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How to Write Technical Reports

Understandable Structure, Good Design, Convincing Presentation

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Preface

Technical Reports are usually written according to general standards, corporate design standards of the current university or company, logical rules and practical experiences. These rules are not known well enough among engineers. There are many books that give general advice in writing. This book is specialised in how to write Technical Reports and addresses not only engineers, but also natural scientists, computer scientists, etc. It is based on the 6th edition published in 2008 by Vieweg in German and is now published as 1st edition by Springer in English.

Both authors of the German edition have long experience in educating engineers at the University of Applied Sciences Hannover. They have held many lectures where students had to write reports and took notes about all positive and negative examples that occurred in design reports, lab work reports, and in theses. Prof. Dr. Lutz Hering has worked for VOLKSWAGEN and DAIMLER and then changed to the University of Applied Sciences Hannover where he worked from 1974 until 2000. He held lectures on Technical Drawing, Construction and Design, CAD and Materials Science. Dr. Heike Hering worked nine years as a Technical Writer and was responsible for many CAD manuals in German and English. She is now employed at TÜV NORD Akademie, where she is responsible for E-Learning projects, technical documentation and software training and supervises students who are writing their theses. Prof. Dr.-Ing. Klaus-Geert Heyne joined the team as co-author for the 2nd German edition. He redesigned chapter 5 "Presenting the Technical Report". He contributes his experiences from Motorenwerke Mannheim AG (1978 to 1985) and University of Applied Sciences Wiesbaden from lectures about Combustion Engines, Technical Mechanics, and Technical Communication.

This book answers questions of engineering students and practitioners occurring when writing Technical Reports or preparing presentations on the PC. These questions refer to contents as well as formal aspects. Such questions occur during the whole work on the report or presentation from the beginning to the end. Therefore this book is designed as a guideline or manual „How to write Technical Reports". It is ordered by timeline along the process of writing Technical Reports into the three phases **planning, creation, and finishing**.

My father died in March 2004, Prof. Heyne prepares himself for retirement. I will continue this book as a guide with many examples and strong relationship to practical technical writing. Many comments of the German readers helped to improve this book. I hope that I will get similar positive feedback from international readers. If possible, please add example texts and figures, which I may publish in this book and correct menu translations, because I only have the Microsoft Office and Open Office programs in German. Please contact heike.hering@gmx.de.

Hannover, March 2010 *Heike Hering*

Contents

1 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.

ISO 5966 "Documentation – 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 can be defined as follows:

Technical Report =
- 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 fund-

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ing 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 among your 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, time-saving 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 easy 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 and marked with a pointing hand: ☞.
- 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.) follows the syntax <chapter number>-<current number>. In examples the numbering syntax is <current number>.

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.

☞ We *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"**.

2 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
- Elaborate the text (on a computer)
- Create or select figures and tables
- Develop the detailed structure
- Perform the final check
- Print copy originals or create PDF file
- Copy and bind the report
- Distribute the report to the defined recipients

Work steps to be performed partly parallel or overlapping

This list is complete, but the clarity can be further improved. To accomplish this, network planning is applied.

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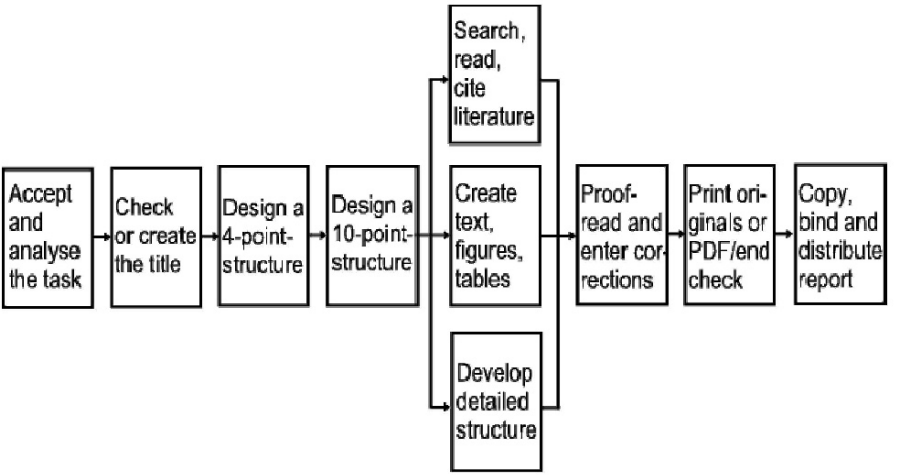


This network plan is always repeated when the different steps to create a Technical Report are described, where the current work step is marked in gray.

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

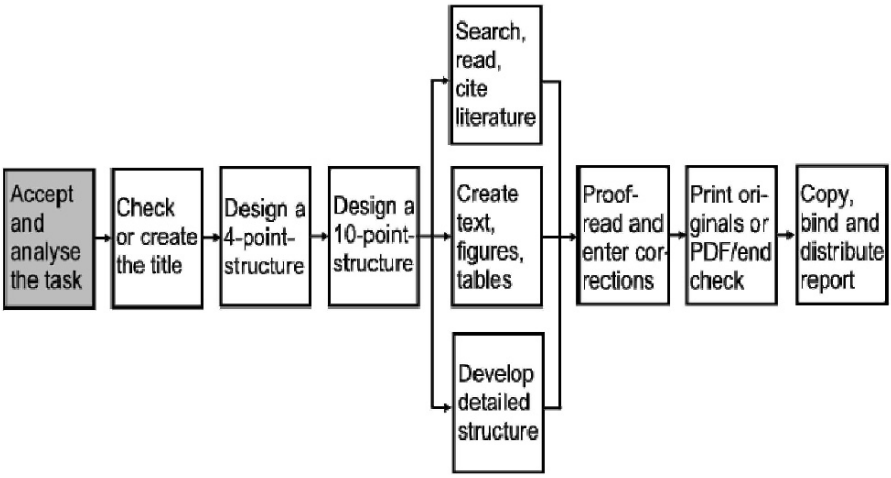
When you write a Technical Report, there is nearly always a task, which you either selected yourself or it was defined by someone else. You should analyze this task precisely during the planning of the Technical Report, **Checklist 2-2**.

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 it is marked in gray.

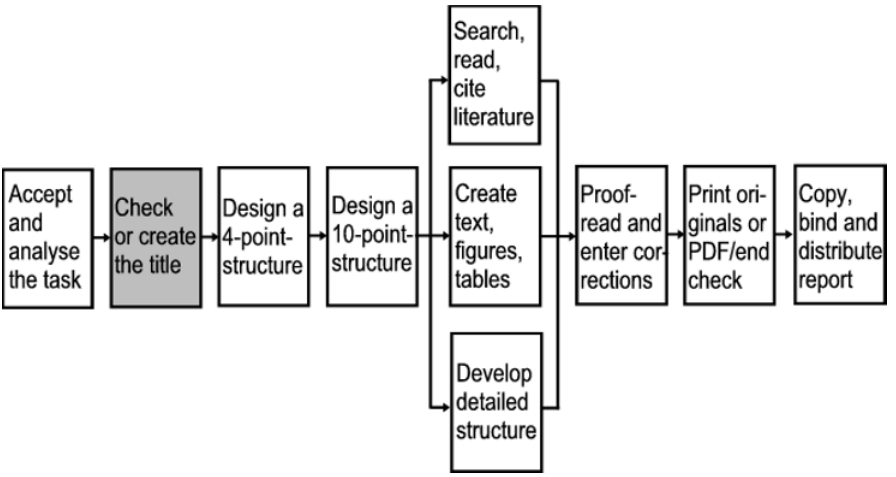


In addition, during the planning of the report the following questions must be answered:

- 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 evtl. a new title must 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.