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Structured Reusable Creation and Maintenance of Technical Information

A Case Study

Liiketalous ja matkailu
2012

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Tietojenkäsittelyn koulutusohjelma

TIIVISTELMÄ

Author	Niclas Öster
Title	Structured Reusable Creation and Maintenance of Technical Information
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Name of Supervisor	Kenneth Norrgård

Tutkielma käsittelee erästä teknisen informaation osa-aluetta. Tutkielman aihe nousi esiin projektista ja kehitysprosesseista, jotka olivat työn alla Wärtsilä Finlandissa vuosina 2007–2008 ja Wärtsilä Corporationissa vuonna 2009. Tutkielman tavoitteena on paikantaa ja selittää teknisen informaation ja perinteisen dokumentaation välistä eroa. Dokumentaatio on pitkään ollut teknisen informaation tavoite. Asiaa syvemmin tutkittaessa selviää, että niin tärkeää kuin dokumentaatio onkin, se on vain yksi teknisen informaation osa ja sitä voidaan pitää teknisen informaation tuloksena. Tutkimuksen toisena tavoitteena on selvittää, miten informaatiota voidaan tehokkaasti järjestää, luoda ja ylläpitää. Tutkimuksessa osoitetaan, miten tehokkuus vaikuttaa kustannussäästöihin ja informaation uudelleenkäyttöön. Uudelleenkäytön kautta mahdollistetaan jo olemassa olevasta tiedosta muodostettavien uusien tuotteiden kehittäminen.

Tutkielman teoreettisen kehyksen luomisen aloitan tarkastelemalla tuotetiedon hallinnan ohjelmistoympäristöä eli PDM-järjestelmää. Järjestelmää tarkastellaan erityisten, vain tekniseen informaatioon liittyvien, osa-alueiden kannalta. Laajempi tuotteen elinkaaren hallintajärjestelmä (PLM) on toinen tähän kenttään liittyvä alue, joka sopisi lisätutkimuksen aiheeksi. Jatkan teoreettisen kehyksen rakentamista tarkastelemalla sisällönhallintajärjestelmiä (CMS) sekä niiden käyttöä sisällön luomisessa ja ylläpitämisessä. Lopuksi käsittelen valinnan standardia informaation järjestämiseksi siten, että se on uudelleen käytettävissä ja täsmällistä. Tarkastelen lyhyesti muutamia lausuntoja koskien standardeja siirtyessäni käsittelemään DITA-arkkitehtuurin (Darwin Information Typing Architecture) käyttöä teknisen informaation kontekstissa.

Tutkielmassani kerron, miten ylläkuvattuja tekniikoita ja metodeja sovellettiin käytännössä vuosina 2007–2008 läpiviedyssä projektissa. Loppupäätelmissäni osoitan, kuinka tämä projekti vahvistaa otaksuman, että näiden järjestelmien käyttö mahdollistaa informaation uudelleenkäytön ja säästää merkittävästi kuluja. Lisäksi otan esille muutamia ajatuksia, miten tätä aihealuetta voitaisiin tutkia edelleen.

Avainsanat rakenteinen, sisällöntuotanto, arkkitehtuuri

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ABSTRACT

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The topic of this thesis covered a certain field within technical information, as the title suggests. The idea for this thesis emerged from a project and development of processes that took place in Wärtsilä Finland 2007- 2008 and in Wärtsilä Corporation in 2009. The aim of this thesis was to discover and explain the difference between technical information and traditional documentation. Documentation has for a long time been the object for technical information. When further exploring the topic it will become evident that documentation as vital as it is, is only one part of technical information as a whole and it can also be considered to be a result of it. Another aim of this study was to explain how to structure, create and maintain information in an efficient manner. It was be shown how this efficiency is related to cost savings as well as to the ability to reuse information. Furthermore, the concept of reusing introduces the possibility to introduce new products derived from already existing information.

As theoretical framework for this thesis the work began by looking into *Product Data Management* or PDM as it is more commonly referred to. PDM was looked into from specific areas related to technical information only. The larger area of PLM or *Product Lifecycle Management* is another topic suitable for further studies within this area. The work continued by looking into *Content Management Systems* or CMS and their usage in relation to content creation and maintenance. Lastly the standards of choice when it comes to structuring information in such a way that it is reusable and accurate were discussed. Certain statements of standards were discussed as the work moved on to the usage of DITA, *Darwin Information Typing Architecture* in the context of technical information.

The thesis shows how the techniques and methods explained above were applied to a concrete example from a project carried out in the years 2007-2008. In the conclusions it was shown how this project has acted as proof to the hypothesis that so it enables reuse and also saves a lot of costs. In addition, some thoughts on how to further explore this area were explained in the study.

Keywords structured, content production, architecture

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1. INTRODUCTION

During the last decade there was a tremendous increase in order intake for Wärtsilä Corporation. This was also the case both for the Ship Power and Power Plants sections. Most of the organizations grew organically. However, some did not grow in such a pace as it would have been required to meet the demand. One of those organizations was Documentation. On the other hand, it was not possible to grow organically either in order to meet the new demands. Why?

First of all, the processes were not of such a nature that it would have been justified to increase the resources. During the year 2005, especially when making manuals and instructions for various purposes, the way of working was still in the area of desktop publishing. Desktop publishing was a major leap forward in the development during the 90's. PC Desktops made it possible to create publications with nice layouts and it was even much faster than the previous procedures had been. It was also during this area that many newspaper organizations moved from manual work to desktop publishing.

With this as background knowledge it was a step in the right direction that the process basically broke down in this area. It enabled the management to notice the importance of documentation at that time. However as documentation was only an outcome of the information handling it also produced opportunities to look under the surface.

In this case there were three main areas that needed development. First, the processes themselves, as they are the foundation to all work done and described. Secondly, defining the way of working, this including a standard for documentation. And third, the systems. The systems had to be viewed from two viewpoints. The first and most important was, "where do we want to be?" Secondly and also from a function point of view, "what can we do with what we have?" Starting from what is available with the target clearly in sight, it is possible to achieve significant improvements without renewing all systems at once.

What will be shown later on in this thesis in more detail is the increase in delivery performance as measured to a level above 90 percent. Other measurements in the implementation projects pointed out reusability levels of content to be above 40 percent. How these goals were met will be revealed later in this thesis.

As the writer of this thesis I have had the following roles; I started as a line manager for the department, making catalogues for spare parts and coordinating the external partner delivering manuals. As the development process was started the functions were split into two different entities. The original department was concentrating on the making of spare part catalogues and the coding of spare parts into the PDM and ERP systems. A new department was formed and named Contents Management. I was the manager of this department during the development of the content management process responsible for the P-process described later in this paper. A major part of the contents management function was to develop the processes and methods for structuring information utilizing the methods and tools described in this paper. As the processes and methods were proven successful it was decided that the same methods should be used within the whole company. Implementation projects where started and I was the project manager for those and at the same time responsible for further developing the systems and methods utilized.

This paper is divided into two major parts with the first one dealing with the theoretical principles used and the second part with the actual implementation of processes and tools. The first theoretical part, chapters 2-4, describes the cornerstones i.e. product lifecycle or data management, content management and DITA. The second part elaborates on the processes in chapter 5 and finally the project itself in chapter 6. In chapters 7 and 8 the reader can also expect some opinions of the writer in this particular area. Figures not having a source reference are either the writers own production or have been made by the project team involved in the project.

2. PRODUCT LIFECYCLE MANAGMENT (PLM) AND PRODUCT DATA MANAGEMENT (PDM)

Product Life Cycle Management strives to get a system environment that can manage all information related to the product when it comes to information and planning processes. The system gathers all information necessary for the product into one system instead of several systems. By doing so the whole process chain is easily reachable and transparent to its stakeholders.

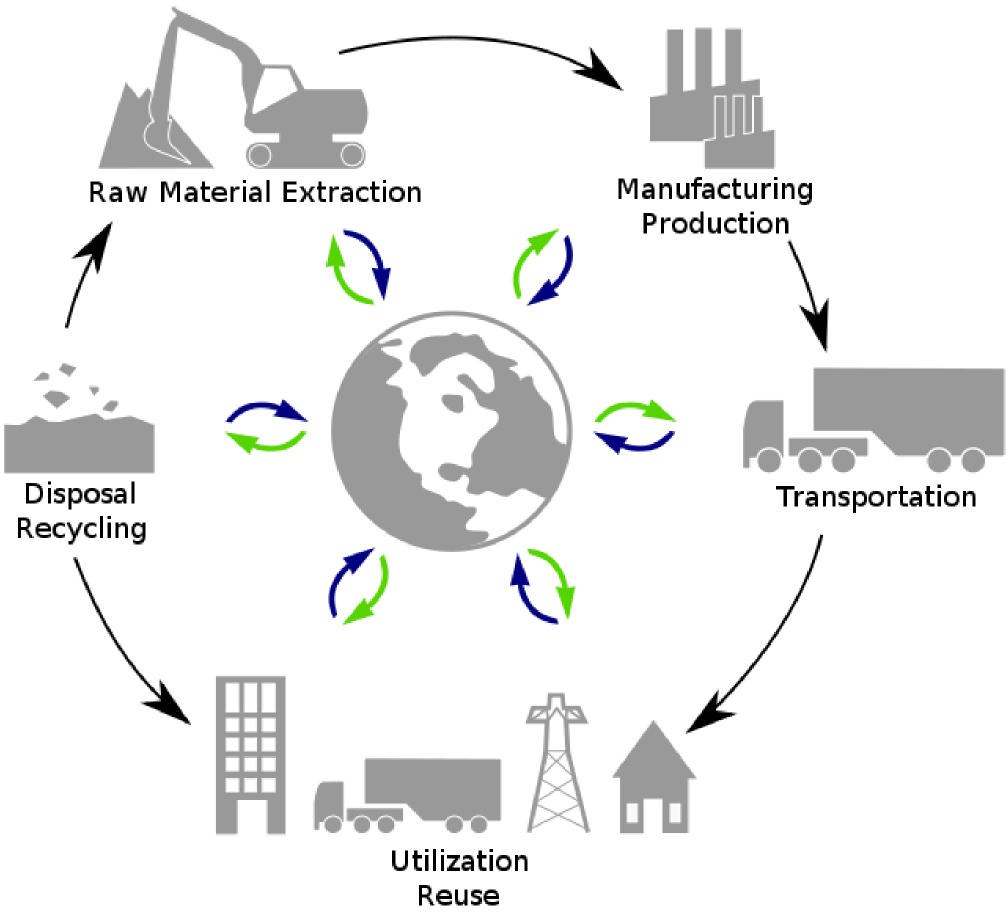


Figure 1. A generic lifecycle of products.

During its lifetime the system goes through several stages. These stages contain definition, planning, production and maintenance. It even includes the phase of obsolescence i.e. the ending of the product and replacing it with a new one if necessary. A PLM system handles the product lifecycle information and its availability throughout its lifetime. (Wikipedia Foundation, Inc., 2012)

2.1 PLM Briefly

PLM or Product Lifecycle Management is based on Product Data Management or PDM. This model was developed during the 90's and several companies still have their own tailor made PDM system. The first commercial systems were simultaneously developed, but have only during the mid-2000 become a center of focus for companies. The strength of PLM systems lay in their ability to share knowledge, files and other special skills in a fast and easy manner. It also enables the handling of complex designs and design processes. Another benefit is its agility e.g. ability to adapt to environmental changes. These changes can be market demands or legislation changes. PLM also enables better quality management when designing and managing the product life cycle. Many of the quality check points can be automated and built into the system that will never, if so configured, forgive poor quality. Naturally a PLM system will also bring monetary benefits to its users. Main enablers to this are higher quality and faster throughput of development of products. (Wikipedia Foundation, Inc., 2012) (Grieves, 2006, pp. 6-25)

2.2 Product Data Management (PDM)

In the previous chapter there was a brief explanation of the PLM systems or how the lifecycle of the product is handled much from a process point of view. It is also covering a large portfolio of products. Now to pin down to a more earth near environment we will look into the Product Data Management or PDM systems as it is generally referred to. (Wikipedia Foundation, Inc., 2012) (Grieves, 2006, p. 52)

A PDM system is as it says a system consisting of the normal system cornerstones. Typically a system consists of servers, one or many, in where there are applications and databases. A PDM system is used either in the client environment or as a connection to a server system. In modern PDM systems the integration to the different client systems are generally good. The most common client system would be the CAD system but also normal office software as Word and Excel can be very well integrated to the PDM system. Integration on this level enables creation and maintenance of several types of information types and having them tightly connected to the product itself. What naturally come to mind as a connection to the product structure are the drawings. Drawings are a significant part of especially manufactured products. However, also other types of documents can be connected in a similar way. These could be made up of calculation sheets, test reports and specifications. Usually a system also contains a visualization system that enables working groups to check properties of documents and make remarks to those. In this context it is also noteworthy to mention the document management functions usually contained within a PDM system. The ability to version and revision documents of any kind and binding them together to the change management is sometimes critical. (Grieves, 2006) (Wikipedia Foundation, Inc., 2012)

Another role of the PDM system is the management of the users having access to different type of information. In the context of technical documentation where an end product could be a spare parts catalogue or a manual it may not be necessary to provide access to calculations or production drawings. This could in some cases be seen as a security risk. Another important feature of the PDM system that will also be looked into later in this thesis is the Bill of Material. The bill of material makes the actual recipe for a component, module or product. We will see the importance of this in the project part of this thesis. A general function in the PDM based on the Bill of Material is the ability to configure products. (Grieves, 2006) (Wikipedia Foundation, Inc., 2012)

2.3 PLM vs. ERP

As mentioned earlier the PLM is much focused on the life cycle of the product. Before explaining the difference between PLM and ERP it should be mentioned that PLM is the business view of the life cycle while PDM is the system view of the same. These terms are thus often mixed and perhaps misunderstood. However, remembering this simple rule of difference will help in thinking in business terms and systems terms. In the project part of this thesis I will concentrate on the system view and how it gives benefits to the process of technical information. ERP or Enterprise Resource Planning has in common with a PLM system that it revolves around such things as Functions, Installation, Product, Customer etc. In this sense it can be seen that they are partly overlapping each other. However, there is a distinct difference and that is in the granularity of the information in the systems. A PDM system is interested in everything and anything while the ERP system is "only" concerned about the information related to the transaction at hand. When the transaction is completed the mission is so to speak completed. This granularity can increase and seem broader but what in reality happens is that one transaction is expanded with relations to other transactions. This eventually leads to the fact that multiple transactions can be the basis for a program. (Grieves, 2006, p. 56)

2.4 Bill of Materials

The bill of materials (also called bill of material or BOM) in this thesis is explained on a high level. This as it will have relevance further on when coming to the part where describing the project and an actual implementation. (Grieves, 2006, p. 174)

To keep it simple it can be said that a bill of materials is a list of raw materials, single components, assemblies of several components with a sub relation. It is a basic recipe to make or manufacture a product. This means that the bill of materials can have different content depending on the industry. The contents depend to a great extent on what is necessary to trace. An example of this difference is that the manufacturers of an iron part, like a piston, have a higher probability to be interested in molecules and different iron alloys. From the point of view of an engine manufacturer the actual material have lower priority while the piston will be an important piece of equipment or part along with piston rings and cylinder liners. Bill of materials is hierarchical and represents the function the assembly will perform. There are also different types of bill of materials that are used for different purposes. The first bill of material is generally the engineering BOM followed by the manufacturing BOM, Sales BOM and service BOM for keeping track of changes to the product or assembly. (Wikipedia Foundation, Inc., 2012) (Grieves, 2006)

2.5 Change drivers

There are several things that make changes necessary to a product. The most natural is product development. The product as such and its components are constantly improved. This means that a company's internal change process as well as sub supplier's changes needs to be taken into consideration. In a first instance it affects the product engineering but eventually also the updating of information related to the product. Other change drivers are legislation and market demands. Legislation could in some case require better traceability or improved quality according to a certain adopted standard. Market demands could also act as change drivers and adapting to those means coping with competition and staying competitive. (Grieves, 2006, pp. 95-127)

3. CONTENT MANAGEMENT

Even if there are many systems involved in the process of refining information such as technical information about products, there are also factors that make these insufficient. (Wikipedia Foundation, Inc., 2012)

Content management, or CM, is a collection of processes and technologies that supports the managing of contents. The management includes collecting, refining, writing, updating and publishing of information. Another essential part of modern content management is the ability to introduce collaboration. The role of content management is tightly connected to the importance of information. It is said that information is the lifeblood of knowledge. Such information is created in every moment of life or history. This makes information something that is a lot if not to say nearly too much to capture. This amount of information needs to be filtered so at least the most important pieces of information do not slip through the fingers, and due to the amount time will become a restraint. (Cameron, 2011, pp. 2-6)

3.1 Introduction

First of all to get a common understanding of contents management for this thesis we need to look at some definitions. As with the product life cycle and product management systems we also here find the similarity of a business view and a system view. The business view focuses as it should on the business aspect i.e. how organizations work with information as well as introducing concepts on how to implement the function. The business view is usually referred to as Enterprise Content Management, ECM. Enterprise Content Management strives to deal with information in all its forms across and trough the organizations. Enterprise Content Management also includes strategies, methods and tools. The aim for all this is to take the unstructured information wherever and whenever found and structures it for a purpose. (Wikipedia Foundation, Inc., 2012)

The scope of ECM is built up of its acronym that stands for the following definitions.

1. Enterprise. This is the perspective that describes all the functions of distribution, application and publication and defines where and how ECM takes effect. One could say it answers the questions *where* and *how*.
2. Content. This describes all that is contained in the functions and systems i.e. components, information, data weather it is structured or not. It can break down information to records, structures topics and templates. This aspect is an answer to *what.*
3. Management. This is a discipline answering questions like *who, when* and *why*. It is tightly connected to the areas of collaboration that includes all sorts of communication preferable in a controlled workflow. It reaches out to the important stakeholders basically trough any mean on interaction and information exchange.

It can be concluded that the Enterprise Content Management can be involved in all kinds of information management. When we look at a more tangible part, the systems, we will find that they are differently suited for different type of content management. The most normal association would be the web content management. Rightfully earning this reputation due to the large implementation of web content management systems for both internet and intranet sites. However there are also systems that are better suited for writing and describing technical products and solutions. These might be less user friendly but on the other hand more customizable to the intended use. In the analysis of this thesis such a system, InfoShare, will be looked at more in detail. (Cameron, 2011, pp. 2-3)

3.2 Content life cycle

There are various phases when developing content. The main ones identified here will be creation, review, management and delivery. (Cameron, 2011, pp. 6-13) I will now give a brief introduction to these, beginning with content creation.

3.2.1 Content creation

Content creation includes planning, design, authoring and review. When planning the content there are the following factors to take into account. Who will need the content? How should it be presented? How do we structure it visually for the targeted audience?

In the analysis to follow the audience will be identified as end customers needing operation and maintenance manuals as well as spare parts catalog. In addition to this there could be a need to produce work cards for specific maintenance tasks. The internal audience would have similar needs but the richness of the content would be a much higher requirement. The latter due to the business perspective, meaning all instructions should not be given away as it will bring income to the one selling such a service. The presentation part is also much related to the audience. Once the information architecture is defined for a specific information product it can be joined together with the right version of the visual specification.

Authoring involves reviewing relevant information found in other systems like the Product Data Management system or the Document Management System. Based on reviews, decisions have to be made on what kind of content types are needed. It could be written text or graphical media. Modern content delivery methods also include the possibility to make content that is not static. Examples of this are videos and animations.

Reviewing content is a vital part of the managing explained earlier. Due to complicated products and other factors like legislation everything needs to be thoroughly reviewed by authorized people before distributed and published. This process can effectively be handled by the implementation of workflow for content pieces.

Last but not least in this context is the versioning control. Even if the Product Data Management system have versioning control on its bill of materials, that will not be sufficient. Also the content management system needs to have a separate versioning control on all its pieces and compositions of content. This enables tractability in published material as well as targeted updating. In some cases also legislation require that published content can be regenerated and republished as it was at a certain moment in time. This was enforced by e.g. Sarbanes–Oxley Act of 2002 also referred to as SOX. (Wikipedia Foundation, Inc., 2012) (Cameron, 2011) (Rockley, 2003, pp. 311-362)

3.3 Collaboration

Collaboration is a vital part of the content creation process. Workflows were mentioned earlier and as such it is functionality in the system enabling collaboration. As a concept collaboration is not new. However, the implementation of collaborative authoring sets focus on some strategic points more than on technical issues. What needs to be worked out for effective collaboration can be presented in the following:

1. How groups are organized and managed
2. How groups work together
3. How individual authors work
4. How models are implemented and used

All the above points are basically management and strategic issues. That is why it is important for an organization to realize the importance of setting up the collaboration in a correct way that is accepted by all parties. It also requires a clear ownership and communication of the ownership of the different areas of content creation and maintenance.

To summarize collaboration one can compare it to breaking down silo walls. Having everyone working together to achieve a common goal requires hard work just as with breaking down physical silo walls. An important enabler for this is the collaboration in a content management system. (Rockley, 2003) (Cameron, 2011) (Wikipedia Foundation, Inc., 2012) (Glazer, David; Jenkins, Tom; Schaper, Harmut;, 2005)

4. DITA

Darwin Information Typing Architecture (DITA) is one of the most powerful tools for creating or constructing technical information. By implementing DITA organizations can gain substantially more value from their technical information or documentation. Not only in its possibilities to save costs but also as it will open new opportunities to reuse information. Darwin Information Typing Architecture is an XML-based architecture. This makes it very compatible also with other systems such as content management systems. It therefore makes the communication with other systems easy and information can be molded into several forms with ease. (Bellamy, Carey, & Schlotfeldt, 2011)

4.1 DITA defined

Darwin: DITA utilizes principles of inheritance for specialization

Information Typing: DITA was designed for technical information based on information architecture or Concept, Task and Reference

Architecture: DITA is a model for extension both of design and of processes. (Bellamy, Carey, & Schlotfeldt, 2011, p. 7)

4.2 Background

To give a short background to the standards it was designed by teams within IBM. During the years 1999 – 2005 it was collaboratively worked on within the company. However the standard was made public and is now managed by the OASIS, (Organization for the Advancement of Structured Information Standards). OASIS is a nonprofit consortium driving the development, convergence and adoption of open standards including DITA. This means the DITA standard can be taken into use by any corporation or company with a desire to manage technical content in a structured way. (IBM: Don Day, Michael Priestley, David Schell, 2005) (Wikipedia Foundation, Inc., 2011)

4.3 Generally about standards

To give the readers of this thesis the correct understanding of DITA in this context it is also important to understand the role of a standard. A simple explanation of a standard is that it is an agreed, repeatable way of doing something. It is also something that is published normally as a document. This publication or document will contain the technical specification or criteria's on a rather precise level. These specifics are rules, guidelines or definitions. By having a common understanding on this level it makes communication easier and more reliable increasing effectiveness of work we do and deliver. Standards are created when experience and knowhow in a certain area is brought together by the parties involved. This was also the case within IBM. Having lots of information created in different environments and with different methodologies even if using systems there where anyway a challenge to bring this scattered information forward in a structured manner. (Wikipedia Foundation, Inc., 2012) (Wikipedia Foundation, Inc., 2011)

4.4 Advantages with DITA

One of the main advantages with DITA is its ability to deal with topics. This is a way of minimalism that will benefit both the target user reading the topic in its final context as well as the author or editor when writing. A well written topic improves retrievability, navigation and usability. It also enhances the possibilities to reorganize quickly and thus also enabling more flexible thinking. To understand the topic-based writing it is also necessary to understand the terminology of a topic in this context. A short description would be that it is a conversational piece and in technical information it could be an article. As such it contains only the necessary information to make sense on its own. This information would be a title and some content. The idea is that it would be as much as possible self-contained, not to be mixed with live alone. The latter is due to the fact that a topic however self-contained usually needs a home in a larger organized collection of topics. (Bellamy, Carey, & Schlotfeldt, 2011, p. 17)

4.4.1 Advantages with DITA topics

As concluded earlier the topic based writing is not only a help for users to find information. It is also a valuable way of making content for the writers. Imagine the benefits where different writers can concentrate on different topics. This will lead to increased productivity when multiple writers can contribute to the larger picture. Sharing the writing of a large project will also be made easier. This can be illustrated by having several writers on a 50-100 pages long document. It will probably be locked by some writer during his time of edit. A definite show stopper compared to splitting the content into smaller manageable pieces or topics.

Another advantage will be the possibility to reuse already written content. Especially in technical information context some equipment is usually used in several products. All written about this certain piece of equipment in a topic form can be easily reused without rewriting or editing.

Furthermore a topic based approach will ease the possibility to reorganize how content is being presented. One topic can be included in several information products. An example of this could be an instruction with a reference needed in both a manual and service work instruction.

There is also another type of audience that can easily be forgotten when planning content. That is the reviewer. Very seldom the reviewer has a lot of time to read through long articles and chapters in manuals due to some small change somewhere. Imagine the possibility to be able to present a simple topic with a highlighted change and reference to the material affecting the change of content within the topic. In this context the workflow in a content management system will also be a significant part of the writing and reviewing process. (Bellamy, Carey, & Schlotfeldt, 2011, pp. 7-20) (Wikipedia Foundation, Inc., 2011)

4.5 The core in DITA – The "IT"

We have already described the advantages of topic based writing. To take this to the next level we need to look into the main topic types. These are:

1. Concept: A concept topic defines what something is and how it works (process)
2. Task: This topic describes one procedure (that can be built up of several steps, ex. change oil in the car engine)
3. Reference: Contains one type of reference information that a user might need to perform task. (5 liters of oil, Oil filter nr 1234)

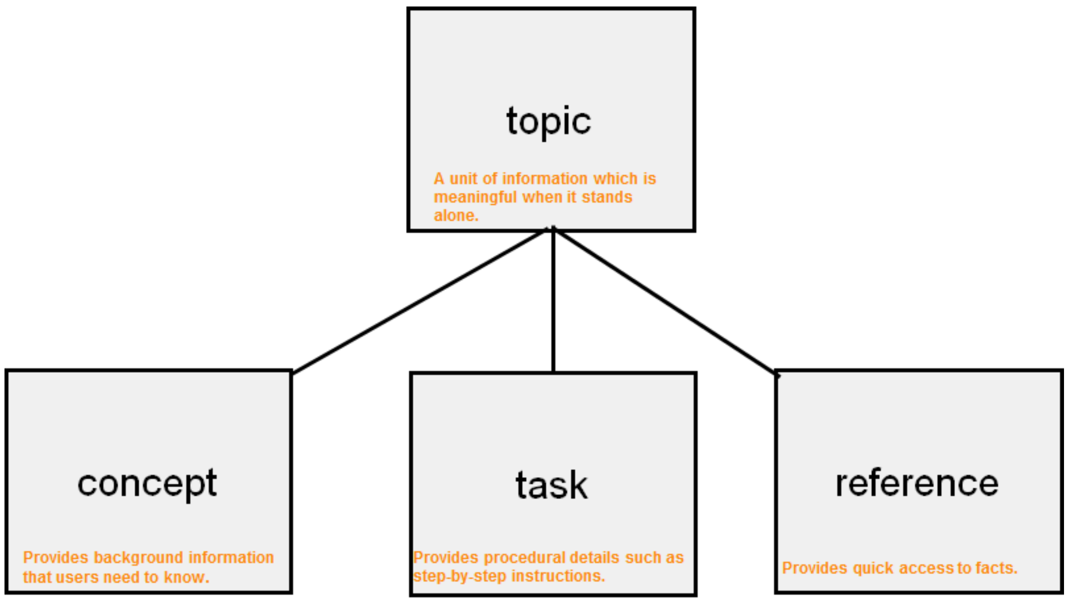


Figure 2. The core DITA topic types.

By separating content by type one can prevent users from going through irrelevant information. To illustrate how this can work in practice we can take a home entertainment system. It would cause confusion to include remote control information into the topic of installing the system. Rather it would be logical to have one or several topics explaining the installation and other topics concentrating on the various usages of the remote control. Here it is again obvious how the element of reuse can be applied as the same remote control can be used for many home entertainment systems and thus some of the same topics are valid. (Bellamy, Carey, & Schlotfeldt, 2011)

4.6 DITA summary

Although there are several other standards that aim to support the process of making technical information it is by this short introduction quite obvious that DITA can provide a flexible and rigid framework when creating technical information.

As it is a new way of thinking to write topic based content there is a learning curve before achieving the desired effects. This was also noticed in the project for Wärtsilä. But once overcoming this challenge with topic based writing DITA users can find information they need much faster. They can focus on relevant content and shorten the lead time to achieve desired goals.

Another advantage by introducing topic based writing is the need to get a good understanding of the users and their goals. Some amount of time will at least in the beginning be spent to analyze tasks and how they are performed before writing anything. This step can also be very valuable for the organization normally doing these tasks on a daily basis. When putting things down to simple topics and connecting them to each other the outcome can be increased productivity also for the organization analyzed. Supporting this statement is a Work Card project completed 2010 together with the field service organization. Thorough analysis where made on work procedures by analyzing and documenting how the actual work was performed in the local work shop in Vaasa. Based on this information it was fairly easy to list the needed tasks and reference data needed for each task. (Bellamy, Carey, & Schlotfeldt, 2011) (Bruski, 2007) (Core Committers: IBM, Citec Information, Suite Solutions) (Dr. JoAnn Hackos, 2012) (IBM: Don Day, Michael Priestley, David Schell, 2005) (Kristen Eberlein, 2012) (Robin Cover at Oasis, 2009) (Wikipedia Foundation, Inc., 2011) (dita xml org, 2012)

5. DEVELOPMENT OF PROCESSES AND BASIC PRINCIPLES

This chapter will outline some basic principles and processes that first were applied on the production of Spare Parts Catalogues. However the exact same process was used and implemented in the STRICT project explained in chapter 6 in this thesis.

As information for the reader it can be worth noting that this was an ongoing development starting with developing processes in-house and later extending the same methods to the partnership company responsible for making information products like the manuals and work cards. The company here in which the process was first implemented was Wärtsilä Finland. The first results were already achieved the same year but the full potential of the savings were reached after some refinement during the second year and thus clearly evident beyond that. The success of this project was also recognized by the company management and in 2008 it was decided that a rollout project should be started with the target to have the same methodology implemented in all Wärtsilä companies handling technical information.

5.1 Defining mission and vision in the documentation case

Technical information is traditionally seen as documentation in form of paper copies in binders would need a little explanation. The word documentation comes from Latin, docére and means ‘to teach’. This has therefore been the main purpose of documentation i.e. to teach. Teaching as such relates to giving information to people for certain services or tasks so that these can be performed in a safe an efficient way. As safety is brought into the picture, content correctness becomes an essential part of what is documented. Another player increasing the quality aspect is also the legislator.

Documentation in practice will thus mean to create information products more than to create the content in its context itself. Making an individual Manual or any other information product will be the purpose for documentation and related processes.

To achieve certain goals it is also important to have guidelines. Figure 3 illustrates the usage of guidelines. Guidelines will give some room for local adaptions but in general they, in a very precise manner, set the “road ahead” for certain processes and functions.

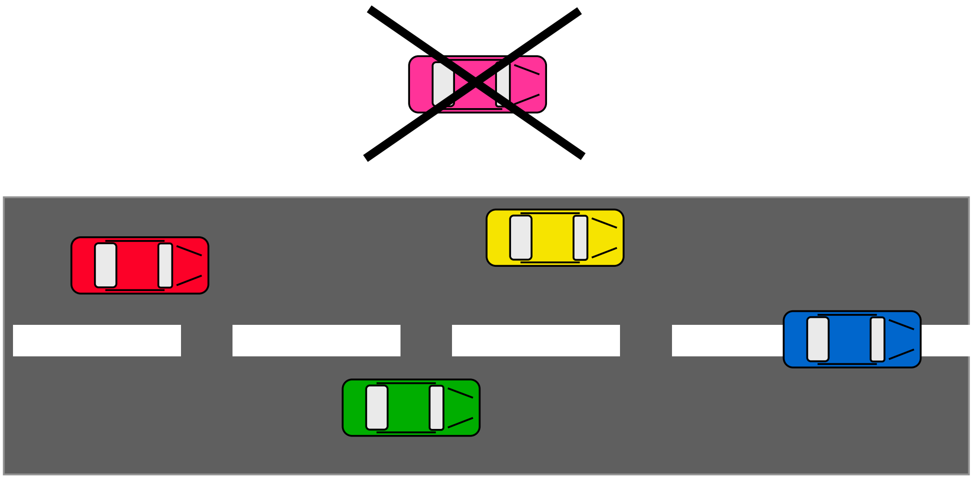


Figure 3. Illustration of the benefits using standards.

The mission for the actions set out for the case presented in this case study were three main ones

- To produce, distribute and update structured and relevant Operation and Maintenance information connected to the product structure as well as utilizing information type definitions and chosen standards for writing content.
- To create and sustain the needed processes and systems to facilitate this production, distribution and updating in close cooperation with external and internal partners.
- To implement the efficient use of this information within the company and for the benefits of the customers of the company.

The long term vision would be to have documentation or technical information as it would rather be called to be viewed upon as the most reliable source of vital instructions, always available and of such quality that when instructions are observed also costs of operation would go down. This way it would also be the viewpoint of the company employees that it contributes to the EBIT as well as the overall vision of the company.

5.2 Main principles

There are a few major issues that need to be dealt with in order to achieve the outlined goals.

- Need for short delivery time of existing information products
- Need for fast accurate updating
- Need for short creation time of new information products
- Need for lower production costs

To meet these challenges there is a need to have a well-defined process implemented. In this thesis there are two processes that will be referred to as they have during years of searching for optimal ways of working turned out to be beneficial for both internal and external stakeholders.

5.3 Creation principle

Information products are created utilizing an information structure based on modules connected to a product structure. The product structure was previously explained in the PDM part of this paper. Figure 4 shows a general level information structure. Reading the structure it will show what kind of information types are included in a certain information product and also in which order they occur.

The information modules are carriers of the information types and they make up the building blocks of the information product. This makes the information modules neutral when it comes to the information product. In this context it is worth mentioning that this requires a different kind of thinking when wringing content. As the information modules are neutral they should not be put into a context of a product as this would force a certain mindset to the writer and in later stages create obstacles in terms of reusing content.

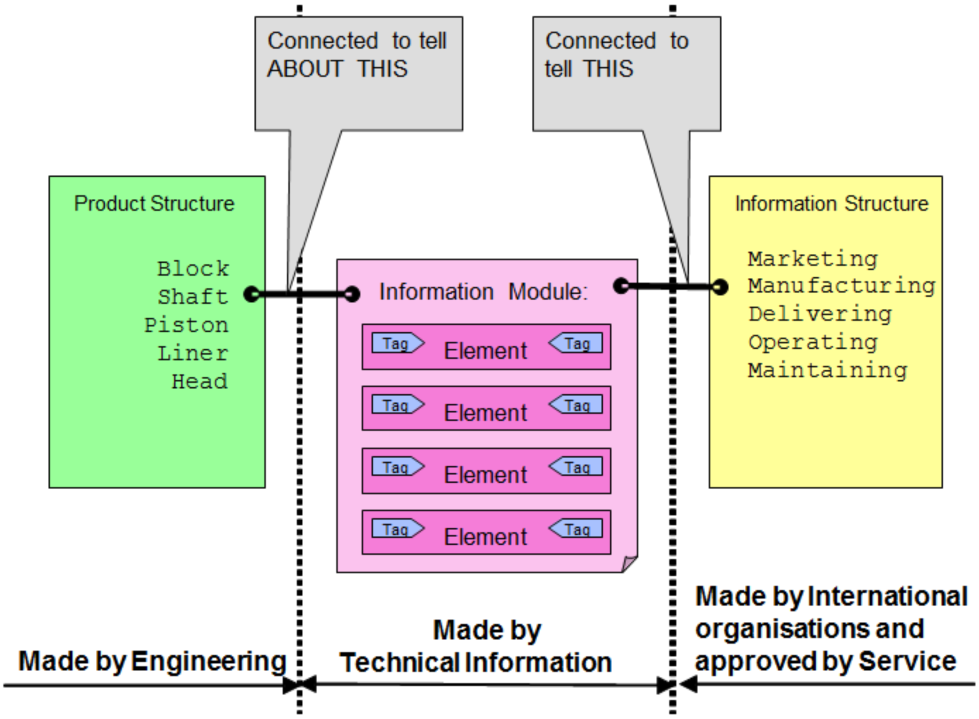


Figure 4. The connection between product and instruction.

The product structure is retrieved from the PDM systems and can on a general level be called a certain Bill of Material that is dividing the product into logical modules that makes handling of them both mentally and physically easier as it has clear boundaries.

The product structure in Figure 4 is generated by the engineering teams in business's functions not necessary interested in the parts and components levels of a module. This means that an extended structure in some cases must be added to be able to make detailed enough instruction on a certain task or identification of a spare part.

The information products must be "on pair" (match) with the physical product. In other words there must not be instructions for something that is not included in the "iron" product or vice versa, that there is lacking information on certain areas. A typical example of this would be reference data on tightening torques and work step descriptions.

This in turn also puts higher requirements on the product structure itself. It cannot just be a description of an assembly but rather it needs to be the specific recipe for the assembled product. In order for this to be accurate there needs to be defined rules on how to connect design modules to information modules. Some light will be shed on this ahead in the thesis.

5.4 Way of working by processes, tools and technologies

To reach the goals set by the mission and vision statements as well as to be able to produce and deliver the promised information products, a certain way of working was introduced. The way of working relies in its simplicity upon two processes, E and P process as shown in Figure 5.

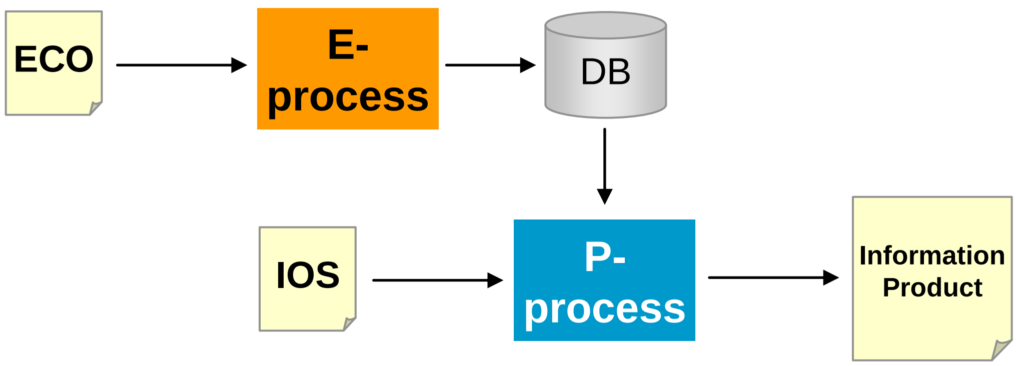


Figure 5. Simplified view of E and P processes.

The E stands for Engineering and P for Project. There will be referred to as the E-Process and P-Process.

5.5 The E-process

The E-process is triggered by the ECO or Engineering Change Oder that is issued by the engineering function for the iron product. Each ECO is immediately processed to check if there is any impact on connected information modules. Alternatively an ECO triggers a creation of a new information module if the products are of such nature that it needs a maintenance instruction, reference data or spare part number.

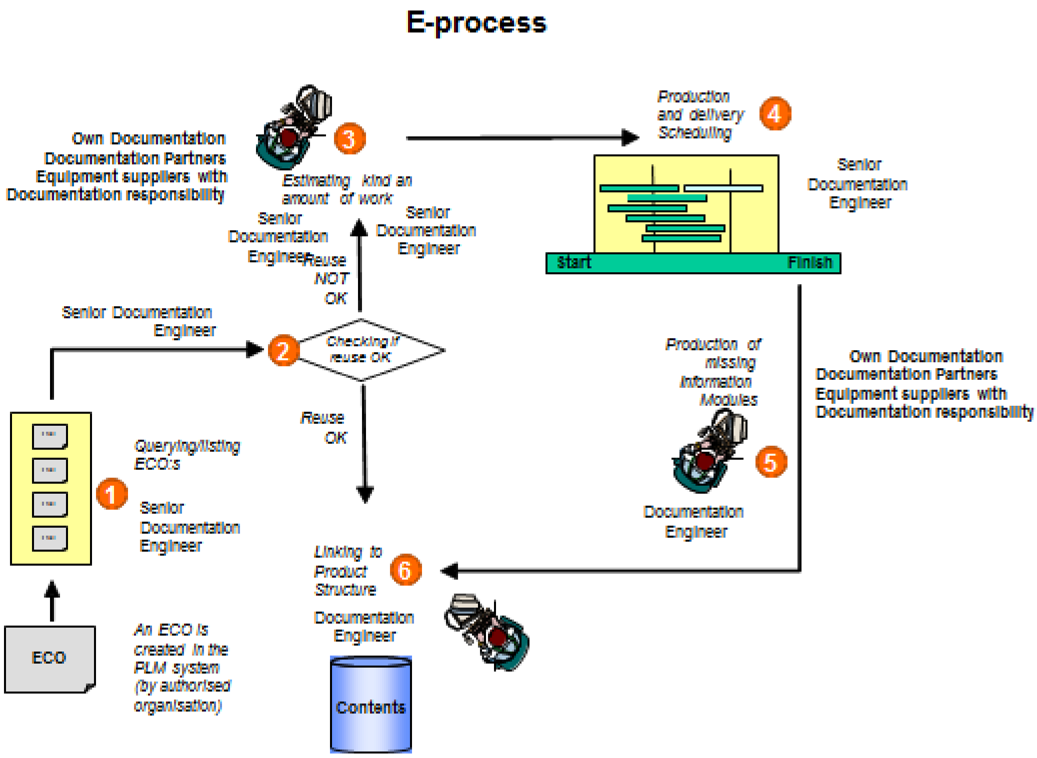


Figure 6. E-process step by step.

In Figure 6 a more detailed overview of the E-process. This figure reveals six different steps that are in the core of the process.

1. Checking the arrival of new ECO in the PDM system by querying.
   This is performed on a regular basis depending on the situation and anticipated frequency. However at a minimum once a week. This task also requires a certain skill and knowledge of the products.
2. Evaluating information updating status.
   For the actual ECO, it is by retrieval of the old or replaced material number and comparing it to the new one, a decision can be made if an update of the connected information module is needed. The number itself does not reveal the need but the motivation made by engineering and the content of the updated drawings and supported material can give such vital information needed for a decision.
3. Evaluating amount of work
   Based on the decision and that it will require a change or making of a new information module the person with the same skill profile as in step 2

makes an evaluation of the amount of work needed to update the information module(s). Figure 7 gives an example on how early estimations where made in excel. The same has during time been improved and the final goal would be to have this facility included in the PDM systems itself or optionally in the technical contents management system.

	A	B	C	D	E	F	G
4	Auxpac	PAAE043949	_				
5	YRF-2004-178	PAAE043945	_				
6		PAAE041141	_				
7		PAAE043918	_				
8		PAAE011484	b				
9		PAAE005071	b				
10		PAAE043251	_				
11		PAAE021628	_				
12		PAAE043831	_				
13		PAAE005798	b				
14		PAAE043998	a				
15		PAAE005627	_				
16		PAAE004781	a				
17				9	days		
18							
19	PAAE014713						
20	Auxpac	PAAE029253	c	1	day		
21	Zhejiang Ouhua 2035	PAAE039293	_	2	day		
22		PAAE035120	_	0	day		
23		PAAE035986	b	0,5	day		
24		PAAE023276	a	0		1	week
25		PAAE040808	_	0,5	day		
26		PAAE039130	_	0,5	day		
27		PAAE021628	_	0		?	week
28		PAAE040040	_	0,5	day		
29		PAAE044259	_	0	day		
30				5	days		
31							

Figure 7. Scheduling in the E-process.

4. Scheduling

   Based on the above and available resources, urgent needs and other factors, the work to change the information module is put into a schedule that is published and contains a date of promised delivery time. This delivery date will be vital for the P-process to plan its production. The scheduling also supports the quality thinking enabling KPI's for the work performed. These KPI's enables cost tracking and cost transfers according to agreed procedures.

5. Production.

   The listed information modules are modified or in certain cases new ones are created. This is done by a documentation engineer with special skills for either writing according to DITA standard or in case of Spare Parts information has skills for making Spare Part pictures and relevant coding.

6. Linking to product structure and approving content.
   When the information module is altered or created and approved it is connected to the product structure (material number). In this context it can be repeated that the reuse of the made information module will occur when the same material number is used in a product and the information module is part of the information product. Alternatively a new material can use the same information module.

5.5.1 Considerations for contents making in the E-process

To enable reuse, the content created is made as general as possible and making it independent of its carrier. The trigger or incentive to alter or create new content comes to the documentation engineers from various sources. It could be environmental such as legislation or utilization. It could be a supplier change or design improvement or in a not so glamorous case a design bug fix.

The following considerations should be thought of when creating contents:

- Consulting the ITD to make sure the right type of information is created
- Ensure the information created will be connected to the right module in the product structure
- Create a first version using prevailing knowledge
- Test the first version theoretically and in practice
- Make alterations
- Get the contents approved.

ITD stands for Information Type Definition and means a standardized way to categorize information. Typical examples of information types are <description> and <text>.

Only after successfully passing these gates, the information is ready to be used in an information product.

There are also layout considerations when making contents. In a few cases when it is not possible to utilize the CMS system and its authoring tools where the layout is predefined according to layout guidelines the author needs to be aware of them.

- Fonts
- Paragraphs
- Numbering
- Bullets and lists
- Pictures
- Drawings
- Movies
- Sounds

As these are normally described in branding guidelines and implemented in the CMS publishing system no further explanations to this will be covered here.

The storage of content needs to be managed in a controlled way even if the system landscape for producing and linking can be scattered. By making agreements and updating guidelines on system usage this can be accomplished. These agreements and descriptions will also be a good basis when renewing old systems as the way of working has not been tied too much to the system limitations.

The border line between the E-process and P-process is basically approved and not approved content. In case a certain information module is not officially approved with a stamp in the system it is not legal to use. Therefore the approving of content is of high importance.

5.6 The P-Process

The P-process or Project process is different from the E-process in its nature that it has a relation to the end customer. The trigger is an internal order specification for a certain delivery. Scanning for new deliveries is made at minimum on a weekly basis. A notification system provided by basic SAP functionality is used to create the internal order for information products to a specific delivery. This connection allows seeing the expected delivery date for the project as a whole and thus helps planning the production of the information products.

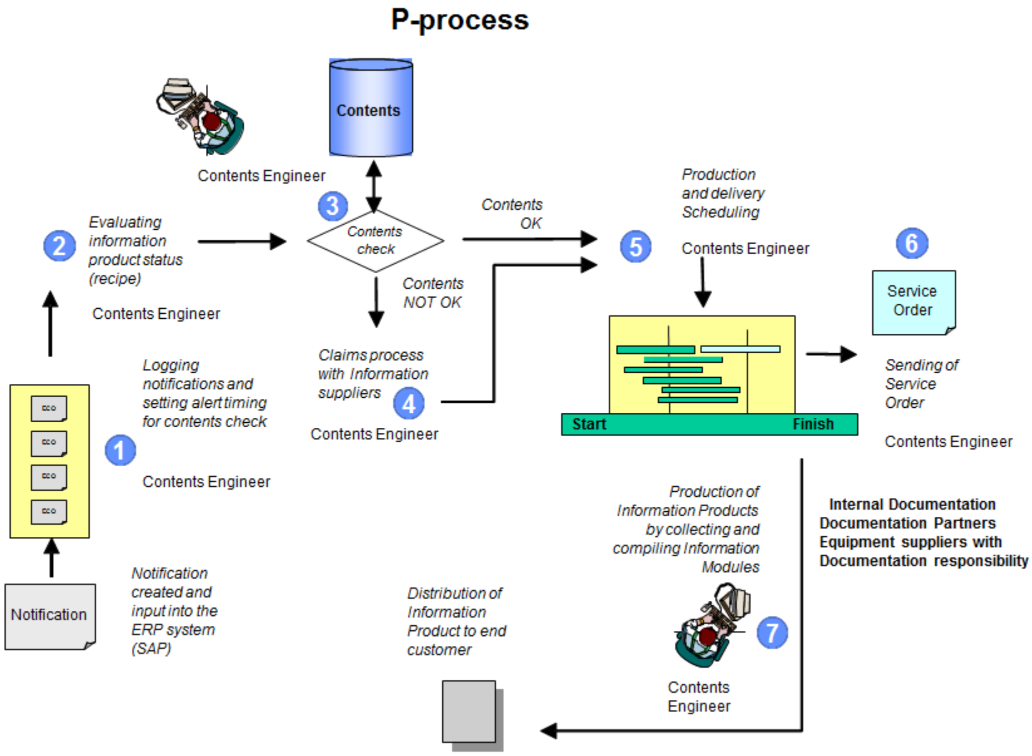


Figure 8. P-process step by step.

The process in Figure 8 contains the following steps, all in all seven.

1. Logging.

   A contents management function is responsible to, on a regular basis, check for newly arrived notifications trough the SAP system. As the SAP system itself contains limitations when it comes to logging non transactional activities, a separate system has been kept to enable richer description of the order content.

2. Evaluating the information products specification.

   The second step is to check that the information product specified in the notification or order has an approved recipe i.e. a listing of all information types to be included.

3. Contents check.

   As the arrival of the order is approximately one year ahead of delivery and the E-process generating changes at a frequency of ~700 ECO's per month the actual contents check is scheduled to about three months before requested delivery.

Contents check furthermore means that the information product is checked and verified against the product structure. All information types needs to have an approved information modules with connection to the Bill of Material of the final iron product.

If the outcome of the check is OK, a scheduling of assembling the information product can be made and communicated. In case NOT OK, the E-Process schedule needs to be consulted and if missing work is scheduled in the E-process that can be the input for P-process assembly scheduling.

4. Claim handling with information suppliers.

   If information is missing and there is no schedule on when to take corrective action, a claim can be made to the previous process, in this case the E-process. As the E-process is also dependent on input from processes taking place in the engineering, a claim can be issued even beyond the technical information function.

5. Production and delivery scheduling.

   When the contents check is made and possibly missing information modules are precisely known, reliable work planning and delivery time estimation can be made. In the case of Wärtsilä, the Spare Parts Catalogue is made in-house and the Manuals by a partner. This means both parties for their respective information product need to have a reliable scheduling and communication of any change impact.

6. Sending of Service order.

   As a final verification of point 5 a Service Order is issued to the internal customer (Information products are delivered as part of a larger project delivery). The service order contains a time stamp with a promised time of delivery. This means that this will be an important measuring point from a KPI point of view.

7. Production of information product trough compiling of information modules.

Through a manual, semi-automatic or fully automatic process relevant information modules are gathered and made into a publication. The output of the publication can have various formats depending on the delivery format. To simplify this one can aim at a paper through a published PDF file.

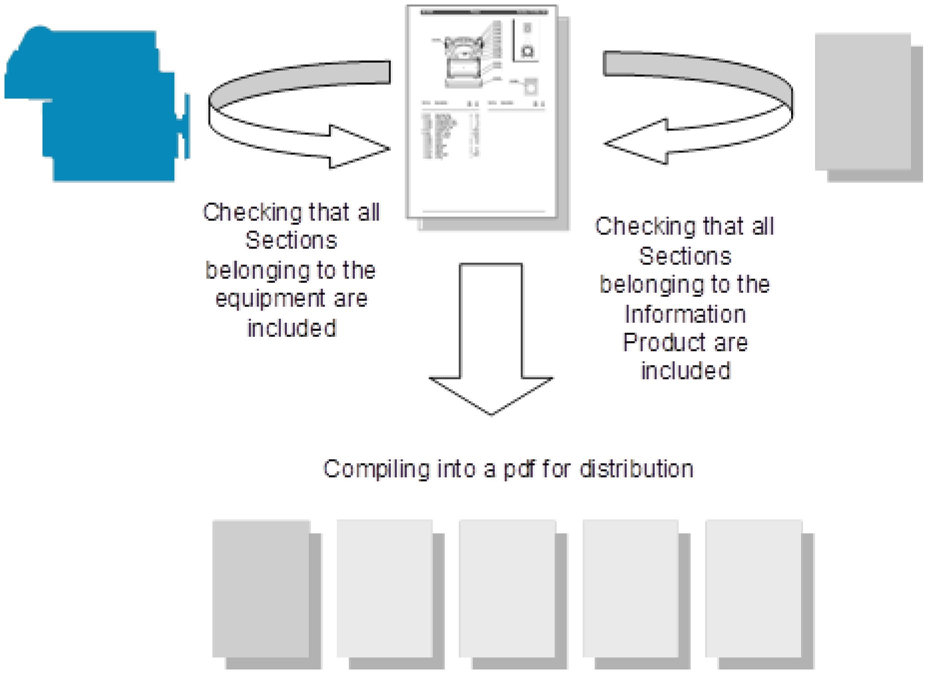


Figure 9. Comparing product with information for publishing.

6. STRICT PROJECT

The project applying the previously described processes, E and P, for operation and instruction manuals as well as other similar information products was named STRICT. STRICT stands for Structured Reusable Information Creation Tools. Looking at the theoretical part of this thesis it might now become more obvious why the different “corner stones” have been explained in more detail. When it comes to PLM or PDM there is the connection to the life cycle. The information life cycle follows the product life cycle and thus a strong connection to the product is needed.

For all this to become manageable tools are also needed, and here there is the connection to the PDM and Content Management Systems. The Content Management System would also bring the benefits to have a common look and feel on all content published. In combination with DITA the way of describing how to write content, the area of reusability would be achieved also for these kinds of information products.

6.1 Project Background

For many years it had been recognized that at some point in time a change is needed to move away from the basic desktop publishing to a more efficient and structured way of making documentation.

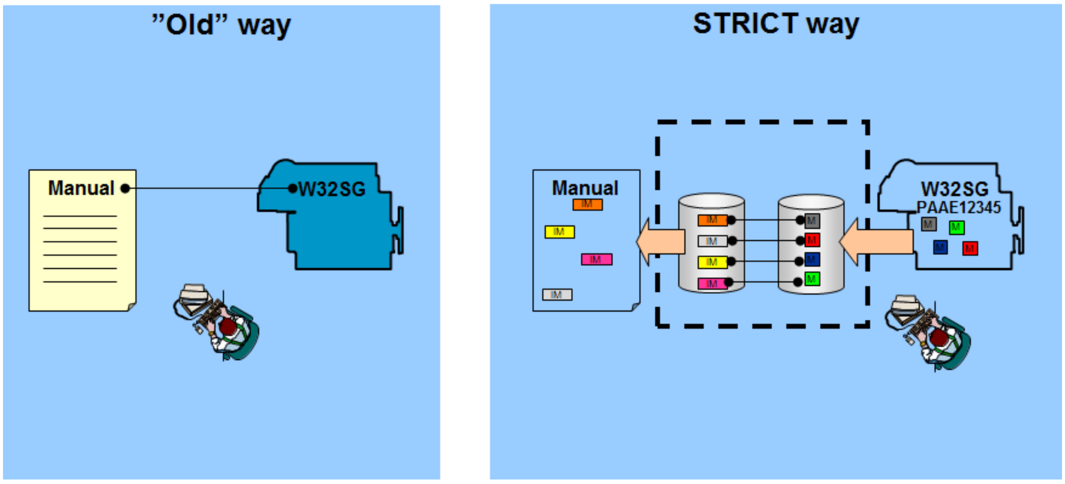


Figure 10. Old way of working vs. the new way.

With that said this is not something that was invented nor done by other companies. However, the time when a company reaches the maturity level to take steps towards new developments in processes and systems vary and has different drivers.

A vital player in corporate projects are however the business driver i.e. the monetary benefits. It can either be that something suddenly becomes too costly or that a solid business case to increase income through a certain development becomes obvious. In the case of Wärtsilä it was in that order and realizing the opportunities with structured information that was the main and first driver. The final approval for the development was although made first when the cost of the old way of working reached such heights that it was not possible to continue. This would be a typical behavior of a large company. Costs are to be reduced or kept on a low level making proactive development more difficult.

The angle to start the project was with focus on customer documentation. Customer documentation consisted of Spare Part Catalogues, Manuals and in some cases Work Cards or sets of instructions to perform certain maintenance tasks.

6.2 Project Definitions

The project was setup to start with a model iron product that represented well the entire population of iron products i.e. the engine. The chosen engine was the

Wärtsilä 32. By starting with an engine that had good references of information products it would ensure that the coverage of needed topics would be higher than for any other engine type.

The aim was to utilize structured documentation with all the elements as described earlier. The E and P processes would be implemented for the writers even if it was another company handling the actual writing.

New tools were also to be taken into use. A separate stream for setting up the needed system environment was started. The choice of CMS was InfoShare made by TriSoft and now owned by SDL more known for its Tridion system.

The major part of the project aside from setting up the new CMS system was the transfer of information from chapters written with desktop publishing tools.

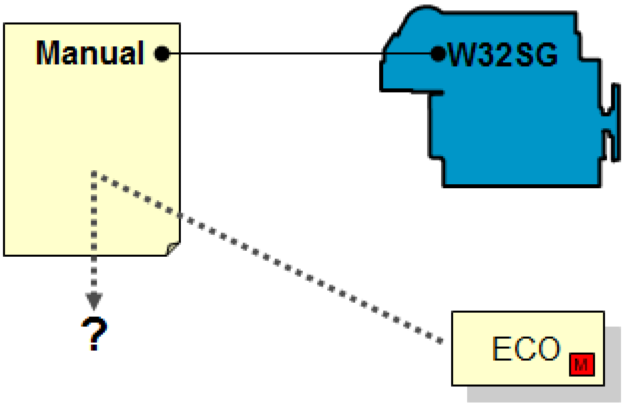


Figure 11. The challenge without structuring.

These chapters as seen in the Figure 11 were also connected to the whole reference type of the engine family. This made updating very time consuming and difficult in matter of finding the relevant place(s) for update.

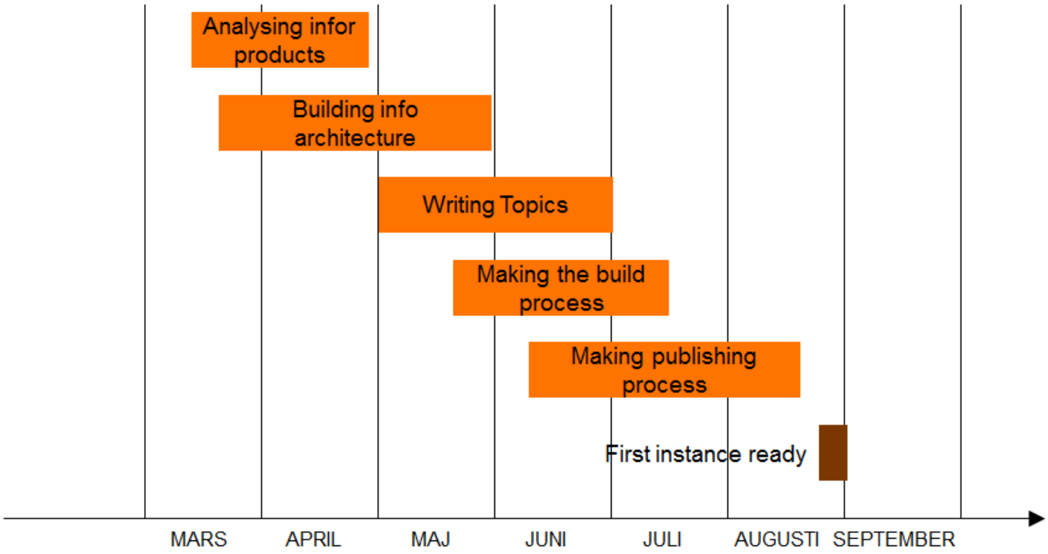


Figure 12. Steps in project schedule.

Figure 12 outlines the project main phases and an approximate time schedule.

6.3 Strict for Spare Parts Catalogue

At this point it was decided to leave the spare parts catalogue out of the CMS system. A tailor made system for keeping track of spare part pictures and spare part codes in connection to the current PDM system was seen as sufficient enough. As a new PDM system implementation project was started in 2006 it was also more feasible to leave this part out of the STRICT project. However the processes and methods described earlier in this thesis are used and followed strictly in the making of spare parts catalogues.

6.4 Strict for Manuals (and other information products)

The starting point was an assessment of the current situation. The following was found from a content view point.

- Approximately 770 pages of material for the Wärtsilä 32 engine
- Approximately to consist of 620 DITA topics
- Chapters about 400 DITA topics
    - 200 Concept topics
    - 150 Task topics
    - 50 Reference topics
- Appendixes containing about 200 topics

The task of the project was to transform the written material not only to DITA topics but also creating the DITA map.

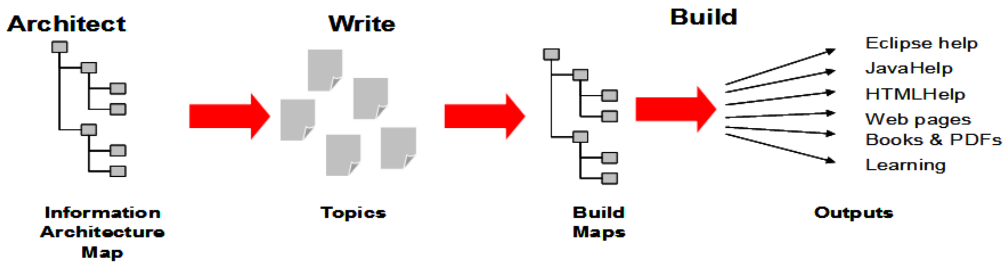


Figure 13. DITA Architecture.

The DITA map as shown above applies context to the topics. It helps organize a set of topics into hierarchies, tables and different kinds of groups. Ultimately it would be possible to build chapters from pieces of topics based on the map and having the desired output in form of a chapter based manual.

Figure 14 shows a simplified information product with the main elements and its linking to the product trough data base connections.

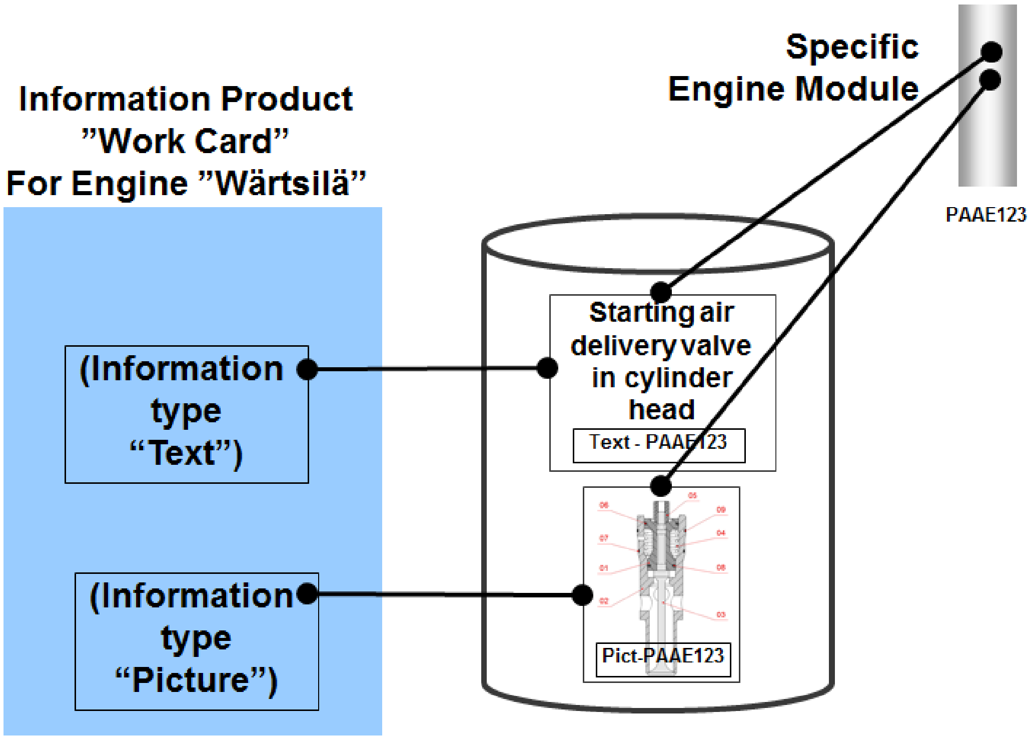


Figure 14. Separating content from container.

Another challenge for the writers is the move from a monolithic writing approach to a modular based. In a monolithic approach the writer can concentrate on the entire information product and how to describe it to a certain audience.

This can perhaps be compared to writing a thesis like this one. It will be published as such when ready and no needs for changes once approved. With the modular approach one could imagine that each chapter’s content in this thesis would be written by different writers and used in several theses where the statements would be valid. It proved to be challenging to change this mindset for some technically well experienced people.

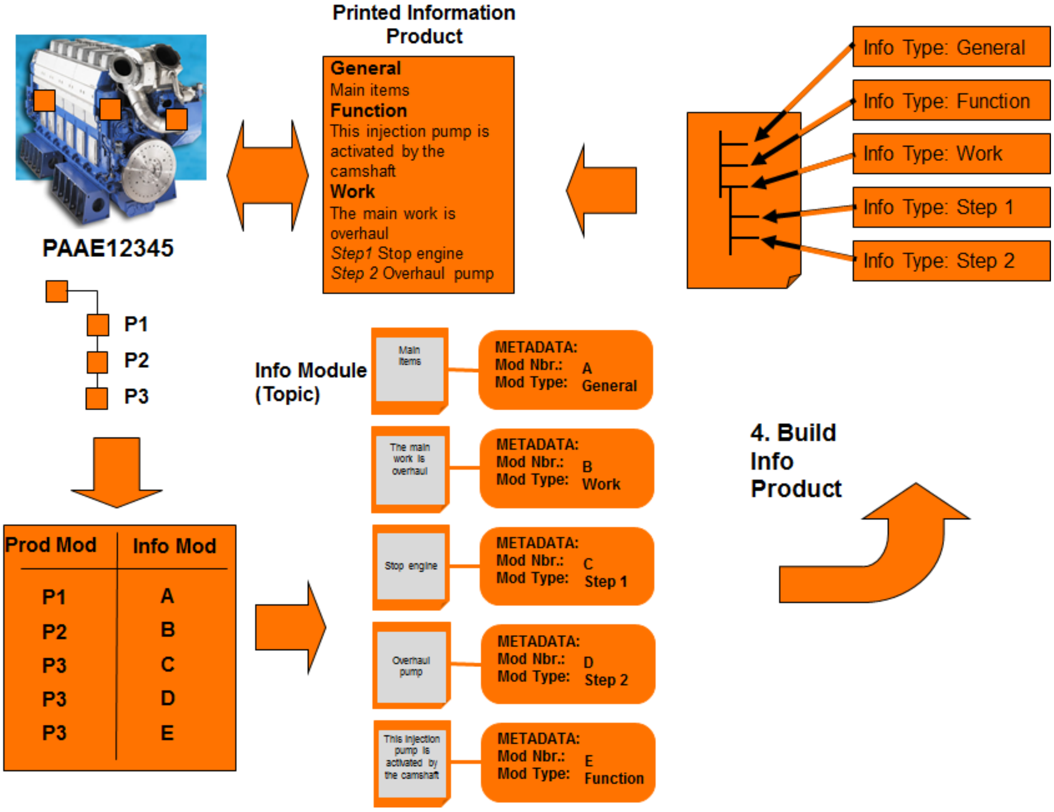


Figure 15. From B.O.M to information modules.

The second challenge shown in Figure 15 is the connection of modules to the product structure or Bill of Material. The Bill of Material could as such be described as modules. The connection to the right level in the Bill of Material would therefore be very important. There is no ready template for this and it therefore requires its own product expertise to make the first judgment. However, with time the experience would be gained to pin point the connection between the material numbers in the bill of the material and the correct information modules or topic in DITA vocabulary.

A challenge yet to overcome is the originating material itself. This occurs when "going modular"; there is usually a starting point. The information products usually have an accepted format and standard from a content point of view. However when starting to write in DITA, the following things can be observed.

- Old sections do not always contain enough material to function as independent DITA topics. The solution is to have these sections combined with others, expanded, or deleted as redundant.
- Old sections can contain a mixture of concept and task information (sometimes concept/reference, and sometimes even task/reference). In this position a decisions is needed on how to write these topics
  - what is the main aim → selection of information type
  - is there enough material to write several topics of different information types
- There are titles that do not have any contents of their own, only other subsections. In cases like these, redundant titles are removed and for own subsections content is made or created.
- It will be a challenge for the expert writers to start in DITA environment by filling in the gaps. It is worth mentioning that the DITA expert is not the same as the product expert. These two need to work together.

To illustrate the statements and challenges when converting from monolithic to modular below is a DITA module made from the monolithic original.

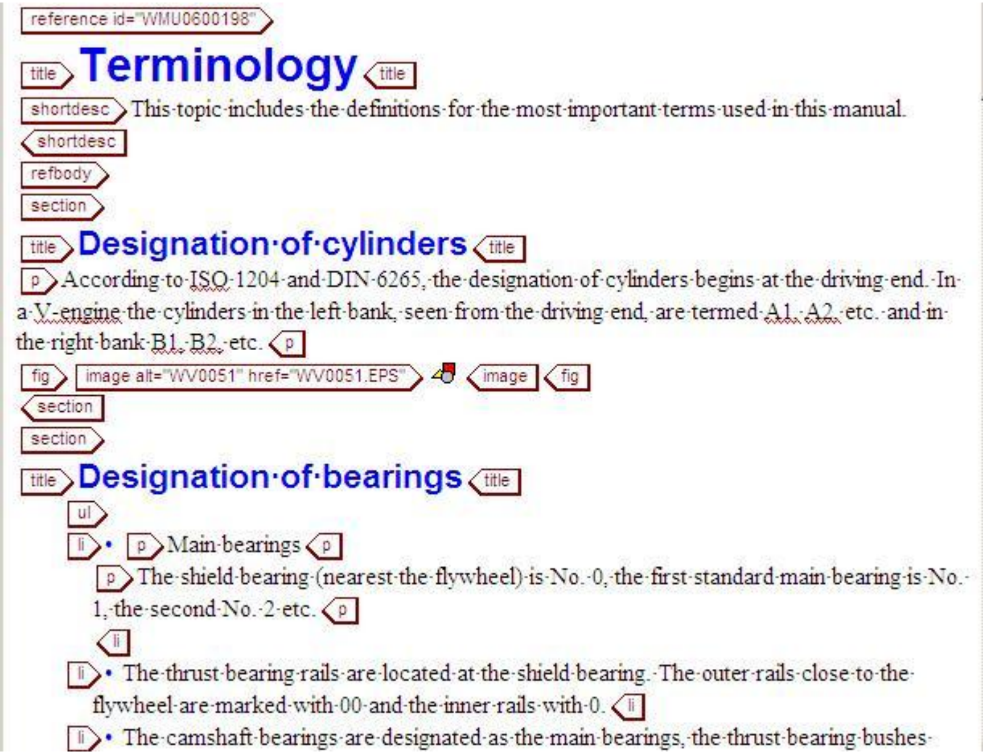
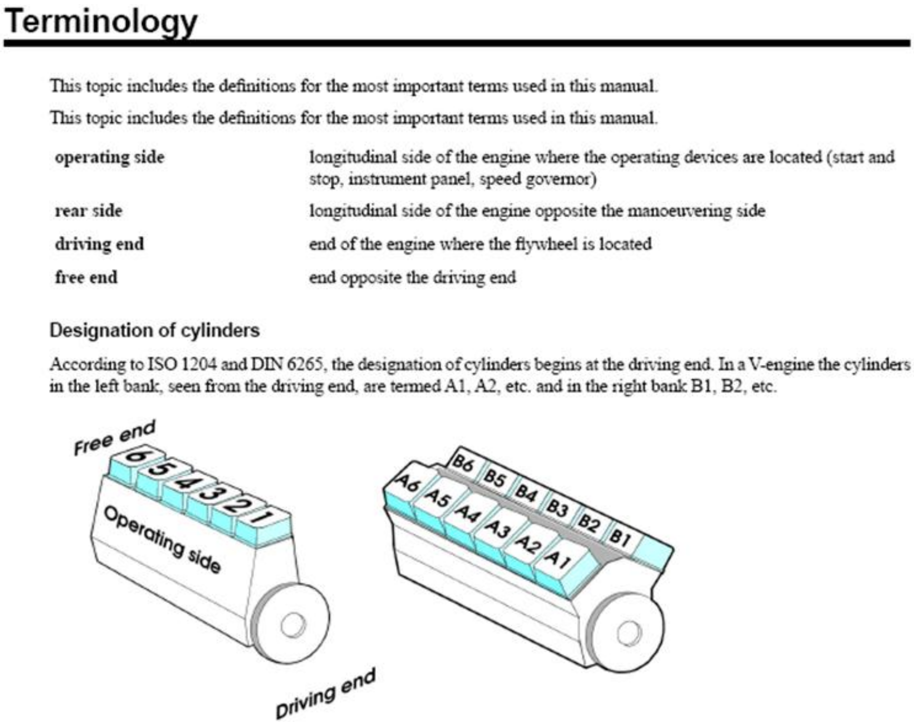


Figure 16. Dita based on monolithic writing.



Terminology

This topic includes the definitions for the most important terms used in this manual.

This topic includes the definitions for the most important terms used in this manual.

operating side	longitudinal side of the engine where the operating devices are located (start and stop, instrument panel, speed governor)
rear side	longitudinal side of the engine opposite the manoeuvering side
driving end	end of the engine where the flywheel is located
free end	end opposite the driving end

Designation of cylinders

According to ISO 1204 and DIN 6265, the designation of cylinders begins at the driving end. In a V-engine the cylinders in the left bank, seen from the driving end, are termed A1, A2, etc. and in the right bank B1, B2, etc.

Figure 17. In publication.

In contrast to the example above the following figures will show how the content is enriched and clarified. All three elements in the DITA topic are much more clearly seen.

First an example view of the topic and its references to its content.

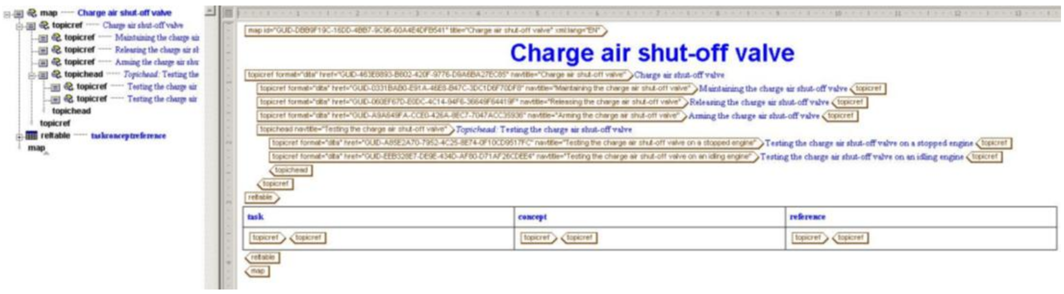


Figure 18. Topic with connection to information architecture.

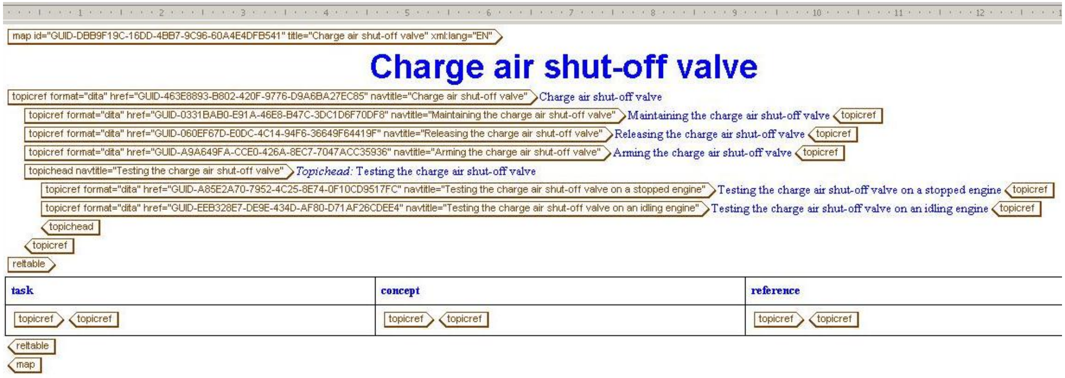


Figure 19. Close-up of topic.

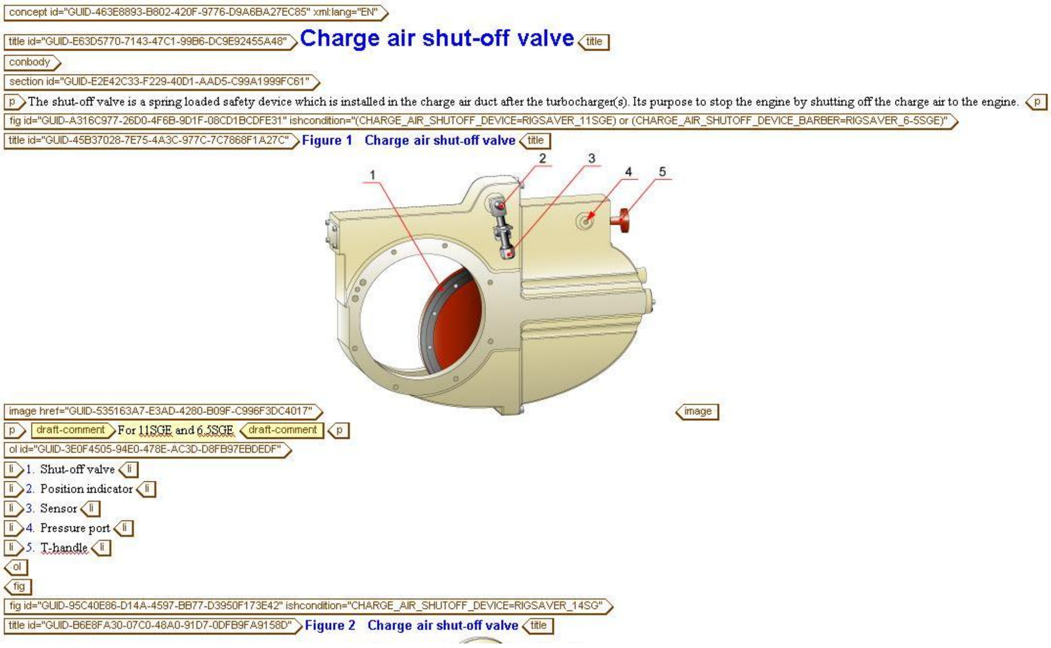


Figure 20. Concept of a topic.

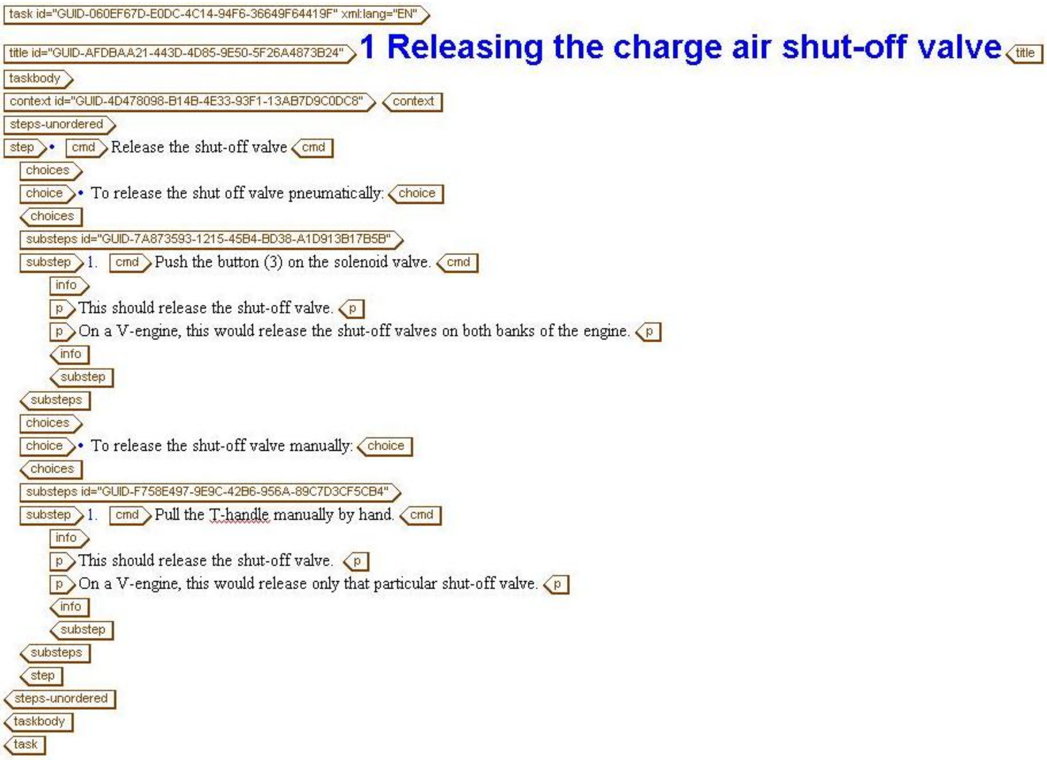
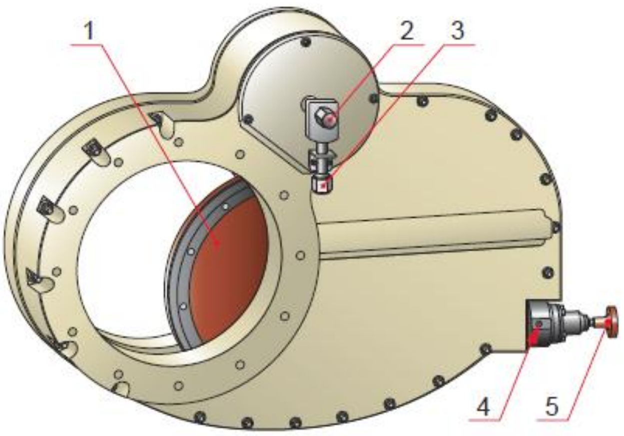


Figure 21. Task of topic.

The result in the final publication would look like the following figures presented as screen shots from a manual.

Charge air shut-off valve

The shut-off valve is a spring loaded safety device which is installed in the charge air duct after the turbocharger(s). Its purpose to stop the engine by shutting off the charge air to the engine.



1 Shut-off valve
2 Position indicator
3 Sensor
4 Pressure port
5 T-handle

Fig 1-1 **Charge air shut-off valve**

Figure 22. Concept in final publication.

1.2 Releasing the charge air shut-off valve

- **Release the shut-off valve**
  - To release the shut off valve pneumatically:

  a **Push the button (3) on the solenoid valve.**

  This should release the shut-off valve.

  On a V-engine, this would release the shut-off valves on both banks of the engine.
  - To release the shut-off valve manually:

  a **Pull the T-handle manually by hand.**

  This should release the shut-off valve.

  On a V-engine, this would release only that particular shut-off valve.

Identifier: GUID-A9A649FA-CCE0-426A-8EC7-7047ACC35936
Type: task **Version:** 1 **Status:** Draft **Author:** Manu

Figure 23. Task in final publication.

A compiled example of the information product is added as an appendix.

As the bill of material is extracted from the PDM system cluster the connection between structures and information modules are stored in the CMS system. A separate program or component is used to get the recipe based on the product serial number. This system is simply called SPECO, Specific Engine Configuration.

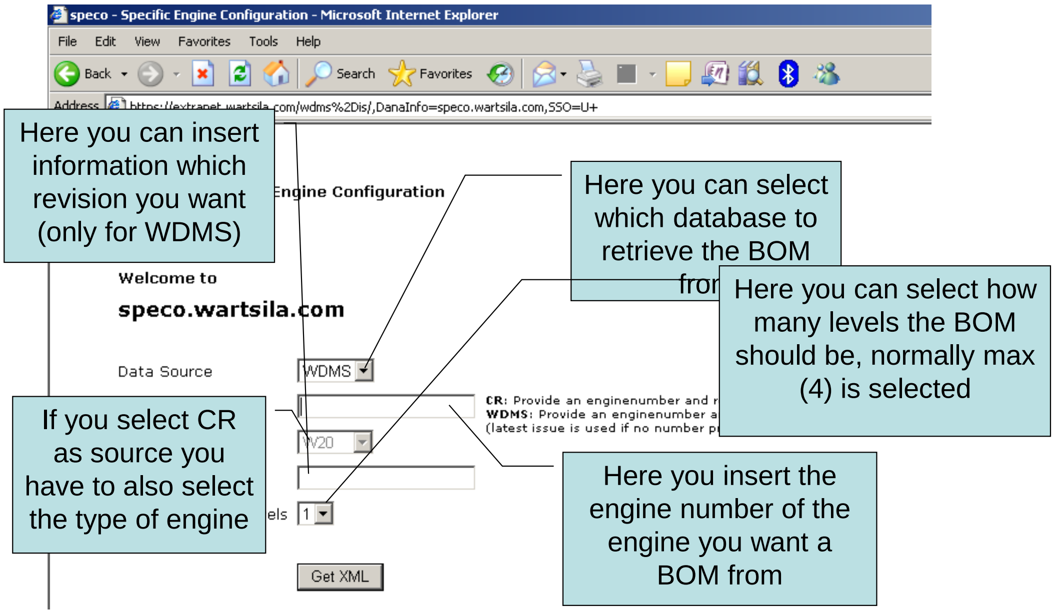


Figure 24. SPECO configuration tool.

As not everything in the structure has a corresponding information module or topic, a “black list” is kept to store those materials with no relevance. This is a semi-automatic connection that can be significantly improved using an integrated system. In this project phase such integration did not exist. Figure 25 illustrates the growing amount of number or codes to manage in conditions for the topic or information modules.

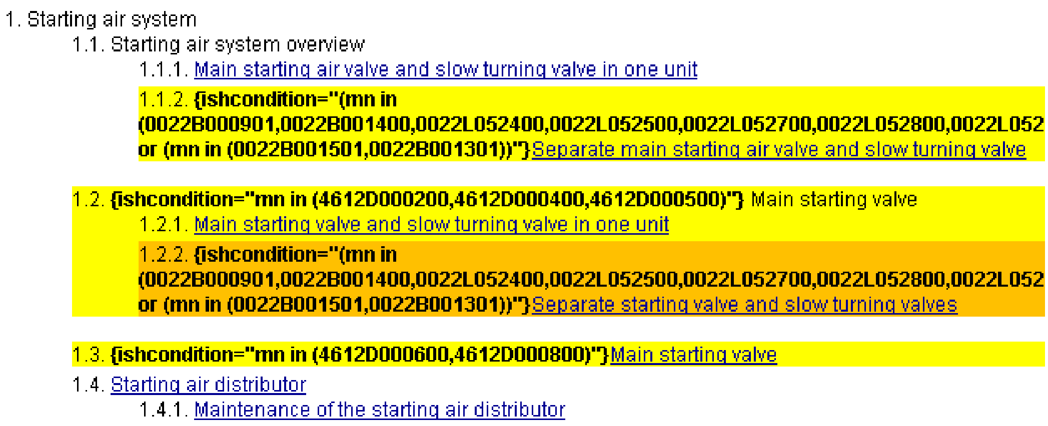

1. Starting air system
   1.1. Starting air system overview
      1.1.1. Main starting air valve and slow turning valve in one unit
      1.1.2. **{ishcondition="(mn in (0022B000901,0022B001400,0022L052400,0022L052500,0022L052700,0022L052800,0022L052 or (mn in (0022B001501,0022B001301))"}**Separate main starting air valve and slow turning valve
   1.2. **{ishcondition="mn in (4612D000200,4612D000400,4612D000500)"}** Main starting valve
      1.2.1. Main starting valve and slow turning valve in one unit
      1.2.2. **{ishcondition="(mn in (0022B000901,0022B001400,0022L052400,0022L052500,0022L052700,0022L052800,0022L052 or (mn in (0022B001501,0022B001301))"}**Separate starting valve and slow turning valves
   1.3. **{ishcondition="mn in (4612D000600,4612D000800)"}**Main starting valve
   1.4. Starting air distributor
      1.4.1. Maintenance of the starting air distributor

Figure 25. Categorization using conditions in Dita.

To make this more manageable the material numbers where bundled into categories that made more sense to the writer. Figure 26 shows how different component types are connected, and at the lowest level of the material number.

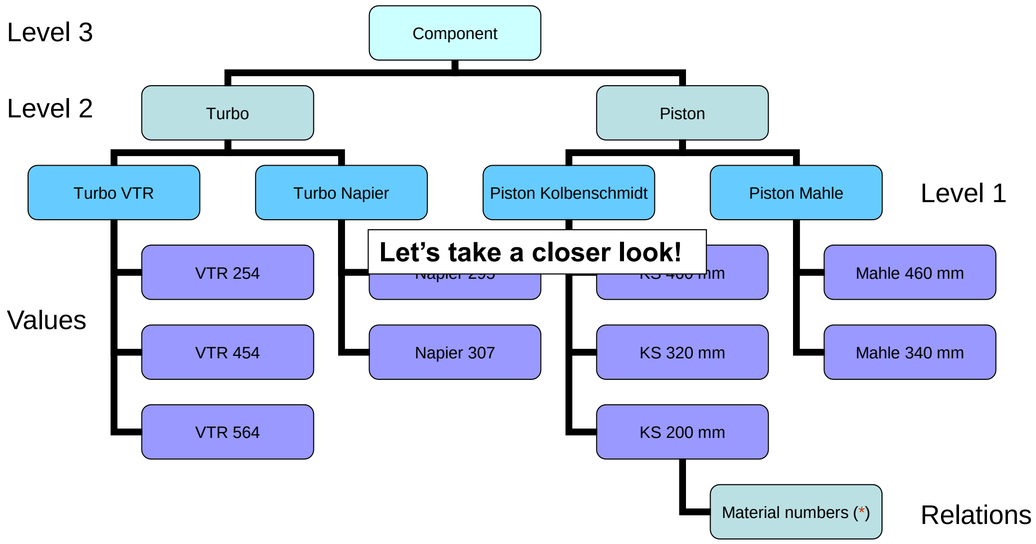


Figure 26. Categorization view.

However, from a process point of view it is not necessary to automate and from a system point of view it is doable. The work of maintaining the black list is reduced as the information modules increases and reusability rates gets higher.

Figure 27 shows how the red thread is going through the different stages and binding the iron together with the information describing it.

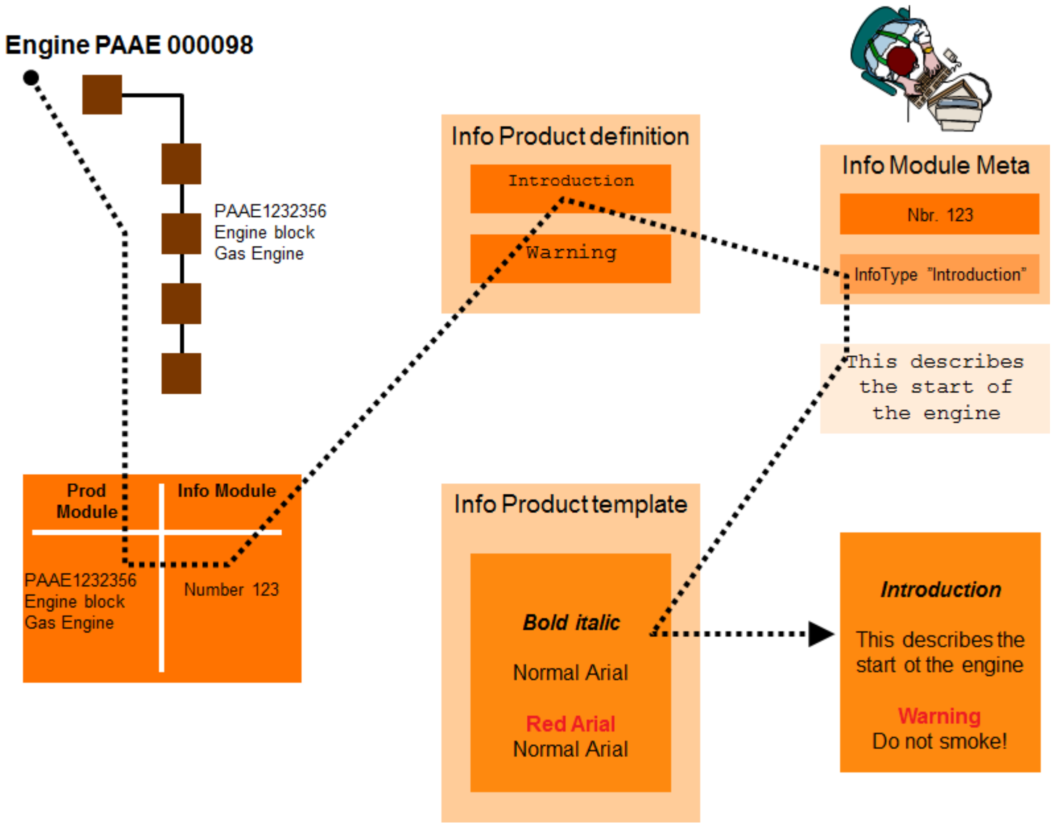
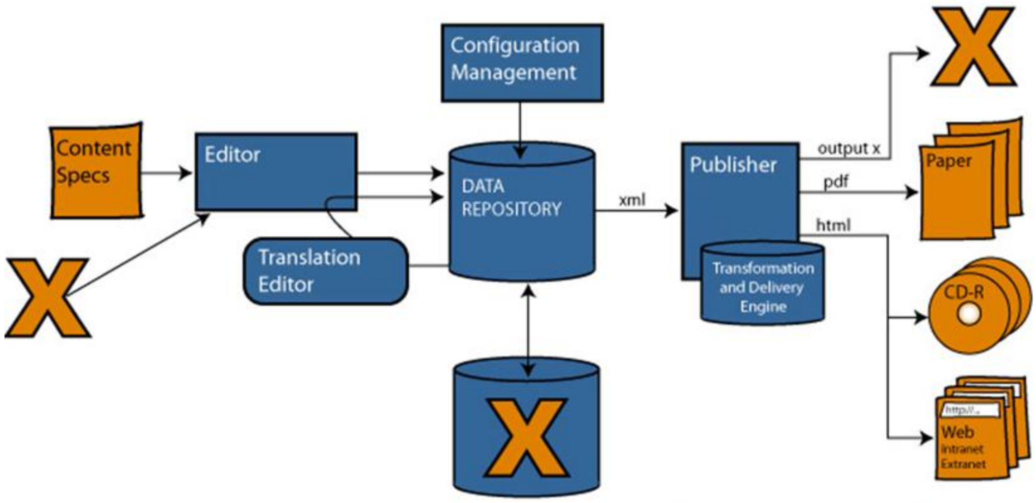


Figure 27. End to end illustration.

6.5 STRICT CMS Environment

For the purpose of making technical information a CMS system named InfoShare was selected. The setup of the system has the basic components described Figure 28.



Content creation/ update	Content Management System	Publishing Engine	Publications
Epic	Infoshare	Epic/FrameMaker	PDF
MS Word 2004 Pro		Black-Box (Citec/WFI-S)	Eldoc
			Mama WCs

Figure 28. Infoshare CMS system overview.

The writer’s main tools are from the Arbortext product family. The reason for this is best explained by the product maker SDL. The following is a quote from the official Product Brief. (SDL plc, 2010) (The SDL Trisoft CCM, 2010)

“The SDL Trisoft CCM system is an authoring tool independent and integrates with any XML-based authoring tool. Authoring tools like Arbortext Editor, XMetaL, In.vision’s Xpress Author and Adobe FrameMaker all integrate with SDL Trisoft. These tools are tightly coupled with the repository through an Authoring Bridge. All other XML editors can be used in a loosely coupled way and can be tightly integrated if required. SDL Trisoft is also publishing engine independent and integrates with SDL LiveContent and other professional publishing engines.”

Figure 29 displays a more modern version of the InfoShare main components and its relation to the writing processes.

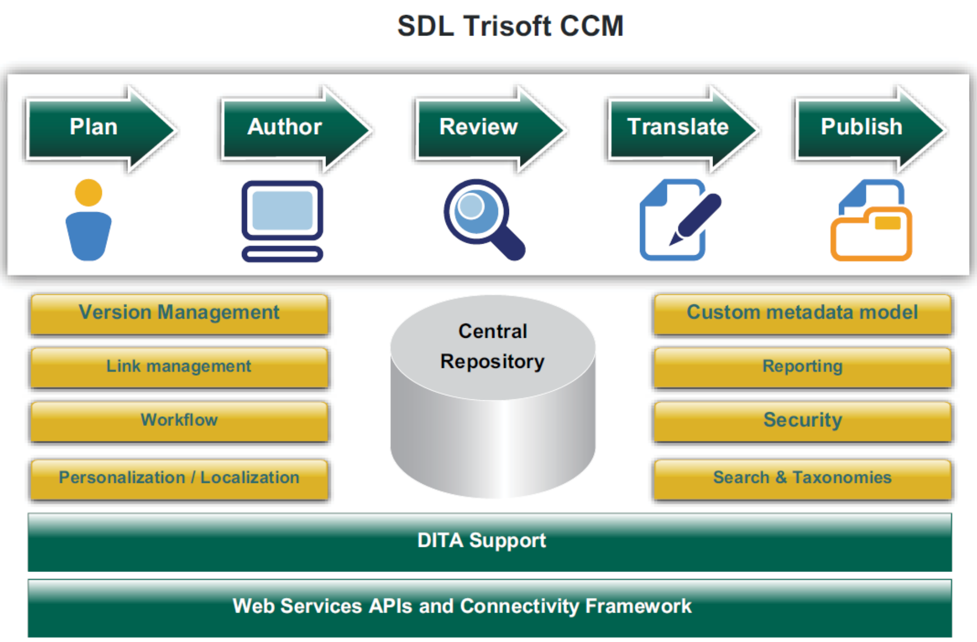


Figure 29. Infoshare in a new version - renamed to Trisoft CCM.

The specific view for the implementation reaching from the PDM to the Publishing and distribution of content is illustrated in Figure 30. The same Figure 30 also contains the separate system for maintaining Spare Part Catalogue information according to the STRICT methodology and processes earlier described.

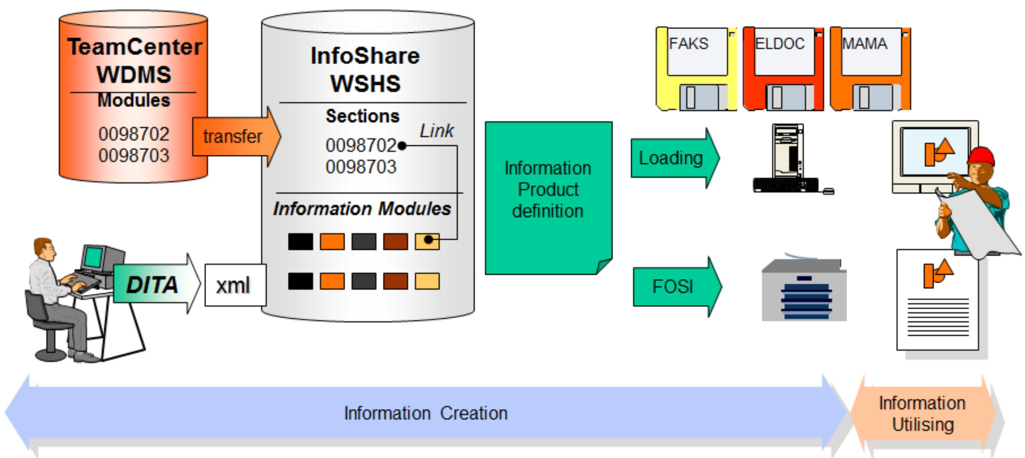


Figure 30. Information creation from PDM to Publication.

6.6 Project outcome

One of the main business drivers in any project is to optimize the performance of the process. The performance is usually measured by certain key performance indicators. In this case the first and main objective was to increase the KPI for the delivery of technical information. As seen in Figure 31 the change was notable. The project started for the first engine type, the Wärtsilä 32 with a process change. During the same time the change to a modular and structured way of working was developed for Manuals and other information products for instructive purpose.

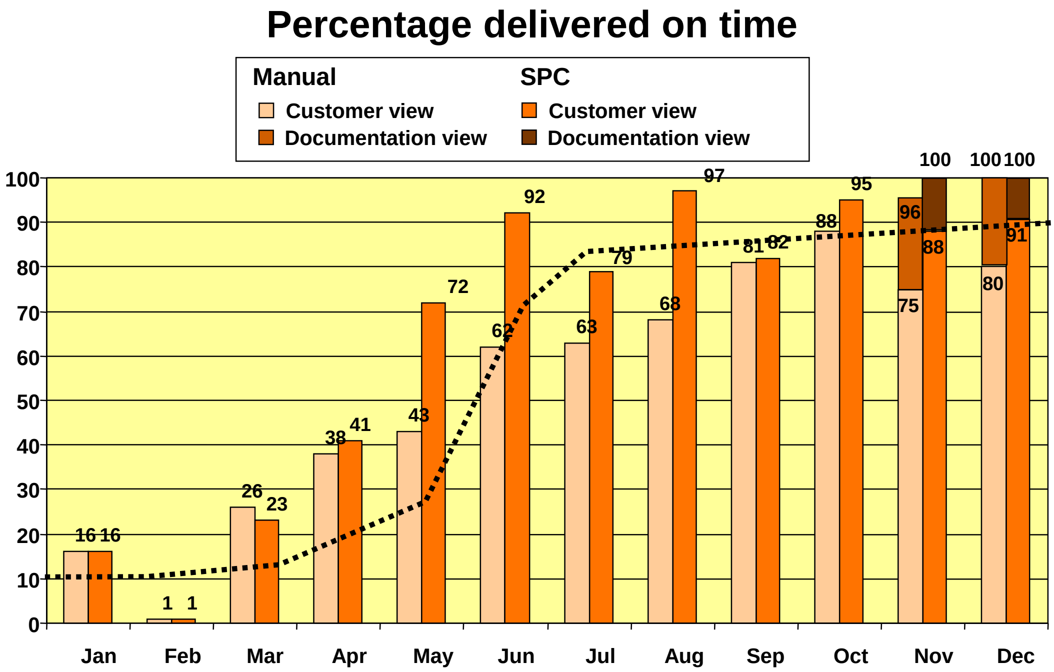


Figure 31. Statistic of on time delivery KPI.

6.6.1 Efficiency

The efficiency of the process was also noted, as the need to increase resources was eliminated and the precision of the work became much higher. The following figures illustrate the three main areas where the efficiency was increased.

The first area improved, easy finding correlated part of documentation.

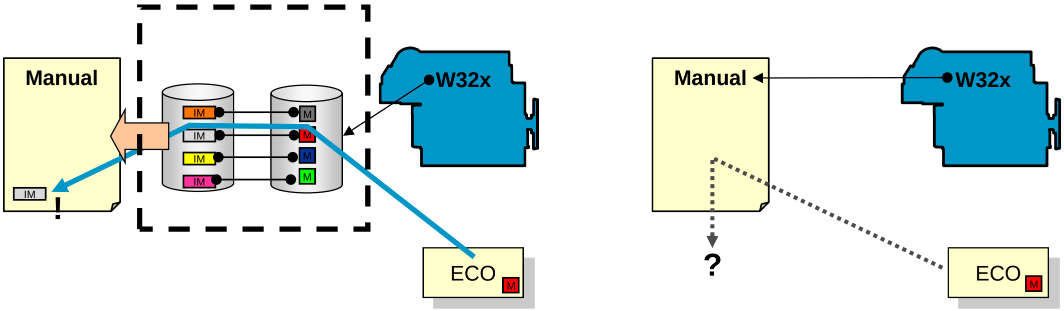


Figure 32. Easy finding information impacting on publications.

The second area improved possibility to use the same information modules in different information products for better reuse and easier synchronizing of updating of different information products.

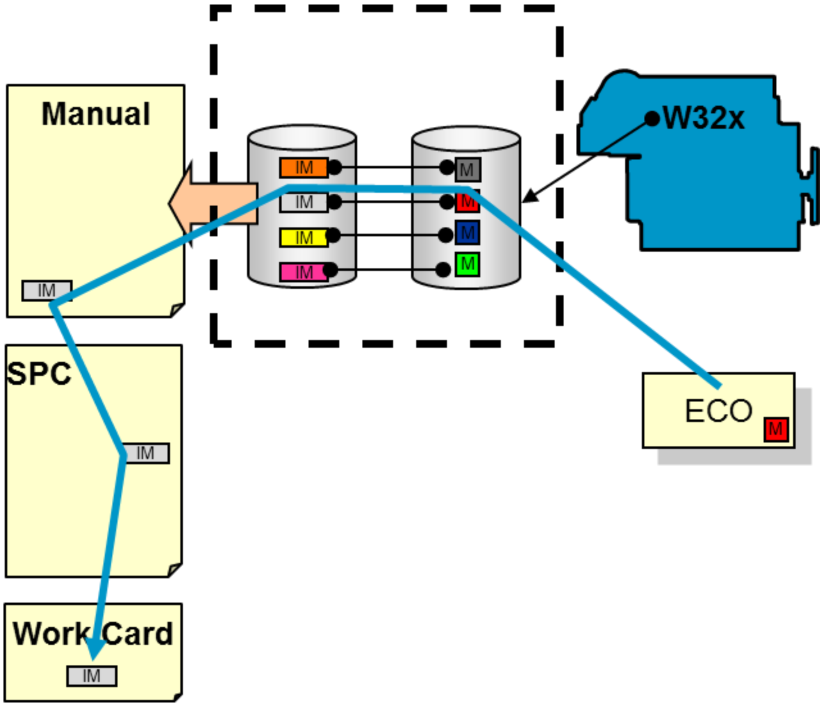


Figure 33. Reuse and synchronization of information updates.

The third area is the possibility to make new information products from existing information modules.

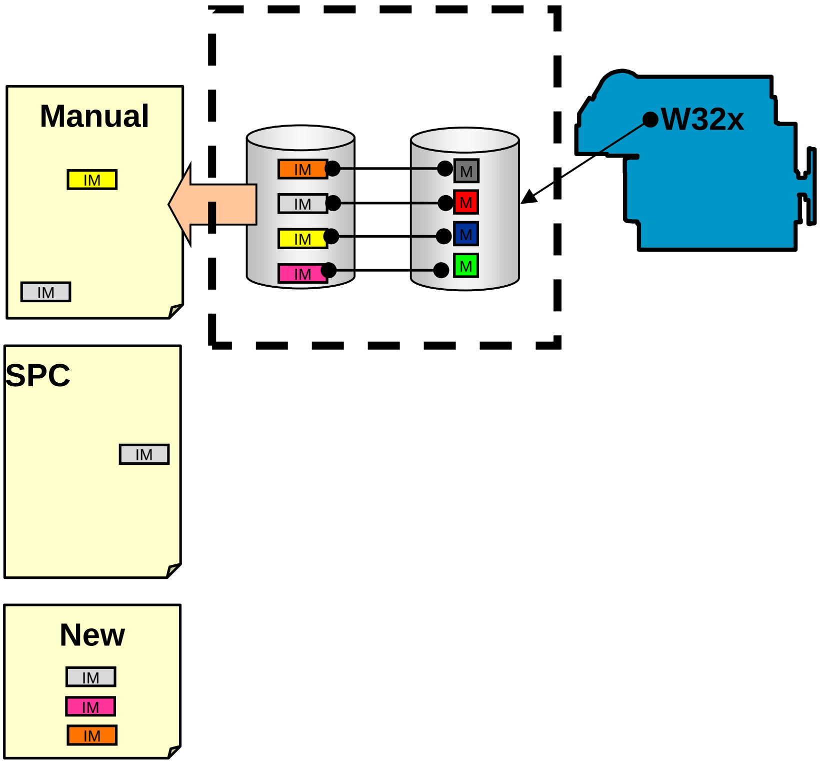


Figure 34. Reuse for creating new information products.

6.6.2 Reusability

Reusability is also one of the main targets when going for structured and modular writing. The estimates and goals prior to the start of the project were to get a reuse level between 15-40 %. This would not only be reflected in the actual reuse of topics but also in costs.

To be able to reach the targets set this had to be thought of in advance. Modules cannot simply be built or written without a clear mindset of the writer to achieve this goal. This also resulted in a separate task when the first versions of the topics were written to look at this specific area. The first versions of the topics were clearly modular, but the reuse was a bit similar Figure 35 illustrates caused challenges.

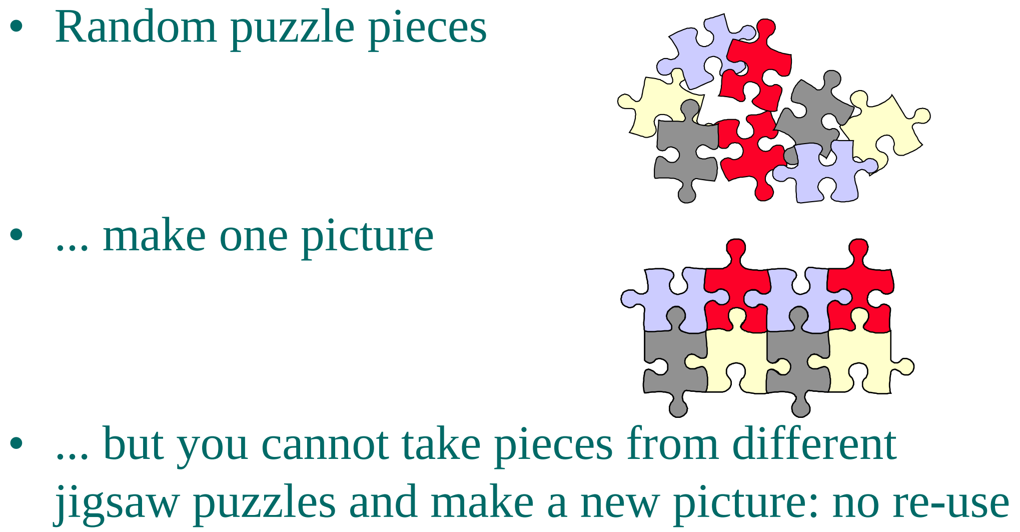


Figure 35. Modularized but not reusable.

After a revision of the topics the result was quite different and the measures of reuse pointed upwards for each delivery. Figure 36 shows in an illustrative way how topics were transformed from the previous state to the more reusable state.

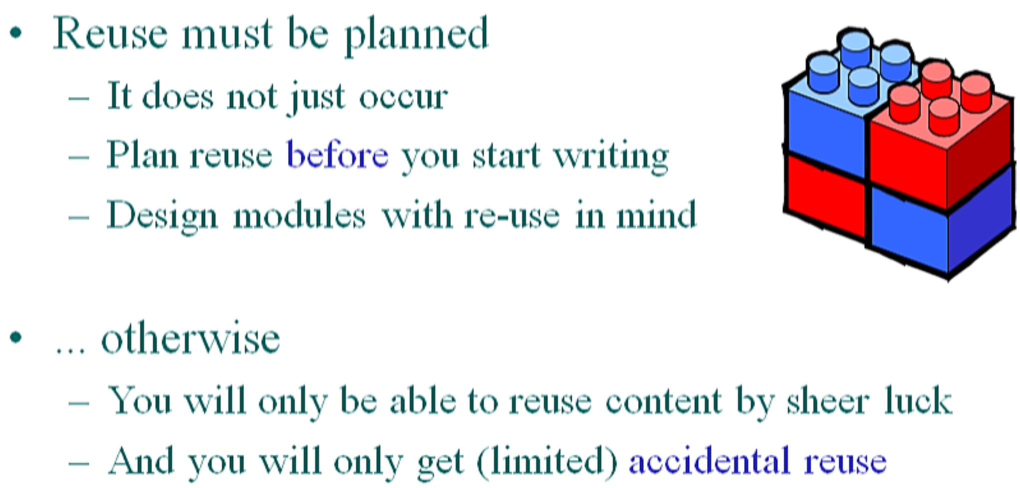


Figure 36. Modularized and reusable.

To present the results of the reusability the following reporting extracted from the CMS system shows clear benefits.

6.6.3 Reuse reports

This comparison includes engine types **W20**, **W32**, **W46**, **W50DF**.

Total reuse / Month	**Amount of objects**	**Unique objects**	**Reused objects**	**Reuse percentage**
March	4194	3329	865	20.6 %
April	4232	3352	880	20.8 %
May	4288	3373	915	21.3 %
June	4355	3413	942	21.6 %

Figure 37. Reusability statistics for several engines.

Comparing W32 vs. all included	Amount of objects	Unique objects	Reused objects	Reuse percentage
Masters	48	36	12	25.0 %
Modules	904	644	260	28.8 %
Library Modules	2	1	1	50.0 %
Illustrations	491	312	179	36.5 %
Total	1445	993	452	31.3 %

Figure 38. Reusability statistics.

This report is from quite an early stage and as more iron products are added there will be fluctuations. However over time it is possible to reach with more than 60 % of reusability on mature iron products.

The picture below shows in a more explanatory way how the reuse has affected the different information products. Note how the reuse is expanded from the manual to a work card. A work card contains information on a specific work to be done in relation to a maintenance procedure. Earlier this was presented in the Task illustration “Releasing the charge air shut off valve.”

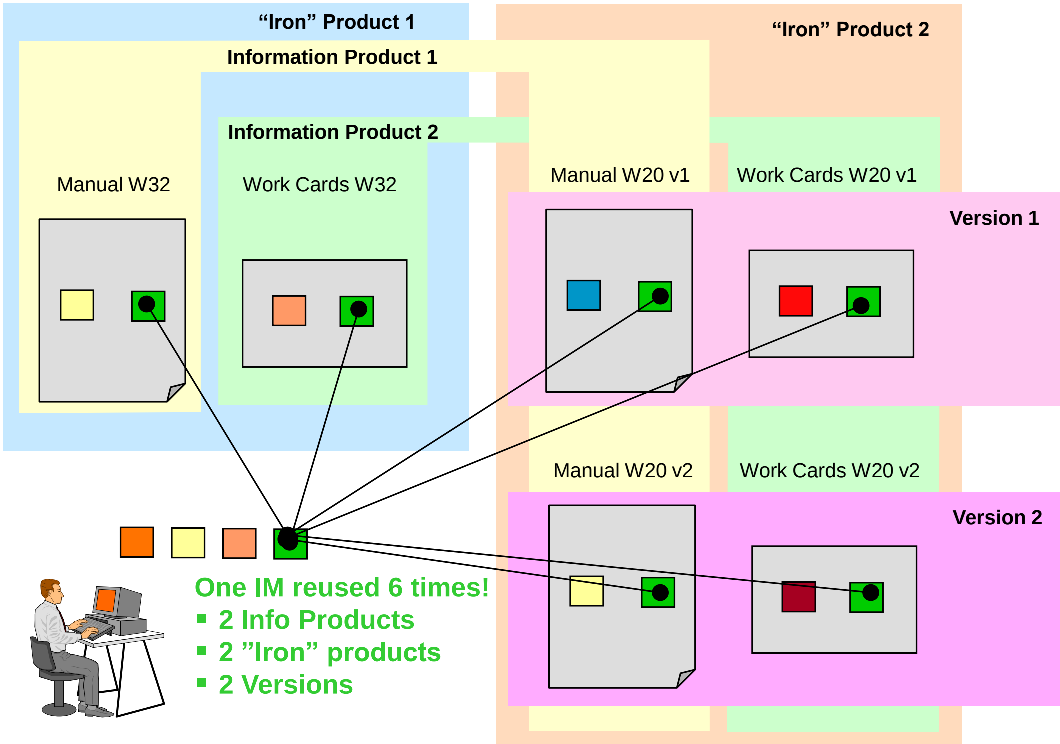


Figure 39. Reusability map.

Another area where the reuse gives added value is the translations. As the information products usually have its standard audience based on markets it is possible to define a few standard languages into which it is necessary to translate. As a module or topic is changed or a new one is created it should also immediately after approval in the original language be translated. In this way a library of translated topics is always available and the lead time and costs can be kept on a very effective level.

Write a single page	200 $/p
Illustration	200 $/p
Translate in 20 languages (50+20+20)/3 +10 = 40 $/language	800 $/p
Total	**1200 $/p**

	Increase reuse by 20 %
5 000 p x 1200 $/p = 6 M$	1.2 M$ cost reduction
10 000 p x 1200 $/p = 12 M$	2.4 M$ cost reduction
20 000 p x 1200 $/p = 24 M$	4.8 M$ cost reduction

Figure 40. Cost benefits of reusability.

Figure 40 explains a general cost calculation on savings based on several implemented projects with modular writing. This means that the numbers should not be taken as an exact result of the described case in this thesis but rather as an indication on how costs for translations develop. However the benefits are related to the increase of reuse i.e. the higher reuse percentage the higher are the cost savings for translations. The same applies to lead times of deliveries. The less there is to translate the faster an information product can be delivered.

7. TECHNICAL INFORMATION PROSPECTS

The project of structuring the creation of technical information in its various forms has, as shown earlier, brought by itself benefits. Among those can be mentioned here the precision of the content. The connection to the bill of material makes it very precise and in that instance also quite unique. However, the uniqueness can be reused and is for that reason quite general. This makes an ideal combination of both features.

Using the strengths of DITA also enables the creation of new information products. This feature can be explored much more. By expanding the offer of new topics for different purposes it will be possible for the end user to compose a totally own information product. It would basically be possible to create a Topic Store where the user for his own products can download needed or required topics. This would conceptually be almost comparable to the iTunes store. Another possibility would be to make it possible for the user to some extent order needed topics that are not currently available. This would even create a business opportunity i.e. selling tailor made topics for a certain customer and his products and being able to reuse the same for others.

Also, when introducing totally new iron products it would not necessarily be necessary to create a specific information product for that iron product. This as there is already a library of topics available to choose from. Especially the part of topics describing concept and tasks would enable very high reusability. The feature of conditions in DITA would allow almost no rewriting of many topics and those not covering the new iron product would consequently be very few and keeping costs of producing them at a minimal level.

From a business point of view it is also essential to be able to follow the cost development. By having information modules as descried it will allow price tagging of each module. Or looking from the other view point one could follow up where and how often a certain information module or topic is used. By having these measuring points it will be very easy to determine if a certain topic is worth making, weather it has an audience or not, how many are using it etc.

Traditionally the making and updating of information has been done from the back office close to the engineering and by technical writers. By utilizing the new technology of Content Management Systems and standards like DITA that technically support xml, it will be possible to reach out with the information to new environments. The biggest change will not be from a publishing point of view but rather from the contribution to the content. As Figure 41 illustrates it will be possible for people operating in the field with the actual iron product to influence the information products directly. When operating on a certain engine the engineer can notice that a change in a procedure is needed and gives this as feedback directly to the CMS system. Through well-defined workflows this information goes to technical personnel reviewing and approving if seen applicable.

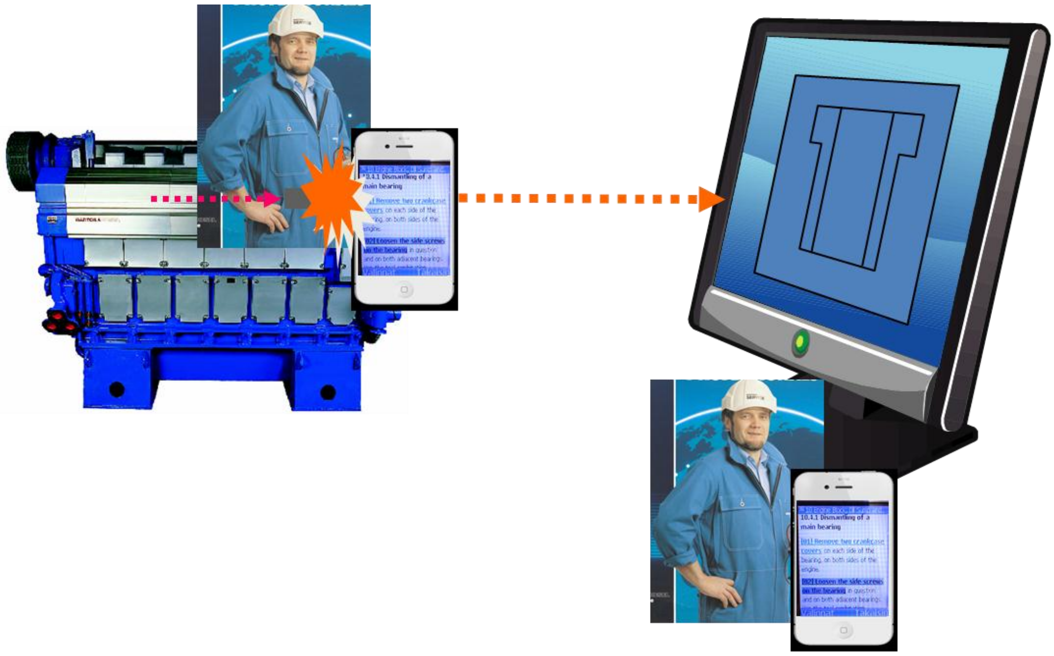


Figure 41. Updating from the field.

As there is a connection to the product structure this update will automatically reach others in need of the same instruction or performing the same type of work on other engines. As the procedure is changed the engineer making this requires will also immediately be updated with “his own” information. In addition he might receive updates on parts and tools essential for the changed procedure. However, this is a major opportunity to influence content from where it is used and not as traditionally only from where it is written.

These are some of the examples a structured way of making information would introduce new possibilities. However, the making of information in a structured way can also be viewed as knowledge engineering i.e. the starting point of knowhow in certain areas. This would shorten the gap to new areas such as knowledge management. By structuring information one will create a good quality input for other systems to use and as a result making the output in those other areas of much higher quality.

8. CONCLUSIONS

It is obvious that the "Structured Reusable Creation and Maintenance of Technical Information" gives instant improvements to the entire process of making high quality information products. This is the method not of the future but of the present. As the future brings challenges to the quality and agility of information there are no other means with enough cost efficiency or throughput time that would fulfill such requirements. Furthermore, it builds the foundation for using information in ways not thought of before.

Nevertheless, there are challenges that are not to be taken lightly. These are not technical but rather related to change in management. It is not always easy to convince people to think differently. (It hurts to stretch the mind). As the making of technical information is a collaborative effort, meaning there are not only writers involved, it is very important to have well defined processes describing the responsibility of all involved. To get the processes approved it is essential that also top management in a company gives its approval. The buy in is not to be taken for granted. It can mean more effort than the actual technical implementation. If this would not succeed it could result in change resistance and by time a deterioration of the processes leading to bad quality content. This being said, it is of such great importance for a company to stay competitive that it is worth the efforts on all levels. And, as is the case with Wärtsilä the rewards have come faster than anticipated on all levels.

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INSTRUCTIONS

Document ID	
Date of issue	
Status	Draft
Classification	Internal use

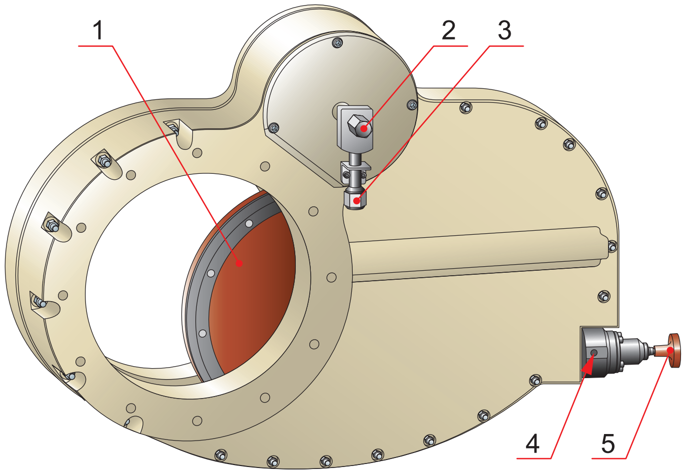
WÄRTSILÄ

Table of Contents

Identifier:	GUID-463E8893-B802-420F-9776-D9A6BA27EC85						
Type:	concept	**Version:**	1	**Status:**	Draft	**Author:**	Manu

1 Charge air shut-off valve

The shut-off valve is a spring loaded safety device which is installed in the charge air duct after the turbocharger(s). Its purpose to stop the engine by shutting off the charge air to the engine.



1 Shut-off valve

2 Position indicator

3 Sensor

4 Pressure port

5 T-handle

Fig 1-1 Charge air shut-off valve

The shut-off valve is not activated in normal operation but only in case of emergency and overspeed.

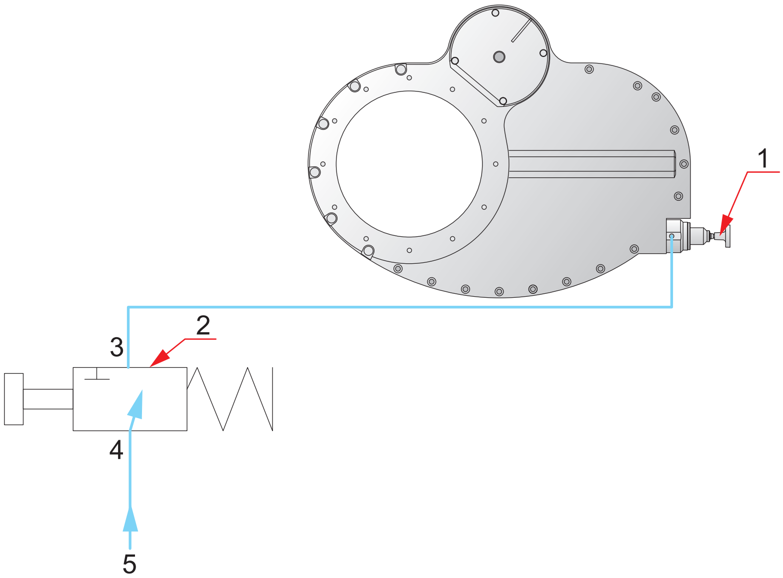
The shut-off valves are activated at the same time in case of an emergency. The shut-off valve is released by a solenoid valve which receives the signal from the engine safety system (overspeed or emergency shutdown buttons). The solenoid valve can be manually activated by a push button which is located on the side of the solenoid.

The shut-off valve is also equipped with a T- handle so that it can be released manually by pulling the handle in case of an emergency. The handle is shut-off valve dependent. When the shut-off valve is released it must be reset or armed manually.

The shut-off valve is also equipped with a T- handle so that it can be released manually by pulling the handle in case of an emergency. The handle is shut-off valve dependent and in V-engines it does not automatically release the other valves. When the shut-off valve is released it must be reset or armed manually.

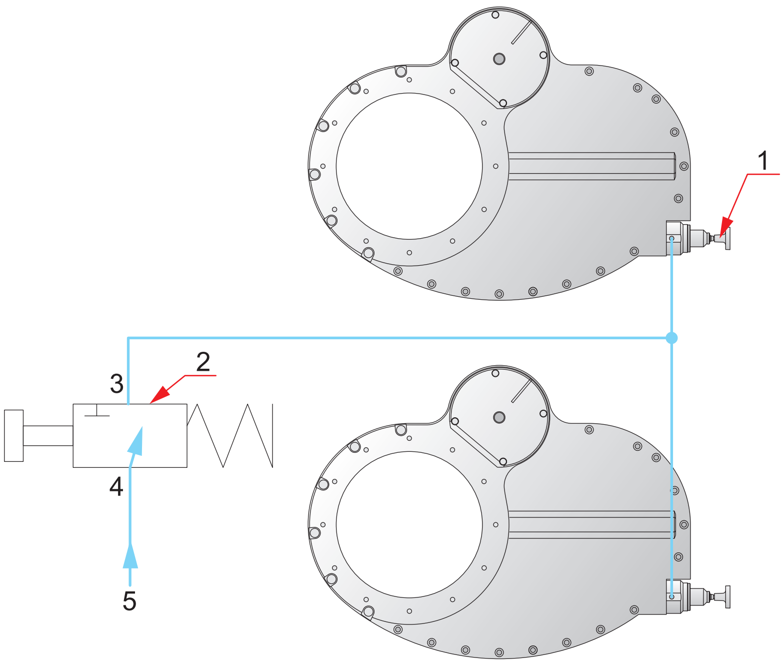
The shut-off valves must be tested regularly according to the maintenance schedule and the test result recorded in the log book.

The figure shows only the principle of the system. The real views can vary, depending on the installation and the equipment used.



1 T-handle
2 Solenoid valve
3 Air outlet
4 Air inlet

Fig 1-2 Principle of the shut-off valve



1 T-handle
2 Solenoid valve
3 Air outlet
4 Air inlet

Fig 1-3 Principle of the shut-off valve

For a detailed schematic, see installation specific documents.

The shut-off valve gets the operating air from the instrument air system. Normal working pressure on the shut-off valve is 5-8 bar. Ensure that the instrument air pressure system inclusive piping, air dryers, drain points etc. are in good condition.

NOTE

The air supply to the shut-off valve must be open all the times. If the supply air is closed, the charge air shut-off valve will not work. The air supply may be closed only when the engine is stopped for maintenance and must be opened before the engine is started.

Identifier:	GUID-0331BAB0-E91A-46E8-B47C-3DC1D6F70DF8						
Type:	concept	**Version:**	1	**Status:**	Draft	**Author:**	Manu

1.1 Maintaining the charge air shut-off valve

The charge air shut–off valve is normally placed in a clean air stream. But occasionally dirt, grease, oil or carbon residue can come in contact with the device and impede its operation. Since the valve is intended for emergency use, it is important to carry out test operation regularly. If the shut-off valve is released when the engine load is over 50%, turbocharger inspection is recommended.

WARNING

Before maintenance or during transportation and installation, ensure that the charge air shut-off valve has released in the closed position.

It is recommended to test the shut-off valve every second week.

For overhauling the shut-off valve, please contact the nearest Wärtsilä office.

Identifier:	GUID-060EF67D-E0DC-4C14-94F6-36649F64419F						
Type:	task	**Version:**	1	**Status:**	Draft	**Author:**	Manu

1.2 Releasing the charge air shut-off valve

- **Release the shut-off valve**
  - To release the shut off valve pneumatically:

  a Push the button (3) on the solenoid valve.

  This should release the shut-off valve.

  On a V-engine, this would release the shut-off valves on both banks of the engine.
  - To release the shut-off valve manually:

  a Pull the T-handle manually by hand.

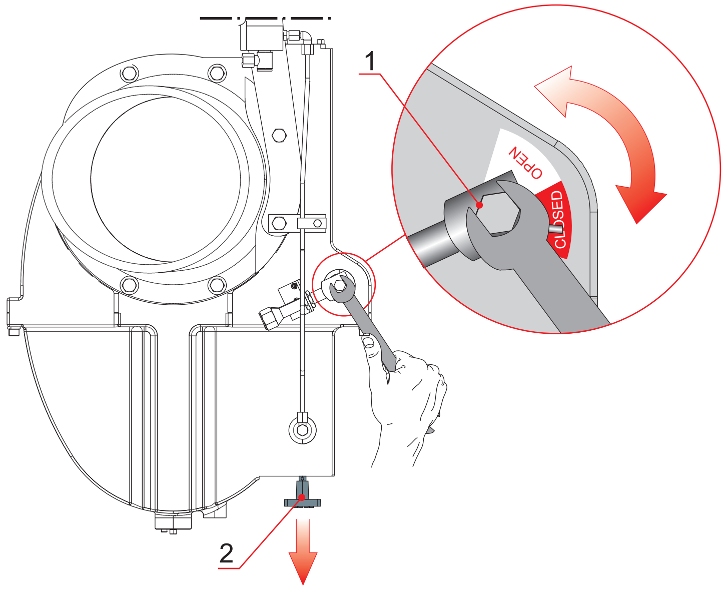
  This should release the shut-off valve.

  On a V-engine, this would release only that particular shut-off valve.

Identifier:	GUID-A9A649FA-CCE0-426A-8EC7-7047ACC35936						
Type:	task	**Version:**	1	**Status:**	Draft	**Author:**	Manu

1.3 Arming the charge air shut-off valve

The shut-off valve needs to be manually armed after releasing.



1 Operating shaft

2 Manual T-handle

Fig 1-4 **Shut-off valve adjustment**

Procedure

1. **Turn the hex head of the operating shaft (1) towards the indicator pointing to the open position using a box-end wrench.**
2. **Check that the shut-off valve is securely latched in the open position.**

Identifier:							
Type:	topic	**Version:**		**Status:**		**Author:**	

1.4 Testing the charge air shut-off valve

Identifier:	GUID-A85E2A70-7952-4C25-8E74-0F10CD9517FC						
Type:	task	**Version:**	1	**Status:**	Draft	**Author:**	Manu

1.4.1 Testing the charge air shut-off valve on a stopped engine

Prerequisites

- Open the air supply to the shut-off valve and check that the air pressure is correct.
- Check for leakages.

WARNING
The charge air shut-off valve operation must be tested according to these testing procedures every time the valve has released in a real operating situation.

On a V-engine, both charge air shut-off valves must be activated simultaneously. This must be confirmed after each test!

Procedure

1 **Test the shut-off valve on a stopped engine.**

- To test manually:

a **Pull the T-handle.**

b **Check that the shut-off valve closes (closed valve position).**

In this position the sensors must give an alarm signal and block the starting of the engine.

c **Arm the shut-off valve.**

NOTE
Repeat the manual testing procedure 3 times if the shut-off valve has released in a real operating situation. The purpose of this additional test is to remove any deposit that might interfere with its operation.

d **Repeat the procedures above on the other bank of a V-engine.**

- To test pneumatically,

a **Push the button (3) on the solenoid valve.**

On a V-engine, this releases the charge air shut-off valves on both banks of the engine.

Check for leakages.

b **Check that the shut-off valve closes (closed valve position).**

In this position the sensors must give an alarm signal and block the starting of the engine.

c **Arm the shut-off valve(s).**

d **Simulate an overspeed situation.**

e **Check that the shut-off valve closes (closed valve position).**

In this position the sensors must give an alarm signal and block the starting of the engine.

f **Arm the shut-off valve(s).**

g **Activate the emergency stop.**

h **Check that the shut-off valve closes (closed valve position).**

In this position the sensors must give an alarm signal and block the starting of the engine.

i **Arm the shut-off valve(s).**

Postrequisites

After successful testing on a stopped engine, test the function of the charge air shut-off valve on an idling engine.

If the charge air shut-off valve(s) fail to shut off during the test, contact the local Wärtsilä office immediately. The reason must be found and rectified. New tests must be performed after rectification before the engine can be taken into operation.

If any of the tests fails or there is some reason to suspect that the shut-off valve is damaged during the shutdown, the whole safety system including the shut-off valve itself must be inspected by Wärtsilä.

All damaged or worn parts of the shut-off valve or the system must be replaced and the system is tested once again according to the test procedure, before the engine can be operated.

Identifier: GUID-EEB328E7-DE9E-434D-AF80-D71AF26CDEE4
Type: task **Version:** 1 **Status:** Draft **Author:** Manu

1.4.2 Testing the charge air shut-off valve on an idling engine

Prerequisites

- Test the charge air shut-off valve on a stopped engine.

NOTE

Testing on an idling engine should be carried out only after successful tests on a stopped engine.

- Open the air supply to the shut-off valve and check that the air pressure is correct.
- Check for leakages.

WARNING

The charge air shut-off valve operation must be tested according to these testing procedures every time the valve has released in a real operating situation.

On a V-engine, both charge air shut-off valves must be activated simultaneously. This must be confirmed after each test!

Procedure

1. **Run the engine on idle with no load.**
2. **Ensure that the air supply to the shut-off valve is open and the pressure is correct.**
3. **Check that the shut-off valve is armed and the start of the engine is not blocked.**
4. **Prepare the engine for start-up.**
5. **Start the engine.**
6. **Simulate overspeed trip when the engine is idling.**
   The engine stops.
7. **Arm the shut-off valve and start the engine.**
8. **Activate the emergency stop when the engine is idling.**
   The engine stops.
9. **Arm the shut-off valve.**

Postrequisites

If the charge air shut-off valve(s) fail to shut off during the test, contact the local Wärtsilä office immediately. The reason must be found and rectified. New tests must be performed after rectification before the engine can be taken into operation.

If any of the tests fails or there is some reason to suspect that the shut-off valve is damaged during the shutdown, the whole safety system including the shut-off valve itself must be inspected by Wärtsilä.

All damaged or worn parts of the shut-off valve or the system must be replaced and the system is tested once again according to the test procedure, before the engine can be operated.