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**CAPABILITY LEVELS**

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<th>CL 3</th>
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$^1$ VDA scope  $^2$ extended VDA scope  $^3$ with assessment guideline for rating consistency
How to read this SPICE Guide

This SPICE guide provides the customers of Knüvenen Mackert a wealth of both basic and detailed information which will help to obtain the maximum benefit from Automotive SPICE. The SPICE guide contains 4 main sections:

1. An introduction to Automotive SPICE and how to apply it together with agile methods and concepts for functional safety and cybersecurity
2. The processes of Automotive SPICE and Mechanical Engineering SPICE. Red is assigned to supporting, Black to system level, Blue to subdomain level, Green to component level
3. The process attributes and generic practices for capability level 1 to 3
4. An assessment guide including templates, guidelines and requirements

In addition, numerous diagrams reflecting the rating guidelines and dependencies between the elements.
The VDA (“Verband der Automobilindustrie”) published Automotive SPICE® Guidelines 1st Edition 2017. The Rating Consistency diagrams have been derived from this set of rules, recommendations and overviews, which reflect the rating consistency rules and recommendations of the publication and provide an overview of the key dependencies. The Rating Consistency Diagrams have been reviewed carefully. You will find the relevant diagram immediately following each of the VDA scope process definition.

The practice rating depends on … based on the rule 5 (RL.5) of the related process (or process attribute) in the Automotive SPICE® Guideline.

The practice rating depends on … based on the recommendation 5 (RC.5) of the related process (or process attribute) in the Automotive SPICE® Guideline.

The practice rating depends on … based on the content of the base practice or based on an additional recommendation by an expert team.

The bidirectional traceability and consistency between the outputs are required by base practices.

MAN.3 BP1: The first base practice of the process is underlined to support an easy start of analysis.
Why process quality?
ASPICE supports the quality of your daily processes

✓ Increase quality
  ▪ Work products (WPs) are based on qualified input
  ▪ WPs are verified and validated based on criteria
  ▪ WPs are produced as planned and scheduled
  ▪ Organizational Learning due to improved standards

✓ Reduce cost
  ▪ Early identification and correction of lacks
  ▪ Proven processes and templates; experienced team
  ▪ Transparent and smooth progress
  ▪ Do it right the first time
  ▪ Less duplicated work, re-work and extra work
  ▪ Productivity increase

✓ Manage risks and complexity
  ▪ Manage risks effectively and in time
  ▪ Develop increasing functionality in reduced time

✓ Meet customers expectation – current and future business
  ▪ Avoid penalty (payments and/or ‘high’ awareness)
  ▪ Win quotations (positive supplier ranking, flexibility)

✓ For your own sake
  <please add your personal bullet points here>
### How effective are your processes?

#### WHAT MATCHES BEST?

<table>
<thead>
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<th>Reduction of quality cost</th>
<th>Managed risks</th>
<th>Increase of productivity</th>
<th>Customer Satisfaction</th>
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<tr>
<td>- Fewer quality issues and lower warranty cost</td>
<td>- Early risk identification</td>
<td>- People concentrate on their tasks efficiently</td>
<td>- Flexibility within distributed development</td>
</tr>
<tr>
<td>- Early error identification and correction</td>
<td>- Systemic risk tracking and mitigation</td>
<td>- Templates and tools are aligned to standards</td>
<td>- Detailed insight into progress and status</td>
</tr>
<tr>
<td>- Global learning and prevention</td>
<td>- Certifications are easy to achieve</td>
<td>- Limited maintenance cost for standard tools</td>
<td>- Easy adaption of products, standards, and tools to project and culture needs</td>
</tr>
</tbody>
</table>

| □ | or | □ |
| □ | or | □ |
| □ | or | □ |

- Increasing number of quality issues
- Poor rectification of root causes
- Checks are late or incomplete
- Poor / unknown product component mature

- Problems appear ‘suddenly’
- Reputation drops
- Certifications are missing or at risk
- New bids are hard to win (e.g. for Safety)

- Fire fighting
- Unclear responsibilities
- Priority hopping
- Poor tool alignment to specific ways of working

- Internal and external deliverables are late, incomplete, or of poor quality
- Deliveries are difficult to integrate
- Needed flexibility results in extraordinary cost
How to benefit from Automotive SPICE®

- Identification of development risks and capabilities associated with suppliers of mechatronic systems
- Identification of risks and capabilities in your own development
- Benchmarking for strengths and potentials of development processes of a project or an organizational unit
- Evaluation of implemented process changes
- Improve transparency, quality and productivity by clarifying and tracking the responsibilities within the development

FIX THE PROCESS TO ACHIEVE QUALITY
INTRODUCTION TO AUTOMOTIVE SPICE
Automotive SPICE® is a standard used for improving and evaluating development processes of mechatronic systems. It is a framework which applies to traditional or agile developments. It supports the engineering of products which are critical according to safety or security. With the “Plug-in concept” of Automotive SPICE® version 3.x the processes for development of mechanical and EE parts are more and more in focus.

In development: processes for HW-Engineering.

Engineering processes defined in Automotive SPICE®

Mechanical SPICE is an valid extension and approved by Intacs™
The concept of process capability determination by using the Automotive SPICE® assessment model is based on a two-dimensional framework. The framework consists of a process dimension and a capability dimension.

**Capability dimension**
- Capability levels
- Process attributes
- Rating
  - Scale
  - Rating method
  - Aggregation method
- Process capability level model

**Process dimension**
- Domain and scope
- Processes with purpose and outcomes
Investing in process improvement led by the OU-wide quantitative feedback and causal analysis resolution.

Quantitative data about process performance is measured, recorded and statistically analysed to allow objective decisions.

A set of specific standard processes for the organisation is used. The organization learns by improving the standards.

Performance is controlled (planned, monitored, adjusted) and responsibilities are defined.

Results are quality checked and managed.

* By experience, lower Capability Levels are not stable i.e. either increase or decrease other a period of about 18 months.
**Organizational Maturity**

In addition to capability evaluations of single processes, the capability level of an entire organization may be evaluated. One refers to Organizational Maturity Levels (OML) in this case.

Project assessments dominate currently, but the interest in Organizational Maturity Assessments is growing because of the desire to reduce the effort needed for assessments.

Organizational assessments examine the entire company, including a majority of its projects. Ultimately, it is the organization that makes it possible for the employees in the projects to apply processes effectively.

These organizational assessments evaluate the capability and maturity of the company, to deliver quality systematically. The basis for this assessment is ISO / IEC 15504-7, which defines the concept of "Organizational Maturity Model". In assessments multiple process instances are investigated.
4 Key Concepts Of Automotive SPICE™

Divide and control
On system, domain, sub-domain and component level:

1. **Specify** and **design** the solution.
2. **Delegate to lower level** OR implement solution on unit level.
3. **Integrate** and **verify integration** against the design before **qualifying** the solution against the specification.

Use qualified input to aim qualified output
Each expert shall perform the work using **qualified input** and shall provide **qualified output** to the next one in the value chain. **Hints:**
- Divide the work into small tasks (e.g. < 40h)
- Get the tasks ‘done’ continuously one after another
- Qualify and approve the work products continuously
- Use clear criteria and efficient methods to qualify

Agree and summarize
Engineering processes:
- **Agree** on requirements and design
- **Summarize** results of step-by-step verification

Management and support processes:
- **Agree** on strategies, plans and schedules
- **Summarize** the results and report to relevant parties

Traceability
Each item (requirement, design element, implementation, test case / result, finding, scheduled activity, ...) has to have a **reference to its source and to its verification**.
The traceability is used ...
... to check for **consistency**, ...
... to analyze its **impact** and ...
... to show **completeness**.
**Qualification Test Versus Integration Test**

Some processes have similar purpose, but differ in their level of detail:

**Left:** In requirements processes the problem is specified; In design processes the planned solutions, their structure elements, interfaces and dynamic behavior are specified.

**Right:** Tests verify the test object either versus the related specification (dark red) or versus the related design (light red).
Evaluation, Verification Criteria And Compliance

SYS.2: System Requirements Analysis
SYS.3: System Architectural Design
SWE.1: Software Requirements Analysis
SWE.2: Software Architectural Design
SWE.3: Software Detailed Design & Unit Construction
SWE.4: Software Unit Verification
SWE.5: Software Integration and Integration Test
SWE.6: Software Qualification Test
SYS.4: System Integration and Integration Test
SYS.5: System Qualification Test
SUP.2: Verification

SYS.2 BP.5: Verification criteria
SYS.5 BP.2: Compliance
SYS.4 BP.3: Compliance
SWE.6 BP.2: Compliance
SWE.1 BP.5: Verification criteria
SWE.5 BP.3: Compliance
SWE.4 BP.2: Compliance

SYS.3 BP.5: Evaluate
SWE.2 BP.6: Evaluate
SWE.3 BP.4: Evaluate

SYSTEM LEVEL
DOMAIN SUB-SYSTEM LEVEL
COMPONENT/UNIT LEVEL
Agree, Summarize And Communicate

- “Communicate agreed” – there is a joint understanding between affected parties of what is meant by the content of the work product.
- “Summarize and communicate” refers to abstracted information resulting from test executions made available to all relevant parties.
- Note: both concepts do not mean formal approval or confirmation (this would be GP 2.1.7 at CL 2).
- Note: a part of a specification or design is called "Element“ (left); a part of the product is called “Item“ (right).
Bidirectional Traceability And Consistency

Stakeholder requirements

System requirements

- SYS.2 BP6
- SYS.3 BP7

System architecture

- SYS.3 BP6
- SYS.3 BP7

Software requirements

- SWE.1 BP6
- SWE.1 BP7

Software architecture

- SWE.2 BP7
- SWE.2 BP8

Software detailed design

- SWE.3 BP5
- SWE.3 BP6

Software units

Change requests

System qualification test specification

- test cases

- SYS.5 BP5

System integration test specification

- test cases

- SYS.4 BP7

Software qualification test specification

- test cases

- SWE.6 BP5

Software integration test specification

- test cases

- SWE.5 BP7

Unit test specification

- SWE.4 BP5

Static verification results

To affected work products

SUP.10 BP8

SYSTEM LEVEL

DOMAIN SUB-SYSTEM

COMPONENT LEVEL

UNIT LEVEL
Supporting And Management Processes
The Dependencies Of The Supporting And Management Processes Of The VDA Scope

**SUP.1: Quality Assurance**
- Plan for quality
- Measure product & process quality
- Ensure correction & prevention
- Report, track & escalate non-conformities

**SUP.9: Problem Resolution Management**
- Record non-conformities
- Alert & initiate emergency plan if needed
- Initiate CR or resolution action
- Track to closure & analyze trends

**SUP.10: Change Request Management**
- Record change requests
- Analyze impact
- Approve change requests
- Review implementation & track to closure

**MAN.3: Project Management**
- Set up project
- Estimate effort & schedule tasks
- Review & report progress versus plan
- Adjust to recover
- Close project

**SUP.8: Configuration Management**
- NCs
- CRs
- NFs
- Tasks

(depend on strategy)
REU.2 Reuse Program Management

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.

**Output work products**

<table>
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<th>Work product</th>
<th>Outcome(s)</th>
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<td>04-02 Domain architecture</td>
<td>OUTCOME 2</td>
</tr>
<tr>
<td>04-03 Domain model</td>
<td>OUTCOME 2, 5, 6, 8</td>
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<td>08-17 Reuse plan</td>
<td>OUTCOME 5, 6, 8</td>
</tr>
<tr>
<td>09-05 Reuse policy</td>
<td>OUTCOME 1, 4</td>
</tr>
<tr>
<td>12-03 Reuse proposal</td>
<td>OUTCOME 4</td>
</tr>
<tr>
<td>13-04 Communication record</td>
<td>OUTCOME 7</td>
</tr>
<tr>
<td>15-07 Reuse evaluation report</td>
<td>OUTCOME 5, 6, 8</td>
</tr>
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<td>15-13 Assessment/audit report</td>
<td>OUTCOME 3, 4</td>
</tr>
<tr>
<td>19-05 Reuse strategy</td>
<td>OUTCOME 1</td>
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**REU 2 with 8 Base practices**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP 1</td>
<td>Define organizational reuse strategy. Define the reuse program and necessary supporting infrastructure for the organization. [Outcome 1]</td>
</tr>
<tr>
<td>BP 2</td>
<td>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]</td>
</tr>
<tr>
<td>BP 3</td>
<td>Assess domains for potential reuse. Assess each domain to identify potential use and applications of reusable components and products. [OUTCOME 3]</td>
</tr>
<tr>
<td>BP 4</td>
<td>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]</td>
</tr>
<tr>
<td>BP 5</td>
<td>Evaluate reuse proposals. Evaluate suitability of the provided reusable components and product(s) to proposed use. [OUTCOME 5]</td>
</tr>
<tr>
<td>BP 6</td>
<td>Implement the reuse program. Perform the defined activities identified in the reuse program. [OUTCOME 6]</td>
</tr>
<tr>
<td>BP 7</td>
<td>Get feedback from reuse. Establish feedback, assessment, communication and notification mechanism that operate between affected parties to control the progress of reuse program. [OUTCOME 7, 8]</td>
</tr>
<tr>
<td>BP 8</td>
<td>Monitor reuse. Monitor the implementation of the reuse program periodically and evaluate its suitability to actual needs. [OUTCOME 6, 8]</td>
</tr>
</tbody>
</table>

1. Affected parties may include reuse program administrators, asset managers, domain engineers, developers, operators, and maintenance groups.
2. The quality requirements for re-use work products should be defined.
Work product characteristics in Annex B of Automotive SPICE v3.1

WP ID
An identifier number for the work product which is used to reference the work product.

WP Name
Provides an example of a typical name associated with the work product characteristics. Organizations may call these work products by different names and 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.

WP 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.

<table>
<thead>
<tr>
<th>WP ID</th>
<th>WP Name</th>
<th>WP Characteristics</th>
</tr>
</thead>
</table>
| 04-00 | Design  | ▪ Describes the overall product/system structure  
       |         | ▪ Identifies the required product/system elements  
       |         | ▪ Identifies the relationship between the elements  
       |         | ▪ Consideration is given to:  
       |         |   - any required performance characteristics  
       |         |   - any required interfaces  
       |         |   - any required security characteristics |
### Work product characteristics – Example in Annex B of Automotive SPICE v3.1

<table>
<thead>
<tr>
<th>WP ID</th>
<th>WP Name</th>
<th>WP Characteristics</th>
</tr>
</thead>
</table>
| 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 application parameters or variables) 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 behavior of the software (Start-up, shutdown, software update, error handling and recovery, etc.)  
- 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 |
Automotive SPICE® and Agility

Automotive SPICE applications can benefit by agile methods, e.g. in project management. Automotive SPICE is a framework for agility.

- Approved feature increments
- Approved stakeholder change requests
- Problem reports with approved correction plan

**Open Points**

- Backlog of Open Points which are assigned to deliveries
- Backlog of derived Work Packages for the upcoming delivery assigned to its domain
- Backlog of derived tasks, which are assigned to the upcoming iteration

**Delivery Cycle**
- Iteration Cycle
- Sys Eng.
- Domain Eng.
- Sys Test

Analysis, implementation, integration and qualification is managed in small iteration cycles of fixed time slots.

**Verified Open Points**
An Example For A Functional Safety Implementation

Prepare
- Initiate Safety-Life-Cycle
- Create Safety-Plan
- Generate Tool-Qualification-Report
- Create Technical-Safety-Concept

Input for
- Project Manual
- Project Schedule

Execute
- Analyse Safety
- Carry out Functional-Safety-Audit
- Generate Confirmation Measure-Report

Continuous analysis, auditing and reporting for ongoing progress

Approve
- Generate Safety-Case
- Carry out Functional-Safety-Assessment

Smooth Approval
## Automotive SPICE® and Functional Safety

A successful application of Automotive SPICE supports the compliance to ISO 26262. The related Automotive SPICE process provides weak / medium / strong (+/++/+++)) support to the related chapter in ISO 26262.

<table>
<thead>
<tr>
<th>Automotive SPICE</th>
<th>ISO 26262</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAN.3 Project Management</td>
<td>++ Safety management during the concept phase and the product development</td>
</tr>
<tr>
<td></td>
<td>+++ Item definition (top level)</td>
</tr>
<tr>
<td></td>
<td>++ Initiation of the safety lifecycle</td>
</tr>
<tr>
<td></td>
<td>++ Initiation of product development at the system level</td>
</tr>
<tr>
<td></td>
<td>++ Initiation of product development at the hardware level</td>
</tr>
<tr>
<td></td>
<td>++ Initiation of product development at the software level</td>
</tr>
<tr>
<td>ACQ.4 Supplier Monitoring</td>
<td>++ Interfaces within distributed developments</td>
</tr>
<tr>
<td>SUP.1 Quality Assurance</td>
<td>++ Safety management during the concept phase and the product development</td>
</tr>
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<td></td>
<td>+++ Functional safety assessment</td>
</tr>
<tr>
<td>SUP.2 Verification</td>
<td>+++ Verification</td>
</tr>
<tr>
<td>SUP.7 Documentation</td>
<td>+++ Documentation</td>
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## Automotive SPICE® and Functional Safety

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If compliance to ISO 26262 is required, the related chapters shall be considered during application of Automotive SPICE.
If compliance to ISO 27001 is required, the related chapters of Annex A shall be considered during application of Automotive SPICE.

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AUTOMOTIVE SPICE PROCESSES
MAN.3 Project Management

The purpose of the Project Management Process is to identify, establish, and control the activities and resources necessary for a project to produce a product, 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 activities and resources necessary to complete the work are sized and estimated;
4. interfaces within the project, and with other projects 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. corrective action is taken when project goals are not achieved, and recurrence of problems identified in the project is prevented.

Output work products

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<tr>
<th>Outcome</th>
<th>Description</th>
<th>Process Outcomes</th>
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<td>08-12</td>
<td>Project plan</td>
<td>OUTCOME 1, 3, 4, 5</td>
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<tr>
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<td>Communication record</td>
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<td>13-16</td>
<td>Change request</td>
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<tr>
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<td>14-02</td>
<td>Corrective action register</td>
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<td>Schedule</td>
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<td>14-09</td>
<td>Work breakdown structure</td>
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<td>14-50</td>
<td>Stakeholder groups list</td>
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<tr>
<td>15-06</td>
<td>Project status report</td>
<td>OUTCOME 4, 6</td>
</tr>
</tbody>
</table>
Define the **scope of work**. Identify the project’s goals, motivation and boundaries. [OUTCOME 1]

**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]

1. *This typically means that the project life cycle and the customer's development process are consistent with each other.*

**Evaluate feasibility of the project.** Evaluate the feasibility of achieving the goals of the project in terms of technical feasibility within constraints with respect to time, project estimates, and available resources. [OUTCOME 2]

**Define, monitor and adjust project activities.** Define, monitor and adjust project activities and their dependencies according to defined project life cycle and estimations. Adjust activities and their dependencies as required. [OUTCOME 3, 5, 7]

2. *A structure and a manageable size of the activities and related work packages support an adequate progress monitoring.*

3. *Project activities typically cover engineering, management and supporting processes.*

**Define, monitor and adjust project estimates and resources.** Define, monitor and adjust project estimates of effort and resources based on project’s goals, project risks, motivation and boundaries. [OUTCOME 2, 3, 7]

4. *Appropriate estimation methods should be used.*

5. *Examples of necessary resources are people, infrastructure (such as tools, test equipment, communication mechanisms...) and hardware/materials.*

6. *Project risks (using MAN.5) and quality criteria (using SUP.1) may be considered.*

7. *Estimations and resources typically include engineering, management and supporting processes.*
| BP 6 | **Ensure required skills, knowledge, and experience.** Identify the required skills, knowledge, and experience for the project in line with the estimates and make sure the selected individuals and teams either have or acquire these in time. [OUTCOME 3, 7]  
**In the case of deviations from required skills and knowledge training are typically provided.** |
| --- | --- |
| BP 7 | **Identify, monitor and adjust project interfaces and agreed commitments.** Identify and agree interfaces of the project with other (sub-) projects, organizational units and other affected stakeholders and monitor agreed commitments. [OUTCOME 4, 7]  
**Project interfaces relate to engineering, management and supporting processes.** |
| BP 8 | **Define, monitor and adjust project schedule.** Allocate resources to activities, and schedule each activity of the whole project. The schedule has to be kept continuously updated during lifetime of the project. [OUTCOME 3, 5, 7]  
**This relates to all engineering, management and supporting processes.** |
| BP 9 | **Ensure consistency.** Ensure that estimates, skills, activities, schedules, plans, interfaces, and commitments for the project are consistent across affected parties. [OUTCOME 3, 4, 5, 7] |
| BP 10 | **Review and report progress of the project.** Regularly review and report the status of the project and the fulfillment of activities against estimated effort and duration to all affected parties. Prevent recurrence of problems identified. [OUTCOME 6, 7]  
**Project reviews may be executed at regular intervals by the management. At the end of a project, a project review contributes to identifying e.g. best practices and lessons learned.** |
Rating consistency – MAN.3 Project Management

- **MAN.3 BP2:** Define project life cycle
  - is appropriate for
  - according to

- **MAN.3 BP4:** Define, monitor and adjust project activities
  - schedule activities

- **MAN.3 BP7:** Identify, monitor and adjust project interfaces and agreed commitments

- **MAN.3 BP1:** Define scope of work
  - with respect to
  - based on

- **MAN.3 BP10:** Review and report the progress of the project
  - related to

- **MAN.3 BP3:** Evaluate feasibility of the project
  - related to

- **MAN.3 BP5:** Define, monitor and adjust project estimates and resources
  - makes resources available

- **MAN.3 BP8:** Define, monitor and adjust project schedule
  - related to

- **MAN.3 BP9:** Ensure consistency
  - allocates resources

- **MAN.3 BP6:** Ensure required skills, knowledge, and experience

*: comparison against each other
MAN.5 Risk Management

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.

Output work products

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<tr>
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<td>15-09</td>
<td>Risk status report [OUTCOME 4, 5]</td>
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MAN.5 with 7 Base practices

BP 1 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]

Risks may include technical, economic and timing risks.
**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]

**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. [OUTCOME 2, 3]

1. Examples of risk areas that are typically analyzed for potential risk reasons or risks factors include: cost, schedule, effort, resource, and technical.
2. Examples of risk factors may include: unsolved and solved trade-offs, decisions of not implementing a project feature, design changes, lack of expected resources.

**Analyze risks.** Analyze risks to determine the priority in which to apply resources to mitigate these risks. [OUTCOME 4]

1. Risks are normally analyzed to determine their probability, consequence, and severity.
2. Different techniques may be used to analyze a system in order to understand if risks exist, for example, functional analysis, simulation, FMEA, FTA, etc.

**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. [OUTCOME 5, 6]

**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 mitigation activities. Apply and assess these risk measures. [OUTCOME 5, 6]

1. Major risks may need to be communicated to and monitored by higher levels of management.

**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]

1. Corrective actions may involve developing and implementing new mitigation strategies or adjusting the existing strategies.
REU.2 Reuse Program Management

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.

Output work products

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<td>12-03 Reuse proposal</td>
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</table>
Define organizational reuse strategy. Define the reuse program and necessary supporting infrastructure for the organization. [Outcome 1]

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]

Assess domains for potential reuse. Assess each domain to identify potential use and applications of reusable components and products. [Outcome 3]

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]

Evaluate reuse proposals. Evaluate suitability of the provided reusable components and product(s) to proposed use. [Outcome 5]

Implement the reuse program. Perform the defined activities identified in the reuse program. [Outcome 6]

Get feedback from reuse. Establish feedback, assessment, communication and notification mechanism that operate between affected parties to control the progress of reuse program. [Outcome 7, 8]

- Affected parties may include reuse program administrators, asset managers, domain engineers, developers, operators, and maintenance groups.

Monitor reuse. Monitor the implementation of the reuse program periodically and evaluate its suitability to actual needs. [Outcome 6, 8]

- The quality requirements for re-use work products should be defined.
ACQ.4 Supplier Monitoring

The purpose of the Supplier Monitoring Process is to track and assess the performance of the supplier against agreed requirements.

**Process outcomes – as a result of successful implementation of this process**

1. joint activities, as agreed between the customer and the supplier, are performed as needed;
2. all information, agreed upon for exchange, is communicated regularly between the supplier and customer;
3. performance of the supplier is monitored against the agreements; and
4. changes to the agreement, if needed, are negotiated between the customer and the supplier and documented in the agreement.

**Output work products**

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<th>13-01 Acceptance record</th>
<th>13-04 Communication record</th>
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<th>13-14 Progress status record</th>
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<td>[OUTCOME 1]</td>
<td>[OUTCOME 2]</td>
<td></td>
<td></td>
<td>[OUTCOME 4]</td>
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</table>
ACQ.4 with 5 Base practices

**BP 1**

Agree on and maintain joint processes, joint interfaces, and information to be exchanged. Establish and maintain an agreement on information to be exchanged and on joint processes and joint interfaces, responsibilities, type and frequency of joint activities, communications, meetings, status reports and reviews. [OUTCOME 1, 2, 4]

1. *Joint processes and interfaces usually include project management, requirements management, change management, configuration management, problem resolution, quality assurance and customer acceptance.*

2. *Joint activities to be performed should be mutually agreed between the customer and the supplier.*

3. *The term customer in this process refers to the assessed party. The term supplier refers to the supplier of the assessed party.*

**BP 2**

Exchange all agreed information. Use the defined joint interfaces between customer and supplier for the exchange of all agreed information. [OUTCOME 1, 2, 3]

4. *Agreed information should include all relevant work products.*

**BP 3**

Review technical development with the supplier. Review development with the supplier on the agreed regular basis, covering technical aspects, problems and risks and also track open items to closure. [OUTCOME 1, 3, 4]

**BP 4**

Review progress of the supplier. Review progress of the supplier regarding schedule, quality, and cost on the agreed regular basis. Track open items to closure and perform risk mitigation activities. [OUTCOME 1, 3, 4]

**BP 5**

Act to correct deviations. Take action when agreed objectives are not achieved to correct deviations from the agreed project plans and to prevent reoccurrence of problems identified. Negotiate changes to objectives and document them in the agreements. [OUTCOME 4]
Rating consistency – ACQ.4 Supplier Monitoring

ACQ.4 BP1: Agree on and maintain joint processes

ACQ.4 BP2: Exchange all agreed information

ACQ.4 BP3: Review technical development with the supplier

ACQ.4 BP4: Review progress of the supplier

ACQ.4 BP5: Act to correct deviations

MAN.3: Project Management

SYS.1: Requirements Elicitation

SUP.9: Problem Resolution Management

SUP.10: Change request management
SUP.1 Quality Assurance

The purpose of the Quality Assurance Process is to provide independent and objective assurance that work products and processes comply with predefined provisions and plans and that non-conformances are resolved and further prevented.

Process outcomes – as a result of successful implementation of this process

1. a strategy for performing quality assurance is developed, implemented, and maintained;
2. quality assurance is performed independently and objectively without conflicts of interest;
3. non-conformances of work products, processes, and process activities with relevant requirements are identified, recorded, communicated to the relevant parties, tracked, resolved, and further prevented;
4. conformance of work products, processes and activities with relevant requirements is verified, documented, and communicated to the relevant parties;
5. authority to escalate non-conformances to appropriate levels of management is established; and
6. management ensures that escalated non-conformances are resolved.

Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
<th>OUTCOME</th>
<th>Work Product</th>
<th>OUTCOME</th>
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</thead>
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<td>[1,2]</td>
<td>13-19 Review record</td>
<td>[2,3,4]</td>
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<tr>
<td>13-18 Quality record</td>
<td>[2,3,4]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Develop a project quality assurance strategy. Develop a strategy in order to ensure that work product and process quality assurance is performed at project level independently and objectively without conflicts of interest. [OUTCOME 1, 2]

1. Aspects of independence may be financial and/or organizational structure.

2. Quality assurance may be coordinated with, and make use of, the results of other processes such as verification, validation, joint review, audit and problem management.

3. Process quality assurance 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.

4. Work product quality assurance may include reviews, problem analysis, reports and lessons learned that improve the work products for further use.

Assure quality of work products. Perform the activities according to the quality assurance strategy and the project schedule to ensure that the work products meet the defined work product requirements and document the results. [OUTCOME 2, 3, 4]

5. Relevant work product requirements may include requirements from applicable standards.

6. 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.
**Assure quality of process activities.** Perform the activities according to the quality assurance strategy and the project schedule to ensure that the processes meet their defined goals and document the results. [OUTCOME 2, 3, 4]

7. Relevant process goals may include goals from applicable standards.

8. Problems detected in the process definition or implementation may be entered into a process improvement process (PIM.3) to describe, record, analyze, resolve, track to closure and prevent the problems.

**Summarize and communicate quality assurance activities and results.** Regularly report performance, deviations, and trends of quality assurance activities to relevant parties for information and action according to the quality assurance strategy. [OUTCOME 3, 4]

**Ensure resolution of non-conformances.** Deviations or non-conformance found in process and product quality assurance activities should be analyzed, tracked, corrected, and further prevented. [OUTCOME 3,6]

**Implement an escalation mechanism.** Establish and maintain an escalation mechanism according to the quality assurance strategy that ensures that quality assurance may escalate problems to appropriate levels of management and other relevant stakeholders to resolve them. [OUTCOME 5, 6]
Rating consistency – SUP.1 Quality Assurance

SUP.1 BP1: Develop a project quality assurance strategy

SUP.1 BP2: Assure quality of work products

SUP.1 BP3: Assure quality of process activities

SUP.1 BP4: Summarize and communicate QA activities & results

SUP.1 BP5: Ensure resolutions of non-conformances

SUP.1 BP6: Implement an escalation mechanism

SUP.1 BP8: Verify information about configuration items

SUP.9 Problem Resolution Management
SUP.2 Verification

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.

Output work products

<table>
<thead>
<tr>
<th>Process outcome</th>
<th>Description</th>
<th>Outcome Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-04 Communication record</td>
<td></td>
<td>[OUTCOME 5]</td>
</tr>
<tr>
<td>13-07 Problem record</td>
<td>[OUTCOME 3, 4, 5]</td>
<td></td>
</tr>
<tr>
<td>13-25 Verification results</td>
<td>[OUTCOME 2, 3, 4, 5]</td>
<td></td>
</tr>
<tr>
<td>14-02 Corrective action register</td>
<td></td>
<td>[OUTCOME 4]</td>
</tr>
<tr>
<td>18-07 Quality criteria</td>
<td></td>
<td>[OUTCOME 2]</td>
</tr>
<tr>
<td>19-10 Verification strategy</td>
<td></td>
<td>[OUTCOME 1]</td>
</tr>
</tbody>
</table>
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 activities. [OUTCOME 1]

1. Verification strategy is implemented through a plan.
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.
3. Verification methods and techniques may include inspections, peer reviews (see also SUP.4), audits, walkthroughs and analysis.

Develop criteria for verification. Develop the criteria for verification of all required technical work products. [OUTCOME 2]

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]

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]

Report verification results. Verification results should be reported to all affected parties. [OUTCOME 5]
SUP.4 Joint Review

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.

**Joint review should be performed at specific milestones during project/product development. The scope and the goals of joint review may be different depending on project/product development phase (for example, in the early stage of a project joint review may be “conceptual” in order to analyze the customer requirements; in later stages joint review may be concerned with the implementation).**

**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).**

**Output work products**

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-04 Communication record</td>
<td>OUTCOME 3</td>
</tr>
<tr>
<td>13-05 Contract review record</td>
<td>OUTCOME 1, 2, 3</td>
</tr>
<tr>
<td>13-07 Problem record</td>
<td>OUTCOME 3, 5</td>
</tr>
<tr>
<td>13-09 Meeting support record</td>
<td>OUTCOME 1, 2</td>
</tr>
<tr>
<td>13-19 Review record</td>
<td>OUTCOME ALL</td>
</tr>
<tr>
<td>14-02 Corrective action register</td>
<td>OUTCOME 3, 4, 5</td>
</tr>
<tr>
<td>14-08 Tracking system</td>
<td>OUTCOME 3, 4, 5</td>
</tr>
<tr>
<td>15-01 Analysis report</td>
<td>OUTCOME 3, 5</td>
</tr>
<tr>
<td>15-13 Assessment/audit report</td>
<td>OUTCOME 1, 2</td>
</tr>
<tr>
<td>15-16 Improvement opportunity</td>
<td>OUTCOME 3, 4</td>
</tr>
</tbody>
</table>
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]

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]

Prepare joint review. Collect, plan, prepare and distribute review material as appropriate in preparation for the review. [OUTCOME 1]

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.).

Conduct joint reviews. Conduct joint management and technical reviews as planned. Record the review results. [OUTCOME 1, 2]

Distribute the results. Document and distribute the review results to all the affected parties. [OUTCOME 3]

Determine actions for review results. Analyze the review results, propose actions for resolution and determine the priority for actions. [OUTCOME 4]
Track actions for review results. Track actions for resolution of identified problems in a review to closure. [OUTCOME 4]

Identify and record problems. Identify and record the problems detected during the reviews according to the established mechanism. [OUTCOME 5]
**SUP.7 Documentation**

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.

**Output work products**

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Process Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-26 Documentation plan</td>
<td>[OUTCOME 1, 2]</td>
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<tr>
<td>13-01 Acceptance record</td>
<td>[OUTCOME 4, 5]</td>
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<tr>
<td>13-19 Review record</td>
<td>[OUTCOME 4, 5]</td>
</tr>
<tr>
<td>14-01 Change history</td>
<td>[OUTCOME 5, 6]</td>
</tr>
<tr>
<td>14-11 Work product list</td>
<td>[OUTCOME 3]</td>
</tr>
</tbody>
</table>

**SUP.7 with 8 Base practices**

**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.

*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.*

**BP 1**

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.**
Establish standards for documentation. Establish standards for developing, modifying and maintaining documentation. [OUTCOME 2]

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]

Identify the relevant documentation to be produced. For any given development life cycle, identify the documentation to be produced. [OUTCOME 3]

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]

Check documentation. Review documentation before distribution, and authorize documentation as appropriate before distribution or release. [OUTCOME 5]

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.

Documentation should be checked through verification or validation process.

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]

Maintain documentation. Maintain documentation in accordance with the determined documentation strategy. [OUTCOME 6]

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.
SUP.8 Configuration Management

The purpose of the Configuration Management Process is to establish and maintain the integrity of all work products of a process or project and make them available to affected parties.

**Process outcomes – as a result of successful implementation of this process**

1. a configuration management strategy is developed;
2. all configuration items generated by a process or project are identified, defined and baselined according to the configuration management strategy;
3. modifications and releases of the configuration items are controlled;
4. modifications and releases are made available to affected parties;
5. the status of the configuration items and modifications is recorded and reported;
6. the completeness and consistency of the baselines is ensured; and
7. storage of the configuration items is controlled.

**Output work products**

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome(s)</th>
<th>Work Product</th>
<th>Outcome(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-02 Handling and storage guide</td>
<td>[OUTCOME 3, 4, 5, 7]</td>
<td>13-10 Configuration management record</td>
<td>[OUTCOME 2, 5, 7]</td>
</tr>
<tr>
<td>08-04 Configuration management</td>
<td>[OUTCOME 1, 2, 7]</td>
<td>14-01 Change history</td>
<td>[OUTCOME 3]</td>
</tr>
<tr>
<td>08-14 Recovery plan</td>
<td>[OUTCOME 1,7]</td>
<td>16-03 Configuration management system</td>
<td>[OUTCOME 1, 3, 4]</td>
</tr>
<tr>
<td>13-08 Baseline</td>
<td>[OUTCOME 2, 3, 4, 5, 6]</td>
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</tbody>
</table>
Develop a configuration management strategy. Develop a configuration management strategy, including
- responsibilities;
- tools and repositories;
- criteria for configuration items;
- naming conventions;
- access rights;
- criteria for baselines;
- merge and branch strategy;
- the revision history approach for configuration items [OUTCOME 1]

1 The configuration management strategy typically supports the handling of product/software variants which may be caused by different sets of application parameters or by other causes.

2 The branch management strategy specifies in which cases branching is permissible, whether authorization is required, how branches are merged, and which activities are required to verify that all changes have been consistently integrated without damage to other changes or to the original software.

Identify configuration items. Identify and document configuration items according to the configuration management strategy. [OUTCOME 2]

3 Configuration control is typically applied for the products that are delivered to the customer, designated internal work products, acquired products, tools and other configuration items that are used in creating and describing these work products.

Establish a configuration management system. Establish a configuration management system according to the configuration management strategy. [OUTCOME 1, 2, 3, 4, 6, 7]
### Establish branch management
Establish branch management according to the configuration management strategy where applicable for parallel developments that use the same base. [OUTCOME 1, 3, 4, 6, 7]

### Control modifications and releases
Establish mechanisms for control of the configuration items according to the configuration management strategy, and control modifications and releases using these mechanisms. [OUTCOME 3, 4, 5]

### Establish baselines
Establish baselines for internal purposes and for external delivery according to the configuration management strategy. [OUTCOME 2]

For baseline issues refer also to the product release process SPL.2.

### Report configuration status
Record and report status of configuration items to support project management and other relevant processes. [OUTCOME 5]

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.

### Verify the information about configured items
Verify that the information about configured items, and their baselines is complete and ensure the consistency of baselines. [OUTCOME 6]

A typical implementation is performing baseline and configuration management audits.

### Manage the storage of configuration items and baselines
Ensure the integrity and availability of configuration items and baselines through appropriate scheduling and resourcing of storage, archiving (long term storage) and backup of the used CM systems. [OUTCOME 4, 5, 6, 7]

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 2 and 3. Availability may be specified by contract requirements.
Rating consistency – SUP.8 Configuration Management

SUP.8 BP1: Develop a configuration management strategy

SUP.8 BP2: Identify configuration items

SUP.8 BP3: Establish a configuration management system

SUP.8 BP4: Establish branch management

SUP.8 BP5: Control modifications and releases

SUP.8 BP6: Establish baselines

SUP.8 BP7: Report configuration status

SUP.8 BP8: Verify the information about configured items

SUP.8 BP9: Manage the storage of configuration items and baselines

SUP.8 BP10: Verify information about configured items

SPL.2 BP3 Establish a product release classification and numbering schema

SPL.2 BP13 Deliver the release to the intended customer

MAN.3 BP10: Verify information about configured items

Reflects according to for 3

Support delivery for 8
SUP.9 Problem Resolution Management

The purpose of the Problem Resolution Management Process is to ensure that problems are identified, analyzed, managed and controlled to resolution.

Process outcomes – as a result of successful implementation of this process

1. a problem resolution management strategy is developed;
2. problems are recorded, uniquely identified and classified;
3. problems are analyzed and assessed to identify an appropriate solution;
4. problem resolution is initiated;
5. problems are tracked to closure; and
6. the status of problems and their trend are known.

Output work products

| 08-27 Problem management plan [OUTCOME 1] | 15-05 Evaluation report [OUTCOME 3] |
| 13-07 Problem record [OUTCOME 2, 3, 4, 5] | 15-12 Problem status report [OUTCOME 6] |
| 15-01 Analysis report [OUTCOME 3] |
Develop a problem resolution management strategy. Develop a problem resolution management strategy, including problem resolution activities, a status model for the problems, alert notifications, responsibilities for performing these activities and an urgent resolution strategy. Interfaces to affected parties are defined and definitions are maintained. [OUTCOME 1]

1. Problem resolution activities can be different during the product life cycle, e.g. during prototype construction and series development.

Identify and record the problem. Each problem is uniquely identified, described and recorded. Supporting information should be provided to reproduce and diagnose the problem. [OUTCOME 2]

2. Supporting information typically includes the origin of the problem, how it can be reproduced, environmental information, by whom it has been detected, etc.

3. Unique identification supports traceability to changes made.

Record the status of problems. A status according to the status model is assigned to each problem to facilitate tracking. [OUTCOME 6]

Diagnose the cause and determine the impact of the problem. Investigate the problem and determine its cause and impact in order to categorize the problem and to determine appropriate actions. [OUTCOME 2, 3]

4. Problem categorization (e.g. A, B, C, light, medium, severe) may be based on severity, impact, criticality, urgency, relevance for the change process, etc.

Authorize urgent resolution action. If according to the strategy a problem requires an urgent resolution, authorization shall be obtained for immediate action also according to the strategy. [OUTCOME 4]
### BP 6. Raise alert notifications.
If according to the strategy the problem has a high impact on other systems or other affected parties, an alert notification needs to be raised also according to the strategy. [OUTCOME 4]

### BP 7. Initiate problem resolution.
Initiate appropriate actions according to the strategy to resolve the problem including review of those actions, or initiate a change request. [OUTCOME 4]

5. Appropriate actions may include the initiating of a change request. See SUP.10 for managing of change requests.

6. The implementation of process improvements (to prevent problems) is done in the process improvement process (PIM.3). The implementation of generic project management improvements (e.g. lessons learned) are part of the project management process (MAN.3). The implementation of generic work product related improvements are part of the quality assurance process (SUP.1).

### BP 8. Track problems to closure.
Track the status of problems to closure including all related change requests. A formal acceptance has to be authorized before closing the problem. [OUTCOME 5, 6]

Collect and analyze problem resolution management data, identify trends, and initiate project related actions, according to the strategy. [OUTCOME 6]

7. Collected data typically contains information about where the problems occurred, how and when they were found, what were their impacts, etc.
Rating consistency – SUP.9 Problem Resolution Management

SUP.10 BP7 Track change request to closure

SUP.9 BP8: Track problems to closure including related CRs

SUP.9 BP9: Analyze problem trends

SUP.10 BP2: Identify and record the change requests

SUP.9 BP2: Identify and record the problem

SUP.9 BP3: Record the status of the problem

SUP.9 BP1: Develop a problem resolution management strategy

SUP.9 BP4: Diagnose the cause and determine the impact of the problem

SUP.9 BP5: Authorize urgent resolution actions

SUP.9 BP6: Raise alert notifications

SUP.9 BP7: Initiate problem resolution

Initiate CR

Based on determined actions

investigate

assigned to

according to

according to

according to

according to

according to

according to

based on
SUP.10 Change Request Management

The purpose of the Change Request Management Process is to ensure that change requests are managed, tracked and implemented.

### Process outcomes – as a result of successful implementation of this process

1. a change request 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 change requests are defined;
5. requests for change are analyzed, and resource requirements are estimated;
6. changes are approved and prioritized on the basis of analysis results and availability of resources;
7. approved changes are implemented and tracked to closure;
8. the status of all change requests is known; and
9. bi-directional traceability is established between change requests and affected work products.

### Output work products

<table>
<thead>
<tr>
<th>08-28 Change management plan</th>
<th>[OUTCOME 1]</th>
<th>13-19 Review record</th>
<th>[OUTCOME 7]</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-16 Change request</td>
<td>[OUTCOME 2, 3, 4, 5, 6, 7]</td>
<td>13-21 Change control record</td>
<td>[OUTCOME 8,9]</td>
</tr>
</tbody>
</table>
Develop a change request management strategy. Develop a change request management strategy, including change request activities, a status model for the change requests, analysis criteria, and responsibilities for performing these activities. Interfaces to affected parties are defined and maintained. [OUTCOME 1]

1. A status model for change requests may contain: open, under investigation, approved for implementation, allocated, implemented, fixed, closed, etc.

2. Typical analysis criteria are: resource requirements, scheduling issues, risks, benefits, etc.

3. Change request activities ensure that change requests are systematically identified, described, recorded, analyzed, implemented, and managed.

4. The change request management strategy may cover different proceedings across the product life cycle, e.g. during prototype construction and series development.

Identify and record the change requests. Each change request is uniquely identified, described, and recorded according to the strategy, including the initiator and reason of the change request. [OUTCOME 2, 3]

Record the status of change requests. A status according to the status model is assigned to each change request to facilitate tracking. [OUTCOME 8]

Analyze and assess change requests. Change requests are analyzed according to the strategy including their dependencies to affected work products and other change requests. Assess the impact of the change requests and establish criteria for confirming implementation. [OUTCOME 3, 4, 5, 9]
**BP 5** Approve change requests before implementation. Change requests are prioritized based on analysis results and availability of resources before implementation and approved according to the strategy. [OUTCOME 6]

5. A Change Control Board (CCB) is a common mechanism used to approve change requests.

6. Prioritization of change requests may be done by allocation to releases.

**BP 6** Review the implementation of change requests. The implementation of change requests is reviewed before closure to ensure that their criteria for confirming implementation are satisfied, and that all relevant processes have been applied. [OUTCOME 7, 8]

**BP 7** Track change requests to closure. Change requests are tracked until closure. Feedback to the initiator is provided. [OUTCOME 7, 8]

**BP 8** Establish bidirectional traceability. Establish bidirectional traceability between change requests and work products affected by the change requests. In case that the change request is initiated by a problem, establish bidirectional traceability between change requests and the corresponding problem reports. [OUTCOME 9]

7. Bidirectional traceability supports consistency, completeness and impact analysis.
Rating consistency – SUP.10 Change Request Management

**SUP.9 BP1:** Develop a change request management strategy

**SUP.10 BP2:** Identify and record the change requests

**SUP.10 BP3:** Record the status of change requests

**SUP.10 BP4:** Analyze and assess change requests

**SUP.10 BP5:** Approve change requests before implementation

**SUP.10 BP6:** Review the implementation of change requests

**SUP.10 BP7:** Track change requests to closure

**SUP.10 BP8:** Establish bidirectional traceability

**Process Performance** (of all relevant processes) (affected work products)

**SUP.9 BP7:** Initiate problem resolution (corresponding problem report)

- SPL.2 BP.1: Define the functional content of releases
- SUP.10

Consistent with 23
SPL.2 Product Release

The purpose of the 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 are 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.

Output work products

<table>
<thead>
<tr>
<th>Output work products</th>
<th>Outcomes</th>
<th>Output work products</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-16 Release plan</td>
<td>[OUTCOME 1, 3]</td>
<td>13-06 Delivery record</td>
<td>[OUTCOME 6, 7]</td>
</tr>
<tr>
<td>11-03 Product release information</td>
<td>[OUTCOME 1, 3, 4, 6]</td>
<td>13-13 Product release approval record</td>
<td>[OUTCOME 5]</td>
</tr>
<tr>
<td>11-04 Product release package</td>
<td>[OUTCOME 2, 3, 6]</td>
<td>15-03 Configuration status report</td>
<td>[OUTCOME 2]</td>
</tr>
</tbody>
</table>
Define the functional content of releases. Establish a plan for releases that identifies the functionality to be included in each release. [OUTCOME 1, 3]

1. *The plan should point out which application parameters influencing the identified functionality are effective for which release.*

Define release products. The products associated with the release are defined. [OUTCOME 1]

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.*

Establish a product release classification and numbering scheme. A product release classification and numbering scheme are established based upon the intended purpose and expectations of the release(s). [OUTCOME 2]

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

Define the build activities and build environment. A consistent build process is established and maintained. [OUTCOME 2]

4. *A specified and consistent build environment should be used by all parties.*

Build the release from configured items. The release is built from configured items to ensure integrity. [OUTCOME 2]

5. *Where relevant the software release should be programmed onto the correct hardware revision before release.*
Communicate the type, service level and duration of support for a release. The type, service level and duration of support for a release are identified and communicated. [OUTCOME 3]

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]

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.

Identify the packaging for the release media. The packaging for different types of media is identified. [OUTCOME 4]

7 The packaging for certain types of media may need physical or electronic protection for instance specific encryption techniques.

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]

Ensure product release approval before delivery. Criteria for the product release are satisfied before release takes place. [OUTCOME 5]

Ensure consistency. Ensure consistency between software release number, paper label and EPROM-Label (if relevant). [OUTCOME 5]
BP 12

**Provide a release note.** A release is supported by information detailing key characteristics of the release. [OUTCOME 6]

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.

BP 13

**Deliver the release to the intended customer.** The product is delivered to the intended customer with positive confirmation of receipt. [OUTCOME 6, 7]

9 Confirmation of receipt may be achieved by hand, electronically, by post, by telephone or through a distribution service provider.

10 These practices are typically supported by the SUP.8 Configuration Management Process.
SYS.1 Requirements Elicitation

The purpose of the Requirements Elicitation Process is to gather, process, and track evolving stakeholder needs and requirements throughout the lifecycle 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 stakeholder is established;
2. agreed stakeholder requirements are defined and baselined;
3. a change mechanism is established to evaluate and incorporate changes to stakeholder requirements into the baselined requirements based on changing stakeholder needs;
4. a mechanism is established for continuous monitoring of stakeholder 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 stakeholder needs are identified, the associated risks assessed and their impact managed.

Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-19 Risk management plan</td>
<td>[OUTCOME 6]</td>
</tr>
<tr>
<td>08-20 Risk mitigation plan</td>
<td>[OUTCOME 6]</td>
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<tr>
<td>13-04 Communication record</td>
<td>[OUTCOME 1, 4]</td>
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<tr>
<td>13-19 Review record</td>
<td>[OUTCOME 4, 5]</td>
</tr>
<tr>
<td>13-21 Change control record</td>
<td>[OUTCOME 3, 4]</td>
</tr>
<tr>
<td>15-01 Analysis report</td>
<td>[OUTCOME 2, 3, 6]</td>
</tr>
<tr>
<td>17-03 Stakeholder Requirements</td>
<td>[OUTCOME 1, 2]</td>
</tr>
</tbody>
</table>
Obtain stakeholder requirements and requests. Obtain and define stakeholder 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. [OUTCOME 1, 4]

1. Requirements elicitation may involve the customer and the supplier.
2. The agreed stakeholder requirements and evaluation of any change may be based on feasibility studies and/or cost and time analyzes.
3. The information needed to keep traceability for each customer requirement has to be gathered and documented.

Understand stakeholder expectations. Ensure that both supplier and customer understand each requirement in the same way. [OUTCOME 2]

4. Reviewing the requirements and requests with the customer supports a better understanding of customer needs and expectations. Refer to the process SUP.4 Joint Review.

Agree on requirements. Obtain an explicit agreement from all relevant parties to work on these requirements. [OUTCOME 2]

Establish stakeholder requirements baseline. Formalize the stakeholder’s requirements and establish them as a baseline for project use and monitoring against stakeholder needs. The supplier should determine the requirements not stated by the stakeholder but necessary for specified and intended use and include them in the baseline. [OUTCOME 2,3]
Manage stakeholder requirements changes. Manage all changes made to the stakeholder requirements against the stakeholder requirements baseline to ensure enhancements resulting from changing technology and stakeholder 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. [OUTCOME 3, 6]

Requirements change may arise from different sources as for instance changing technology and stakeholder needs, legal constraints.

An information management system may be needed to manage, store and reference any information gained and needed in defining agreed stakeholder requirements.

Establish customer-supplier query communication mechanism. Provide 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]

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.

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.

The formats of the information communicated by the supplier may include computer-aided design data and electronic data exchange.
SYS.2 System Requirements Analysis

The purpose of the System Requirements Analysis Process is to transform the defined stakeholder requirements into a set of system 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 verifiability;
3. the impact of system requirements on the operating environment is analyzed;
4. prioritization for implementing the system requirements is defined;
5. the system requirements are updated as needed;
6. consistency and bidirectional traceability are established between stakeholder requirements and system requirements;
7. the system requirements are evaluated for cost, schedule and technical impact; and
8. the system requirements are agreed and communicated to all affected parties.

Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
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<tbody>
<tr>
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<tr>
<td>13-21 Change control record</td>
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<tr>
<td>13-22 Traceability record</td>
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<tr>
<td>15-01 Analysis report</td>
<td>[OUTCOME 2, 3, 4, 7]</td>
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<tr>
<td>17-08 Interface requirements specification</td>
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<tr>
<td>17-12 System requirements specification</td>
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</tr>
<tr>
<td>17-50 Verification criteria</td>
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</table>
Specify system requirements. Use the stakeholder requirements and changes to the stakeholder requirements to identify the required functions and capabilities of the system. Specify functional and non-functional system requirements in a system requirements specification. [OUTCOME 1, 5, 7]

1. Application parameter influencing functions and capabilities are part of the system requirements.

2. For changes to the stakeholder’s requirements SUP.10 applies.

Structure system requirements. Structure the system requirements in the system requirements specification by e.g.

- grouping to project relevant clusters,
- sorting in a logical order for the project,
- categorizing based on relevant criteria for the project,
- prioritizing according to stakeholder needs.

[OUTCOME 2, 4]

3. Prioritizing typically includes the assignment of functional content to planned releases. Refer to SPL.2.BP1.

Analyze system requirements. Analyze the specified system requirements including their interdependencies to ensure correctness, technical feasibility and verifiability, and to support risk identification. Analyze the impact on cost, schedule and the technical impact. [OUTCOME 1, 2, 7]

4. The analysis of impact on cost and schedule supports the adjustment of project estimates. Refer to MAN.3.BP5.

Analyze the impact on the operating environment. Identify the interfaces between the specified system and other elements of the operating environment. Analyze the impact that the system requirements will have on these interfaces and the operating environment. [OUTCOME 3, 7]
Develop verification criteria. Develop the verification criteria for each system requirement that define the qualitative and quantitative measures for the verification of a requirement. [OUTCOME 2, 7]

Verification criteria demonstrate that a requirement can be verified within agreed constraints and is typically used as the input for the development of the system test cases or other verification measures that ensures compliance with the system requirements.

Verification which cannot be covered by testing is covered by SUP.2.

Establish bidirectional traceability. Establish bidirectional traceability between stakeholder requirements and system requirements. [OUTCOME 6]

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency. Ensure consistency between stakeholder requirements and system requirements. [OUTCOME 6]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Communicate agreed system requirements. Communicate the agreed system requirements and updates to system requirements to all relevant parties. [OUTCOME 8]
Rating consistency – SYS.2 System Requirements Analysis

SYS.2 BP1: Specify system requirements
- Structure system requirements (SYS.2 BP2)
- Analyze system requirements (SYS.2 BP3)
- Analyze impact on the operating environment (SYS.2 BP4)
- Develop verification criteria (SYS.2 BP5)
- Communicate agreed system requirements (SYS.2 BP8)
- Establish bidirectional traceability (SYS.2 BP6)
- Ensure consistency (SYS.2 BP7)

MAN.5 BP3: Identify Risks
- Define, monitor and adjust project estimates and resources (MAN.3 BP5)

SYS.1: Requirements Elicitation

.rating consistency - SYS.2 System Requirements Analysis

SYS.2 BP4: Analyze impact on the operating environment

SYS.2 BP2: Structure system requirements

SYS.2 BP3: Analyze system requirements

SYS.2 BP5: Develop verification criteria

SYS.2 BP8: Communicate agreed system requirements

SYS.2 BP6: Establish bidirectional traceability

SYS.2 BP7: Ensure consistency

MAN.3 BP5: Define, monitor and adjust project estimates and resources

MAN.5 BP3: Identify Risks

SYS.1: Requirements Elicitation
The purpose of the System Architectural Design Process is to establish a system architectural design and identify which system requirements are to be allocated to which elements of the system, and to evaluate the system architectural design against defined criteria.

**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;
2. the system requirements are allocated to the elements of the system;
3. the interfaces of each system element are defined;
4. the dynamic behavior of the system elements is defined;
5. consistency and bidirectional traceability are established between system requirements and system architectural design; and
6. the system architectural design is agreed and communicated to all affected parties.

**Output work products**

<table>
<thead>
<tr>
<th>Work Product</th>
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<th>Work Product</th>
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<td>13-19 Review record</td>
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</tbody>
</table>
**BP 1**  
**Develop system architectural design.** Develop and document the system architectural design that specifies the elements of the system with respect to functional and non-functional system requirements. [OUTCOME 1]

1. *The development of system architectural design typically includes the decomposition into elements across appropriate hierarchical levels.*

**BP 2**  
**Allocate system requirements.** Allocate the system requirements to the elements of the system architectural design. [OUTCOME 2]

**BP 3**  
**Define interfaces of system elements.** Identify, develop and document the interfaces of each system element. [OUTCOME 3]

**BP 4**  
**Describe dynamic behavior.** Evaluate and document the dynamic behavior of the interaction between system elements. [OUTCOME 4]

2. *Dynamic behavior is determined by operating modes (e.g. start-up, shutdown, normal mode, calibration, diagnosis, etc.)*

**BP 5**  
**Evaluate alternative system architectures.** Define evaluation criteria for the architecture. Evaluate alternative system architectures according to the defined criteria. Record the rationale for the chosen system architecture. [OUTCOME 1]

3. *Evaluation criteria may include quality characteristics (modularity, maintainability, expandability, scalability, reliability, security realization and usability) and results of make-buy-reuse analysis.*
Establish bidirectional traceability. Establish bidirectional traceability between system requirements and elements of the system architectural design. [OUTCOME 5]

- Bidirectional traceability covers allocation of system requirements to the elements of the system architectural design.
- Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency. Ensure consistency between system requirements and the system architectural design. [OUTCOME 1, 2, 5, 6]

- Consistency is supported by bidirectional traceability and can be demonstrated by review records.
- System requirements typically include system architectural requirements. Refer to BP5.

Communicate agreed system architectural design. Communicate the agreed system architectural design and updates to system architectural design to all relevant parties. [OUTCOME 6]
Rating consistency – SYS.3 System Architectural Design

SYS.3 BP3: Define interfaces of system elements

SYS.3 BP2: Allocate system requirements

SYS.3 BP6: Establish bidirectional traceability

SYS.3 BP4: Describe dynamic behavior

SYS.3 BP5: Evaluate alternative system architectures

SYS.3 BP7: Ensure consistency

SYS.3 BP8: Communicate agreed system architectural design

SYS.2: System requirements analysis

SYS.3 BP1: Develop system architectural design

BP 6, 7

uses

establish/ensure

3, 4

allocate to

7

relates to each other

8

based on

based on

according to defined criteria

communicate

7

2 with respect to

SYN.3
SYS.4 System Integration and Integration Test

The purpose of the System Integration and Integration Test Process is to integrate the system items to produce an integrated system consistent with the system architectural design and to ensure that the system items are tested to provide evidence for compliance of the integrated system items with the system architectural design, including the interfaces between system items.

Process outcomes – As a result of successful implementation of this process:

1. a system integration strategy consistent with the project plan, the release plan and the system architectural design is developed to integrate the system items;
2. a system integration test strategy including the regression test strategy is developed to test the system item interactions;
3. a specification for system integration test according to the system integration test strategy is developed that is suitable to provide evidence for compliance of the integrated system items with the system architectural design, including the interfaces between system items;
4. system items are integrated up to a complete integrated system according to the integration strategy;
5. test cases included in the system integration test specification are selected according to the system integration test strategy and the release plan;
6. system item interactions are tested using the selected test cases and the results of system integration testing are recorded;
7. consistency and bidirectional traceability between the elements of the system architectural design and test cases included in the system integration test specification and bidirectional traceability between test cases and test results is established; and
8. results of the system integration test are summarized and communicated to all affected parties.
Output work products

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<thead>
<tr>
<th>Output work product</th>
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<tr>
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<tr>
<td>13-50 Test result</td>
<td>[OUTCOME 6, 8]</td>
</tr>
</tbody>
</table>

SYS.4 with 9 Base practices

**BP 1**

**Develop system integration strategy.** Develop a strategy for integrating the system items consistent with the project plan and the release plan. Identify system items based on the system architectural design and define a sequence for integrating them. [OUTCOME 1]

**BP 2**

**Develop system integration test strategy including regression test strategy.** Develop a strategy for testing the integrated system items following the integration strategy. This includes a regression test strategy for re-testing integrated system items if a system item is changed. [OUTCOME 2]
Develop specification for system integration test. Develop the test specification for system integration test including the test cases for each integration step of a system item according to the system integration test strategy. The test specification shall be suitable to provide evidence for compliance of the integrated system items with the system architectural design. [OUTCOME 3]

1. The interface descriptions between system elements are an input for the system integration test cases.

2. Compliance to the architectural design means that the specified integration tests are suitable to prove that the interfaces between the system items fulfill the specification given by the system architectural design.

3. The system integration test cases may focus on
   - the correct signal flow between system items
   - the timeliness and timing dependencies of signal flow between system items
   - the correct interpretation of signals by all system items using an interface
   - the dynamic interaction between system items

4. The system integration test may be supported using simulation of the environment (e.g. Hardware-in-the-Loop simulation, vehicle network simulations, digital mock-up).

Integrate system items. Integrate the system items to an integrated system according to the system integration strategy. [OUTCOME 4]

5. The system integration can be performed step wise integrating system items (e.g. the hardware elements as prototype hardware, peripherals (sensors and actuators), the mechanics and integrated software) to produce a system consistent with the system architectural design.
**Select test cases.** Select test cases from the system integration test specification. The selection of test cases shall have sufficient coverage according to the system integration test strategy and the release plan. [OUTCOME 5]

**Perform system integration test.** Perform the system integration test using the selected test cases. Record the integration test results and logs. [OUTCOME 6]

6 See SUP.9 for handling of non-conformances.

**Establish bidirectional traceability.** Establish bidirectional traceability between elements of the system architectural design and test cases included in the system integration test specification.

Establish bidirectional traceability between test cases included in the system integration test specification and system integration test results. [OUTCOME 7]

7 Bidirectional traceability supports coverage, consistency and impact analysis.

**Ensure consistency.** Ensure consistency between elements of the system architectural design and test cases included in the system integration test specification. [OUTCOME 7]

8 Consistency is supported by bidirectional traceability and can be demonstrated by review records.

**Summarize and communicate results.** Summarize the system integration test results and communicate them to all affected parties. [OUTCOME 8]

9 Providing all necessary information from the test case execution in a summary enables other parties to judge the consequences
Rating consistency –SYS.4 System Integration and Integration Test

**SYS.4 BP1: Develop system integration strategy**

Consistent with plans

**SYS.4 BP4: Integrate system items**

According to

**SYS.4 BP2: Develop system integration test strategy including regression test strategy**

Consistent with

**SYS.4 BP8: Ensure consistency**

Uses

**SYS.4 BP3: Develop specification for system integration tests**

Select from

**SYS.4 BP5: Select test cases**

Using

**SYS.4 BP6: Perform integration tests**

Provide evidence for compliance with

**SYS.3 BP6: Establish bidirectional traceability**

Establish bidirectional traceability

**MAN.3: Project Management**

**SPL.2: Product release**

According to

**SYS.4 BP9: Summarize and communicate results**

Communicate
SYS.5 System Qualification Test

The purpose of the System Qualification Test Process is to ensure that the integrated system is tested to provide evidence for compliance with the system requirements and that the system is ready for delivery.

Process outcomes – As a result of successful implementation of this process:

1. a system qualification test strategy including regression test strategy consistent with the project plan and release plan is developed to test the integrated system;
2. a specification for system qualification test of the integrated system according to the system qualification test strategy is developed that is suitable to provide evidence for compliance with the system requirements;
3. test cases included in the system qualification test specification are selected according to the system qualification test strategy and the release plan;
4. the integrated system is tested using the selected test cases and the results of system qualification test are recorded;
5. consistency and bidirectional traceability are established between system requirements and test cases included in the system qualification test specification and between test cases and test results; and
6. results of the system qualification test are summarized and communicated to all affected parties.

Output work products

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<td>08-52 Test plan</td>
<td>[OUTCOME 1]</td>
<td>13-22 Traceability record</td>
<td>[OUTCOME 5]</td>
</tr>
</tbody>
</table>

SYS.5 with 7 Base practices

B 1 Develop system qualification test strategy including regression test strategy. Develop a strategy for system qualification test consistent with the project plan and the release plan. This includes a regression test strategy for re-testing the integrated system if a system item is changed. [OUTCOME 1]
## Develop specification for system qualification test

Develop the specification for system qualification test including test cases based on the verification criteria according to the system qualification test strategy. The test specification shall be suitable to provide evidence for compliance of the integrated system with the system requirements. [OUTCOME 2]

## Select test cases

Select test cases from the system qualification test specification. The selection of test cases shall have sufficient coverage according to the system qualification test strategy and the release plan. [OUTCOME 3]

## Test integrated system

Test the integrated system using the selected test cases. Record the system qualification test results and logs. [OUTCOME 4]

1. See SUP.9 for handling of non-conformances.

## Establish bidirectional traceability

Establish bidirectional traceability between system requirements and test cases included in the system qualification test specification. Establish bidirectional traceability between test cases included in the system qualification test specification and system qualification test results. [OUTCOME 5]

2. Bidirectional traceability supports coverage, consistency and impact analysis.

## Ensure consistency

Ensure consistency between system requirements and test cases included in the system qualification test specification. [OUTCOME 5]

3. Consistency is supported by bidirectional traceability and can be demonstrated by review records.

## Summarize and communicate results

Summarize the system qualification test results and communicate them to all affected parties. [OUTCOME 6]

4. Providing all necessary information from the test case execution in a summary enables other parties to judge the consequences.
SYS.5 BP1: Develop system qualification test strategy including regression test strategy

SYS.5 BP2: Develop specification for system qualification tests

SYS.5 BP3: Select test cases

SYS.5 BP4: Test integrated system

SYS.5 BP5: Establish bidirectional traceability

SYS.5 BP6: Ensure consistency

SY.2 BP5: Establish bidirectional traceability

MAN.3: Project Management

SPL.2: Product release

SYS.5 BP7: Summarize and communicate results

Rating consistency – SYS.5 System Qualification Test
SWE.1 Software Requirements Analysis

The purpose of the Software Requirements Analysis Process is to transform the software related parts of the system requirements into a set of software requirements.

**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 verifiability;
3. the impact of software requirements on the operating environment is analyzed;
4. prioritization for implementing the software requirements is defined;
5. the software requirements are updated as needed;
6. consistency and bidirectional traceability are established between system requirements and software requirements; and consistency and bidirectional traceability are established between system architectural design and software requirements;
7. the software requirements are evaluated for cost, schedule and technical impact; and
8. the software requirements are agreed and communicated to all affected parties.

**Output work products**

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<thead>
<tr>
<th>Work Product</th>
<th>Outcome</th>
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<tr>
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<td>[OUTCOME 1,6]</td>
<td>17-50 Verification criteria</td>
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</table>
Specify software requirements. Use the system requirements and the system architecture and changes to system requirements and architecture to identify the required functions and capabilities of the software. Specify functional and nonfunctional software requirements in a software requirements specification. [OUTCOME 1, 5, 7]

1. Application parameter influencing functions and capabilities are part of the system requirements.
2. In case of software development only, the system requirements and the system architecture refer to a given operating environment (see also [5]). In that case, stakeholder 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.

Structure software requirements. Structure the software requirements in the software requirements specification by e.g.
- grouping to project relevant clusters,
- sorting in a logical order for the project,
- categorizing based on relevant criteria for the project,
- prioritizing according to stakeholder needs.

[OUTCOME 2, 4]
3. Prioritizing typically includes the assignment of software content to planned releases. Refer to SPL.2.BP1.

Analyze software requirements. Analyze the specified software requirements including their interdependencies to ensure correctness, technical feasibility and verifiability, and to support risk identification. Analyze the impact on cost, schedule and the technical impact. [OUTCOME 2, 7]

4. The analysis of impact on cost and schedule supports the adjustment of project estimates. Refer to MAN.3.BP5.
Analyze the impact on the operating environment. Analyze the impact that the software requirements will have on interfaces of system elements and the operating environment. [OUTCOME 3, 7]

The operating environment is defined as the system in which the software executes (e.g. hardware, operating system, etc.).

Develop verification criteria. Develop the verification criteria for each software requirement that define the qualitative and quantitative measures for the verification of a requirement. [OUTCOME 2, 7]

Verification criteria demonstrate that a requirement can be verified within agreed constraints and is typically used as the input for the development of the software test cases or other verification measures that should demonstrate compliance with the software requirements.

Verification which cannot be covered by testing is covered by SUP.2.

Establish bidirectional traceability. Establish bidirectional traceability between system requirements and software requirements. Establish bidirectional traceability between the system architecture and software requirements. [OUTCOME 6]

Redundancy should be avoided by establishing a combination of these approaches that covers the project and the organizational needs.

Bidirectional traceability supports coverage, consistency and impact analysis.
**Ensure consistency.** Ensure consistency between system requirements and software requirements. Ensure consistency between the system architecture and software requirements. [OUTCOME 6]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

In case of software development only, the system requirements and system architecture refer to a given operating environment (see also [2]). In that case, consistency and bidirectional traceability have to be ensured between stakeholder requirements and software requirements.

**Communicate agreed software requirements.** Communicate the agreed software requirements and updates to software requirements to all relevant parties. [OUTCOME 8]
Rating consistency – SWE.1 Software Requirements Analysis

SWE.1 BP4: Analyze impact on the operating environment

SWE.1 BP2: Structure software requirements

SWE.1 BP3: Analyze software requirements

SWE.1 BP5: Develop verification criteria

SWE.1 BP8: Communicate agreed software requirements

SWE.1 BP1: Specify software requirements

MAN.3 BP5: Determine, monitor and adjust project estimates and resources

MAN.5 BP3: Identify risks

SYS.2: System requirements analysis

SYS.3: System architectural design

BP 6, 7

uses

10

establish/ensure

9, 10, 11, 12

uses

10

uses

10

uses

10

uses

10

update

7, 8

structure

10

analyze

10

analyze

10

according to

10

Ensure consistency
SWE.2 Software Architectural Design

The purpose of the Software Architectural Design Process is to establish an architectural design and to identify which software requirements are to be allocated to which elements of the software, and to evaluate the software architectural design against defined criteria.

Process outcomes – As a result of successful implementation of this process:
1. a software architectural design is defined that identifies the elements of the software;
2. the software requirements are allocated to the elements of the software;
3. the interfaces of each software element are defined;
4. the dynamic behavior and resource consumption objectives of the software elements are defined;
5. consistency and bidirectional traceability are established between software requirements and software architectural design; and
6. the software architectural design is agreed and communicated to all affected parties.

Output work products

<table>
<thead>
<tr>
<th>04-04 Software architectural design</th>
<th>[OUTCOME 1, 2, 3, 4, 5]</th>
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<td>[OUTCOME 6]</td>
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<td>13-19 Review record</td>
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</table>
Develop software architectural design. Develop and document the software architectural design that specifies the elements of the software with respect to functional and non-functional software requirements. [OUTCOME 1]

1. The software is decomposed into elements across appropriate hierarchical levels down to the software components (the lowest level elements of the software architectural design) that are described in the detailed design.

Allocate software requirements. Allocate the software requirements to the elements of the software architectural design. [OUTCOME 2]

Define interfaces of software elements. Identify, develop and document the interfaces of each software element. [OUTCOME 3]

Describe dynamic behavior. Evaluate and document the timing and dynamic interaction of software elements to meet the required dynamic behavior of the system. [OUTCOME 4]

2. Dynamic behavior 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.

3. During evaluation of the dynamic behavior the target platform and potential loads on the target should be considered.

Define resource consumption objectives. Determine and document the resource consumption objectives for all relevant elements of the software architectural design on the appropriate hierarchical level. [OUTCOME 4]

4. Resource consumption is typically determined for resources like Memory (ROM, RAM, external / internal EEPROM or Data Flash), CPU load, etc.
Evaluate alternative software architectures. Define evaluation criteria for the architecture. Evaluate alternative software architectures according to the defined criteria. Record the rationale for the chosen software architecture.

[OUTCOME 1, 2, 3, 4, 5]

Evaluation criteria may include quality characteristics (modularity, maintainability, expandability, scalability, reliability, security realization and usability) and results of make-buy-reuse analysis.

Establish bidirectional traceability. Establish bidirectional traceability between software requirements and elements of the software architectural design. [OUTCOME 5]

Bidirectional traceability covers allocation of software requirements to the elements of the software architectural design. Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency. Ensure consistency between software requirements and the software architectural design. [OUTCOME 1, 2, 5, 6]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Communicate agreed software architectural design. Communicate the agreed software architectural design and updates to software architectural design to all relevant parties. [OUTCOME 6]
SWE.3 Software Detailed Design and Unit Construction

The purpose of the Software Detailed Design and Unit Construction Process is to provide an evaluated detailed design for the software components and to specify and to produce the software units.

**Process outcomes – As a result of successful implementation of this process:**

1. a detailed design is developed that describes software units;
2. interfaces of each software unit are defined;
3. the dynamic behavior of the software units is defined;
4. consistency and bidirectional traceability are established between software requirements and software units; and consistency and bidirectional traceability are established between software architectural design and software detailed design; and consistency and bidirectional traceability are established between software detailed design and software units;
5. the software detailed design and the relationship to the software architectural design is agreed and communicated to all affected parties; and
6. software units defined by the software detailed design are produced.

**Output work products**

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome(s)</th>
<th>Work Product</th>
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<tr>
<td>04-05 Software detailed design</td>
<td>[OUTCOME 1, 2, 3]</td>
<td>13-19 Review record</td>
<td>[OUTCOME 4]</td>
</tr>
<tr>
<td>13-04 Communication record</td>
<td>[OUTCOME 5]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**BP1** Develop software detailed design. Develop a detailed design for each software component defined in the software architectural design that specifies all software units with respect to functional and non-functional software requirements. [OUTCOME 1]

**BP2** Define interfaces of software units. Identify, specify and document the interfaces of each software unit. [OUTCOME 2]

**BP3** Describe dynamic behavior. Evaluate and document the dynamic behavior of and the interaction between relevant software units. [OUTCOME 3]

1. *Not all software units have dynamic behavior to be described.*

**BP4** Evaluate software detailed design. Evaluate the software detailed design in terms of interoperability, interaction, criticality, technical complexity, risks and testability. [OUTCOME 1,2,3,4]

2. *The results of the evaluation can be used as input for software unit verification.*

**BP5** Establish bidirectional traceability. Establish bidirectional traceability between software requirements and software units. Establish bidirectional traceability between the software architectural design and the software detailed design. Establish bidirectional traceability between the software detailed design and software units. [OUTCOME 4]

3. *Redundancy should be avoided by establishing a combination of these approaches that covers the project and the organizational needs.*

4. *Bidirectional traceability supports coverage, consistency and impact analysis.*
<table>
<thead>
<tr>
<th><strong>BP6</strong></th>
<th>Ensure consistency. Ensure consistency between software requirements and software units. Ensure consistency between the software architectural design, the software detailed design and software units. [OUTCOME 4]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5</strong></td>
<td><strong>NOTE 5</strong>: Consistency is supported by bidirectional traceability and can be demonstrated by review records.</td>
</tr>
<tr>
<td><strong>BP7</strong></td>
<td>Communicate agreed software detailed design. Communicate the agreed software detailed design and updates to the software detailed design to all relevant parties. [OUTCOME 5]</td>
</tr>
<tr>
<td><strong>BP8</strong></td>
<td>Develop software units. Develop and document the executable representations of each software unit according to the software detailed design. [OUTCOME 6]</td>
</tr>
</tbody>
</table>
Rating consistency – SWE.3 Software Detailed Design & Unit Construction

SWE.3 BP2: Define interfaces of software units

SWE.3 BP3: Describe dynamic behavior

SWE.3 BP4: Evaluate software detailed design

SWE.3 BP5: Establish bidirectional traceability

SWE.3 BP6: Ensure consistency

SWE.3 BP7: Communicate agreed software detailed design

SWE.3 BP8: Develop software units

SWE.1: software requirements analysis

SWE.2 Software Architectural Design
SWE.4 Software Unit Verification

The purpose of the Software Unit Verification Process is to verify software units to provide evidence for compliance of the software units with the software detailed design and with the non-functional software requirements.

Process outcomes – As a result of successful implementation of this process:

1. a software unit verification strategy including regression strategy is developed to verify the software units;
2. criteria for software unit verification are developed according to the software unit verification strategy that are suitable to provide evidence for compliance of the software units with the software detailed design and with the non-functional software requirements;
3. software units are verified according to the software unit verification strategy and the defined criteria for software unit verification and the results are recorded;
4. consistency and bidirectional traceability are established between software units, criteria for verification and verification results; and
5. results of the unit verification are summarized and communicated to all affected parties.

Output work products

| 08-50 Test specification E          | [OUTCOME 2] | 13-22 Traceability record | [OUTCOME 4] |
| 08-52 Test plan                   | [OUTCOME 1] | 13-25 Verification results | [OUTCOME 3, 5] |
Develop software unit verification strategy including regression strategy. Develop a strategy for verification of the software units including regression strategy for re-verification if a software unit is changed. The verification strategy shall define how to provide evidence for compliance of the software units with the software detailed design and with the non-functional requirements. [OUTCOME 1]

1. Possible techniques for unit verification include static/dynamic analysis, code reviews, unit testing etc.

Develop criteria for unit verification. Develop criteria for unit verification that are suitable to provide evidence for compliance of the software units, and their interactions within the component, with the software detailed design and with the non-functional requirements according to the verification strategy. For unit testing, criteria shall be defined in a unit test specification. [OUTCOME 2]

2. Possible criteria for unit verification include unit test cases, unit test data, static verification, coverage goals and coding standards such as the MISRA rules.

3. The unit test specification may be implemented e.g. as a script in an automated test bench.

Perform static verification of software units. Verify software units for correctness using the defined criteria for verification. Record the results of the static verification. [OUTCOME 3]

4. Static verification may include static analysis, code reviews, checks against coding standards and guidelines, and other techniques.

5. See SUP.9 for handling of non-conformances.

Test software units. Test software units using the unit test specification according to the software unit verification strategy. Record the test results and logs. [OUTCOME 3]

6. See SUP.9 for handling of non-conformances.
Establish bidirectional traceability. Establish bidirectional traceability between software units and static verification results. Establish bidirectional traceability between the software detailed design and the unit test specification. Establish bidirectional traceability between the unit test specification and unit test results. [OUTCOME 4]

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency. Ensure consistency between the software detailed design and the unit test specification. [OUTCOME 4]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results. Summarize the unit test results and static verification results and communicate them to all affected parties. [OUTCOME 5]

Providing all necessary information from the test case execution in a summary enables other parties to judge the consequences.
Rating consistency – SWE.4 Software Unit Verification

SWE.1 Software Requirements Analysis

SWE.4 BP1: Develop software unit verification strategy including regression strategy

SWE.4 BP2: Develop criteria for unit verification

SWE.3 Software Detailed Design & Unit Construction

SWE.4 BP3: Perform static verification of software units

SWE.4 BP4: Test software units

SWE.4 BP5: Establish bidirectional traceability

SWE.4 BP6: Ensure consistency

SWE.4 BP7: Summarize and communicate results

1. Show evidence for compliance
2. Show evidence for compliance
3. 4 establish/ensure

7 according to
8, 9 using

10, 11
SWE.5 Software Integration and Integration Test

The purpose of the Software Integration and Integration Test Process is to integrate the software units into larger software items up to a complete integrated software consistent with the software architectural design and to ensure that the software items are tested to provide evidence for compliance of the integrated software items with the software architectural design, including the interfaces between the software units and between the software items.

Process outcomes – As a result of successful implementation of this process:

1. a software integration strategy consistent with the project plan, release plan and the software architectural design is developed to integrate the software items;
2. a software integration test strategy including the regression test strategy is developed to test the software unit and software item interactions;
3. a specification for software integration test according to the software integration test strategy is developed that is suitable to provide evidence for compliance of the integrated software items with the software architectural design, including the interfaces between the software units and between the software items;
4. software units and software items are integrated up to a complete integrated software according to the integration strategy;
5. test cases included in the software integration test specification are selected according to the software integration test strategy, and the release plan;
6. integrated software items are tested using the selected test cases and the results of software integration test are recorded;
7. consistency and bidirectional traceability are established between the elements of the software architectural design and the test cases included in the software integration test specification and between test cases and test results; and
8. results of the software integration test are summarized and communicated to all affected parties.
Output work products

| 01-03 Software item | [OUTCOME 4] | 13-19 Review record | [OUTCOME 7] |
| 08-50 Test specification | [OUTCOME 3,5] | 13-50 Test result | [OUTCOME 6, 8] |
| 08-52 Test plan | [OUTCOME 1,2] | 17-02 Build list | [OUTCOME 4, 7] |
| 13-04 Communication record | [OUTCOME 8] |

SWE.5 with 9 Base practices

BP1 **Develop software integration strategy.** Develop a strategy for integrating software items consistent with the project plan and release plan. Identify software items based on the software architectural design and define a sequence for integrating them. [OUTCOME 1]

BP2 **Develop software integration test strategy including regression test strategy.** Develop a strategy for testing the integrated software items following the integration strategy. This includes a regression test strategy for re-testing integrated software items if a software item is changed. [OUTCOME 2]
Develop specification for software integration test. Develop the test specification for software integration test including the test cases according to the software integration test strategy for each integrated software item. The test specification shall be suitable to provide evidence for compliance of the integrated software items with the software architectural design. [OUTCOME 3]

1. Compliance to the architectural design means that the specified integration tests are suitable to prove that the interfaces between the software units and between the software items fulfill the specification given by the software architectural design.

2. The software integration test cases may focus on
   - the correct dataflow between software items
   - the timeliness and timing dependencies of dataflow between software items
   - the correct interpretation of data by all software items using an interface
   - the dynamic interaction between software items
   - the compliance to resource consumption objectives of interfaces

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 4]

Select test cases. Select test cases from the software integration test specification. The selection of test cases shall have sufficient coverage according to the software integration test strategy and the release plan. [OUTCOME 5]
Perform software integration test. Perform the software integration test using the selected test cases. Record the integration test results and logs. [OUTCOME 6]

3 See SUP.9 for handling of non-conformances.
4 The software integration test may be supported by using hardware debug interfaces or simulation environments (e.g. Software-in-the-Loop-Simulation).

Establish bidirectional traceability. Establish bidirectional traceability between elements of the software architectural design and test cases included in the software integration test specification. Establish bidirectional traceability between test cases included in the software integration test specification and software integration test results. [OUTCOME 7]

5 Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency. Ensure consistency between elements of the software architectural design and test cases included in the software integration test specification. [OUTCOME 7]

6 Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results. Summarize the software integration test results and communicate them to all affected parties. [OUTCOME 8]

7 Providing all necessary information from the test case execution in a summary enables other parties to judge the consequences.
Rating consistency – SWE.5 Software Integration and Integration Test

SWE.5 BP1: Develop software integration strategy

SWE.5 BP2: Develop software integration test strategy including regression test strategy

SWE.5 BP3: Develop specification for software integration tests

SWE.5 BP4: Integrate software units and software items

SWE.5 BP5: Select test cases

SWE.5 BP6: Perform integration tests

SWE.5 BP7: Establish bidirectional traceability

SWE.5 BP8: Ensure consistency

MAN.3: Project Management

SPL.2: Product release

consistent with 10

consistent with 12

consistent with 9, 11

consistent with 9, 14

consistent with 4, 3

consistent with 6, 7

consistent with 2, 13

consistent with 5, 15

consistent with 8

Provide evidence for compliance with 9, 11

Provide evidence for compliance with 9, 14

Provide evidence for compliance with 13

Provide evidence for compliance with 15

Provide evidence for compliance with 6, 7

Provide evidence for compliance with 4, 3
## SWE.6 Software Qualification Test

The purpose of the Software Qualification Test Process is to ensure that the integrated software is tested to provide evidence for compliance with the software requirements.

### Process outcomes – As a result of successful implementation of this process:

1. a software qualification test strategy including regression test strategy consistent with the project plan and release plan is developed to test the integrated software;
2. a specification for software qualification test of the integrated software according to the software qualification test strategy is developed that is suitable to provide evidence for compliance with the software requirements;
3. test cases included in the software qualification test specification are selected according to the software qualification test strategy and the release plan;
4. the integrated software is tested using the selected test cases and the results of software qualification test are recorded;
5. consistency and bidirectional traceability are established between software requirements and software qualification test specification including test cases and between test cases and test results; and
6. results of the software qualification test are summarized and communicated to all affected parties.

### Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome Reference</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-50 Test specification</td>
<td>[OUTCOME 2, 3]</td>
<td>13-19 Review record</td>
</tr>
<tr>
<td>08-52 Test plan</td>
<td>[OUTCOME 1]</td>
<td>13-22 Traceability record</td>
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</tbody>
</table>
Develop software qualification test strategy including regression test strategy. Develop a strategy for software qualification testing consistent with the project plan and the release plan. This includes a regression test strategy for re-testing the integrated software if a software item is changed. [OUTCOME 1]

Develop specification for software qualification test. Develop the specification for software qualification test including test cases based on the verification criteria, according to the software test strategy. The test specification shall be suitable to provide evidence for compliance of the integrated software with the software requirements. [OUTCOME 2]

Select test cases. Select test cases from the software test specification. The selection of test cases shall have sufficient coverage according to the software test strategy and the release plan. [OUTCOME 3]

Test integrated software. Test the integrated software using the selected test cases. Record the software test results and logs. [OUTCOME 4]

1 See SUP.9 for handling of non-conformances.

Establish bidirectional traceability. Establish bidirectional traceability between software requirements and test cases included in the software qualification test specification. Establish bidirectional traceability between test cases included in the software qualification test specification and software qualification test results. [OUTCOME 5]

2 Bidirectional traceability supports coverage, consistency and impact analysis.
Ensure consistency. Ensure consistency between software requirements and test cases included in the software qualification test specification. [OUTCOME 5]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results. Summarize the software qualification test results and communicate them to all affected parties. [OUTCOME 6]

Providing all necessary information from the test case execution in a summary enables other parties to judge the consequences.
Rating consistency – SWE.6 Software Qualification Test

SWE.6 BP1: Develop software qualification test strategy including regression test strategy

SWE.6 BP2: Develop specification for software qualification tests

SWE.6 BP3: Select test cases

SWE.6 BP4: Test integrated software

SWE.6 BP5: Establish bidirectional traceability

SWE.6 BP6: Ensure consistency

MAN.3: Project Management

SPL.2: Product release

SWE.6 BP7: Summarize and communicate results
MECHANICAL ENGINEERING SPICE PROCESSES
Nomenclature:
MSE.4  BP5.1 refers to
MSE.4  Mechanical system qualification test
BP5.1  Establish bidirectional traceability. Establish bidirectional
traceability between mechanical system requirements and test cases
included in the mechanical system qualification test specification.

Red: bidirectional traceability  Blue: consistency
Mechanical System Engineering

MSE.1 Mechanical System Requirements Analysis

The purpose of the Mechanical System Requirements Analysis process is to derive the mechanical system requirements from the upper system requirements together with all affected stakeholders.

Process outcomes – as a result of successful implementation of this process

1. the mechanical system requirements are derived from the upper system requirements and the upper system architecture;
2. Note: If the mechanical system is the highest system the source of these requirements are the only the stakeholders, in other cases the requirements’ source is the upper system requirements and the upper system architecture.
3. the mechanical system requirements are categorized and analyzed for correctness and verifiability;
4. the impact of mechanical system requirements on the operating environment is analyzed and communicated;
5. prioritization for implementing the mechanical system requirements is defined;
6. the mechanical system requirements are updated as needed;
7. consistency and bidirectional traceability are established between upper system requirements and mechanical system requirements; and consistency and bidirectional traceability are established between upper system architecture and mechanical system requirements;
8. the mechanical system requirements are evaluated for cost, schedule and technical impact; and
9. the mechanical system requirements are agreed and communicated to all affected stakeholders.

Output work products

<table>
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<tr>
<th>01-51 Application parameter</th>
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<th>15-01 Analysis report</th>
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<td>[OUTCOME 8]</td>
<td>17-08 Interface requirements specification [1]</td>
<td>[OUTCOME 1]</td>
</tr>
<tr>
<td>13-19 Review record</td>
<td>[OUTCOME 6]</td>
<td>17-ME01 Mechanical system requirements specification</td>
<td>[OUTCOME 1]</td>
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<tr>
<td>13-21 Change control record</td>
<td>[OUTCOME 5, 7]</td>
<td>17-50 Verification criteria</td>
<td>[OUTCOME 2]</td>
</tr>
<tr>
<td>13-22 Traceability record</td>
<td>[OUTCOME 1, 6]</td>
<td></td>
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</tbody>
</table>
Specify mechanical system requirements.
Use the upper system requirements and the upper system architecture as well as changes to the upper system requirements and architecture to identify the required functions and capabilities of the mechanical system. Specify functional and non-functional mechanical system requirements in a mechanical system requirements specification. [OUTCOME 1, 5, 7]

1. Non-functional requirements may include e.g. production, maintenance, exchangeability of systems and components in the field, logistic, packaging, sizing, weight, price per unit, producibility, environmental, design guidelines, modelling guidelines and patents.

2. Mechanical system requirements should include tolerances as necessary.

Structure mechanical system requirements.
Structure the mechanical system requirements in the mechanical system requirements specification by e.g.
- grouping to project relevant clusters like architecture elements,
- sorting in a logical order for the project,
- categorizing based on relevant criteria for the project,
- prioritizing according to stakeholder needs.
[OUTCOME 2, 4]

3. Prioritizing typically includes the assignment of mechanical content to planned releases. Refer to SPL.2 BP1.

Analyze mechanical system requirements.
Analyze the specified mechanical system requirements including their interdependencies to ensure correctness, technical feasibility and verifiability, and to support risk identification. Analyze the impact on cost, schedule and the technical impact.
[OUTCOME 2, 7]

4. The analysis of impact on cost, schedule and quality supports the adjustment of project estimates. Refer to MAN.3 BP5.
Analyze the impact on the operating environment.
Analyze the impact that the mechanical system requirements will have on upper system elements and the operating environment. [OUTCOME 3, 7]

Develop verification criteria.
Develop the verification criteria for each mechanical system requirement that define the qualitative and quantitative measures for the verification of a requirement. [OUTCOME 2, 7]

5 Verification criteria demonstrate that a requirement can be verified within agreed constraints and is typically used as the input for the development of the test cases or other verification measures that should demonstrate compliance with the mechanical system requirements.

6 Verification which cannot be covered by testing is covered by SUP.2.

Establish bidirectional traceability.
1. Establish bidirectional traceability between upper system requirements and mechanical system requirements.
2. Establish bidirectional traceability between the upper system architecture and mechanical system requirements. [OUTCOME 6]

7 Bidirectional traceability supports coverage, consistency and impact analysis.
BP7 Ensure consistency.
1. Ensure consistency between upper system requirements and mechanical system requirements.
2. Ensure consistency between the upper system architecture and mechanical system requirements.
[OUTCOME 6]
8 Consistency is supported by bidirectional traceability and can be demonstrated by review records.
9 In case of mechanical development only, the upper system requirements and upper system architecture refer to a given operating environment. In that case, consistency and bidirectional traceability has to be ensured between stakeholder requirements and mechanical system requirements.

BP8 Communicate agreed mechanical requirements.
Communicate the agreed mechanical system requirements and updates to mechanical system requirements to all relevant stakeholders. [OUTCOME 8]
MSE.2 Mechanical System Architectural Design

The purpose of the Mechanical System Architectural Design Process is to establish an architectural design and to identify which mechanical system requirements are to be allocated to which elements of the mechanical system, and to evaluate the mechanical system architectural design against defined criteria.

**Process outcomes – as a result of successful implementation of this process**

1. As a result of successful implementation of this process:
2. a mechanical system architectural design is defined that identifies the elements of the mechanical system;
3. the mechanical system requirements are allocated to the elements of the mechanical system;
4. the interfaces of each mechanical system elements are defined;
5. the static and dynamic behaviour and design constraints of the mechanical system elements are defined;
6. consistency and bidirectional traceability are established between mechanical system requirements and mechanical system architectural design; and
7. the mechanical system architectural design is agreed and communicated to all affected stakeholders.

**Output work products**

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<thead>
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<th>Output work products</th>
<th>Process outcomes</th>
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<td>[OUTCOME 1, 2, 3, 4, 5]</td>
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<tr>
<td>13-04 Communication record</td>
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<tr>
<td>13-19 Review record</td>
<td>[OUTCOME 5]</td>
</tr>
<tr>
<td>13-ME01 Characteristics classification record</td>
<td>[OUTCOME 1]</td>
</tr>
<tr>
<td>13-22 Traceability record</td>
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</tr>
<tr>
<td>17-08 Interface requirement specification</td>
<td>[OUTCOME 3]</td>
</tr>
</tbody>
</table>
Develop mechanical system architectural design.
Develop and document the mechanical system architectural design that specifies the elements of the mechanical system with respect to functional and non-functional mechanical system requirements. [OUTCOME 1]

1. The mechanical system is decomposed into elements across appropriate hierarchical levels down to the mechanical components (the elements on the lowest level of the mechanical system architectural design) that are described in the mechanical component design.
2. Consider make, buy and reuse options.
3. Model-based development (e.g. FEM, SysML) may facilitate the collaboration of the different engineering domains.

Allocate mechanical system requirements.
Allocate all mechanical system requirements to the elements of the mechanical system architectural design. [OUTCOME 2]

Define interfaces of mechanical elements.
Identify, develop and document the interfaces of each mechanical system element. [OUTCOME 3]

Identify special characteristics.
Identify and document special characteristics of the mechanical system elements. [OUTCOME 1]

4. The identification of special characteristics is supported by e.g. simulation, risk analyses, sizing calculations.

Describe dynamic and static behaviour.
Evaluate and document the dynamic and static behaviour of and the interaction between mechanical system elements. [OUTCOME 4]

5. Static and dynamic behaviour is determined by e.g. stress, force, pressure, strain, temperature, operating modes (open, closed, in motion, misuse, emergency, etc.)
Consider, determine, and document design constraints. 
Determine and document design constraints for all mechanical system elements and take them into account for creating the mechanical system architecture. [OUTCOME 4]

Evaluate alternative mechanical system architectures. 
Define evaluation criteria for architectural design. Evaluate alternative mechanical system architectures according to the defined criteria. Record the rationale for the chosen mechanical system architecture. [OUTCOME 1, 2, 3, 4, 5]

- Evaluation criteria may include quality characteristics (cost, weight, packaging, modularity, maintainability, expandability, scalability, reliability, safety and usability) and results of make-buy-reuse analysis.

Verify mechanical system architectural design. 
Ensure that the mechanical system architectural design meets all mechanical system requirements. [Outcomes 4, 5]

- Verification of mechanic system architectural design may include FEA, simulation, or Product FMEA.

Establish bidirectional traceability. 
1. Establish bidirectional traceability between mechanical system requirements and elements of the mechanical system architectural design.
2. Establish bidirectional traceability between elements of the mechanical system architectural design and elements of the system architectural design.

[OUTCOME 5]

- Bidirectional traceability covers allocation of mechanical system requirements to the elements of the mechanical system architectural design.
- Bidirectional traceability supports coverage, consistency and impact analysis.
<table>
<thead>
<tr>
<th>BP10</th>
<th>Ensure consistency.</th>
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<tbody>
<tr>
<td>1. Ensure consistency between mechanical system requirements and the mechanical system architectural design.</td>
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</tr>
<tr>
<td>2. Ensure consistency between elements of the mechanical system architectural design and elements of the system architectural design.</td>
<td></td>
</tr>
<tr>
<td>[OUTCOME 1, 2, 5, 6]</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><em>Consistency is supported by bidirectional traceability and can be demonstrated by review records.</em></td>
</tr>
<tr>
<td>11</td>
<td><em>Mechanical system requirements include mechanical system architectural requirements, refer to BP7.</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP11</th>
<th>Communicate agreed mechanical system architectural design.</th>
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<tbody>
<tr>
<td>Communicate the agreed mechanical system architectural design and updates to mechanical system architectural design to all relevant stakeholders. [OUTCOME 6]</td>
<td></td>
</tr>
</tbody>
</table>
MSE.3 Mechanical System Integration and Integration Test

The purpose of the Mechanical System Integration and Integration Test Process is to integrate the mechanical items (mechanical component items and/or mechanical system items) into larger mechanical items up to a complete integrated mechanical system item consistent with the mechanical system architectural design and to ensure that the mechanical items are tested to provide evidence for compliance of the integrated mechanical items with the mechanical system architectural design, including the interfaces between the mechanical items.

**Process outcomes – as a result of successful implementation of this process**

1. a mechanical system integration strategy consistent with the project plan, release plan and the mechanical system architectural design is developed to integrate the mechanical items;
2. a mechanical system integration test strategy including the regression test strategy is developed to test the mechanical items interactions;
3. a specification for mechanical system integration test according to the mechanical system integration test strategy is developed that is suitable to provide evidence for compliance of the integrated mechanical items with the mechanical system architectural design, including the interfaces between the mechanical items;
4. mechanical items are integrated up to a complete integrated mechanical system according to the integration strategy;
5. test cases included in the mechanical system integration test specification are selected according to the mechanical system integration test strategy, and the release plan;
6. integrated mechanical items are tested using the selected test cases and the results of mechanical system integration testing are recorded;
7. consistency and bidirectional traceability are established between the elements of the mechanical system architectural design and the test cases included in the mechanical system integration test specification, between test cases and test results and between integrated mechanical items and recorded process data; and
8. the results of the mechanical system integration test are summarized and communicated to all affected stakeholders.
Output work products

| 08-ME01 Sample control plan | [OUTCOME 1,2] | 13-22 Traceability record | [OUTCOME 7] |
| 17-ME02 Assembly instruction | [OUTCOME 1] | 17-ME03 Bill of material (BOM, Build list) | [OUTCOME 3, 4, 7] |
| 13-ME02 Assembly record | [OUTCOME 4] | 11-ME01 Mechanical System | [OUTCOME 4] |
| 08-50 Test specification | [OUTCOME 3,5] | 13-04 Communication record | [OUTCOME 8] |
| 13-50 Test result | [OUTCOME 6,8] | 13-19 Review record | [OUTCOME 7] |

MSE.3 with 9 Base practices

BP1
Develop mechanical system integration strategy.
Develop a strategy for integrating mechanical sub-systems consistent with the project plan and the release plan. Identify mechanical sub-systems based on the mechanical system architectural design and define a sequence for integrating them. [OUTCOME 1]

BP2
Develop mechanical system integration test strategy including regression test strategy.
Develop a strategy for testing the integrated mechanical item following the mechanical system integration strategy. This includes a regression test strategy for re-testing integrated mechanical item if a mechanical item is changed. [OUTCOME 2]

BP3
Develop specification for mechanical system integration test.
Develop the test specification for mechanical system integration test including the test cases according to the mechanical system integration test strategy for each integrated mechanical item. The test specification shall be suitable to provide evidence for compliance of the integrated mechanical items with the mechanical system architectural design. [OUTCOME 3]

Compliance to the architectural design means that the specified integration tests are suitable to prove that the interfaces between the mechanical items fulfill the specification (e.g. special characteristics) given by the mechanical system architectural design.
**Integrate mechanical items.**
Integrate the mechanical items to integrated mechanical system item according to the mechanical system integration strategy and record process data according to the integration strategy. [OUTCOME 4]

**Select test cases.**
Select test cases from the mechanical system integration test specification. The selection of test cases shall have sufficient coverage according to the mechanical system integration test strategy and the release plan. [OUTCOME 5]

**Perform mechanical system integration test.**
Perform the mechanical system integration test using the selected test cases. Record the integration test results and logs. [OUTCOME 6]

2. See SUP.9 for handling of non-conformances
3. Capable test environment as defined in the test strategy needs to be available for performing mechanical system integration and integration test.

**Establish bidirectional traceability.**
1. Establish bidirectional traceability between elements of the mechanical system architectural design and test cases included in the mechanical system integration test specification.
2. Establish bidirectional traceability between test cases included in the mechanical system integration test specification and mechanical system integration test results.
3. Establish bidirectional traceability between integrated mechanical items and recorded process data according to the mechanical system integration strategy.
4. Establish bidirectional traceability between integrated mechanical items and the considered mechanical system item.
5. Establish bidirectional traceability between the mechanical integration test results and the integrated mechanical systems. [OUTCOME 7]

4. Bidirectional traceability supports coverage, consistency and impact analysis.
MSE.3 with 9 Base practices

Ensure consistency.

1. Ensure consistency between elements of the mechanical system architectural design and test cases included in the mechanical system integration test specification.
2. Ensure consistency between test cases included in the mechanical system integration test specification and mechanical system integration test results.
3. Ensure consistency between integrated mechanical items and recorded process data according to the mechanical system integration strategy.
4. Ensure consistency between integrated mechanical items and the considered mechanical system item.
5. Ensure consistency between the mechanical integration test results and the integrated mechanical systems.

[OUTCOME 7]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results.

Summarize the mechanical system integration test results and communicate them to all affected stakeholders. [OUTCOME 8]

Providing all necessary information (e.g. test results, recorded process data) from the test case execution in a summary enables stakeholders to judge the consequences.
MSE.4 Mechanical System Qualification Test

The purpose of the Mechanical System Qualification Test Process is to ensure that the integrated mechanical system is tested to provide evidence for compliance with the mechanical system requirements.

Process outcomes – as a result of successful implementation of this process

1. a mechanical system qualification test strategy including regression test strategy consistent with the project plan and the release plan is developed to test the integrated mechanical system;
2. a specification for mechanical system qualification test of the integrated mechanical system according to the mechanical system qualification test strategy is developed that is suitable to provide evidence for compliance with the mechanical system requirements;
3. test cases included in the mechanical system qualification test specification are selected according to the mechanical system qualification test strategy and the release plan;
4. the integrated mechanical system is tested using the selected test cases and the results of mechanical system qualification test are recorded;
5. consistency and bidirectional traceability are established between mechanical system requirements and mechanical system qualification test specification including test cases and between test cases and test results; and
6. results of the mechanical system qualification test are summarized and communicated to all affected stakeholders.

Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome Code [ ]</th>
<th>Work Product</th>
<th>Outcome Code [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-52 Test plan (DVP)</td>
<td>[OUTCOME 1, 2, 6]</td>
<td>13-22 Traceability record</td>
<td>[OUTCOME 5]</td>
</tr>
<tr>
<td>08-50 Test specification</td>
<td>[OUTCOME 2, 3]</td>
<td>13-04 Communication record</td>
<td>[OUTCOME 6]</td>
</tr>
</tbody>
</table>
## MSE.4 with 7 Base practices

<table>
<thead>
<tr>
<th>BP1</th>
<th>Develop mechanical system qualification test strategy including a regression test strategy.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Develop a strategy for mechanical system qualification testing consistent with the project plan and the release plan. This includes a regression test strategy for re-testing the integrated mechanical system if a mechanical sub-system is changed. [OUTCOME 1]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP2</th>
<th>Develop specification for mechanical system qualification test.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Develop the specification for mechanical system qualification testing including test cases based on the verification criteria according to the mechanical system test strategy. The test specification shall be suit-able to provide evidence for compliance of the integrated mechanical system with the mechanical system requirements. [OUTCOME 2]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP3</th>
<th>Select test cases.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select test cases from the mechanical system qualification test specification. The selection of test cases shall have sufficient coverage according to the mechanical system qualification test strategy and the release plan. [OUTCOME 3]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP4</th>
<th>Test the integrated mechanical system.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test the mechanical system using the selected test cases. Record the mechanic system qualification test results and logs. [OUTCOME 4]</td>
</tr>
</tbody>
</table>

1. See SUP.9 for handling of non-conformances
2. Capable test environment as defined in the test strategy needs to be available for performing mechanical system qualification testing.
Establish bidirectional traceability.

1. Establish bidirectional traceability between mechanical system requirements and test cases included in the mechanical system qualification test specification.
2. Establish bidirectional traceability between test cases included in the mechanical system qualification test specification and mechanical system qualification test results.
3. Establish bidirectional traceability between the mechanical system qualification test results and the integrated mechanical systems.

[OUTCOME 5]

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency.

1. Ensure consistency between mechanical system requirements and test cases included in the mechanical system qualification test specification.
2. Ensure consistency between test cases included in the mechanical system qualification test specification and mechanical system qualification test results.
3. Ensure consistency between the mechanical system qualification test results and the integrated mechanical systems.

[OUTCOME 5]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results.

Summarize the mechanical system qualification test results and communicate them to all affected stakeholders.

[OUTCOME 6]

Providing all necessary information from the test case execution in a summary enables stakeholders to judge the consequences.
1. Establish bidirectional traceability between mechanical system requirements and test cases included in the mechanical system qualification test specification.

2. Establish bidirectional traceability between test cases included in the mechanical system qualification test specification and mechanical system qualification test results.

3. Establish bidirectional traceability between the mechanical system qualification test results and the integrated mechanical systems.

Outcomes

**Outcome 5**

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency.

1. Ensure consistency between mechanical system requirements and test cases included in the mechanical system qualification test specification.

2. Ensure consistency between test cases included in the mechanical system qualification test specification and test results.

3. Ensure consistency between the mechanical system qualification test results and the integrated mechanical systems.

**Outcome 5**

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results.

Summarize the mechanical system qualification test results and communicate them to all affected stakeholders.

**Outcome 6**

Providing all necessary information from the test case execution in a summary enables stakeholders to judge the consequences.
## MCE.1 Mechanical Component Requirements Analysis

The purpose of the Mechanical Component Requirements Analysis process is to establish the requirements for the mechanical component.

### Process outcomes – as a result of successful implementation of this process

1. the mechanical component requirements are derived from the upper system requirements and upper system architecture;
2. mechanical component requirements are categorized and analyzed for completeness, correctness, and verifiability;
3. the impact of mechanical component requirements on the operating environment is analyzed;
4. prioritization for implementing the mechanical component requirements is defined;
5. the mechanical component requirements are updated as needed;
6. consistency and bidirectional traceability are established between upper system requirements and mechanical component requirements; and consistency and bidirectional traceability are established between upper system architectural design and mechanical component requirements;
7. the mechanical component requirements are evaluated for cost, schedule and technical impact; and
8. the mechanical component requirements are agreed and communicated to all affected stakeholders.

### Output work products

<table>
<thead>
<tr>
<th>Output work products</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-04 Communication record</td>
<td>[OUTCOME 8]</td>
</tr>
<tr>
<td>13-19 Review record</td>
<td>[OUTCOME 6]</td>
</tr>
<tr>
<td>13-21 Change control record</td>
<td>[OUTCOME 5,7]</td>
</tr>
<tr>
<td>13-22 Traceability record</td>
<td>[OUTCOME 1, 6]</td>
</tr>
<tr>
<td>15-01 Analysis report</td>
<td>[OUTCOME 2, 3, 4, 7]</td>
</tr>
<tr>
<td>17-08 Interface requirements specification</td>
<td>[OUTCOME 1]</td>
</tr>
<tr>
<td>17-ME04 Mechanical component requirements specification</td>
<td>[OUTCOME 1]</td>
</tr>
<tr>
<td>17-50 Verification criteria</td>
<td>[OUTCOME 2]</td>
</tr>
</tbody>
</table>
Specify mechanical component requirements.

Use the upper system requirements and the upper system architecture and changes to the upper system requirements and the upper system architecture to identify the required functions and capabilities of the mechanical component. Specify functional and non-functional mechanical component requirements in a mechanical component requirements specification.

[OUTCOME 1, 5, 7]

1. If the system requirements and the system architectural design refer to a given operating environment, then the stakeholder requirements should be used as the basis for identifying the required functions and capabilities of the mechanical component.

2. Non-functional requirements may include e.g. production, maintenance, logistic, environmental.

Structure mechanical component requirements.

Structure the mechanical component requirements in the mechanical component requirements specification by e.g.

• grouping to project relevant clusters,
• sorting in a logical order for the project,
• categorizing based on relevant criteria for the project,
• prioritizing according to stakeholder needs.

[OUTCOME 2, 4]

3. Prioritizing typically includes the assignment of mechanical content to planned releases. Refer to SPL.2 BP1.
Analyze mechanical component requirements.
Analyze the specified mechanical component requirements including their interdependencies to ensure correctness, technical feasibility, producibility and verifiability, and to support risk identification. Analyze the impact on cost, schedule and the technical impact. [OUTCOME 2, 7]

The analysis of impact on cost, schedule and quality supports the adjustment of project estimates. Refer to MAN.3 BP5.

Analyze the impact on the operating environment.
Analyze the impact that the mechanical component requirements will have on interfaces of system elements and the operating environment. [OUTCOME 3, 7]

Develop verification criteria.
Develop the verification criteria for each mechanical component requirement that define the qualitative and quantitative measures for the verification of a requirement. [OUTCOME 2, 7]

Verification criteria demonstrate that a requirement can be verified within agreed constraints and are typically used as the input for the development of the test cases or other verification measures that should demonstrate compliance with the mechanic component requirements.

Verification which cannot be covered by testing is covered by SUP.2.

Establish bidirectional traceability.
1. Establish bidirectional traceability between upper system requirements and mechanical component requirements.
2. Establish bidirectional traceability between the upper system architecture and mechanical component requirements. [OUTCOME 6]

Redundancy should be avoided by establishing a combination of the approaches BP6.1 and BP6.2 that covers the project and the organizational needs.

Bidirectional traceability supports coverage, consistency and impact analysis.
Ensure consistency.
1. Ensure consistency between upper system requirements and mechanical component requirements.
2. Ensure consistency between the upper system architecture and mechanical component requirements.

[OUTCOME 6]

Consistency is supported by bidirectional traceability and can be demonstrated by review records.

If the system requirements and the system architectural design refer to a given operating environment, then the stakeholder requirements should be used as the basis for identifying the required functions and capabilities of the mechanic component.

Communicate agreed mechanical component requirements.
Communicate the agreed mechanical component requirements and updates to mechanical component requirements to all relevant stakeholders. [OUTCOME 8]
MCE.2 Mechanical Component Design

The purpose of the Mechanical Component Design process is to provide an evaluated design for the mechanical component.

Process outcomes – as a result of successful implementation of this process

1. a design is developed that describes the mechanical component;
2. interfaces of the mechanical component are defined;
3. consistency and bidirectional traceability are established between mechanical component requirements and mechanical component design; and consistency and bidirectional traceability are established between upper system architecture and mechanical component design; and
4. the mechanical component design is agreed and communicated to all affected stakeholders.

Output work products

<table>
<thead>
<tr>
<th>04-ME02 Mechanical component design</th>
<th>[OUTCOME 1,2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-04 Communication record</td>
<td>[OUTCOME 4]</td>
</tr>
<tr>
<td>13-22 Traceability record</td>
<td>[OUTCOME 3]</td>
</tr>
</tbody>
</table>
Develop mechanical component design.
Develop a design for the mechanical component using the functional and non-functional mechanical component requirements including interfaces. [OUTCOME 1]
While developing the mechanical component design the requirements and data relevant for production are identified and documented.

1. Non-functional requirements may include e.g. price per unit, maintenance, logistic, packaging, size, weight, manufacturability, environmental constraints, design guidelines, modelling guidelines, failure times.
2. Design for Manufacturing and Design for Assembly may be used to ensure manufacturability.

BP2: Evaluate mechanical component design.
Evaluate the mechanical component design in terms of interaction, criticality, technical complexity, risks, measurability and verifiability. [OUTCOME 1,2]

3. The results of the evaluation can be used as input for test against mechanical component design.

Verify mechanical component design.
Ensure that the mechanical component design meets all mechanical component requirements. [Outcomes 4, 5]

4. Verification of mechanic component design may include FEA, simulation, or Product FMEA.
Establish bidirectional traceability.

1. Establish bidirectional traceability between mechanical component requirements and mechanical component design.
2. Establish bidirectional traceability between the mechanical system architectural design and mechanical component design.

[OUTCOME 3]

5 Redundancy should be avoided by establishing a combination of the approaches BP4.1 and BP4.2 that covers the project and the organizational needs.

6 Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency.

1. Ensure consistency between mechanical component requirements and mechanical component design.
2. Ensure consistency between the mechanical system architectural design and mechanical component design.

[OUTCOME 3]

7 Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Communicate agreed mechanical component design.

Communicate the agreed mechanical component design and updates to the mechanical component design to all relevant stakeholders. [OUTCOME 4]
MCE.3 Mechanical Component Sample Production

The purpose of the Mechanical Component Sample Production process is to produce a mechanical component item that reflects properly the mechanical component design and mechanical component production strategy.

Process outcomes – as a result of successful implementation of this process

1. a mechanical component production strategy is developed, communicated to, and agreed on with all affected stakeholders,
2. mechanical component items are produced according to the mechanical component design,
3. bidirectional traceability are established between the produced mechanical component and recorded process data according to the mechanical component production strategy; and consistency and bidirectional traceability are established between recorded process data and the mechanical component production strategy (control plan), and
4. information gathered during production is communicated to all affected stakeholders. Base Practices

Output work products

<table>
<thead>
<tr>
<th>Work Product</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-ME02 Mechanical Component</td>
<td>[OUTCOME 1,2]</td>
</tr>
<tr>
<td>19-ME01 Production strategy</td>
<td>[OUTCOME 1]</td>
</tr>
<tr>
<td>13-ME03 Production record</td>
<td>[OUTCOME 2,4]</td>
</tr>
<tr>
<td>13-22 Traceability record</td>
<td>[OUTCOME 3]</td>
</tr>
<tr>
<td>13-04 Communication record</td>
<td>[OUTCOME 4]</td>
</tr>
<tr>
<td>15-01 Analysis report</td>
<td>[OUTCOME 4]</td>
</tr>
</tbody>
</table>

(Containing analyses results of e.g. suitability of chosen production method regarding effectiveness, timing, cost)
Develop mechanical component production strategy.
Develop a strategy for production of the mechanical component item. The mechanical component production strategy shall be consistent with the mechanical component design, project plan (e.g. estimation of number of built items needed), release plan (e.g. definition of releases and their content), and test strategy (e.g. mapping of test methods to releases). 

[OUTCOME 1] The mechanical component production strategy may contain the definition of the production method(s), verification method(s) (control plan).

Agree on mechanical component production strategy.
Communicate the agreed mechanical component production strategy between all involved stakeholders (e.g. engineering, sample shop, production). [OUTCOME 1]

1. The communication of the mechanical component production strategy to suppliers is handled by ACQ.4 Supplier monitoring.

Ensure and support production of mechanical components.
Ensure and support production of mechanical component items according to:
- the mechanical component design
- mechanical component production strategy
- the requirements and data relevant for production.

Record process data according to the mechanical component production strategy. [OUTCOME 2, 4]

2. Production here means only sample phases (e.g. prototype building, pre-series production) and does not cover the process of industrialization.
Establish bidirectional traceability.
1. Establish bidirectional traceability between mechanical component production strategy and mechanical component design.
2. Establish bidirectional traceability between the produced mechanical component item and recorded process data according to the mechanical component production strategy.
3. Establish bidirectional traceability between recorded process data and mechanical component production strategy (control plan).

[OUTCOME 3]

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency.
1. Ensure consistency between recorded process data and mechanical component production strategy (control plan).
2. Ensure consistency between produced mechanical component item and recorded process data according to the mechanical component production strategy.
3. Ensure consistency between recorded process data and mechanical component production strategy (control plan).

[OUTCOME 3]

NOTE 4: Consistency is supported by bidirectional traceability and can be demonstrated by review records.
BP6 Provide feedback to all affected stakeholders

Communicate information gathered during the production of the mechanical component to all affected stakeholders.

[OUTCOME 4]

These information may contain:

- Capability of chosen production method
- Manufacturability of the mechanic component
- Improvement potentials for future releases
- Process data and information

See SUP.9 for handling of non-conformances

The communication of information mentioned above is handled by ACQ.4 Supplier monitoring in case of production at a supplier’s site.

Affected stakeholders may be:

- Industrialization
- Series production
- Mechanical engineering
- Project management
MCE.4 Test against Mechanical Component Design

The purpose of the Test against mechanical component design process is to test the mechanical component item to provide evidence for compliance of the mechanical component item with the mechanical component design.

Process outcomes – as a result of successful implementation of this process

1. a strategy for test against mechanical component design including regression test strategy is developed;
2. a specification for test against mechanical component design is developed according to the strategy for test against mechanical component design that is suitable to provide evidence for compliance of the mechanical component item with the mechanical component design;
3. test cases included in the test specification for test against mechanical component design are selected according to the test strategy for test against the mechanical component design and the release plan;
4. the mechanical component item is tested according to the strategy for test against mechanical component design and the test specification for test against mechanical component design and the results are recorded;
5. consistency and bidirectional traceability are established between the mechanical component design and the test specification for test against mechanical component design as well as between the test specification for test against mechanical component design and test results; and
6. results of the test against mechanical component design are summarized and communicated to all affected stakeholders.

Output work products

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Test plan</td>
<td>[OUTCOME 1]</td>
<td>13-22 Traceability record</td>
<td>[OUTCOME 4]</td>
</tr>
<tr>
<td>Communication record</td>
<td>[OUTCOME 5]</td>
<td>13-50 Test result</td>
<td>[OUTCOME 3, 5, 6]</td>
</tr>
</tbody>
</table>
### Develop strategy for test against mechanical component design including regression test strategy.

Develop a strategy for test against mechanical component design including regression test strategy for re-test if the mechanical component design is changed. The test strategy shall define how to provide evidence for compliance of the mechanical component item with the mechanical component design. [OUTCOME 1]

1. The test strategy shall contain a planning of needed items for testing and the allocation of tests to be performed within different releases. The needed amount of items for dedicated tests shall consider that random and systematic faults have to be detected.

### Develop test specification for test against mechanical component design.

Develop test specification for test against mechanical component design including test cases that are suitable to provide evidence for compliance of the mechanical component item with the mechanical component design according to the test strategy. [OUTCOME 2]

### Select test cases.

Select test cases from the test specification for test against mechanical component design. The selection of test cases shall have sufficient coverage according to the test strategy for test against mechanical component design and the release plan. [OUTCOME 3]

### Test mechanical component item.

Test the mechanical component item using the test specification for test against mechanical component design according to the strategy for test against mechanical component design. Record the test results and measured values. [OUTCOME 4]

2. See SUP.9 for handling of non-conformances.

3. Capable test environment as defined in the test strategy needs to be available for performing test against mechanical component design.
Establish bidirectional traceability.
1. Establish bidirectional traceability between the mechanical component design and the mechanic component test specification for test against mechanical component design.
2. Establish bidirectional traceability between the test results and tested mechanical component items.
3. Establish bidirectional traceability between test cases included in the mechanic component test specification and mechanic component test results.

[OUTCOME 5]
4. *Bidirectional traceability supports coverage, consistency and impact analysis.*

Ensure consistency.
1. Ensure consistency between the mechanical component design and the test specification for test against mechanical component design.
2. Ensure consistency between the test results and tested mechanical component items.
3. Ensure consistency between test cases included in the mechanic component test specification and mechanic component test results.

[OUTCOME 5]
5. *Consistency is supported by bidirectional traceability and can be demonstrated by review records.*

Summarize and communicate results.
Summarize the test results and communicate them to all affected stakeholders. [OUTCOME 6]
6. *Providing all necessary information from the test case execution in a summary enables stakeholders to judge the consequences.*
The purpose of the Test against Mechanical Component Requirements process is to test the mechanical component to provide evidence for compliance of the mechanical component with the mechanical component requirements.

Process outcomes – as a result of successful implementation of this process

1. a strategy for the test against mechanical component requirements including regression test strategy consistent with the project plan and the release plan is developed;
2. a specification for the test against mechanical component requirements is developed according to the strategy for the test against mechanical component requirements that is suitable to provide evidence for compliance of the mechanical component with the mechanical component requirements;
3. test cases included in the test specification for the test against mechanical component requirements are selected according to the test strategy for the test against mechanical component requirements and the release plan
4. the mechanical component is tested according to the strategy for the test against mechanical component requirements and the test specification for the test against mechanical component requirements, and the results are recorded;
5. consistency and bidirectional traceability are established between the mechanical component requirements and the test specification for the test against mechanical component requirements as well as between the test specification for the test against mechanical component requirements and test results; and
6. results of the test against mechanical component requirements are summarized and communicated to all affected stakeholders.

Output work products

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>08-52 Test plan</td>
<td>[OUTCOME 1]</td>
<td>13-22 Traceability record</td>
<td>[OUTCOME 4]</td>
</tr>
</tbody>
</table>
Develop strategy for the test against mechanical component requirements including regression test strategy. 
Develop a strategy for the test against mechanical component requirements consistent with the project plan and the release plan. This includes a regression test strategy for re-testing the mechanical component if it has been changed. [OUTCOME 1]

The test strategy shall include a plan of which items need to be tested and the allocation of tests to be performed within different releases. The needed amount of items for dedicated tests shall consider that random and systematic faults have to be detected.

Develop test specification for the test against mechanical component requirements. 
Develop test specification including test cases for the test against mechanical component requirements that are suitable to provide evidence for compliance of the mechanical component with the mechanical component requirements according to the test strategy. [OUTCOME 2]

Select test cases. 
Select test cases from the test specification for the test against mechanical component requirements. The selection of test cases shall have sufficient coverage according to the test strategy for the test against mechanical component requirements and the release plan. [OUTCOME 5]

Test the mechanical component. 
Test the mechanical component using the test specification for the test against mechanical component requirements according to the strategy for the test against mechanical component requirements. Record the test results and measured values. [OUTCOME 3]

See SUP.9 for handling of non-conformances.

Capable test environment as defined in the test strategy needs to be available for performing test against mechanical component requirements.
Establish bidirectional traceability.
1. Establish bidirectional traceability between the mechanical component requirements and the test specification for test against mechanical component requirements.
2. Establish bidirectional traceability between the test specification for the test against mechanical component requirements and test results.
3. Establish bidirectional traceability between the mechanic component qualification test results and the tested mechanical component items.

**[OUTCOME 4]**

Bidirectional traceability supports coverage, consistency and impact analysis.

Ensure consistency.
1. Ensure consistency between the mechanical component requirements and the test specification for the test against mechanical component requirements.
2. Ensure consistency between the test specification for the test against mechanical component requirements and test results.
3. Ensure consistency between the mechanic component qualification test results and the tested mechanical component items.

**[OUTCOME 4]**

NOTE 5: Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results.
Summarize the test results and communicate them to all affected stakeholders. **[OUTCOME 5]**

Providing all necessary information from the test case execution in a summary enables stakeholders to judge the consequences.
1. Ensure consistency between the mechanical component requirements and the test specification for the test against mechanical component requirements.

2. Ensure consistency between the test specification for the test against mechanical component requirements and test results.

3. Ensure consistency between the mechanical component qualification test results and the tested mechanical component items.

NOTE 5: Consistency is supported by bidirectional traceability and can be demonstrated by review records.

Summarize and communicate results.

Summarize the test results and communicate them to all affected stakeholders. [OUTCOME 5]

Providing all necessary information from the test case execution in a summary enables stakeholders to judge the consequences.

CAPABILITY LEVELS
Process capability Level 1: Performed process

The implemented process achieves its process purpose. The following process attribute demonstrates the achievement of this level

PA 1.1 Process performance process attribute

The process performance process 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

Generic practices 1.1.1

GP 1.1.1 Achieve the process outcomes [ACHIEVEMENT a]
Achieve the intent of the base practices. Produce work products that evidence the process outcomes.

Generic resources

Resources are used to achieve the intent of process specific base practices [ACHIEVEMENT a]
Process capability 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 process attributes, together with the previously defined process attribute, demonstrate the achievement of this level:

PA 2.1 Performance management process attribute

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

a) Objectives for the performance of the process are identified;
b) Performance of the process is planned;
c) Performance of the process is monitored;
d) Performance of the process is adjusted to meet plans;
e) Responsibilities and authorities for performing the process are defined, assigned and communicated;
f) Personnel performing the process are prepared for executing their responsibilities;
g) Resources and information necessary for performing the process are identified, made available, allocated and used;
h) Interfaces between the involved parties are managed to ensure both effective communication and clear assignment of responsibility.
Identify the objectives for the performance of the process. [ACHIEVEMENT a]

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.

1. **Performance objectives may include**
   - (1) timely production of artifacts meeting the defined quality criteria,
   - (2) process cycle time or frequency
   - (3) resource usage; and
   - (4) boundaries of the process.

2. **At minimum, process performance objectives for resources, effort and schedule should be stated.**

Plan the performance of the process to fulfill the identified objectives. [ACHIEVEMENT b]

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.

Monitor the performance of the process against the plans. [ACHIEVEMENT c]

The process is performed according to the plan(s).
Process performance is monitored to ensure planned results are achieved and to identify possible deviations.
Adjust the performance of the process. [ACHIEVEMENT d]
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.

Define responsibilities and authorities for performing the process. [ACHIEVEMENT e]
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.

Identify, prepare, and make available resources to perform the process according to plan. [ACHIEVEMENT f, g]
The human and infrastructure resources, necessary for performing the process are identified made available, allocated and used.
The individuals performing and managing the process are prepared by training, mentoring, or coaching to execute their responsibilities.
The information necessary to perform the process is identified and made available.

Manage the interfaces between involved parties. [ACHIEVEMENT h]
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.
PA 2.2 Work product management process attribute

The work product management process 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 process 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.

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, distribution of work products, and for making relevant versions of applicable work products available at points of use.

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

**Generic practices 2.2.1**

**Define the requirements for the work products.** [ACHIEVEMENT a]

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.
Generic practices 2.2.2 - 2.2.4

**GP 2.2.2**

**Define the requirements for documentation and control of the work products.** [ACHIEVEMENT b]
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 and

(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.** [ACHIEVEMENT c]

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.** [ACHIEVEMENT d]

Work products are reviewed against the defined requirements in accordance with planned arrangements.
Issues arising from work product reviews are resolved.
Rating consistency – PA2.2 Work Product Management

**GP2.2.1:** Define requirements for the work products against defined requirements

**GP2.2.2:** Define requirements for documentation and control of the work products in accordance with requirements

**GP2.2.3:** Identify, document and control the work products

**GP2.2.4:** Review and adjust work products to meet the defined requirements (of the work products)

Ensure consistency ...
- SYS.2 BP7
- SYS.3 BP7
- SYS.4 BP8
- SYS.5 BP6
- SWE.1 BP7
- SWE.2 BP8
- SWE.3 BP6
- SWE.4 BP6
- SWE.5 BP8
- SWE.6 BP6

**SUP.1 BP1:** Develop a project quality assurance strategy

**SUP.1 BP2:** Assure quality of work products

**SUP.8 BP8:** Verify the information about configured items

**SUP.8 BP1:** Develop a config. management strategy

**SUP.8 BP2:** Identify config items

**SUP.8 BP3:** Establish a config. management system

**SUP.8 BP5:** Control modifications and releases

**SUP.8 BP6:** Establish baselines

**SUP.10 BP1:** Develop a change request management strategy

**SUP.10 BP2:** Identify and record the change requests

**SUP.10 BP3:** Record the status of change requests

**SUP.10 BP7:** Track change requests to closure
Process capability Level 3: Established process

The previously described Managed process is now implemented using a defined process that is capable of achieving its process outcomes. The following process attributes, together with the previously defined process attributes, demonstrate the achievement of this level:

PA 3.1 Process definition process attribute

The process definition process 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 process attribute:

a) A standard process, including appropriate tailoring guidelines, is defined and maintained 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 is determined.

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

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

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

Generic practices 3.1.1

Define and maintain the standard process that will support the deployment of the defined process. [ACHIEVEMENT a]

A standard process is developed and maintained 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.
**Generic practices 3.1.2 - 3.1.5**

**GP 3.1.2**
**Determine the sequence and interaction between processes so that they work as an integrated system of processes.**

[ACHIEVEMENT b]
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, responsibilities, and authorities for performing the standard process.**

[ACHIEVEMENT c]
Process performance roles are identified
Competencies for performing the process are identified.
Authorities necessary for executing responsibilities are identified.

**GP 3.1.4**
**Identify the required infrastructure and work environment for performing the standard process.** [ACHIEVEMENT d]
Process infrastructure components are identified (facilities, tools, networks, methods, etc.). Work environment requirements are identified.

**GP 3.1.5**
**Determine suitable methods and measures to monitor the effectiveness and suitability of the standard process.** [ACHIEVEMENT e]
Methods and measures 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 conduct internal audit and management review is established.
Process changes are implemented to maintain the standard process.
The process deployment process attribute is a measure of the extent to which the standard process is deployed as a defined process to achieve its process outcomes. As a result of full achievement of this process 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 the process, to demonstrate the suitability and effectiveness of the process, and to evaluate where continual improvement of the process can be made.

Generic practices 3.2.1 - 3.2.2

**GP 3.2.1**

**Deploy a defined process that satisfies the context specific requirements of the use of the standard process. [ACHIEVEMENT a]**

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. [ACHIEVEMENT b]**

The roles for performing the defined process are assigned and communicated. The responsibilities and authorities for performing the defined process are assigned and communicated.
Generic practices 3.2.3 - 3.2.6

**GP 3.2.3**
Ensure necessary competencies for performing the defined process. [ACHIEVEMENT c]
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. [ACHIEVEMENT d]
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. [ACHIEVEMENT e]
Required infrastructure and work environment is available.
Organizational support to effectively manage and maintain the infrastructure and work environment is available.
Infrastructure and work environment is used and maintained.

**GP 3.2.6**
Collect and analyze data about performance of the process to demonstrate its suitability and effectiveness.
[ACHIEVEMENT f]
Data required to understand the behavior, suitability and effectiveness of the defined process are identified.
Data is collected and analyzed to understand the behavior, 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.

1 Data about process performance may be qualitative or quantitative.
Rating consistency – PA3.1 and PA3.2 Process Definition and Process Deployment

GP3.1.1: Define and maintain the standard process ...

GP3.1.2: Determine sequence and interaction ...

GP3.1.3: Identify the roles and competencies ...

GP3.1.4: Identify the required infrastructure ...

GP3.1.5: Determine suitable methods and measures to monitor...

GP3.2.1: Deploy a defined process ...

GP3.2.2: Assign and communicate roles ...

GP3.2.3: Ensure necessary competencies ...

GP3.2.4: Provide resources and information ...

GP3.2.5: Provides adequate process infrastructure ...

GP3.2.6: Collect and analyze data about performance ...

GP2.1.5: Define responsibilities and authorities ...

GP2.1.6: Identify, prepare and make available resources ...

Monitor effectiveness

Based on the standard processes

Based on definitions of identification and availability of resources

Based on definitions of identification and availability of resources

Based on definitions of responsibilities

Based on measures
## Dependencies between processes and Process Attributes (ASPICE and ME SPICE)

<table>
<thead>
<tr>
<th>Processes</th>
<th>Description</th>
<th>PA 2.1</th>
<th>PA 2.2</th>
<th>PA 3.1</th>
<th>PA 3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAN.3</td>
<td>Project Management</td>
<td>+++</td>
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<tr>
<td>MAN.5</td>
<td>Risk Management</td>
<td>+++</td>
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<tr>
<td>REU.2</td>
<td>Reuse Program Management</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ACQ.4</td>
<td>Supplier Monitoring</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>SUP.1</td>
<td>Quality Assurance</td>
<td>+++</td>
<td>++</td>
<td>+</td>
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<tr>
<td>SUP.2</td>
<td>Verification</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
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<tr>
<td>SUP.4</td>
<td>Joint Review</td>
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<tr>
<td>SUP.7</td>
<td>Documentation</td>
<td>++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUP.8</td>
<td>Configuration Management</td>
<td>+++</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>SUP.9</td>
<td>Problem Resolution Management</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>SUP.10</td>
<td>Change Request Management</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPL.2</td>
<td>Product Release</td>
<td>+</td>
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</tr>
</tbody>
</table>

A +/++ entry in a cell indicates a dependency: a weakness in the process most likely corresponds to a weakness in the related Process Attribute (PA).
## Rating Consistency Diagrams

<table>
<thead>
<tr>
<th>Diagram Explanation</th>
<th>Page</th>
<th>Process Area</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAN.3 Project Management</td>
<td>05</td>
<td>SYS.5</td>
<td>System Qualification Test</td>
<td>92</td>
</tr>
<tr>
<td>ACQ.4 Supplier Monitoring</td>
<td>34</td>
<td>SWE.1</td>
<td>SW Requirements Analysis</td>
<td>98</td>
</tr>
<tr>
<td>SUP.1 Quality Assurance</td>
<td>42</td>
<td>SWE.2</td>
<td>SW Architectural Design</td>
<td>103</td>
</tr>
<tr>
<td>SUP.8 Configuration Management</td>
<td>47</td>
<td>SWE.3</td>
<td>SW Detailed Design &amp; Unit Constr.</td>
<td>107</td>
</tr>
<tr>
<td>SUP.9 Problem Resolution Management</td>
<td>59</td>
<td>SWE.4</td>
<td>SW Unit Verification</td>
<td>111</td>
</tr>
<tr>
<td>SUP.10 Change Request Management</td>
<td>63</td>
<td>SWE.5</td>
<td>SW Integration &amp; Integration Test</td>
<td>116</td>
</tr>
<tr>
<td>SYS.2 System Requirements Analysis</td>
<td>67</td>
<td>SWE.6</td>
<td>SW Qualification Test</td>
<td>168</td>
</tr>
<tr>
<td>SYS.3 System Architectural Design</td>
<td>79</td>
<td>CL 2</td>
<td>Capability Level 2, PA 2.1</td>
<td>164</td>
</tr>
<tr>
<td>SYS.4 System Integration &amp; Integr. Test</td>
<td>83</td>
<td>CL 2</td>
<td>Capability Level 2 PA 2.2</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>CL 3</td>
<td>Capability Level 3 PA 3.x</td>
<td>174</td>
</tr>
</tbody>
</table>
### intacs™ Certification Levels For Assessors And Instructors

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Additional Requirements &amp; Capability</th>
</tr>
</thead>
</table>
| **“intacs™ certified Instructor Competent Level”**<br>(qualified for all PAMs; domain specific qualifications may apply) | • Capable of performing competent assessor trainings  
• Approval by a certified instructor (observation process) |
| **“intacs™ certified Instructor Provisional Level”**<br>(qualified for all PAMs; domain specific qualifications may apply) | • Capable of performing provisional assessor trainings  
• Proven teaching skills  
• Approval by a certified instructor (observation process) |
| **“intacs™ certified Principal Assessor”**<br>(qualified for all PAMs; domain specific qualifications may apply) | • Continuously and actively contributes to the international ISO/IEC 1550/33000 community’s knowledge & best practices  
• Min. 8 assessment experiences |
| **“intacs™ certified Competent Assessor”**<br>(ISO/IEC 15504-5, ISO/IEC 330xx, Automotive SPICE®, TestSPICE, ISO 20000 PAM) | • Capable of leading assessments  
• Approval by a certified assessor (observation process)  
• Min. 5 assessment experience  
• 2 additional trainings & one exam |
| **“intacs™ certified Provisional Assessor”**<br>(ISO/IEC 15504-5, ISO/IEC 330xx, Automotive SPICE®, TestSPICE, ISO 20000 PAM) | • Capable of acting as a co-assessor  
• Little or no assessment experience  
• Passed training course & exam |
intacs™ Experience Evidence (EE)

To be granted or have renewed an assessor grade you have to prove that you maintain technical skills & experience with using the standard by collecting Experience Evidence (EE):

<table>
<thead>
<tr>
<th>EE Type</th>
<th>EE Name</th>
<th>EE Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-AT</td>
<td>Assessment Team member</td>
<td>50h Co-Assessor in an ISO/IEC 15504/330xx compliant assessment</td>
</tr>
<tr>
<td>EE-AL</td>
<td>Assessment Leading</td>
<td>50h Lead Assessor in an ISO/IEC 15504/330xx compliant assessment</td>
</tr>
<tr>
<td>EE-IP</td>
<td>Internal Passive</td>
<td>6h participation in an internal SPICE event hold by intacs certified assessors</td>
</tr>
<tr>
<td>EE-EP</td>
<td>External Passive</td>
<td>6h participation in an external and intacs acknowledged SPICE event</td>
</tr>
<tr>
<td>EE-AC</td>
<td>Active Contribution</td>
<td>Contributions to the SPICE community on how to comprehend and apply SPICE</td>
</tr>
<tr>
<td>EE-CT</td>
<td>Course training</td>
<td>Delivering an intacs assessor training course</td>
</tr>
</tbody>
</table>

Intacs™ requirements for provisional assessor Automotive SPICE™ (valid for 3 years)

<table>
<thead>
<tr>
<th>Requirements for receiving assessor certification</th>
<th>Requirements for assessor grade renewal</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Passed provisional assessor training and examination</td>
<td>- Payment of fee (450 EUR in 2019)</td>
</tr>
<tr>
<td>- Payment of fee (450 EUR in 2019)</td>
<td></td>
</tr>
<tr>
<td>- No assessment experience and no EE required</td>
<td></td>
</tr>
</tbody>
</table>
**Intacs™ requirements for competent / principal assessor Automotive SPICE™**  
(valid for 3 years)

<table>
<thead>
<tr>
<th>Requirements for receiving assessor certification</th>
<th>Requirements for assessor grade renewal</th>
</tr>
</thead>
<tbody>
<tr>
<td>• intacs Provisional Assessor Certification</td>
<td>• Payment of fee (450 EUR in 2019)</td>
</tr>
<tr>
<td>• 4 years of professional experience in development of technical complex systems or quality assurance, confirmed by employer or customer</td>
<td>• 6 EEs in last 36 months:</td>
</tr>
<tr>
<td>• Attended the course „Introduction to the VDA Automotive SPICE Guidelines”</td>
<td></td>
</tr>
<tr>
<td>• Passed competent assessor training and examination in last 12 months</td>
<td></td>
</tr>
<tr>
<td>• 5 EE-AT in last 60 months (all led by an certified Automotive SPICE assessor; at least 4 out of 5 EE-AT in Automotive)</td>
<td></td>
</tr>
<tr>
<td>• Positive assessment lead observation by an intacs certified Competent or Principal assessor</td>
<td></td>
</tr>
<tr>
<td>• Payment of fee (450 EUR in 2019)</td>
<td></td>
</tr>
<tr>
<td>• intacs Competent Assessor Certification</td>
<td>• Payment of fee (450 EUR in 2019)</td>
</tr>
<tr>
<td>• 3 EE-AL gathered in at least 3 assessments plus 2 EE-AC plus one more EE (either EE-EP or EE-AC)</td>
<td>• 6 EEs in last 36 months:</td>
</tr>
<tr>
<td>• All EEs have to be granted within the last 36 months and only EE gathered after the certification as Competent Assessor are valid.</td>
<td></td>
</tr>
<tr>
<td>• Payment of fee (450 EUR in 2019)</td>
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</table>

**Competent**

<table>
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<tr>
<th>EE Type</th>
<th>EE Type</th>
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<th>EE Type</th>
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<tbody>
<tr>
<td>AT or AL</td>
<td>AL</td>
<td>AL</td>
<td>EP or AC</td>
<td>AT, AL, IP, EP or AC</td>
<td>AT, AL, IP, EP or AC</td>
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**Principal**

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</thead>
<tbody>
<tr>
<td>AT or AL</td>
<td>AL</td>
<td>AL</td>
<td>EP or AC</td>
<td>AC</td>
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</table>
### Intacs™ Requirements for Instructor Automotive SPICE Provisional / Competent Course
(valid for 3 years)

<table>
<thead>
<tr>
<th>Requirements for Receiving Assessor Certification</th>
<th>Requirements for Assessor Grade Renewal</th>
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</thead>
<tbody>
<tr>
<td>• Intacs Principal Assessor Certification</td>
<td>• Payment of fee (450 EUR in 2019)</td>
</tr>
<tr>
<td>• Having demonstrated didactic skills, independent and objectively confirmed</td>
<td>• 7 EEs in last 36 months:</td>
</tr>
<tr>
<td>• Positive provisional assessor training course observation by an intacs acknowledged certified instructor</td>
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</tr>
<tr>
<td>• Payment of fee (450 EUR in 2019)</td>
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</table>

<table>
<thead>
<tr>
<th>Provisional Course</th>
<th>Competent Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>intacs Instructor Provisional Course</td>
<td></td>
</tr>
<tr>
<td>• Positive competent assessor training course observation by an intacs acknowledged certified instructor</td>
<td></td>
</tr>
<tr>
<td>• Payment of fee (450 EUR in 2019)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EE Type</th>
<th>EE Type</th>
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<th>EE Type</th>
<th>EE Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT or AL</td>
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<td>AL</td>
<td>EP or AC</td>
<td>AC or CT</td>
<td>AC or CT</td>
<td>CT</td>
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<table>
<thead>
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<th>EE Type</th>
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<tbody>
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<td>AL</td>
<td>EP or AC</td>
<td>AC or CT</td>
<td>AC or CT</td>
<td>CT</td>
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</table>
## Assessment Input Part 1 of 3: Assessment Plan

<table>
<thead>
<tr>
<th>Roles and Assignments</th>
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<tbody>
<tr>
<td>Sponsor, Position</td>
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<tr>
<td>Lead Assessor, Certification ID</td>
</tr>
<tr>
<td>Co Assessor(s), Certification ID(s)</td>
</tr>
<tr>
<td>Local Coordinator</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Standards and Classifications</th>
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<tbody>
<tr>
<td>Product(s), ASIL Level(s)</td>
</tr>
<tr>
<td>Assessment Standard</td>
</tr>
<tr>
<td>Assessment Process</td>
</tr>
<tr>
<td>Organization Unit Classification</td>
</tr>
</tbody>
</table>

**Application of VDA Assessment Guideline chapter 2.2: Assessing specific application environments**

| 2.2.1 Model based development | Yes/No | 2.2.4 Management of third party software | Yes/No |
| 2.2.2 Agile environments     | Yes/No | 2.2.5 Management of platform and legacy software SW | Yes/No |
| 2.2.3 Distributed development| Yes/No | 2.2.6 Application parameters | Yes/No |
## Assessment Input Part 2 of 3: Assessment Scope

### Assessment scope

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Process Assessment Model version</td>
<td>e.g. Automotive SPICE 3.1</td>
</tr>
<tr>
<td>VDA Guideline version</td>
<td>e.g. 1st edition 2017 (or none)</td>
</tr>
<tr>
<td>Company and organizational Unit(s)</td>
<td>&lt;Name(s) of the assessed …&gt;</td>
</tr>
<tr>
<td>Project(s)</td>
<td>&lt;Name(s) of the assessed project(s)&gt;</td>
</tr>
<tr>
<td>Location(s)</td>
<td>&lt;Name of the cities with countries&gt;</td>
</tr>
</tbody>
</table>

### Assessment purpose

- e.g. "Identify potentials for (or evaluation of) process improvement" or “Identify process related product risk”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Assessed processes</td>
<td>e.g. VDA scope including MAN.5 and REU.2</td>
</tr>
<tr>
<td>Target capability level</td>
<td>e.g. CL 3 for all assessed processes</td>
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</tbody>
</table>

### Assessment class

<table>
<thead>
<tr>
<th>Class</th>
<th>Independence category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2, or 3</td>
<td>A, B, C or D</td>
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</table>

### Process context

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process context category</td>
<td>A (part of product/delivery) or B (Entire product/delivery)</td>
</tr>
<tr>
<td></td>
<td>e.g. &quot;A subset of stakeholder requirements valid for a specific release&quot; OR &quot;All changes between two defined project milestones&quot; OR &quot;All software requirements implemented by improved processes&quot;</td>
</tr>
</tbody>
</table>
**Assessment class / Assessment type**

**Assessment class:**

1. 4 or more process instances per process
   
   *If there are fewer than the required number of process instances available in the organization, all process instances shall be selected.*

2. 2 or more process instances per process
   
   *If there are fewer than … (ditto)*

3. else

**Example for a specific application environment:**

**2.2.5 Management of platform and legacy SW**

**No** (i.e. the Management of platform and legacy software is not applied): *The assessment covers the current project and former projects in which platform and legacy software were developed. The platform and legacy software development is assessed and rated in separate instances.*

<table>
<thead>
<tr>
<th>Assessment class / Assessment type</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body performing the assessment</strong></td>
<td>The body performing the assessment is independent of the organization being assessed</td>
<td></td>
<td>The body performing the assessment is part of the organization being assessed</td>
<td>The body performing the assessment may or may NOT be independent being assessed</td>
</tr>
<tr>
<td><strong>Competent assessor</strong></td>
<td>Independent of the organization being assessed</td>
<td>Independent of the organization being assessed</td>
<td>Adequate separation of responsibility from personnel in other functions</td>
<td>Need NOT be independent of the organization being assessed</td>
</tr>
<tr>
<td><strong>Assessors (other than competent assessor)</strong></td>
<td>May be from the organization being assessed provided clear separation of the responsibilities of the assessors from personnel in other functions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Assessment Input Part 3 of 3: Assessment Agenda

### Day 1

<table>
<thead>
<tr>
<th>Start</th>
<th>End</th>
<th>Topic</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>9:15</td>
<td>Kick off</td>
<td>Sponsor, Assessment Team</td>
</tr>
<tr>
<td>9:15</td>
<td>10:50</td>
<td>MAN.3 - Project Management - Project Level</td>
<td></td>
</tr>
<tr>
<td>10:50</td>
<td>11:00</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td>12:00</td>
<td>MAN.3 - Project Mngt. - Sub-Project/Teams</td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td>12:30</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>12:30</td>
<td>13:30</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
<tr>
<td>13:30</td>
<td>15:00</td>
<td>SUP.1 - Quality Assurance</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>15:30</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
<tr>
<td>15:30</td>
<td>17:00</td>
<td>SUP.8 - Configuration Management</td>
<td></td>
</tr>
</tbody>
</table>

### Day 2

<table>
<thead>
<tr>
<th>Start</th>
<th>End</th>
<th>Topic</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>10:30</td>
<td>SYS.2 - System Requirements</td>
<td></td>
</tr>
<tr>
<td>10:30</td>
<td>11:00</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
<tr>
<td>11:00</td>
<td>12:15</td>
<td>SYS.3 - System Architecture</td>
<td></td>
</tr>
<tr>
<td>12:15</td>
<td>13:00</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td>13:30</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
<tr>
<td>13:30</td>
<td>15:00</td>
<td>SWE.1 - SW Requirements</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>15:30</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
<tr>
<td>15:30</td>
<td>17:00</td>
<td>SWE.2 - SW Architecture</td>
<td></td>
</tr>
<tr>
<td>17:00</td>
<td>17:30</td>
<td>Consolidation</td>
<td>Assessment Team only</td>
</tr>
</tbody>
</table>
The LA clarifies planning input & plans the assessment. All participants agree to the agenda. The assessors sign the NDA.

The LA briefs the CA & LC. The SP explains the assessment purpose. The LA briefs the organization.

The assessors assign an interviewer to lead the interview. The IN answers. The assessors take notes. The LC collects evidence.

The assessors consolidate the information & identify gaps. The assessors draft a 1st rating.

The assessors ask what is needed to close the information gaps. The IN answers. The assessors take notes. The LC collects evidence.

**Assessment Scope**
- Kick-off presentation

**Assessment Plan**
- Notes & evidence

**Assessment Agenda**
- Strengths, potentials & information gaps

**Onsite**
- Notes & evidence
### KM Assessment Process 4.1 (Overview) Part 2

#### Onsite

**Rate PAs & calculate levels**
- The assessors consolidate information.
- The assessors perform the ratings and calculate levels.
- The assessors prepare the feedback.

**Feedback to organization**
- The LA presents the feedback.

**Feedback to sponsor**
- (optional step)
  - The LA explains the results and answers the questions from the SP.

**Report assessment**
- The LC provides the list of evidences.
- The assessors draft & review the report.
- The LA sends the report.
- The SP, LA & CA sign the log.

**Plan improvement**
- The SP sets priorities and initiates related improvement workshops.

#### Process profiles

<table>
<thead>
<tr>
<th>SP: Sponsor</th>
<th>LA: Lead Assessor</th>
<th>CA: Co-Assessor</th>
<th>LC: Local Contact</th>
<th>IN: Interviewee</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>S</td>
<td>S</td>
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<td>S</td>
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<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

#### Feedback presentation

<table>
<thead>
<tr>
<th>Process profiles</th>
<th>Feedback presentation</th>
<th>-</th>
<th>Assessment report</th>
<th>Improvement plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP: Sponsor</td>
<td>LA: Lead Assessor</td>
<td>CA: Co-Assessor</td>
<td>LC: Local Contact</td>
<td>IN: Interviewee</td>
</tr>
</tbody>
</table>
Guideline For Interviewees

Prepare for the interview

Understanding
- Ensure correct understanding of the SPICE process, its purpose and practices
- Ensure correct understanding of our strategy, process description, and needed artifacts
- Reflect on the last “Process Audit” and weaknesses that were detected

Presentation
- Prepare introduction slides
- Choose at least 5 examples to show that all actions are performed throughout the whole process
- Exercise presentation several times

Artifacts
- Update, release and check-in artifacts as planned
- Be prepared to show coverage
- Ensure you are able to guide the assessor through each artifact

Convince in the interview

Strategy
- Report your responsibility – very compactly; use the role description or ONE introduction slide for your work
- Show the defined process as the basis for your explanation

Consistency
- Explain what you do using the defined process step by step. In parallel open the artifacts and show your work
- Use the prepared examples and show consistency

Completeness
- Report progress and status
- Show coverage
- Show trends and derived actions
Guideline For Interviewer

Start of interview

▪ Be friendly. Reduce stress. Ensure, that the interviewee does not feel he is being grilled. Start with a very easy question.

How to raise questions

▪ Start with an ‘open’ question to get a lot of information. Use ‘closed’ questions to get precise or detailed answers.
▪ Be an active listener. Repeat what you have understood if you need additional confirmation.

Do not …

▪ Never assume any activities or work products
▪ Never phrase a question in a way that indicates a certain answer or expectation
▪ Never blame a person. Never provide feedback (i.e. rating or indicators for it) during interviews. Never be ironic.

Find the gaps

▪ Follow the feature / change request / bug report from the source to the realization, to the qualification and to closure
▪ Repeat at least 3 times. Check consistency and completeness. Do not get distracted by sidetracks of ‘storytellers’

End of interview

▪ Be friendly. Reduce stress. Ensure, that the interviewee does not feel he is being grilled.
▪ Invite participants to the feedback presentation.
| N | Not achieved 0% to 15% | There is little or no evidence of achievement of the defined attribute in the assessed process.  
**Outcome:** Outcome/achievement not existent, or content judged unacceptable. |
|---|----------------------|--------------------------------------------------------------------------------|
| P | Partially achieved >15% to 50% | There is some evidence of an approach to, and some achievement of, the defined attribute in the assessed process. Some aspects of achievement of the attribute may be unpredictable.  
**Outcome:** Some outcomes/achievements implemented, but projects/OUs still incapable of reaching quality, time, or budget goals and targets |
| L | Largely achieved > 50% to 85% | There is evidence of a systematic approach to, and significant achievement of, the defined attribute in the assessed process. Some weakness related to this attribute may exist in the assessed process.  
**Outcome:** Outcome/achievement implies a significant likelihood, however no certainty, of reaching quality, time, and budget goals and targets. |
| F | Fully achieved > 85% to 100% | There is evidence of a complete and systematic approach to, and full achievement of, the defined attribute in the assessed process. No significant weaknesses related to this attribute exist in the assessed process.  
**Outcome:** No process risk with respect to quality, time, budget. Goals and targets identified, even in presence of imperfections. |
Rating Guideline

1. **Interview** the team members who perform the process and gather evidences like affirmations and work products for each practice (of both Base Practices and Generic Practices) within the assessment scope.

2. **Clarify** how each practice is expected to be applied within the specific project, scope and schedule.

3. **Rate** the achievement of each practice based on the evidence of application using **NPLF** (Not achieved / Partly achieved / Largely achieved / Fully achieved)

4. **Rate** the degree to which the related Process Attributes (PAs) are achieved using NPLF.

5. If applicable, **aggregate** the PA ratings of several process instances (but never of different processes)
   a. Assign values for each NPLF rating: N → 0; P– → 1; P+ → 2; L– → 3; L+ → 4; F → 5
   b. Assign each value a pre-defined weighting, round the arithmetic mean and convert back

6. **Check** for rating consistency

7. **Calculate** the capability level of the related process: a ‘F’ rating of the PAs is expected – start with capability level 1 and climb up level for level. Only at the highest level is a PA rating of ‘L’ accepted.

<table>
<thead>
<tr>
<th>Process xyz</th>
<th>PA1.1</th>
<th>PA2.1</th>
<th>PA2.2</th>
<th>PA3.1</th>
<th>PA3.2</th>
<th>PA4.1</th>
<th>PA4.2</th>
<th>PA5.1</th>
<th>PA5.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability Level 1</td>
<td>L/F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capability Level 2</td>
<td>F</td>
<td>L/F</td>
<td>L/F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capability Level 3</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>L/F</td>
<td>L/F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Assessment Report**

The lead assessor reports the assessment team result to the sponsor.

The report includes as a minimum:

- The assessment input including constraints, if any
- The strengths and potentials per process
- The resulting capability and process attribute profiles
- The practice ratings and objective evidences
- The reasons for rule deviations, if applicable
- Unique title, version number, change history, distribution list

The report should also include:

- A Management Summary
- Basic recommendation for next improvement steps

In addition the lead assessor asks the sponsor to sign the assessment log.
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