CONFORMITY ASSESSMENT FOR THE EXECUTION OF STEEL & ALUMINIUM STRUCTURES

DOCUMENT CAESAS/1: SCHEME DESCRIPTION AND BENEFITS

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Issued under the authority of the Governing Board for Certification
All correspondence should be addressed to:

TWI Certification Ltd
Granta Park
Great Abington
Cambridge CB21 6AL
United Kingdom

Tel: +44 (0) 1223 899000
Fax: +44 (0) 1223 894219
Email: Enquiries@EN1090cert.org
Web: www.EN1090Cert.org

1 GENERAL BACKGROUND

TWI Certification Ltd has been assessed against the requirements of the Construction Products Directive (CPD) (EC Directive 89/106/EEC) and EN 45011 by the United Kingdom Accreditation Service (UKAS), the sole national accreditation body recognised by the UK Government. UKAS is independent of Government but is appointed as the national accreditation body by the Accreditation Regulations 2009 (SI No 3155/2009) and operates under a Memorandum of Understanding with the Government through the Secretary of State for Business, Innovation and Skills (BIS). On the basis of satisfactory assessment by UKAS and its recommendation to BIS, TWI Certification Ltd has been notified to the European Commission (EC) and the other Member States as a body, which fulfils the relevant requirements, and has been designated to carry out conformity assessment according to the CPD. The Notified Body status and scope of conformity assessment of TWI Certification Ltd is published at http://ec.europa.eu/enterprise/newapproach/nando.

The relevant European harmonised Standard for CE Marking fabricated steelwork is EN 1090-1 Execution of steel structures and aluminium structures, the other two essential parts are as follows

Part 2 Technical requirements for the execution of steel structures

Part 3 Technical requirements for the execution of aluminium structures

BS EN 1090-2 supports the application of EN 1090-1 by providing the technical requirements relevant to the manufacture of steel components. BS EN 1090-3 supports the application of EN 1090-1 by providing the technical requirements relevant to the manufacture of aluminium components. With respect to CE Marking the relevant clauses of BS EN 1090-2 and BS EN 1090-3 are as follows:

• Documentation (clause 4 and Annex A) additional information, list of options and requirements related to the execution classes

1. Scope
2. Normative references
3. Terms and definitions
4. Specifications and documentation
5. Constituent products
6. Preparation and/or assembly
7. Welding
8. Mechanical fastening (and adhesive bonding) (for aluminium only)
9. Erection
10. Surface treatment
11. Geometrical tolerances
12. Inspection, testing and correction

BS EN 1090-3 supports the application of EN 1090-1 by providing the technical requirements relevant to the manufacture of aluminium components. With respect to CE Marking the relevant clauses of BS EN 1090-3 are as follows:

How to Determine the correct Execution Class

BS EN 1090 Parts -2 and 3 introduce the concept of Execution Class. There are four execution classes which range from Execution Class 1 which is the least onerous through to Execution Class 4 which is the most onerous.

Each Execution Class contains a set of requirements for fabrication and erection and these requirements may be applied to the structure as a whole, an individual component or a detail of a component. Those items that are dependent on the choice of Execution Class are itemized in Annex A.3 of BS EN 1090-2. (Steel) and BS EN 1090-3 Reference Section 4.1.2 guidance on Execution Classes (Aluminium)

It is a design decision for the specifier to select the Execution Class required for the structure, the individual component or the particular detail of a component. The main reason for giving four execution classes is to provide a level of reliability against failure that is matched to the consequences of failure for the structure,

the component or the detail. Execution Class is widely used throughout the Standard as a reliability differentiator for providing choice of quality, testing and qualification requirements.

How do I find out what execution class is needed?

For general guidance please refer to Appendix 1(Steel) and Appendix 2 (Aluminium).

Welding Coordination

For Execution Classes 2, 3 and 4, welding coordination shall be maintained during the execution of welding by welding coordination personnel suitably qualified for, and experienced in the welding operations they supervise as specified in EN ISO 14731.

What level of Coordinator is required?

For general guidance please refer to Appendix 3.

Weld Quality Levels

For structures/components/details that are designed for fatigue, additional requirements to those given in BS EN 1090-2 are required. This is because the simple choice between SC1 (for quasi-static) and SC2 (for fatigue) does not sufficiently discriminate between the required weld quality levels in terms of fatigue classes.

Further information on weld quality levels is given in the national forewords to BS EN 1090-2 and BS EN 1090-3, which refer the reader to EN ISO 5817, “Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections”.

2 ATTESTATION OF CONFORMITY (AOC)

Depending on the required level of safety criticality of a product (i.e., structural products are usually very safety critical, decorative products are usually not critical), CE Marking can involve different levels of *Attestation of Conformity.* For safety-critical products, this will normally involve testing, inspection and certification by a third-party body. For non-safety critical products, the CE marking will usually involve a manufacturer’s declaration only, without third party involvement.

The level of Attestation of Conformity is set by the Commission for product families. There are six given levels. For each level of Attestation of Conformity the manufacturer must have factory production control (FPC) and initial type-testing (ITT), and produce a manufacturer’s declaration of conformity.

The levels of Attestation of Conformity are 1+, 1, 2+, 2, 3 and 4 the highest being 1+ and the lowest level being 4, the processes involved in attaining the level and who is responsible for those tasks are shown in Table 1.

Under system 2+ Attestation of Conformity the tasks to be carried out by a Notified Body (TWI CL) are initial inspection of the factory and a Factory Production Control (FPC) audit and continuous surveillance, assessment and approval of FPC. When satisfactorily carried out this results in the issue of an EC Certificate of Factory Production Control.

Under system 2 the factory is not subject to continuous surveillance.

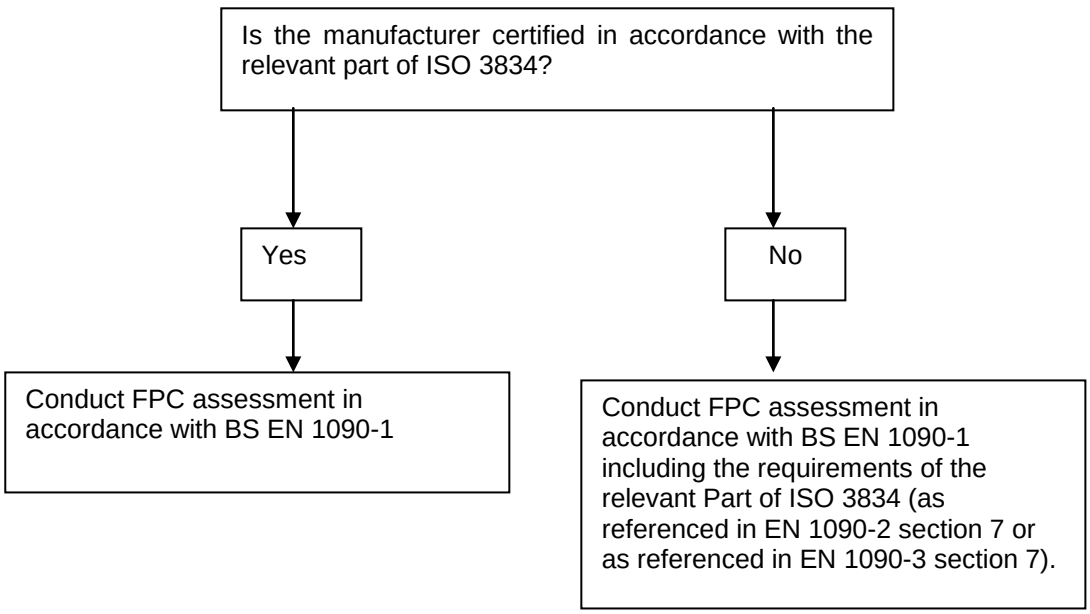
Table 1

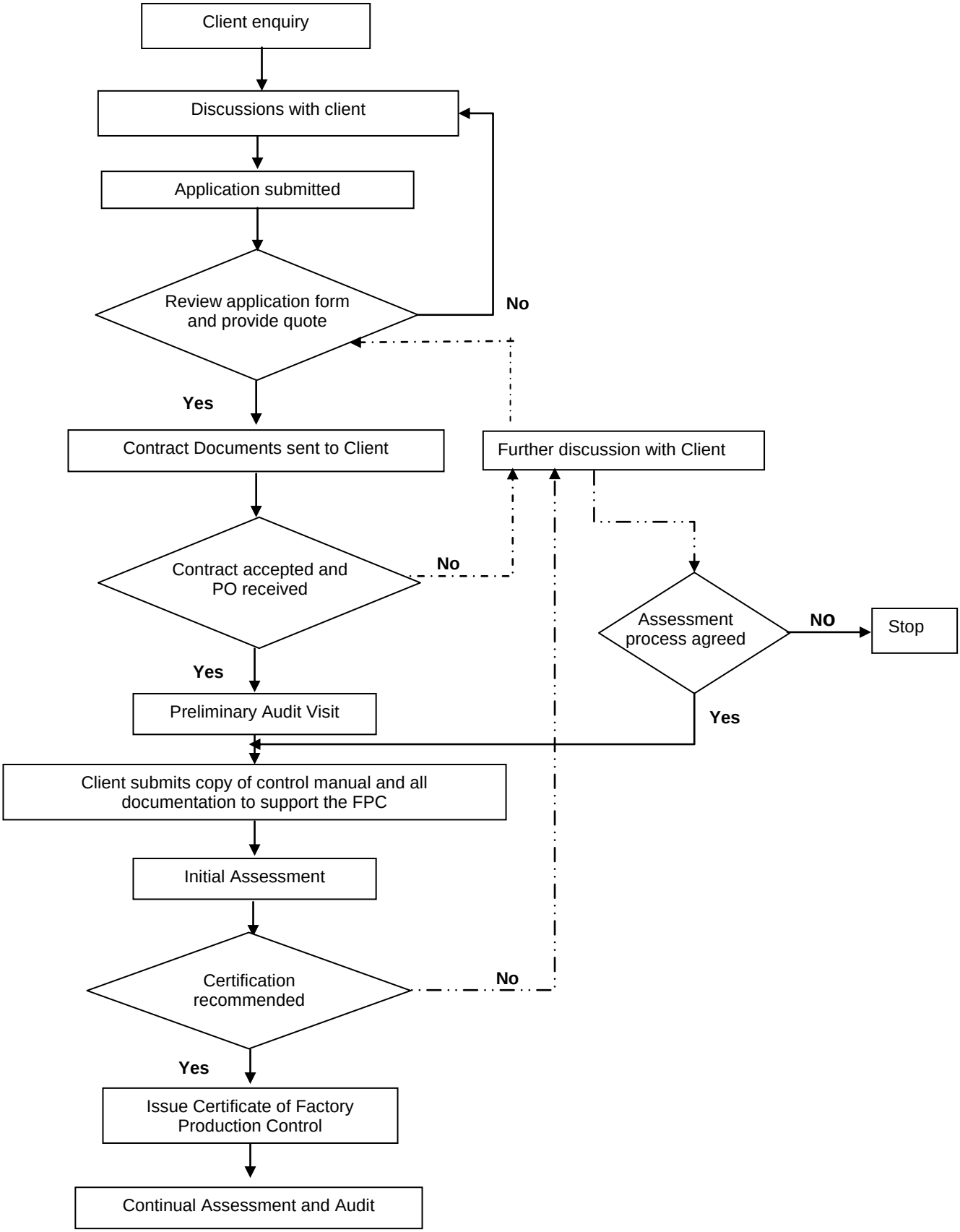
Tasks for Manufacturer	1+	1	2+	2	3	4
Factory Production Control (FPC)	✓	✓	✓	✓	✓	✓
Further testing of samples taken at factory according to prescribed test plan	✓	✓	✓			
Initial type testing			✓	✓		✓
Tasks for the notified body	**1+**	**1**	**2+**	**2**	**3**	**4**
Initial type testing	✓	✓			✓	
Certification of FPC	✓	✓	✓	✓		
Surveillance of FPC	✓	✓	✓			
Audit testing of samples	✓					

The TWICL scheme for Conformity Assessment of the Execution of Steel and Aluminium Structures (CAESAS) in accordance with the requirements of the standard BS EN 1090-1 covers the essential parts of Factory Production Control (FPC) requirements, it also covers a large part of the requirement for a satisfactory assessment of the manufacturer in accordance with the WFCS for the relevant Part of ISO 3834 (as referenced in EN 1090-2 section 7 or as referenced in EN 1090-3 section 7).

3 .Flow Chart for EC Certificate of Factory Production Control Procedure

The following flow chart shows the TWI Certification Ltd process, from the initial receipt of an enquiry to the issue of an EC Certificate of Factory Production Control in accordance with EN 1090-1.





Action	By Whom
1) Apply for accreditation	Applicant
2) Fill in Preliminary enquiry	Applicant
3) Review & issue of quotation and contract	TWI
4) Carry out preliminary visit	Assessor/Lead assessor
5) Complete Document Review Form send to TWI CL	Applicant
6) Assess Document Review	Assessor/Lead assessor
7) Formal Assessment	Lead assessor
8) Report Finding to TWI Certification Ltd	Lead assessor
9) Report findings to Management Committee	TWI Certification Ltd
10) Invoice Applicant	TWI Certification Ltd
11) Pay Invoice	Applicant
12) Confirm Certification	Management Committee/Scheme Manager
13) Issue Certificates	TWI Certification Ltd

As part of the factory control process verification in quality terms, welding is identified as a 'Special Process' which means that it requires specialist management, personnel and procedures. This has led to a number of developments, notably the publications of BS EN ISO 3834. This document prescribes requirements to provide assurance of welding and fabricating competence, and includes the feature of welding co-ordination in which companies must nominate competent Welding Co-ordinators (Welding Engineers, Welding Supervisors, etc) who take responsibility for welding functions on behalf of their employers. Separate documents are available on the Certification of people with Welding Coordination responsibilities through CSWIP and/or through the European Welding Federation (EWF)/International Institute of Welding (IIW).

4 OUTLINE OF THE WELDING FABRICATOR CERTIFICATION SCHEME (WFCS)

ISO 3834 defines management quality requirements for fusion welding it incorporates the following parts:

ISO 3834 Quality Requirements for Fusion Welding of Metallic Materials
Part 1: Criteria for the Selection of the Appropriate Level of Quality Requirements
Part 2: Comprehensive Quality Requirements
Part 3: Standard Quality Requirements
Part 4: Elementary Quality Requirements
Part 5: Documents with which it is necessary to confirm to claim conformity to the quality requirements of 3834-2, 3834-3, 3834-4.
Part 6: Guidelines on implementing ISO 3834.

The TWI Certification Ltd scheme is administered by the Welding Fabricator Certification Management Committee (WFCMC) on behalf of the Governing Board of TWI Certification Ltd.

Companies that meet the requirements of the Scheme are entered on the TWI CL Register and the web-site. All Registered Fabricators receive a Certificate of Registration from TWI Certification Ltd and are permitted to use the scheme logo.

5 BENEFITS FOR REGISTERED COMPANIES

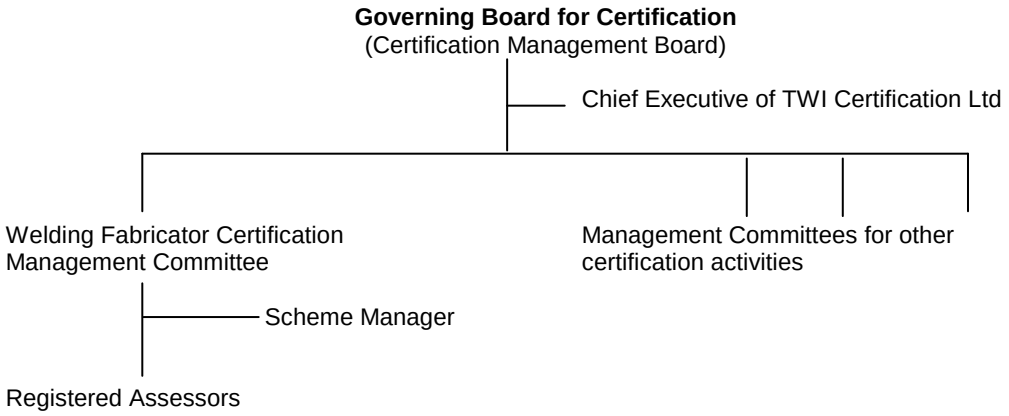
- Clear, high profile independent verification of its compliance with BS EN 1090 and UKAS requirements.
- Independent confirmation of competence for its welding and fabricating capabilities and staff in a defined scope of activity.
- Welding quality management and fabrication capability assessments carried out by specialist assessors registered by TWI Certification Ltd.
- Increased national and international business potential through demonstrated compliance with legal manufacturing requirements which are internationally recognised.
- Companies who do not wish to have their Quality Management system certificated to the full requirements of ISO 9001 can have their welding quality system and FPC in accordance with EN 1090 and also competence assessed against ISO 3834 and registered under the Schemes.

6 BENEFITS FOR CLIENTS OF REGISTERED COMPANIES

- Expertly led, independent, vendor assessment.
- In-depth, authoritative evaluation of fabricator's capability.
- Consistent assessment.
- Uniform presentation of information and data.

7 ORGANISATIONAL STRUCTURE

The certification management structure of TWI Certification Ltd is as follows:



8 SCHEME OPERATION

Applicant companies are audited by assessment teams specifically approved by the Scheme Manager. Assessors have proven welding knowledge and experience, and this ensures that assessment is expertly directed and that the results are authoritative.

Following successful assessment of the applicant company, the Lead Assessor reports the data and the result to the Scheme Manager, who initiates the award of the Certificate of Conformity from TWI Certification Ltd.

9 STEPS TO CERTIFICATION

The process for applicant companies involves the following stages:

a) Submission of the application form directly to TWI Certification Ltd together with the application fee, quality management documentation and evidence of any existing certification.

b) Appointment/approval of Assessment Team by Scheme Manager.

c) Preliminary evaluation by the Lead Assessor to establish quality system status and scope of manufacturing facility.

d) Notification to applicant company with quotation and assessment documentation for completion by the company.

e) Planning of the assessment by Assessment Team.

f) Assessment is carried out by the approved Assessment Team. During the assessment, interviews will be conducted with welding co-ordination personnel and verification of fabrication capability obtained.

10 CERTIFICATION AND REGISTRATION OF APPLICANT COMPANIES BY TWI CERTIFICATION LTD

a) **Registration**

Lead Assessor will submit all relevant information to the Scheme Manager for inclusion on the Register. This may include the following information:

- Factory production Control
- Execution of steel structures
- Structural Design process
- Classification and designation
- Current product range
- Maximum handling size and weight
- Product Evaluation (Initial type testing)
- ISO 3834
- Welding co-ordination personnel
- Weldability/welding processes
- Materials and thickness ranges
- Equipment (i.e. welding, forming, machining and cutting facilities)
- Major use and control of sub-contractors
- Sub-contracting (relevant to fabrication)
- NDT facilities
- Heat treatment facilities
- Personnel
- Constituent products used in manufacture
- Component Specification
- Non-conforming products
- Marking
- training facilities
- transportation limitations

This information will be publicly available.

b) **Certification**

A company that has demonstrated compliance with these requirements shall be issued with a Certificate of Conformity and Welding Certificate identifying the relevant information, . This will be awarded by TWI Certification Ltd.

c) **Surveillance of Registered Fabricators**

Surveillance visits will be performed in accordance with Table B.3 of BS EN 1090-1.

11 NOTIFICATION OF CHANGE OF CAPABILITY

The Registered Fabricator shall notify the Scheme Manager immediately when there is any reduction in the facilities or capabilities assessed. Changes of welding co-ordination personnel shall be notified and any new appointees' documentation will be reviewed for adequacy.

An increase in the capability may be notified between assessments or surveillance visits, and will be entered as provisional on the database, until verified, as per the requirements of BS EN ISO 1090-1 (appendix "B" Section 4.1)

12 SCHEME DOCUMENTATION

CAESAS/1 Scheme Description and Benefits

13 FURTHER INFORMATION

TWI Certification Ltd
Granta Park
Great Abington, Cambridge CB21 6AL, UK
Phone +44 (0) 1223 899000
Fax + 44 (0) 1223 894219
Email: enquiries@EN1090Cert.org
Web: www.EN1090Cert.org

Appendix 1

Annex B of BS EN 1090-2 recommends that the choice of Execution Class is based on the 'service category' (SC) (SC1 – quasi-static, SC2 - fatigue) and the 'production category' (PC) (method of fabrication, PC1 or PC2 where structures/components/details in PC2 are more difficult to produce than those in PC1). Most steel structures in the UK will include components in both production categories and most will be in SC1 (static) unless they are designed for fatigue (in which case they will be in SC2). Thus the default execution classes are likely to be:

Execution Class 2 –
Building structures/components/details

Execution Class 3 –
Bridge structures/components/details

From Annex B BS EN 1090-2

Table B.3 Recommended matrix for determination of execution classes

Consequences Classes		**CC 1 see BS EN 1999 Annex B**		**CC 2 see BS EN 1999 Annex B**		**CC 3 see BS EN 1999 Annex B**	
Service Categories		**SC1**	**SC2**	**SC1**	**SC2**	**SC1**	**SC2**
Production Categories	**PC 1**	EXC 1	EXC 2	EXC 2	EXC 3[a]	EXC 3[a]	EXC 3[a]
	PC 2	**EXC 2**	**EXC 2**	**EXC 2**	**EXC 3**	**EXC 3[a]**	**EXC 4**
[a] EXC 4 Should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.							

The Execution Class determines the requirements for the various activities of the execution given in EN 1090-2. The requirements are summarised in Annex A.3.

Table B.1 Suggested Criteria for service categories

Categories	Criteria
SC1	• Structures & 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 & components designed for fatigue actions from cranes (class S_0)**
SC2	• Structures & components designed for fatigue actions according to EN 1993 (examples Road & railway bridges cranes (class S_1 to S_9) **, structures susceptible to vibrations induced by wind, crowd or rotating machinery) • Structures & components with their connections designed for seismic actions in regions with medium or high seismic activity & in DCM* & DCH*
* DCL, DCM, DCH: Ductility classes according to EN 1988-1 ** For classifications of fatigue actions from cranes. See EN 1991-3 and EN 13001-1	

Table B.2 Suggested Criteria for production categories

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

BS EN 1999 Annex B

Table B.1 Definition of consequences classes

Consequences 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**	Grandstand, public buildings where consequences of failure are high (e.g. a concert hall)
CC2	**Medium** consequence for loss of human life, *or* 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, *or* economic, social or environmental consequences **small or negligible**	Agricultural buildings where people do not normally enter (e.g. storage buildings), greenhouses

Appendix 2

BS EN 1090-3 recommends that the choice of execution class should also depend on the service category (SC)

From BS EN 1090-3 Reference Section 4.1.2 guidance on Execution Classes

From BS EN 1999-1: 2007+A1 2009 Annex A Section A.5 Determination of execution class

1) The recommended procedure for determination of the execution class is the following:

a) Determination of consequences class, expressed in terms of predictable consequences of a failure or collapse of a component, see EN 1990

b) Determination of service category and production category, see Table A.1 and A.2

c) Determination of execution class from the results of the operations a) and b) in accordance with the recommended matrix Table A.3

BS EN 1999-1-1 Table A.3. Required additional information, options to be specified and requirements for execution classes

Consequences Classes		**CC 1**		**CC 2**		**CC 3**	
Service Categories		**SC1**	**SC2**	**SC1**	**SC2**	**SC1**	**SC2**
Production Categories	**PC 1**	**EXC 1**	**EXC 1**	**EXC 2**	**EXC 3**	**EXC 3[a]**	**EXC 3[a]**
	PC 2	**EXC 1**	**EXC 2**	**EXC 2**	**EXC 3**	**EXC 3[a]**	**EXC 4**

[a] EXC 4 Should be applied to special structures or structures with extreme consequences of a structural failure also in the indicated categories as required by national provision

BS EN 1999-1-1 Table A.2 Criteria for production categories

Categories	Criteria
PC1	• Non welded components
PC2	• Welded components

BS EN 1999-1-1 Table A.1 Criteria for service categories

Categories	Criteria
SC1	• Structures subject to quasi static actions [a]
SC2	• Structures subject to repeated actions of such intensity that the inspection regime specified for components subject to fatigue is required [b]

[a] Guidance is given in EN 1999-1-3 whether a component or structure may be regarded as subject to quasi static actions and classified in category SC1.

[b] Service category SC2 should be used for cases not covered by SC1.

BS EN 1999 Annex B

Table B.1 Definition of consequences classes

Consequences 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**	Grandstand, public buildings where consequences of failure are high (e.g. a concert hall)
CC2	**Medium** consequence for loss of human life, *or* 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, *or* economic, social or environmental consequences **small or negligible**	Agricultural buildings where people do not normally enter (e.g. storage buildings), greenhouses

Appendix 3

Technical Knowledge of the Coordination Personnel – Structural Carbon Steels

EXC	Steels (Steel group)	Reference Standards	Thickness (mm)		
			t ≤ 25[a]	25< t ≤ 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, 30	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, 30	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 end plates ≤ 50mm
[b] Column base plates and end plates ≤ 75mm
[c] For steels up to and including S275, level S is sufficient
[d] For steels, N, NL, ML, level S is sufficient

Technical Knowledge of the Coordination Personnel – Structural Carbon Steels

EXC	Steels (Steel group)	Reference Standards	Thickness (mm)		
			t ≤ 25	25< t ≤ 50	t ≥ 50
EXC2	Austenitic (8)	EN 10088-2:2005, Table 3 EN 10088-3:2005, Table 4 EN 10296-2:2005, Table 1 EN 10297-2-:2005, Table 2	B	S	C
	Austenitic-Ferritic (10)	EN 10088-2:2005, Table 4 EN 10088-3:2005, Table 5 EN 10296-2:2005, Table 1 EN 10297-2-:2005, Table 3	S	C	C
EXC3	Austenitic (8)	EN 10088-2:2005, Table 3 EN 10088-3:2005, Table 4 EN 10296-2:2005, Table 1 EN 10297-2-:2005, Table 2	S	C	C
	Austenitic-Ferritic (10)	EN 10088-2:2005, Table 4 EN 10088-3:2005, Table 5 EN 10296-2:2005, Table 1 EN 10297-2-:2005, Table 3	C	C	C
EXC4	All	All	C	C	C

Technical Knowledge of the Coordination Personnel – Aluminium

EXC	Parent Material	Type of Welding Consumables			
		Type 3, Type 4		Type 5	
		Nominal thickness of material in mm		Nominal thickness of material in mm	
		t ≤ 12[a=]	t > 12	t ≤ 12[a=]	t > 12
EXC2	3XXX, 5,XXX	B	S	B	S
	Other			S	
EXC3	3XXX, 5,XXX	S	S	S	C
	Other		C	C	
EXC4	All	C	C	C	C

B = Basic technical knowledge according to EN ISO 14731
S = Specific technical knowledge according to EN ISO 14731
C = Comprehensive technical knowledge according to EN ISO 14731