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Technical product documentation — Life cycle model and allocation of documents

Documentation technique de produits — Modèles de cycle de vie et affectation de documents

Reference number
ISO 15226:1998(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 15226 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Subcommittee SC 1, *Basic conventions*.

Annexes A, B and C of this International Standard are for information only.

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Introduction

Technical product documentation (TPD) is becoming more and more extensive, and in order to give protection against claims related to product liability it is necessary to store technical documents for a long period of time. Growing knowledge in all technical disciplines is reflected by increasing documentation. As companies transfer parts of production to subsuppliers, the exchange of documentation among companies increases accordingly. The necessity to interchange larger amounts of technical information more frequently increases the importance of product documentation management and justifies standardization in this area, if only for economic reasons.

The method described in this International Standard meets the principal requirements of product documentation management:

— documentation as easy to understand as possible so that, for example, every user of a document knows who has prepared the document and which other documents have been used in its preparation;

— simultaneous or concurrent engineering consisting of parallel activities during the product life cycle;

— implementation of project management techniques with the registration of the document flow in the company;

— registration and proof of existing documents in a documentation overview;

— control and coordination of paper documentation and electronic documentation;

— clear delineation of responsibilities, processes, results and persons responsible for preparing documents.

This International Standard results from the obvious need to establish common principles for dealing with technical documentation in a company.

Technical product documentation — Life cycle model and allocation of documents

1 Scope

This International Standard gives a method of establishing a flexible life cycle model and gives guidance on efficient and easy-to-understand handling technical documents during the product life cycle. The product life cycle takes different company-specific requirements into account, in accordance with project management techniques. For general use in connection with non-company-specific requirements, procedures, processes and products, it may be necessary to establish a standardized life-cycle model with defined phases.

This International Standard is intended for use in companies, bodies of authority and other organizations who deal with manufactured products, with the compilation and use of technical documents during the product life cycle. It is not applicable either to services or software.

This International Standard is intended to be an aid in controlling and coordinating documents, in accordance with ISO 9001, ISO 9002, and ISO 9003.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5127-1:1983, *Documentation and information — Vocabulary — Part 1: Basic concepts.*

ISO 9001:1994, *Quality systems — Model for quality assurance in design, development, production, installation and servicing.*

ISO 9002:1994, *Quality systems — Model for quality assurance in production, installation and servicing.*

ISO 9003:1994, *Quality systems — Model for quality assurance in final inspection and test.*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1
activity
processes, procedures or parts of them, usually related to established organization units

NOTE The terms "process" and "procedure" are defined in ISO 8402. A detailed explanation of processes within companies is given in ISO 9000-1.

3.2
activity matrix
matrix allocating activities to phases of the product life cycle and to a fixed organization unit

3.3
document
recorded information which can be treated as a unit in a documentation process

[ISO 5127-1:1983]

3.4
documentation
set of documents collected for a specific purpose

[ISO 5127-1:1983]

3.5
product
thing or substance produced by a natural or artificial process

[ISO 10303-1:1994]

NOTE For the purposes of this International Standard a product is usable or saleable and is documented.

3.6
organization unit
part of an organization, with a fixed function

EXAMPLES Departments, project teams.

3.7
product life cycle
period of time from the first idea to the ultimate disposal of a product

NOTE The product life cycle is divided into defined periods called phases in which activities that belong together are grouped, e.g. product concept, design, production etc. The beginning and ending of phases require definite decisions (e.g. releases).

3.8
concurrent engineering
coordination of parallel activities in the product life cycle, especially in the phases up to market introduction

4 Determining a product life cycle

4.1 General

Because requirements are different and depend on the branch of industry, the product, and the internal structure of a company involved, a standard general life cycle for all technical products would hardly be relevant. Moreover, a general standard would restrict the freedom of companies to manage their own organizational structure. Every company must therefore develop one or more of its own product life cycles, depending on specific product requirements. Subclauses 4.2 and 4.3 present a general method for defining and describing a product life cycle.

NOTES

1 The tables shown in annex B are examples intended to assist in the development of life cycle models. The phases described may have to be edited, extended, deleted, etc. to suit individual company-specific life cycles.

2 The descriptions of phases in the design process are given in ISO 11442-3.

Table 1 — General life cycle

	Phases			
	Phase 1	**Phase 2**	**. . .**	**Phase *n***
	Name of phase	**Name of phase**	**. . .**	**Name of phase**
Conditions, beginning and end of phase	Conditions — beginning — end	Conditions — beginning — end	. . .	Conditions — beginning — end
Activities	Activity 1.1	Activity 2.1	. . .	Activity *n*.1
	Activity 1.2	Activity 2.2	. . .	Activity *n*.2
	. . .	. . .	. . .	. . .
	Activity 1.*m*	Activity 2.*m*	. . .	Activity *n*.*m*
NOTE — The variables *n* and *m* denote that the number of phases and activities is not restricted. They are not designations.				

4.2 General model of a product life cycle

As a first step in developing a life cycle model the phases necessary for the life cycle of a specific product must be listed. Phases are delineated by activities and conditions which mark their beginning and their end. The result is an overview; see table 1.

The beginning and end of a phase have fixed times which are determined by documentation and by company and product-specific requirements. Such requirements are often called "release", "development valuation", or "milestones" and must be given in the row "Conditions, beginning and end of a phase" for each phase. The activities associated with a phase must take the product from phase beginning to phase end. Activities are processes, procedures or parts thereof. Generally, an activity is allocated to a fixed organization unit so that it becomes clearly delineated on the activity matrix.

The defined method can also be represented by the flow of documents in concurrent engineering. To gain quick access to the market it is often not feasible to wait until all type-related activities in one phase are completed before beginning the next phase. Figure 1 shows an example of part of a product life cycle. The curves illustrate the work intensity for the different kinds of activities.

The temporal aspects of phases must be determined in a way which ensures that most type-related activities become part of one phase. All activities in the phase must then reach a state that enables the next phase to begin. In principle, resources devoted to activities must be used during the phase in which the particular activities occur.

The product life cycle, the activity matrix (see clause 5) and the allocation of documents to activities (see clause 6) should be independently documented within the company. Authorized members of the staff must have access to such documentation. Documentation may be in the form of printed matter or computer-based information.

4.3 Procedure for defining a specific product life cycle

The definition of a product life cycle is divided into four steps described in 4.3.1 to 4.3.4.

4.3.1 Specifying relevant product life cycle

Different products in the company can have different life cycles. The development of specific life cycles will depend on whether the products concerned are the subject of single or series production, or whether complex systems or simple consumer products are manufactured.

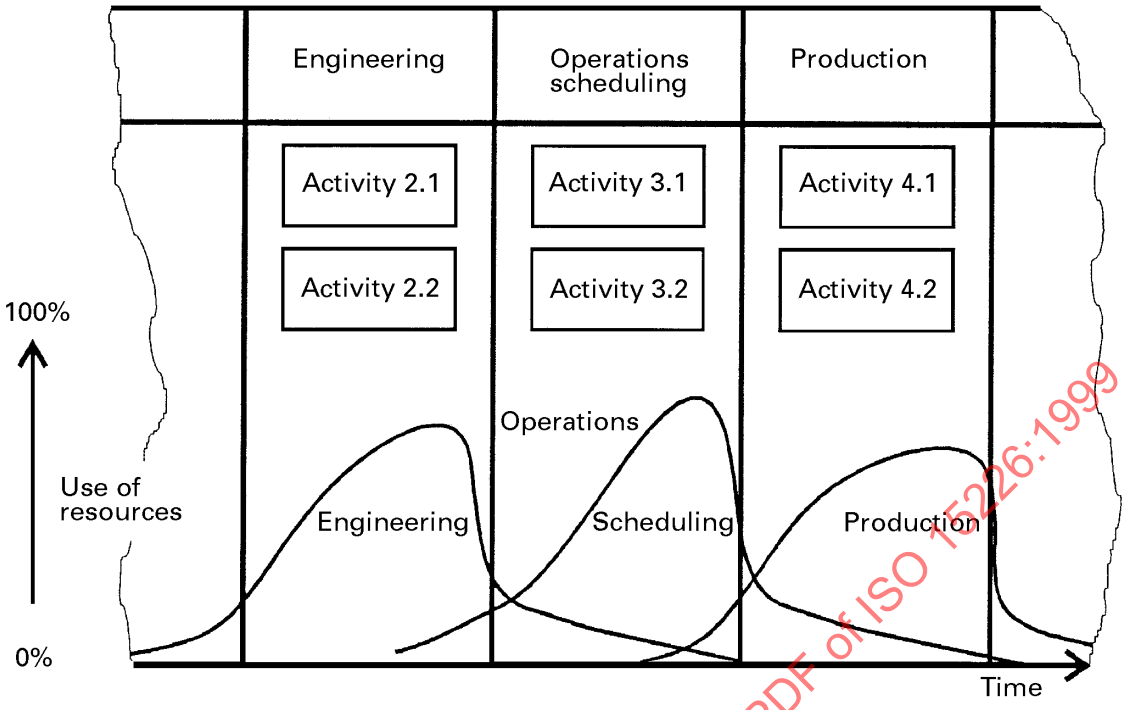


Figure 1 — Allocation of activities in terms of time and content

The decision on whether two or more products/product groups should have the same life cycle is a question of optimization: optimum adaptation of the product life cycle to the single product, or the rationalization/unification of administrative work. The more similar the handling of the products in the company becomes, the greater is the possibility of using common life cycles.

4.3.2 Elaborating product life cycle phases

After determining the relationship between a product or product group, the company-relevant phases of the product life cycle have to be determined. Such decisions have to be made on the basis of the company functions and organization units concerned with the product in question. In these functions and units similar activities are often grouped. Additional information can be found in procedural and organizational rules, and in quality management documents.

4.3.3 Listing activities and allocating them to phases

The allocation of activities to different organization units has to be systematic. If activities are part of project management they are usually adequately defined. If this is not the case, activities must be described in a separate list. Such a list should give an identification number for each activity so that an activity matrix can be drawn up (see 5.3). In addition to describing activities, the list should also contain designations referring to the organization units responsible for carrying them out.

Each activity must also be clearly allocated to a phase in the product life cycle. Therefore, it may be necessary to divide one activity into several individual activities which can be clearly allocated.

In many companies such activities are already listed in organizational documents and quality management documents. Decisions are also activities. When collecting and defining activities, all employees concerned should be included in the process in order to stimulate the acceptance of changes.

4.3.4 Specifying conditions for beginning and end of phases

Phases begin and end with decisions, e.g. releases. They are described in organizational and quality-management documents. Usually the conditions for ending a phase simultaneously present the conditions for beginning the next

phase. If this is the case it is sufficient to define only the condition for ending the first phase, i.e. not the beginning of the next. Of course, it is necessary to define the beginning and end of the initial phase of a life cycle.

When considering information gained during a product life cycle it may be necessary to repeat the steps given in 4.3.1 to 4.3.4 to bring the cycle up to the optimum again.

5 Drawing up the activity matrix

5.1 General activity matrix

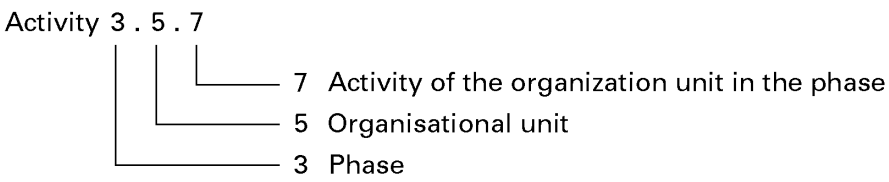
The activities of each organization unit in each phase of the life cycle are presented in an activity matrix (see table 2).

Table 2 — General activity matrix

Organization unit	Phases			
	Phase 1	**Phase 2**	**...**	**Phase *n***
Organization unit 1	Activity 1.1.1 Activity 1.1.2 ...	Activity 2.1.1 Activity 2.1.2 ...	...	Activity *n*.1.1 Activity *n*.1.2 ...
Organization unit 2	Activity 1.2.1 Activity 1.2.2 ...	Activity 2.2.1 Activity 2.2.2 ...	...	Activity *n*.2.1 Activity *n*.2.2 ...
...	...	...	...	...
Organisation unit *i*	Activity 1.*i*.1 Activity 1.*i*.2 ...	Activity 2.*i*.1 Activity 2.*i*.2 ...	...	Activity *n*.*i*.1 Activity *n*.*i*.2 ...
NOTE — The variables *i* and *n* indicate that there is no limit on the number of phases and organization units.				

5.2 Identification of activities

The index in the activity matrix can be used to identify an activity. The first digit represents the phase, the second the organization unit, and the third the number of activities of the organization unit in the phase. See figure 2.



NOTE Instead of the word "activity" the description of a concrete activity in the product life cycle must be given.

Figure 2 — Example of activity indexing

5.3 Method for drawing up the matrix

An activity matrix is drawn up in a two-stage process, as described in 5.3.1 and 5.3.2.

5.3.1 Registration of existing organization units

The different organization units in a company that work on a product during its life cycle are listed vertically in the activity matrix. The phases from the product life cycle are then listed horizontally. To list the organization units it is necessary to find the correct hierarchy level. In one case it might be sufficient to give a unit the name "Development", in another case it might be necessary to differentiate, e.g. "Process-development", "Electronic-development", etc. Before defining the specific level of hierarchy the following aspects should be considered:

— The more detailed the organization units are, the more complicated the drawing up of the activity matrix becomes and the more inflexible its relationship to different projects will be.

— The more general the scope of the organization units, the more abstract the activity matrix becomes and the wider the interpretation possibilities will be.

5.3.2 Allocating activities to organization units

Within each phase, all activities must be allocated to the different organization units. It is necessary to allocate activities definitively to one organization unit. If necessary, activities must be divided into sub-activities that can be allocated unambiguously. Each activity in the product life cycle must be traceable to its related phase in the activity matrix. Activities performed in several organization units should be clearly marked accordingly in the activity matrix. Activities that are performed by several organizational units simultaneously should also be especially marked in the activity matrix.

6 Allocating documents to activities

6.1 General

On defining the product life cycle and the activity matrix, the basis of allocating the necessary technical documents to activities must be given.

For every activity of an organization unit, four different types of documents can be issued (see figure 3):

— documents that arrive in an organization unit (incoming documents);

— document that describe the operation of an organization unit in a particular phase (standards, guidelines, process guidelines, etc.);

— documents necessary for internal purposes in an organization unit, and which remain in the organization unit (working/internal documents). Such documents must be specific to activities within the organization unit, must have no bearing on documentation outside the organization unit, but must describe and enable the retrieval, implementation, etc. of proceedings and processes. Filed working/internal documents must also be registered;

— documents that leave the organization unit (outgoing documents).

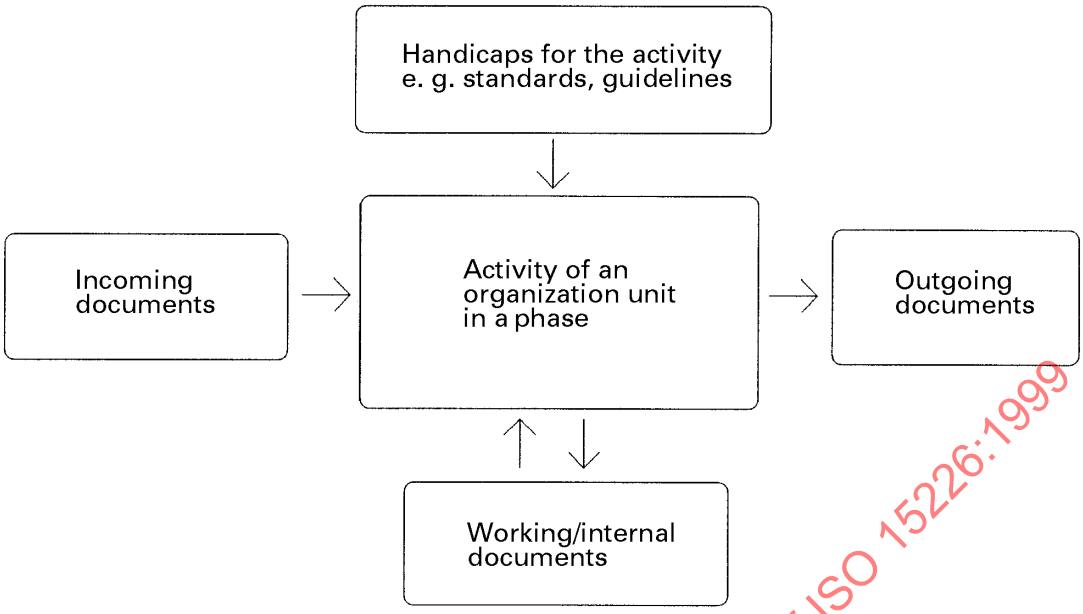


Figure 3 — Document flow for the realization of an activity

Not every organization unit uses all types of documents for all activities. Certain documents can be common to successive activities. All working and outgoing documents can be edited by an organization unit. Handicaps (standards, guidelines, etc.) are normally for reference purposes only. Each time a document leaves an organization unit it must be approved by the responsible person. For the exchange with external organizations determinations regarding the use of the documents have to be agreed.

6.2 Documents of an organization unit in a phase

Table 3 shows the activities within a phase and the relevant documents. Such a table can be prepared for each field of the activity matrix.

The document flow in a company can be said to be the complete allocation of documents to activities. Thus, the flow of technical information in a company can be represented as an integrated module in which each outgoing document must become the incoming document of another organization unit.

Table 3 — Allocation of documents within an organization unit for a phase

Activity	Incoming documents	Standards, guidelines, etc.	Working/internal documents	Outgoing documents
Name of 1st activity	Names of incoming documents	Standards, guidelines, etc. to be used	Working/internal documents to be used	Names of documents that leave the organization unit
. . .	. . .	. . .	. . .	. . .

7 Data necessary for the management of documents

A minimum of administrative information for each document is necessary when organizing technical documentation:

— a set of information for the identification of each document. The information set may consist of a single identification code or of a set of attributes. Document identification procedures must exist in each of the companies concerned;

— an object identification code;

— which document type (e.g. drawing, item list, etc.);

— a designation or title, e. g. type of document and name of the object in question;

— a responsible person and/or the manufacturer, i.e. company name and also the organization unit;

— date of compilation;

— release and revision status, i.e. issue or date of last revision.

Three possibilities exist for the exchange of documents with external organizations:

— Filed external documents: such documents can be identified by indicating the external organization that has prepared the document. This procedure presupposes that the above listed minimum set of information is contained in the document and is clearly interpretable. This method is advantageous when documents require no amendment by communication with the compiling organization.

— To enable the adoption and further processing of an external document, the original set of information can be replaced by a company-specific set of information. This ensures uniform compilation and processing. To ensure traceability, a cross-reference index should be used. which relates the original document and its minimum set of information to the adopted document.

— Original information might be retained for editing and/or supplementing with a related set of information.

Documents exchanged with external sources must be included in the document allocation table. Which of the described methods is applied and how the minimum set of information is to be handled should be determined within the company. Additionally, documents exchanged with external sources must be included in overviews (see clause 8) and must be identified.

8 Overviews of existing technical documents

Overviews of existing technical documents are necessary to register all relevant technical documents. In some circumstances, e.g. with very large projects, it might be necessary to use separate overviews of existing technical documents in different departments. In such cases the different overviews must be centrally registered. Suitable documented procedures can be used to ensure that all overviews are prepared and handled in accordance with the same rules.

At least the minimum set of information necessary for the identification of the documents must be recorded. For large numbers of documents, the additional registration of descriptive document data for retrieval, etc., might be necessary. In the case of computer-based overviews, information about change and release must be recorded and constantly updated. It must be ensured that only valid documents are used.

9 Adaptation of the method to specific procedures

Because of the difference between products and because production processes are constantly being developed and optimized, an established method of adaptation must be used. This must be flexible and facilitate modifications and optimization.

There is no purpose in laying down a product life cycle and the relevant activity matrix in detail and then give unalterable stipulations stating how methods shall be applied within the company. It is preferable to establish a suitable life cycle for each new product development. This does not necessarily mean that the phases in product life cycles will differ each time in regard to duration or type, but that activities will be different. Activities can then be added, omitted or modified as different products are developed, or to suit the changes in the organization of the company that occur between individual product development projects.

It is important that the actual document flow be documented so that the information flow in the life cycle of a product is also clearly documented. Therefore it is necessary to introduce all changes in the product life cycle, the activity matrix and document allocation table during the course of the project. In relation to the past, the documents must show activities that have been implemented and the document flow. In relation to the future, they will form the basis for planning.

Table 4 shows a simplified activity matrix. For clarification, three different points in time are indicated:

— t_1 represents the beginning of the product life cycle. The contents of the activity matrix and all document allocation tables are dealt with at the planning stage. The further a phase lies in the future, the less detailed the planning is. Activities that are combined during preliminary outline planning are divided during detailed planning.

— At t_2 the life cycle is at an advanced stage. Everything previous to t_2 is of course in the past and cannot be altered, i.e. the contents of the activity matrix and the document allocation table in the period of time t_1 to t_2 document the past. For the period of time t_2 to t_3 the contents of the activity matrix and of the document allocation table express plans.

— At t_3 the life cycle of the product is finished. The life cycle has now been completely described by actual document flow through the activity matrix, the document allocation table, and the contents of technical documentation.

Table 4 — Contents of the activity-matrix at different times

Organization unit	**Phases**			
	Phase 1	**Phase 2**	**Phase 3**	**. . .**
Organization unit 1	Activities	Activities	Activities	**. . .**
. . .	**. . .**	**. . .**	**. . .**	**. . .**
t_1		t_2		t_3

Documentation of the information flow in a company offers a basis for the constant optimization of technical information management.

Annex A
(informative)

Comparison of a company-specific product life cycle with the life cycle described in ISO 9004-1

It is useful to compare different company life cycles with the product life cycle specified in ISO 9004. In most cases the phases described in ISO 9004-1 and in company-specific life cycles will differ.

Table A.1 — Overview of a company-specific product life cycle

Life cycle phases described in ISO 9004-1	Examples for phases in a company-specific life cycle
Marketing and market research	Product idea
Product design and development	Concept definition, development, design
Process planning and development	—
Purchasing	Prototype phase
Production or provision of service	Production (series production)
Verification	(Takes place in every phase)
Packaging and storage	—
Sales and distribution	Distribution
Installation and commissioning	—
Technical assistance and servicing	Product care (maintenance and service)
After sales	—
Disposal or recycling at the end of useful life	Disposal, recycling phase

Annex B
(informative)

Examples

Table B.1 — Example of a product life cycle

	Phases							
	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Phase 7**	**Phase 8**
	Product idea	**Concept definition**	**Develop-ment**	**Design**	**Prototype phase**	**Production (Series production)**	**Mainten-ance and service**	**Disposal**
Activities	1.1 Patent analysis	2.1 Drawing up feasibility studies	3.1 Drawing up function plans	4.1 Manufacture of test models	5.1 Performing field tests	6.1 Material management	7.1 Service	8.1 Recycling management
	1.2 Information collection	2.2 Drawing up list of requirements	3.2 Drawing up sketches	4.2 Preparation of documents for production	5.2 Performing function tests	6.2 Production of single parts	7.2 Observing the product in the market	8.2 Disposal of non-recyclable parts
	1.3 Drawing up studies	2.3 Developing a product-concept	3.3 Solving detail problems	4.3 Carrying out a design review	5.3 Optimization of production documents	6.3 Quality control and analysis	7.3 Management of product modifications	8.3 Transport management
	1.4 Market studies	2.4 Developing the function concept	3.4 Producing function models	4.4 Compilation of handbooks	5.4 Permission application	6.4 Assembly	7.4 Maintenance	8.4 Dismantling
	1.5 Analysing market potential	2.5 Project-planning	3.5 Defining the product structure	4.5 Procurement (process/ order)	5.5 Performing prototype tests	6.5 Performing tests (customer)	7.5 Repair and exchange	8.5 Disposal confirmation
	1.6 Gathering customer requirements	2.6 Development of quality assurance concept	3.6 Reliability tests	4.6 Valuation of risks for specific attributes (e.g. dimensions)	5.6 Release for series production	6.6 Analysis of field test results	7.6 Supply spare parts	
	1.7 Drawing up a marketing concept	2.7 Development of packaging concept	3.7 Planning production of processes	4.7 Check of sales docu-mentation	5.7 Supplier release		7.7 Updating delivery statistics	
Conditions for end	Concept release	Development release	Design release	Prototype release	Production release	Delivery release	Disposal release	

Table B.2 — Example of an activity matrix

Organiz-ation units	Phases							
	Product idea	**Concept definition**	**Develop-ment**	**Design**	**Prototype phase**	**Production (Series production)**	**Mainten-ance and service**	**Disposal**
Marketing	1.4 Market studies 1.7 Drawing up a marketing concept 1.5 Analysing the market potential				5.1 Performing field tests	6.6 Analysis of filed test results	7.2 Observing the product in the market 7.7 Updating delivery statistics	
Technical development	1.1 Patent analysis 1.2 Collecting information	2.1 Drawing up feasibility studies 2.2 Drawing up list of requirements 2.3 Development of product concept 2.4 Development of function concept	3.1 Drawing up function plans 3.2 Drawing up sketches	4.1 Manufacture of test models	5.2 Performing function tests			
Design I (product)	1.3 Drawing up studies	2.5 Project planning	3.3 Solving detail problems 3.5 Definition of product structure	4.2 Preparation of production documents 4.3 Design review 4.6 Valuation of risks for specific attributes (e.g. dimensions)	5.3 Applying for permissions 5.4 Compiling registration documents		7.3 Product modification management	
Design II (tools)				4.2 Preparation of production documents	5.3 Applying for permissions			
Production planning			3.7 Planning production processes					
Procurement				4.5 Procurement (process/ order)	5.7 Supplier release	6.1 Material management	7.6 Supply of spare parts	