Technical Reports

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Chapter 1

Introduction

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Introduction

People communicate in their spare time and in the professional area. They communicate either in oral or in written form. If they communicate about technical topics, this process is called technical communication. If they communicate in written form, they write or read "Technical Reports". If the Technical Report is communicated in oral form, it is a presentation to an audience.

Presentation of scientific and technical reports" defines, that a **scientific or Technical Report describes a research process or research and development results or the current state-of-the-art in a certain field of science or technology**. Therefore, all documents in the following list are Technical Reports, if they deal with a technical subject:

- reports about laboratory experiments
- construction and design reports
- reports about testing and measurements
- various theses written at the end of study courses, doctorate theses
- articles or reports about research works in scientific journals
- project reports etc.

A Technical Report is a report about technical subjects written in the "language of science and technology" (special terms and phrases, display rules etc.). In general, Technical Reports must comply with the following request:

Technical Reports must have a high level of systematic order, inner logic, consistency etc.

The Technical Report shall bring **clarity** to the reader! This means, the reader must understand the topics described in the Technical Report in exactly the same manner as the author has meant it without any feedback or answers from the author. This can be checked as follows:

Imagine you are a reader who has basic technical knowledge, but no detailed knowledge about the topic or project described in the Technical Report. This fictive reader shall understand the Technical Report without any questions!

This book is primarily addressed to readers with basic knowledge or people who are working in the various fields of engineering coming from universities and companies, i.e., it is primarily addressed to engineers and technicians, natural and computer scientists etc.

Today it is increasingly important to **present your ideas and work results** in Technical Reports to the scientific community, in interdisciplinary teams, to funding organizations and the interested public **in a positive, professional manner**. However, this is sometimes very difficult for engineers and natural scientists. Too often they are not good sales people, in many cases they prefer to cope with technical problems. Yet, it is not all that difficult to present one's working results in a logical, clearly reproducible and interesting way to create the impression amongyour audience that this work was done by an experienced professional.

You can avoid mistakes and obstacles that other people – including the authors– have experienced before, if you read this book thoroughly or consult it when you have questions while preparing your next Technical Report.

It starts with taking a written report into your hands. Is it bound properly? Is it stored in a clean, tidy and wrinkle-free binder? Is there a clearly understandable title leaf? After you have got a rough overview of the contents you may ask: Does the title give sufficient and representative information about the contents of the Technical Report?

If you go into more detail, the following questions may occur. Is there a table of contents? Does it list page numbers? Is the table of contents ordered by logical rules, can you recognize the *"backbone"*? Does the report describe the starting point of the situation or project in an understandable way? Did the author critically reflect the task at the end of the report? Does the report contain citations? Is there a list of references etc.? Can you find tables, figures and references easily and are they designed according to common rules? If such formal requirements are not fulfilled, you will irritate your readers. Your readers will then have unnecessary difficulties in reading and understanding your message. This also influences how your project, your work results and you as a person are accepted.

For writing Technical Reports **word processors or desktop publishing systems** like **Microsoft Word**, **Open Office Writer,** etc. are used. At various spots in the text, you will find hints, how to use Microsoft

Word in an efficient, timesaving manner. If you use programs that are similar to Word, the program features will probably operate in a similar way. Hints how to use Open Office Writer are collected in a separate section. To create slide shows you will use **presentation programs**, such as **Microsoft PowerPoint**. Where it fits with the text and examples in this book, especially in chapter 5, you will find hints, how to create slides with Microsoft PowerPoint. Hints how to create slides with **Open Office Impress** can also be found in a separate section.

This book is designed to be lying beside the PC. Its layout uses little space to keep the production price low. However, it can be used as an example for creating your own Technical Reports. Terms from the fields documentation and printing technology can be found in appendix B "Glossary – terms of printing technology".

When working yourself though this book you can acquire the knowledge you need to write Technical Reports and presentations. **The concept of this book is that it shall answer questions instead of putting up new questions**. This book shall be a **guideline or manual how to write Technical Reports**. How is that meant? A user of a complicated technical product, like a video recorder, uses his instruction manual to be able to use the technical product. All functions of the product are described in detail in the instruction manual. The manual also lists all required warnings that allow safe usage of and working with the product.

Being an author, you can use this book similarly as an author's manual. In addition, you will get important information regarding how to

avoid mistakes and obstacles during the presentation of your Technical Report. Moreover, this book will show you many important rules and checklists for text, table and image creation as well as for working with literature. Applying these rules and hints will make your Technical Reports readable and clearly understandable and comprehensible for your audience.

In accordance with the manual character of this book you – our audience – will often be personally addressed, so that the given information will reach you in an easily readable and motivating way. In doubt, we used simple instead of complicated sentences to improve the understandability of the texts. Moreover, we have kept several layout **rules**, which shall help you to orient yourself:

- Orders, notes, intermediate summaries etc. are written in italic letters.
- Series of menu commands are listed in their click sequence, separated by a dash, example: Format – Character.
- Graphics just illustrating the current text are used without a figure subheading.
- Examples are often indented.
- Important words are marked by boldface typing, so that you can find the required information quicker.
- The numbering of tables, figures and checklists, which also appear in the according list (of figures etc.).

If you read this book from the first to the last page you will notice, that **several information is presented more than once**. This was done on purpose. Most information required to create a Technical Report is closely linked with other pieces of information. In order **to present each section** of this book **as complete as possible** in itself and to avoid too many cross-references which would disturb fluent reading, we tried to give all the information you need to complete the task which is just described in the current section of the book.

I *recommend all of you who are not very experienced in writing Technical Reports to read chapter 2 "Planning the Technical Report" and subchapter 3.7 "Using word processing and desktop publishing (DTP) systems", before writing your next Technical Report.*

Each writer's problem described in this book has occurred in Technical Reports submitted by students or during the authors supervised the writing of diploma, bachelor, master or doctorate theses. In addition, the daily professional experience of the authors and many comments of our (German) readers have influenced the contents and layout of this book. Therefore, this book reports **"from practical experience for practical usage.**

Chapter 2

Planning the Technical Report

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Planning the Technical Report

Technical Reports shall be written so that they reach your readers. This requires a high level of systematic order, logic and clarity. These understandability aspects must already be taken into account, when you plan the necessary work steps. This is the only way to perform all work steps accurately. As a result, all facts about the described items or processes and the thoughts of the writer of a Technical Report become clear for the reader without any questions and without doubt.

In technical study courses a systematic approach is used to solve tasks and larger projects. Tasks are solved in the sequence *planning*, *realization* and *checking*. This approved approach should be applied in a similar way when creating Technical Reports. Here the necessary work steps can be grouped in the phases *planning, creation and finishing (with check-ups)*. However, before describing the single measures in the planning process we will present a general overview of all required work steps to create a Technical Report.

## *2.1 General overview of all required work steps*

The following **Checklist 2-1** shows all required work steps.

Checklist 2-1 Required work steps to create Technical Reports

- Accept and analyze the task
- Check or create the title

• Design a 4-point-structure

• Design a 10-point structure

• Search, read and cite literature Work steps

• Elaborate the text (on a computer) to be performed

• Create or select figures and tables partly parallel

• Develop the detailed structure or overlapping

• Perform the final check

• Print copy originals or create PDF file

• Copy and bind the report

• Distribute the report to the defined recipients

This list is complete, but the clarity can be further improved. To accomplish this, network planning is applied.
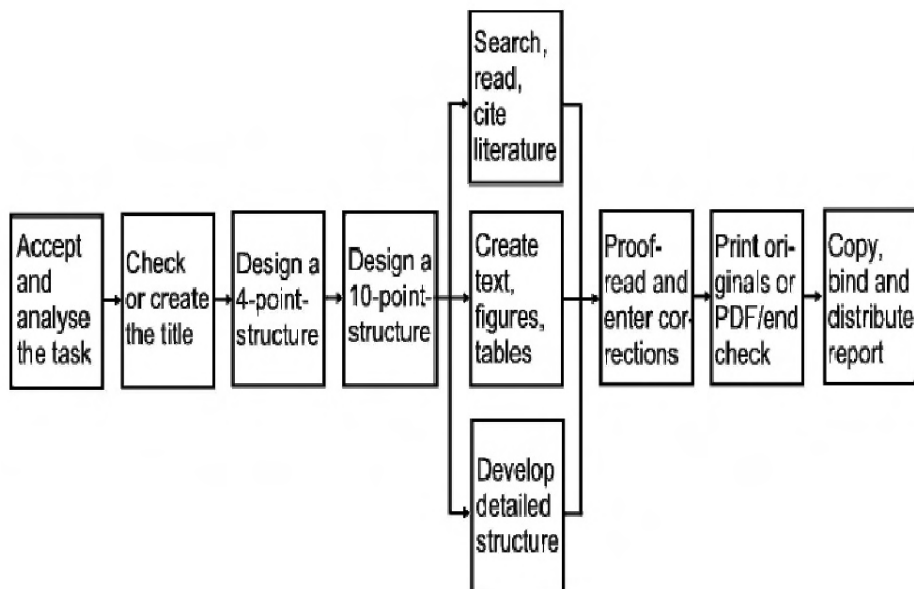
This network plan is always repeated when the different steps to create a Technical Report are described, where the current work step is

marked in gray. Please keep in mind, that the amount of work to create a Technical Report is regularly *completely* underestimated. To avoid this, make a proper assumption of the required time and double the estimated timeframe! Start early enough to create your Technical Report – no later than after 1/3 of the total timeframe of your project.

## *2.2 Accepting and analyzing the task*

When you write a Technical Report, there is nearly always a task, which you either selected yourself or it was defined by someone else. You should analyze this task precisely during the planning of the Technical Report, **Checklist 2-2**.

Checklist 2-2 Analysis of the task to write a Technical Report

- Who has defined the task?
    - a professor or an assistant (in case of a report written during your studies)
    - a supervisor
    - the development team
    - a consulting company
    - a customer
    - you yourself (e. g. if you write an article for a scientific journal)
- Did I understand the task correctly?
- Who belongs to the target group? For whom do I write the report? Please take notes accordingly!

- Which contents shall my report contain? Please write that down!

- Does the task already contain a correct and complete title?

- Which work steps are necessary?

- Which help and assistance do I need?

  – help by people, e. g. *advice-giving specialists*

  – help by equipment, e. g. *a color laser printer*

  – help by information, e. g. *scientific literature*

This work step is called "Accept and analyze the task" in the network plan and it is marked in gray.
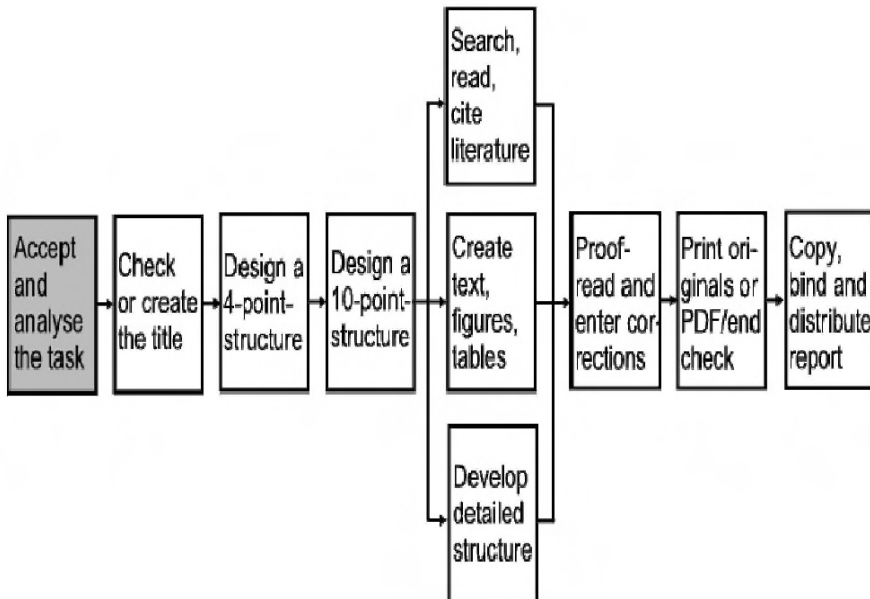

In addition, during the planning of the report the following questions must be answered:

- Which shall be the title of the report? (develop a proposal and discuss it with the supervisor or customer)

- Which work steps that are not mentioned in the network plan need to be accomplished?

- Which background knowledge, interests and expectations do the readers of the Technical Report have?
- How do I organize the required help?
- Which help and work steps are time-critical?

2.3 Checking or creating the title

In the next step, see network plan, the title which in most cases is predefined by the supervisor or customer must be checked and evaluated. A new title should be created.
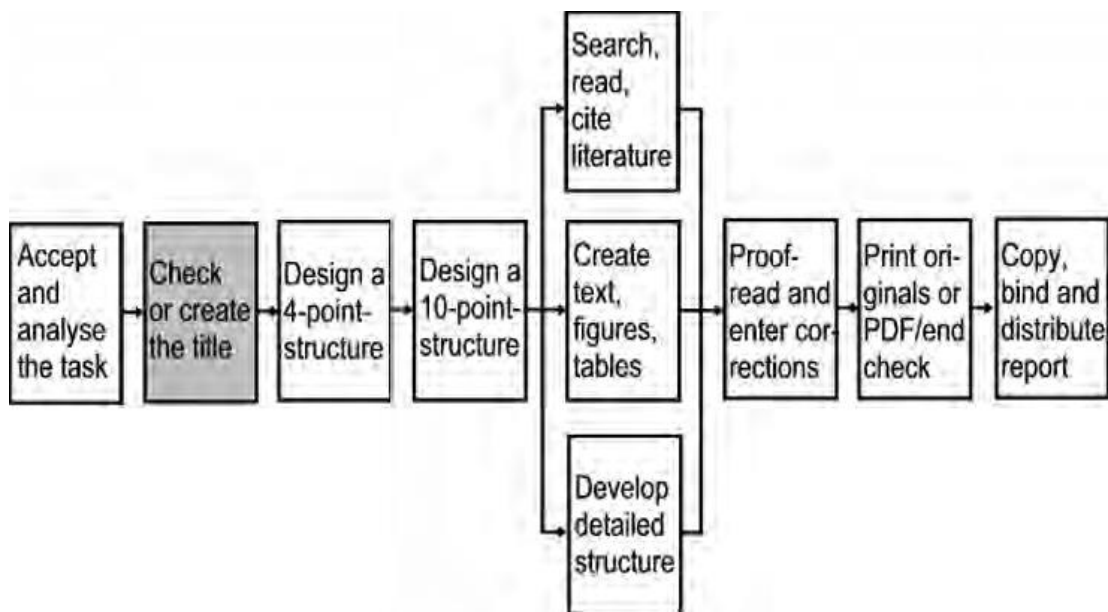
The title of the Technical Report is the first thing a reader will notice. Therefore, it shall create interest and curiosity to learn more about the contents of the Technical Report.

The title shall contain the main topic or the main keywords of the report, it shall be short, precise and true. It shall have a good speech melody

and create interest. Explaining or additional aspects can appear in a subtitle. In any case the title (and subtitle if applicable) shall describe the contents of the Technical Report accurately and it must not create undesired associations or wrong expectations.

These demands, the title of a Technical Report must fulfil, must also be fulfilled by all other titles and headings of paragraphs, figures, tables etc.

In many cases the task can already be used as the title of the Technical Report. Here are some examples of such tasks:

• Design of a drilling rig

• Outline of a sprayer shredding rig

• Analysis of component combinations for sales optimization

• Equipment of a meeting room with radio technology

Even, if a title seems to be usable, we recommend that you systematically create possible title variants. Then you (and eventually the supervisor or customer) can decide which title shall be used. It is also possible to use the task as a working title in the beginning of your project.

The final decision which title shall be used can then be found later during your project without time pressure. The following **Checklist 2-3** shows again all requirements of the title of the Technical Report as a conclusion.

Checklist 2-3 Requirements of the title of the Technical Report

> • The title must be clear, true, honest, short and accurate,
>
> • it must contain the main topics or main keywords (for data base searches!),
>
> • it must create interest and curiosity,
>
> • have a good speech melody and
>
> • eventually an additional subtitle.

Write down the main keywords which characterize your Technical Report by hand, connect these keywords to a title, create several title variants by using different keywords and select the "best" title.

Now the process to create a title will be explained in an example.

Example for the creation of a title

We are looking for the title of a doctorate thesis. In the doctorate project a computer program has been developed, that allows the selection of the materials of designed parts depending on the stress on the part, abrasion requirements etc. The designer enters the requirements which the material must fulfill and the system provides the materials, which are stored in its database and match the given requirements. It has been quite early in the project that the developer of the system, the doctorate candidate, has defined the term "CAMS" = Computer Aided Material Selection to describe the purpose of the program.

The doctorate candidate starts to create a title for his thesis as described above. He starts to **write down the keywords** that shall be contained in the title.

– **material selection**

– **design**

– **education**

– **CAMS**

– **with computer**

The next step is to **combine the keywords** to get different titles:

- **Contribution to computer-aided material selection**

- **Computer-aided material selection in design**

- **Computer-aided material selection in design education**

- **Computer Aided Material Selection = CAMS**

- **CAMS in design education**

- **Help to select materials by the computer**

- **Computer application for material selection**

- **CAMS in design**

- **Design with CAMS**

- **Computer support in design education**

- **Material selection with the computer**

Since the doctorate candidate has defined the term CAMS it shall definitely appear in the title of his doctorate thesis, so he decides to select the following title:

**Computer Aided Material Selection – CAMS in Design Education**

The following list of work steps summarizes the process to find a good title for your Technical Report. *Use the following work steps to create the title:*

- *write down the task*
- *write down the keywords which characterize the report*
- *combine the keywords to a title*
- *find new titles by varying the usage of these keywords*
- *read possible titles aloud to optimize the speech melody*
- *select the "best" title*

After the title has been created, the next step is to **design the structure**.

2.4 The structure as the "backbone" of the Technical Report

In our network plan to create Technical Reports we have now arrived at the two last work steps in the phase of planning the report. These work steps are designing the 4-point- and 10-point-structure.
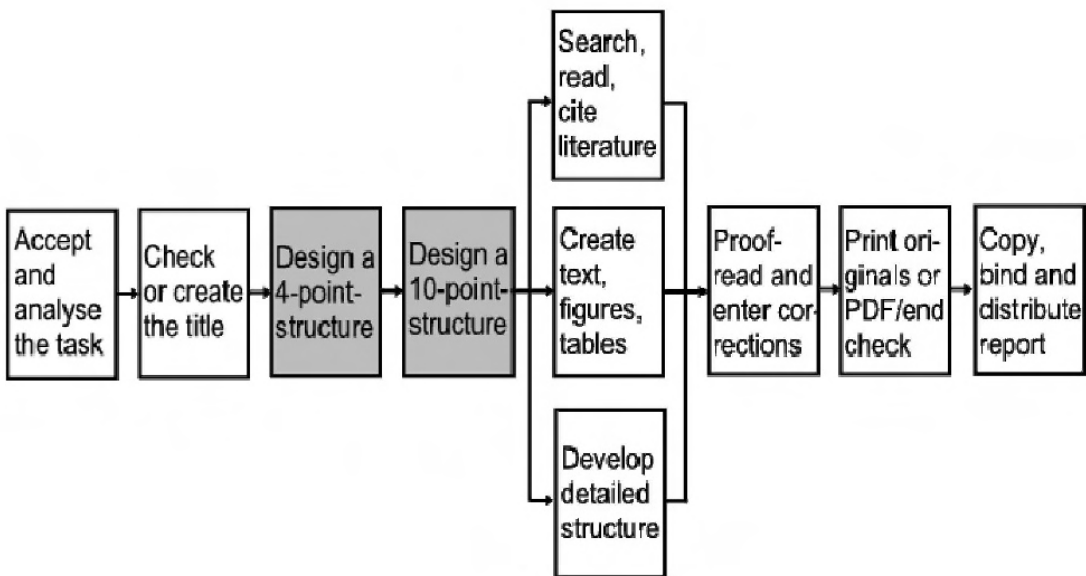
Since **designing the structure is the main step of planning** the Technical Report, we want to give you an introduction to the underlying rules of logic and formal design in the next three sections. Then we will show you how to create a logical structure and provide you with four structure patterns in sections 2.4.4 and 2.4.5. Many people do not distinguish properly between the terms "structure" and "table of contents" (ToC). Therefore we define these terms as follows:

Structure	*Without* page numbers	contains the logic	is **intermediate result**
ToC	*with* page numbers	allows searching	is **final result**

The typographic design or layout of the structure or table of contents is not a work step in the phase of planning the Technical Report, but it belongs to creating the Technical Report.

2.4.1 General information about structure and table of contents

The **structure** (while writing the Technical Report) or the table of contents (after finishing the Technical Report) is the **"front entrance door"** into your Technical Report. It is the next piece after title leaf and Preface/Foreword and/or Summary that is read in larger documents like books, applications for research projects, final reports of research projects, design descriptions, etc.

A good structure is so important for the understandability and plausibility of texts – even of short texts like e-mails –, that you should always structure every text that exceeds the amount of about one page with intermediate headings – at least every text describing facts.

The structure allows you to get a **quick overview•** to find your way into the contents of the Technical Report, to get help from your supervisor, and to evaluate/grade your Technical Report.

Therefore, you should always take the current state of the structure with you when you are going to discuss the current status of your project with your supervisor (boss, assistant, professor, etc.) or with your customer. They ask for it quite frequently!

Other materials which are not necessarily required (e. g. literature references and copies which are important or difficult to get) should also be available in the meeting.

For each reader of a Technical Report the structure is the most important tool to understand the contents. Therefore, you should not make

any compromises with yourself when designing the structure! This also holds true for writing the whole Technical Report. Wherever you are not confident with your report, the supervisor will criticize this not so successful part of the Technical Report in most cases – and a customer will make up his/her mind.

The information, which forms your Technical Report, will only be sorted into the drawers, which are defined by the structure. Thus, creating the structure is the creative part of the work. Writing the text is just "craftsmanship", which requires only routine.

2.4.2 Rules for the structure in ISO 2145

When explaining the term **structure**, it is also necessary to discuss **levels of document part headings**. People use terms like chapter, subchapter, section, subsection, main item, item, clause, sub clause, paragraph, listing, etc. To refer to document parts of various levels, but these terms are not used by all people in the same sense.

If you look into the standard ISO 2145 "Documentation – Numbering of divisions and subdivisions in written text", you will find that the standard uses the terms "main divisions" for the 1st level, "subdivisions" for the 2nd level and "further levels of subdivision" for the 3rd and all lower levels.

However, this terminology does not comply with the general usage of language of most people, who think of large documents being subdivided into chapters. Therefore, in this book we will use the following system of terminology based on the term "chapter".

title (whole report)
 chapter
  subchapter
   section — *document part headings*
    subsection
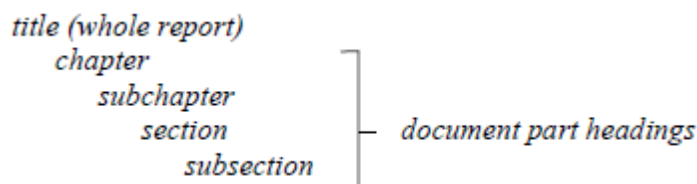
This gives clarity and the text blocks on all different levels of hierarchy can be individually named. To continue this hierarchy, the following terms should be used to refer to **text elements**.

paragraph
 sentence
  word
   character

Apart from text the document parts can also contain other objects that illustrate the statements or messages given in the text. In many texts the following objects, which are equivalent to paragraphs, occur.

table
figure
equation
list

The standard ISO 2145 "Documentation – Numbering of divisions and subdivisions in written text" is the most important standard for creating the structure of a document. It is relevant for all types of contents, i.e. for texts dealing with technology, commerce, humanities, laws, medicine etc. and for all kinds of written documents like manuscripts, printed works, books, journal articles, manuals, directions for use and standards.

The standard itself has the following structure:

- Scope and field of application
- Numbering of divisions and subdivisions

• Citation of division and subdivision numbers in text

• Spoken form

The numbering of document parts is in consecutive Arabic numerals. Each document part can be further subdivided into at least two subdivisions. The subdivisions are also continuously numbered. The document part hierarchy is expressed by a **full stop between the numbers of subdivisions on different levels**. No full stop shall be used at the end of the final level, i. e. chapter numbers will not have a full stop at the end.

According to ISO 2145 there can be any number of document part levels, but the number should be limited, so that reference numbers are still easy to identify, to read and to cite. We recommend, that the **number of document part levels should be limited to three, if possible.** Example: A document has nine chapters numbered 1, 2, 3, etc. Chapter two is e. g. subdivided into subchapters 2.1 and 2.2. Subchapter 2.1 is subdivided into sections 2.1.1, 2.1.2 and 2.1.3. To keep the document numbers simple, we recommend, that the **number of equal document parts on the same level should not exceed nine**.

A document part number "0" (zero) can be assigned to the first division of each level, if the contents of that document part has the character of a foreword, preface, introduction or similar type. This is more frequently used for the chapter and subchapter levels (numbers 0 and n.0) than for the further levels.

Technical reports require a high level of tidiness and logic. This logic must naturally speaking be reflected in the structure. Therefore, when writing a Technical Report, the author must always **keep the inner logic from the first sketch to the final version of the structure**. The sequence of work steps described in 2.4.4 "Work steps to create a structure and example structures" will nearly automatically result in a good and logical structure. Before this is described in detail, we want to introduce important rules for document part numbers and document part headings, because these rules will be applied in section 2.4.4 during the creation of structures.

2.4.3 Logic and formal design of document part headings

Document part numbers and document part headings express the logic of the sequence of thoughts and work steps (the "thread" or "backbone") in the Technical Report. For many people "logic" has something to do with mathematics and its rules. However, there is also the logic of language, which is examined in many intelligence tests beside the mathematical logic.

You should be able to optimize your own structures according to the logical sequence of thoughts and work steps described in your Technical Report. This requires that you develop the ability to check your own structures for proper logic of language.

This recommendation will now be explained by means of examples and further descriptions. It is a key requirement of a logical structure that **different document part headings on the same level of hierarchy must**

be equally important and consistent. Therefore, the following part of a structure is **not logical**:

3.5 Technical evaluation of concept variants

3.5.1 Technical evaluation table

3.6 Economical evaluation table

It happens quite frequently in Technical Reports and other larger documents or books that a document part heading is **subdivided only once**. However, this is not logical, because the subdivision into document parts of a lower than the current level happens, because *several* aspects of a superordinated topic shall be distinguished from each other.

Therefore it is **not logical, to subdivide** a higher-level topic **in the next lower document hierarchy level into only one document part heading**. Here you should either add one or more additional document part headings of the same hierarchy level or leave the super ordinated topic without subdivision. Here is a correct alternative for the bad example above:

3.5 Technical-economical evaluation of the concept variants

3.5.1 Technical evaluation of the concept variants

3.5.2 Economical evaluation of the concept variants

3.5.3 Summarizing evaluation of the concept variants in the s-diagram

Here is another example.

Not logical:

1 Introduction

1.1 Starting point

2 Basics of metal powder production

Logical solution:

1 Introduction

1.1 Starting point

1.2 Goals of this work

2 Basics of metal powder production

Other logical solution:

1 Introduction

2 Basics of metal powder production

Each document part heading shall be complete in itself and represent the contents of the document part properly! It shall be short, clear and accurate as the title of the whole Technical Report. **Document part headings that consist of one word only can often be improved**. Exceptions from this rule are *generally-used* single words like Introduction, References, Appendices etc.

Please find a summary of the rules mentioned so far plus additional rules for document part headings and numbers in the following **Checklist 2-4**.

Checklist 2-4 Rules for document part numbers and headings

Rules of logic

- Full stops in section numbers define the hierarchy level in the document

- Document part numbers0, n.0 etc. can be used for foreword/preface, introduction etc.

- Each hierarchy level consists of at least two document parts which are logically of equal importance

- The document part heading may not be the first part of the first sentence of the first paragraph in the appertaining text, but it must be an own and independent element of the Technical Report. The first sentence of the following text must be a complete sentence, which may pick up or repeat the contents of the document part heading.

Formal rules

- The declaration in lieu of an oath, task, abstract, foreword/preface and table of contents always get a document part heading, but no document part number.

- At the end of document part number and document part heading *never* use a punctuation mark like period, colon, question mark, exclamation mark etc.

- It is unusual to formulate the document part heading as a complete sentence or as a main clause with one or more subclasses.

- At the end of document part headings there is *never* a reference to the literature like "[13]".

Layout rules

- If you want to create the table of contents automatically with your word processing program, use the standard format patterns or formatting styles resp. in the continuous text. Format chapter headings with "Heading 1", subchapter headings with "Heading 2", section headings with "Heading 3" etc. You may as well change the formatting of these format patterns to modify the appearance of the headings in the continuous text. To modify the appearance of the table of contents, change the format patterns "ToC 1", „ToC 2" or however they are called in your word processor, see also 3.7.4. It is general use that the document part headings appear in boldface typing and larger than the normal text. They must not be underlined.

- Please avoid capital letters in headings and table items (in the table of contents, list of figures, list of tables etc.), because this is substantially more difficult to read than the ordinary mixture of capital and small letters.

- It is not clearly defined in ISO 5966 "Documentation – Presentation of scientific and technical reports" and in other documentation standards (e.g. ISO 8 "Documentation - Presentation of periodicals"), which distance document part headings should have from the previous and following text. In the different standards, this distance is sometimes alike (ISO 5966) and sometimes the distance to the previous text is larger (ISO 8). If the distance above a document part heading is larger than the distance below, it becomes

clearer, which heading belongs to which text, and therefore we recommend this layout principle.

The rules above hold similarly true for titles of tables and figures/illustrations with the following exceptions:

- At the end of table and figure titles *there must appear* a citation, if the figure or table is created by other authors.

- There are other rules for table numbers and figure numbers than for document part numbers. Figures and tables are either chronologically numbered through the complete Technical Report or the numbers are combined using the chapter number and a running number within the current chapter. Often these two components of the table or figure number are connected by a hyphen, see also 3.3.2 and 3.4.2.

- If the list of figures and list of tables shall be created automatically from the figure and table titles, you must not use manual formatting to influence the appearance of the text, but you should apply appropriate format patterns or formatting styles resp., see also 3.3.2 and 3.4.2 as well as 3.7.4.

After we have introduced you to the most important rules for the formulation and layout of document part numbers and headings, now we can use that knowledge to create the structure.

2.4.4 Work steps to create a structure and example structures

The creation of the structure should be divided into several consecutive work steps. Starting from the working title (or the final title) the **main topic or core message** of the Technical Report should be formulated **in *one* sentence**. This information will **then be further subdivided** into document part headings up to the complete final structure which will appear in the Technical Report as the table of contents later. To develop the final, logical structure, the following procedure has quite frequently been successfully applied, **Checklist 2-5**.

Checklist 2-5 Work steps to create a structure

1. Formulate the title of the main topic, main target or core message of the Technical Report in one sentence.

2. Subdivision into 3 to 4 main items (4-point-structure).

3. Further subdivision into 8 to 10 main items (10-point-structure).

4. Further subdivision of extensive main items.

5. Further subdivision into the final detailed structure parallel with the further elaboration of the Technical Report.

6. Last but not least: Check whether the document part numbers and headings are identical in the structure and in the text (check for completeness and correctness) and add page numbers to the structure to make it a table of contents, if the table of contents shall not be automatically created by your word processor.

If you apply this procedure, the logical order of information which is already defined in the 4-point-structure cannot be lost any more up to the final detailed structure, when you add divisions or split divisions into subdivisions!

Now this **procedure shall be explained by means of examples**. The examples are derived from a report about the enhancement of the computer network at a customer company (a project report), a design report, a report about executed measurements (laboratory report), and a diploma thesis, where a computer program has been developed. Naturally speaking, this procedure can be applied for any other type of report like for literature research works etc. **Checklist 2-6** provides a summary.

Example 1: Report about the enhancements of a computer network

Title of the report:
Equipment of a meeting room with radio technology

1st Step: Formulate the main topic (main target) of the Technical Report
The computer network in the customer company shall be enhanced so that there are two additional internet access points for external staff members in the training room and two additional internet access points for training participants in the lounge.

2nd Step: Subdivision into 3 to 4 items (4-point-structure)
- Analysis of the customer's requirements
- Planning of the new network structure
- Realization of the network enhancements in the customer company
- Billing and payment

3rd Step: Subdivision into 8 to 10 items (10-point structure)
1 Introduction
2 Analysis of the customer's requirements
3 Planning of the new network structure
4 Preparing work steps
5 Realization of the network enhancements in the customer company
6 Inspection
7 Billing and payment
8 Conclusions

4th Step: Further subdivision of extensive main items
Chapter 2 can be subdivided into the steps status quo-analysis and target situation-analysis. Chapters 3, 4 and 5 and 9 Appendices have also been subdivided further in the original work.

5th Step: Further subdivision into the final detailed structure
parallel with the further elaboration of the Technical Report
3 Planning of the new network structure
   3.1 Collection of offers from hardware suppliers
   3.2 Benefit analysis and decision of suppliers for the hardware to be used
   3.3 Planning the wiring
   3.4 Planning of external services

Example 2: Design report

Title of the report:
Redesign of a production plant for Magnesium-Lithium-Hydrogen alloys

1st Step: Formulate main topic (main target) of the Technical Report
    Weaknesses of the existing founding plant shall be improved by the redesign.
2nd Step: Subdivision into 3 to 4 main items (4-point-structure)
- State of the art
- Description of the existing weaknesses
- Description of the modifications
3rd Step: Subdivision into 8 to 10 main items (10-point-structure)
    1   Introduction
    2   State of the art
    3   Necessary modifications of the existing plant
    4   Requirements the new plant shall fulfill
    5   Redesign and reconstruction of the existing plant
    6   Practical testing of the new plant
    7   Evaluation of the tests with the new founding plant
    8   Conclusions and outlook
4th Step: Further subdivision of extensive main items
    Chapter 3 can be subdivided into the necessary modifications (possible usage of the plant for other technological processes, facilitated usage and handling, facilitated cleaning, improved safety while working with hydrogen etc.).
    Chapter 5 can be subdivided into basic design principles applied for the redesign of the founding plant and design details.
5th Step: Further subdivision into the final detailed structure
             parallel with the further elaboration of the Technical Report
    5   Redesign of the new plant
        5.1   Basic design principles and principle drawing
        5.2   Design details to realize the required modifications
            5.2.1   Basic design of the founding plant
            5.2.2   Temperature flow in the plant components
            5.2.3   Gas flow of inert gas and alloy gas
            5.2.4   Modifications of the casting device
            5.2.5   Flexible structure of the cast container via plugging system
            5.2.6   Inert gas container for the die-cast
            5.2.7   Central plant control via the control panel

Example 3: Report about executed measurements

Title of the report:
Damage detection with holographic interferometry

1st **Step:**   Formulate main topic (main target) of the Technical Report
The deformation of a steel container under inner pressure shall be measured with holographic interferometry (target: identification of the influence of container geometry, welding zone, heat affected zone and intentionally added material flaws on the deformation of the steel container).

2nd **Step:**   Subdivision into 3 to 4 main items (4-point-structure)
- State of the art
- Testing plant design
- Test execution
- Test results

3rd **Step:**   Subdivision into 8 to 10 main items (10-point-structure)
1   Introduction
2   State of the art
3   Testing plant design
4   Test preparation
5   Test execution
6   Evaluation of the interferograms
7   Estimation and classification of measurement flaws
8   Proposals for continuing works
9   Conclusions

4th **Step:**   Further subdivision of extensive main items
Chapter 5 can be subdivided by the type of the executed work steps into estimation of the required inner pressure in the testing container, description of the unintended material flaws in the welding zone, the heat affected zone and the intentionally added material flaws, description of the measurement points, influence of the container geometry.
In chapter 6 the evaluation of the measuring results can be subdivided into the local influence of the weld seam and welding zone and the types of intentionally added material flaws.

5th **Step:**   Further subdivision into the final detailed structure
             parallel with the further elaboration of the Technical Report
6   Evaluation of the interferograms
    6.1   Relative deformation extremae
    6.2   Influence of the heat affected zone
    6.3   Influence of the welding bead
    6.4   Influence of the intentionally added material flaws

---

Example 4: Report about the development of software

Title of the report:
Computer-aided analysis and optimization of the understandability of technical texts

1st **Step:**   Formulate the main topic (main target) of the Technical Report
Starting from existing approaches to improve the understandability of texts an interactive computer program shall be developed that measures the understandability of text and that stepwise improves the understandability of the text in constant dialogue with the user.

2nd **Step:**   Subdivision into 3 to 4 main items (4-point-structure)
- Approaches to measure and improve the understandability of texts
- Development of the understandability improvement concept of docutune
- The program system docutune
- Documentation of the source code

3rd **Step:**   Subdivision into 8 to 10 main items (10-point-structure)
1   Introduction
2   Approaches to measure and improve the understandability of texts
3   Development of the understandability improvement concept of docutune
4   The program system docutune
5   Documentation of the source code
6   The practical use of docutune
7   Further development of docutune
8   Conclusions and outlook

4th **Step:**   Further subdivision of extensive main topics
Chapter 2 deals with the state-of-the-art as it is described in the literature. It has been further subdivided into scientific approaches to the research on understandability, practically-oriented approaches to improve the understandability and Hamburg concept of understandability.

5th **Step:**   Further subdivision into the final detailed structure
parallel with the further elaboration of the Technical Report
4   The program system docutune
  4.1   The menu structure of docutune
  4.2   The sequence of docutune's feature groups
    4.2.1   General overview of the sequence of all feature groups
    4.2.2   Sequence of the feature group Typography
    4.2.3   Sequence of the feature group Clarity
    … (further sections for Logic, Shortness, Motivators)
    4.2.8   Sequence of the feature group Orthography
  4.3   Help features for searching and classification
    4.3.1   The word classification object
    4.3.2   The dictionary object

Checklist 2-6   Rules and tips for creating the structure

1st Step: Formulate main topic (main target) of the Technical Report
Here you should formulate the target of the project, the literature research, the tests, the measurements, the design, the expert opinion or the report in general. Even if it seems hard to accomplish: Write that down in one sentence only!

2nd Step: Subdivision into 3 to 4 main items (4-point-structure)
Examples:
- "Starting situation – Own contribution – Improvements of the situation – Summary"
- "State-of-the-art – Testing rig design – Test execution – Test results – Conclusions"

If you integrate the task of your project into your Technical Report as an independent chapter, then the chapter "Task" and the various chapters about fulfilling the task (general draft, detailed design, computation of loads or testing rig design, test execution, test results etc.) are each an individual chapter.

3rd Step: Subdivision into 8 to 10 main items (10-point-structure)
Possible structuring principles for the 3rd, 4th and 5th step are:
- by time sequence or
- by starting point conditions
- by project targets
- by possible alternatives
- by components or part groups
- by improvement steps
- by related topics or in the special case depending on the task

4th Step: Further subdivision of extensive main items
Possible structuring principles have already been mentioned in the 3rd step. We recommend, that *before* writing the text for a chapter, you should create a temporary structure of this chapter into subchapters. In the same way, *before* writing the text for a subchapter, you should create a temporary structure of this subchapter into sections or consciously decide that no further subdivision is necessary etc. This recommendation corresponds to the sequence of work steps to create a temporary 4-point- and 10-point-structure of the Technical Report, before you start at all with writing text, searching for literature and collecting other materials.

To reach your target group you should use common document part headings, which your reader expects to find in your Technical Report. In a report about laboratory experiments, a reader would for example expect document part headings like testing rig design, test execution and test evaluation or test results. Therefore you should use these document part headings in your Technical Report and in your literature and material collection.

5th Step: Further subdivision into the final detailed structure
parallel with the further elaboration of the Technical Report
This step needs no further explanation.

2.4.5 General structure patterns for Technical Reports

In the following, we show you **structure patterns for often written types of Technical Reports**, which have been successfully used in practice. If you use such a structure pattern, you don't need to create a 4-point- and 10-point-structure.

At first we provide a structure pattern for a rough design description in which after analyzing the sub functions and the design solutions of the sub functions several concept variants are defined. These will then be evaluated according to the VDI guidelines for design methodology VDI 2222 and 2225 (see also 3.3.3 "The morphological box – a *special* table").

Structure pattern of a rough design description – several concept variants
1   Starting situation
2   Task
2.1   Task definition
2.2   List of requirements
3   Function analysis
3.1   Formulating the overall function
3.2   Subdivision into sub functions
3.3   Morphological box
3.4   Definition of the concept variants
3.5   Technical evaluation of the concept variants
3.6   Economical evaluation of the concept variants
3.7   Selection of the most useful concept variant with the s-diagram
4   Design
4.1   Design description
4.2   Computation of loads
5   Summary and conclusions
6   References
A   Bill of materials
B   Manufacturer documents

If you do not add manufacturer documents, just use the appendix "A Bill of materials". If you want to add printouts or plots or photocopies of technical drawings in reduced size, you can structure the appendices as follows: A Bill of materials, B Assembly drawing, C Component drawings, D Manufacturer documents. The bill of materials is actually not a part of the report, but it belongs to the set of drawings. Since in universities the drawings are transported in drawing rolls, it has proven to be practical, to add the bill of materials twice to the Technical Report: one copy of the bill of materials is added as an appendix of the bound Technical Report and the other is added to the set of drawings in the drawing roll.

If in industry during a presentation plotted drawings are fixed to the walls of the meeting room, the (enlarged!) bill of materials can also be hung up at the wall. Please decide, whether you want to add a photocopy of the assembly drawing in reduced size to your Technical Report. It can either be added to an appendix (directly behind the bill of materials) or used in a text chapter (preferably in the chapter "Design description".

If the photocopy of the assembly drawing in reduced size is bound in your Technical Report, this has another advantage: In the design description the parts can be referred to with their names and in addition with their position numbers, e. g. "Handle (23)" in the assembly drawing and in the bill of materials. However, when the first part name with added position number occurs in the text of the design description, you should explain, that the number is a position number and refers to the assembly drawing and the bill of materials.

Identical parts, which are used in two different components (e. g. headless screws at two halves of a clutch), occur only once in the bill of materials in a common line with a common position number.

The column "Number" contains the information, how often the part is used in the complete assembly. So the person who mounts the part can check, whether all required single parts are available.

Now we want to look at the structure patterns again. In the following you will find a structure pattern for a rough design description where the most useful design solutions of the sub functions are combined to only one concept.

Structure pattern of a rough design description – one concept variant

1   Introduction
2   Task
    2.1   Task definition
    2.2   List of requirements
3   Function analysis
    3.1   Formulating the overall function
    3.2   Subdivision into sub functions
    3.3   Morphological box
    3.4   Verbal evaluation of the design alternatives for the sub functions
    3.5   Description of the concept variant
4   Design
    4.1   Design description
    4.2   Computation of loads
5   Summary and conclusions
6   References
A   Bill of materials
B   Manufacturer documents

Now we want to give you a structure pattern for projects dealing with *laboratory experiments or other experimental works*. First there is an important rule:

Laboratory experiments must always be documented "reproducible"!

This means, that all information must be provided in detail so that another team of researchers can execute the experiments again under exactly the same conditions and they will get the same results. Therefore, the following information may never be left out:

- Testing machine, device, or rig with manufacturer, type number and/or name, inventory number etc.

- All parameters set or selected at the machine, device or rig

- All measuring instruments, always with manufacturer, type number and/or name, inventory number, set or selected parameters etc.

- tested specimens with all required data according to the appertaining standard, regulation or guideline (ISO, EN, DIN or other), taken samples

- In experiments which are not standardized similar data regarding specimen shape, experiment parameters, temperatures, physical/chemical properties etc.

- All measured values or test results with all parameters

- Used evaluation formulas with complete bibliographical data of used references

Provide so much information, that someone else will measure the same values or find out the same test results as you, if he/she executes the experiments exactly under the described conditions.

Structure pattern of an experimental work

1 Target and scope of the test
2 Theoretical basics
3 The laboratory experiment/test
   3.1 Testing rig design
       3.1.1 Testing machine, plant, rig or device
       3.1.2 Used measuring instruments
   3.2 Test preparations
       3.2.1 Specimen preparations
       3.2.2 Setup of the starting conditions
   3.3 Test execution
       3.3.1 Execution of the preparation tests
       3.3.2 Execution of the main tests
   3.4 Test results
   3.5 Test evaluation
   3.6 Estimation of measurement flaws
4 Critical discussion of the laboratory experiments/tests
5 Conclusions
6 References
A Measurement protocols of the preparation tests
B Measurement protocols of the main tests

Now we want to give you a short introduction to a different type of document or Technical Report before we will provide you with a structure pattern for that document type.

Manuals and instructions for the usage for complex technical products should be written by technical writers. However, in practice they are often

written by engineers. During engineering study courses the supervisor gives the task to develop a new electronic circuit or the design of a plant or rig. As part of the project it is always necessary to prepare the technical documents, but in more and more cases, it is also required that the instruction manual for a potential user must be written.

Therefore, we will give you a structure pattern for manuals and instructions for use. Manuals and instructions for use are structured according to different schemes. They can be subdivided and numbered according to ISO 2145, but they can as well have document part headings without document part numbers, which are just layouted in boldface typing.

To provide more uniformity here, EN 62079 "Creation of instructions; Structure, contents and presentation" has been published. Among other information this standard describes, which information shall be given in which sequence in instruction manuals. Other definitions used in the following structure pattern are derived from DIN 31051 "Grundlagen der Instandhaltung (Basics of maintenance)", DIN 32541 "Betreiben von Maschinen und vergleichbaren technischen Arbeitsmitteln – Begriffe für Tätigkeiten (Running machines and comparable technical devices – Terms for work steps", VDI guideline 4500 "Technische Dokumentation (Technical documentation)".

The information can either be presented according to the structure and logic of the product (product-oriented) or according to the sequence and logic of work steps during product usage (task-oriented).

Structure pattern for manuals and instructions for use

  1 Before operating the machine/device

    1.1 Important information about the machine/device (Definition/description of the machine/device, description of the benefits, safety notes and warnings, overview of the functions)

    1.2 Supplied/delivered scope and optional parts

    1.3 Usage of the machine/device (Rules and regulations, safety notes and warnings, intended usage, unintended usage, documentation provided by third parties)

    1.4 Transportation of the machine/device

    1.5 Requirements regarding the site

    1.6 Unwrapping, assembling, mounting and setup of the machine/device

    1.7 Connection of the machine/device to supply and disposal networks (water, electricity, computer network etc.) and operation test

  2 Operation and usage of the machine/device

    2.1 Initiation of the machine/device

    2.2 Functions of the machine/device during normal operation, safety notes and warnings

    2.3 Refilling consumptive materials

    2.4 Cleaning the machine/device

    2.5 Preventive maintenance (maintenance, inspections)

    2.6 Disposal of supporting and operating materials

    2.7 Shutting-down the machine/device

  3 After operating the machine/device

    3.1 Finding the cause of disorder and resolving it

    3.2 Ordering spare parts, wear and tear parts and electric plans

    3.3 Disassembling the machine/device

    3.4 Disposal and recycling of the machine/device (what? where? how?)

  4 Appendices

    4.1 Possible causes of disorder/Trouble shooting (what shall I do, if ...?)

> 4.2 Spare parts, additional parts (exceeding the supplied/delivered scope)
> 4.3 Glossary
> 4.4 Index

The above structure pattern for manuals and instructions for use differs from the other structure patterns, because the individual document part headings are partially not as detailed as in the other structure patterns. This was done intentionally, because the described technical products can have very different levels of complexity and very different philosophies of use. Therefore look at this last structure pattern only as an orientation and adopt it to your described technical product.

Naturally speaking all structure patterns described in this section can be adopted to the described project, product, topic or task. If the supervisor has published an own structure pattern, it should be used. On the other hand, if you use the structure patterns presented in this book, you will establish a correct logical sequence of thoughts, topics, work steps etc.

2.5 Project notebook (jotter)

In a guideline how to write Technical Reports by Thomas Hirschberg, a professor at the University of Applied Sciences in Hannover I found the following advice.

You should s*tructure the contents of your report as early as possible and note all open problems, decisions and remaining work steps regarding your project "online" in a project notebook (jotter). Do **not** start with writing your Technical Report after all practical work has been completed.*

Since you need your project notebook both at your workplace/in the laboratory and at home, you should use a small booklet.

2.6 The style guide advances consistency in wording and design

A style guide is **only required for the creation of larger written documents**. It is similar with the documentation manual of a documentation or translation service provider. It has the purpose that within a larger document the same things or ideas have the same names (**terminology**) or that they are displayed in the same way (l**ayout**), so that the document (or Technical Report) is **consistent** in itself.

Therefore, in the Style Guide you can collect your preferred **spelling of words, wording of phrases, special terms** as well as **layout rules**. Let us refer to the first and fourth line of the current paragraph. You have probably noticed that the spelling of the special term style-guide differs from the spelling in the previous paragraph and in the heading. However, this should not happen within the same report.

Therefore such rules are listed in a style guide and checked during proof-reading and final check with the function "Find" or "Find and replace" of your word processor. Violations of the rules in the style guide are then corrected. In this way the style guide helps to keep consistency in formulation and design within the Technical Report.

In the following **Checklist 2-7** you can see examples of what can be listed or standardized in a style guide. The checklist shows part of the

checklist for this book (the German version). The spelling and layout rules have been defined by the editors and the authors of this book, here the editors have mainly defined the margins and the formatting patterns (corporate design). These formatting rules result in a packed layout. For normal Technical Reports the font size of the standard text should be 11 or 12 pt and the gap between paragraphs 6 pt. All other formats listed in the checklist must be adjusted accordingly. Similar layout rules as we have got from the editors can be found in most institutes and companies.

The **usage of a style guide can save a lot of time and effort**. For example, you can store terms, preferred spellings, standard figure titles, drawings, illustrations, logos, copyright notes etc., which appear several times in your Technical Report, in your style guide and copy them where needed from your style guide to your current text file. It is strongly recommended, that you create and use an own style guide for your Technical Reports. It is too time-consuming and insecure, to try to keep in mind all defined rules and regulations.

Checklist 2-7   Example entries in a Style Guide for a Technical Report

Bullet lists and ordered lists always start at the left document margin.
* the first list mark is a small thick bullet (Alt + 0149 while Num Lock key is pressed)
  – the second list mark is a dash (Ctrl + Minus in the numeral keyboard)

Behaviour guidelines (you-form, the hand symbol is not italic, indentation 0,5 cm):
 Write down ...

Spelling

use	*do not use*
Words and phrases	
design report	design-report
PowerPoint	Powerpoint

Self-defined formatting patterns

Element	Formatting pattern	Keywords
above list	ListAbove	2 pt empty line
below list	ListBelow	6 pt empty line
figure heading	HeadingFigure	9 pt/ distance above 24 pt/below 12 pt
formula	Formula	10 pt, indentation 1 cm
handwriting	Handwriting	Segoe Script 9 pt/bold/indentation 0.5 cm
standard paragraphs	Standard	10 pt/distance below 4 pt
table heading	HeadingTable	9 pt/distance above 12 pt/below 12 pt Double line ¾ pt
document part	Heading 1	16 pt/bold/distance below 30 pt
headings	Heading 2	13 pt/bold/distance above 18 pt/below 9 pt
level 1 to 3	Heading 3	11 pt/bold/distance above 12 pt/below 4 pt

Entering symbols via numeral keyboard (switched on with FN+NumLock or FN+F11)

Standard font:		– Alt-0150	Symbol font:		⇒ Alt-0222
©	Alt-Ctrl-C, Alt-0169	• Alt-0149	•	Alt-0183	× Alt-0180
®	Alt-Ctrl-R, Alt-0174	· Alt-0183	≈	Alt-0187	≤ Alt-0163
~	Alt-0126	« Alt-0171	≅	Alt-0064	≥ Alt-0179
±	Alt-0177	» Alt-0187	≠	Alt-0185	™ Alt-0212

soft line break: Ctrl-Minus   dash: Ctrl-Minus in the numeral keyboard

This completes the planning of your Technical Report. Now the most extensive part of the work steps on your Technical Report will be described, i.e. the practical realization of your plans. This contains literature research and reading, writing text, creating figures and tables as well as the continuous adoption of your structure to the current state of your project and development of your Technical Report.

Chapter 3

Writing and creating the

Technical Report

Chapter 3

Writing and creating the Technical Report

In this chapter, you will get many tips and see many examples for the appropriate creation of the Technical Report. Hints for working with word processor systems are mainly collected in sections 3.7.1, 3.7.4 and 3.7.5. However, before showing the details of chapter 3, we want to present some general and summarizing thoughts.

We have already discussed that creating the structure of the Technical Report is the difficult and creative part of the whole task. The structure determines, whether the Technical Report has a comprehensible inner logic.

Despite the fact, that many beginners in "Technical Writing" find it difficult, creating the complete Technical Report is more or less a craft. It includes keeping the rules, which are introduced and explained in detail in this book.

Often you can see it in Technical Reports from when on the time-pressure in the project has raised, i. e. from when on errors and un-precise descriptions show up more frequently! Therefore, the final check is a very important work step, which may not be left out due to time-pressure at all, see section 3.9.3.

It may happen that a supervisor or customer does not have contents-related reasons to criticize your work. If he/she still wants to find

something, he/she often criticizes little odd details or formal aspects. To avoid these problems you should work in many projects in practice.

Often institutes, companies, authorities, and other institutions have rules for the optical appearance and computer-based creation of letters, reports, overhead slides, and other documents, so that they fit into the unique optical appearance (corporate design) of the institution. Such rules and guidelines should be integrated into the style guide (section 2.6) and the report checklist (section 3.9.1) and applied during the whole process of creating the Technical Report.

After finishing the phase planning the Technical Report we will now go into the details of writing and creating the Technical Report. In the network plan this phase is marked in gray again.

Please keep in mind the following rule for all tasks marked in the network plan:

From time to time you should imagine to be the reader and ask yourself: When does the reader need which information? Does the current figure appear "out of the blue"? Should I pick up the structure, write an intermediate summary, or announce the new document part from a very general point of view? Is the subdivision of information logical and comprehensible?

Prior to describing the single steps to create the report in detail, we will provide you with an overview of the general structure of a Technical Report with all partsthat need to be written.
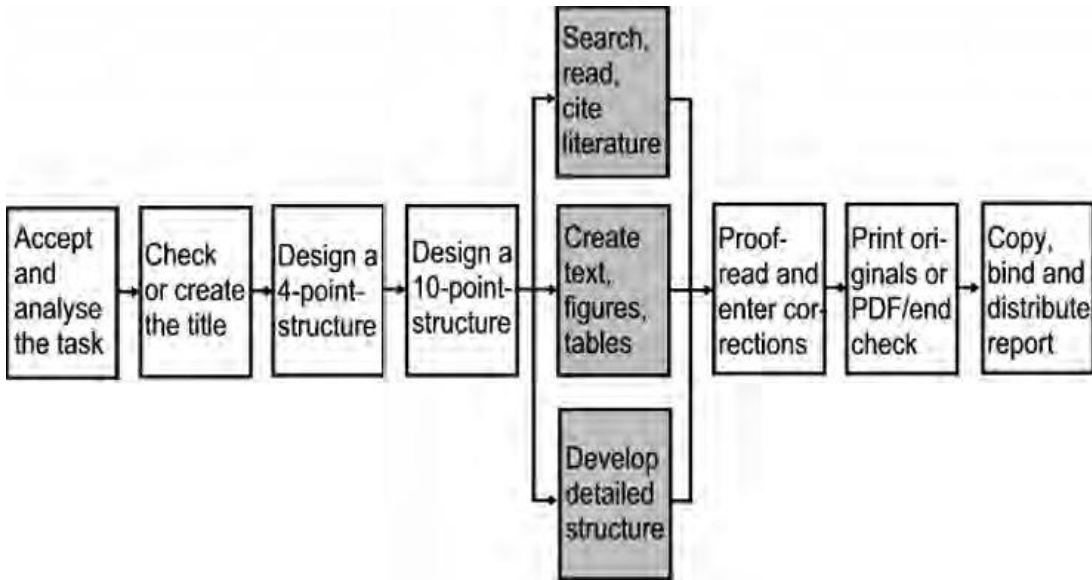
3.1 Parts of the Technical Report and their layout

The names, contents and order of the parts of a Technical Report in general are defined in ISO 7144 "Documentation – Presentation of thesis and similar documents",

Checklist 3-1. In Germany this is standardized in DIN 1422. The order of the required parts of the Technical Report as defined in DIN 1422 is slightly different from the order defined in ISO 7144.

Checklist 3-1 Parts of a Technical Report or a thesis according to ISO 7144

– Front matter

– Outside and inside front cover (cover pages 1 and 2)

– Title leaf

– Errata page(s)

– Abstract

– Preface

– Table of contents

– List of illustrations (figures) and list of tables

– List of abbreviations and symbols

– Glossary

Body of thesis

– Main text with essential figures, illustrations and tables, list of references

Annexes

Tables, figures, illustrations, bibliography etc.

End matter

– index (es)

– Curriculum vitae of the author

– Inside and outside back cover (cover pages 3 and 4)

– accompanying material

Not all parts are necessary or required in all Technical Reports. It is the writer's duty to ask the supervisor or customer which rules and guidelines must be kept as long as they are not available in written form.

In the following, we will introduce the individual parts of the Technical Report and give some hints regarding their layout.

3.1.1 Front cover sheet and title leaf

After the "best" title has been developed in section 2.3, the absolute and relative position of all parts that must appear on a front cover sheet and/or

title leaf must be defined. A front cover sheet and/or title leaf is a must for a Technical Report.

You should distinguish the (inner) title leaf from the (outer) front cover sheet. The **front cover sheet** is the title visible when the Technical Report lies on a table as a closed book. The **title leaf** is only visible after you opened the Technical Report and in most cases after you turned a blank white sheet of paper.

However, if the Technical Report is bound so that the **(outer) front cover sheet is a transparent sheet of plastics**, then inner and outer **title are identical**, i. e. the information provided on the (inner) title leaf and the (outer) front cover sheet are identical. Then the blank white sheet of paper which usually follows the front cover sheet will follow the title leaf instead.

Beside this special case the following rule holds true: the title leaf always contains more information than the front cover sheet. For instance, in Technical Reports written during study courses it is unusual to list the supervisors on the front cover sheet, whereas they definitely have to be listed on the title leaf.

There are some faults which occur quite frequently on front cover sheets. Some of them are displayed in **Figure 3-1**.

The faults occurring most frequently on front cover sheets are:

- The name of the institution is missing on the top of the page.
- The name of the university is correctly specified, but the name of the department and/or institute are missing.

• The title (essential!) is layouted with a too small font size, while the type of report (not so important!) is much larger than the title.

The layout of the front cover and title leaf are also influenced by more general rules. For example, the corporate design of a company or university may define that for a special type of Technical Report a specific form, e.g. "Cover for laboratory reports" must be used.

In most cases there are also rules for the layout, e. g. that the company logo must always be located at the top and on the right or left side or in the middle. Other layout rules define which font type and font sizes must be used. In universities these rules may exist for an institute, a department, or for the whole university. Naturally speaking, you should follow these rules.

The right version in **Figure 3-1** is fine as long as it does not disobey existing rules of the university or customer. Now we want to look at the steps how to develop the front cover and the title leaf of your Technical Report. The example to explain the work steps is again the dissertation "Computer-aided material selection – CAMS in design education". Our doctorate candidate has got the information from his university which rules should be followed when designing a front cover and title leaf, and he has looked at other dissertations in the university library to see good examples for the application of these rules. The following information must occur on the title leaf of a dissertation:
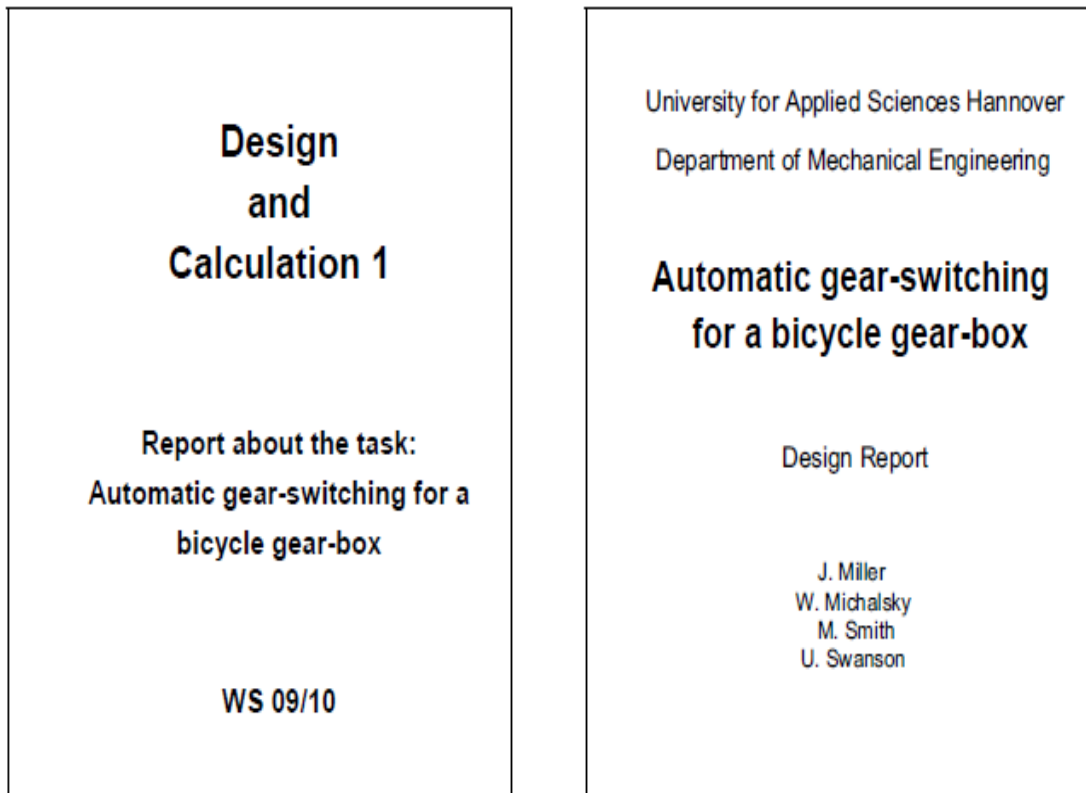
Figure 3-1 Comparison of a faulty (left side) and a correct (right side) front cover sheet for a design report.

- The title of the work with the additional specification
- "Dissertation to qualify for a doctorate degree at the University of Klagenfurt",
- The names of both supervisors and the author with full academic titles as well as the city, where the university is located, together with month and year when the dissertation is submitted.

There are no exact rules for the positioning of the information on the title leaf. Therefore, the doctorate candidate has manually written down

four variants how his title leaf could look like, to judge the line breaking of the single information blocks and to get an impression of the proportions of text and intermediate white space, **Figure 3-2**. The doctorate candidate then types his favourite version into his word processor. There the following typographic design options are optimized:

- Font type and font size,
- Methods to emphasize text like bold, italic, expanded spacing etc. and
- Justification of the text blocks: centred, left-justified, right-justified, or along a line.

The title leaves for reports and theses written during a study course like diploma thesis, project reports, laboratory, and design reports contain slightly different information from the information in this example. In case of a diploma thesis the student ID number and start and end date of the diploma project must be specified. In case of project reports or other university-internal reports the student ID number and the term or semester are specified. Please refer to the front cover and the title leaf of a diploma thesis, **Figure 3-3**, and a design report, **Figure 3-4**.
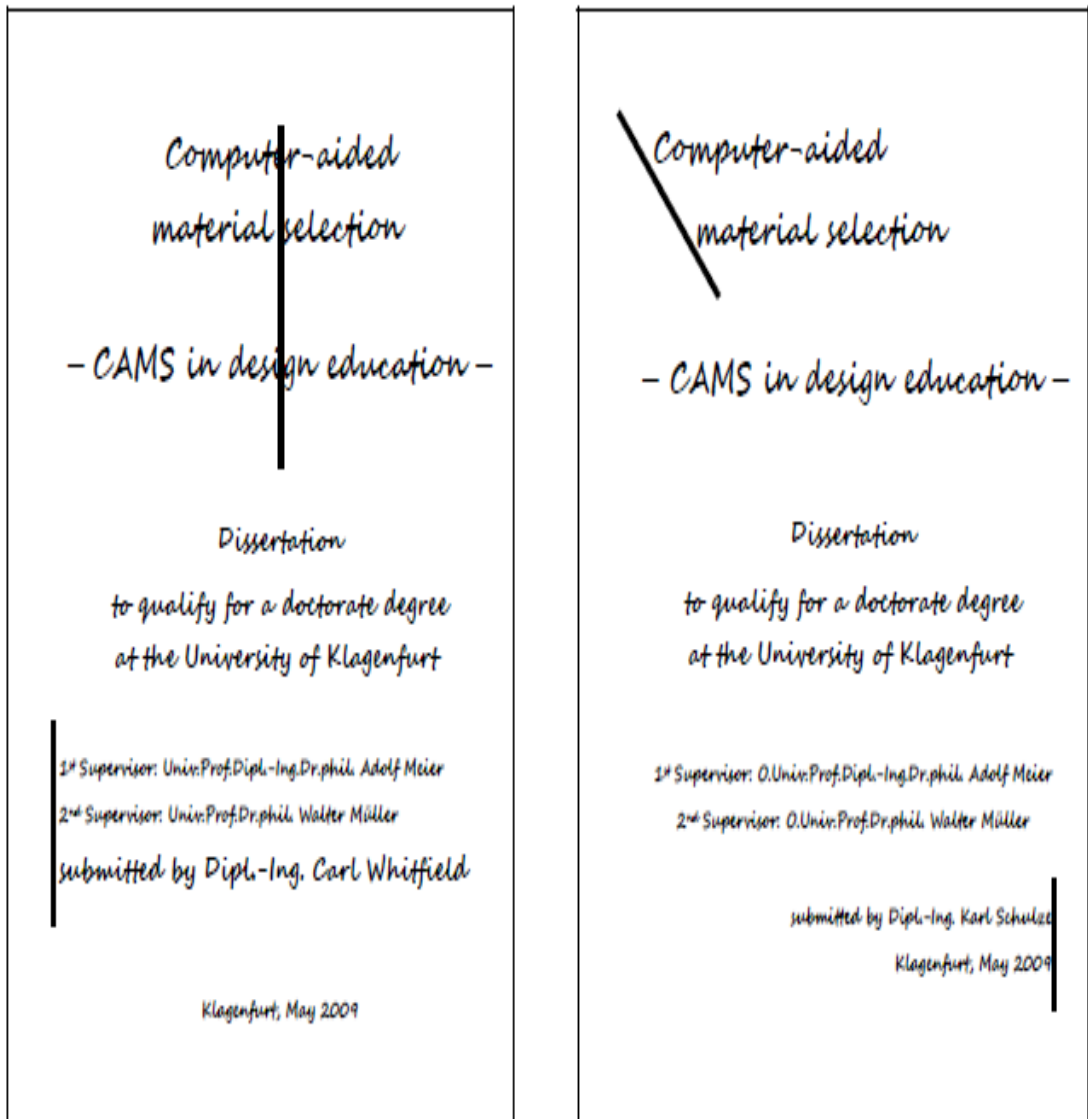
Figure 3-2 Four handwritten drafts of the title leaf of a dissertation (the placement of information varies between centered, left-justified, along a line, and right-justified) <to be continued>

Figure 3-2 Four handwritten drafts of the title leaf of a dissertation (the placement of information varies between centered, left-justified, along a line, and right-justified) <continued>

Figure 3-3 Front cover sheet and title leaf of a diploma thesis

Department of
mechanical engineering   Fachhochschule
Hannover

Design of a lifting platform
for maintenance and repair
of small aircrafts

Development Report

Michael Bloom
Carl Remblovsky
Thomas Smith
Lewis Vandenburgh

Department of
mechanical engineering   Fachhochschule
Hannover

Design of a lifting platform
for maintenance and repair
of small aircrafts

Development Report
SS 09

supervised by: written by:

Prof. L. Holz   Michael Bloom, 935648
                        Carl Remblovsky, 945561
                        Thomas Smith, 948823
                        Lewis Vandenburgh, 936712

Figure 3-4 Front cover sheet and title leaf of a design report

The following **Checklist 3-2** summarizes again the minimum information that must be provided ("What") and their location on the front cover sheet and title leaf together with a qualitative specification of the font size ("How").

Checklist 3-2 Minimum information on front cover sheet and title leaf

Front cover sheet for all types of Technical Reports:

(Logo and) institution

Title of the work (large!)

Subtitle (if applicable)

Type of report (smaller!)

Author/s (medium)

Characteristic image or illustration (if applicable)

Title leaf for all Technical Reports in a study course beside final theses

(Logo and) institution: university/department/institute

Title of the work (large!)

Subtitle (if applicable)

Type of report (smaller!)

in the subject <name of the subject>

Specification of semester or term (e. g. SS 09)

supervised by: written by: name/s or group and group number

(name with title/s) (first name/s, name/s, student ID number/s)

Title leaves for final theses

(Logo and) institution: university/department/institute

Title of the work (large!)

Subtitle (if applicable)

Type of report (smaller!)

1st Supervisor: written by:

2nd Supervisor: (first name/s, name/s, student ID number/s)

Start: (exact date)

End: (exact date)

Title leaves for Technical Reports in industry

(Logo and) company, main department, department

Title of the work (large!)

Type of report (smaller!)

written by

Author/s (title/s, first name/s, name/s, department/s, evtl. e-mail, telephone, fax,

evtl. addresses of contact persons, promoters, sponsors etc.)

Date and evtl. version (e. g. June 2009 or Version 1, June 2009)

This completes the description of which information is placed where in which layout on the front cover sheet and the title leaf. You have seen different designs in the examples above. The following **Checklist 3-3** summarizes again the work steps to design the front cover sheet and title leaf from sections 2.3 and 3.1.1.

Checklist 3-3 Placement of information on front cover sheet and title leaf

Work steps to place the information on a front cover sheet and title leaf:

- create several variants, use handwriting on paper to avoid restricting your creativity by a limited screen
- try out different line breaks
- form different blocks of information (title, supervisors, company/university, date)
- arrange these blocks centred, left-justified, right-justified or along an angular line
- select the "best" arrangement
- transfer it to your word processor and optimize it there
- care for layout rules of your university, institute, or company

Behind the front cover sheet and title leaf the task, declaration in lieu of an oath (for bachelor, master and diploma theses etc.), acknowledgements, and preface may occur. The next part of the Technical Report is always the table of contents.

3.1.2 Structure with page numbers = Table of Contents (ToC)

In subchapter 2.4 "The structure as the 'backbone' of the Technical Report" it has been stated, that the document part headings in the structure contain the inner logic of the Technical Report. The structure defines the

sequence and the logical super and subordination of the document part headings. However, in that shape it is not yet suited to look up and search specific passages in the text. Only after adding page numbers the structure becomes a table of contents and then it is suited to look up text passages. Therefore the table of contents of a Technical Report must *always* have page numbers for all document part headings from level 1 to 3 (4).

In this section, we will deal with the layout and formal design of the table of contents on the paper. By the way, the table of contents of this book is a good "guideline" for *your* tables of contents.

The headline of the table of contents is *not* - as frequently written - "table of contents". The headline is just "Contents". The fact that it is a "table of …" becomes clear at first sight on any page of the table of contents. Now we want to present some thoughts regarding page numbers and page numbering.

The **page numbering always begins on the** *first text page*. This is the page, which displays the chapter number "1". In seldom cases the chapter number "0" may occur, if this chapter is a foreword, a preface, an introduction, or other division of similar type, see ISO 7144. In front of the first text page there may occur other pages according to **Checklist 3-1,** especially the table of contents. These parts of the Technical Report are called *front matter*.

Whether the parts of the front matter occur in the table of contents at all and whether they occur with or without page numbers is treated very different. Nearly every book uses different rules for this problem.

Therefore, we want to make a proposal, how you can solve this issue in your Technical Reports.

- The front matter can get Roman page numbers or no page numbers at all. If the front matter gets page numbers, the title leaf is the first page of the front matter. It is integrated into the page numbering with Roman page numbers, but it does not get a page number printed onto the page. If you apply **book page numbering** with page numbers on the front and reverse side of the pages, the reverse side of the title leaf also does not get a page number. Therefore the printed page numbers start with III on the first page of the foreword/preface or table of contents.

- If you apply the common **report page numbering** with page numbers only on the front side of the pages, the first page of the foreword/preface or of the table of contents, which follows the title leaf, will get the page number II. The rest of the table of contents and the other parts for the front matter will also get Roman page numbers. However, in small and medium-sized Technical Reports the front matter should not get page numbering.

- The **table of contents (ToC)** shall list the parts of the **front matter**, but without page numbers, so that in the table of contents there are only Arabic page numbers. The Roman page numbers of the front matter are much wider than the Arabic page numbers of the normal text chapters. The table of contents should also list the parts of the Technical Report which occur behind the indexes and appendices,

like "Curriculum vitae" and "Declaration in lieu of an oath" in dissertations in the right order, but without page numbers.

- ISO 7144 establishes the following rules regarding page numbering:
  - Title leaves are integrated into the page numbering, but they do not get a page number.
  - The pages are consecutively numbered with Arabic numbers; empty pages and the front matter are counted as well. The first page number occurs on the front side of the first printed page.
  - The pages of the annexes/appendices will get own page numbers with Arabic numbers which contain the letter of the annex/appendix and the page number starting from 1.

In the table of contents, the page number being listed is **only the first page number** of any document part. A frequently occurring mistake in Technical Reports is to list start and end page number of the document parts with an extension mark in between.

Thus, the following ToC entry is wrong:

5.1 Experiment set-up.. 35-36

While, the correct TOC is:

5.1 Experiment set-up... 35

The page numbers in the table of contents are printed right-justified.

After the placement of the page numbers is defined, the placement of the document part headings still needs to be discussed. ISO 2145 "Documentation – Numbering of divisions and subdivisions in written documents" provides a layout example for a table of contents where

independent of the hierarchy level in the document all document part numbers are aligned along a common building line.

All document part headings are aligned along another common building line more to the right. **Indentations are not recommended in ISO 2145**. This kind of layout is shown in the following **Figure 3-5**.

Figure 3-5 Table of contents of a chapter according to ISO 2145

However, since many decades tables of contents are often layouted with indentations, as it is shown in the following **Figure 3-6**.

Figure 3-6 Table of contents of a chapter with indentations for a better overview.

A structure or a table of contents with indentations is much clearer and is therefore recommended!

To achieve this result you should use indentations and tabs. If you use space characters, it is not possible to keep the vertical building lines precisely. If each level in the document hierarchy starts at an own building line, the reader can comprehend the inner structure of the Technical Report much better. And the author can constantly check the logic of the report when writing the 4- and 10-point structure and the detailed structure.

Next it will be shown how much the checking of the logical order of document part headings is facilitated by the indentations. Look at **Figure 3-6** and read the document part headings on level 2 along their building line. You can read the following terms: "Experiment set-up", "Preparations

for the experiments", "Experiment execution" and "Experiment evaluation".

A check of the inner logic ("backbone") results in the following thoughts. After the description of the experimental equipment there is a description of the preparations which have to be executed before the experiments can be started. Then there is a description of how the experiments are executed and an evaluation of the measured results. Conclusion: the inner logic is properly built up!

These constant checks for the logic of the report during writing are effectively supported by the indentations in the structure and the table of contents.

In ISO 2145 all document part headings are arranged along a common building line. This makes it harder to optically recognize the document part headings of the same hierarchy level which belong together. When looking for the next document part heading of the same hierarchy level you have to read the next headings one after the other, check their hierarchy level, and eventually reject them. If e. g. the headings of the second hierarchy level shall be checked, and along the common building line there are headings of the first and third hierarchy level as well, the reader has to execute complicated comparing and sorting processes in his brain, which require an unnecessary amount of memory capacity. These processes are superfluous and can be easily avoided by a better alignment of document part headings. Beside indentations the structure of the document part headings can also be optically emphasized by other means.

Chapter headings are often printed in bold type in the table of contents, while the document part headings of lower hierarchy levels aren't. The hierarchy level can also be expressed by the font size, e. g.

- chapters 14 pt,
- subchapters 12 pt and
- sections 11 pt.

Document part headings should **never be printed in upper-case letters only** (capital letters or small capital letters), because the eye is not used to it. Thus, the headings are much harder to read. The reason is, that during reading eye and brain process the word contours like a picture as a "skyline" and compare them with formerly stored "skylines". If capital letters are used, the letters have to be read one after the other and the meanings of the words have to be analyzed.

Moreover, **groups of document part headings** can be built up by a **variation of the vertical distance** between the document part headings in the table of contents. Leading characters (dots) should be used between document part heading and appertaining page number to facilitate reading. **Figure 3-7** shows an example, how these mechanisms can interact effectively.

If a document part heading does not fit on one line any more (because it is too long or indented), it must be continued in the next line/s at the appropriate building line for the text of the document part headings of the relevant hierarchy level. The leading characters (dots) and the page number appear in the *last* line of this document part heading. The page

numbers should be formatted with the same font size without any accentuations, **Figure 3-7**.

It is clearer and more pretty, if you insert a space *between the document part heading in the table of contents and the tab with the leading dots as well as between the tab and the page number. In Word, you can search for the tabs with Edit – Search – Extended – Other or search for "^t" and replace the tabs with space, tab, space.*

Contents

Figure 3-7 More typographic accentuations make the structure of the table of contents even clearer.

The **gap between all document part headings and the** appertaining **page number** should be **filled with the same leading dots**. The tab with the leading dots should not be formatted in bold face typing. This is the same **for chapter headings**. The font size should also be the same in the gaps, because dots have a larger distance and diameter at 14 pt font size compared with 10 pt, **Figure 3-8**.

...

3.2 Command sequence for the installation 5

4 Program usage **6**

4.1 Submenu "File" 6

4.1.1 File – New 7
4.1.2 File – Open 7

...

Figure 3-8 Leading dots (and page numbers) in bold type and different font size should be avoided.

3.1.3 Text with figures, tables, and literature citations

The "text" contains all information presented in the chapters (e. g. starting with *Introduction* and ending with *Summary*). In the text you will also find tables and figures, formulas and literature citations. Information which is not written by the author but cited as a base for the author's ideas or argumentations, must be clearly marked as a citation, see 3.5. This is also necessary for cited figures and tables.

The individual parts of the Technical Report like tables, figures, literature citations, text, and formulas are described in more detail in subchapters 3.3 to 3.7. Here in the beginning of the chapter some aspects shall be discussed, that cannot be assigned to the more detailed subchapters because of their general relevance.

The **author** of a Technical Report **shall guide the reader with his words**. All intermediate thoughts, conclusions, etc. shall be explicitly communicated to the reader in the text. **Thus, the reader can follow all logical thoughts of the author** regarding the sequence of the report **and follow the thread in his own mind**. This improves the understandability of the Technical Report very much.

However, if a figure, a table or a bullet list follows directly upon a document part heading, the reader is often somewhat left alone. In most cases an "introductory sentence" is missing here, which announces and explains the logic thread or the contents of the figure, table, or bullet list.

Introduction and summary

The chapters "Introduction" and "Summary" are of major importance for the Technical Report. These two chapters are the first ones most readers scan after a quick look into the title and table of contents, before they start to read the text thoroughly.

These chapters are introduced in **Checklist 3-4** together with examples of structure and contents.

Checklist 3-4 Introduction and Summary

The introduction

- is located at the beginning of the text and is normally the first chapter.

- describes the starting situation at the beginning of the project, the relevance of the project for the particular field of science, the results of the research for the society, and other similar aspects.

- can contain a description of the project task and project target formulated by the author.

- can also contain thoughts related with the project regarding the following topics: economics, technology, laws, environment, organization, social care, politics, or similar topics.

- should tie up with prior knowledge and experiences of the readers.

The summary

- is located at the end of the text and is normally the last chapter.

- can have document part headings like: summary, summary and conclusions, summary and evaluation etc.

- discusses the task. Hence: What should be done and what has actually been reached, where have been special difficulties and which parts of the task could eventually not be treated and why.

- normally describes shortly what is covered in which chapter and subchapter of the Technical Report (picking up the structure!). When writing these sentences, you should express how the

document parts are logically related with each other (starting with ..., then ..., next ..., due to …).

- can give advice for a reasonable continuation of the project or scientific work in the conclusion. Such advice is normally based upon experiences made during the work on the current project.

3.1.4 List of references

The (overall) list of references is normally put directly after the last text chapter and lists all references to the literature from which there are citations in the whole Technical Report. In larger documents (e. g. in manuals or textbooks) there may be a capitular list of references after each chapter. The appendices follow the overall list of references or the capitular list of references of the last text chapter. It is unusual to integrate the list of references into the appendix. The list of references of a Technical Report has its own chapter number and stands alone between text and appendix or appendices.

To present all information regarding working with literature citations together, we have concentrated the why and how to make literature citations and how to design the list of references in subchapter 3.5.

3.1.5 Other required or useful parts

The position of other required or useful parts within the Technical Report and their layout is even more dependent on university or company internal regulations than this is the case e. g. for the list of references.

A bound thesis like a diploma, bachelor or master thesis often contains the **task**. It is written by the institute or the supervisor and bound with the rest of the thesis. It is usually the first sheet after the inside front cover.

In addition, a diploma, bachelor or master thesis requires that the student presents a **declaration in lieu of an oath**. This declaration confirms that the student has written the thesis himself and that all used literature sources, rigs, machines and tools are listed completely and truthfully. The exact wording and the position of the declaration in lieu of an oath within the thesis are generally defined by the university. Beside to diploma, bachelor and master theses, doctorate thesis and other final theses also contain such a declaration in lieu of an oath. The declaration in lieu of an oath must be personally signed by the candidate for the bachelor, master, diploma or doctorate degree. In most cases it is even required that the signature may not be copied. In bachelor, master and diploma theses the declaration in lieu of an oath is mostly part of the front matter and follows directly after the task, in doctorate theses it is mostly part of the back matter and is located directly before the Curriculum Vitae (CV).

In bachelor, master, and diploma theses there is often a page with **Acknowledgements**. This is mainly the case, if the project, which the thesis describes, has taken part outside of the university and if there shall be expressed a special thank you to staff members of industrial companies. However, you should not forget the supervisors from the university here. Without their willingness to supervise the project and the writing of the

thesis, and without their experiences, which topic is suited in which detail as a bachelor, master, diploma, or doctorate project, many projects would not take part at all or would last much longer than planned. If nothing else is defined or required, the acknowledgements should be put before the table of contents or the preface/foreword, if there is one.

Eventually, an **abstract** is required by the institute or company. In any case it may not be longer than one page, better is only half a page. Its heading is "Abstract" (or "Short summary") to distinguish it from the normal "Summary" at the end of the Technical Report. The abstract is put directly in front of the introduction. For most articles in scientific journals an abstract is obligatory before the article text following the title and the names of the authors. This abstract of an article is often in italic type and occurs in English and German or another language.

Books often have a **foreword or preface**, pointing out the information target, changes since the last edition or specific rules how to use the book. A foreword or preface is always located directly before the table of contents. The layout of the table of contents is described in 3.1.2.

A **List of figures** contains figure numbers, figure titles, and page numbers. A **List of tables** contains table numbers, table titles, and also page numbers. The page numbers should be placed right-justified along a common building line. The distance between the end of the figure or table title and page number should be filled with leading dots as in the table of contents.

The **List of abbreviations** contains the used abbreviations – in alphabetical order – and an explanation for each of them. The explanations should start at a common building line on the right side of the abbreviations. If the explanations have the character of definitions, they can be introduced by equal signs. If the abbreviations are a combination of the first letters of the words in the explanation, these first letters can be emphasized with bold type and evtl. capital letters and underlining.

If a Technical Report contains many mathematical formulas, a **List of used formulas and units** may be helpful. The explanations of the formula symbols should again start at a common building line on the right side of the formula symbols. Depending on the type of your report you may as well create other lists, e. g. for checklists, exercises, link lists etc., see Appendix A of this book.

As a comparison and to summarize it, we want to remind you of the structure of a Technical Report according to ISO 7144:

- **Front matter:** Front cover (cover pages 1 and 2), title leaf, evtl. errata page(s), task (What should be done?), evtl. declaration in lieu of an oath (How has it been done? "on my own"!), evtl. acknowledgements, abstract (What is the result?), foreword or preface, table of contents, list of figures, list of tables, list of abbreviations and symbols, glossary.

- **Body:** text chapters with required figures, tables, formulas, list of references.

- **Appendix/Appendices:** annex material like figures, tables, bibliography, list of standards, evtl. accompanying material, evtl. glossary, index(es).

- **End matter:** curriculum vitae of the author, inside and outside back cover (cover pages 3 and 4), evtl. accompanying material.

Accompanying material like the bill of materials, technical drawings, measuring protocols, slides, models, leaflets, brochures etc. can be presented as independent appendix chapters or as subchapters in an appendix. They can be bound in the Technical Report or delivered in an external container like a second volume, a drawing roll, a folder or a box.

To place figures, tables and measuring protocols into the appendix/appendices is only useful, if placing them in the body would disturb smooth reading of the text chapters too much.

The appendix/appendices in the list above can be independent chapters. Then they get consecutively numbered appendix chapter numbers. If the number of appendix chapters becomes too large, the annex materials, lists, and accompanying materials can be combined in one common **chapter "Appendix"**. The **Glossary** – if in opposition to ISO 7144 it is put at the end of the Technical Report – **and Index** remain **separate chapters** in any case. The page numbers for the Glossary and Index may be just Arabic numbers or a combination of a letter for the chapter and a number (e. g. page numbers C-1 to C-10) or a combination of the chapter name and a number (e. g. page numbers Index-1 to Index-10).

The following two examples demonstrate that an appendix can be organized as one chapter with subchapters or as several chapters.

The variant "Appendix as one chapter" has the advantage that the document part numbers remain smaller and clearer. Besides the text chapters are normally subdivided, so that the chapter heading is the superordinated concept. It is more logic in itself to apply this approach in the appendix as well. Therefore, the structure on the right is recommended. Naturally speaking, all document part headings in the table of contents get page numbers.

Now we want to give you hints for the design of the different parts of the appendix.

Figures or tables as annex material are often arranged in the appendix due to comfort reasons, because figures and tables can be handled more easily in an appendix than in a text chapter. Such an appendix forces the readers to turn the pages back and forth in the Technical Report very much. The text-figure-relationship of this solution is quite bad. Therefore figures and tables should rather be integrated into the text chapters in the front. However, *design* drawings should be placed in an appendix. If they would all be integrated in the text chapters, this would disturb smooth reading too much. If individual drawings are explained in the text in detail (e. g. Modification of an experiment rig), these drawings may additionally occur in the appertaining text chapter, evtl. as a reduced DIN A4 or A3 copy.

If you *cite* **other materials** (brochures by associations or companies, catalogues by manufacturers, important standards and other literature) *as references*, they *must appear in the list of references*. If they are not cited, it is sufficient to just add them to your appendix as additional information (as original or copy).

Please plan this early and do not write notes into your original materials. You may mark selected dimensions with yellow highlighter. The pages of the appendices may get consecutive Arabic numbers (continued from the last page of the list of references). However, according to ISO 7144 the appendices get consecutive capital letters instead of chapter numbers and the page numbers consist of chapter letter and a consecutive Arabic number.

Enclosed documents or copies usually have their own page numbers. These existing page numbers remain untouched and every brochure, catalogue, or technical document gets a consecutive document number ("1", "2", "3", … or "Document 1", "Document 2", "Document 3" …), which is glued onto the document with **white adhesive label**. Sticky-notes ("Post-it") are not suited for this purpose.

Usually the enclosed documents are original brochures or photocopies which are bound with the other pages of the Technical Report. If the enclosed documents cannot be bound, because they are too thick, too many or larger than DIN A4, they should be enclosed in a *separate folder or box or roll*. Such *documents or drawings which are delivered separate* from the Technical Report are *listed in the table of contents* of the Technical Report *at the logically right position* and get a comment like "(in drawing roll)" or "(in separate folder)". Example:

If an appendix has a substructure, a **title leaf for an appendix chapter** is very useful. Such a title leaf gives an overview of the appendix and forms a capitular table of contents. For example, Appendix A contains a bill of materials and (bound) design drawings. In the front in the **overall table of contents** this structure would be displayed as follows:

In the back in the **Appendix A** the reader would be reminded of the structure of the appendix by means of a **title leaf**. This creates clarity and overview for the reader.

The layout of the title leaf of an appendix is partly equivalent to the layout of tables of contents (bold type of the chapter heading, leading dots, page numbers) and partly equivalent to the layout of title leafs (generous spread and pleasing arrangement of the printing ink on the paper).

A Drawings

A-1

If the appendix/appendices contain many plots, measuring protocols, program listings, drawings and other documents printed on DIN A4 paper, these **annex materials can be bound separately as volume 2**. The table of contents of both volumes should list all contents in both volumes, i. e. volume 1 and volume 2 have an overall table of contents with the sections "Contents – Volume 1" and "Contents – Volume 2".

Now some remarks regarding special appendices that – if they exist – must always be separate appendices following the other appendices or the list of references. They are listed in consecutive order.

A **Glossary** contains technical terms and explanations of these terms. It is helpful, if the Technical Report deals with a specific field and the readers may not completely know the relevant terminology of this field. If the Technical Report is written in English but published in a country with an official language other than English, you should think of adding the technical terms in the official language of the country after the English term. You can add it in brackets or with a dash. To combine the technical terms in the official language with the technical terms in English facilitates the exchange of ideas in the scientific community, because much of the literature is written in English and many conferences are held in English. The technical terms in the glossary are accentuated by bold or italic type. They are ordered along a common building line. The explanations start either on the right side of the terms at another common building line or in the next line indented by approx. one or two centimetres.

An **Index** contains keywords in alphabetical order. It is only useful for larger Technical Reports. The entries must be formulated *from the readers' point of view*. A structuring into superordinated and subordinated concepts (on max. two levels) results in more clarity and better overview. The page numbers are partly added with commas directly after the keywords or they are displayed rightjustified along a common building-line. The gap between index entries and page numbers should then be filled with leading dots. This looks more pleasing, especially, if the index has two or more columns. If an index entry occurs on more than one page in the text and on one page there is more or very important information, this

page number can be accentuated by bold type and thus it can be marked as main entry.

Doctorate thesis (Ph. D. thesis) normally have a **Curriculum Vitae** (CV). It lists roughly the previous educational and professional development of the doctorate candidate. In doctorate thesis, another part in the appendices is the **Declaration in Lieu of an Oath**. Often it is placed behind the List of References or behind the CV. Contents and structure of the CV depend very much on the university or faculty. Also the placement of CV and Declaration in Lieu of an Oath might be different than proposed here. Therefore the doctorate candidate should ask his doctoral supervisor for an example CV and Declaration in Lieu of an Oath.

3.2 Collecting and ordering the material

Up to now, the following parts of the Technical Report have been created:

- Exact title with design of the title leaf and
- Structure (detailed up to 10-point-structure or finer).

These parts give orientation for collecting the material. They help to answer the following questions:

- What is needed overall?
- What is already available?
- What is still needed?

Collecting the required material and information must be oriented towards the information target and the target group.

- Which knowledge and experiences do I want to impart how?
- Is there a visualisation (figure, table, formula) for each important statement or at least a bullet list?

In most cases, to collect, order, and write something the reader does not need is unnecessary work!

Now we want to describe how the **material collection** can be done in practice. All spontaneous **thoughts and ideas regarding the contents of the Technical Report** should be collected on one or more sheets of paper regardless of their sequence and their assignment to already existing items in the structure. Evtl. youwant to note **each idea separately on note sheets**, writing paper or file cards e. g. in DIN A5 landscape format. Then you should write on the front sides only, so that you can spread the sheets or cards on the desk or floor to sort and order them.

The material collection should include information, in which section of the own Technical Report which internet sources, books and other references shall be referred to or cited. Right from the beginning, please write down all required bibliographical data exactly with page number(s), section number or exact URL (internet address and date when the information was accessed), so that when you start writing you do not need unnecessarily long time for (re-)searching what you had "digged out" before and you can cite correctly.

If a Technical Report is more comprehensive, i. e. it has **more than 20 pages**, the material collection should not be done for the whole report.

In this case, it is better to execute a separate material collection **for each chapter** or subchapter.

Ordering the material can be executed in different ways. In this phase you should again have your target group in mind:

- *Are all noted items interesting for the readers? (if not: cross them out)*
- *Can the noted items be already assigned to existing items of the structure? (If not: Open a new item in the structure)*
- *If you took your notes one after the other on Din A4 paper, you should mark your ideas according to their "sequence". You can, for example, use the document part numbers from the structure and consecutive numbers within one section. If you noted each of your ideas on separate sheets or cards, you can order the sheets or cards according to their "sequence".*

The "sequence" of thoughts can follow a chronological or logical order (by starting conditions, targets, alternatives, components, fields of knowledge, branches of science etc.). This chronological or logical order is – at least partly – predefined by the already existing structure of the Technical Report. Therefore, ordering the material is only possible, if a 4-point- and 10-point-structure have been previously created. Due to the order of work steps recommended here, collecting and ordering the material will automatically be logical und oriented towards the information target. This method saves working time, because all work results fit together and only a few of them will end up in the "wastebasket".

3.3 Creating good tables

Tables display information in a matrix of rows and columns. The fields in this matrix are called **cells**. Tables often have a header and an introductory column. The **header** contains the **superordinated concepts (generic terms) of the columns**. The **introductory column** contains the **superordinated concepts (generic terms) of the rows**. The terms in the header and in the introductory column should as much as possible be consistent in themselves and logically equal.

↓ introductory column

header → Product	Unit price	Complete price (4 pieces)
Winter tyres	49,30	189,90
Summer tyres	46,50	179,90
Steel wheels	28,90	109,90
Aluminum wheels	126,30	479,90

The **upper left cell** in a table which belongs to the header and the introductory column can contain the following:

• both superordinated concepts of header and introductory column

• only the superordinated concept of the introductory column

• no entry (empty)

If both superordinated concepts are short, this cell may be separated by a diagonal line from the upper left to the lower right corner. However, if the terms are longer, you should use arrows to indicate which term

belongs to the header and the introductory column, **Figure 3-9**. Diagonal line and arrows can be created as graphical elements.

In **smaller tables** the impression overweighs, that **information can be displayed very systematically, well-arranged and structured** in tables. However, **larger tables** are often **confusing** due to their poor amount of visualization. If the table displays words, this is less problematic than if it displays figures.

Load / Type	10 N	20 N	30 N
A	2 mm	4 mm	6 mm
B	1 mm	3 mm	7 mm
C	2 mm	5 mm	9 mm

Voltage → Potentiometer position	50 V	150 V	250 V
Position 1	6 A	18 A	30 A
Position 2	8 A	24 A	40 A
Position 3	12 A	36 A	60 A

Figure 3-9 Different ways to structure the upper left table cell

Summary

Now all details, rules and working procedures relevant for writing and presenting Technical Reports have been introduced in detail. Our network plan for creating Technical Reports has been processed from accepting and analyzing the task to presenting or distributing the final report.
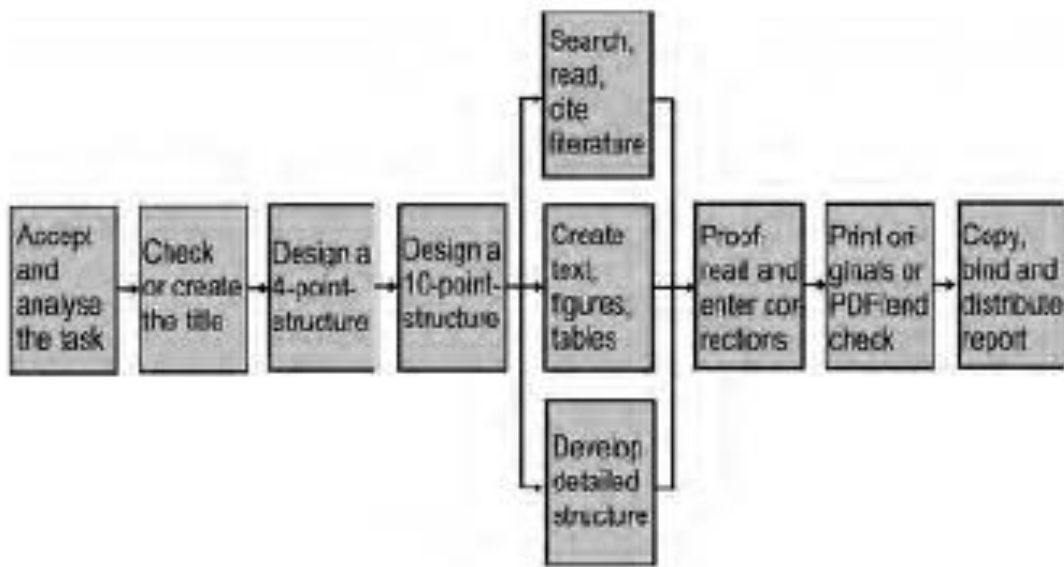
During all work steps the following basic rule needs to be considered. The creator of the Technical Report must always ask at first, whether there are rules issued by the customer or already existing within the own institution, how Technical Reports must be written and designed. When using this book, please keep in mind: Already existing rules (standards of the department or professor or company or customer) must be followed prior to the tips and rules provided in this book.

If such institutional standards do not exist or do not cover all details, you should use the hints and suggestions in this book. The consequent application of the information and working procedures described in this book will probably improve the quality of your future Technical Reports as compared with the quality of your previous ones. Therefore, we want to close this book wish good wishes:

We wish you that your future Technical Reports and their presentation will contribute to your personal success!
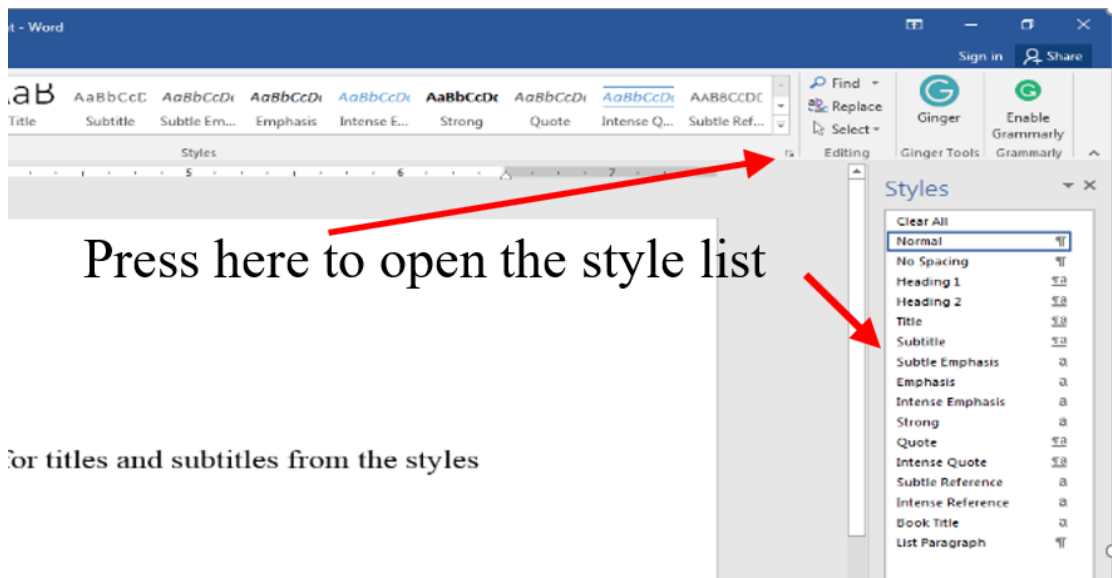
Chapter (4)

Using Microsoft word Styles to edit technical writing files

It is important to learn how to edit your technical report in Microsoft word as a common program for reports, books and thesis writing and editing. In the next paragraphs we will show how to use word to carry out this task.

1.1. Chapters' titles and heading and subheading

When you open new word file, you can automatically make ordering for titles and subtitles from the styles list as indicated in the following figure

In the style list you will find all the predefined styles like (as indicated in the last figure):

Normal: for the normal text format.

Heading 1 & 2: for the chapters' titles and subtitles.

Title: for the thesis or paper title………etc.

List Paragraph: for the list of objects inserted inside any paragraph like 1. 2. 3. etc.
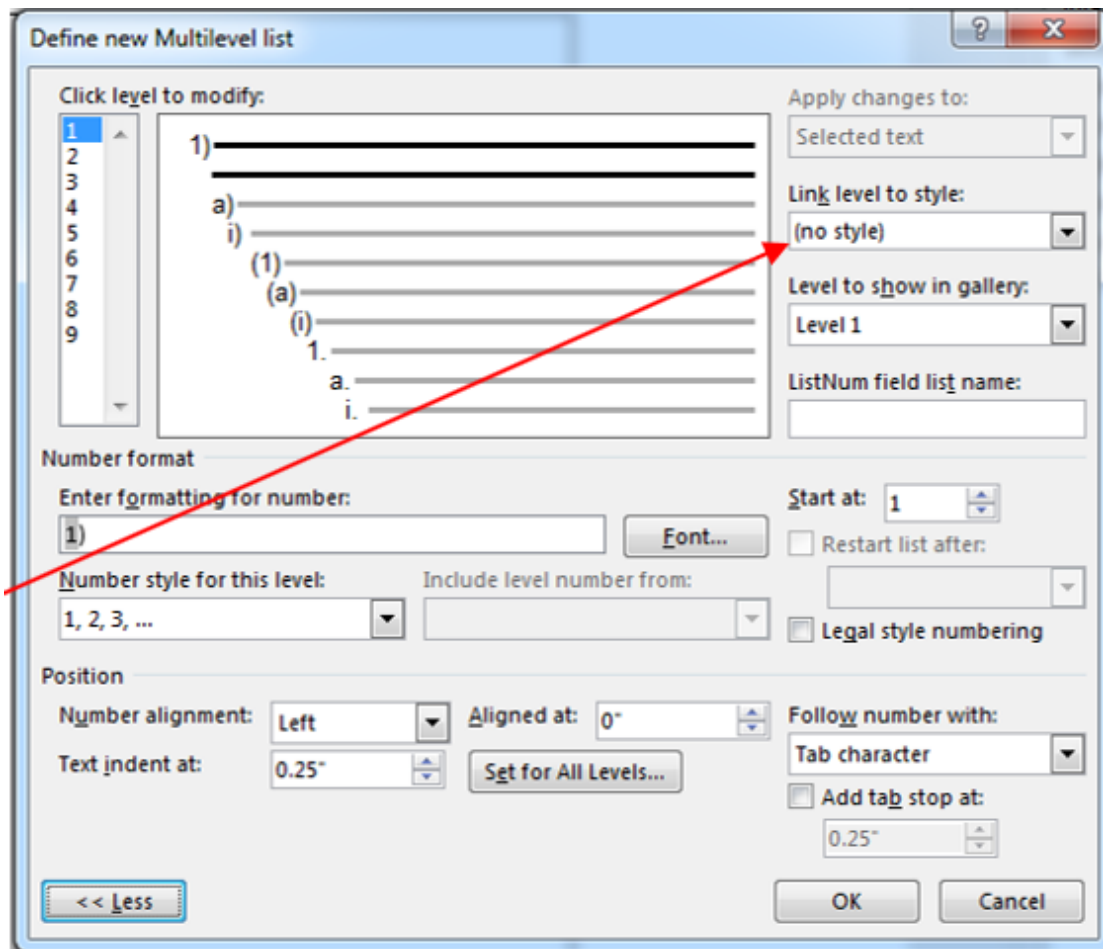
When we want to make heading for the chapter title we use **Heading 1** from this list but from the **Mthultilevel list** and choosing **Define New Multiple List** as indicated in the next figure
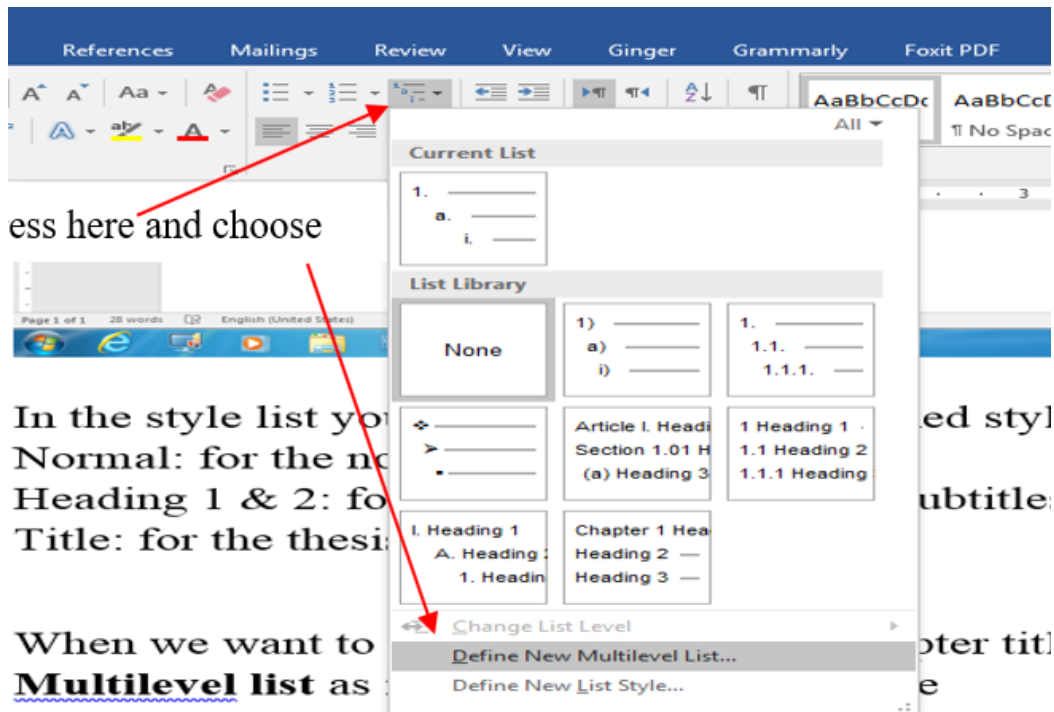
The next window appears
 Press **More** to show more properties.
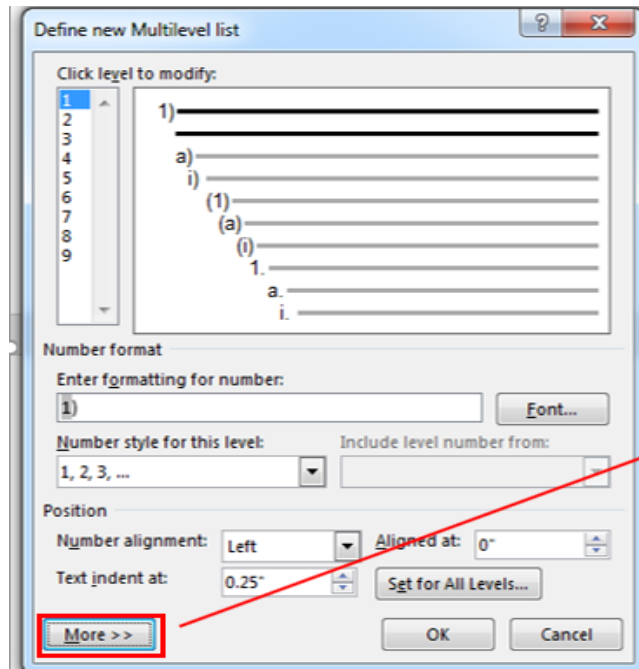
Then more properties will appear as follow:

You will find level is at level 1:

1. Set the link level to style to heading 1 (to link level 1 with heading 1).

In **Enter formatting for number** delete the predefined data to enter the required data. In this field we want heading 1 to be the chapter title to use it after that in the caption of figures and tables. There for we need the chapter title to be ***Chapter (I): Chapter title***, therefor we will type Chapter (*list*) the list will be taken from the **number style for this level** then specify required font and position.
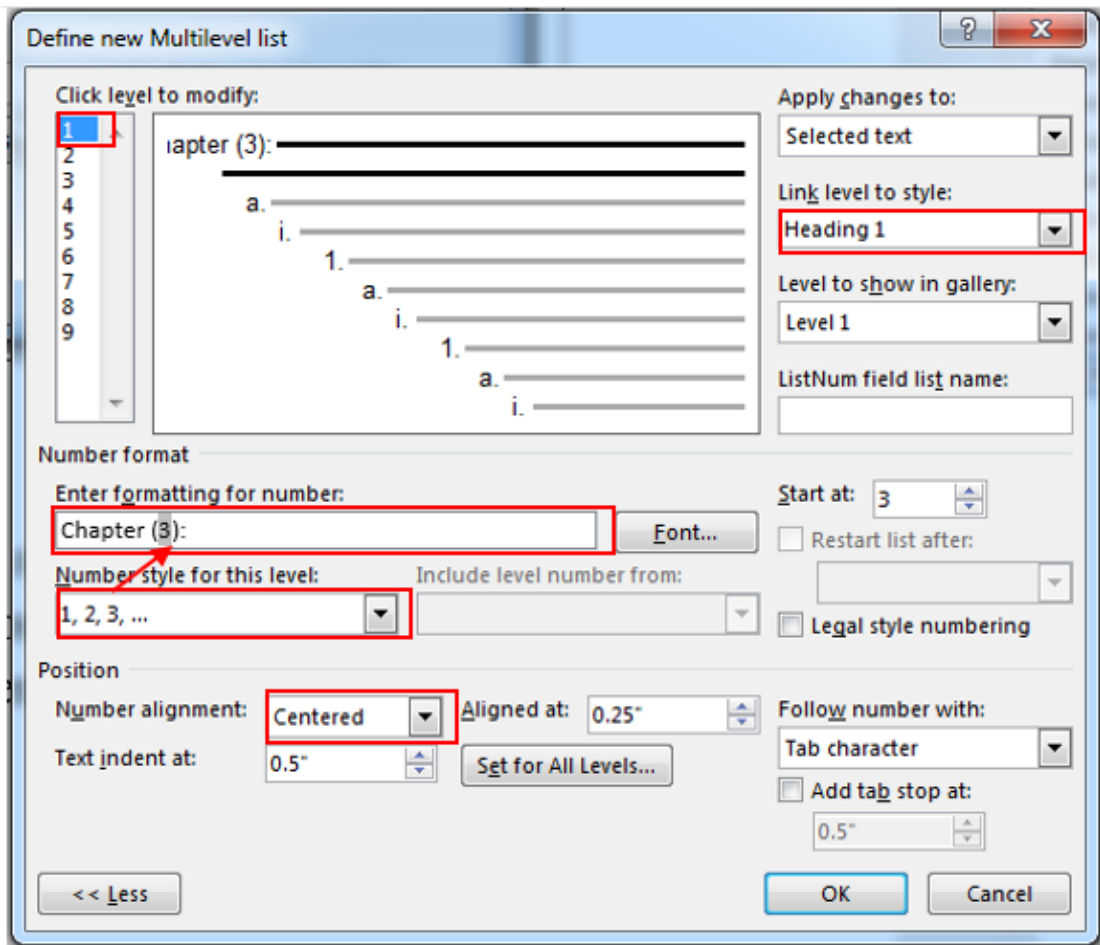
When we want to add a Subtitle to the chapter like **1.1. Introduction** we will use **Heading 2** go with the mouse and press on the chapter title and then press on **Multilevel list** to make sure that you will resume the same list and then press **Define New Multilevel list**. Therefore, you will find that **level 1** matches **Heading 1** as we adjusted before then press to **level 2** and match it to **Heading 2** in **link level to style** box. After that, enter the required formatting to the **Enter formatting for number** box (1.1.) as the first (1) will be taken from **Include level number from** box as **level 1** to

include chapter number and the second (1) will be taken from the **Number style for this level** box. Then specify the font and position.
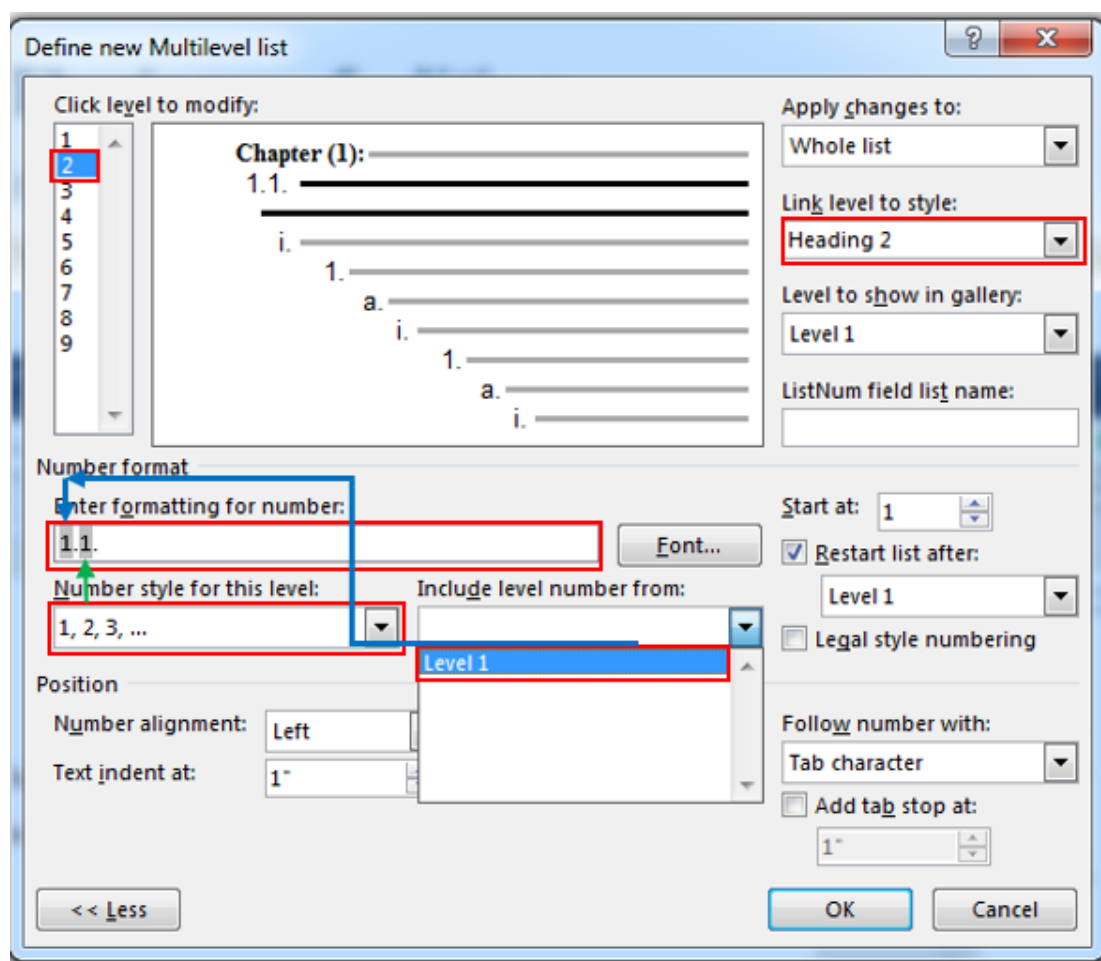
And so on for level 3, 4 ….etc.

1.2. Change the formatting of headings

If we want to modify the formatting of the heading, there are two methods:

Press (R.C) on the heading on the style list and choose modify and make the required formatting modifications and press OK.

Go to any heading written in the paper and matches the required heading and make the required formatting on it and after that go to the heading in

the style list and press (R.C) on it and choose **Update heading to match selection**. You will find that the last modification was generalized to all the headings written by this heading style.

1.3. Inserting table of contents

Go to the raw in the paper you want to insert the table of contents into and press with the mouse on it and from **References** press on table of contents and select the suitable style for your paper because you will find automatic formatting and manual inserting (you will write the content of table of contents).

1.4. Editing the table of contents

Firstly, all the content of the table of contents will be marked as **Hyperlink** in the **style list**, so you can navigate into its paragraph through the article by pressing long press on **control** button and press on it heading on the **table of contents**.

Also there are to methods to modify the table of contents:

For every **level** you add in the **Multiple list** another style is automatically added to the **style list** and takes the name of (**TOC**) and represents the style of this **level** on the **table of contents**. Therefore, **TOC1** represents **Heading 1** in the **table of contents** and so on. Therefore, to modify the formatting of **Heading 1** in the **table of contents** press (R.C) on **TOC1**, choose modify, make the required modification, and press ok.

References label – Table of contents – Custom table of contents. The **Table of contents** window appears. You can see print preview zone to see the effect of modifications. The modifications are:

a) Show page numbers or not.

b) Right align page numbers or put it beside the heading.

c) Using hyperlinks for heading (ctrl + press on the heading to navigate).

d) Tab leader: to choose the style between the heading and page number.

e) Formats: to choose the style or template you want.

f) Show levels: to select the number of levels you want to show in the Table of contents.

g) In the option button you can find and organize the matching of headings and the TOC.

From the Modify button you can modify the formatting of the Table of contents through the TOC level adjusted in (g).