VDA

4

Quality Management in the Automotive Industry

Quality Assurance prior to Serial Application

Part 3

Project Planning

Table of contents

1st Edition 1998

Quality Assurance prior to Serial Application

Project Planning

1st Edition 1998

Verband der Automobilindustrie e.V. (VDA)

Liability exclusion

Volumes of the VDA publications „Quality Management in the Automotive Industry“ are guidelines available for anyone to use. It is the responsibility of the person using the guidelines to ensure their correct use in each specific case.

They take into account state of the art technology, current at the time of issue. By using the VDA guidelines, nobody is relieved of the responsibility for their own actions. Each person acts, in this respect, at their own risk. Liability by VDA, and those persons involved in issuing VDA guidelines, is hereby excluded.

If during the use of VDA guidelines, errors or the possibility of misinterpretation are found, it is requested that these be notified to the VDA immediately, so that any possible faults can be corrected.

Referenced standards

The extracts from standards identified with their DIN number and issue date are reproduced with the permission of the DIN Deutsches Institut für Normung e.V. (German Institute for Standardization). The version with the latest issue date isdefinitive for the use of the standard, which can be attained from the publishers Beuth Verlag GmbH, 10772 Berlin.

Copyright

ISSN 0943-9412

Online production:
VDA- QMC
D-60325 Frankfurt am Main, Lindenstraße 5

Foreword

With the second edition of Volume 4 of the VDA publications „Quality Management in the Automotive Industry„ in 1986, essential methods of quality assurance prior to serial application were already described for the first time.

Quality work in the automotive industry has strongly decentralized, extended to all areas of a company and is carried out to a large extent simultaneously (Simultaneous Engineering), especially in the development phase. Furthermore, additional methods have come into practice, which are comprehensively described in Volume 4, Part 1.

The present Volume 4, Part 3 represents a supplement and extension to this, by placing focus on the continuous presentation of a project for new products and processes. The aim of this being to systematically and early prepare and plan all measures necessary to achieve a preformance that satisfies the customer.

Suggestions for this volume were also obtained from the already published procedures of European and American car manufacturers. Especially the procedures of the "Advanced Product Quality Planning" (APQP), as described by Chrysler, Ford and General Motors, have been considered.

We would like to thank all the companies and their employees for their help with this publication, as well as the many individual suggestions from the circle of involved authors. The following companies were involved:

BMW AG, Munich
Robert Bosch GmbH, Stuttgart
Daimler-Benz AG, Stuttgart
Johnson Control GmbH, Burscheid
Merten Qualitätsmanagement International GmbH, Schwechat
Steyr-Daimler-Puch Fahrzeugtechnik AG & Co KG, Graz
Mannesmann VDO AG, Babenhausen
Volkswagen AG, Wolfsburg

Frankfurt/Main in April 1998

VERBAND DER AUTOMOBILINDUSTRIE E.V. (VDA)

List of Contents **Page**

1 Introduction

1.1 Purpose

The present VDA Volume shall be a common guideline and aid for car manufacturers, as well as their internal and external suppliers, so that product and process development steps can be established to satisfy the customer expectations and further requirements.

The hitherto held opinion that the factors quality, cost and time exclusively negatively influence each other, is replaced by the realization that a high quality development and production process also leads to a reduction in expenditures of the other two factors (Figure 1-1).

This is expressed in the closer examination of the overall process from the product idea through to the serial application.

By increasing the process quality, a more effective material and information flow and reduced expenditure is achieved. This inevitably results in a reduction of development and supply time.

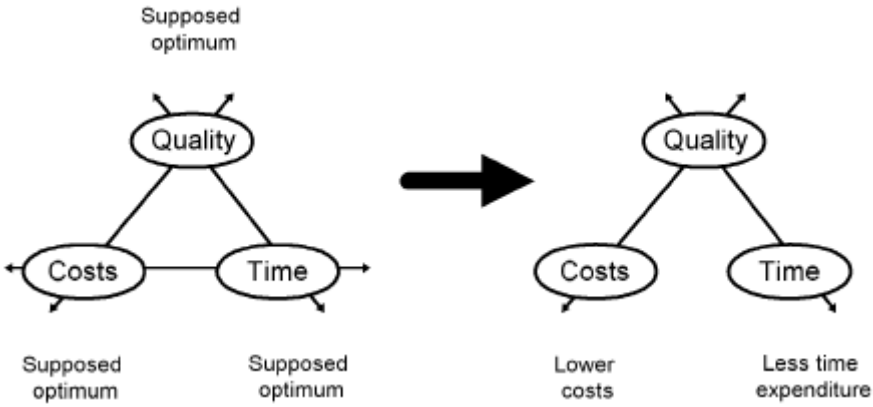


Figure 1-1: Customer Expectations Factors

The authors of this publication are convinced that if the described procedures are consistently applied, an improvement of the product and information-related processes will be achieved. This leads to advantages for both customers and suppliers.

1.2 Structure of the Volume

Within the descriptions of the volume, the term „must„ is used as follows:

- "must, has/have, is to be": the procedure is to be applied,
- with all other formulations, the procedures – as far as necessary – are also to be applied; alternative procedures which serve the same purpose may also be used.

The volume incorporates the basic course of a project.

The flow chart (Figure 2-1) gives an overall summary of the task fields to be worked through and the results to be reviewed during the course of the project.

The relationship to other VDA Volumes is shown in Appendix 2.

Task Fields

The task fields clarify the basic activities which are carried out during project processing. The overlap of the individual task fields shows the basic necessary Simultaneous Engineering Process of a product and process development.

Milestones

The milestones represent checkpoints during the processing of the task fields.

The activities laid down in the checklists are to be finished at each of the milestones (see Figure 1-2).

At these checkpoints, the fulfillment of the set work results is checked. The results are prerequisite for the release of the subsequent tasks.

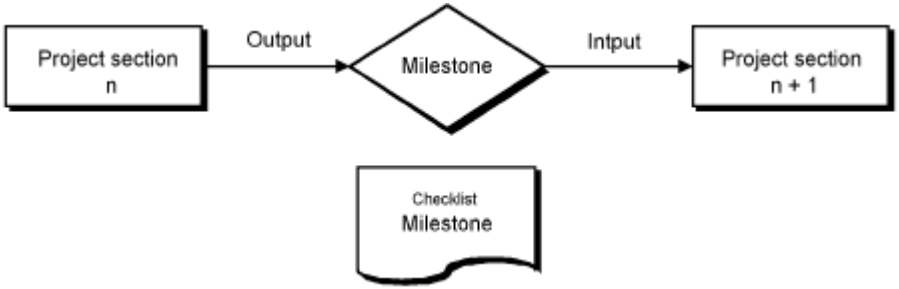


Figure 1-2: Milestones/Checklists

Checklists

Each milestone has a corresponding checklist. It gives a summary of the results which should be available at the checkpoint.

1.3 Important Prerequisites

Targets and Requirements of the Project

Establishing the targets must take place at the beginning of the project. The project plan is to be derived from this.

Interdisciplinary Planning

All parties participating in the overall process (customers, suppliers, sub-suppliers) have to be involved in the establishment of the flow chart for a particular project at an early stage. Thereby, it is guaranteed that all required steps according to the planning (reviews) can be achieved. A permanent coordination between the partners, orientated to the milestones, is required. Coordination between the partners is also indispensable with regards to necessary changes in the project.

Support through Management and Provision of the Resources

In order to work through the task fields shown in the flow chart and to achieve the results required for the milestones, the consent and active support of the Management is an absolute precondition for the realization of the contents. This applies especially during appropriation of the required resources for the implementation of elements of a project plan derived from this volume.

Knowledge and Skills

Comprehensive and continual employee qualification has to be carried out independent of the contents of this volume. Employee knowledge makes it possible to satisfy the requirements resulting from customer expectations.

Communication Paths

Communication paths (Meetings, video conferences or other means of coordination) between all teams must be provided for the success of the project.

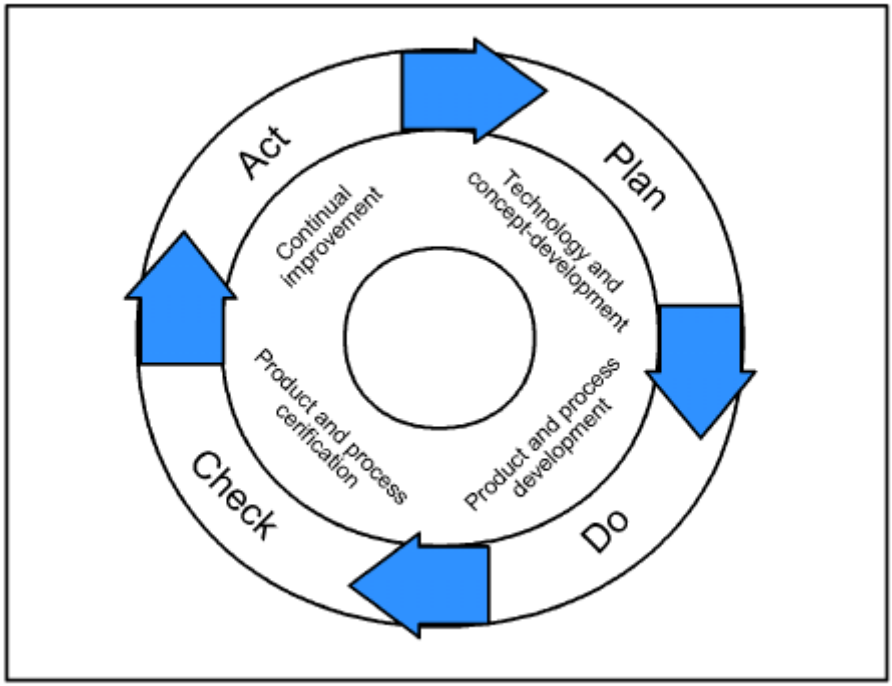


Figure 1-3: PDCA -Cycle

1.4 Continual Improvement

Activities for the continual improvement of all company processes must be carried out parallel to the project processing. Thereby, methods for systematic process analysis and synthesis on the basis of PDCA (Plan - Do - Check - Act) are used (see Figure 1-3).

The project reviews are used to establish and document data for stipulating and implementing of process improvements.

2 Flow Chart

The flow chart (Figure 2-1) represents the ideal course of project aimed for by the automotive industry. It encompasses, in its structure, thetask fields and milestones of project processing from the concept phase through to start fo series.

It is the basic framework for the project plan. The project plan is to be coordinated orientated to the milestones, between the customer (purchaser) and the supplier.

The flow chart is laid out for use at car manufacturers, as well as suppliers.

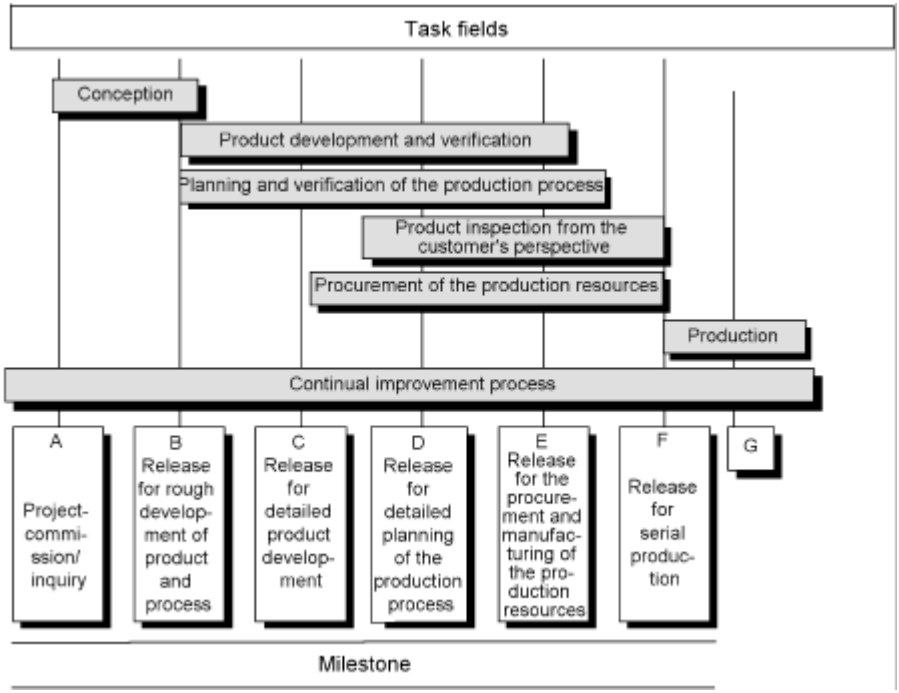


Figure 2-1: Flow Chart

3 Task Fields

Task fields contain all activities in a project from the project idea through to serial production. The overlap of the task fields shows the Simultaneous Engineering Process. The project activities must lead to documented results. These results form the basis of the evaluations of the milestones described in Chapter 4 (Milestones).

3.1 Conception

The aim of the task field „Conception„ is to work out decisive product and process alternatives, including stipulating of the project organization. The alternatives concern economical, technical, as well as organizational objectives and frame targets in different variations. These are the basis for the decision about a rough development in Milestone B.

3.2 Product Development and Verification

In this task field, the product is detailled in concept it‘s final form until it‘s readiness for serial production.

Product verification means the review of the extent to which the product is capable of complying with the specified requirements. This is, for example, carried out with the help of technical calculations and the building and testing of prototypes.

3.3 Planning and Verification of the Production Process

This task field encompasses the planning and complete development of production processes which are able to safely and constantly comply with the requirements.

The verification of the production process means the review of the extent to which the production process is capable of complying with the specified requirements of the product and process. This is, for example, carried out with the help of capability assessments.

3.4 Product Inspection from the Customer‘s Perspective

In this task field, it is checked if the product complies with the wishes of the customer, i.e. is suitable for the foreseen purpose.

Deviations from the customer‘s wishes can be caused by the product itself and/or the production process.

3.5 Procurement of Production Resources

In this task field, the procuring of resources required for production is carried out. This concerns the raw materials, parts and components used in the project, as well as the production means required for the manufacturing.

The aim is the correctly timed provision of production means and materials.

3.6 Production

After serial release, it has to be ensured in this task field that the customer‘s requirements of the product continue to be satisfied, including during serial production.

The aim is to maintain capable and controlled processes and to ensure, through suitable measures (e.g. SPC, maintenance measures, audits, training and instruction) that deviations are immediately detected and corrected

3.7 Continual Improvement Process

The continual improvement process relates to all functional units of a company. It is a permanent task. Here, project-related company processes are analyzed and starting-points for improvements which have to be implemented are found.

Product-related and/or project management-related improvement potentials, identified within the framework of project processing, are to be implemented throughout the project. An appropriate corresponding system is to be installed.

4 Milestones with Checklists

Milestones are checkpoints for project planning and control. At these junctures, an evaluation of the project progress (Project review) is carried out in order to detect risks and deficits early on. Measures for their elimination are to be deducted and implemented.

The evaluation of the project progress concerns, for the majority of milestones, several or all of the task fields, whereby the naming of the milestones only refers to the essential event to simplify matters.

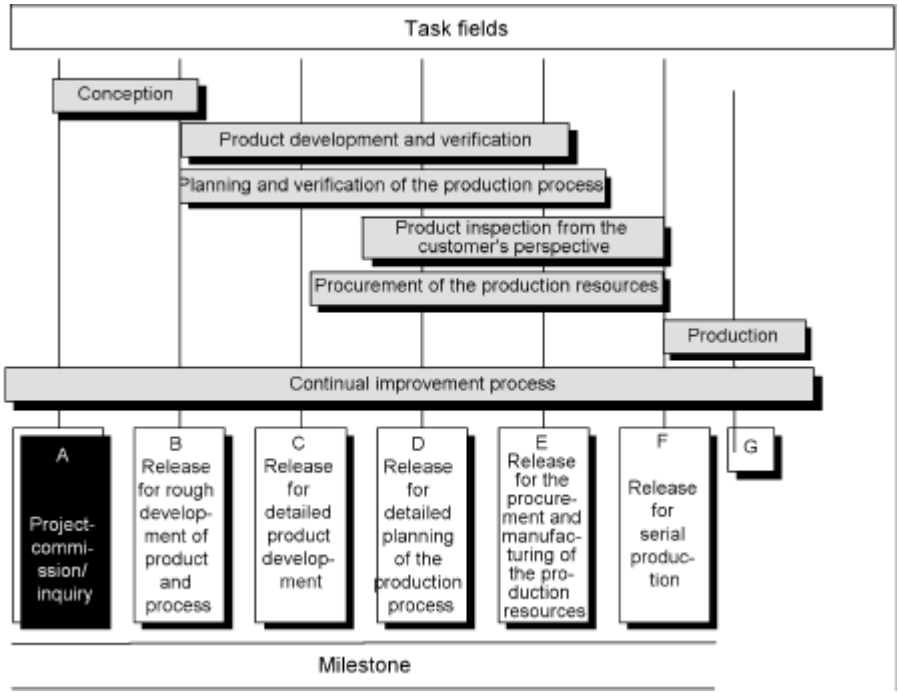
Checklists are related to the milestones which refer to all events from the individual task fields relevant to this milestone.

The checklists can be used for the planning of the overall project. Furthermore, they are aids to check the results of the preceding activities.

The persons involved and decision makers have to be stipulated for the handling of the individual milestones.

In the following, criteria for the evaluations and decisions to take place at each milestones are described. The user should set up his own company-specific checklists. He can adjust number, description and contents of the milestones to the project conditions.

4.1 Milestone A: Project Commission/Inquiry



The impetus for a project commission can be either a specific customer order, market demands or a company strategic necessity.

The project is carried by those departments of a company which have the required company-strategic information and are responsible for the company strategy.

Up to Milestone A, the following points are to be stipulated:

- Company strategy
- Economic frame conditions
- Technical frame conditions
- Organizational frame conditions
- Concept team
- Customer wishes, market demands, "Voice of the Customer"
- Strengths/Weaknesses Analysis.

The project commission must be documented and initiates the task field „Conception„.

Checklist Milestone A

- Company Strategy

  The company must have formulated a strategy to ensure long-term economic security. The economic and technical frame conditions for concepts result from this.

- Economic Frame Conditions

  Economic frame conditions are defined For the preparation of the concept. These are, for example:

  - Product prices
  - Development costs
  - Project-related investments (e.g. production material, buildings).

  The targets are oriented to customer-specific requirements regarding the amortization periods, general contract structure, such as e.g. life-time contracts, company-strategic aspects of the production location, make or buy decisions, patent claims etc.

- Technical Frame Conditions

  These take into consideration, for example, information on materials, production procedures, weight, function, durability and customer service, assembly conditions, patents and legislation.

- Organizational Frame Conditions

  The organizational frame conditions for the project have to be defined. This includes, for example, schedule dates possibly adjusted to a customer's schedule, company departments involved, cooperations.

- Concept Team

  The team for the handling of the task field „Conception„ is made up of personnel from across all areas. These include, for example, customer, development, production, procurement, marketing, quality assurance, cooperation partners and suppliers.

  The tasks, authorities and responsibilities of the members of the team and the lineal organization have to be stipulated.

- "Voice of the Customer"

  It is necessary, that the wishes and expectations of the customer are understood by the company. The following options, for example, are available for analysis:

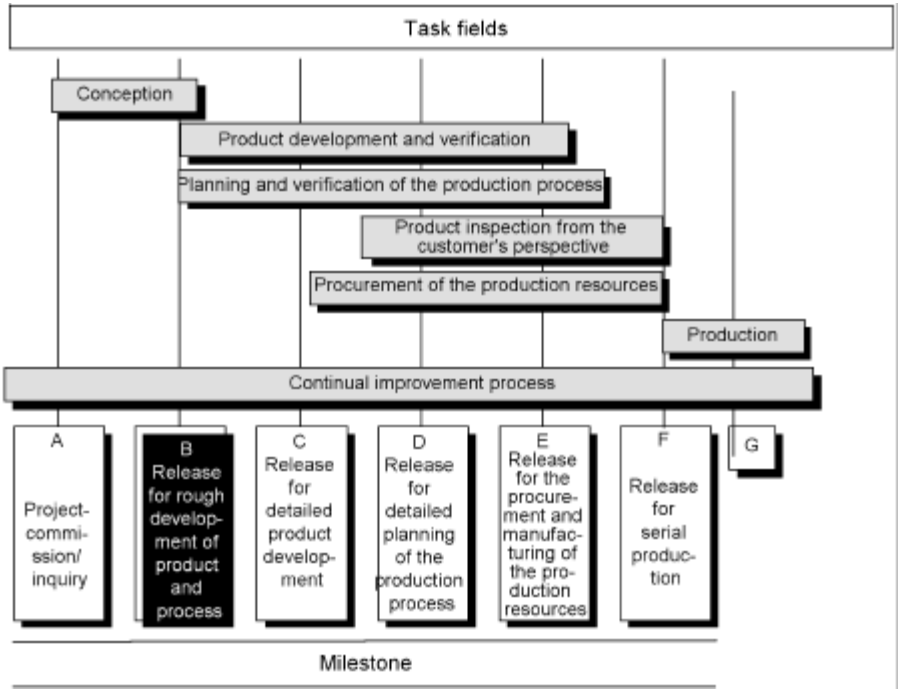
  - market research,
  - guarantee performances,
  - quality information
  - strengths/weaknesses analyses.

- Strengths/Weaknesses Analysis

  In order that the long-term competitive orientation of the company is guaranteed, strengths and weaknesses analyses are to be carried out and measures are to be determined. The following can be compared, for example:

  - processing times
  - development times
  - service
  - guarantee periods
  - benchmarks

4.2 Milestone B: Approval for Rough Development of Product and Process



The approval for rough development of the product, as well as the production process, is given through a decision based on basic principle in which the established frame parameters and targets for the project, compiled from the preceeding task field „Conception„, are submitted and approved.

Stipulations and results from the preceeding project section, as prerequisites for the decision at Milestone B are, for example:

- customer wishes, expectations and requirements
- project targets and requirements of the product and process
- feasibility studies
- concepts for product and processes
- project manager, project organization

- project plan
- planning of the reviews
- information flow and project documentation.

These are the basic requirements for the decision about the start of the rough development of product and process.

Checklist Milestone B

- customer wishes, expectations and requirements

  For the further course of the project, the customer wishes, expectations and requirements have to be known, analyzed and stipulated.

  Foundations for this are, e.g.:

  - analyzed market research results (market studies, customer surveys, market development) and preceeding guarantee performances/quality information
  - deductions from company strategies, business plan and market strategies
  - competition analyses and benchmarks of produkt and process
  - preconditions for, and requirements of product and process realization
  - project input of the internal or external customer
  - legislative requirements
  - patent situations.

- Project targets and requirements of product and process

  Targets for product, process and project have to be defined and described with measurable criteria for realization, based on the customer wishes, expectations and requirements. Target criteria may relate to, e.g.:

  - customer requirements/product and process characteristics
  - technical targets (e.g. reliability requirements, weight, maintenance, customer services, spare parts supply, new materials, new technologies)
  - cost targets (e.g. parts/material costs, project costs, investments)

- schedules (e.g. for market launch, project reviews, important milestones, running periods)
- guarantee frame, warranties
- capacities/resources.

The defined targets are to be coordinated and agreed with regard to their coherence and freedom from conflicts.

- Feasibility Studies

  In feasibility studies, the possibilities and risks for the implementation of the project or project targets are assessed.

  The aim of the study is to obtain a reliable statement from all areas regarding the feasibility and costs of implementing the project or project targets.

  The criteria to be considered must be stipulated. They may encompass, for example, the following points:

  - Capacities
  - Costs
  - Ecology
  - Quality
  - Technology
  - Schedules.

  The evaluation can be based on concept designs, producibility forecasts about the process, cost calculation, capacity determination, coordinated scheduling and risk assessment.

- Concept for product and processes

  As far as useful, concept variations have to be worked out for product and processes. They show differing solutions/alternatives for the technical and economic implementation of the project. They may also contain variations of the project organization.

  Up to Milestone B it has to be decided, which variation(s) is/are followed up.

- Project Manager/Project organization

  The company management must assign a project manager and determine his duties and authorities.

  The project manager is responsible, for example, for:

  - the setting-up of a project team covering all areas
  - the preparation and implementation of the project targets
  - the planning of the overall project
  - the monitoring of the project progress
  - the representation of the project results to the customer
  - the determination of the communication paths, contents and means
  - the documentation (type, location and scope).

  The inclusion of the project into the company processes and strucure is to be stipulated.

- Project plan

  An essential element of project management is strict project planning. A project plan has to be set up. It is based on the criteria of the feasibility study and is to be detailed further as the project progresses.

  Compliance with the planning is monitored by the person responsible for the project. When nonconformities are found, corresponding action must be taken.

- Planning of the reviews

  In reviews, a required/actual comparison is to be carried out which shows to what extent the requirements of the product and process development are fulfilled. If already due requirements are not yet fulfilled, suitable actions must be stipulated and followed.

  The review dates and their contents are to be determined in the project plan. The specific criteria to be checked in each case are to be defined in checklists or similar. The project progress is followed with the help of the reviews.

Based on the product requirements, the following points, amongst others, are evaluated in the reviews:

- requirements for the product development with respect to function, safety, reliability, certainty of the evidence etc.
- requirements for the process development with respect to technology, process capability requirements, etc.
- results of computer simulations
- results of FMEA's
- calculation results
- results of trials
- knowledge gained from prototype production and assembly (problems, estimation of process capabilities etc.).

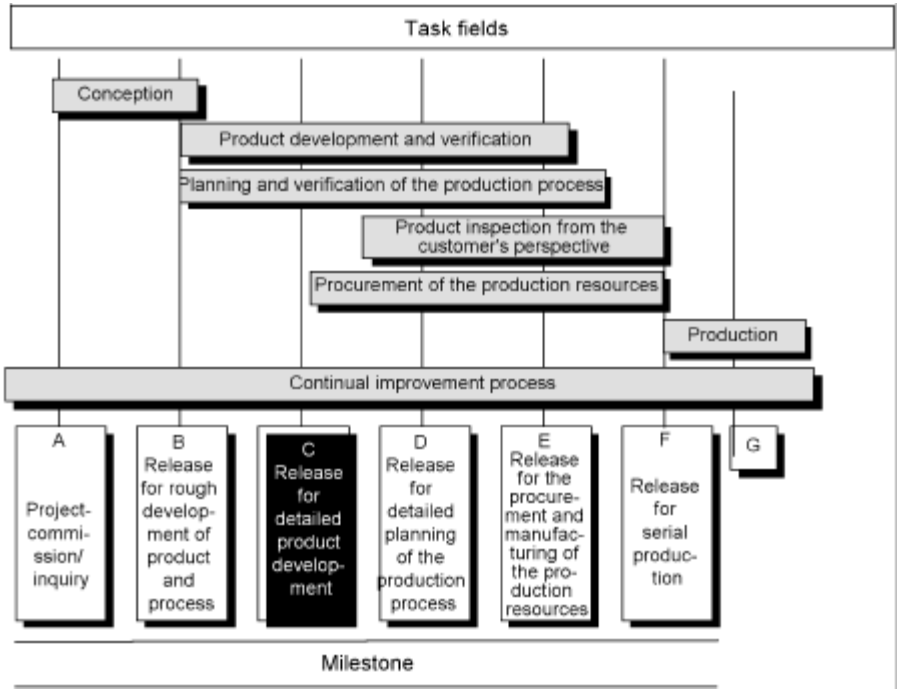
- Information flow and project documentation

  According to the scope of the project, a suitable stipulation regarding the project documentation and the distribution and coordination of information between the companies and employees involved in the project is to be made.

  This includes, amongst others, the planning of the communication means (e.g. video conference, telephone/fax, meetings) and their chronological order.

  The topicality of the documents has to be ensured at all times during the entire course of the project. This applies, for example, to the project plan, requirements specifications, drawings and parts lists.

4.3 Milestone C: Approval for Detailed Development of the Product



Stipulations and results from the preceeding project sections, as prerequisite for the decision about the implementation of detailed development of the product at Milestone C are, e.g.:

- Provision of the project resources
- System-FMEA or comparable analyses
- Performance specification
- Important characteristics
- Feasibility records
- Product and process specifications
- Planning of product and process trials
- Purchased engineering services
- Review results.

The aim of the milestone is the approval for and assignment to detailed development of the product, as well as the stipulation of the responsibilities and schedules.

Checklist Milestone C

- Provision of the project resources

  The resources (employees, test stands, CAD-work stations etc.) required for the further processing of the project must be available in accordance with the project planning.

- System-FMEA or comparable analyses

  Due to the high demands (e.g. low failure quota) on the products with simultaneous high complexity, a systematic assessment of the potential system failures based on the functional connections of the system components, must be carried out at a very early stage of the project. Interfaces with the system environment are also to be checked.

  This can be achieved, for example, through a System FMEA (see VDA 4, Part 2) which, at this point, represents a preliminary result.

- Performance specification

  The customer requirements (= requirements specification) are to be supplemented with internal and legal requirements. The performance specification must define how and with what these requirements are to be realized (contents of the performance specification, see Appendix A 1, Term Definitions).

- Important characteristics

  The important product and process characteristics which are of special significance for functional safety (operational and application safety) must be identified and preliminarily stipulated. This serves the identification and estimation of the risk potential which receives special consideration during the further course of the project.

- Feasibility records

  The feasibility of the design must be evaluated and documented. This also applies, if the customer carries the responsibility for development.

- Product and process specifications

  The results of the rough development are documented in designs, preliminary parts lists and the corresponding preliminary specifications of the foreseen manufacturing process. These documents divide into, e.g.:

  - Designs (Drawings, Models, CAD-Data)
  - Preliminary parts lists (assembly of all components and parts of the product to be developed)
  - Preliminary process plan (assembly of the process steps and procedures which are foreseen for the manufacture of the product).

- Planning of product and process trials

  In order to ensure the product and process requirements are fulfilled, product and process trials are required. The trials must be planned and documented with regards to time and content. Product trial procedures are, for example, mounting, functional, durability, material, load and environmental simulation tests, as well as crash tests. Processes can be evaluated, e.g., through sample productions or capability analyses of machines, processes and inspection, measuring and test equipment.

- Purchased engineering services

  The differentiation between internal and purchased engineering activities are to be clearly determined and documented. The potential service providers must be evaluated to ascertain their suitability to provide the service. The engineering scope to be purchased and the organizational and technical interfaces are to be clearly defined.