed use. [Outcome 5] **REU.2.BP6: Implement the reuse program.** Perform the defined activities identified in the reuse program. [Outcome 6] **REU.2.BP7: Get feedback from reuse.** Establish feedback, assessment, communication and notification mechanism to control the progress of reuse program. [Outcomes 7 and 8] **REU.2.BP8: Monitor reuse.** Monitor the implementation of the reuse program periodically and evaluate its suitability to actual needs. [Outcomes 6, 8]

Output Work Products
04-02 Domain architecture [Outcome 2]
04-03 Domain model [Outcome 2]
08-17 Reuse plan [Outcome 5, 6]
09-03 Reuse policy [Outcome 1]
12-03 Reuse proposal [Outcome 4]
13-04 Communication record [Outcome 7]
15-07 Reuse evaluation report [Outcome 5, 6, 8]
15-13 Assessment/audit report [Outcome 3, 4]
19-05 Reuse strategy [Outcome 1]

5 Process Capability Indicators (level 1 to 5)

Process capability indicators are the means of achieving the capabilities addressed by the considered process attributes. Evidence of process capability indicators supports 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 ISO/IEC 15504-2. The process capability indicators for the 9 process attributes included in the capability dimension for level 1 to 5 are described.

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

NOTE ISO/IEC 15504-2 process attribute definitions and attribute outcomes are duplicated from ISO/IEC 15504-2 in italic font.

5.1 Level 1: Performed process

5.1.1 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:

a) the process achieves its defined outcomes.

5.1.1.1 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 1 The assessment of a performed process is based on process performance indicators, which are defined in Clause 5 of this document [ISO/IEC 15504-2].

NOTE 2 Generic resources and Generic work products do not exist for the assessment of the PA 1.1 attribute.

5.1.1.2 Generic Resources for PA 1.1

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

5.2 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.

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

5.2.1 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.

5.2.1.1 Generic Practices for PA 2.1

GP 2.1.1 Identify the objectives for the performance of the process.

NOTE 1: 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.

The scope of the process performance is defined.

Assumptions and constraints are considered when identifying the performance objectives.

NOTE 2: At minimum, project performance objectives for resources, effort and schedule should be stated.

GP 2.1.2 Plan and monitor the performance of the process to fulfill 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.
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. The necessary infrastructure and facilities are 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.

5.2.1.2 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 issues management mechanisms. [PA 2.1 Achievement c]

5.2.2 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.

5.2.2.1 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.
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.

5.2.2.2 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]

5.3 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:

5.3.1 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 1 A standard process may be used as-is when deploying a defined process, in which case tailoring guidelines would not be necessary.

5.3.1.1 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.

5.3.1.2 Generic Resources for PA 3.1

Process modeling 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]

5.3.2 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:

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

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

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

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

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

f) appropriate data are collected and analysed 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 1 Competency results from a combination of knowledge, skills and personal attributes that are gained through education, training and experience.

5.3.2.1 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 analyse 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 analysed 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.

5.3.2.2 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]

Audit/review system. [PA 3.2 Achievement f]

5.4 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:

5.4.1 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:

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

b) *process measurement objectives are derived from identified process information needs;*

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

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

e) *results of measurement are collected, analysed and rep*orted in order to monitor the extent to which the quantitative objectives for process performance are met;

f) measurement results are used to characterise 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.

5.4.1.1 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.

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.

Measurement results are reported to those responsible for monitoring the extent to which quantitative 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 similar techniques are used to quantitatively understand process performance and capability within defined control limits.

Trends of process behaviour are identified.

5.4.1.2 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]

5.4.2 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 analysed 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.*

5.4.2.1 Generic Practices for PA 4.2

GP 4.2.1 Determine analysis and control techniques, appropriate to control the process performance. Process control analysis methods and 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.
GP 4.2.3 Analyse process and product measurement results to identify variations in process performance. Measures are used to analyse process performance. All situations are recorded when defined control limits are exceeded. Each out-of-control case is analysed to identify potential cause(s) of variation. Special 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.

5.4.2.2 Generic Resources for PA 4.2

Process control and analysis techniques; [PA 4.2 Achievement a, c]

Statistical analysis tools/applications; [PA 4.2 Achievement b, c, e]

Process control tools/applications. [PA 4.2 Achievement d, e]

5.5 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:

5.5.1 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 analysed to identify common causes of variations in process performance;

c) appropriate data are analysed 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.

5.5.1.1 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 Analyse measurement data of the process to identify real and potential variations in the process performance. Measurement data are analysed and made available. Causes of variation in process performance are identified and classified. Common causes of variation are analysed 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.

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.

5.5.1.2 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]

5.5.2 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.

5.5.2.1 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.

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, organisational 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 analysed 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.

5.5.2.2 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]

Annex A

Conformity of the Process Assessment Model

Introduction

For ease of reference, the requirements from Clause 6.3 of ISO/IEC 15504-2 are embedded verbatim in the text.
The Process Assessment Model is constructed to be an elaboration of the Automotive SPICE® Process Reference Model that in turn is derived from ISO/IEC 12207 AMD 1 and 2, and a subset of the measurement framework from ISO/IEC 15504-2 that is elaborated in ISO/IEC 15504-5.

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

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, 6.3.1]

The purpose of this Process Assessment Model is to support assessment of process capability in the automotive domain in accordance with the requirements of ISO/IEC 15504-2.

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.

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, 6.3.2]*

The Process Assessment Model is based upon the Automotive SPICE® Process Reference Model that is itself derived from ISO/IEC 12207 AMD 1 and AMD 2. A statement of compliance of the Automotive SPICE® Process Reference Model is provided in the Automotive SPICE® Process reference Model document.

In the process dimension of the Process Assessment Model, the model provides coverage of all the processes in the Automotive SPICE® Process Reference Model.

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.

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, 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 and generic resources

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

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, 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 Outcomes it addresses. All Work Products relate as Outputs to the Process as a whole.
Each of the Process Attributes in this Process Assessment Model is identical to the Process Attribute defined in the Measurement Framework in ISO/IEC 15504-2. The Generic Practices address the characteristics from each Process Attribute. The Generic Resources 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 fulfill 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	Practice Name	Maps To
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 standard process.	PA.3.1.c
GP 3.1.4	Identify the required infrastructure and work environment for performing the standard process.	PA.3.1.d
GP 3.1.5	Determine suitable methods to monitor the effectiveness and suitability of the standard 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
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 analyse 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	Practice Name	Maps To
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	Analyse 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	Analyse 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

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, 6.3.5]*

The processes in this Process Assessment Model are identical to those defined in the Automotive SPICE® 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 in ISO/IEC 15504-2. 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.

Annex B

Work product characteristics

Work product characteristics listed in this Annex can be used when reviewing potential 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. Work products are defined using the schema in Table B.1.

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.

Work Products (with the ID nn-00) 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 specific work products defined as process performance indicators.
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: The generic work products denoted with * are not used in the Automotive SPICE® Process Assessment Model but are included for completeness.

	WP ID	WP Name	WP Characteristics
	01-00	Configuration item	– Item which is maintained under configuration control: – – may include modules, subsystems, libraries, test cases, compilers, data, documentation, physical media, and external interfaces – Version identification is maintained – Description of the item is available including things like: – – type of item – – associated configuration management library, file, system – – responsible owner – – date when placed under configuration control – – status information (i.e., development, baselined, released) – – relationship to lower level configured items – – identification of the change control records – – identification of change history
	01-03	Software item	– Integrated software consisting of: – – source code – – software elements – – executable code – – configuration files – Documentation, which: – – describes and identifies source code – – describes and identifies software elements – – describes and identifies configuration files – – describes and identifies executable code – – describes software life-cycle status – – describes archive and release criteria – – describes compilation of software units – – describes building of software item
	01-50	Integrated Software	– An aggregate of software items – A set of executables for a specific ECU configuration and possibly associated documentation and data

	WP ID	WP Name	WP Characteristics
	01-51	Application Parameter	– Name – Description – Value domain, threshold values, characteristic curves – Owner – Means of data application (e.g. flashing interfaces) – If necessary a grouping/a categorization: – – name of the category/group/file name – – description – Actual value or characteristic curve applied
	02-00	Contract	– Defines what is to be purchased or delivered – Identifies time frame for delivery or contracted service dates – Identifies any statutory requirements – Identifies monetary considerations – Identifies any warranty information – Identifies any copyright and licensing information – Identifies any customer service requirements – Identifies service level requirements – References to any performance and quality expectations/constraints/monitoring – Standards and procedures to be used – Evidence of review and approval – As appropriate to the contract the following are considered: – – references to any acceptance criteria – – references to any special customer needs (i.e., confidentiality requirements, security, hardware, etc.) – – references to any change management and problem resolution procedures – – identifies any interfaces to independent agents and subcontractors – – identifies customer's role in the development and maintenance process – – identifies resources to be provided by the customer

	WP ID	WP Name	WP Characteristics
	02-01	Commitment/agreement	– Signed off by all parties involved in the commitment/agreement – Establishes what the commitment is for – Establishes the resources required to full fill the commitment, such as: – – time – – people – – budget – – equipment – – facilities
	03-00	Data	– Result of applying a measure
	03-03	Benchmarking data	– Results of measurement of current performance that allow comparison against historical or target values – Relates to key goals/process/product/market need criteria and information to be benchmarked
	03-04	Customer satisfaction data	– Determines levels of customer satisfaction with products and services – Mechanism to collect data on customer satisfaction: – – results of field performance data – – results of customer satisfaction survey – – interview notes – – meeting minutes from customer meetings
	[deleted]		
	03-06	Process performance data	– Data comparing process performance against expected levels – Defined input and output work products available – Meeting minutes – Change records – Task completion criteria met – Quality criteria met – Resource allocation and tracking
*	04-00	Design	– Describes the overall product/system structure – Identifies the required product/system elements – Identifies the relationship between elements – Consideration is given to: – – any required performance characteristics – – any required interfaces – – any required security characteristics

	WP ID	WP Name	WP Characteristics
	04-02	Domain architecture	– Identified domain model(s) tailored from – Identified asset specifications – Definition of boundaries and relationships with other domains (Domain Interface Specification) – Identification of domain vocabulary – Identification of the domain representation standard – Provide an overview of the functions, features capabilities and concepts in the domains
	04-03	Domain model	– Must provide a clear explanation and description, on usage and properties, for reuse purposes – Identification of the management and structures used in the model
	04-04	Software architectural design	– Describes the overall software structure – Describes the operative system including task structure – Identifies inter-task/inter-process communication – Identifies the required software elements – Identifies own developed and supplied code – Identifies the relationship and dependency between software elements – Identifies where the data (such as parameters) are stored and which measures (e.g. checksums, redundancy) are taken to prevent data corruption – Describes how variants for different model series or configurations are derived – Describes the dynamic behaviour of the software (Start-up, shutdown, software update, error handling and recovery, etc.) – Identifies where the data (such as parameters) are stored and which measures (e.g. checksums, redundancy) are taken to prevent data corruption – Describes which data is persistent and under which conditions – Consideration is given to: – – any required software performance characteristics – – any required software interfaces – – any required security characteristics required – – any database design requirements

	WP ID	WP Name	WP Characteristics
	04-05	Software detailed design	– Provides detailed design (could be represented as a prototype, flow chart, entity relationship diagram, pseudo code, etc.) – Provides format of input/output data – Provides specification of CPU, ROM, RAM, EEPROM and Flash needs – Describes the interrupts with their priorities – Describes the tasks with cycle time and priority – Establishes required data naming conventions – Defines the format of required data structures – Defines the data fields and purpose of each required data element – Provides the specifications of the program structure
	04-06	System architectural design	– Provides an overview of all system design – Describes the interrelationship between system elements – Describes the relationship between the system elements and the software – Specifies the design for each required system element, consideration is given to things like: – – memory/capacity requirements – – hardware interfaces requirements – – user interfaces requirements – – external system interface requirements – – performance requirements – – commands structures – – security/data protection characteristics – – system parameter settings – – manual operations – – reusable components – Mapping of requirements to system elements – Description of the operation modes of the system components (startup, shutdown, sleep mode, diagnosis mode, etc.) – Description of the dependencies among the system components regarding the operation modes – Description of the dynamic behaviour of the system and the system components

	WP ID	WP Name	WP Characteristics
	05-00	Goals	– Identifies the objective to be achieved – Identifies who is expected to achieve the goal – Identifies any incremental supporting goals – Identifies any conditions/constraints – Identifies the timeframe for achievement – Are reasonable and achievable within the resources allocated – Are current, established for current project, organization – Are optimized to support known performance criteria and plans
*	06-00	User documentation	– Identifies: – – external documents – – internal documents – – current site distribution and maintenance list maintained – Documentation kept synchronized with latest product release – Addresses technical issues
	06-01	Customer manual	– Takes account of: – audience and task profiles – the environment in which the information will be used – convenience to users – the range of technical facilities, including resources and the product, available for developing and delivering on-screen documentation – information characteristics – cost of delivery and maintainability – Includes information needed for operation of the system, including but not limited to: – product and version information – instructions for handling the system – initial familiarisation information – long examples – structured reference material, particularly for advanced features of the software – checklists – guides to use input devices

	WP ID	WP Name	WP Characteristics
	06-02	Handling and storage guide	– Defines the tasks to perform in handling and storing products including: – – providing for master copies of code and documentation – – disaster recovery – – addressing appropriate critical safety and security issues – Provides a description of how to store the product including: – – storage environment required – – the protection media to use – – packing materials required – – what items need to be stored – – assessments to be done on stored product – Provides retrieval instructions
	06-04	Training material	– Updated and available for new releases – Coverage of system, application, operations, maintenance as appropriate to the application – Courses listings and availability
*	07-00	Measure	– Available to those with a need to know – Understood by those expected to use them – Provides value to the organization/project – Non-disruptive to the work flow – Appropriate to the process, life cycle model, organization: – – is accurate – – source data is validated – – results are validated to ensure accuracy – Has appropriate analysis and commentary to allow meaningful interpretation by users
	07-01	Customer satisfaction survey	– Identification of customer and customer information – Date requested – Target date for responses – Identification of associated hardware/software/product configuration – Ability to record feedback

	WP ID	WP Name	WP Characteristics
	07-02	Field measure	– Measures attributes of the performance of system's operation at field locations, such as: – – field defects – – performance against defined service level measures – – system ability to meet defined customer requirements – – support time required – – user complaints (may be third party users) – – customers requests for help – – performance trends – – problem reports – – enhancements requested
	07-03	Personnel performance measure	– Real time measures of personnel performance or expected service level – Identifies things like: – – capacity – – throughput – – operational performance – – operational service – – availability
	07-04	Process measure	– Measures about the process' performance: – – ability to produce sufficient work products – – adherence to the process – – time it takes to perform process – – defects related to the process – Measures the impact of process change – Measures the efficiency of the process
	07-05	Project measure	– Monitors key processes and critical tasks, provides status information to the project on: – – project performance against established plan – – resource utilization against established plan – – time schedule against established plan – – process quality against quality expectations and/or criteria – – product quality against quality expectations and/or criteria – – highlight product performance problems, trends – Measures the results of project activities: – – tasks are performed on schedule – – product's development is within the resource commitments allocated – References any goals established

	WP ID	WP Name	WP Characteristics
	07-06	Quality measure	– Measures quality attributes of the work products defined: – functionality – reliability – usability – efficiency – maintainability – portability – Measures quality attributes of the "end customer" product quality and reliability NOTE: Refer ISO/IEC 9126 for detailed information on measurement of product quality.
	07-07	Risk measure	– Identifies the probability of risk occurring – Identifies the impact of risk occurring – Establishes measures for each risk defined – Measures the change in the risk state
	07-08	Service level measure	– Real time measures taking while a system is operational, it measures the system's performance or expected service level – Identifies things like: – – capacity – – throughput – – operational performance – – operational service – – service outage time – – up time – – job run time

	WP ID	WP Name	WP Characteristics
	08-00	Plan	(As appropriate to the application and purpose) – Identification of the plan owner – Includes: – – the objective and scope of what is to be accomplished – – assumptions made – – constraints – – risks – – tasks to be accomplished – – schedules, milestones and target dates – – critical dependencies – – maintenance disposition for the plan – Method/approach to accomplish plan – Identifies: – – task ownership, including tasks performed by other parties (e.g. supplier, customer) – – quality criteria – – required work products – Includes resources to accomplish plan objectives: – – time – – staff (key roles and authorities e.g. sponsor) – – materials/equipment – – budget – Includes contingency plan for non-completed tasks – Plan is approved
	08-04	Configuration management plan	– Defines or references the procedures to control changes to configuration items – Defines measurements used to determine the status of the configuration management activities – Defines configuration management audit criteria – Approved by the configuration management function – Identifies configuration library tools or mechanism – Includes management records and status reports that show the status and history of controlled items – Specifies the location and access mechanisms for the configuration management library – Storage, handling and delivery (including archival and retrieval) mechanisms specified

	WP ID	WP Name	WP Characteristics
	08-06	Project activity network	– A graphic illustration of a project as a network diagram showing all of the project's activities, their attributes, and the relationships between them; the most common form is the PERT chart – Activity attributes include: – – activity name – – estimated duration – – planned and actual start date – – planned and actual completion date – – resource requirements – The relationships between the activities may include: – – predecessor activities – – successor activities – – dependency delays
	08-12	Project plan	– Defines: – – work products to be developed – – life cycle model and methodology to be used – – customer requirements related to project management – – tasks to be accomplished – – task ownership – – project resources – – schedules, milestones and target dates – – estimates – – quality criteria – Identifies: – – critical dependencies – – required work products – – project risks and risk mitigation plan – – contingency actions for non-completed tasks

	WP ID	WP Name	WP Characteristics
	08-13	Quality plan	– Objectives/goal for quality – Defines the activities tasks required to ensure quality – References related work products – Method of assessment/assuring quality – References any regulatory requirements, standards, customer requirements – Identifies the expected quality criteria – Specifies the monitoring timeframe and quality checkpoints for the defined life cycle and associated activities planned – Target timeframe to achieve desired quality – Method to achieved goals: – – tasks to be performed – – ownership for tasks – – audit to be performed – – resource commitments – Identifies the quality criteria for work products and process tasks – Specifies the threshold/tolerance level allowed prior to requiring corrective actions – Defines quality measurements and benchmark data – Defines the quality record collection mechanism and timing of the collection – Specifies mechanism to feed collected quality record back into process impacted by poor quality – Approved by the quality responsible organization/function - Defines types of independence of the QA - Identifies escalations opportunities and channels -Defines the cooperation with customer and supplier QA

	WP ID	WP Name	WP Characteristics
	08-14	Recovery plan	– Identifies what is to be recovered: – – procedures/methods to perform the recovery – – schedule for recovery – – time required for the recovery – – critical dependencies – – resources required for the recovery – – list of backups maintained – – staff responsible for recovery and roles assigned – – special materials required – – required work products – – required equipment – – required documentation – – locations and storage of backups – – contact information on who to notify about the recovery – – verification procedures – – cost estimation for recovery
	08-16	Release plan	– Identifies the functionality to be included in each release – Identifies the associated elements required (i.e., hardware, software, documentation etc.) – Mapping of the customer requests, requirements satisfied to particular releases of the product
	08-17	Reuse plan	– Defines the policy about what items to be reused – Defines standards for construction of reusable objects: – – defines the attributes of reusable components – – quality/reliability expectations – – standard naming conventions – Defines the reuse repository (library, CASE tool, file, data base, etc.) – Identifies reusable components: – – directory of component – – description of components – – applicability of their use – – method to retrieve and use them – – restrictions for modifications and usage – Method for using reusable components – Establishes goal for reusable components

	WP ID	WP Name	WP Characteristics
	08-18	Review plan	– Defines: – – what to be reviewed – – roles and responsibilities of reviewers – – criteria for review (check-lists, requirements, standards) – – expected preparation time – – schedule for reviews – Identification of: – – procedures for conducting review – – review inputs and outputs – – expertise expected at each review – – review records to keep – – review measurements to keep – – resources, tools allocated to the review
	08-19	Risk management plan	– Project risks identified and prioritized – Mechanism to track the risk – Threshold criteria to identify when corrective action required – Proposed ways to mitigate risks: – – risk mitigator – – work around – – corrective actions activities/tasks – – monitoring criteria – – mechanisms to measure risk

	WP ID	WP Name	WP Characteristics
	08-20	Risk mitigation plan	– Planned risk treatment activities and tasks: – – describes the specifics of the risk treatment selected for a risk or combination of risks found to be unacceptable – – describes any difficulties that may be found in implementing the treatment – Treatment schedule – Treatment resources and their allocation – Responsibilities and authority: – – describes who is responsible for ensuring that the treatment is being implemented and their authority – Treatment control measures: – – defines the measures that will be used to evaluate the effectiveness of the risk treatment – Treatment cost – Interfaces among parties involved: – – describes any coordination among stakeholders or with the project's master plan that must occur for the treatment to be properly implemented – Environment/infrastructure: – – describes any environmental or infrastructure requirements or impacts (e.g., safety or security impacts that the treatment may have) – Risk treatment plan change procedures and history
	08-26	Documentation plan	– Identifies documents to be produced – Defines the documentation activities during the life cycle of the software product or service – Identifies any applicable standards and templates – Defines requirements for documents – Review and authorization practices – Distribution of the documents – Maintenance and disposal of the documents
	08-27	Problem management plan	– Defines problem resolution activities including identification, recording, description and classification – Problem resolution approach: evaluation and correction of the problem – Defines problem tracking - Mechanism to collect and distribute problem resolutions

	WP ID	WP Name	WP Characteristics
	08-28	Change management plan	– Defines change management activities including identification, recording, description, analysis and implementation – Defines approach to track status of change requests – Defines verification and validation activities – Change approval and implication review
	08-29	Improvement plan	– Improvement objectives derived from organizational business goals – Organizational scope – Process scope, the processes to be improved – Key roles and responsibilities – Appropriate milestones, review points and reporting mechanisms – Activities to be performed to keep all those affected by the improvement programme informed of progress
	08-50	Test specification	- Level Test Design (according to IEEE definition) - Level Test Case (according to IEEE definition) - Level Test Procedure (according to IEEE definition) - Identification of test cases for regression testing Additionally for system integration: – Identification of required system elements (hardware elements, wiring elements, parameter settings, data bases, etc.) – Necessary sequence or ordering identified for integrating the system elements
	08-51	Technology monitoring plan	*No requirements additional to Plan (Generic)*
	08-52	Test plan	- Level Test Plan (according to IEEE definition) - Test strategy (black-box and/or white-box-testing, boundary class test determination, regression testing strategy, etc.) Additionally where necessary: - Master Test Plan (according to IEEE definition)
*	09-00	Policy	– Authorized – Available to all personnel impacted by the policy – Establishes practices/rules to be adhered to

	WP ID	WP Name	WP Characteristics
	09-03	Reuse policy	– Identification of reuse requirements – Establishes the rules of reuse – Documents the reuse adoption strategy including goals and objectives – Identification of the reuse program – Identification of the name of the reuse sponsor – Identification of the reuse program participants – Identification of the reuse steering function – Identification of reuse program support functions
	10-00	Process description	– A detailed description of the process/procedure which includes: – – tailoring of the standard process (if applicable) – – purpose of the process – – outcomes of the process – – task and activities to be performed and ordering of tasks – – critical dependencies between task activities – – expected time required to execute task – – input/output work products – – links between input and outputs work products – Identifies process entry and exit criteria – Identifies internal and external interfaces to the process – Identifies process measures – Identifies quality expectations – Identifies functional roles and responsibilities – Approved by authorised personnel
*	11-00	Product	– Is a result/deliverable of the execution of a process, includes services, systems (software and hardware) and processed materials – Has elements that satisfy one or more aspects of a process purpose – May be represented on various media (tangible and intangible)

	WP ID	WP Name	WP Characteristics
	11-03	Product release information	– Coverage for key elements (as appropriate to the application): – Description of what is new or changed (including features removed) – System information and requirements – Identification of conversion programs and instructions – Release numbering implementation may include: – – the major release number – – the feature release number – – the defect repair number – – the alpha or beta release; and the iteration within the alpha or beta release – Identification of the component list (version identification included): – – hardware/software/product elements, libraries, etc. – – associated documentation list – New/changed parameter information and/or commands – Backup and recovery information – List of open known problems, faults, warning information, etc. – Identification of verification and diagnostic procedures – Technical support information – Copyright and license information – The release note may include an introduction, the environmental requirements, installation procedures, product invocation, new feature identification and a list of defect resolutions, known defects and workarounds
	11-04	Product release package	– Includes the hardware/software/product – Includes and associated release elements such as: – – system hardware/software/product elements – – associated customer documentation – – parameter definitions defined – – command language defined – – installation instructions – – release letter

	WP ID	WP Name	WP Characteristics
	11-05	Software unit	– Follows established coding standards (as appropriate to the language and application): – – commented – – structured or optimized – – meaningful naming conventions – – parameter information identified – – error codes defined – – error messages descriptive and meaningful – – formatting - indented, levels – Follows data definition standards (as appropriate to the language and application): – – variables defined – – data types defined – – classes and inheritance structures defined – – objects defined – Entity relationships defined – Database layouts are defined – File structures and blocking are defined – Data structures are defined – Algorithms are defined – Functional interfaces defined
	11-06	System	– All elements of the product release are included – Any required hardware – Integrated product – Customer documentation – Fully configured set of the system elements: – – parameters defined – – commands defined – – data loaded or converted
	11-07	Temporary solution	– Problem identification – Release and system information – Temporary solution, target date for actual fix identified – Description of the solution: – – limitations, restriction on usage – – additional operational requirements – – special procedures – – applicable releases – Backup/recovery information – Verification procedures – Temporary installation instructions

	WP ID	WP Name	WP Characteristics
*	12-00	Proposal	– Defines the proposed solution – Defines the proposed schedule – Identifies the coverage identification of initial proposal: – – identifies the requirements that would be satisfied – – identifies the requirements that could not be satisfied, and provides a justification of variants – Defines the estimated price of proposed development, product, or service
	12-01	Request for proposal	– Reference to the requirements specifications – Identifies supplier selection criteria – Identifies desired characteristics, such as: – – system architecture, configuration requirements or the requirements for service (consultants, maintenance, etc.) – – quality criteria or requirements – – project schedule requirements – – expected delivery/service dates – – cost/price expectations – – regulatory standards/requirements – Identifies submission constraints: – – date for resubmitted of the response – – requirements with regard to the format of response
	12-03	Reuse proposal	– Identifies the project name – Identifies the project contact – Identifies the reuse goals and objectives – Identifies the list of reuse assets – Identifies the issues/risks of reusing the component including specific requirements (hardware, software, resource and other reuse components) – Identifies the person who will be approving the reuse proposal
	12-04	Supplier proposal response	– Defines the suppliers proposed solution – Defines the suppliers proposed delivery schedule – Identifies the coverage identification of initial proposal: – – identifies the requirements that would be satisfied – – identifies the requirements that could not be satisfied, and provides a justification of variants – Defines the estimated price of proposed development, product, or service

	WP ID	WP Name	WP Characteristics
	13-00	Record	– Work product stating results achieved or provides evidence of activities performed in a process – An item that is part of a set of identifiable and retrievable data
	13-01	Acceptance record	– Record of the receipt of the delivery – Identification of the date received – Identification of the delivered components – Records the verification of any customer acceptance criteria defined – Signed by receiving customer
	13-04	Communication record	– All forms of interpersonal communication, including: – – letters – – faxes – – e-mails – – voice recordings – – telexes
	13-05	Contract review record	– Scope of contract and requirements – Possible contingencies or risks – Alignment of the contract with the strategic business plan of the organization – Protection of proprietary information – Requirements which differ from those in the original documentation – Capability to meet contractual requirements – Responsibility for subcontracted work – Terminology – Customer ability to meet contractual obligations.
	13-06	Delivery record	– Record of items shipped/delivered electronically to customer – Identification of: – – who it was sent to – – address where delivered – – the date delivered – Record receipt of delivered product

	WP ID	WP Name	WP Characteristics
	13-07	Problem record	– Identifies the name of submitted and associated contact details – Identifies the group/person(s) responsible for providing a fix – Includes a description of the problem – Identifies classification of the problem (criticality, urgency, relevance etc.) – Identifies the status of the reported problem – Identifies the target release(s) problem will be fixed in – Identifies the expected closure date – Identifies any closure criteria – Identifies re-inspection actions
	13-09	Meeting support record	– Agenda and minutes that are records that define: – – purpose of meeting – – attendees – – date, place held – – reference to previous minutes – – what was accomplished – – identifies issues raised – – any open issues – – next meeting, if any
	13-10	Configuration management record	– Status of the work products/items and modifications – Identifies items under configuration control – Identifies activities performed e.g. backup, storage, archiving, handling and delivery of configured items – Supports consistency of the product
	13-13	Product release approval record	– Content information of what is to be shipped or delivered – Identification of: – – who it is intended for – – address where to delivered – – the date released – Record of supplier approval

	WP ID	WP Name	WP Characteristics
	13-14	Progress status record	– Record of the status of a plan(s) (actual against planned) such as: – – status of actual tasks against planned tasks – – status of actual results against established objectives/goals – – status of actual resource allocation against planned resources – – status of actual cost against budget estimates – – status of actual time against planned schedule – – status of actual quality against planned quality – Record of any deviations from planned activities and reason why
	13-15	Proposal review record	– Scope of proposal and requirements – Possible contingencies or risks – Alignment of the proposal with the strategic business plan of the organization – Protection of proprietary information – Requirements which differ from those in the original documentation – Capability to meet contractual requirements – Responsibility for subcontracted work – Terminology – Supplier ability to meet obligations – Approved
	13-16	Change request	– Identifies purpose of change – Identifies request status (new, accepted, rejected) – Identifies requester contact information – Impacted system(s) – Impact to operations of existing system(s) defined – Impact to associated documentation defined – Criticality of the request, date needed by

	WP ID	WP Name	WP Characteristics
	13-17	Customer request	– Identifies request purpose, such as: – – new development – – enhancement – – internal customer – – operations – – documentation – – informational – Identifies request status information, such as: – – date opened – – current status – – date assigned and responsible owner – – date verified – – date closed – Identifies priority/severity of the request – Identifies customer information, such as: – – company/person initiating the request – – contact information and details – – system site configuration information – – impacted system(s) – – impact to operations of existing systems – – criticality of the request – – expected customer response/closure requirements – Identifies needed requirements/standards – Identifies information sent with request (i.e., RFPs, dumps, etc.)
	13-18	Quality record	– Defines what information to keep – Defines what tasks/activities/process produce the information – Defines when the data was collected – Defines source of any associated data – Identifies the associated quality criteria – Identifies any associated measurements using the information – Identifies any requirements to be adhered to create the record, or satisfied by the record

	WP ID	WP Name	WP Characteristics
	13-19	Review record	– Provides the context information about the review: – – what was reviewed – – lists reviewers who attended – – status of the review – Provides information about the coverage of the review: – – check-lists – – review criteria – – requirements – – compliance to standards – Records information about: – – the readiness for the review – – preparation time spent for the review – – time spent in the review – – reviewers, roles and expertise – Identifies the required corrective actions: – – risk identification – – prioritized list of deviations and problems discovered – – the actions, tasks to be performed to fix the problem – – ownership for corrective action – – status and target closure dates for identified problems

	WP ID	WP Name	WP Characteristics
	13-20	Risk action request	– Date of initiation – Scope – Subject – Request originator – Risk management process context: – – this section may be provided once, and then referenced in subsequent action requests if no changes have occurred – – process scope – – stakeholder perspective – – risk categories – – risk thresholds – – project objectives – – project assumptions – – project constraints – Risks: – – this section may cover one risk or many, as the user chooses – – where all the information above applies to the whole set of risks, one action request may suffice – – where the information varies, each request may cover the risk or risks that share common information – – risk description(s) – – risk probability – – risk consequences – – expected timing of risk – Risk treatment alternatives: – – alternative descriptions – – recommended alternative(s) – – justifications – Risk action request disposition: – – each request should be annotated as to whether it is accepted, rejected, or modified, and the rationale provided for whichever decision is taken

	WP ID	WP Name	WP Characteristics
	13-21	Change control record	– Used as a mechanism to control change to baselined products/products in official project release libraries – Record of the change requested and made to a baselined product (work products, software, customer documentation, etc.): – – identification of system, documents impacted with change – – identification of change requester – – identification of party responsible for the change – – identification of status of the change – Linkage to associated customer requests, internal change requests, etc. – Appropriate approvals – Duplicate requests are identified and grouped
	13-22	Traceability record	– All requirements (customer and internal) are to be traced – Identifies a mapping of requirement to life cycle work products – Provides the linkage of requirements to work product decomposition (i.e., requirement →design →code →test →deliverables, etc.) – Provides forward and backwards mapping of requirements to associated work products throughout all phases of the life cycle – NOTE: this may be included as a function of another defined work product (example: A CASE tool for design decomposition may have a mapping ability as part of its features)
	13-24	Validation results	– Validation check-list – Passed items of validation – Failed items of validation – Pending items of validation – Problems identified during validation – Risk analysis – Recommendation of actions – Conclusions of validation – Signature of validation

	WP ID	WP Name	WP Characteristics
	13-25	Verification results	– Verification check-list – Passed items of verification – Failed items of verification – Pending items of verification – Problems identified during verification – Risk analysis – Recommendation of actions – Conclusions of verification – Signature of verification
	13-50	Test result	- Level Test Log (according to IEEE definition) - Anomaly Report (according to IEEE definition) - Level Test Report (according to IEEE definition) Additionally where necessary: - Level Interim Test Status Report (according to IEEE definition) - Master Test Report (according to IEEE definition)
*	14-00	Register	– A register is a compilation of data or information captured in a defined sequence to enable: – – an overall view of evidence of activities that have taken place – – monitoring and analyses – – provides evidence of performance of a process over time
	14-01	Change history	– Historical records of all changes made to an object (document, file, software module, etc.): – – description of change – – version information about changed object – – date of change – – change requester information – – change control record information
	14-02	Corrective action register	– Identifies the initial problem – Identifies the ownership for completion of defined action – Defines a solution (series of actions to fix problem) – Identifies the open date and target closure date – Contains a status indicator – Indicates follow up audit actions
	14-05	Preferred suppliers register	– Subcontractor or supplier history – List of potential subcontractor/suppliers – Qualification information – Identification of their qualifications – Past history information when it exists

	WP ID	WP Name	WP Characteristics
	14-06	Schedule	– Identifies the tasks to be performed – Identifies the expected and actual start and completion date for required tasks – Allows for the identification of critical tasks and task dependencies – Identifies task completion status, vs. planned date – Has a mapping to scheduled resource data
	14-08	Tracking system	– Ability to record customer and process owner information – Ability to record related system configuration information – Ability to record information about problem or action needed: – – date opened and target closure date – – severity/criticality of item – – status of any problem or actions needed – – information about the problem or action owner – – priority of problem resolution – Ability to record proposed resolution or action plan – Ability to provide management status information – Information is available to all with a need to know – Integrated change control system(s)/records
	14-09	Work breakdown structure	– Defines tasks to be performed, and their amendments – Documents ownership for tasks – Documents critical dependencies between tasks – Documents inputs and output work products – Documents the critical dependencies between defined work products
	14-11	Work product list	– Identifies: – – name of work product – – work product reference ID – – work product revision – – when updated – – work product status – – when approved – – reference to approval source – – file reference

	WP ID	WP Name	WP Characteristics
	14-50	Stakeholder groups list	– Identifies: – – relevant stakeholder groups – – weight/importance of each stakeholder group – – representative(s) for each stakeholder group
*	15-00	Report	– A work product describing a situation that: – – includes results and status – – identifies applicable/associated information – – identifies considerations/constraints – – provides evidence/verification
	15-01	Analysis report	– What was analyzed – Who did the analysis – The analysis criteria used: – – selection criteria or prioritization scheme used – – decision criteria – – quality criteria – Records the results: – – what was decided/selected – – reason for the selection – – assumptions made – – potential risks – Aspects of correctness to analyze include: – – completeness – – understandability – – testability – – verifiability – – feasibility – – validity – – consistency – – adequacy of content
	15-03	Configuration status report	– Identification of the number of items under configuration management – Identification of risks associated to configuration management – Identification of the number of configuration management items lost and reason for their loss – Identification of problem and issues related to configuration management – Identification of receiving parties – Identification of baselines made

	WP ID	WP Name	WP Characteristics
	15-05	Evaluation report	– States the purpose of evaluation – Method used for evaluation – Requirements used for the evaluation – Assumptions and limitations – Identifies the context and scope information required: – – date of evaluation – – parties involved – – context details – – evaluation instrument (check-list, tool) used – Records the result: – – data – – identifies the required corrective and preventive actions – – improvement opportunities, as appropriate
	15-06	Project status report	– A report of the current status of the project – Schedule: – – planned progress – – actual progress – – reasons for variance from planned progress – – threats to continued progress – – contingency plans to maintain progress – Budget: – – planned expenditure – – actual expenditure – – reasons for variance between planned and actual expenditure – – expected future expenditure – – contingency plans to achieve budget goals – Quality goals: – – actual quality measures – – reasons for variance from planned quality measures – – contingency plans to achieve quality goals – Project issues: – – issues which may affect the ability of the project to achieve its goals. – – contingency plans to overcome threats to project goals
	15-07	Reuse evaluation report	– Identification of reuse opportunities – Identification of investment in Reuse – Identification of current skills and experience – Identification of reuse infrastructure – The evaluation report must represent current status in implementation of the reuse program

	WP ID	WP Name	WP Characteristics
	15-08	Risk analysis report	– Identifies the risks analyzed – Records the results of the analysis: – – potential ways to mitigate the risk – – assumptions made – – constraints
	15-09	Risk status report	– Identifies the status of an identified risk: – – related project or activity – – risk statement – – condition – – consequence – – changes in priority – – duration of mitigation, when started – – risk mitigation activities in progress – – responsibility – – constraints
	15-12	Problem status report	– Presents a summary of problem records – – by problem categories/classification – Status of problem solving – – development of solved vs. open problems
	15-13	Assessment/audit report	– States the purpose of assessment – Method used for assessment – Requirements used for the assessment – Assumptions and limitations – Identifies the context and scope information required: – – date of assessment – – organizational unit assessed – – sponsor information – – assessment team – – attendees – – scope/coverage – – assessees' information – – assessment Instrument (check-list, tool) used – Records the result: – – data – – identifies the required corrective actions – – improvement opportunities

	WP ID	WP Name	WP Characteristics
	15-16	Improvement opportunity	– Identifies what the problem is – Identifies what the cause of a problem is – Suggest what could be done to fix the problem – Identifies the value (expected benefit) in performing the improvement – Identifies the penalty for not making the improvement
	15-18	Process performance report	No requirements additional to Evaluation report (Generic)
	15-21	Supplier evaluation report	No requirements additional to Evaluation report (Generic)
*	16-00	Repository	– Repository for components – Storage and retrieval capabilities – Ability to browse content – Listing of contents with description of attributes – Sharing and transfer of components between affected groups – Effective controls over access – Maintain component descriptions – Recovery of archive versions of components – Ability to report component status – Changes to components are tracked to change/user requests
	16-03	Configuration management library	– Correct creation of products from the library. – Can recreate any release or test configuration – Ability to report configuration status
	16-06	Process repository	– Contains process descriptions – Supports multiple presentations of process assets
	17-00	Requirement specification	– Each requirement is identified – Each requirement is unique – (Each requirement is verifiable or can be assessed (see 17-50)) – Includes statutory and regulatory requirements – Includes issues/requirements from (contract) reviews
	17-02	Build list	– Identification of aggregates of the software application system – Identification of required system elements (parameter settings, macro libraries, data bases, job control languages, etc.) – Necessary sequence ordering identified for compiling the software release – Input and output source libraries identified

	WP ID	WP Name	WP Characteristics
	17-03	Customer requirements	– Purpose/objectives defined – Includes issues/requirements from (contract) reviews – Identifies any: – – time schedule/constraints – – required feature and functional characteristics – – necessary performance considerations/constraints – – necessary internal/external interface considerations/constraints – – required system characteristics/constraints – – human engineering considerations/constraints – – security considerations/constraints – – environmental considerations/constraints – – operational considerations/constraints – – maintenance considerations/constraints – – installation considerations/constraints – – support considerations/constraints – – design constraints – – safety/reliability considerations/constraints – – quality requirements/expectations
	17-05	Documentation requirements	– Purpose/objectives defined – Proposed contents (coverage) defined – Intended audience defined – Identification of supported hardware/software/product release, system information – Identification of associated hardware/software/product requirements and designs satisfied by document – Identification of style, format, media standards expected definition of the intended distribution requirement – Includes storage requirements

	WP ID	WP Name	WP Characteristics
	17-08	Interface requirements specification	– Defines relationships between two products, process or process tasks – Defines criteria and format for what is common to both – Defines critical timing dependencies or sequence ordering – Description of the physical interfaces of each system component like – Bus Interfaces (CAN, MOST, LIN, etc.) – Transceiver (type, manufacturer, etc.) – additional Interfaces (IEEE, ISO, Bluetooth, USB, etc. – Digital Interfaces (PWM, etc.) – Analogue Interfaces – Identification of the software interfaces of software components and other software item in terms of – Inter-process communication mechanisms – Bus communication mechanisms
	17-11	Software requirements specification	– Identifies standards to be used – Identifies any software structure considerations/constraints – Identifies the required software elements – Identifies the relationship between software elements – Consideration is given to: – – any required software performance characteristics – – any required software interfaces – – any required security characteristics required – – any database design requirements – – any required error handling and recovery attributes – – any required resource consumption characteristics

	WP ID	WP Name	WP Characteristics
	17-12	System requirements specification	– System requirements include: functions and capabilities of the system; business, organizational and user requirements; safety, security, human-factors engineering (ergonomics), interface, operations, and maintenance requirements; design constraints and qualification requirements. (ISO/IEC 12207) – Identifies the required system overview – Identifies any interrelationship considerations/constraints between system elements – Identifies any relationship considerations/constraints between the system elements and the software – Identifies any design considerations/constraints for each required system element, including: – – memory/capacity requirements – – hardware interfaces requirements – – user interfaces requirements – – external system interface requirements – – performance requirements – – commands structures – – security/data protection characteristics – – system parameter settings – – manual operations – – reusable components – Describes the operation capabilities – Describes environmental capabilities – Documentation requirements – Reliability requirements – Logistical Requirements – Describes security requirements – Diagnosis requirements
	17-50	Verification Criteria	-Each requirement is verifiable or can be assessed - Verification criteria define the qualitative and quantitative criteria for verification of a requirement. - Verification criteria demonstrate that a requirement can be verified within agreed constraints. (Additional Requirement to 17-00 Requirements specification)

	WP ID	WP Name	WP Characteristics
*	18-00	Standard	– Identification of who/what they apply to – Expectations for conformance are identified – Conformance to requirements can be demonstrated – Provisions for tailoring or exception to the requirements are included
	18-01	Acceptance criteria	– Defines: – – interfaces – – schedule – – messages – – documents – – meetings – – joint review
	18-06	Product release criteria	– Defines expectations for product release: – – release type and status – – required elements of the release – – product completeness including documentation – – adequacy and coverage of testing – – limit for open defects – – change control status
	18-07	Quality criteria	– Defines expectations for quality: – – establishes what is an adequate work product (required elements, completeness expected, accuracy, etc.) – – identifies what constitutes the completeness of the defined tasks – – establishes life cycle transition criteria and the entry and exit requirements for each process and/or activity defined – – establishes expected performance attributes – – establishes product reliability attributes
	18-50	Supplier qualification criteria	– Expectations for conformance, to be fulfilled by competent suppliers, are identified – Links from the expectations to national/international/domains-specific standards/laws/regulations are described – Conformance to requirements can be demonstrated by the potential suppliers or assessed by the acquiring organisation – Provisions for tailoring or exception to the requirements are included

	WP ID	WP Name	WP Characteristics
*	19-00	Strategy	– Identifies what needs and objectives or goals there are to be satisfied – Establishes the options and approach for satisfying the needs, objectives, or goals – Establishes the evaluation criteria against which the strategic options are evaluated – Identifies any constraints/risks and how these will be addressed
	19-05	Reuse strategy	– Identify the goals for reuse – Identify the commitment for creating reusable components – Determine which product lines and type of artefacts should be supported with reuse – Identify system and hardware/software/product elements which can be reused within the organization – Identify the reuse repository and tools
	19-10	Verification strategy	– Verification methods, techniques, and tools – Work product or processes under verification – Degrees of independence for verification – Schedule for performing the above activities – Identifies what needs there are to be satisfied – Establishes the options and approach for satisfying the need – Establishes the evaluation criteria against which the strategic options are evaluated – Identifies any constraints/risks and how these will be addressed -Test ending criteria -Test start criteria, test abort, test re-start criteria
	19-11	Validation strategy	– Validation methods, techniques, and tools – Work products under validation – Degrees of independence for validation – Schedule for performing the above activities – Identifies what needs there are to be satisfied – Establishes the options and approach for satisfying the need – Establishes the evaluation criteria against which the strategic options are evaluated – Identifies any constraints/risks and how these will be addressed

	WP ID	WP Name	WP Characteristics
	20-00	Template	– Defines the attributes associated with a work product to be created as a consequence of a process execution – Identifies technical elements typically associated with this product type – Defines expected form and style
	21-00	Work product	– Defines the attributes associated with an artefact from a process execution: – – key elements to be represented in the work product

Annex C

Terminology

Annex C lists the applicable terminology references from IEEE 630, BS 7925-1 and notes from the FDA General principles of software validation. Annex D provides a schematic of key concepts used in the terminology.

Acceptance testing	BS7925-1 / IEEE610	Formal testing conducted to enable a user, customer, or authorised entity to decide whether to accept a system or component
Architectural design	IEEE610	The process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of the system
Baseline	IEEE610	A specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and can be changed only through formal change control procedures.
Black box testing	BS7925-1	Test case selection based on an analysis of the specification of the component without reference to its internal workings
Code review	IEEE610	A meeting at which software code is presented to project personnel, mangers, users, customers, or other interested parties for comment or approval
Coding	IEEE610	The transforming of logic and data from design specifications (design descriptions) into programming language

Component	BS7925-1	A minimal software or hardware item for which a separate specification is available One of the parts that makes up a system. A component may be hardware or software and may be subdivided into other components
Component testing	IEEE610	Testing of individual components or groups of related components
Defect	IEEE610	See fault
Design	IEEE610	The process of defining the architecture, components, interfaces, and other characteristics of a system or component.
Detailed design	IEEE610	The process of refining and expanding the preliminary design of a system or component to the extent that the design is sufficiently complete to be implemented
Development testing	IEEE610	Formal or informal testing conducted during the development of a system or component, usually in the development environment by the developer
Dynamic testing / Dynamic analysis	BS7925-1 / IEEE610	A process of evaluating a system or component based on its behaviour during execution
Embedded software	BS7925-1	Software in an embedded system, dedicated to controlling the specific hardware of the system
Embedded system	BS7925-1	A system that interacts with the real physical world using actors and sensors
Error	BS7925-1 / IEEE610	A human action that produces an incorrect result
Failure	BS7925-1	A deviation of the system from its expected delivery or service
Fault	BS7925-1	A manifestation of an error in software. A fault, if encountered, may cause a failure
Functional requirement	BS7925-1	The required functional behaviour of a system
Functional specification	IEEE610	A document that specifies the functions that a system or component must perform. Often part of a requirements specification
Functional testing	IEEE610	Testing that ignores the internal mechanism of a system or component and focuses solely on the outputs generated in response to selected inputs and execution conditions

Hardware	IEEE610	Physical equipment used to process, store, or transmit computer programs or data
High level testing	BS7925-1	A process of testing whole, complete products
HiL Hardware in the loop	BS7925-1	A test level where real hardware is used and tested in a simulated environment
Integration	BS7925-1	A process combining components into larger assemblies
Integration testing	BS7925-1	Performed to expose faults in the interfaces and in the interaction between integrated components
Low-level tests	BS7925-1	A process of testing individual components one at a time or in combination
MiL Model in the loop	BS7925-1	A test level where the simulation model of the system is tested dynamically in a simulated environment
Model based development	BS7925-1	A development method where the system is first described as a model. The code is then generated automatically from the models.
Module	IEEE610	A program unit that is discrete and identifiable with respect to compiling, combining with other units, and loading.
Preliminary design	IEEE610	The process of analysing design alternatives and defining the architecture, components, interfaces and timing and sizing estimates for a system or component
Rapid prototyping	BS7925-1	A test level where a simulated embedded system is tested while connected to the real environment
Regression testing	BS7925-1	Regression of a previously tested object following modification to ensure that faults have not been introduced or uncovered as a result of the changes made
Requirement	IEEE610	A condition that must be met or possessed by a system or component to satisfy a contract, standard, specification, or other formally imposed documents
Requirements specification	IEEE610	A document that specifies the requirements for a system or component. Typically included are functional requirements, performance requirements, interface requirements, design requirements, and development standards

Simulator	BS7925-1	A device, or computer program, or system used during software verification that behaves or operates like a given system when provided with a set of controlled inputs
SiL Software in the loop	BS7925-1	A test level where the real software is used and tested in a simulated environment or with experimental hardware
Software	IEEE610	Computer programs, procedures, and possibly associated documentation and data pertaining to the operation of a computer system.
Software item	IEEE610	Source code, object code, job control code, control data, or a collection of these items
Static testing/static analysis	BS7925-1 / IEEE610	A process of evaluating a system or component without executing the test object
System	IEEE610	A collection of components organised to accomplish a specific function or set of functions

System testing	BS7925-1	A process of testing an integrated system to verify that it meets specified requirements
Test object	BS7925-1	A system (or part of it) to be tested
Test unit	BS7925-1	A set of processes, transactions and/or functions which are tested collectively
Testing	BS7925-1	The process of planning, preparation, execution and analysis aimed at establishing the quality level of a system
Traceability	IEEE610	The degree to which a relationship can be established between two or more products of the development process, especially products having a predecessor-successor or master-subordinate relationship to one another
Quality assurance	IEEE610	A planned and systematic pattern of all actions necessary to provide adequate confidence that an item or product conforms to established technical requirements
Quality control	IEEE610	The process of verifying ones own work with that of a co-worker
Unit	IEEE610	A software component that is not subdivided into other components
Unit test	BS7925-1	The testing of individual software components
Validation	IEEE610	The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements
Software validation	FDA-General principles of software validation	(note) Software validation activities may occur both during, as well as at the end of the software development life cycle to ensure that all requirements have been fulfilled. Since software is usually part of a larger hardware system, the validation of software typically includes evidence that all software requirements have been implemented correctly and completely, and are traceable to system requirements. A conclusion that software is validated is highly dependent upon comprehensive software testing, inspections, analyses, and other verification tasks performed at each stage of the software development life cycle. Testing of device software functionality in a simulated use environment, and user site testing are typically included as components of an

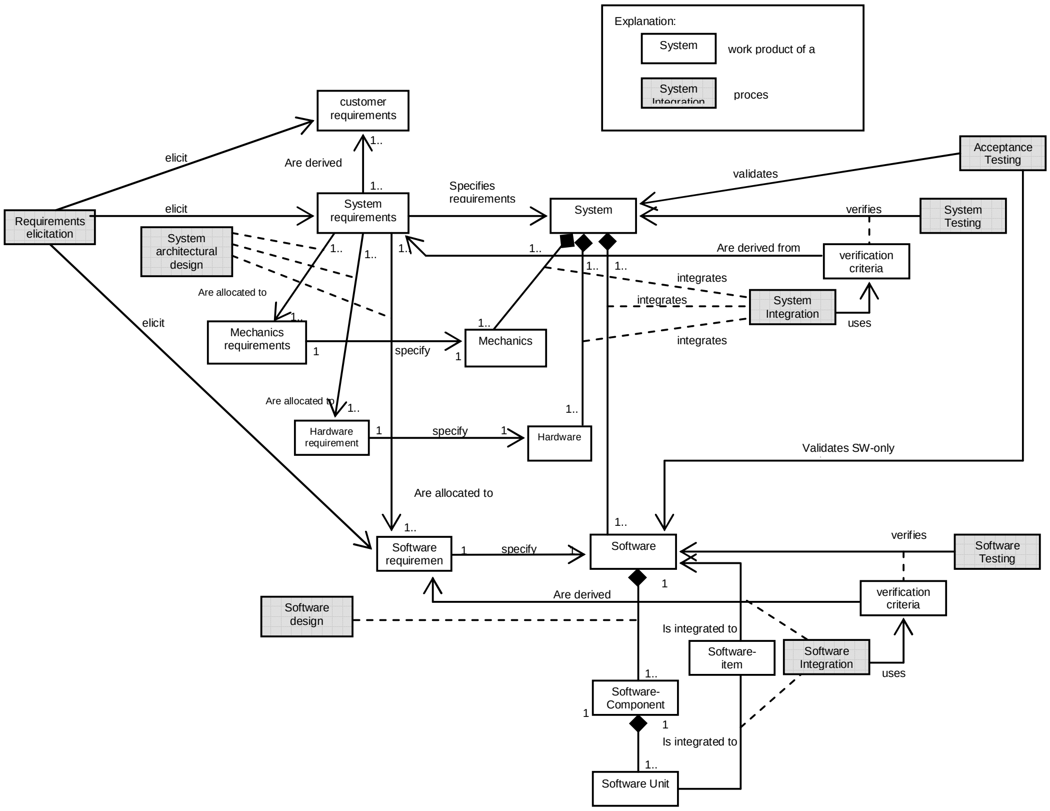
		overall design validation program for a software automated device. In large measure, software validation is a matter of developing a "level of confidence" that the device meets all requirements and user expectations for the software automated functions and features of the device. Measures such as defects found in specifications documents, estimates of defects remaining, testing coverage, and other techniques are all used to develop an acceptable level of confidence before shipping the product.
Verification	IEEE610	The process of evaluating a system or component to determine whether products of a given development phase satisfy the conditions imposed at the start of that phase
Software verification	FDA-General principles of software validation	(note) Software verification looks for consistency, completeness, and correctness of the software and its supporting documentation, as it is being developed, and provides support for a subsequent conclusion that software is validated. Software testing is one of many verification activities intended to confirm that software development output meets its input requirements. Other verification activities include various static and dynamic analyses, code and document inspections, walkthroughs, and other techniques.
White-box testing	BS7925-1	Test design techniques that derive test cases from the internal properties of an object, using knowledge of the internal structure of the object

Annex D

Key Concepts Schematic

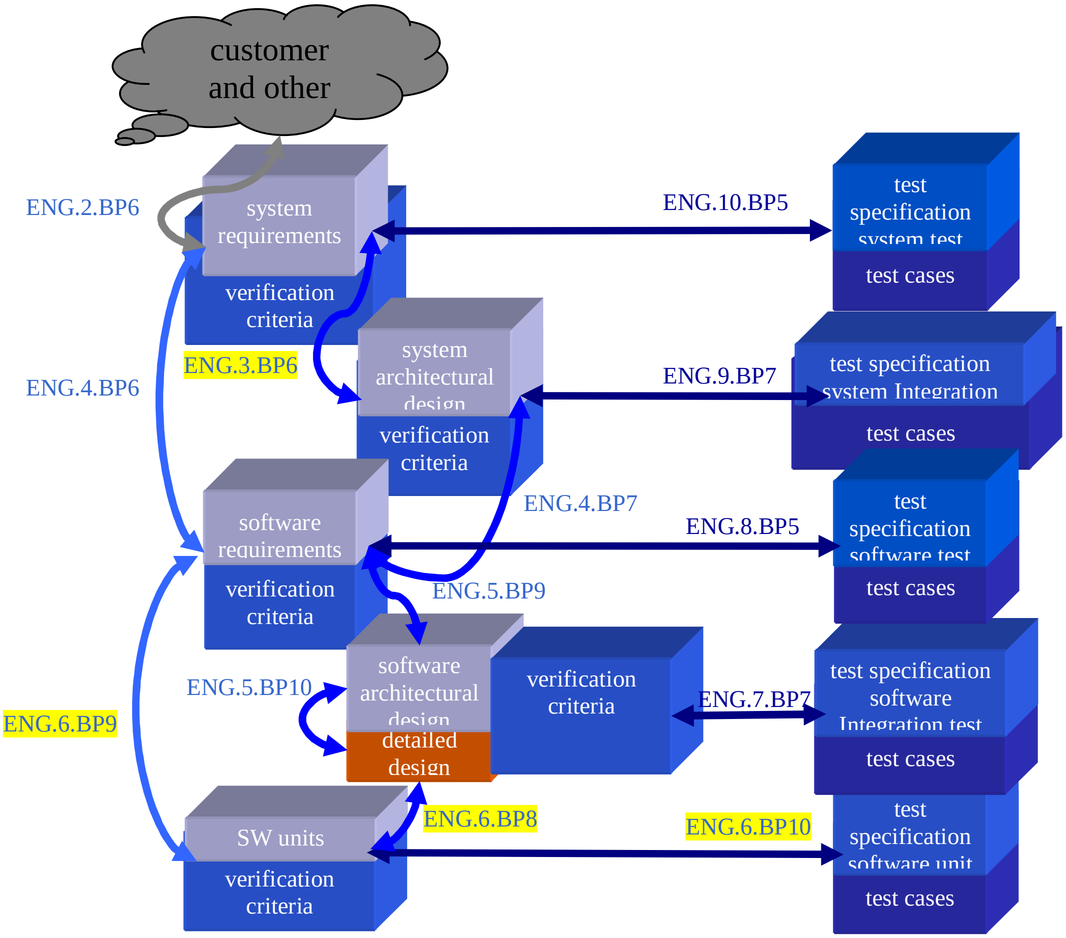
The following schematic has been developed to indicate key concepts in terms of processes and work products that flow through the engineering processes within the Automotive SPICE® PRM. It relates to the terminology described in Annex C Terminology.

The schematic highlights that a system may consist of hardware, software and mechanics. Software may consist of a number of software components. A software component has a component specification. The lowest level of a software component that is not sub-divided into other components is termed a software unit. Software units are integrated into software items to form the software to be tested. Software may be integrated with hardware and mechanics to form the system to be tested.



Annex E

Bi-lateral Traceability



Annex F

Reference Standards

Annex F provides a list of reference standards and guidelines that support implementation of the processes in the PRM.

a. IEEE STD 1233-1998 Guide for Developing System Requirements Specifications
b. IEEE STD 1471-2000 Recommended Practice for Architectural Description
c. IEEE STD 830-1998 Recommended Practice for Software Requirements Specifications
d. IEEE STD 829-2008 Standard for Software and System Test Documentation
e. IEEE STD 1058-1998 Standard for Software Project Management Plans
f. IEEE Std. 610.12-1990 IEEE Standard Glossary of Software Engineering Terminology
g. IEEE Std. 828-1998 IEEE Standard for Software Configuration Management Plans
h. IEEE Std. 730-1998 IEEE Standard for Software Quality Assurance Plans
i. IEEE Std. 1016-1998 IEEE Recommended Practice for Software Design Descriptions