

Experiences with ASPICE 3.1 and the VDA Automotive SPICE Guidelines Using Advanced Assessment Systems

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“In God we trust – all others have to measure/assess” –

Watts Humphrey

So we need assessments.

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**Trusting the network/cloud without using your brain would mean giving up your
human existence – Richard Messnarz**

Our society develops towards networks and cloud. This is an evolution and assessors must cope with the complexity of networked systems, interrelated processes and potential contradictions.

**Assessment models overloading assessors without efficient computer support will
lead to incorrect or inconsistent results.**

In industry and defence it is known that a human can handle approx. 7 signals in parallel. How can we managed many hundred rules without computer guidance?

Introduction

- Automotive SPICE 3.1 Introduced in late 2017
- Based on the ISO/IEC 33002:2015.
- Addressing the development of embedded software-based systems in the automotive domain.
- In addition → Automotive SPICE® Guidelines published by the VDA in 2017
- Non-binding VDA standard recommendation

“The Association of the German Automotive Industry (VDA) recommends its members to apply the following standard for the implementation and maintenance of quality management systems.”

VDA Guidelines

- To support the interpretation and application of Automotive SPICE 3.1
- To provide guidance and recommendations in order to increase the comparability of assessments results.
- Only available for the processes in the VDA Scope

System Engineering Process Group (SYS)

SYS.2 System Requirements Analysis
SYS.3 System Architectural Design
SYS.4 System Integration and Integration Test
SYS.5 System Qualification Test

Software Engineering Process Group (SWE)

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

Supporting Process Group (SUP)

SUP.1 Quality Assurance
SUP.8 Configuration Management
SUP.9 Problem Resolution Management
SUP.10 Change Request Management

Management Process Group (MAN)

MAN.3 Project Management

Acquisition Process Group (ACQ)

ACQ.4 Supplier Monitoring

Rules and Recommendations

- Major part of the rating guidelines are rules and recommendations
- The aim of a **rule** is to provide rating principles, which are valid in the majority of assessment situations.
- Rules **shall** be followed for the rating in an assessment → otherwise a documented justification is required.
- The aim of the recommendation **should be followed** for the rating in an assessment → no justification is required if not followed

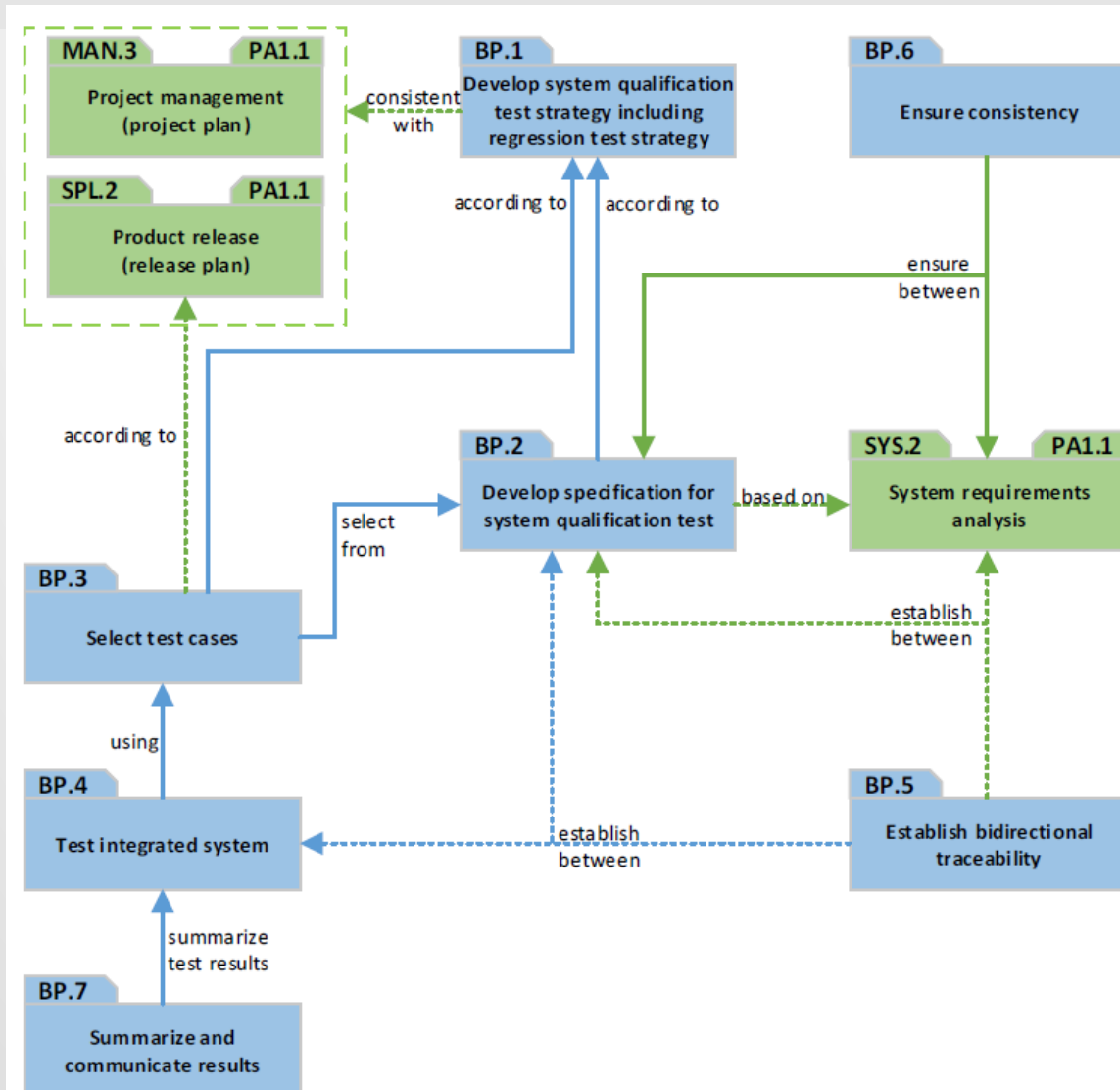
Examples

- **[SYS.5.RL.3]:** If the test specifications are not based on the requirement specifications and the verification criteria, the indicator BP2 must not be rated higher than P.
- **[SWE.1.RL.6]:** If the software requirements and their interdependencies are not evaluated in terms of correctness, technical feasibility and verifiability the indicator BP3 must not be rated F.
- **[SWE.1.RC.2]:** If the analysis of impact on cost and schedule is covered by the estimation of work packages in the project planning this should not be used to downrate the indicator BP3.
- **[MAN.3.RL.5]:** If the schedule does not contain all of the following
 - a start and end date,
 - duration,
 - degree of fulfillment (for monitoring purposes),
 - resources,
 - dependenciesthe indicator BP8 must not be rated higher than L.
- **[MAN.3.RL.6]:** If any of the following:
 - start and end date,
 - effort,
 - degree of fulfillmentis missing, the indicator BP8 must not be rated higher than P.

Consistency

- Additional rules and recommendations for assuring the consistency of the process attribute ratings
- Dependencies between base practices within one specific process
- Dependencies between base practices of one process to base practices / process attribute of another process
- Dependencies between generic practices

Relationships between SYS.5 base practices





Example SYS.5

- **[SYS.5.RL.8]** If the strategy-related activities are not performed according to the defined strategy (BP1), the indicators BP2 and BP3, respectively, shall be downrated.
- BP2 Develop specification for system qualification test
- **[SYS.5.RL.9]** If the indicator for developing the test strategy (BP1) is downrated due to missing or inadequate definitions of methods for test case and test data development, the indicator BP2 shall be downrated.
- BP3 Select test cases
- **[SYS.5.RL.10]** If the indicator for developing the test specification (BP2) is downrated, the indicator BP3 must not be rated higher.
- **[SYS.5.RL.11]** If the indicator for developing the test strategy (BP1) is downrated due to a missing or inadequate definition of the test case selection criteria, the indicator BP3 shall be downrated.
- BP4 Test integrated system
- **[SYS.5.RL.12]** If the indicator for selecting test cases (BP3) is rated P or N, the indicator BP4 shall be downrated.

Example Level 2

- GP 2.1.2 Plan the performance of the process to fulfill the identified objectives
- **[CL2.RL.22]** If the indicator for identifying the objectives for the performance of the process (GP 2.1.1) is downrated, the indicator GP 2.1.2 shall be downrated.
- GP 2.1.3 Monitor the performance of the process against the plans
- **[CL2.RL.23]** If the indicator for planning the performance of the process (GP 2.1.2) is downrated, the indicator GP 2.1.3 must not be rated higher.
- GP 2.1.7 Manage the interfaces between involved parties
- **[CL2.RC.8]** The rating of the indicator GP 2.1.7 of all processes should be in line with the rating of the indicator MAN.3.BP7.
- **[CL2.RC.9]** The rating of the indicator GP 2.1.7 of the considered process should be in line with the rating of its indicator for "Communicate Agreed ..." (SYS.2.BP8, SYS.3.BP8, SWE.1.BP8, SWE.2.BP9, SWE.3.BP7).
- **[CL2.RC.10]** The rating of the indicator GP 2.1.7 of the considered process should be in line with the rating of its indicator for "Summarize and Communicate" (SYS.4.BP9, SYS.5.BP7, SWE.4.BP7, SWE.5.BP9, SWE.6.BP7).

How to manage assessments according to the guidelines?

- Assessment requires more days/effort required
- Consolidation required more effort
- Consistency between base/generic practices difficult
- RCs and RLs are mixed in the text

→ Only through tool support

Different Views


Automotive SPICE 3.1

System Qualification Test


Automotive SPICE 3.1 Assessment


The purpose of the System Qualification Test is to provide evidence for the system requirements and that the system is tested to provide evidence for the system requirements and that the system is tested to provide evidence for the system requirements.


SYS.5.1:      

SYS.5.BP1  **Develop system qualification test strategy including regression testing.** Develop the system qualification test strategy for system qualification test consistent with the project plan. The strategy shall include a regression test strategy for re-testing the integrated system after changes. [OUTCOME 1]


N  P  L  F  Not App. 

SYS.5.BP2  **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]


N  P  L 




SYS.5.BP3  **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]


N  P  L 

SYS.5.BP4  **Test integrated system.** Test the integrated system to provide evidence for compliance of the integrated system with the system requirements. [OUTCOME 4]


N  P  L 

SYS.5.BP5  **Establish bidirectional traceability between system requirements and test cases.** Establish bidirectional traceability between system requirements and test cases included in the system qualification test specification. [OUTCOME 5]

N  P  L 

SYS.5.BP6  **Ensure consistency.** Ensure consistency between system requirements and test cases included in the system qualification test specification. [OUTCOME 5]

N  P  L  F  Not App. 

SYS.5.BP2  **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]


[SYS.5.RL.3] If the test specifications are not based on the requirement specifications and the verification criteria, the indicator BP2 must not be rated higher than P.

[SYS.5.RL.8] If the strategy-related activities are not performed according to the defined strategy (BP1), the indicators BP2 and BP3, respectively, shall be downrated.

[SYS.5.RL.9] If the indicator for developing the test strategy (BP1) is downrated due to missing or inadequate definitions of methods for test case and test data development, the indicator BP2 shall be downrated.


N  P  L  F  Not App. 

Note

SYS.5.BP3  **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]

The expectations for a successful implementation of the test case selection cover the following aspects:

- a) The selection of the test cases has to be performed according to the defined strategy
- b) The selection of test cases has to consider the intended use of the deliverable item (test bench, test track, use on public road, ?)
- c) The used selection criteria (defined in the strategy) have to be documented
- d) The selection of the test cases has to be documented

SYS.5.BP2  **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]

[SYS.5.RL.3] If the test specifications are not based on the requirement specifications and the verification criteria, the indicator BP2 must not be rated higher than P.

[SYS.5.RL.8] If the strategy-related activities are not performed according to the defined strategy (BP1), the indicators BP2 and BP3, respectively, shall be downrated.

[SYS.5.RL.9] If the indicator for developing the test strategy (BP1) is downrated due to missing or inadequate definitions of methods for test case and test data development, the indicator BP2 shall be downrated.

[SYS.5.RC.3] If the PA 1.1 for SYS.2 is downrated, this should be in line with the rating of the indicator BP2.

N  P  L  F  Not App. 

Note


Note

Consistency check

- Hard to display with a simple (Excel based) assessment tool.
- Contains rules and recommendations
- More than 800 relationships between practices
- Automatic check is required


682	SUP.10 2.1	SUP.10 2.1	>=	[CL2.RL.25] If the indicator for planning the performanc
683	SUP.10 2.1	SUP.10 2.1	>=	[CL2.RL.27] If the indicator for planning the performanc
684	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.4] The rating of the indicator GP 2.1.2 of all proi
685	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.4] The rating of the indicator GP 2.1.2 of all proi
686	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.4] The rating of the indicator GP 2.1.2 of all proi
687	SUP.10 2.1	SUP.10 2.1	>=	[CL2.RL.26] If the indicator for monitoring the performa
688	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.5] The rating of the indicator GP 2.1.3 of all proi
689	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.5] The rating of the indicator GP 2.1.3 of all proi
690	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.5] The rating of the indicator GP 2.1.3 of all proi
691	SUP.10 2.1	MAN.3.BP	<=	[CL2.RC.6] The rating of the indicator GP 2.1.4 of all proi

CONSISTENCY CHECK

SYS.5.BP1  **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]


N ☐ P ☒ L ☐ F ☐ Not App. ☐

Note

SYS.5.BP2  **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]

N ☐ P ☐ L ☒ F ☐ Not App. ☐

Note

SYS.5.BP3  **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]

N ☐ P ☐ L ☒ F ☐ Not App. ☐

Note

Hide Rating Rules

Hide Rating Recommendations

Rated Rating	Rating	Related Rating	Rating	Rating Consistency:
SYS.5.BP3	L	SYS.5.BP1	P	[SYS.5.RL.11] If the indicator for developing the test strategy (BP1) is downrated due to a missing or inadequate definition of the test case selection criteria, the indicator BP3 shall be downrated.
SYS.5.BP2	L	SYS.5.BP1	P	[SYS.5.RL.9] If the indicator for developing the test strategy (BP1) is downrated due to missing or inadequate definitions of methods for test case and test data development, the indicator BP2 shall be downrated.

SUMMARY

- Through the usage of assessment tools effort for performing assessments according to the VDA Guideline can be reduced (to 5 days for Level 3)
- Difficult to perform VDA guideline assessments without any tool
- Ensuring consistency and checking dependencies of ratings require some kind of automated checks
- More customer specific requirements/guidelines can be integrated with the same approach (e.g. KGAS by VW)

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- Raspberry Solution
- Team Assessment



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Using Advanced Assessment Systems

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“Always design a thing by considering it in its next larger context. An assessment of a process, an assessment of n process instances, an assessment with many assessors delivering consistent results, an assessment of a cluster of components in a car, an assessment of cloud functions connected to all assessed components in the car, assessing the cloud supporting artificial intelligence, assessing a whole planet in a consistent way” – Eero Saarinen – “Extended”.

Assessors not ready for networked and interrelated processes will vanish from Earth in the next decade – Richard Messnarz.