HISTORICAL WELDED STEEL STRUCTURES - QUALITY IN WELDING AND EXECUTION CLASSES ACCORDING TO SR EN-1090

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Abstract: *The importance of standardization for the historical welded steel structures is well evidenced by the examples which occur day by day around us. This paper highlights the fact that the designer, beneficiary and execution all must attach great importance to the strict compliance of the standards; communication between designer - beneficiary - executor is very important. The decision to apply for a particular class of consequence and execution class of a structure or some elements of it is very important; if from the beginning the choice of a class consequence or execution class is incorect can occur unpleasant events. Through the examples presented in the paper highlights the importance of framing a structure or its elements depending on the loads they are subjected and its importance.*

Keywords: *execution classes, consequences classes, SR EN 1090 Requirements, service category, quality in welding*

1.Introduction

The standard affects all companies who manufacture and sell steel and aluminum structures and structural products in European Union. The requirements of SR-EN 1090 ensure that appropriate controls are in place at every stage of the manufacturing process.

There are four execution classes (EXC1 to EXC4); the execution class determines the requirements for the various activities.

If no execution class is specified, EXC2 will apply even if the structure falls under EXC1.

Table 1. Service categories according SR EN 1090

Suggested criteria for service categories

Categories	Criteria
SC1	- Structures and components designed for quasi static actions only (Example: Buildings) - Structures and components with their connections designed for seismic actions in regions with low seismic activity and in DCL* - Structures and components designed for fatigue actions from cranes (class S_0)**
SC2	- Structures and components designed for fatigue actions according to EN 1993. (Examples: Road and railway bridges, cranes (class S_1 to S_9)**, structures susceptible to vibrations induced by wind, crowd or rotating machinery) - Structures and components with their connections designed for seismic actions in regions with medium or high seismic activity and in DCM* and DCH*

* DCL, DCM, DCH: ductility classes according to EN 1998-1

** For classification of fatigue actions from cranes, see EN 1991-3 and EN 13001-1

Table2. Production categories according SR EN 1090

Suggested criteria for production categories

Categories	Criteria
PC1	- Non welded components manufactured from any steel grade products - Welded components manufactured from steel grade products below S355
PC2	- Welded components manufactured from steel grade products from S355 and above - Components essential for structural integrity that are assembled by welding on construction site - Components with hot forming manufacturing or receiving thermic treatment during manufacturing - Components of CHS lattice girders requiring end profile cuts

Table 3. Conseque classes according SR EN 1090

Consequence classes	Description	Examples of buildings and civil engineering works
CC3	**High** consequence for loss of human life, or economic, social or environmental consequences - **very great**	Grandstands, public buildings where consequences of failure are high(e. g. a concert hall)
CC2	**Medium** consequence for loss of human life, economic, social or environmental consequences -**considerable**	Residential and office buildings, public buildings where consequences of failure are medium (e.g. an office building)
CC1	**Low** consequence for loss of human life, and economic, social or environmental consequences -**small or negligible**.	Agricultural buildings where people do not normally enter (e. g. storage buildings), greenhouses.

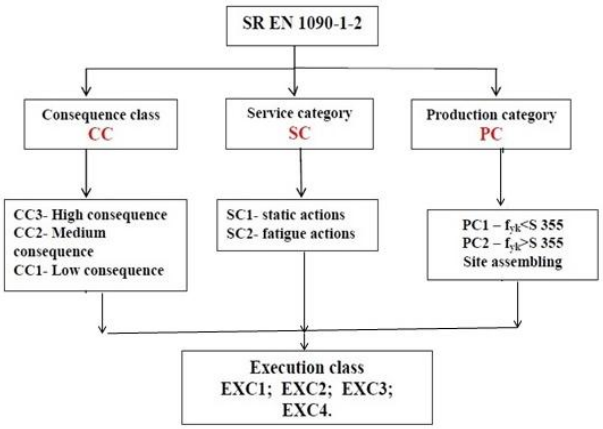

Figure 1. Flowchart for execution classes

Table 4. Requirements to each execution class

Clauses	EXC1	EXC2	EXC3	EXC4
4 – Specifications and documentation				
4.2 Constructor's documentation				
4.2.1 Quality documentation	Nr (No requirement)	Yes	Yes	Yes
5 – Constituent products				
5.2 Identification, inspection documents and traceability				
Inspection documents	See Table 1	See Table 1	See Table 1	See Table 1
Traceability	Nr (No requirement)	Yes (partial)	Yes (full)	Yes (full)
Marking	Nr	Yes	Yes	Yes
5.3 Structural steels products				
5.3.2 Thickness tolerances	Class A	Class A	Class A	Class B
5.3.3 Surface conditions	Flat - Class A2 Long – Class C1	Flat - Class A2 Long – Class C1	More stringent conditions if specified	More stringent conditions if specified
5.3.4 Special properties	Nr	Nr	Internal discontinuity quality class S1 for welded cruciform joints	Internal discontinuity quality class S1 for welded cruciform joints
6 – Preparation and assembly				
6.2 Identification	Nr	Nr	Finished components / Inspection certificates	Finished components / Inspection certificates

2. Proposal for the harmonisation reliability classes versus consequence classes

There are three reliability classes- RC, defined by the reliability index β, for the ultimate limit states which may be associated with the consequence classes.

Table 5. Reliability Class acording standards and SR EN 1090

Reliability Class	Minimum values for β	
	1 year reference period	50 years reference period
RC3	5.2	4.3
RC2	4.7	3.8
RC1	4.2	3.3

Table 6 Reliability Class versus execution class acording standards and SR EN 1090

Reliability class (RC) Consequence class (CC)	SC 1 (Static)	SC 2 (Fatigue)
RC3/CC3	EXC3	EXC3
RC2/CC2	EXC2	EXC3
RC1/CC1	EXC1	EXC2

Another important parameter is the design working life

Table 7. Design working life category

Design working life category	Indicative working life (years)	Examples
1	10	Temporary structures(1)
2	10 to 25	Replaceable structural parts, e.g. gantry girders, bearings
3	15 to 30	Agricultural and similar structures
4	50	Building structures and other common structures
5	100	Monumental building structures, bridges, and other civil engineering structures
(1) Structures or parts of structures that can be dismantled with a view to being re-used should not be considered as temporary.		

3. Conclusion

Verification of compliance with SR EN 1090 will include some general aspects as:material certification of analysis, testing and storage staff training, testing and qualification, equipment calibration, Consumable certification and control quality and testing of products.

Another important aspect is Design working life category and Reliability Class versus execution class according SR EN 1090, the designer need choose a correct Reliability Class.

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