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CE-MARKING AND THE FPC MANUAL

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ABSTRACT

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Name of thesis CE-Marking and the FPC-manual		
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<p>The topic of my thesis is to help Rautakone, a small local metalworking company, to obtain CE marking capability. This thesis was commissioned in late 2014. My aim was to provide a framework for a successful and acceptable FPC manual and documentary procedures, and to describe the CE marking process in Finland in the English language. The material used is largely from public institutions like the European Commission, the Finnish Standards Association and the Mechanical Engineering and Metals Industry Standardization in Finland. The material was collected by desktop research. The thesis is research oriented by nature, but also resulted in an FPC manual for the commissioner.</p> <p>The work began with a familiarization into the EN 1090 and other relevant standards and to the state of the company. It then continued as an independent project with the practical part of the thesis, writing the FPC manual and supporting documentation.</p> <p>As a result of the thesis I have submitted an FPC manual for the company. Due to time constraints, the company contracted the CE auditing process to a consulting company and received a complete FPC manual more or less at the same time. The thesis commissioner is planning to have an audit for the CE marking in the February of 2016.</p>		
Key words		
CE, Factory Production Control, Construction Products Regulation, EN 1090, hEN – harmonized production standard		

CONCEPT DEFINITIONS

NoBo	The Notified Body is an inspecting organization that is qualified by the relevant national institute to issue CE markings. The CE marking standard defines whether or not the NoBo is able to issue them. In Finland the national institute is the Ministry of Environment. <i>Ilmoitettu laitos</i>
hEN	A harmonized European Standard. <i>Harmonisoitu Eurooppalainen Tuotestandardi.</i>
CE	A physical marking used to distinguish products that conform to industry requirements. <i>Conformité Européene.</i>
ETA	European Technical Standard. <i>Eurooppalainen Tekninen Standardi.</i>
SFS EN	The Finnish Standards Association EN-standard. <i>Suomen Standardisoimisliiton EN-standardi.</i>
ISO	International Standards Organization. In Finland Represented by SFS.
WPS	Welding Procedure Specification
DoP	Declaration of Performance. A document certifying the standards-required performance, and issued by the manufacturer. Can be issued after a successful audit by NoBo. <i>Suoritustasoilmoitus.</i>
CPR	Construction Products Regulation, officially CPR 305/2011. <i>Rakennustuoteasetus.</i>
FPC Manual	Factory Production Control Manual. A mean to control the continuance of quality. <i>Sisäisen laadunhallinnan käsikirja.</i>
AVCP	Assessment and Verification of Constancy of Performance. Defines how to assess products to quarantee the accuracy and reliability of DoP. All hEN provide a mean to implement AVCP. <i>Suoritustason pysyvyyden arviointi- ja varmentamisjärjestelmä.</i>

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1 INTRODUCTION

Quality control in the Finnish metal industry has, in the past, relied on standards published by the Finnish Standards Association (SFS). The manuals published by the SFS base their requirements and guidelines into International Standards Organization (ISO) and European Committee for Standardization (CEN) material. With the creation of the common European Economic Area (EEA), a wide variety of national standards became unfeasible to use due to the varying scale, coverage and level of standards. The harmonization of these multiple standards thus became desirable, and the Conformité Européenne– CE – marking was born to cover certain product categories in such a way that product quality could be ensured across the whole EEA.

The CE marking has been in use since the late 1980s, and most recently became mandatory on loadbearing steel and aluminum structures by the decision of the European Parliament on the 1st of July 2013 with a one year transitional period.

This deadline has caused a great demand in CE-related material and guidance, and has affected a change in manufacturing profile for many small and medium-sized companies; some decide to invest in the certification process, some concentrate on products that don't require the CE marking, and some leave the market altogether (Tammelin 2015).

This thesis was commissioned by a local metalworking company that works as a subcontractor for a local housebuilding company. The company had been unable to complete its transition into the standards required of the industry by the CE marking by the due date, 1st of July 2014. (European Commission 2015a.)

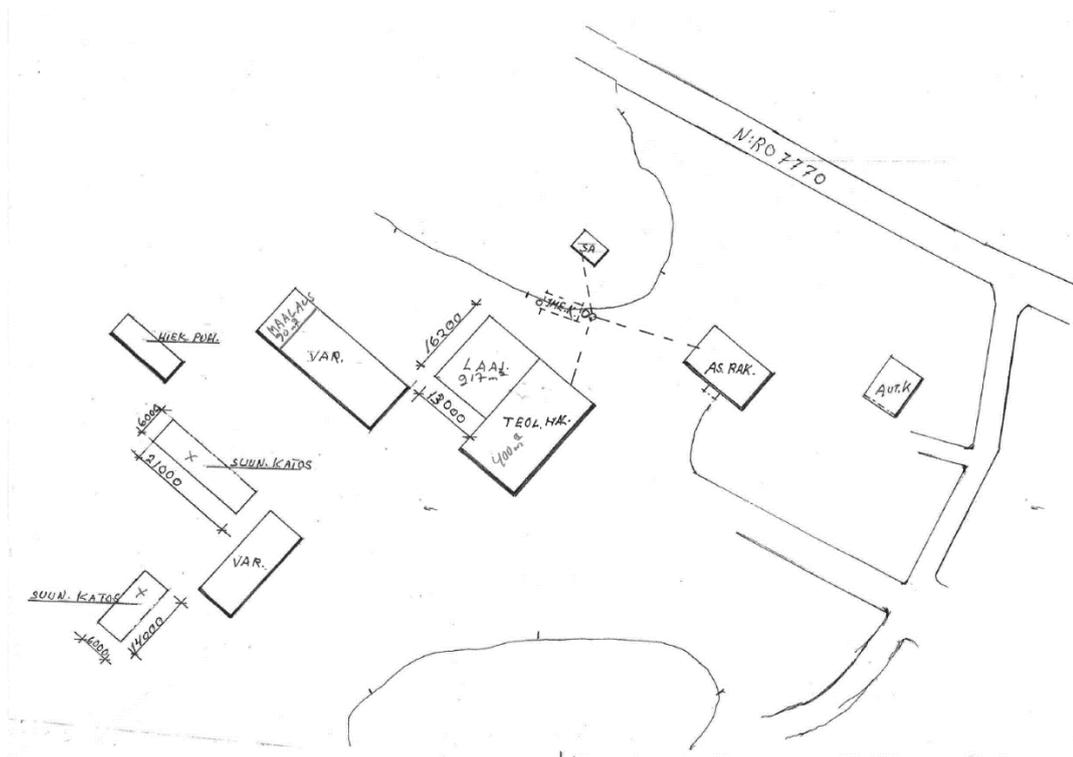
2 COMPANY BACKGROUND

The company was founded by Mr. Esa Pudas and it functions as a sole trader. The company has existed since 1995 and started as a company that “repairs and maintains cars and machinery and manufactures machinery parts and conducts the sawing of lumber” (Kauppalehti yrityshaku 2016). The company logo is in GRAPH 1. The company has one additional hired employee. Currently the company works a limited week, as the owner is participating in the Welding Procedure Specification course on two days of the week with the aim of becoming a certified welding coordinator as required by the ISO 3834 standard. Most of the company’s income comes from manufacturing subcontracted loadbearing metal structures. Rautakone also does limited repairs on local farm equipment such as tractors and trailers.



GRAPH 1. The company logo.

The company has production facilities in Alavieska, some 15 kilometers away from the city of Ylivieska. The main production facility encompasses around 250 square meters, and also has an office and assorted material stores. GRAPH 2 shows an outline of the premises.



GRAPH 2. *Company premises.*

The products are mostly steel constructs for house and storage area frames. The company doesn't have any product families *per se*, since the measurements and dimensions are item-specific and change frequently. The company's work forms around two different sources: clients consist of individual repair and manufacturing assignments and regular orders mainly from Vieskan Elementti, a local construction company that specializes in delivering package solutions for houses and farm structures.

Rautakone has been delivering loadbearing steel frames, assemblies and constructs to building sites for Vieskan Elementti for around 10 years without any troubles. The pressure to conform Vieskan Elementti's products to a CE mark standard is the driving force behind the CE marking process for Rautakone.

3 CE MARKING SYSTEM

The newest form of CE marking system has been in effect since last July, but the concept has existed in its present form since 1985. It denotes products that the manufacturer guarantees -and has tested- to be up to industry-specific European common standard, such as ISO 20347:2012 (for personal protective footwear) or in this case EN 1090:2012 (execution for steel and aluminum structures). Producers that have been audited and accepted for their manufacturing processes and standards can therefore use the CE marking. The CE marking is not an indication of the products' European origins, but rather an advantage and increasingly also a prerequisite for entering the European markets. On a curious note, the CE marking is also required on products that fall on the designated categories that enter the Turkish markets. (European Commission 2014, 48.)

Not all product categories have a requirement for CE marking, however. The categories are specified in EU directives about CE markings. The European Commission has published a guide book regarding implementation rules, officially titled as "The "Blue Guide" on the Implementation of EU Product Rules 2014". Any product that has the CE marking can be placed on markets on any EEA country with no official inspections required.

The CE marking and assorted documents like the Declaration of Performance (DoP) show that the manufacturer has researched the attributes of a product according to the relevant standard or standards and maintains them there. There are over 20 different directives that define CE marking requirements for different product classes.

The path of finding out a product's classification into a CE marking is as follows:

- 1 The European directives and regulations give minimum standards in various safety and quality –related attributes for a given industry field.
- 2 These specifications are then used to modify existing or new technical standards, called harmonized standards (harmonized because the standards are pan-European and therefore demand an identical performance level

regardless of a product's country of origin). The standards relevant to Rautakone like SFS-EN 1090:2012, EN ISO 3834 and ISO 9013:2002 are good examples of harmonized standards.

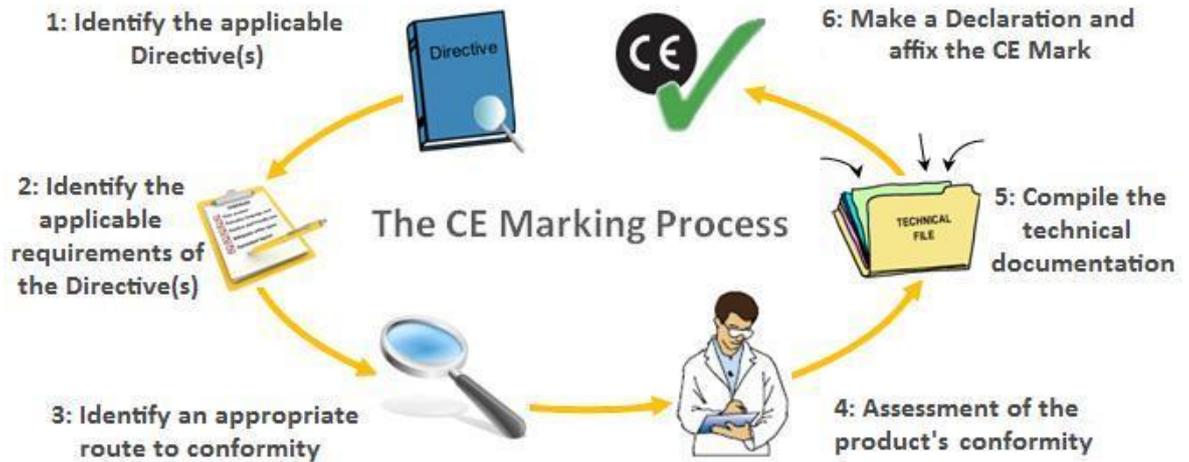
- 3 The standards lay out relevant execution classes and their demands for the products.

(European Commission 2014, 37-39.)

3.1 Steps for the CE Marking

The actual process by which a company qualifies for the CE marking is six-fold and illustrated in GRAPH 3:

- Firstly, the manufacturer identifies whether or not the CE marking is mandatory by checking the applicable EU directives, of which there are around 20.
- Secondly, the manufacturer selects which requirements are mandatory to him from the EU directive.
- Thirdly, the appropriate route to directive conformity (using notified body or in-house procedure) is assessed.
- Fourthly, the products' quality vis-à-vis the minimum requirements are assessed (the products are tested).
- Fifthly, all the relevant technical documentation must be maintained or created.
- Lastly, the product must be declared CE-capable and be affixed with the CE marking.



GRAPH 3. The CE marking process (adapted from CE Marking Association 2014).

The following paragraphs outline the process per its relevance to the thesis commission.

For fabricated structural steelworks the directive is the Construction Products Regulation, and the applicable requirements are found in the standards that have been harmonized with CPR (SFS-EN 1090-1 +A1, SFS-EN 1090-2 +A1) and the successive harmonized standards that are quoted in these documents.

Identifying an appropriate route for regulation conformity is simple: the fabricated structural steelworks sector must be approved by a Notified Body in most instances. In Ostrobothnia the most practical Notified Bodies are VTT Services and DNV.

The assessment of the products' conformity to the applicable standard requirements, and the compilation of technical documents are the most time-consuming of the steps.

Compiling the technical documentation to the required level can also be time-consuming. The documentation process is outlined in the various different guides for compiling the FPC manual, and the requirements of the FPC manual itself on documentation give a good basis for the work. The level EN-1090 requires of documentation overlaps significantly with the ISO 9001 quality control standard.

Making the declaration means passing the initial audit and having the right to affix the products with a CE marking.

3.2 Construction Products Regulation 305/2011/EY

The Construction Products Regulation (CPR) was accepted by the European Parliament and Commission in 2011, and was set to be implemented by the July of 2013. It was to replace the identically named directive (Construction Products Directive 89/106/EY) that covered the same areas of responsibility.

The aim of CPR is to harmonize the performance declaration process of construction materials and therefore to increase interstate trade in the EEA. By combining quality requirements and procedures through unified standards the trade becomes much easier and streamlined. The resulting CE marking on a product means that it has been manufactured according to the harmonized standard(s), or hEN. National requirements for the product might still not be met, however. They are a guarantee by the European Committee of Standardization that the given standard fulfills the demands for CPR, making it easier for the manufacturer to make the declaration of performance and to apply the CE marking. (European Commission 2014.)

CPR defines a construction product as “any product or kit which is produced and placed on the market for incorporation in a permanent manner in construction works or parts thereof and the performance of which has an effect on the performance of the construction works with respect to the basic requirements for construction works”. (European Commission 2015b. 2§1.)

Even though this regulation lowers the barriers of interstate trade, it also poses a number of big problems to small and medium-sized companies: the new quality requirements can deviate from the old processes so much that it might not be feasible to attain the CE marking. The process that results in the right to attach the marking to products might require an extensive monetary investment, new purchases, training and a lot of extra work (Tammelin 2015).

The construction sector in hEN covers more than 3000 work items on product standards and test methods (for use in building and civil engineering). Of these, about 600 standards started to be prepared under the Construction Products

Directive (CPD) and are or will be harmonized under the CPR, along with about 1500 supporting standards. (European Committee of Standardization 2016.)

Using these standards the manufacturer will be in position to make the declaration of performance (DoP) of his product as defined in the CPR and to affix the CE marking.

If the product category doesn't have a hEN standard, it can only qualify for a CE marking through passing a European Technical Assessment.

3.3 ETA - European Technical Assessment

In case there are no applicable harmonized standards, the marking is obtained by completing a European Technical Assessment (ETA). The framework for an ETA is laid in the Construction Products Regulation (EU/305/2011). It is meant to function as a Declaration of Performance in lieu of an actual DoP. An ETA contains the following information:

- General information on the manufacturer and the product type, name and manufacturing plant
- Performances of the product to be declared and references to the methods used for its assessment
- Technical details necessary for the implementation of the AVCP (Assessment and Verification of Constancy of Performance) system

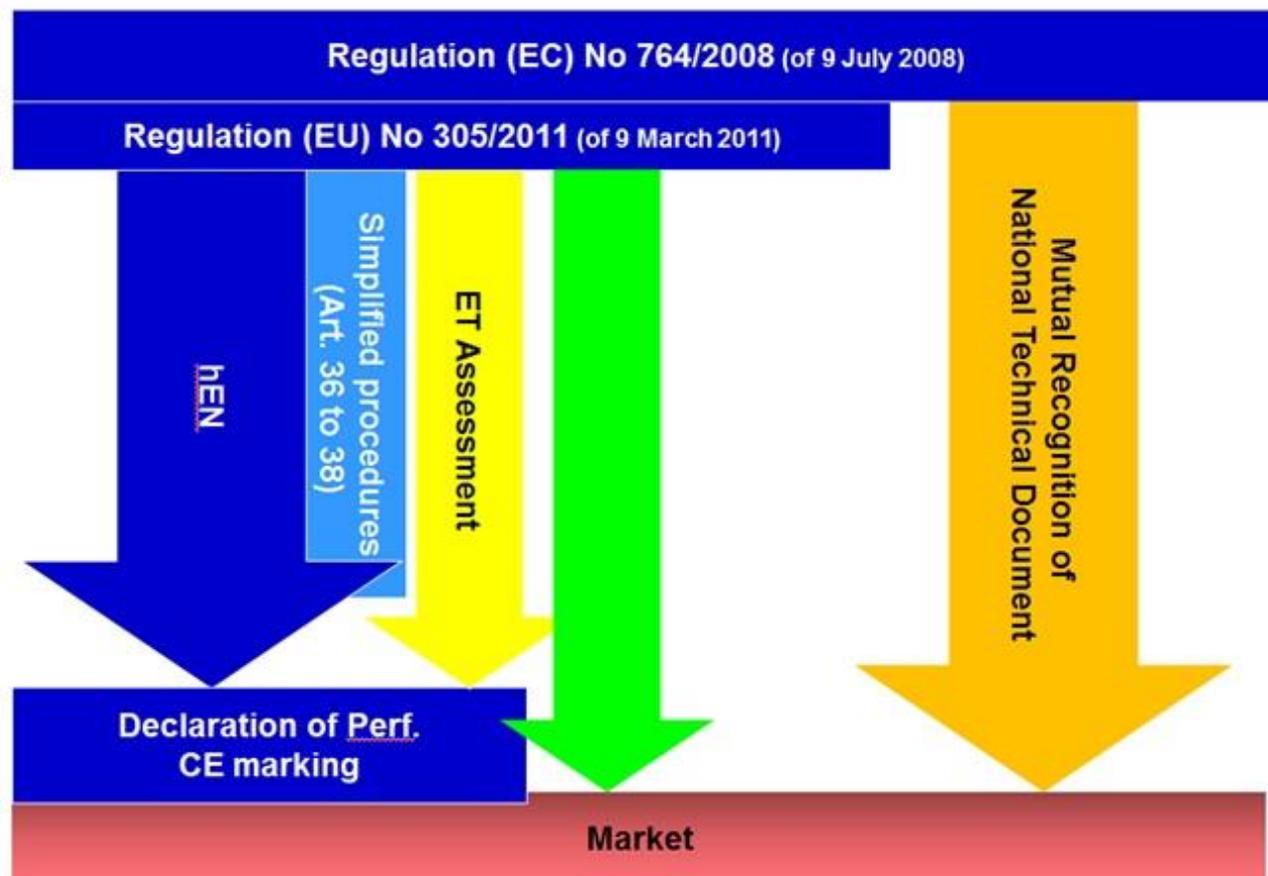
An ETA which has been issued after 1st of July 2013 is valid of indeterminate duration. On the EOTA website references to issued ETAs are published. (EOTA 2015.)

The ETA's are published to the manufacturers by Technical Assessment Bodies, which inspect the product's manufacturing process according to a European Assessment Document adopted by the European Organization for Technical Assessment (EOTA). In other words, the EOTA publishes European Assessment Documents for areas that are not covered by the hEN. These documents lay the

framework for non-hEN covered products, to be inspected by the Technical Assessment Bodies. (EOTA 2015.)

3.4 CE regulation outlined

From these you eventually get templates on how and what to do for the products and product documentation to receive the CE marking. GRAPH 4 illustrates the order of frameworks that form the CE marking requirements for any given product within the construction products industry:

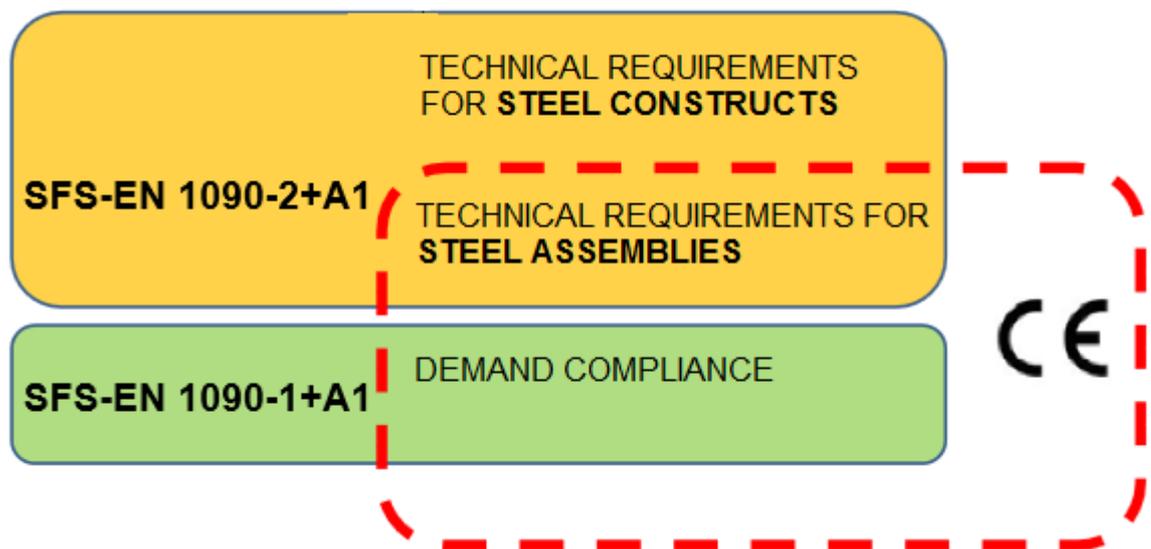


GRAPH 4. Schematic on the regulation on obtaining a CE marking on a product (EOTA 2015).

In practice the CE marking requires that

- 1 the manufacturer has followed the product standard in the manufacturing process
- 2 the manufacturer has maintained the factory's quality control and done the necessary testing as required
- 3 a notified body, independent of the manufacturer, has completed a CE-marking conformity assessment for the factory and the products.

The regulations related to the CE mark are applied to all products that are either for use domestically in Finland, exported to within the European Economic Area or imported to Finland from anywhere. GRAPH 5 shows the parts of standards that regulate the CE mark for loadbearing steel and aluminum constructs:



GRAPH 5. The standards that comprise the CE marking regulations (adapted from Metsta 2014a).

3.5 DoP – Declaration of Performance

The declaration of performance tells the attributes, that the product needs to have quantified, in a harmonized form. Usually in metal constructs this means

- Individual identifier for the product type
- The manufacturer's name and address
- A reference to the harmonized product standard or ETA
- The intended use(s) for the product
- The performance levels for the attributes by use
- Employed AVCP systems
- The names of the notified bodies that have evaluated the product
- The manufacturer's signature and date

A sample DoP is shown in the GRAPH 6:

Muurauslaastin suoritusasoilmoitus DoP esimerkki

<p>SUORITUSTASOILMOITUS No. 001CPR2013-07-01</p>	<p>9. Ilmoitetut suoritusasot:</p> <table border="1"> <thead> <tr> <th>Perus-ominaisuudet</th> <th>Suoritusaso</th> <th>Yhdenmukais-tettu tekninen eritelmä</th> </tr> </thead> <tbody> <tr> <td>Puristuslujuus</td> <td>M5</td> <td rowspan="10">EN 998-2:2010</td> </tr> <tr> <td>Leikkausstartunta (kalkkahiiekkatiilelle)</td> <td>0,35 MPa</td> </tr> <tr> <td>Kloridipitoisuus</td> <td>NPD</td> </tr> <tr> <td>Palokäyttäytyminen</td> <td>A1</td> </tr> <tr> <td>Veden imukyky</td> <td>0,05 kg/(m²min^{0,5})</td> </tr> <tr> <td>Vesihöyrynläpäisevyys</td> <td>µ 15/35</td> </tr> <tr> <td>Lämmönjohtavuus /Tiheys</td> <td>λ10,dry = 0,83 W/mk (taulukko)</td> </tr> <tr> <td>Pitkäaikaiskestävyys</td> <td>SFS 7001 Liite 4 testin läpäisy</td> </tr> <tr> <td>Vaarallisten aineiden päästöt</td> <td>NPD</td> </tr> <tr> <td colspan="3">Taivutustartunta 0,16 MPa (kalkkahiiekkatiilelle).</td> </tr> </tbody> </table>	Perus-ominaisuudet	Suoritusaso	Yhdenmukais-tettu tekninen eritelmä	Puristuslujuus	M5	EN 998-2:2010	Leikkausstartunta (kalkkahiiekkatiilelle)	0,35 MPa	Kloridipitoisuus	NPD	Palokäyttäytyminen	A1	Veden imukyky	0,05 kg/(m ² min ^{0,5})	Vesihöyrynläpäisevyys	µ 15/35	Lämmönjohtavuus /Tiheys	λ10,dry = 0,83 W/mk (taulukko)	Pitkäaikaiskestävyys	SFS 7001 Liite 4 testin läpäisy	Vaarallisten aineiden päästöt	NPD	Taivutustartunta 0,16 MPa (kalkkahiiekkatiilelle).		
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Taivutustartunta 0,16 MPa (kalkkahiiekkatiilelle).																										
<p>1. Tuotetyypin yksilöivä tunnistus: Muurauslaasti M100</p> <p>2. Tuotteen yksilöinti: Muurauslaasti M100</p> <p>3. Aiottu käyttötarkoitus: Muuratut kantavat rakenteet ulko- ja sisäkäyttöön</p> <p>4. Valmistaja: Yritys ABC Katu 1, 00110 Helsinki Sähköposti: yritysabc@abc.fi</p> <p>5. Valmistajan virallinen edustaja: Ei ole</p> <p>6. AVCP-luokka: AVCP 2+</p> <p>7. Harmonisoituun tuotestandardiin perustuva DoP: Laadunvalvonnan sertifiointilaitos No. CPR/2345 on suorittanut tehtaan ja sen sisäisen laadunvalvonnan alkutarkastuksen sekä jatkuvaa valvontaa, arviointia ja hyväksymisen ja antanut laadunvalvonnan varmentamistodistuksen No. 001CPR5678</p> <p>8. ETAan perustuva DoP: Ei tarvita</p> <p>Huom: Tarvittaessa linkki käyttöturvallisuustiedotteeseen</p>	<p>10. Valmistajan edustajan allekirjoitus Paikka ja pvm: _____ Nimi: _____</p>																									



GRAPH 6. A sample DoP of plaster in Finnish (Pulkki 2013).

The term Declaration of Conformity was used from the same document until the 1st of July 2013, when it was changed to a Declaration of Performance.

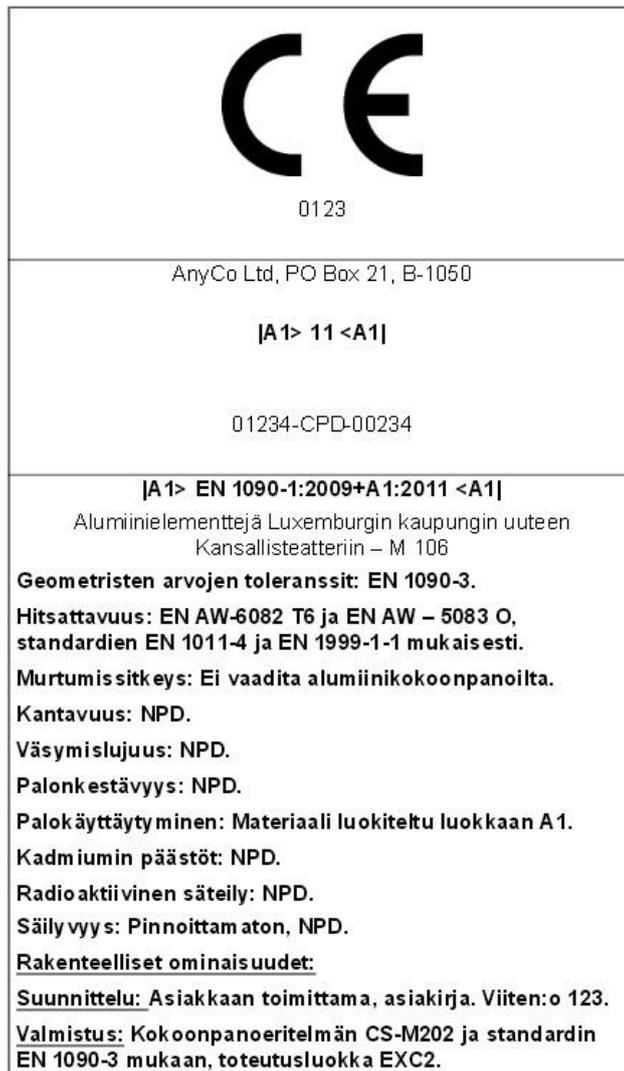
3.6 CE Marking

The actual CE mark is a declaration of performance marking that is the result of the European Union directives. The mark itself consists of the letters “CE” in specific measurements, and of other necessary information, mainly the relevant standard and the qualifying body. GRAPH 7 shows the CE mark in its correct dimensions. The mark itself can be of any size.



GRAPH 7. The CE mark in its correct dimensions (Ministry of Environment 2014).

GRAPH 8 shows the CE marking in a product information sheet. This kind of a marking would be found on the steel assemblies and would also be provided with other delivery notes or attached to pallets.



GRAPH 8. The CE mark in a product, complete with required information for Method 3a of guidance paper L. (adapted from EN 1090-1).

The GRAPH 8 CE marking contains information that is mandatory in EXC2-class metal or aluminum constructs. In products that fall under the CPR, the marking should include

the CE marking, followed by the two last digits of the year in which it was first affixed, the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity, the unique identification code of the product-type, the reference number of the declaration of performance, the level or class of the performance declared, the reference to the harmonised technical specification applied, the identification number of the notified

body, if applicable, and the intended use as laid down in the harmonised technical specification applied. (European Commission 2015b, 9§2)

The product presented in GRAPH 8 is an aluminium product, but otherwise the CE markings for Rautakone's products would list the same product attributes.

4 THE STEEL STRUCTURES STANDARD SFS-EN 1090

CE marking became mandatory in loadbearing steel and aluminum structures on the 1st of July 2013 with one year transitional period. The metal industry in EU is a vast and diverse sector, and contains the entire supply chain from rock mining to extremely refined metal parts, such as monocrystalline turbine blades and satellite bodies, and recycling and secondary use industries. As such, it is classified as a key industry sector by the European Commission. (European Commission 2015d.)

The adoption of CPR in July 2013 was widely anticipated in the EU countries and different guides were published by the industry associations and OSHA agencies. The scope of change invariably resulted in confusion regarding the specifics of the regulation, such as what products actually need to qualify and the status of assembly parts (Tukes 2015.).

The EN-1090 comprises of three sub-standards:

- SFS-EN 1090-1+A1. Execution of steel structures and aluminum structures.
Part 1: Requirements for conformity assessment of structural components (Hereafter EN 1090-1)
- SFS-EN 1090-2+A1. Execution of steel structures and aluminum structures.
Part 2: Technical requirements for steel structures (Hereafter EN 1090-2)
- SFS-EN 1090-3. Execution of steel structures and aluminum structures.
Part 3: Technical requirements for aluminum structures.

Rautakone doesn't manufacture any aluminum products, so the relevant standards for the CE marking are the conformity assessment requirements and the technical requirements, EN 1090-1 and 2.

4.1 When to use the CE Marking

The standard covers virtually all permanent, loadbearing steel structures that are used commercially. There are some exceptions to the rule, such as when a product is meant to temporary support a permanent build, is manufactured on-site and on-place or when the products attributes don't affect the structure (i.e. a rack for hats), but the rule of thumb is that all products meant for bearing any loads require the CE marking. (Tukes 2014.)

For clarity's sake, the standard necessitates CE marking from steel structures, e.g. house steel frames. Steel assemblies in the context of CE marking mean assemblies that are joined into the steel structure, like pillars of the aforementioned frame.

4.2 Requirements for CPR-related CE Marking

The steel structures standard EN 1090-1 demands three central things from a company to qualify for the CE marking:

1. A reliable quality control mechanism
2. A defined and met execution class
3. Welding Procedure Specifications

The nature of demanded quality control mechanism for the standard directs companies to use the industry default, ISO 9001. It is not specified, however. This is opened in the following chapter.

The second demand means that the company must have defined uses and consequences for their products. These are specified in the chapter 4.2.2.

The third demand covers the welding procedures used in steel construction. For EN-1090-1 the company must certify for the SFS-EN ISO 3834 standard. This is opened in the chapter 4.2.3.

4.2.1 Quality control

As stated, the FPC manual requires a set amount of organized and traceable documentary procedures. With a functional FPC, the company can prove the

- quality of materials used;
- manufacturing process;
- products' conformity to the applicable directives; and
- documentation on the order-delivery chain.

The required extents for quality control depend on the harmonized standard in question.

A harmonized product standard is separated by a regular standard by its appendix ZA. This appendix defines the standard's area of application and product-related features, the AVCP-class and the correct ways of affixing the CE marking. The ZA appendix for EN-1090 -1standard is presented in TABLE 1:

TABLE 1. Conformity assessment procedure (adapted from EN 1090-1).

Control Methods	Conformity assessment procedure (AC classes)				
	Certificate of a notified body in AC classes 1+, 1 and 2+, with manufacturer's declaration in all classes				
	1+	1	2+	3	4
Initial inspection of the FPC system	P	P	C		
Continuous surveillance	P	P	C		
Determination of product type	P	P	M	T	M
Audit testing	P				
FPC	M	M	M	M	M
Sample testing	M	M	M		

Type of Notified body:

P - Product certification body, C - FPC Certification body, T - Test laboratory, M - Manufacturer responsibility

The AVCP-class demanded by the SFS 1090-1 is 2+. In addition to the FPC manual it means that sample testing and product type testing is required, and that it is the manufacturer's responsibility. The FPC system also needs to be audited by a notified body in order to be able to affix a DoP, and its continuous surveillance is accepted by an independent source, typically the same notified body.

Standards refer to other standards (some are general uses like ISO 3834-1, others are for different materials or demand classes like ISO 3834-3 or SFS EN 1090-3) and these standards refer to other standards like accuracy, reporting or testing standards (SFS 9013, SFS EN 10204, CEN/TR 10347). This ensures that the documentary basis for designing and adopting new products that need the CE marking is identical in all the EEA countries.

4.2.2 Defined and met Execution Class

Steel structures are used in a large variety of different purposes. The execution class defines the maximum acceptable parameters for the use through consequences, service environments and manufacturing methods.

The CE marking system utilizes the EN 1090-2 as a reference guide. This standard presents the requirements for structural steel that ensure sufficient mechanical durability and stability, usability and feature consistency. The requirements presented in the standard are divided into execution classes. They range from EXC1 to EXC4, with the larger number meaning more stringent requirements. EXC2 is commonly used as a ballpark requirement because it is universally applicable for structures.

The designer is responsible for defining the correct class for the product. Product parts, assemblies or details can also have a different execution class from the "main product". (Metsta 2014b)

The TABLE 2 presents the classification method of products into execution classes. The class is a sum of Consequence and Service Classes, as well as the Production Category i.e. the nature of the product.

TABLE 2. The EXC classification matrix. (adapted from Metsta 2014a)

Recommendations for choosing the EXC class:			
Consequence Class	Service Class	Production Category 1	Production Category 2
CC1	SC1	EXC1	EXC2
CC2	SC1	EXC2	EXC2
CC3	SC1	EXC3/4	EXC3/4
CC1	SC2	EXC2	EXC2
CC2	SC2	EXC3	EXC3
CC3	SC2	EXC3/4	EXC4

The Consequence Class simply classifies the possible consequences from minimal to catastrophic in the case of a structural failure. The Service Class differentiates between non-dissipative (low ductile class, DCL) and dissipative structures (medium and high ductile class, DCM, DCH).

The Production Category divides the production method into PC1, non-welded steel products and welded steel products that use sub-S355 strength category steel; and PC2, which is basically anything more complicated or demanding than PC1. For example over S355 strength category welded steel, structurally critical assemblies that are installed in-site, products that are heat-treated during manufacture and frames consisting of circular tubes whose ends have to be cut into shape. (Metsta 2014a.)

The main uses for the four classes can be described as follows:

- EXC1 – None to low static fatigue, minimal consequences. Typically covers farm buildings, nonhabitable house extensions, light rails etc.
- EXC2 – Only static fatigue, serious consequences. Covers buildings in general, light ramps, supporting frameworks etc.

- EXC3 – Dynamic loads and/or fatigue, very serious consequences. Covers bridges, stadiums etc.
- EXC4 – Very dynamic loads and/or fatigue, catastrophic consequences. Power plants, oil platforms and the like.

A product might contain parts and subassemblies with different execution classes, and in this case a company may only manufacture the parts it has been certified to.

4.2.3 WPS – Welding Procedure Specification

The single most limiting factor in choosing the execution class for a company is the applicable welding standard and whether the company has the capability to weld and to co-ordinate the welding to the standard required. The WPS outlines competences required from welders and welding coordinators.

According to the EN 1090-2 the EXC2-class applies the EN ISO 3834 part 3, standard quality requirements. During the welding process a welding coordinator must supervise the work. The competence of the welding coordinator affects the scope of work he/she can supervise. TABLE 3 shows the requirements a welding coordinator must fulfill when supervising EXC2-class work:

TABLE 3. Technical knowledge of the coordination personnel w/regards to structural carbon steels. (adapted from EN 1090-2.)

EXC	Steels (steel group)	Reference standards	Thickness (mm)		
			$t \leq 25$ ^a	$25 < t \leq 50$ ^b	$t > 50$
EXC2	S235 to S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	B	S	C ^c
	S420 to S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	S	C ^d	C
EXC3	S235 to S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	S	C	C
	S420 to S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	C	C	C
EXC4	All	All	C	C	C
^a Column base plates and endplates ≤ 50 mm. ^b Column base plates and endplates ≤ 75 mm. ^c For steels up to and including S275, level S is sufficient. ^d For steels N, NL, M and ML, level S is sufficient.					

The coordinator must qualify for at least one of the requirements in the table. The requirements are divided into

- B, International Welding Specialist (IWS),
- S, International Welding Technologist (IWT), and
- C, International Welding Engineer (IWE).

The different routes for qualifying as an IIW-certified coordinator are defined by the IIW in their IIW Guideline: Minimum Requirements for the Education, Examination and Qualification (IAB-252-07).

A welding coordinator can also supervise work if he/she demonstrates competence to the requirements of EN ISO 14731 and the relevant part of EN ISO 3834. In the case of a third-party accreditation, the competence must be proved by means of a training certificate that specifically states the training covered the requirements of the above standards and the training provider is acceptable by the notified body that inspects the manufacturer (EN ISO 14731 2006, Annex A).

5 THE PATH FOR RAUTAKONE'S CE MARKING

From the early thesis draft onwards it became apparent that the CE marking was not achievable in the timeframe of this thesis. The entrepreneur was partaking in a WPS training course in order to qualify for the status of a welding coordinator, an important status in any CE-mark –clamoring company that does welding.

As a result, the central part of a CE marking process, the FPC manual, will invariably be incomplete as long as the relevant welding parts of the manual will stay incomplete. This and some other practical issues were discussed with the commissioner on 27th of March 2015, and it was agreed that the FPC manual would be completed to the best possible degree before it became impractical to continue. As a result, the manual attached to this thesis is not a complete manual nor are all the tests mandated by the CE marking regulation done. The description of tests and what is expected of the welding parts of FPC will be discussed later.

Rautakone's path towards a CE marking started on 2011, when the Construction Products Regulation was accepted into a law by the European Commission. The products covered by it had different transitional periods, with the loadbearing steel structures having most, until the 1st of July 2014. The following three years were however challenging enough without starting a process for CE qualification. As a result the process became necessary when an important client announced its desire to have CE-qualified parts for its' constructs. The commissioner began preparations for the qualification by starting the welding procedure specification. During the course he sought people from the teachers and staff of the classifying institute that could help him with the other parts of the CE process. I had contacted one of the staff members earlier and he introduced me to Mr. Esa Pudas.

The work towards being audited for a CE marking began with a preliminary meeting where I and Mr. Pudas mapped his needs and my possibility for contribution. The work then continued independently.

6 FPC MANUAL

In the CE marking process, the internal factory quality control plays an essential part, and is achieved with a Factory Production Control –or FPC– manual. The manual contains a written description on the company’s product design and manufacturing process.

The FPC manual includes process descriptions, documented internal guides on design and manufacture, inspection plans and updated files regarding requirements conformity. The FPC manual also describes what certifications the company must have in producing its services.

As with the CE marking process, there are several guides, templates and consulting services for companies looking to complete an FPC manual. Typically commercial services provide either a completed FPC manual or at least aid in its completion as a part of helping the customer receive the CE qualification, along with testing and possible qualifications. The manuals can be of any confirmation, as long as they document and present the manufacturing process in a satisfying manner.

The manual for Rautakone was comprised from a collection of helpful document templates and a template for the FPC manual itself. The package was published by Metsta (Mechanical Engineering and Metal Industry Standardization in Finland), a national standards governing and writing body. As a sample the manual’s table of contents is included to the thesis in the appendix.

6.1 Contents of the manual

In this chapter I will list the contents of Rautakone’s FPC manual and briefly describe their contents. The structure of the manual means that many chapters contain references to manual annexes that are listed in the chapter manual annexes.

The manual consists of the following main chapters, translated from Finnish:

1. Abstract and requirements for factory production control. This chapter outlines the relevant standards and practices, as well as the requirements that the FPC manual must fulfill.
2. General description. Presents a description of the manufacturing facilities and information about the company, including manufacturing techniques.
3. Assemblies, product families and product types. Presents the product families and details the production.
4. Personnel. Details the personnel organization, roles, responsibilities, qualifications and competences.
5. Production equipment, facilities and environment. Describes the production and storage facilities and their features (insulated, ventilated, etc.), measurement and testing equipment, production equipment and machinery and their maintenance plans. Includes any electronic equipment that is used in the production, e.g. CAD/CAM and maintenance planning systems.
6. Evaluation on the product planning. Outlines the responsibilities for professional and up-to-required structural design and production. Describes the component specification guideline that is used. Rautakone makes products according to the purchaser's wishes, meaning that the component specification is done according to method 3a, shown in GRAPH 8. Also describes the structural testing done in the manufacturing phase.
7. Products and services used in the manufacture. Details the practices when purchasing products and services with regards to material documentation and certificates, and presents listed requirements for subcontractors and suppliers. Also describes the reception of material and methods for its efficient tracking in the inventory.
8. Production. Describes the general phases (identification, storage and handling, cutting, shaping, holing, cut-outs, assembly and assembly check, mechanical fastening, erection, surface treatment and geometrical tolerances) and material flow of production. Actual production and assembly instructions are describes in specific work instructions that are listed in 4_FPC-PR0001-00_Work instruction list. Welding is an important component

in the production process, and its details and responsibilities -WPS and welding coordination- are also described here.

9. Evaluation of completed products and assemblies. This chapter deals with establishing proper testing procedures to ensure demand compliance on the end product. This means verifying that the proper methods of production were used, checking and sampling the characteristics of the finished product are in accordance with EN 1090-1 requirements (1090-1, 6.3.7 Table 2), and checking the accordance of any additional requirements.
10. Handling non-standard raw materials, products and assemblies. Describes handling non-standard material in accordance with the EN 1090-2, includes a specific instruction (7_FPC-QA-0001-00_Noncompliance report) and the persons responsible for it. Must also cover cases where the material fault is noted after delivery.
11. Change management. Defines the person responsible for changing work conditions, manufacturing processes, quality control systems and responsibilities as well as their documentation and handling.
12. Assembly marking. Describes monitoring practices that are used to accurately know the phase and place of raw material and products from purchasing to delivery. Also describes the documentation practices and customer service on the use of these marking practices.
13. Document management. Describes the legal requirements for documentary holding periods, and the method for document handling (ISO 9001 or comparable).
14. Appendix. Lists the annexes present in the FPC manual, see chapter 6.2.
15. Terms and glossary. A collection of terms used within the FPC manual.

The manual's table of contents is presented in the appendix as APPENDIX I, pages 1-3. APPENDIX II shows the manual annexes that have been included in it, as well as a number of relevant standards.

6.2 Manual annexes

The manual also has several annexes as a part of the CE-required documentation. Their templates were provided as a package by Metsta. The manual annexes are designed according to the standard's demands, but the documents can be of any form.

They are as follows, translated from Finnish:

1. 1_FPC-PR-0001-00_Layout
2. 2_FPC-PE-0001-00_Organization
3. 3_FPC-PE-0002-00_Competerences
4. 4_FPC-PR0001-00_Work instruction list
5. 5_FPC-QA-0002-01_Work station inspection report
6. 6_FPC-QA-0002-02_Work approval report
7. 7_FPC-QA-0001-00_Noncompliance report
8. 8_FPC-QA-0001-01_Glossary list
9. FPC-EQ-0001-01_Equipment list
- 10.FPC-EQ-0001-01_Storage statement

These are central to the documentary handling demands (ISO 9001 or applicable) of the CE marking. The central annex for ISO 9001 –capable documentation is the work instruction list. It lists all separate work instructions for different production phases, and is needed to ensure a continuance of quality across different users. It contains 45 different document references from purchasing to instrument calibration.

7 THE TESTS

The FPC-manual needs a series of tests done in order for the company to qualify for the CE marking. The scope of these tests depends greatly on the execution class of the final products. This chapter presents the demands for EXC2-class and, as an example, shows the details of one area of testing.

7.1 Testing demands list

The execution class is a combination of demands for the product that ensures minimal acceptable mechanical endurance and stability, usability and endurance of attributes. The resulting execution classes range from EXC1 to EXC4, with EXC4 being the most demanding class. The class that is practical for Rautakone's products is EXC2, and the customer should bear this in mind. Parts of a structure, structural details and specific assemblies can however have differing (lower) execution classes. (Metsta 2014b.)

The EX2 class lists a variety of demands for the products. These demands can be found from the SFS EN 1090-2 –standard and are as follows (TABLE 4):

TABLE 4. EXC2-Class testing demands list (adapted from EN 1090-2)

Phase	Test area	Demands for EXC2
Specification and documentation	Quality documentation	Yes
Constituent products	Inspection documents	See table 1
Preparation and assembly	Traceability	Yes (partial)
	Marking	Yes

(Continues)

TABLE 4. (Continues)

	Thickness tolerance	Class A
	Surface conditions	Flat class A2, long class C1
	Thermal cutting	EN ISO 9013 u = range 4 Rz5 = range 4 Hardness according Table 10, if specified
	Holing	Punching
	Cut-outs	Min. radius 5 mm
	Assembly	Drifting: Elongation Functional tolerance Class
Welding	Welding	EN ISO 3834-3
	Qualification of welding procedures	See Table 12 and Table 13
	Qualification of welders and operators	Welders: EN 287-1 Operators: EN 1418
	Welding coordination	Technical knowledge according to Tables 14 or 15
	Tack welds	Qualified welding procedure
	Butt welds	Run on/run off pieces if specified
	Acceptance criteria	EN ISO 5817 Quality level C generally
Erection of structure	Handling and storage on site	Documented restoration procedure

(Continues)

TABLE 4. (Continues)

Inspection, testing and repair	Scope of inspection	NDT: See Table 24
	Correction of welds	According to WPQ
	Inspection of preloaded bolts and connections	as follows
	<ul style="list-style-type: none"> • Before tightening 	Checking the tightening procedure
	<ul style="list-style-type: none"> • During and after tightening 	2 tightening step, Sequential type A
	<ul style="list-style-type: none"> • Torque method 	Assembly lot location, 2 tightening step
	<ul style="list-style-type: none"> • Combined method 	Inspection of marking 2 tightening step
	Inspection, testing and repair of hot rivets	Ring test, sequential type A

7.2 Thermal cutting phase

As an example I will describe one of the more straightforward of these steps: the testing of cutting accuracy. The cutting must be made in a manner that fulfills the requirements for geometric tolerances, hardness and free edges as defined in the EN 1090-2 standard. Tolerances are explained in the appendix D.1 of EN 1090-2. This sub-chapter is adapted from that appendix.

The cutting process must be checked periodically by Rautakone with a process that's defined in the EN 1090-2 and EN ISO 9013:

Four specimens from the product material that is used in products, with cuts by for different methods:

- A straight cut from the thickest constituent product;
- A straight cut from the thinnest constituent product;

- A sharp angle cut from a representative thickness;
- A curved arc from a representative thickness.

Measurements shall be taken on the straight samples over at least a 200 mm length on each and checked against the required quality class. The sharp corner and curved samples shall be inspected to establish that they produce edges of equivalent standard to the straight cuts.

The quality of cuts surfaces is according to EN ISO 9013, meaning that

- In EXC1, cut surfaces, once free of dross and in their final condition, do not have significant irregularities. This means that for perpendicular or angular tolerance, u , a range of 5 may be used;
- For other execution classes the TABLE 5 specifies the requirements.

TABLE 5. Quality of cut surfaces (adapted from EN 1090-2).

	Perpendicularity or angularity tolerance, u	Mean height of the profile, $Rz5$
EXC2	Range 4	Range 4
EXC3	Range 4	Range 4
EXC4	Range 3	Range 3

Where u and Rz are according to TABLE 6:

TABLE 6. U and Rz ranges (adapted from EN 1090-2).

Range	Perpendicularity or angularity tolerance, u mm	Range	Mean height of the profile, $Rz5$ μm
1	$0,05 + 0,003a$	1	$10 + (0,6a \text{ mm})$
2	$0,15 + 0,007a$	2	$40 + (0,8 a \text{ mm})$
3	$0,4 + 0,01a$	3	$70 + (1,2a \text{ mm})$
4	$0,8 + 0,02a$	4	$110 + (1,8a \text{ mm})$
5	$1,2 + 0,035a$		

And a is the thickness of the piece in millimeters.

Thermal cutting also requires the testing of hardness for the product's free edge surfaces. For carbon steels, if specified, hardness of free edge surfaces shall be in accordance with TABLE 7. In this case processes that are likely to produce local hardness (thermal cutting, shearing, punching) shall have their capability checked.

In order to achieve the required hardness of free edge surfaces, preheating of material shall be applied as necessary.

TABLE 7. Hardness of free edge surfaces (adapted from EN 1090-2).

Product standards	Steel grades	Hardness values
EN 10025-2 to -5	S235 to S460	380
EN 10210-1, EN 10219-1		
EN 10149-2 and EN 10149-3	S260 to S700	450
EN 10025-6	S460 to S690	
NOTE These values are in accordance with EN ISO 15614-1 applied to steel grades listed in ISO/TR 20172.		

Unless otherwise specified, the check of the capability of the processes shall be as follows:

- Four samples shall be produced from procedure tests on constituent product encompassing the range of constituent products processed that are most susceptible to local hardening;
- Four local hardness tests shall be done on each sample in locations likely to be affected. The tests shall be in accordance with EN ISO 6507. (EN 1090-2)

8 AUDIT

The auditing process starts when the applicant and the NoBo agree on an initial inspection date, and a date when the applicant provides their FPC manual for evaluation. These steps happen in the presented order, and must be at least two weeks apart. These dates should be agreed on as early as possible with regards to the FPC documentation, because the inspection happens at NoBos leisure and their capacity is finite.

The initial inspection should include a work order to the EXC2-class requirement. This way, in case there are any deficiencies or substandard procedures in the manufacturing process, they can be identified and fixed. The material from the initial inspection is valid for one year, and is inspected during the audit.

The final part in applying for the right to affix the CE marking to desired products is the audit. The audit is always undertaken by a certified notified body and a successful audit results in a declaration of performance. The requirements for DoP are that

- The notified body agrees that the company manufactures its products according to the applicable parts of standards EN 1090-1 and 2, and that
- The company has a written description of the factory's internal quality control system (an FPC manual). (Metsta 2014b)

Before the product in question is sold as a CE-approved product the company must publish the DoP.

The audit inspects the manufacturer's quality control and bases it on the practices outlined in the existing FPC manual and the demands placed on the manufacturing by the EN 1090-1. After the initial inspection the notified body will continue the audits at set intervals. For EXC classes 1 and 2 the intervals after the initial inspection are 1-2-3-3-... years (EN 1090-1, Table B.3.).

In Finland the notified bodies are

- Inspecta Sertifiointi Oy

- VTT Expert Services Oy
- Contesta Oy
- DNV Certification Oy
- Finotrol Oy
- Ramboll Finland Oy
- Suomen ympäristökeskus.
- Kymenlaakson ammattikorkeakoulu Oy.

Of which VTT and Inspecta can audit execution classes for EN 1090 products.
(Ministry of Environment 2015.)

In practice the audit can stress a particular facet of business, even though it is an audit of the CE-related activity as a whole. It can concentrate on the quality control system, production methods, manufacturer competences or the company's business practices. However, the overall continued quality assurances must be met if the company wishes to qualify for the CE marking.

9 CONCLUSION AND DISCUSSION

This thesis began with the objectives of finding out and explaining in practice the necessary steps for a CE marking for Rautakone and to finish or provide an as-complete-as-possible FPC manual with its annexes. Additionally I wanted to present a picture of the CE marking process in Finland in the English language. My research for the subject was mainly desktop research from the official sources, the national representative for ISO standards (SFS), the trade association for the subject (Metsta) and the materials published by the European Commission along with topical third-party information.

My work with the thesis subject began with a familiarization into supporting literature, relevant standards and source review. I then began to write the theoretical parts and visited Rautakone on three occasions in the winter of 2015 in order to collect material for the FPC manual. I began filling the FPC manual on the 10th of February and submitted the manual on the 18th of January 2016. I started to work fulltime on the 20th of April.

In practice I found balancing working life and this dissertation too difficult and I opted to prioritize work. As a result even though I completed the FPC manual and required annexes, I continuously overshot deadlines and failed to communicate with the thesis commissioner. As a result the thesis commissioner independently contracted the CE marking process to a consulting firm and received a functional FPC manual and its annexes almost simultaneously with my submittal (early January of 2016).

The thesis commissioner proceeded with the CE qualification more or less as I outlined: he began by identifying the necessary standards, assessed his products conformity requirements, and began to compile the technical documentation. The EN 3834 requirements made him opt for a welding coordinator package from Kempfi, and the consultation for other parts of the CE marking came from Ceriffi. He plans to have an initial inspection for the CE marking on February, all prerequisites being met.

My thesis covers the history and current state of European construction products regulation on a general level, and presents the loadbearing steel structures portion of it in a practical way. The issue is academically speaking new, and the nature of the subject means that there is some confusion as to the actual necessary steps to take. The CE marking process is an intensive and complicated thing, and my perception is that it needs one person to work on it either part- or full-time for an extended period of time. The amount of work is formidable, and requires researching both technical standards and legal regulations and directives. In particular the sheer amount and nature of text caused difficulties for me.

I believe that my thesis will somewhat clarify the CE marking procedures in Finland, and will help someone in need of outside input. The thesis work was also useful for the commissioner, if only by providing a reference work to Ceriffi's manual.

The project did meet its stated goal of delivering an FPC manual and annexes to the thesis commissioner, but failed in being delivered in a practical timeframe. The thesis table of contents and list of annexes is presented in the appendix section.

The thesis work has given me a lot of insight into the European regulatory world in general and the steel industry standards in particular. The workload was formidable, but I am proud that I managed to complete it.

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APPENDIX

	FPC-manuaali		2
Yritys:	Tmi Rautakone Esa Pudas	Dokumentti:	FPC-QA-0001-00
Laatija:	Arto Juhani Kallunki	Versio:	Työversio 0.80
Hyväksyjä:		Hyväksymispäivämäärä:	
Voimassaolo:	jatkuva		

FPC-manuaali

Konepajoissa valmistettavien teräskokoonpanojen ja osakokoonpanojen vaatimustenmukaisuus osoitetaan CE-merkinnällä standardin SFS-EN 1090-1+A1 mukaisesti. CE-merkintä kiinnitetään teräs- ja alumiinikokoonpanoihin, ei rakenteisiin.

CE-merkinnässä ilmoitettavat ominaisuudet määräytyvät käytettävän menetelmän 3a perusteella.

Standardia SFS-EN 1090-1+A1 käytetään aina yhdessä standardin SFS-EN 1090-2+A1 tai SFS-EN 1090-3 kanssa.

Tämä sisäisen laadunhallinnan käsikirja on tehty Teknologiateollisuuden julkaisemaan FPC-oppaaseen tukeutuen, joka on puolestaan toteutettu yhteistyössä Teknologiateollisuuden, METSTA:n, Ramsen ja sen alihankkijan Incoservin kanssa. Käsikirja pohjautuu ja sisältää viittauksia seuraaviin standardeihin sekä soveltuviin viitestandardeihin:

SFS-EN 1090-1+A1 Teräs- ja alumiinirakenteiden toteutus. Osa 1: Vaatimukset rakenteellisten kokoonpanojen vaatimustenmukaisuuden arviointiin

SFS-EN 1090-2+A1 Teräs- ja alumiinirakenteiden toteutus. Osa 2: Teräsrakenteita koskevat tekniset vaatimukset

SFS-EN 1090-3 Teräs- ja alumiinirakenteiden toteutus. Osa 3: Alumiinirakenteita koskevat tekniset vaatimukset

Muutoshistoria	pvm	Muutos	Tekijä
Alkuperäinen	10.2.2015	dokumentin perustaminen	AJK
Työversio (0.1)	20.2.2015	Käsikirjan täydennys	AJK
Työversio (0.2)	1.3.2015	Käsikirjan täydennys	AJK
Työversio (0.3)	5.3.2015	Käsikirjan täydennys	AJK
Työversio (0.4)	10.3.2015	Käsikirjan täydennys	AJK
Työversio (0.5)	18.3.2015	Käsikirjan täydennys	AJK
Työversio (0.6)	20.3.2015	Käsikirjan täydennys, layout-kuvat	AJK
Työversio (0.7)	2.9.2015	Muotoilu	AJK
Työversio (0.8)	28.10.2015	Muotoilu	AJK
Työversio (0.9)	18.1.2016	Täydennys, luovutus palautetta varten	AJK

	FPC-manuaali		3
Yritys:	Tmi Rautakone Esa Pudas	Dokumentti:	FPC-QA-0001-00
Laatija:	Arto Juhani Kallunki	Versio:	Työversio 0.80
Hyväksyjä:		Hyväksymispäivämäärä:	
Voimassaolo:	jatkuva		

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Yritys:	Tmi Rautakone Esa Pudas	Dokumentti:	FPC-QA-0001-00
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1 Tiivistelmä

Euroopan parlamentti ja Euroopan Unionin Neuvosto hyväksyivät 2011 rakennustuoteasetuksen (305/2011 EC), joka astui kokonaisuudessaan voimaan 1.7.2013 kaikissa EU- ja ETA-maissa. Rakennustuoteasetuksen tarkoituksena on edistää rakennustuotteiden vapaata liikkuvuutta unionin alueella sekä yritysten kilpailukyvyyn ja kannattavuuden parantamista 500 miljoonan henkilön markkina-alueella.

Markkinoille saattaessaan harmonisoidun standardin, jonka siirtymäaika on kulunut umpeen, soveltamisalaan kuuluvia rakennustuotteita, valmistaja ilmoittaa DoP:lla ja CE-merkinnällä tuotteen ominaisuuksien arvon tai suoritustason.

Kantavat alumiini- ja teräsrakenteet kattava harmonisoitu standardi on SFS-EN 1090-1: [Teräs- ja alumiinirakenteiden toteutus. Osa 1: Vaatimukset rakenteellisten kokoonpanojen vaatimustenmukaisuuden arviointiin](#). Standardi ja siihen liittyvät liitteet on julkaistu 1.1.2011. Siirtymäaika on alkanut 1.1.2011 ja päättyi 1.7.2014, jonka jälkeen ko. tuotteiden CE-merkintä on pakollista.

Standardin SFS-EN 1090-1 +A1 mukainen suoritustasojen pysyvyyden arviointi- ja [varmennusjärjestelmä \(AVCP-luokka\)](#) on 2+. Tämä edellyttää valmistajan suorittaman alkutestauksen, tuotannon sisäisen laadunvalvonnan ja näytteen oton, testauksen ja tarkastuksen tehtaassa sekä lisäksi ilmoitetun laitoksen suorittaman tuotantolaitoksen ja tuotannon alkutarkastuksen ja tuotannon sisäisen jatkuvan laadunvalvonnan.

Ilmoitettu laitos antaa tuotannon sisäisen laadunvalvonnan vaatimustenmukaisuustodistuksen standardin SFS-EN 1090-1 +A1 mukaisesti, jonka perusteella valmistaja voi laatia suoritustasoilmoituksen ja käyttää CE-merkintää.

Valmistajan tuotannon sisäinen laadunvalvontajärjestelmä (Factory Production Control, FPC) varmistaa, että tuotteet ovat jatkuvasti vaatimusten mukaisia.

Suunnittelu, mikäli kuuluu CE-merkinnän piiriin, tulee tehdä eurokoodien mukaisesti.

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Hyväksyjä:		Hyväksymispäivämäärä:	
Voimassaolo:	jatkuva		

14 Liitteet

SFS-EN 1090-1 +A1, SFS EN 10902 +A1, muut käytettävät
SFS EN 10204 [ainestodistukset],
CEN/TR 10347 [opas rakenteellisen teräksen muotoiluun ja muodostukseen prosesseissa],
SFS EN ISO 12944-7 [[Maalit ja lakat. Teräsrakenteiden korroosionesto suojamaaliyhdisteillä. 7. Maalaustyön toteutus ja valvonta](#)]
Rakennustuoteasetus
FPC organisaatio [2_FPC-PE-0001-00_Organisaatio]
FPC pätevyudet [3_FPC-PE-0002-00_Pätevyudet]
FPC Työohjeet [4_FPC-PR-0001-00_Työohjeet]
FPC Valmistusprosessin yleiskuvaus [FPC_PR-0001-01_Valmistusprosessi]
FPC Hitsausprosessin yleiskuvaus [FPC_PR-0001-02_Hitsausprosessi]
FPC laiteluettelo [FPC_EQ-0001-01_Laiteluettelo]
FPC tuotantotilojen layout [FPC_EQ-0001-00_Layout]
FPC työpisteen tarkastuspöytäkirja [5_FPC-QA-0002-01_Työpisteen tarkastuspöytäkirja]
FPC työn hyväksymispöytäkirja [6_FPC-QA-0002-02_Työn hyväksymispöytäkirja]
FPC poikkeamaraportti [7_FPC-QA-0003-00_Poikkeamaraportti]
FPC nimiöinti [8_FPC-QA-0001-01_Nimiöinti]