



Verband der
Automobilindustrie

Quality Management
in the Automotive Industry

Automotive SPICE®

Process Assessment Model

Process assessment using Automotive SPICE®
in the development of software-based systems

1st. edition, December 2008
English edition published in August 2010

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Verband der Automobilindustrie e.V. (VDA)

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Automotive SPICE® Process Assessment Model
The SPICE User Group 2005-2007

ISSN 0943-9412
Printed 08/2010

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Verband der Automobilindustrie e. V. (VDA)
Qualitätsmanagement-Center (QMC)
10117 Berlin, Behrenstrasse 35
Germany

Overall production:
Henrich Druck + Medien
60528 Frankfurt am Main, Schwanheimer Straße 110
Germany

Printed on chlorine-free bleached paper

Preface

The predominant and continually increasing number of innovative vehicle functions relating to the protection of the environment, safety, security, economic efficiency and user-friendliness can only be achieved by the introduction of complex and highly-networked software systems.

Market demands require innovations of increasing complexity at ever shorter intervals. The associated shorter development periods, together with greater demands for reliability, make it essential to improve software development processes.

Due to this fact there is the essential demand for further development of processes and methods for product creation which have been best practice until now. In future only this will guarantee development and manufacturing of products in time and, using controlled and maintained processes, in that quality which satisfies the customer's expectations.

In 2005 the Automotive Special Interest Group¹ published the "Automotive SPICE® Process Assessment Model" relating specifically to the automotive industry and derived from the new ISO/IEC 15504 International Standard for Process Assessments. The objective in drawing up the process assessment model was to undertake the necessary interpretation of this standard for the automotive industry and thus to increase the comparability of the results of assessments. The "Automotive SPICE® Process Assessment Model" is used increasingly for the objective evaluation of processes and the subsequent improvement of processes at project and organisation level.

This does not involve the replacement of internal process improvement strategies and the use of other process reference models (for example, CMMI).

¹ AUDI AG, BMW Group, Daimler AG, Fiat Auto S.p.A., Ford Werke GmbH, Jaguar, Land Rover, Dr. Ing. h.c. F. Porsche AG, VOLKSWAGEN AG, Volvo Car Corporation and The Procurement Forum are represented in the Automotive Special Interest Group.

The objective of Working Group 13 of the VDA is the definition of requirements based on Automotive SPICE[®] relating to the assessment of processes and monitoring of resulting process improvements in the development of software-based systems.

In defining the requirements for the assessment process it is intended to standardize the procedure, so that the companies involved in an assessment are able to adapt better to the assessments and the comparability and reproducibility of results are increased.

With the other members, the Herstellerinitiative Software (HIS²) carried out the definitive preparatory work.

This present volume specifies the requirements relating to the assessment process, as well as the qualification of assessors carrying out supplier assessments based on Automotive SPICE[®] for the VDA.

The associated recommendations for carrying out assessments based on Automotive SPICE[®] reflect best practices, which have been proven in many assessments. A glossary explains the specific technical terms employed, so that the volume can be understood without any detailed knowledge of the standard.

The Working Group is made up of automotive manufacturers and suppliers to the automotive industry (BMW Group, Robert BOSCH GmbH, Continental AG, Daimler AG, Ford Werke GmbH (also representing the Volvo Car Corporation), the KNORR-BREMSE Group, KUGLER MAAG CIE, VOLKSWAGEN AG and ZF Friedrichshafen AG).

² AUDI AG, BMW Group, Daimler AG, Dr. Ing. h.c. F. Porsche AG and VOLKSWAGEN AG are represented in the Herstellerinitiative Software, HIS (Manufacturers' Initiative Software)

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Glossary

Term	Explanation
AO	Assessing organisation: the organisation which places the contract for the assessment (usually the customer)
Accreditation body	A central body which issues guidelines for training, checks the training documentation used by training companies and issues permission for companies to carry out trainings
Assessment	A formalised and standardised evaluation of the processes of an organisational unit against a reference model (the "process reference model"). The assessor's experience is used in the assessment, depending on the situation (cf. ISO/IEC 15504-1:2004, page 4, Definition of the term "Process Assessment").
Assessment log	The formal documentation drawn up by an assessor for the execution of an assessment. The assessment log is the evidence of the assessor's assessment activities and is provided to the certification body.
Assessment team	Team made up of all the assessors of the AO (see "AO") who are involved in the assessment. The assessment team should consist of at least two assessors, one of whom is the so-called "lead assessor" (the assessor responsible). Decisions are taken unanimously in the assessment team.
Assessor	The role of a person in the assessment, who carries out the questioning during the assessment and evaluates the responses
Audit	An evaluation of work products and processes against specifications, standards, processes or other agreements, generally carried out on the basis of check lists.

Term	Explanation
Automotive SPICE®	A process assessment model, compatible with ISO/IEC 15504, written specially for the development of ECUs for the automotive industry. Authors are the members of the Automotive Special Interest Group: AUDI AG, BMW Group, Daimler AG, Fiat Auto S.p.A., Ford Werke GmbH, Jaguar, Land Rover, Dr. Ing. h.c. F. Porsche AG, VOLKSWAGEN AG, the Volvo Car Corporation and the Procurement Forum.
Autosar	Automotive System Architecture: an initiative by the automotive industry to standardise software in electronic control units (www.autosar.org).
Autosar domains	Categories used to classify ECUs by their area of application: chassis, power-train, telematics, body.
Capability level	A quality level of the process. SPICE / Automotive SPICE® contains six capability levels, ranging from Level 0 ("Incomplete process" to Level 5 ("Optimizing process"). (cf. Appendix)
Certification body	A central body which administrates the certification information of the trained assessors and classifies the trained assessors by their qualifications and practical experience.
E, D, C, I	E = Execution, D = Decision-making, C = Cooperation in the action, I = To be informed
Estimated capability level	An estimation, without an assessment, of the process capability level which a project or organisation has achieved.
Evidence	Proof of activities which have been carried out, usually by presenting work products
Evidence repository	Repository for storing evidences which have been obtained
Evidence	Taking evidence, generally by inspecting documents

Term	Explanation
taking	or using interviews. Optionally this can also take place off-site in preparation for an assessment, if the assessment team calls for appropriate documents.
Feedback presentation	A process step at the end of the assessment, when the assessment team provides early feedback on the results of the assessment. It usually covers the main strengths and improvement potentials. The provisional process capability profile is also presented if appropriate.
Findings	The evaluations documented by assessors regarding strengths and improvement potentials of the organisational unit which was evaluated, based on verbal affirmations from interviews and work products presented ("Evidence").
HIS	Herstellerinitiative Software (Manufacturer Initiative Software). Different working groups of German automotive manufacturers (Audi AG, BMW Group, Daimler AG, Porsche AG, VOLKSWAGEN AG), working together in fields not involving competition on the development of software for ECUs, including the subject of process assessments (www.automotive-his.de).
HIS Process Scope	A selected set of processes from Automotive SPICE® which are assessed (where applicable) in every assessment carried out by the automotive manufacturers represented in the HIS (ENG.2 – ENG.10, SUP.1, SUP.8-SUP.10, MAN.3, ACQ.4).
ISO/IEC 15504	An ISO standard which covers in a binding manner the process capability level evaluations arrived at by assessments and contains an example of a process assessment model. ISO/IEC 15504 is often referred to colloquially as "SPICE".
Kick-Off	A process step in the assessment process, in which the AO and OU discuss jointly the execution of the

Term	Explanation
	assessment
Lead Assessor	The leading assessor in the assessment team, who is responsible for carrying out the assessment in an orderly manner in accordance with the standard, as well as for the accuracy of the results. A minimum qualification ("competent assessor") is required.
NDA	Non-Disclosure Agreement
OEM	"Original Equipment Manufacturer". In the automotive industry this term is used to describe the vehicle manufacturers. See also "Tier 1,...n".
PAM	Process Assessment Model
Practice level	Lowest level of granularity within the Automotive SPICE® Model, determined by the "base practices" and "generic practices" of the processes. Strengths and improvement potentials should be traceable to this level and are derived from expectations regarding a state-of-the-art implementation of the practices. Although these expectations constitute good practices in engineering their achievement might not be satisfied in all cases because "state-of-the art" is highly depending on the context and on individual interpretation.
PRM	Process Reference Model
Process assessment model	An extension of the process reference model which, in the process dimension, expands the processes to include base practices, notes and work products and, in the capability dimension, includes generic practices and generic resources (cf. Appendix).
Process capability profile / process profile	In SPICE / Automotive SPICE® the processes are assessed independently of each other, by reference to capability levels. The process capability profile is the collective representation of the capability levels of

Term	Explanation
	the processes which have been observed and includes all the processes which have been examined.
Process reference model	The process reference model sets out in a binding manner the requirements for processes. In the process dimension it includes the process ID (e.g., MAN.3), the name of the process, the purpose and the results ("outcomes"). In the capability dimension it covers the descriptions of the capability levels and the process attributes.(cf. Appendix).
SPICE	<u>S</u> oftware <u>P</u> rocess <u>I</u> mprovement and <u>C</u> apability <u>d</u> etermination. The previous project, in which the draft of ISO/IEC-TR 15504 was written. These days the term "SPICE" is used colloquially to refer to ISO/IEC 15504.
Sponsor	The person placing the contract for an assessment. The sponsor is a member of the AO. In case of supplier assessments the sponsor is usually a member of the customer's organisation.
Tier 1, ..., n	The term "tier 1, ..., n" is used to refer to suppliers at various levels in the supply chain. Direct suppliers to the OEM are referred to as "tier 1", a supplier to a tier 1 supplier is referred to as a "tier 2", etc.
Work products	A list of work products is provided in the Appendix
OU	The organisational unit which is to be assessed. This does usually refer to projects in one or more departments in the supplier's organisation.

The Assessment Process

1 Introduction

The basic principles for carrying out assessments according to Automotive SPICE® are set out in ISO/IEC 15504: "Information technology - Process assessment". The standard restricts itself to basic, mainly formal requirements for the assessment and its work products and establishes the rules for evaluating the findings. Instead of the assessment model described as an example in Part 5 of ISO/IEC 15504, the automotive industry uses the Automotive SPICE® assessment model which is specific to this industry (see appendix). Where processes are not part of Automotive SPICE®, the corresponding processes in ISO/IEC 15504 remain applicable.

Neither ISO/IEC 15504 nor Automotive SPICE® provide detailed procedures describing how an assessment is prepared and executed and how the implementation of improvement actions is monitored.

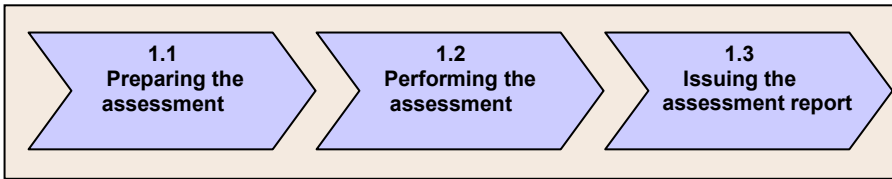
To close this gap, the assessment process provided in this volume establishes requirements for carrying out process evaluations and for tracking the resulting process improvements on the basis of Automotive SPICE®.

For this purpose, a generic assessment process has been defined and modelled.

The partners involved are the assessing organisation, or "AO" (the customer; for example, an OEM) and the organisation which is to be assessed, or "OU" (the supplier - for example, a tier 1 supplier). These roles will apply similarly for relations with sub-suppliers. Service providers involved in the assessment and supporting the assessing organisation (AO) or the organisation being assessed (OU) are regarded as belonging to the AO or OU, as far as the assessment process is concerned.

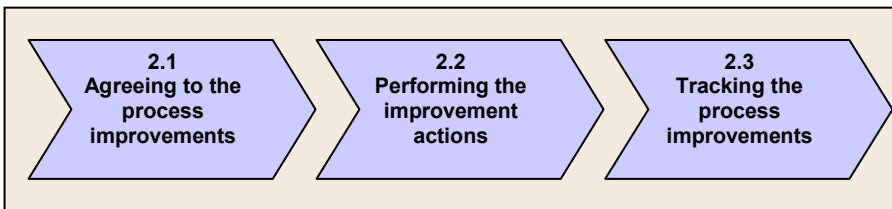
The assessment process is broken down into an evaluation phase and an improvement phase. These are illustrated in the following sections.

The evaluation phase of the assessment process



In the evaluation phase an assessment is prepared, performed and documented. The result is a detailed inventory of the capability of the development process of a project.

The improvement phase of the assessment process



In the improvement phase the assessment results of the evaluation phase are used to plan, execute and track the process improvement actions.

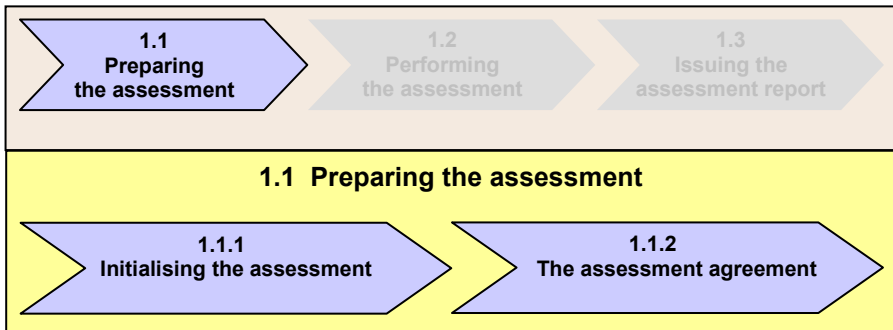
The evaluation phase of the assessment process

1 The evaluation phase in detail

The evaluation phase consists of three sub-processes: preparing the assessment, performing the assessment and issuing the assessment report.

1.1 Preparing the assessment

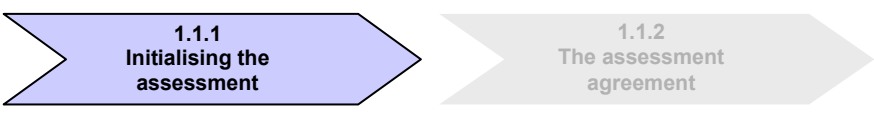
The preparation for an assessment is split into two phases:



In the initialisation phase the assessing organisation (AO) determines the need for an assessment and determines the framework conditions (scope, time period, team, etc.). All necessary information on the project and on the OU is collected.

The exact terms of the assessment are agreed between the two parties.

1.1.1 Initialising the assessment

	
Brief description	The need for an assessment is determined and the framework conditions for its execution are established.
Responsible	AO
<i>E, D, C, I</i> ³	E
Process inputs	<ul style="list-style-type: none"> - Formal or informal assessment enquiry - Information about the OU, - Previous audit reports and assessment reports
Process outputs	<ul style="list-style-type: none"> - Contract - Scope of the assessment - Time frame - Assessment team.
Activities	<ul style="list-style-type: none"> - AO determines the need for an assessment. - Framework conditions are established. - Information on the OU is collected and evaluated. - Scope of the assessment is determined. - Assessment team is determined.

The initialisation of the assessment is carried out by the AO on the basis of information on the OU. The following steps must be taken:

Determining the need for an assessment

The need for an assessment must be determined by the AO. This may be derived, for example, from AO-internal processes or from a risk assessment within the project.

³ E = Execution
D = Decision-making
C = Cooperation in the action
I = To be informed

Establishing the framework conditions

The framework conditions and the assessment scope are determined. This includes:

- The main focus / scope of the assessment. This may be, for example, project management, engineering aspects or other areas of risk. If appropriate, a pre-selection should be made of the processes to be checked.
- The selection of the assessor and the assessment team: assessor(s) from the AO, assessor(s) from the OU who are independent of the project, or external assessor(s).
- Commitment, who will cover the costs.
- The time-frame, within which the assessment should be carried out.
- The business divisions or departments and personnel in the AO and OU that are to be involved.

Collecting and evaluating information on the OU

The information on the OU which is relevant to the assessment must be collected and evaluated. This may include:

- Organisational structure of all those involved in the project, such as
 - Sponsor,
 - Project team,
 - Core/platform development
 - (independent) quality assurance department
 - (independent) test department
 - Sub-suppliers
 - Standard software components/of the shelf items
 - If appropriate, the department responsible for the selection, release and maintenance of tools
 - IT, for example for configuration management.

- Results of other audits and assessments:

Results from previous audits and assessments (for example based on CMMI) can be used for determining the assessment scope. Here, the time has to be considered that has passed since the audit or assessment and whether the results are applicable for the project (assessment method, assessed department, personnel involved).

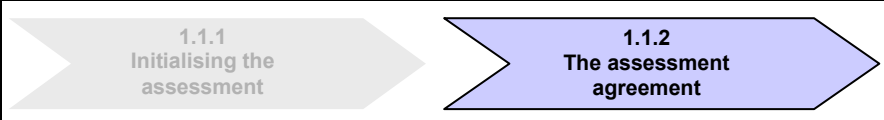
Determining the assessment scope

The processes to be assessed and the time-frame are determined based on the collected information.

Determining the assessment team

The assessment team is determined and appointed.

1.1.2 The assessment agreement

	
Brief description	The assessment and its framework conditions are agreed
Responsible	AO
E, D, C, I	OU
Process inputs	<ul style="list-style-type: none"> - Assessment scope - Time frame - Assessment team
Process outputs	<ul style="list-style-type: none"> - Non-disclosure agreement (NDA) - Assessment time schedule - Documents to be exchanged in advance - Requirements for the evidence repository - Contact persons in both organisations - Distribution list for the report - Optional: minutes of the kick-off meeting
Activities	<ul style="list-style-type: none"> - Details of how the assessment shall be performed are agreed between the parties - Optional: supplier kick-off (on site; by e-mail or by a telecommunications conference)

With the assessment agreement a consensus regarding the assessment should be achieved.

The details of how the assessment shall be performed are agreed between the parties

It is essential that the AO and the OU agree on the need for an assessment. The agreement can be reached formally by means of a written contract and acknowledgement, or in an informal manner. Furthermore, the assessment agreement must consider and specify the following points:

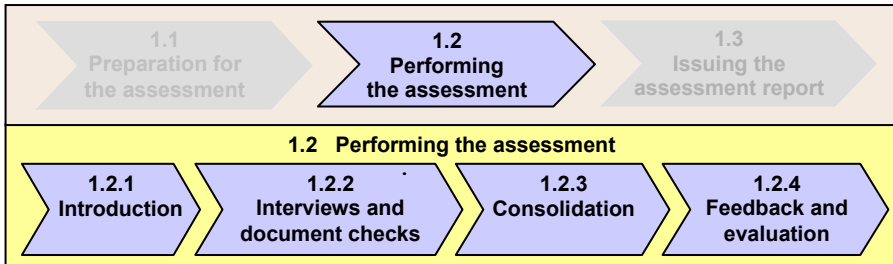
- A non-disclosure agreement (NDA) should be agreed by all parties involved (AO, OU and assessors) and signed (if not already done in the project).
- The final schedule is agreed.
- Contact persons are appointed on both sides for coordination.
- The distribution list for the report is established.
- Requirements relating to the evidence repository for the assessment are established.

Optional: Supplier kick-off (on-site, by e-mail or by a telecommunications conference)

If necessary, a supplier kick-off can be carried out. The purpose is to explain the framework and process of the assessment to the personnel involved. If appropriate, documents can be specified and handed out to the assessment team in advance for study.

1.2 Performing the assessment

The execution of the assessment is split into four phases:



In the introduction phase the project to be assessed and the assessment method are presented. This is followed by the interviews and document reviews, where the actual collection of evidence is done which is the crucial part of the assessment. Once the collection of evidence has been completed, in the consolidation phase starts and the first evaluation of the results (findings) takes place. Finally, in the feedback and evaluation phase, the collected results are stored in the evidence repository, the first capability level results are presented and possible immediate actions are recommended.

1.2.1 Introduction

1.2.1 Introduction	1.2.2 Interviews and document checks	1.2.3 Consolidation	1.2.4 Feedback and evaluation
Brief description	The organisation to be assessed, the project, the evaluation methodology and the activities of the assessment are presented		
Responsible	AO	OU	
E, D, C, I	E	C	
Process inputs	<ul style="list-style-type: none"> - Information on the OU and the project - Assessment scope - Assessment time schedule 		
Process outputs	<ul style="list-style-type: none"> - Presentation of the OU and project - Presentation of Automotive SPICE[®], assessment scope and assessment time schedule 		
Activities	<ul style="list-style-type: none"> - Presentation of the OU and the project - Presentation of Automotive SPICE[®] and the activities of the assessment 		

The introduction should give all those involved an overview of the OU, the project, the assessment methodology and sequence:

Presentation of the OU and the project

The OU presents itself and the project to be assessed to the assessment team. The purpose of this activity is to provide the assessment team with an introduction to the project-specific conditions and circumstances.

Presentation of Automotive SPICE® and the assessment activities

The assessment team presents Automotive SPICE® and the concrete activities of the assessment. The purpose of this activity is to inform the OU and the interviewees about the background of Automotive SPICE® and the detailed procedure which will be followed during the assessment (for example, the evidence repository).

1.2.2 Interviews and document checks

Brief description	The project-related information regarding the selected processes is collected and documented in accordance with the assessment model.
Responsible	AO
E, D, C, I	OU
Process inputs	<ul style="list-style-type: none"> - Assessment time schedule - Project-related work products
Process outputs	<ul style="list-style-type: none"> - Minutes regarding results of interviews, documents which have been examined and results of the inspection of the work environment - List of documents which have been examined - Assessment notes
Activities	<ul style="list-style-type: none"> - Performing interviews, document checks and inspections of the work environment, if appropriate - Collecting evidence of the processes - Documentation of strengths and improvement potentials (e.g., with reference to documents, work results, tools ...)

Evidence which is relevant to the project in terms of the selected processes is collected and documented:

Performing interviews, document checks and inspections of the work environment, if appropriate

Based on the agenda, interviews on the individual processes with the key personnel of the OU are carried out and the associated documents/evidence are examined. If necessary, the conditions under which the process is performed can be checked at the workplace.

Collecting evidence of the processes

The assessment team documents the findings for the individual processes (for example, with regard to process compliance, the tools used in the project and the quality of existing documents).

Documentation of strengths and improvement potentials

The findings are evaluated in terms of strengths and improvement potentials.

1.2.3 Consolidation

1.2.1 Introduction		1.2.2 Interviews and document checks		1.2.3 Consolidation		1.2.4 Feedback and evaluation	
Brief description	The selected processes are evaluated by the assessors on the basis of the evidence available.						
Responsible	AO			OU			
E, D, C, I	E						
Process inputs	- Assessment notes						
Process outputs	- Consolidated assessment notes - Provisional process capability profile						
Activities	- Evaluation of the evidence available for each of the processes examined - Provisional rating						

The evidence collected from interviews and document reviews is consolidated by the assessors.

Evaluating the evidence available

Following the interviews and the document reviews the assessment team consolidates and documents the analysis results and reaches consensus on the identified strengths and improvement potentials of the processes which have been assessed.

Provisional rating

Based on the findings a provisional process capability profile is determined for the assessed processes.

1.2.4 Feedback and evaluation

Brief description	A provisional evaluation of the OU is presented and immediate actions are identified.
Responsible	AO
E, D, C, I	E
Process inputs	<ul style="list-style-type: none"> - Provisional process capability profile - List of documents which have been examined - Consolidated assessment notes
Process outputs	<ul style="list-style-type: none"> - Presentation of the provisional process capability profile and the most important findings (strengths and improvement potentials) - Archiving of the documents related to the assessment - List of immediate actions
Activities	<ul style="list-style-type: none"> - Feedback presentation of the provisional process capability profile and the most important findings (strengths and improvement potentials) - Identification of immediate actions - Storing the evidence repository

A provisional evaluation is presented to the OU and to any AO observers who may be present. Immediate actions are recommended to eliminate critical weaknesses.

Presentation of the provisional process capability profile and the most important findings in the feedback presentation

The provisional process capability profile is prepared and presented to the OU.

Identification of immediate actions

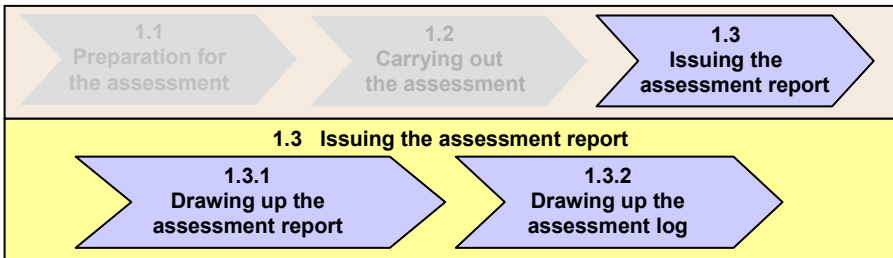
With the AO, the OU analyses the findings which have been presented, prioritizes the improvement potentials, and identifies immediate actions, if applicable.

Storing the evidence repository

The OU stores the evidence repository including references to the documents which have been analysed.

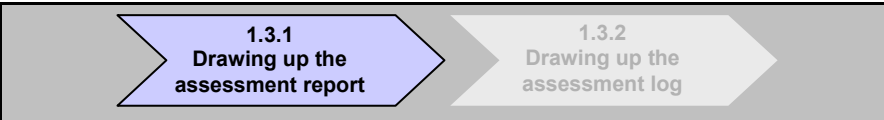
1.3 Issuing the assessment report

The publication of the report following an assessment is split into two phases:



The detailed assessment report is drawn up in order to document the results of the assessment. The assessment log is drawn up for submission to the certification body.

1.3.1 Drawing up the assessment report

	
Brief description	The assessment team draws up the assessment report
Responsible	AO
E, D, C, I	OU
Process inputs	<ul style="list-style-type: none"> - Consolidated assessment notes - Presentation of the provisional process capability profile and the most important findings.
Process outputs	<ul style="list-style-type: none"> - Assessment report with the final process capability profile and an explanation of deviations at the practice level
Activities	<ul style="list-style-type: none"> - Consolidation of the final process capability profile - Assessment report is drawn up promptly by the assessment team - Assessment report is distributed

Consolidation of the final process capability profile

The final process capability profile is drawn up. The consolidated knowledge and observations are documented in detail and given to the AO.

Prompt creation of the assessment report by the assessment team

The assessment report must be drawn up, checked and released promptly by the assessment team (see the section: "Recommendations for performing assessments"). The released version is given to the AO. The lead assessor is responsible for drawing up and releasing the assessment report.

The assessment report shall fulfil the requirements listed in Appendix A.

Distribution of the assessment report

The released version is issued to the AO. The sponsor is responsible for its further distribution.

1.3.2 Drawing up the assessment log

1.3.1 Drawing up the assessment report		1.3.2 Drawing up the assessment log	
Brief description	The assessment team draws up the assessment log		
Responsible	AO	OU	
E, D, C, I	D	M	
Process inputs	- Template for the assessment log		
Process outputs	- The assessment logs		
Activities	- Prompt creation of the assessment logs		

Prompt creation of the assessment logs

The assessment logs are the evidence of the assessors' assessment activities and are provided to the certification body. This evidence is used for the certification of the assessors.

The assessment logs must be drawn up on the basis of the VDA template.

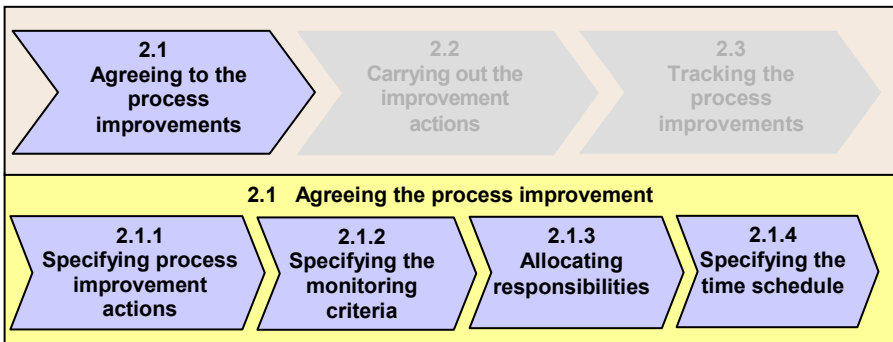
The improvement phase of the assessment process

2 Details of the improvement phase

The process improvement phase follows the evaluation phase and is split into agreement on the process improvement actions, and into performing and tracking these actions.

2.1 Agreeing to the process improvements

In the agreement phase, the process improvement actions are established, together with the monitoring criteria, responsibilities and the time schedule.



2.1.1 Specifying process improvement actions

2.1.1 Specifying process improvement actions		2.1.2 Specifying the monitoring criteria	2.1.3 Allocating responsibilities	2.1.4 Specifying the time schedule
Brief description	The process improvement actions to be carried out are selected and prioritized.			
Responsible	AO		OU	
E, D, C, I	I		E	
Process inputs	<ul style="list-style-type: none"> - Assessment report - If applicable, a list of immediate actions 			
Process outputs	<ul style="list-style-type: none"> - A list of process improvement actions 			
Activities	<ul style="list-style-type: none"> - Specify the process improvement actions - Prioritize the process improvement actions 			

Based on a risk assessment, a list of process improvement actions is established to implement the improvement potentials identified in the assessment. The actions are prioritized.

2.1.2 Specifying the monitoring criteria

2.1.1 Specifying process improvement actions		2.1.2 Specifying the monitoring criteria		2.1.3 Allocating responsibilities		2.1.4 Specifying the time schedule	
Brief description		The monitoring criteria are specified					
Responsible		AO		OU			
E, D, C, I		I		E			
Process inputs		- List of process improvement actions					
Process outputs		- Monitoring criteria for process improvement actions					
Activities		- Specify the monitoring criteria					

Based on the list of process improvement actions monitoring criteria are defined which allow to check whether the implementation of the actions have the desired effects.

2.1.3 Allocating responsibilities

2.1.1 Specifying process improvement actions		2.1.2 Specifying the monitoring criteria		2.1.3 Allocating responsibilities		2.1.4 Specifying the time schedule	
Brief description		Responsibilities are allocated					
Responsible		AO		OU			
E, D, C, I		I		E			
Process inputs		- List of process improvement actions					
Process outputs		- Responsibilities for process improvement actions					
Activities		- Specify responsibilities					

Responsibility for the individual actions in the list of actions is allocated to persons who are responsible for their implementation.

2.1.4 Specifying the time schedule

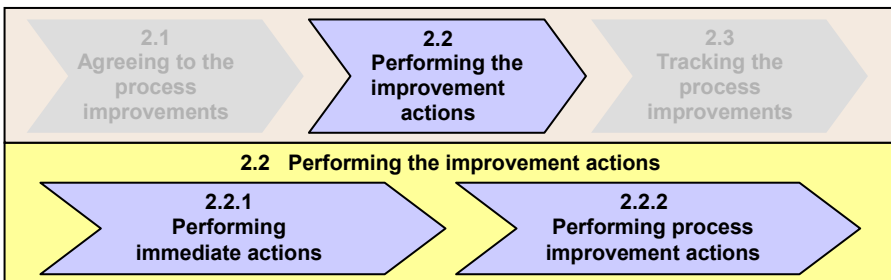
2.1.1 Specifying process improvement actions		2.1.2 Specifying the monitoring criteria		2.1.3 Allocating responsibilities		2.1.4 Specifying the time schedule	
Brief description	The time schedule is specified						
Responsible	AO			OU			
E, D, C, I	I			E			
Process inputs	<ul style="list-style-type: none"> - List of process improvement actions - Responsibilities for process improvement actions 						
Process outputs	<ul style="list-style-type: none"> - Time schedule for implementing the process improvement actions 						
Activities	<ul style="list-style-type: none"> - Specify the time schedule for implementing the process improvement actions 						

Dates and priorities are assigned to the individual process improvement actions.

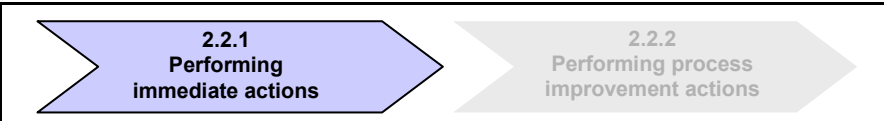
Based on a risk assessment, the actions from the list are identified which are to be implemented in the project and/or in the organisation which has been assessed.

2.2 Performing the improvement actions

Immediate actions should be carried out directly after the assessment. Other process improvement actions are implemented on the basis of a risk assessment.

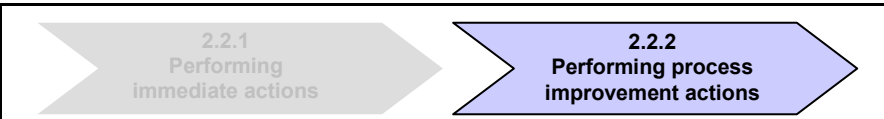


2.2.1 Performing immediate actions

	
Brief description	The immediate actions are carried out
Responsible	AO
E, D, C, I	I
Process inputs	<ul style="list-style-type: none"> - List of immediate actions - Responsibilities for process improvement actions - Time schedule for process improvement actions.
Process outputs	- Documentation of the improvements which have been carried out
Activities	- Execution of the immediate actions

Responsibilities and prompt target dates are allocated to the immediate actions. The immediate actions are carried out.

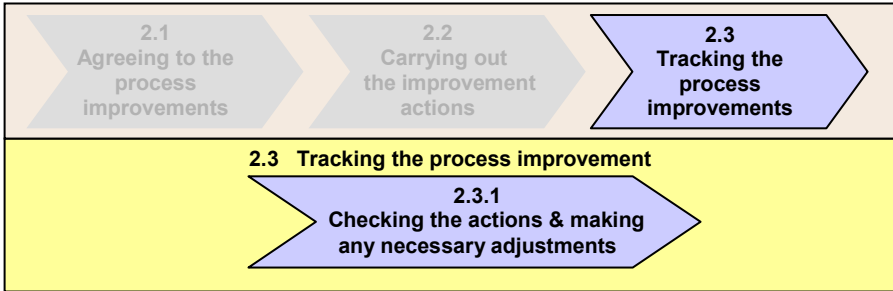
2.2.2 Performing process improvement actions

	
Brief description	The process improvement actions are carried out
Responsible	AO
E, D, C, I	I
Process inputs	<ul style="list-style-type: none"> - List of process improvement actions - Responsibilities for process improvement actions - Time schedule for process improvement actions.
Process outputs	- Documentation of the improvements which have been carried out
Activities	- Execution of the process improvement actions

The process improvement actions should be carried out in due time by those responsible and according to priority.

2.3 Tracking the process improvement

Tracking the process improvement actions represents the completion of the improvement process:



The process improvement actions are checked and any necessary adjustments are made, thereby taking risks into account.

2.3.1 Checking the actions and making any necessary adjustments

Brief description	The actions are checked and adjusted if necessary	
Responsible E, D, C, I	AO	OU
	I	E
Process inputs	<ul style="list-style-type: none"> - List of process improvement actions - Monitoring criteria for process improvement actions - Documentation of the improvements which have been carried out 	
Process outputs	<ul style="list-style-type: none"> - Status report of the process improvement actions - Road map for long term actions exceeding the project scope 	
Activities	<ul style="list-style-type: none"> - Regular checking of the process improvement actions regarding their implementation and effectiveness - Specify new actions if deficiencies are detected - Planning of long term actions that exceeds the project scope 	

Based on the defined monitoring criteria (2.1.2) the implementation of the process improvement actions is checked regularly for effectiveness. If the

actions do not achieve the desired effect, new actions are specified. Long term actions exceeding the project scope should be addressed within a road map.

Requirements relating to assessor qualification

Where Automotive SPICE® assessments are carried out in the automotive industry, it is essential that they are executed by appropriate and trained specialists. In this, the assessor entrusted with the leadership of the assessment, who also accepts responsibility for the result of the evaluation, plays a special role. The German automotive industry accepts a personal Automotive SPICE Competent or Principal SPICE Assessor certificate issued by the VDA as a basis for assessing the qualification and experience of this so-called Lead Assessor. A suitable qualification is also to be demonstrated for further members of the assessment team. This should also be done by providing a VDA certificate.

Within the HIS (manufacturers' initiative software) there are further, additional requirements regarding the practical experience of assessors. Details are published under <http://www.automotive-his.de/processa.htm>.

The training of assessors is carried out by accredited training organisations on the basis of a qualification scheme. Recognition of valid qualification schemes for assessors is carried out by the VDA. In this, conformance with DIN EN ISO/IEC 17024 ("Conformity assessment -- General requirements for bodies operating certification of persons") is a fundamental requirement for acceptance as an Automotive SPICE® training scheme. Details of VDA acknowledged training schemes and accredited training organisations are published under <http://www.vda-qmc.de>.

Recommendations for performing assessments

This section covers recommendations for cooperation between the organisations involved, so that they may maximize the benefits of the assessment for the project, while protecting their own commercial interests. The recommendations set out here give practical advice on the use of the assessment process already defined, where this advice has been proven in the past in the successful execution of assessments. Contracts and non-disclosure agreements are not affected by these recommendations.

1 Assessment results

1.1 Confidentiality of information

As a fundamental rule, assessment results⁴ and the knowledge obtained in the course of an assessment must be treated as confidential by all persons and organisations involved. Assessments covering several levels of suppliers require a separate agreement (for example, an OEM would assess a tier 2 supplier).

1.2 Handling the assessment results

- The AO is the owner of the assessment results.
- The forwarding of assessment results to third parties should be agreed in writing. A typical example of this is the exchange of data within the HIS.
- If the assessment results are issued to third parties, an additional non-disclosure agreement should be signed where appropriate.
- The assessment results and any part of them should be made available to all individuals involved in the project which has been assessed, in accordance with their respective roles. The criterion here is their involvement in the project or process development. Service providers involved

⁴ The assessment results also include the feedback presentation, the assessment report and, if appropriate, a management summary.
Other documents: The evidence repository remains with the organisation which has been assessed and the assessment notes with the assessors.

may also be included.⁵

In practice this can be achieved by including all those involved in a non-disclosure agreement.

- The assessment results should be documented and archived in such a manner that they remain fully comprehensible for the period of validity.

1.3 Parties involved in the assessment

- Several companies or legal entities may act on either side of the assessment.
Example 1: Several companies assess a common supplier, for example an Autosar software manufacturer
Example 2: A single supplier assesses internal and external sub-contractors involved in a project.
- Assessments involving several parties require a special non-disclosure agreement.

2 Feedback

The purpose of feedback is to provide information on the assessment results and to reach a common understanding of the rating.

The feedback shall contain the following as a minimum:

- The provisional process capability profile
- The major strengths and improvement potentials (for each process assessed).

The feedback should be provided directly following the conclusion of all interviews. The contents of the feedback should be documented in writing as a feedback presentation and afterwards made available as a copy to the assessed party.

3 Assessment report

In the assessment report the organisation which has been assessed is given a more detailed feedback of the strengths and improvement potentials detected in the assessment. To enable prompt derivation of

⁵ For example: If, in the project which has been assessed the role of the project manager is taken by an external service provider, he/she should be able to view the results.

process improvement actions, no more than four weeks should elapse between the conclusion of the assessment (the feedback presentation) and the distribution of the assessment report. The assessment report shall document in particular those points which led to a devaluation of the capability level. The devaluation of the capability level shall be explained by reference to the individual base practices and generic practices.

The assessment report shall fulfil the requirements listed in appendix A .

4 Validity of assessments and handling of software provided

4.1 Area of validity of the assessment results

Automotive SPICE® aims at performing project assessments. In these assessments the focus is always on one particular project. Neither the complete set of all projects in an organisation nor a statistically significant selection is investigated. It follows therefore that:

- As a general rule the assessment results are not applicable to the OU as a whole, the development location or the entire company.
- The assessment results can, however, be applied to similar projects of the organisational unit at the same location. Here the following criteria should be borne in mind:
 - Development locations: As a general rule, assessment results are not transferable from one location to another.
 - ECU Autosar domains: If at a large development location ECUs are developed for various Autosar domains, such as powertrain, chassis or body assessment results are transferable only to a limited degree, given the different development environments.
 - Distributed development: Where the development work on ECUs is distributed over several departments or several locations, the assessment results apply only to those locations or departments which have been assessed.
- The degree to which assessment results may be transferred will depend on various factors, including the process capability level and must be examined in each individual case.

4.2 Period of validity of assessment results

Assessment results have only a limited validity in terms of time. Experience has shown that they allow reliable conclusions to be drawn for 12 months regarding the project which has been assessed.

Changes within the project, such as, for example:

- the transfer of the development work to a different location
- a re-organisation in the organisation which has been assessed
- changes to the development processes, for example as the result of process improvement initiatives

can, however, affect significantly the relevance of the assessment results to individual processes even within 12 months. Such changes may cause the actual capability of the development process to be better or worse than indicated by the last assessment result.

On the other hand, where there is a high degree of project stability, the assessment results may permit reliable conclusions regarding the project to be drawn for longer than 12 months. For these reasons, the period of validity must always be considered by reference to the specific project circumstances.

4.3 Handling software provided in an assessment

The development of software provided by another party, or purchased from an external source, is not generally the subject of a project assessment. Assessment results therefore do not permit conclusions to be drawn regarding the development processes of such software.

5 Performing an assessment

The following rules should be observed when performing assessments:

5.1 The time-frame

There should be at least four weeks between agreement on an assessment and its execution.

5.2 Individuals involved in the assessment

- a. The AO ordering the assessment decides on the composition of the assessment team.
- b. In-house assessors in the organisation to be assessed can be considered when forming the assessment team. However, there is no obligation for them to be included and their inclusion requires a special agreement.
- c. Participation by observers on interviews:
 - i. In principle, observers can be present at an interview – e.g., observers from the process development department.
 - ii. The number of people taking part in the interview should be kept as small as possible.
 - iii. The interviews must not be impaired by observers, whether active or passive.
 - iv. The lead assessor decides whether observers may be present at the interviews and can exclude observers (in general or particular individuals) even during the course of the assessment.

5.3 Composition of the assessment team

- a. The interviews in the assessment should be carried out by at least two assessors.
- b. The assessors should be registered with the VDA in accordance with their intended role as Automotive SPICE® assessors.

6 Miscellaneous

The independence of the assessors should be ensured in order to avoid any conflict of interest. Consultancy services and subsequent assessment services must not be provided by the same organisation / person.

Appendix A: Recommendations for the assessment report

The assessment report should contain the following information:

1 Project and organisation

This section contains information about the assessed project and its organisation.

Item	Required information
Assessed Project	<ul style="list-style-type: none">- Project Name / description- Project Domain (e.g. Chassis Electronics, Body Electronics, Power Train, Interior ...)
Organisation	<ul style="list-style-type: none">- Company name- Organisational / Business unit- Assessed sites- Assessed Departments

2 Formal information about the assessment

This section contains formal information about the assessment.

Item	Required information
Assessment Period	<ul style="list-style-type: none">- The period during which the assessment was carried out
Sponsor	<ul style="list-style-type: none">- Name of the assessment sponsor
Contact Persons	<ul style="list-style-type: none">- Name of the contact persons
Evidence	<ul style="list-style-type: none">- Examined documents and other data sources
Distribution list	<ul style="list-style-type: none">- Distribution list of the report

3 Scope of the assessment

This section contains information about the assessment model being used and the assessed processes.

Item	Required information
Assessment Model	- Assessment model and version that has been used (e.g. Automotive SPICE PAM V2.4)
Assessed processes	- Justification of selection of the processes (e.g. HIS/VDA-scope and why e.g. processes has been not assessed) - Target level and highest assessed level for each process
Assessment process	- Used assessment process (e.g. VDA assessment process) incl. deviations if applicable

4 Participants of the assessment

This section contains information about the assessment team, the interview persons and other participants of the assessment.

Item	Required information
Lead assessor	- Name of the lead assessor - Lead assessor grade (e.g. Competent, Principal) - License number of Lead Assessor license (e.g. intacs) - Duration of validity of the assessor license
Co-Assessors	- Name of the Co-Assessor(s) - Co-Assessor(s) grade (e.g. Provisional, Competent, Principal) - License number of Co-Assessor(s) licenses (e.g. intacs) - Duration of validity of the assessor license
Interviewed Persons	- Names of interviewed individuals incl. - their role in the project - mapping to the processes for that they have been interviewed (Project manager e.g. could be interviewed for more than one process)
Observers (optional)	- Names of internal / external observers

5 Constraints

This section contains information about constraints which are influencing the assessment result.

Item	Required information
<p>Constraints (if applicable)</p>	<p>e.g.</p> <ul style="list-style-type: none"> - Somebody was not available (e.g. off, sick) - Separated development areas has been included via Video/WebEx (no on site assessment) - Tier2's has been not assessed - Upcoming reorganisation (e.g. spin off) within the project (validity of assessment results has to be questioned than) - Disclaimer (e.g. that the assessment results does not allow conclusions to the complete organisation or other departments of the organisation that has been not assessed) - Confidentiality constraints (e.g. Sponsor is OEM, assessed organisation is a supplier, and lead assessor is third-party → then the lead assessor cannot submit the evidence list/repository to the Sponsor (even if he would have to acc. to 15504-2) because of confidentiality issues. - Access to evidence may be subject to legal access rights (e.g. military projects) - Access to infrastructure and sites may be subject to legal access rights (e.g. military projects) - ...

6 Overview about the assessment results

This section contains the process capability and attribute profile, general strengths and weaknesses and general immediate actions.

Item	Required information
Process capability profile	- Determined capability level of each process
Process Profile	- Determined process attribute ratings of each process
General strengths and weaknesses	- List of general strengths and weaknesses
General immediate actions (if applicable)	- Proposals for general immediate actions if applicable

7 Process specific results and improvement actions

This section contains information about the results and determined improvement actions derived during the assessment.

Item	Required information
Findings	- Rating at practice level and findings for all practices not rated as “fully”
Improvement actions (if applicable)	- Proposals for improvement actions
Immediate actions (if applicable)	- Proposals for immediate actions if applicable

Appendix B: CMMI® / Automotive SPICE® Mapping⁶

1 Introduction

Objective

The objective of the following mapping between CMMI® and Automotive SPICE® is to permit for a development project a **general trend forecast** of process maturity according to Automotive SPICE, based on the result of a present CMMI appraisal. It is not intended to cover all the details and characteristics of the individual standards. The mapping is based on the models CMMI-DEV V1.2 and Automotive SPICE PAM V2.4. The CMMI process areas of maturity levels 4 and 5 are not taken into account.

Significance of the mapping and comparability of the two models

Within the framework of this investigation a quantitative comparison was made between the two models. The mapping which was undertaken does not in any way permit the "automatic" translation of the result of a CMMI appraisal into Automotive SPICE maturity levels. In each individual case, a translation must be carried out by an expert with thorough knowledge of both models, based on the individual findings. The reason for this is that there are many differences in detail between the models.

If it is desired to increase the significance of the result of a CMMI appraisal in terms of Automotive SPICE, additional questions regarding Automotive SPICE must be raised as the CMMI appraisal is being carried out. Whether this is worth the extra work, compared with a separate Automotive SPICE assessment must be determined in each individual case.

A significant reason for the differences is that, as a general rule, CMMI is formulated at a higher abstraction level in terms of its essential model texts. The base practices of Automotive SPICE can be related to sub-practices or other informative elements of CMMI only to a certain extent - that is, rating-relevant elements in Automotive SPICE are not always directly equivalent to rating-relevant elements of CMMI.

⁶ The term "CMMI" is a registered service mark of Carnegie Mellon University. The term "Automotive SPICE" is a registered trademark of the VDA - Verband der Automobilindustrie.

It is frequently impossible to relate CMMI practices and Automotive SPICE base practices directly and unambiguously to each other. Instead, they stand in an n:m relationship to each other. Because of this, several CMMI practices can make contributions to an Automotive SPICE base practice and a single CMMI practice can make contributions to several Automotive SPICE base practices. However, these contributions are practically impossible to quantify to such an extent that levels of fulfilment can be deduced.

A further difficulty is the fact that, generally speaking, appraisal results do not have the level of detailing required to permit a reliable alignment between the models.

2 Mapping guidelines

2.1 Overview covering Level 1

The following table shows the CMMI model elements corresponding to the Automotive SPICE processes and gives an approximate indication of the coverage of these processes by CMMI.

Automotive SPICE	CMMI	Degree of Coverage
ACQ.4 (HIS)	SAM	4
SUP.1 (HIS)	PPQA	4
SUP.2 (FORD)	VER, GP 2.7	4
SUP.4 (FORD)	RD SG1, GP 2.7	3
SUP.8 (HIS)	CM	4
SUP.9 (HIS)	PMC SG2	2
SUP.10 (HIS)	CM SG2, REQM SP1.3	3
MAN.3 (HIS)	PP, PMC	4
MAN.5 (FORD)	PP, PMC, RSKM	4
ENG.2 (HIS)	RD, VER, REQM SP 1.4	3
ENG.3 (HIS)	TS SG1+2, VER, REQM SP1.4	3
ENG.4 (HIS)	RD, VER, REQM SP 1.4	3
ENG.5 (HIS)	TS SG1+2, VER, REQM SP1.4	3
ENG.6 (HIS)	TS SG3, VER, REQM SP1.4	3
ENG.7 (HIS)	PI, VER, REQM SP1.4	3
ENG.8 (HIS)	VER, VAL, REQM SP1.4	3
ENG.9 (HIS)	PI, VER, REQM SP1.4	3
ENG.10 (HIS)	VER, VAL, REQM SP1.4	3
SPL.2 (FORD)	PI, CM	4
REU.2 (FORD)	-	1

Key to table:

1 = no coverage, 2 = significant gaps, 3 = majority of aspects, 4 = in all significant aspects

(HIS) This process is part of the HIS scope.

(FORD) This process is interrogated by FORD beyond the scope of the HIS.

Automotive SPICE model elements considered:

ACQ.4	Supplier Monitoring
ENG.2	System Requirements Analysis
ENG.3	System Architectural Design
ENG.4	Software Requirements Analysis
ENG.5	Software Design
ENG.6	Software Construction
ENG.7	Software Integration
ENG.8	Software Testing
ENG.9	System Integration
ENG.10	System Testing
MAN.3	Project Management
MAN.5	Risk Management
REU.2	Reuse Program Management
SPL.2	Product Release
SUP.1	Quality Assurance
SUP.2	Verification
SUP.4	Joint Review
SUP.8	Configuration Management
SUP.9	Problem Resolution Management
SUP.10	Change Request Management

CMMI model elements considered:

CM	Configuration Management
GP	Generic Practice
GP 2.7	Identify and Involve Relevant Stakeholders
IPM	Integrated Project Management
OPD	Organisational Process Definition
PI	Product Integration
PP	Project Planning
PMC	Project Monitoring and Control
PPQA	Process & Product Quality Assurance
RD	Requirements Development
REQM	Requirements Management
RSKM	Risk Management
SAM	Supplier Agreement Management
SG	Specific Goal
SP	Specific Practice
TS	Technical Solution
VAL	Validation
VER	Verification

2.2 Details regarding Level 1

2.2.1 ACQ.4 Supplier Monitoring

In CMMI the assessment of Automotive SPICE ACQ.4 "Supplier Monitoring" is based on the process area:

- SAM "Supplier Agreement Management"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: A check should also be made on the implementation of the interface between supplier and customer

2.2.2 SUP.1 Quality Assurance

In CMMI the assessment of Automotive SPICE SUP.1 "Quality Assurance" is based on the process area:

- PPQA "Process & Product Quality Assurance"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Automotive SPICE requires the organisational independence of quality assurance. Against this, the CMMI term contains the expression "objectively evaluate". While this is a requirement for independent reporting, it does not cover full organisational independence.

2.2.3 SUP.2 Verification

In CMMI the assessment of Automotive SPICE SUP.2 "Verification" is based on the process areas:

- VER "Verification" and
- GP2.7 "Identify and involve relevant stakeholders"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: With CMMI, communication of the verification results must be carried out via GP 2.7.

2.2.4 SUP.4 Joint Review

In CMMI the assessment of Automotive SPICE SUP.4 "Joint Review" is based on the process areas:

- RD "Requirements Development"
- in parts on REQM "Requirements Management"
- PMC "Project Monitoring and Control"
- IPM-SG2 "Integrated Project Management, Specific Goal 2" and
- GP 2.7 "Identify and involve relevant stakeholders"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: CMMI has no special process area for such reviews. Even so, many of the required Automotive SPICE practices are present in CMMI, though they are distributed over several process areas. In CMMI the requirement "ensure development of a product that satisfies the stakeholders" is contained mainly in the process area RD (and, to some extent, also via REQM). In CMMI the requirement "maintain a common understanding with the stakeholders of the progress against the objectives of the agreement" is covered mainly by the project management process areas PMC and IPM SG2 and, in a general framework, by GP 2.7.

2.2.5 SUP.8 Configuration Management

In CMMI the assessment of Automotive SPICE SUP.8 "Configuration Management" is based on the process area:

- CM "Configuration management"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.2.6 SUP.9 Problem Resolution Management

In CMMI the assessment of Automotive SPICE SUP.9 "Problem resolution management" is based on the process area:

- PMC SG2 "Project Monitoring and Control", Specific Goal 2".

Assessment: Coverage has significant gaps.
(Degree of coverage = 2)

Notes: To get an Automotive SPICE result from a CMMI appraisal result, a check must also be made in the project to determine whether a strategy and a procedure have been implemented for the management of problem resolution.

2.2.7 SUP.10 Change Request Management

In CMMI the assessment of Automotive SPICE SUP.10 "Change management" is based on the process areas:

- CM SG 2 "Configuration Management", Specific Goal 2 "Track and control changes" and
- REQM SP 1.3 "Requirements Management", Specific Practice 1.3 "Manage requirements changes".

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: In CMMI change requests covering requirements are handled via REQM and changes to other configuration items are handled via CM. Automotive SPICE contains a series of very specific requirements which have no equivalents in CMMI – for examples, inter-dependencies between change requests.

2.2.8 MAN.3 Project management

In CMMI the assessment of Automotive SPICE MAN.3 "Project management" is based on the process areas:

- PP "Project Planning" and
- PMC "Project Monitoring and Control"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both process areas (PP and PMC) contribute to MAN.3 to the same degree.

2.2.9 MAN.5 Risk Management

In CMMI the assessment of Automotive SPICE MAN.5 "Risk management" is based on the process areas:

- PP "Project Planning",
- PMC "Project Monitoring and Control" and
- RSKM "Risk Management"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: PP and PMC determine the handling of project risks but are not sufficient alone for coverage. RSKM requires an extended risk management, potentially with a scope extending beyond the project.

2.2.10 ENG.2 System Requirements Analysis and ENG.4, Software Requirements Analysis

In CMMI the assessment of Automotive SPICE ENG.2 "System requirements analysis" and ENG.4 "Software requirements analysis" is based on the process areas:

- RD "Requirements Development"
- VER "Verification" and
- REQM SP 1.4 "Maintain bidirectional traceability of requirements"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: CMMI does not make any differentiation between systems engineering and software engineering. It is formulated generally for all engineering applications. In CMMI, REQM SP 1.4 "Maintain bi-directional traceability of requirements" is less developed than in Automotive SPICE. In CMMI the verifiability of requirements must be ensured via RD SG3 "Analyse and validate requirements".

2.2.11 ENG.3 System Architectural design and ENG.5, Software design

In CMMI the assessment of Automotive SPICE ENG.3 "System architectural design" and ENG.5 "Software design" is based on the process areas:

- TS SG1 and SG2 "Technical Solution", Specific Goal 1 "Select solutions for product components" and Specific Goal 2 "Develop designs"
- VER "Verification" and
- REQM SP 1.4 "Maintain bidirectional traceability of requirements"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: CMMI does not differentiate between systems engineering and software engineering. It is formulated generally for all engineering applications. In CMMI, REQM SP 1.4 "Maintain bi-directional traceability of requirements" is less developed than in Automotive SPICE. In CMMI design verification must be ensured via TS in association with VER.

2.2.12 ENG.6 Software construction

In CMMI the assessment of Automotive SPICE ENG.6 "Software construction" is based on the process areas:

- TS SG3 "Technical Solution", Specific Goal 3 "Implement the product design"
- VER "Verification" and
- REQM SP 1.4 "Maintain bidirectional traceability of requirements"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: In CMMI REQM SP 1.4 is less developed than in Automotive SPICE. It is not explicitly required for test cases. In CMMI, verification of the software modules must be ensured via VER.

2.2.13 ENG.7 Software integration and ENG.9 System integration

In CMMI the assessment of Automotive SPICE ENG.7 and ENG.9 "Software integration" is based on the process areas:

- PI "Product Integration",
- VER "Verification" and
- REQM SP 1.4 "Maintain bidirectional traceability of requirements"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: CMMI does not differentiate between systems engineering and software engineering. It is formulated generally for all engineering applications. In CMMI REQM SP 1.4 is less developed than in Automotive SPICE. It is not explicitly required for test cases. To arrive at an Automotive SPICE assessment from a CMMI appraisal result, a check must also be made in the project to determine whether the implementation of VER covers regression tests.

2.2.14 ENG.8 Software testing and ENG.10 System testing

In CMMI the assessment of Automotive SPICE ENG.8 "Software testing" and ENG.10 "System testing" is based on the process areas:

- VER "Verification"
- VAL "Validation" and
- REQM SP 1.4 "Maintain bidirectional traceability of requirements"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: CMMI does not differentiate between systems engineering and software engineering. It is formulated generally for all engineering applications. In CMMI REQM SP 1.4 "Maintain bi-directional traceability of requirements" is less developed than in Automotive SPICE. It is not explicitly required for test cases. To arrive at an Automotive SPICE assessment from a CMMI appraisal result, a check must also be made in the project to determine whether the implementation of VER covers regression tests.

2.2.15 SPL.2 Product release

In CMMI the assessment of Automotive SPICE SPL.2 "Product release" is based on the process areas:

- PI "Product Integration" and
- CM "Configuration Management"

Assessment: Coverage is achieved in the majority of aspects.
(Degree of coverage = 3)

Notes: Here, Automotive SPICE contains a series of specific requirements which have no equivalent in CMMI. These include classification and numbering systems for releases, as well as specifying release media.

2.2.16 REU.2 Reuse program management

REU.2 is not covered by CMMI.

Assessment: No coverage is provided.
(Degree of coverage = 1)

2.3 Overview covering Level 2: "Controlled Process"

The following generic practices must be assessed individually for each process.

The table shows the alignment of generic practices in Automotive SPICE with the corresponding generic practices in CMMI. It provides a rough indication of how good the coverage provided by CMMI is.

Automotive SPICE	CMMI	Degree of coverage
Process attribute 2.1 – Performance management attribute		
GP 2.1.1 Identify the objectives for the performance of the process	GP 2.2 Plan the process	4
GP 2.1.2 Plan and monitor the performance of the process to fulfil the identified objectives	GP 2.2 Plan the process GP 2.8 Monitor and control the process	4
GP 2.1.3 Adjust the performance of the process	GP 2.2 Plan the process GP 2.8 Monitor and control the process GP 2.10 Review status with higher management	4
GP 2.1.4 Define the responsibilities and authorities for the performance of the process	GP 2.4 Assign responsibility	4
GP 2.1.5 Identify and make available resources to perform the process according to the plan	GP 2.3 Provide resources	4
GP 2.1.6 Manage the interfaces between the involved parties	GP 2.7 Identify and involve relevant stakeholders	4
Process attribute 2.2 – Work product attribute management		
GP 2.2.1 Define the requirements for the work products	GP 2.2 Plan the process	4
GP 2.2.2 Define the requirements for documentation and control of the work products	GP 2.6 Manage configurations	4
GP 2.2.3 Identify, document and control the work products	GP 2.6 Manage configurations	4
GP 2.2.4 Review and adjust work products to meet the defined requirements	GP 2.8 Monitor and control the process GP 2.9 Objectively evaluate adherence VER SG2 Carry out peer reviews	4

2.4 Details regarding Level 2: "Controlled Process"

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

In CMMI the assessment of Automotive SPICE GP 2.1.1 is based on:

- GP 2.2 "Plan the process"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.2 GP 2.1.2 Plan and monitor the performance of the process to fulfil the identified objectives

In CMMI the assessment Automotive SPICE GP 2.1.2 is based on:

- GP 2.2 "Plan the process" and
- GP 2.8 "Monitor and control the process"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both generic practices (GP 2.2 and GP 2.8) contribute to GP 2.1.2 to the same degree.

2.4.3 GP 2.1.3 Adjust the performance of the process

In CMMI the assessment of Automotive SPICE GP 2.1.3 is based on:

- GP 2.2 "Plan the process"
- GP 2.8 "Monitor and control the process" and
- GP 2.10 "Review status with higher management"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: All generic practices (GP 2.2, GP 2.8 and GP 2.10) contribute to the same degree to GP 2.1.3.

2.4.4 GP 2.1.4 Define the responsibilities and authorities for the performance of the process

In CMMI the assessment of Automotive SPICE GP 2.1.4 is based on:

- GP 2.4 "Assign responsibility"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

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

In CMMI the assessment of Automotive SPICE GP 2.1.5 is based on:

- GP 2.3 "Provide resources"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.6 GP 2.1.6 Manage the interfaces between the involved parties

In CMMI the assessment of SPICE GP 2.1.6 is based on:

- GP 2.7 "Identify and involve relevant stakeholders"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.7 GP 2.2.1 Define the requirements for the work products

In CMMI the assessment of Automotive SPICE GP 2.2.1 is based on:

- GP 2.2 "Plan the process"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.8 GP 2.2.2 Define the requirements for documentation and control of the work products

In CMMI the assessment of Automotive SPICE GP 2.2.2 is based on:

- GP 2.6 "Manage configurations"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.9 GP 2.2.3 Identify, document and control the work products

In CMMI the assessment of Automotive SPICE GP 2.2.3 is based on:

- GP 2.6 "Manage configurations"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.4.10 GP 2.2.4 Review and adjust work products to meet the defined requirements

In CMMI the assessment of Automotive SPICE GP 2.2.4 is based on:

- GP 2.8 "Monitor and control the process"
- GP 2.9 "Objectively evaluate adherence" and
- VER SG2 "Verification", specific goal 2 "Carry out peer reviews"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both generic CMMI practices (GP 2.8 and GP 2.9) contribute to GP 2.2.4 to the same degree. Further review activities are covered via VER SG2.

2.5 Overview covering Level 3: "Established Process"

The following generic practices must be assessed individually for each process.

The table shows the alignment of generic practices in Automotive SPICE with the corresponding generic practices in CMMI. It provides a rough indication of how good the coverage provided by CMMI is.

Automotive SPICE	CMMI	Degree of coverage
Process attribute 3.1 – Process definition attribute		
GP 3.1.1 Define the standard process that will support the deployment of the defined process	GP 3.1 Establish a defined process	4
GP 3.1.2 Determine the sequence and interaction between processes so that they work as an integrated system of processes	GP 3.1 Establish a defined process	4
GP 3.1.3 Identify the roles and competencies for performing the standard process	GP 3.1 Establish a defined process	4
GP 3.1.4 Identify the required infrastructure and work environment for performing the standard process	OPD SP 1.6 Establish work environment standards. <i>in association with</i> GP 3.1 Establish a defined process	4
GP 3.1.5 Determine suitable methods to monitor the effectiveness and suitability of the standard process	IPM SP 1.6 Contribute work results, measurement data and documented experience to the process assets of the organisation. <i>in association with</i> GP 3.1 Establish a defined process	4
Process attribute 3.2 – Process deployment attribute		
GP 3.2.1 Deploy a defined process that satisfies the context specific requirements of the use of the standard process.	GP 3.1 Establish a defined process	4
GP 3.2.2 Assign and communicate roles, responsibilities and authorities for performing the defined process	GP 2.4 Assign responsibility. <i>in association with</i> GP 3.1 Establish a defined process	4

GP 3.2.3 Ensure necessary competencies for performing the defined process	GP 2.5 Train people <i>in association with</i> GP 3.1 Establish a defined process	4
GP 3.2.4 Provide resources and information to support the performance of the defined process	GP 2.3 Provide resources <i>in association with</i> GP 3.1 Establish a defined process	4
GP 3.2.5 Provide adequate process infrastructure to support the performance of the defined process	IPM SP 1.3 Establish and maintain the work environment of the project, based on the organisation's standards for work environments. <i>in association with</i> GP 3.1 Establish a defined process.	4
GP 3.2.6 Collect and analyse data about performance of the process to demonstrate its suitability and effectiveness	GP 3.2 Collect improvement information. <i>and</i> IPM SP 1.6 Contribute work results, measurement data and documented experience to the process assets of the organisation.	4

However, the evaluation of the project area IPM "Integrated project management" is not carried out until an appraisal is made to validate CMMI maturity level 5. This means that the relevant information for evaluating the generic practices GP 3.1.5, 3.2.5 and 3.2.6 are generally not available for an appraisal before CMMI maturity level 3.

2.6 Details regarding Level 3: "Established Process"

2.6.1 GP 3.1.1 Define the standard process

In CMMI the assessment of Automotive SPICE GP 3.1.1 is based on:

- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.6.2 GP 3.1.2 Determine the sequence and interaction

In CMMI the assessment of Automotive SPICE GP 3.1.2 is based on:

- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.6.3 GP 3.1.3 Identify the roles and competencies

In CMMI the assessment of Automotive SPICE GP 3.1.3 is based on:

- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.6.4 GP 3.1.4 Identify the required infrastructure and work environment

In CMMI the assessment of Automotive SPICE GP 3.1.4 is based on:

- OPD SP 1.6 "Establish work environment standards" and
- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: The generic practice GP 3.1 and the specific practice OPD SP1.6 contribute to GP 3.1.4 to an equal degree.

2.6.5 GP 3.1.5 Determine suitable methods

In CMMI the assessment of Automotive SPICE GP 3.1.5 is based on:

- IPM SP 1.6 "Integrated project management", specific practice 1.6 "Contribute to the organisation's process assets" and
- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: The generic practice GP 3.1 and the specific practice IPM SP1.6 contribute to GP 3.1.5 to the same degree.

2.6.6 GP 3.2.1 Deploy a defined process

In CMMI the assessment of Automotive SPICE GP 3.2.1 is based on:

- GP 3.1 "Establish a defined process"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

2.6.7 GP 3.2.2, Assign and communicate roles, responsibilities and authorities

In CMMI the assessment of Automotive SPICE GP 3.2.2 is based on:

- GP 2.4 "Assign responsibility" and
- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both generic practices (GP 2.4 and GP 3.1) contribute to GP 3.2.2 to the same degree.

2.6.8 GP 3.2.3 Ensure necessary competencies

In CMMI the assessment of Automotive SPICE GP 3.2.3 is based on:

- GP 2.5 "Train people" and
- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both generic practices (GP 2.5 and GP 3.1) contribute to GP 3.2.3 to the same degree.

2.6.9 GP 3.2.4 Provide resources and information

In CMMI the assessment of Automotive SPICE GP 3.2.4 is based on:

- GP 2.3 "Provide resources" and
- GP 3.1 "Establish a defined process "

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: Both generic practices (GP 2.3 and GP 3.1) contribute to GP 3.2.4 to the same degree.

2.6.10 GP 3.2.5 Provide adequate process infrastructure

In CMMI the assessment of Automotive SPICE GP 3.2.5 is based on:

- IPM SP 1.3 "Integrated project management", specific practice 1.3 "Establish and maintain the work environment of the project, based on the organisation's standards for work environments" and
- GP 3.1 "Establish a defined process"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: The generic practice GP 3.1 and the specific practice IPM SP1.3 contribute to GP 3.2.5 to the same degree.

2.6.11 GP 3.2.6 Collect and analyse data on the performance of the process

In CMMI the assessment of Automotive SPICE GP 3.2.6 is based on:

- IPM SP 1.6 "Integrated project management", specific practice 1.6 "Contribute work results, measurement data and documented experience to the process assets of the organisation" and
- GP 3.2 "Collect improvement information"

Assessment: Coverage is complete in all significant respects.
(Degree of coverage = 4)

Notes: The generic practice GP 3.2 and the specific practice IPM SP1.6 contribute to GP 3.2.6 to the same degree.

3 Examples

3.1 Example of the result of a CMMI appraisal (SCAMPI A)

This example of an appraisal assesses the seven process areas in CMMI maturity level 2. Firstly, a detailed assessment is made at the level of the individual practices, using colour codes and the evaluation grades NI, PI, LI and FI (similar to the procedure in SPICE). Thereafter those goals are assessed which are more or less comparable with the process attributes in Automotive SPICE.

In order for a goal to be "satisfied" two alternative conditions apply. Either there are no weaknesses in terms of this goal, or all the associated practices must have been assessed as "LI" as a minimum and the aggregated weaknesses in regard to the goal are not so significant that they jeopardize the achievement of the goal.






With such a result no process would achieve an Automotive SPICE Level 3 (because the CMMI appraisal was restricted to maturity level 2). It is not possible to draw any conclusions regarding the Automotive SPICE engineering processes because the CMMI equivalents were not part of the investigation.

It is very probable that ACQ.4 (supplier monitoring), MAN.3 (project management), SUP.1 (quality assurance) and SUP.8 (configuration management) would achieve an Automotive SPICE level 2, because the processes in question and also the generic practices of level 2 are well covered by their CMMI equivalents.

It is not possible to decide whether SUP.9 (problem-solving) is implemented (in this connection it would have been necessary to ask additional, Automotive SPICE-specific questions). The result of "MA" does not influence the Automotive SPICE result, because it has no significance in the extent of the Automotive SPICE process under examination here.

PA →	REQM	PP	PMC	SAM	MA	PPQA	CM
Specific Goal 1	S	S	S	S	U	S	S
SP 1.1	FI	FI	LI	FI	PI	FI	FI
SP 1.2	FI	FI	FI	FI	LI	FI	FI
SP 1.3	FI	FI	FI	LI	PI		LI
SP 1.4	FI	FI	FI		LI		
SP 1.5	LI		LI				
SP 1.6			FI				
SP 1.7			FI				
Specific Goal 2		S	S	S	U	S	S
SP 2.1		FI	FI	FI	PI	FI	LI
SP 2.2		FI	LI	FI	LI	FI	LI
SP 2.3		FI	FI	FI	PI		
SP 2.4		FI		FI	LI		
SP 2.5		FI		FI			
SP 2.6		FI					
SP 2.7		FI					
Specific Goal 3		S					S
SP 3.1		FI					FI
SP 3.2		FI					LI
SP 3.3		FI					
SP 3.4							
SP 3.5							
Generic Goal 2	S	S	S	S	U	S	S
GP 2.1	FI	FI	FI	FI	NI	FI	FI
GP 2.2	LI	FI	FI	FI	LI	FI	FI
GP 2.3	FI	FI	FI	FI	FI	FI	FI
GP 2.4	FI	LI	LI	FI	LI	FI	FI
GP 2.5	FI	FI	FI	FI	FI	FI	FI
GP 2.6	FI	FI	FI	FI	FI	FI	FI
GP 2.7	FI	FI	FI	FI	LI	FI	FI
GP 2.8	FI	FI	LI	FI	FI	FI	FI
GP 2.9	FI	FI	FI	FI	LI	FI	FI
GP 2.10	FI	FI	FI	FI	NI	FI	FI
PA →	REQM	PP	PMC	SAM	MA	PPQA	CM

Key:

Assessment of goals	Assessment of practices
 = Satisfied (S)	 = Not Implemented (NI)
 = Unsatisfied (U)	 = Partially Implemented (PI)
	 = Largely Implemented (LI)
	 = Fully Implemented (FI)

3.2 Example of the result of a CMMI appraisal (SCAMPI B/C)

In this example of an appraisal a number of engineering processes have been assessed in addition to the seven process areas of CMMI maturity level 2). With these two appraisal methods only three investigation grades are used, represented by traffic-light colours. These methods must not be used to assess goals.

PA	REQM	PP	PMC	SAM	MA	PPQA	CM	RD	TS	PI	VER	VAL
SP 1.1	Green	Green	Green	Green	Red	Red	Red	Green	Green	Green	Green	Green
SP 1.2	Green	Green	Green	Green	Red	Yellow	Red	Green	Green	Green	Green	Green
SP 1.3	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
SP 1.4	Red	Green	Green	Grey	Red	Green	Green	Grey	Grey	Grey	Grey	Grey
SP 1.5	Green	Grey	Green	Grey	Green	Green	Green	Grey	Grey	Grey	Grey	Grey
SP 1.6	Green	Green	Red	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey
SP 1.7	Green	Green	Yellow	Green	Green	Green	Green	Grey	Grey	Grey	Grey	Grey
SP 2.1	Green	Green	Green	Yellow	Red	Red	Yellow	Green	Yellow	Yellow	Green	Green
SP 2.2	Green	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Yellow	Green
SP 2.3	Green	Green	Green	Red	Red	Green	Green	Green	Yellow	Green	Red	Green
SP 2.4	Green	Green	Green	Green	Red	Green	Green	Grey	Green	Green	Green	Green
SP 2.5	Green	Green	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green
SP 2.6	Green	Green	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green
SP 2.7	Green	Green	Green	Green	Green	Green	Green	Grey	Green	Green	Green	Green
SP 3.1	Green	Green	Green	Green	Green	Green	Yellow	nr	Green	Yellow	Green	Green
SP 3.2	Green	Green	Green	Green	Green	Green	Yellow	nr	Green	Green	Green	Green
SP 3.3	Green	Green	Green	Green	Green	Green	Green	nr	Green	Green	Green	Green
SP 3.4	Green	Green	Green	Green	Green	Green	Green	nr	Green	Green	Green	Green
SP 3.5	Green	Green	Green	Green	Green	Green	Green	nr	Green	Green	Green	Green
GP 2.1	Yellow	Yellow	Yellow	Yellow	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
GP 2.2	Yellow	Green	Green	Red	Red	Red	Red	Red	Yellow	Yellow	Green	Green
GP 2.3	Green	Green	Green	Red	Green	Green	Green	Green	Red	Red	Red	Red
GP 2.4	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
GP 2.5	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GP 2.6	Red	Yellow	Yellow	Red	Yellow	Red	Red	Red	Yellow	Yellow	Green	Green
GP 2.7	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
GP 2.8	Green	Green	Green	Red	Red	Red	Red	Red	Red	Red	Green	Green
GP 2.9	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
GP 2.10	Green	Green	Green	Red	Yellow	Red	Red	Green	Green	Green	Green	Green
GP 3.1	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green
GP 3.2	Red	Green	Green	Green	Red	Red	Green	Red	Green	Green	Red	Red

Key:
 Green: Practice is implemented in accordance with CMMI
 Yellow: Significant weaknesses but it is not clear whether they jeopardize the goal
 Red: Not in accordance with CMMI
 Grey: Practice not included in the CMMI model
 "nr": Not rated

There is a fairly high probability that:

- no process would achieve an Automotive SPICE level 3, because there appear to be severe weaknesses in the generic practices of levels 2 and 3
- no process, with the possible exception of MAN.3 (Project management) would achieve an Automotive SPICE Level 2. With MAN.3 it might be possible to achieve level 2, because the weaknesses in GP 2.9 in Automotive SPICE can be compensated for by other practices (see the table for level 2). However, this would require that the weaknesses are judged to be less serious at the progress reviews and milestone reviews (SP 1.6 and 1.7) – for example, if there are indications that the weaknesses refer to projects of a certain project category and the project under examination is not included in that category.
- MAN.3 would achieve an Automotive SPICE level 1, if the weaknesses are not seen as excessive at the progress reviews and milestone reviews (SP 1.6 and 1.7), so that an "L" can still be achieved at PA 1.1.
- SUP.1 (Quality assurance) and SUP.8 (Configuration management) would achieve an Automotive SPICE Level 0 because there are too many weaknesses in the corresponding processes PPQA and CM
- ACQ.4 would achieve a level 0.

Without putting additional Automotive SPICE-specific questions it is not possible to decide whether:

- the engineering processes achieve an Automotive SPICE Level 1
- SUP.9 (Problem-solving) reaches an Automotive SPICE Level > 0 (SUP.9 is not well covered by CMMI and the relevant Automotive SPICE practices must be interrogated separately).

Quality management in the automotive industry

The current position regarding VDA publications covering quality management in the automotive industry (QAI) is shown in the Internet under <http://www.vda-qmc.de>.

You may also order via this home page.

NOTE:

The English edition of the process assessment model Automotive SPICE® can be obtained free of charge via <http://www.automotivespice.com>.

The German edition of the process assessment model Automotive SPICE® can be obtained free of charge via <http://www.vda-qmc.de>.

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