SAVONIA

OPINNÄYTETYÖ - **AMMATTIKORKEAKOULUTUTKINTO**
TEKNIIKAN JA LIIKENTEEN ALA

CIVIL ENGINEERING & DESIGN STANDARDS MANUAL

TEKIJÄ/T: Eetu Vänttinen

SAVONIA-AMMATTIKORKEAKOULU

OPINNÄYTETYÖ
Tiivistelmä

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Tiivistelmä

Foster Wheeler Energia Oy:n Contract Engineeringin osasto Civil Discipline Engineering vastaa kattilarakennuksen perustusten, teräsrungon, kuorirakenteiden, LVI:n sekä hissin, nostimen ja keskuspölynpoiston suunnittelusta ja rakennuttamisesta.

Insinöörityön tavoite oli koota suunnittelumanuaali osastolle käytettäväksi helpottamaan suunnittelun aloittamista ja yhtenäistämään sitä. Tarkoituksena oli saada suunnitteluun liittyvät ohjeistukset, standardit ja säädökset helposti saataville sekä koota kirjasto teräsrungon ja kuorirakenteiden liitosdetalji- ja rakennekuville.

Työ toteutettiin tutkimalla Foster Wheelerin tietokantoja sekä standardeja ja keräämällä niistä olennaista tietoa manuaaliin. AutoCAD- kuvat detaljikirjastoon kerättiin saatavilla olleesta opinnäytetyöstä sekä eri projektien tietokannoista. Valmis työ ladattiin yrityksen sähköisiin tietokantoihin helposti saataville ja käytettäväksi.

Tämä julkinen raportti työstä on hyvin rajattu, manuaalin salassapidon vuoksi.

Työssä onnistuttiin saamaan osastolle manuaali käyttöön. Jatkokehittämistä kuitenkin jäi vielä paljon työn laajuuden ja käytettävissä olleen ajan vuoksi. Alun perin rajattuun tavoitteeseen kuitenkin päästiin. Tekemistä jäi vielä poisrajattujen aiheiden osalta, sekä liitos- ja rakennekuvien päivittämisen osalta. Myös kasaan saadun materiaalin osalta tulee jatkossa huolehtia sen päivittämisestä ja täydentämisestä.

Avainsanat: Civil, Engineering, Design, Standards, Manual, EM, DSM

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Abstract

Civil Discipline Engineering department in Foster Wheeler Energia Oy takes care of the construction of foundation, steel frame, platforms, cladding/roofing, HVAC, elevator, hoist and central vacuum system of the boiler building.

The goal of the thesis was to compile a design manual for the department to ease up the startup of the design of a new project and standardize the design. Main objective was to gather together all the existing guidelines, standards and directives regarding the design of a boiler building and put together a library for the existing, acknowledged detail pictures and typical structure pictures.

This project was executed by studying the available databases, standards and directives in Foster Wheeler and by gathering together relevant information. AutoCAD- pictures for the detail- and structure picture library were updated from existing thesis and from databases of previous boiler projects. Finished manual was uploaded to the Foster Wheeler's databases to be easily found and accessed.

This public report of the thesis is very limited, because of the confidentiality agreement.

The originally set goal of the thesis was achieved and manual is in use at the Civil Engineering department. Additional development of the manual is still required, because of the vast scale of the project and because of a limited schedule. More extensive upgrading of the manual is still needed and some of the detail and the structure pictures are still to be updated. Also the information already gathered needs to be complemented and updated from time to time.

Keywords: Civil, Engineering, Design, Standards, Manual, EM, DSM

FOREWORD

This thesis was made during my summer training in Foster Wheeler Energia Oy, Varkaus. Hopefully this thesis will be at least partially as useful to the Civil Discipline Engineering department, as it was to me personally.

I would like to thank Foster Wheeler Energy, especially the Civil Discipline Engineering department, for offering me this great opportunity and all the personnel that was involved in this project for all the help during my summer training and in the making of this thesis.

Especially I would like to thank my supervisor Kari Seppänen, Chief Engineer, Civil Discipline Engineering, Foster Wheeler Energia Oy, for hiring me and giving me this opportunity.

My co-worker Jaakko Säilä, Discipline Engineer, Civil Discipline Engineer, Foster Wheeler Energia Oy, for tutoring me during my internship and in the making of this thesis.

My teacher Seppo Ryynänen, Savonia University of Applied Sciences, for helping me with the reporting.

1 INTRODUCTION

1.1 Goal of the thesis

Main goal of the thesis was to compile a manual for the Civil Engineering department to standardize design of the boiler building and ease up the start-up of a new project. There were a lot of existing, acknowledged and not-so-acknowledged guides, directives and detail/principle -pictures, which had to be verified and assembled in one place to be easily found. Baseline for the manual was the seven step table of contents: Boiler Building Classification, Design Standards, Design Principles, Material Selection, Loading Information, TS- Model Specification and Technical Specification. These seven sections belong to the Engineering Manual –part of the thesis. The eighth section: Library for the Detail Pictures is the Design Standards Manual –part.

1.2 Execution of the thesis

The contents of the manual were limited to the seven aforementioned chapters because of the schedule of the thesis. The study was executed by exploring massive databases of existing boiler projects with Projectwise engineering project collaboration software and by exploring all the standard associations related to the civil works. Also there was a handy existing thesis of some detail pictures available, which were to be updated.

Boiler Building Classification was decided with the management. *Design Standards* were gathered from technical specifications, design criterions and from the national, regional and international standard committees. Descriptive pictures and covering notes for the *Design Principles* were compiled from the databases. Standards were used to clarify *Material Selection* (including surface finishing) and a suggestive reference chart of the international standards for structural steel was put together. Basic guidelines for *Loading Information* was determined by EN-standards. *TS- Model Specification* was displayed in the manual. Layout for the *Technical Specification* for steel structures and cladding and roofing were put together. *Library for the Detail Pictures* was gathered from many projects and from the existing thesis and compiled in an easy-to-use library.

Execution of the thesis was mostly independent work with occasional help and tips from the co-workers. Hours, days and weeks of examination of the databases were needed. Also some CAD and PDMS -skills were needed with the detail/principle -picture library.

1.3 Terms and abbreviations

FWE = Foster Wheeler Energy

CFB = Circulating Fluid Bed

BFB = Bubbling Fluid Bed

MSW = Municipal Solid Waste

SCR = Selective Catalytic Reduction

SNCR = Selective Non-Catalytic Reduction

NOx = Generic term for Mono Nitrogen Oxides

HRSG = Heat Recovery Steam Generator

TS = Tekla Structures

CAD = Computer-Aided Design

PDMS = Plant Design Management System

EM = Engineering Manual

DSM = Design Standards Manual

DS = Design Standard

EN = European Norms

CEN = European Committee for Standardization

ISO = International Organization for Standardization

ANSI = American National Standards Institute

AISC = American Institute of Steel Construction

ASTM = American Society for Testing and Materials

ASCE = American Society of Civil Engineers

ACI = American Concrete Institute

AWS = American Welding Society

ASME = American Society of Mechanical Engineers

RCSC = Research Council for Structural Connections

SSPC = The Society for Protective Coatings (former Steel Structures Painting Council

SFS = Finnish Standards Association

RakMK = The National Building Code of Finland

RIL = Finnish Association of Civil Engineers

RT = Rakennustieto

DIN = German Institute for Standardization

BSI = British Standards Institution

SNIP = National Building Code of the Russian Federation

KBC = Korean Building Code

JIS = Japanese Industrial Standards

IS = Indian Standards

GB = Chinese National Standards

2 FOSTER WHEELER ENERGIA OY

2.1 Company

”Foster Wheeler Energia Oy develops and delivers efficient, low environmental impact utility and industrial boilers and related services. High-efficiency, low-emission circulating fluidized bed technology (CFB) lies at the heart of the business, and Foster Wheeler is the world’s leading supplier.

The company is part of the multinational Foster Wheeler AG corporation, and operates from Espoo and Varkaus in Finland and through subsidiaries in Sweden and Germany. Foster Wheeler Energia offers strong project management expertise and has highly skilled and motivated personnel. ”[1]

”Foster Wheeler Energia Oy is a specialist in efficient, eco-aware energy generation. High-efficiency, low-emission fluidized bed technology – and circulating fluidized bed (CFB) boilers in particular – lie at the heart of the company’s know-how. Foster Wheeler is the world’s leading supplier of CFB boilers, with an approximately 40% share of the market.

The FWEOY Group and other Foster Wheeler companies have delivered close to 500 fluidized bed boilers, of which over 300 have been CFB units. An expert in power and industrial boilers and boiler maintenance and service, the company is an internationally recognized pioneer in energy technology and product development. Successful product development in CFB boilers has allowed steadily increasing gains in unit capacity. The company is currently offering even larger (600 MWe and 800 MWe) versions of the CFB.” [2]

”Foster Wheeler Energia Oy Group comprises Foster Wheeler Energia Oy in Finland, and its subsidiaries Foster Wheeler Energi Ab in Sweden and Foster Wheeler Energie GmbH and flue gas scrubber specialist FW Graf Wulff GmbH in Germany. Foster Wheeler Energia Oy has its headquarters in Espoo, Finland and main functions, including Engineering, Research and Development and Service in Varkaus.

The Group employs around 520 people, of which some 500 are based in Finland. The Group can give leverage to some of Foster Wheeler’s most advanced energy know-how and has strong project management capabilities and highly skilled personnel.

The Foster Wheeler Energia Oy Group is part of Foster Wheeler AG, a global engineering and construction contractor and power equipment supplier that employs over 12,000 professionals in its Global E&C Group and Global Power Group.”[2]

2.2 Values

”Foster Wheeler has committed to core values, which define the standards of behaviour for every employee in Foster Wheeler. Our core values are:

Integrity: Behaving ethically, safely, honestly and lawfully.

Accountability: Working to clear and mutually accepted responsibilities.

High performance: Consistently meeting or exceeding expectations.

Valuing people: Treating people with respect and dignity.

Teamwork: Working collaboratively towards common goals.” [2]

2.3 History

”Foster Wheeler’s long traditions in engineering, machinery and power boilers started in 1851.

1851-1909 Wahl Machinery: The industrial production in Varkaus began in early 1800’s, when Gustav Wrede started a steel mill. Paul Wahl and Erik Längman bought the mill from Wrede in 1834 and in 1851 Paul Wahl started also an engineering workshop in Varkaus. In 1866, ship building started and steam boiler factory was constructed in Pirtinniemi.

1909-1995 A. Ahlström Oy: In 1909, Wahl & Co's workshops were acquired by A. Ahlström Oy. The beginning of the 20th century was very active in shipbuilding industry. In 1930's, the company manufactured construction elements. Power boiler manufacturing for the industry and electricity production started in 1950’s.

1995- Foster Wheeler Energia Oy: In 1995 Foster Wheeler acquired Ahlström’s power boiler business. Foster Wheeler Energia Oy is the leading CFB boiler supplier in the world.”[3]

2.4 Products & Service

”Our products and services include:

- Fluidized bed boilers
- Atmospheric CFB gasifiers
- Waste heat boilers for metallurgical applications
- Pulverized coal boilers
- Boiler maintenance and service

Our main product, CFB boiler, is a clean-coal platform with a unique low temperature combustion process that cleanly and efficiently burns both traditional fuels and carbon-neutral fuels; typical fuels can include biomass, waste coals, tires, and processed waste materials. The CFB's unique multi-fuel capability can utilize opportunity and carbon-neutral fuels to significantly reduce CO2 emissions in relation to conventional pulverized-coal boilers while improving the economics of power generation.

Unlike conventional steam generators, that burn the fuel in a large high-temperature flame, CFB technology does not have burners or a flame within its furnace. The CFB uses fluidization technology to mix and circulate fuel particles with limestone as they burn in a low temperature combustion process. The limestone captures the sulfur oxides as they are formed, while the low burning temperature minimizes the formation of nitrogen oxides. The fuel and limestone particles are recycled over and over back to the process, which results in high efficiency for burning the fuel, capturing pollutants, and for transferring the fuel's heat energy into high-quality steam to produce power.

CFBs are suitable for new power plants as well as the refurbishment of older power plants and often do not require secondary emission control systems. Integration of supercritical once-through boiler technology with CFB technology provides the best combination of features for efficient, cost-effective and environmentally responsible power production.

Foster Wheeler CFBs have been installed in more than 350 industrial and utility applications around the world, with steadily increasing gains in unit capacity. The company is currently offering even larger (600 MWe and 800 MWe) versions of the CFB."[4]

Steam generators: Circulating fluid bed, Pulverized coal, Oil & gas, Bubbling fluid bed, Grate and MSW, Package, HRSG, Metallurgical waste heat, Solar

Environmental products: Circulating fluid bed scrubbers, Fabric filters, SCR and SNCR systems, Low NOx combustion systems, Coal/air control system upgrades, Biomass combustion retrofits

Aftermarket services: Engineered and replamecent pressure parts, Weld overlay and refractory upgrades, Replacement parts, Cyclone burner retrofits, Coal mill service and upgrade, Boiler and HRSG maintenance

Auxiliary equipment: Condensers, Feedwater heaters, Biomass gasifiers

Plant operation: Start-up, Operation and maintenance services

2.5 Civil Discipline Engineering

Civil Discipline Engineering department in Foster Wheeler Energia Oy takes care of the construction of foundation, steel frame, platforms, cladding/roofing, HVAC, elevator, hoist and central vacuum system of the boiler building.

The interface between civil discipline engineering and boiler structural engineering is:

- in the upper support structure:
  - the joint of boiler beams and hanger rods
- in the mid support :
  - the interface between boiler guides and buckstays
- in the bottom support:
  - the interface between bottom support cantilever and furnace

Civil engineering scope of supply:

- buildings
  - boiler house, stair towers, fan rooms, support of fuel day silos, electric rooms, offices, etc.
- structures of buildings:
  - earthworks and foundation
  - anchor bolts + sub racks
  - steel frame
    - erection tiers
    - stiffening platforms
    - outline bracing
    - column and beam profiles (hot rolled and welded)
    - hollow section tube profiles
    - fastening assemblies
  - platform structures
    - gratings
    - tear plates
    - railings
    - kickplates
    - stairs
    - ladders
  - wall and roof structure
  - surface treatment
  - personal safety

3 CIVIL ENGINEERING & DESIGN STANDARDS MANUAL

3.1 General information about Engineering Manuals & Design Standards Manuals

Engineering & Design standards manuals are a part of company's development and management technologies. Manual is a guideline for designers to standardize design and acts as a database for acknowledged, existing designs. It gathers together all the important knowledge to be easily found in one place. Manual also guides new employees and subcontractors and helps them assimilate with the company's products and methods. Basic guidelines for initiating design make engineering more cost-effective.

DSM is more a detailed manual than EM and it's based on graphical drawings, typically a DS contains a simplified detail of parts and it can contain several sub pages to keep the DS/DSM easy to read and if there is need for more specific details.

In the DS pages for example placing and design options, joints, minimum/maximum dimensions, references to other guidelines and standards are usually shown . A typical DSM page consists of: 2D or 3D drawing with written explanations, information to related DSM pages, written notes which must be followed and the latest revision locations marked with revision arrows.

Development of DSM in Foster Wheeler started in 1995. DSMs are located in company's intranet and major updates are made annually, minor updates are made when needed. A couple of designers develop and maintain the design standards with the help of project designers.

3.2 Contents of the Civil Engineering & Design Standards Manual

The manual is divided in two sections: The Engineering Manual contains written information about designing boiler buildings. The DSM contains an index section of a boiler house, which contains links to sections of the boiler house, each of which contains pictures of usual connection details of steel structure, cladding details, roofing details, platform details and some examples of typical structures.

3.3 Civil Engineering Manual

3.3.1 General Description

In this section of the engineering manual can be found a brief description of the manual and the purpose of the documents in the manual and the validation of the scope of the manual are pointed out.

3.3.2 Boiler Building Classification

In this section of the manual, the Boiler building is classified in three different ways: Classification According to Area, Seismic Classification and Classification According to Site Location.

Classification According to Area determines the standards used in the project. In Europe, design follows EN- and local standards and in few areas, seismic matters are to be taken in to consideration. In Far-East areas design usually follows American and local standards and seismic activities are often to be dealt with.

In seismic areas, main object is to define *Seismic Classification* of the area, FWE has developed its own seismic classification, which consists of four classes:

- non-
- low-
- moderate-
- high seismic class

Classification According to Site Location is made according to the weather conditions at hand. Weather conditions vary widely depending on region. These variations have to be taken in to account when designing structures. Wind conditions affect support options, seasonal temperature variations affect material selection and cladding and insulation solutions. Major snow load demands stronger roof structure and humidity and salinity of the air demands thicker surface treatments etc.

Three classes were established in the making of this manual:

- Nordic area
- Mediterranean/Temperate area
- Subtropical/Tropical area

3.3.3 Design Standards

A standard is a published guideline for common and repeated use. It establishes similar, acknowledged technical criteria, methods, processes and practices. Geographical levels of standards are national (e.g. SFS, ASTM), regional (e.g. EN, ANSI) and international (e.g. ISO) level.

In this section of the manual common standards used in designing boiler buildings are listed. The list is limited mainly in European and American standards, but has references to other standards also.

Design standards section is divided to three libraries:

1. EN - European standards are maintained by CEN. CEN is recognized by European Union as sole provider of European standards and technical specifications. CEN co-operates with ISO to make EN- and ISO- standards parallel. Approximately 30 % of EN-standards are known as EN ISO-standards, which are applicable globally.

Eurocode is a set of ten harmonized European standards. It provides general guidelines for designing buildings and other civil engineering works in the European Union:

- EN 1990: Eurocode 0: Basis of structural design
- EN 1991: Eurocode 1: Actions on structures
- EN 1992: Eurocode 2: Design of concrete structures
- EN 1993: Eurocode 3: Design of steel structures
- EN 1994: Eurocode 4: Design of composite steel and concrete structures
- EN 1995: Eurocode 5: Design of timber structures
- EN 1996: Eurocode 6: Design of masonry structures
- EN 1997: Eurocode 7: Geotechnical design
- EN 1998: Eurocode 8: Design of structures for earthquake resistance
- EN 1999: Eurocode 9: Design of aluminium structures

Also approx. 70 other EN/EN-ISO –standards are listed in this section concerning design, materials (steel, concrete), fabrication (welding, fastening, surface finishing)

2. ANSI is American equivalent for CEN. Like CEN, ANSI also co-operates with ISO, so that American standards are valid globally. ANSI accredits standards developed by other American standard organizations. List of American standards consists of various AISC-, ASTM-, ASCE-, ACI-, AWS-, ASME- and RCSC- standards

3. In Far-East and other projects outside of Europe and America local standards are sometimes used. This list consists of some ISO-, SSPC-, SFS-, RakMK-, RIL-, RT-, DIN-, BSI-, SNIP-, KBC-, JIS-, IS- and GB- standards.

3.3.4 Design Principles

Design principles has information and options of five main sections of the boiler building design and construction:

Outline Bracings: Vertical bracing handles the horizontal loads delivered from the lateral bracing system, such as equipment loads, wind loads and seismic loads. System consists of diagonal braces on the outer wall lines of the boiler building.

Figure 1: Boiler house steel frame and a simple outline bracing (Vänttinen 2012, 26.)

Cross Bracings: Cross bracing is recommended in high seismic areas, because of shorter buckling length and larger number of members, which means reasonable joint sizes.

Figure 2: Cross Bracing (Vänttinen 2012, 28.)

Boiler Beams: Boiler is hanged from above using vertical rods supported by a beam grillage system consisting of double channels, welded box-sections and welded I-sections. The beam grillage system carries the boiler loads to the main welded I-section beam(s), which is/are supported by welded box section columns. This kind of top-support allows thermal expansion to take place downwards.

Bottom Support: Boiler support is executed by three different methods. Upper support is the boiler beam grillage system described above. Depending on the project, horizontal boiler guiding is somewhere at stiffening platforms at least on two levels. Bottom support for the furnace is at the grid level and is done with a certain cantilever.

Boiler Guides: Boiler guides are strategically located to sections of boiler to balance forces, which could cause vibration to the steel structure during operation. They also balance wind and seismic forces, which may affect the structures of boiler.

This principle -section has many descriptive pictures and some written, acknowledged information of different types of solutions for the aforementioned structures of the boiler building.

3.3.5 Material Selection

Material selection has two sections. The first one has information about structural steel *Material Comparison* between different European standards, a directional guide of steel grades between international standards and a list of used steel grades in projects around the world.

When comparing different steel grades between international standards, one must keep in mind to always consult latest material standard related to each grade in question and evaluate each material's chemical composition, mechanical properties and the end use of the material before making any decisions between alternative materials.

Second section is about *Painting Recommendation*. In the first place, FWE offers painting recommendation according to the EN standards. If otherwise required, other standards (e.g. SSPC) are used. Painting recommendation consists of:

- General painting system requirements
- Guidelines for using EN ISO 12944 for a project in order to ensure effective corrosion protection
- Classification of environments
- Durability
- Surface preparation
- Recommendation of a paint system for desired durability and corrosivity categories
- Examples of used paint systems in projects
- Executing of surface preparation
- Application of paint
- Hot dip galvanizing

3.3.6 Loading Information

Basis for calculating loads for building is EN 1991: Eurocode 1: Actions on structures. The frame of the boiler building along with boiler supporting beams, platforms, stairs, walls and roof construction shall each be designed to bear:

- Dead loads
- Live loads
- Environmental loads (wind, snow, thermal, earthquake)
- Operation loads
- Construction loads

General notes from standards and some typical values for loads from previous projects were gathered under each topic of the loads.

This section also has the list of load combinations and abbreviations for them and a list of minimum requirements of FWE for allowed deflections and displacements.

3.3.7 TS -Model Specification

Tekla Structures is a 3D BIM-software (Building Information Modeling) used for steel and concrete construction detailing. Tekla stands short for "Teknillinen Laskenta"; Finnish words for technical computation.

EDMS stands short for Engineering Data Management System.

This section shows the TS-model structure, some abbreviations used, and instructions how EDMS-information needs to be filled in TS.

3.3.8 Technical Specification

Technival specification is a set of requirements for design, materials, fabrication, site conditions, execution etc. In the specification the duties of the supplier, designers, the client and the supplier of materials are determined.

Technical specification section of the manual has model versions of *Technical Specifications of Steel Structures* and *Technical Specifications of Cladding and Roofing*.

3.4 Civil Design Standards Manual

This is the ”DSM” – section of the manual, which has an index picture of a boiler building, which has links to different sections of the building: *steel structures*, *platform structures*, *cladding structures*, *roof structures* and *typical structures*, each of which has links to tens of detail pictures of the matter at hand.

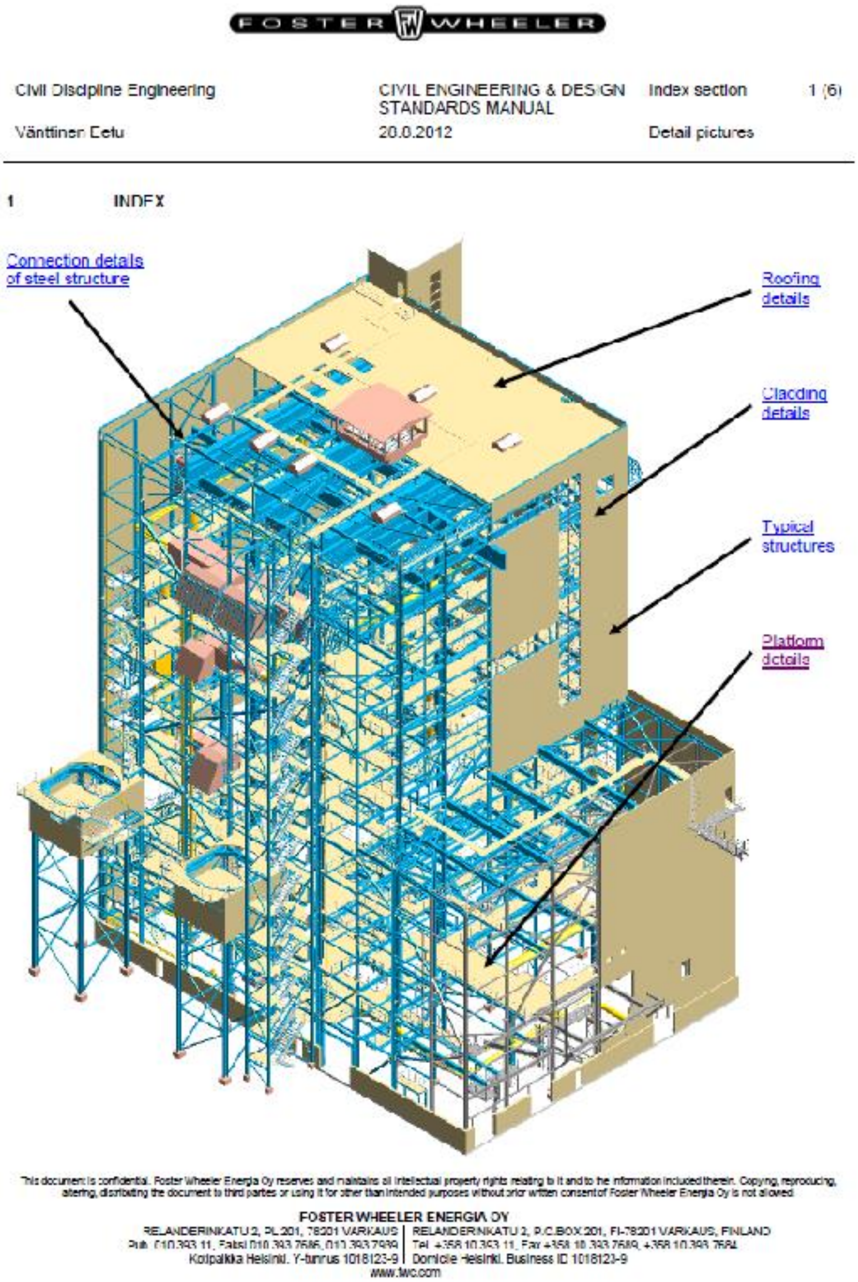

Figure 3: First page of the detail picture –library with links to different sections of a boiler house (Vänttinen 2012, Detail Pictures.)

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Vänttinen Eetu	28.8.2012	Detail pictures	

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Figure 4: List of links to a detail picture of different types of connections of steel structure (Vänttinen 2012, Detail Pictures.)

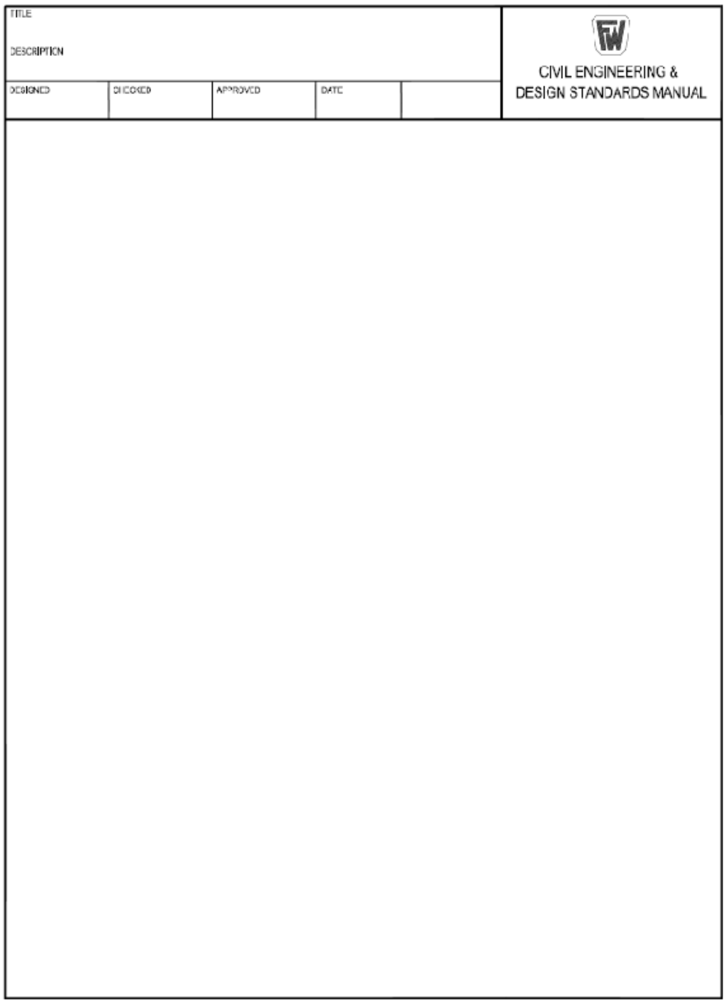

Figure 5: Blank page of a DSM to be filled with a detail picture (Vänttinen 2012, Detail Pictures.)

Connection details of steel structure has pictures of:

- foundation
- steel frame
- platforms
- wall and roof structure
- doors and windows
- lattices
- others

Platform details has pictures of:

- gratings
- fixings
- handrails
- stairs
- checkered plates
- concrete plans
- removable handrails

- kick plates
- ladders
- gates
- temporary handrails and covers

Cladding details has pictures of:

- type of structural sections
- wall structure
    - corners
    - doors
    - windows
    - block elements
- doors
- windows
- lattices
- others

Roofing details has pictures of

- type of structural sections
- eaves
- roof bridges
- wells
- downpipes
- gutters
- walk platforms
- rails
- bollards, fixing point
- smoke hatches

Typical structures has pictures of:

- PAROC wall structure
- Cassette wall structure
- Steel sheet wall structure
- Louvre wall structure
- Concrete wall structure
- Masonry wall structure
- Gypsum board wall structure
- Roof structures
- Intermediate floor structure

4 DEVELOPMENT

4.1 Sections in need of development

Because of the lack of time (3 months) in the making of this manual, some things were needed to be left outside the scope of the manual. In the biggest need of updating are the detail pictures in the DSM, many of them are several years old, and some of the typical details are entirely missing.

Some sections of the Engineering Manual are only for use in European areas, or areas where EN-standards are used. There may be need to extend the manual to concern also other areas, Far-East for example.

Generally speaking it would have been wise to have some time to take the ”finished” manual into more extensive inspection with more eyes and knowledge available and make some modifications to the topics, that were less familiar to the author. But summer holidays were disturbing the progress and because of some company policies things had to be finished in a hurry.

4.2 Development options

The most urgent section in need of development was the detail picture library. Best way to update the pictures would be to hire/appoint a person with expertise in CAD and give him time to go trough the pictures and check them up with a person with experience about the matter at hand. Then necessary revisions should be made if needed and the new detail pictures should be updated to the DSM.

For the Engineering Manual, it would be great that the standards, for example in the U.S., would be as easily accessible as the ones in Europe. So it would be easier to extend some of the sections of the manual to concern other areas than Europe. It was easy to access all the EN-standards in one place, but ANSI (the American equivalent to CEN) has so many suborganizations, it seemed difficult to handle all the spread-around information. Also understanding some other standard-databases other than EN and US, would need some wider language skills.

5 SUMMARY

A chance to do these Engineering & Design Standards Manuals for the Civil Discipline Engineering Department was more than I could have hoped for. This work gave me wide perspective about Foster Wheeler Energy as a company and power boiler business as an industry. I learnt much about working as a part of a worldwide company and I also learnt how to work independently along with given strict schedule. It gave me much stress sometimes, but I also learnt to handle it well.

At first, and also afterwards, this study seemed a bit too large for a bachelor's thesis, but with a little help of some precise guidelines given, I was able to get something concrete ready during three month's time.

We managed to get the manuals up and running into the FWE's intranet system PowerWheel, which is linked to the ProjectWise engineering project collaboration system, where the material is storaged, and where the links from the PowerWheel steer to.

Biggest difficulties during the project was to find the information on the different topics of the thesis. The ProjectWise had extremely large database to scour to and most of the time of my summer training I just browsed the ongoing and finished boiler plant projects. Good thing was, that I had my co-workers and my supervisor always ready to help with all the occurring problems. Also I had technical help always available, when I needed some advise with the CAD- and PDMS- software. This project acted also as great training possibility with the programs in question.

6 REFERENCES

VÄNTTINEN, Eetu 28.08.2012, Civil Engineering & Design Standards Manual, Foster Wheeler Energia Oy Material

[1] fosterwheeler.fi, 6.1.2013, 19:00, Frontpage, http://www.fosterwheeler.fi/en/Default.aspx, Internet

[2] fosterwheeler.fi, 6.1.2013, 19:10, About us, http://www.fosterwheeler.fi/en/About%20us/Default.aspx, Internet

[3] fosterwheeler.fi, 6.1.2013, 19, About us, History, http://www.fosterwheeler.fi/en/About%20us/History/Default.aspx, Internet

[4] fosterwheeler.fi, 6.1.2013, 19:20, Products, http://www.fosterwheeler.fi/en/Products/Default.aspx, Internet