

Guidance Document

Hot dip galvanizing to EN ISO 1461 and CE marking of structural steelwork to EN 1090

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1 CE Marking and EN 1090 for fabricated steelwork

CE Marking for all construction products, covered by a harmonised European standard or conforming to a European Technical Assessment became mandatory from 1 July 2013. CE Marking for fabricated structural steelwork will come into force one year later – on 1 July 2014. This is a major development for engineers, contractors and steelwork fabricators and it demands careful attention to these new obligations. Sub-contract operations are also affected by the CE marking obligations of the steel fabricator.

CE marking simply demonstrates compliance with the appropriate manufacturing standard for a product. The harmonised standard covering fabricated structural steelwork in EN 1090-1 'Execution of Steel Structures and Aluminium Structures'. For a steel fabricator to demonstrate compliance, they must provide:

- i. a factory production control (FPC) certificate;
- ii. a welding certificate and
- iii. a declaration of performance (DoP).

Items (i) and (ii) are issued by notified body authorised for such certification. Item (iii) is issued by the steel fabricator.

2 Hot Dip Galvanizing and EN 1090

EN 1090-1 and EN 1090-2 include specific requirements, related to surface treatment and durability that have consequences for the specification and use of hot dip galvanizing as a sub-contract activity.

These requirements are not difficult to implement for hot dip galvanizing. The requirements can be summarised as:

- Requirements on the steelwork contractor to prepare the steelwork and its surface to be suitable for hot dip galvanizing to EN ISO 1461 and to follow guidance set out in EN ISO 14713-2.
- Requirements on the galvanizer to galvanize to EN ISO 1461
- Additional requirements for hot dip galvanizing within EN 1090-2.

As for any sub-contract activity, as part of their own FPC, the steel fabricator must have a system in place to ensure that the sub-contract activity (e.g., galvanizing) does not compromise that FPC system (e.g. for traceability of components). All this can be implemented, simply but effectively, through defined procedures put in place between galvanizer and steel fabricator that are part of a normal quality management system (e.g. ISO 9000). Those procedures can be established as an extension of the steelwork contractor's FPC system.

It must be emphasized that there is no legal requirement for the galvanizing process to be certified by a notified body to EN 1090. However, it may be desirable to have some form of 'certification' of the procedures for galvanizing in order to demonstrate adequate control within the fabricator's FPC system and avoid repeated audit and inspection procedures by different steelwork contractors. This document also provides the basis for such 'certification' or other type of system - if it is deemed appropriate. Implementation may also be done within other national schemes that exist for other purposes.

By following the above approach, galvanizing can be easily integrated into the CE marking obligations of the steel fabricator. It can be done simply and without significant additional administrative burdens.

Galvanizing is a factory-controlled process – unlike most other forms of steel corrosion protection. The standard EN ISO 1461 includes requirements for statistical process control of parameters such as coating thickness and additional certification is unnecessarily burdensome. In addition to the simple controls mentioned above, provision of a certificate of conformity to EN ISO 1461 is an adequate basis for the DoP where galvanizing has been specified.

3 Factory Production Control Requirements for the Steelwork Contractor / Fabricator

When a steelwork contractor includes hot dip galvanizing in a contract that is carried out in accordance with EN 1090-2, a 'check list' of requirements associated with the sub-contracting of hot dip galvanizing should be integrated within the initial inspection of the factory production control system.

The 'check list' given in Annex I has been established with reference to the associated requirements in EN 1090-2.

4 Requirements for Galvanizer to Support the Factory Production Control System operated by the Steelwork Contractor

A corresponding 'check list' of requirements to ensure the Galvanizer is competent to support the FPC system operated by the Steelwork Contractor is given in Annex II. The Galvanizer should demonstrate compliance with these requirements through reference to this check list within contract documentation and/or through separate certification of that system.

5 Post Galvanizing Inspection

The majority of the technical guidance required to implement the systems required for CE marking of fabricated steelwork that has been hot dip galvanized exists within EN ISO 14713-2 and in readily-available industry guidance.

EN 1090-2 requires that visual post galvanizing inspection is carried out unless it is otherwise specified. The requirements for assessment of the need for specification of post galvanizing inspection, additional NDT requirements and the procedure for that inspection is not given in EN ISO 14713-2. To support implementation of EN 1090-2 and CE Marking, the scheme and guidance given in Annex III has been established. Other approaches may be agreed between Steelwork Contractor and Galvanizer.

6 EN 1090 - Declaration of Durability

There is potential for confusion with regard to declarations of durability within the 'Declaration of Performance' (DoP).

The requirement for durability in EN 1090-1 refers to the need to establish the durability of the other essential characteristics identified in the DoP. One method to establish that durability is through reference to the application of protective coatings. Importantly, EN 1090-1 clearly states that the DoP does not include any direct method to test or declare durability itself. Instead, the conformity criteria are mainly that (a) the correct corrosion protection specification has been made and (b) the preparation of the steel surface for that protective treatment has been carried out in accordance with Clause 10 of EN 1090-2 (for galvanizing this includes, for example, requirements on the steel fabricator to provide adequate venting and draining of the component).

The associated declaration in the DoP for steelwork that has been hot dip galvanized would be:

Galvanized to EN ISO 1461:2009 (or otherwise agreed specification) + mean coating thickness of 't' microns.

t = the mean coating thickness for the most representative steel thickness as required by Table 3 of EN ISO 1461.

7 EN 1090 - Other Characteristics

Other declarations would normally be made as follows for galvanized steelwork:

- Radioactivity – No Performance Declared (NPD)
- Release of Dangerous Substances - No Performance Declared (NPD)
- Reaction to Fire – 'Material classified A1'

Further Information

Further information on CE Marking of Fabricated Structural Steelwork, including the status of certified steelwork contractors and notified bodies for EN 1090-1 can be found at:

<http://www.steelconstruct.com/site/index.php?o=committees&id=75&ct=2>

ECCS Publication 128/2012 'Guide to the CE Marking of Structural Steelwork' can be obtained from ECCS (www.steelconstruct.com).

The check lists in Annex I and II and are available in Microsoft Word format, on request, from EGGA.

Annexes

Annex I

Factory Production Control Requirements for Steelwork Contractor – Checklist for Initial Inspection and Surveillance

Note – this check list is intended for guidance to Notified Bodies when assessing the Factory Production Control system of a steelwork contractor. It has been developed to augment the 'Check list for FPC Inspection' given in Appendix F to ECCS 'Guide to the CE Marking of Structural Steelwork, 1st Edition, ECCS Technical Report 128,2012'.

Requirement	EN 1090-2 Reference	Comments/References <i>To be completed by Steelwork Contractor</i>	Audit Results <i>To be completed by Notified Body</i>
Specification, Documentation and Training			
1. Relevant standards – EN ISO 1461 / EN ISO 14713-2 are available?	10.1 (c)		<input type="checkbox"/> EN ISO 1461 <input type="checkbox"/> EN ISO 14713-2
2. Employees are familiar with the requirements for design for suitability for hot dip galvanizing according to EN ISO 14713-2	10.1 (c)		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Preparation of Steel Components for Galvanizing			
3. A procedure exists to identify surface preparation requirements for the components to be galvanized?	F.2.2		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
4. A procedure and suitable equipment exists for assessment and introduction of vent and drain holes, including provisions for consultations with galvanizer?	10.5		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
5. A procedure exists to identify the need for sealing of weld gaps with attention to the safety considerations associated with sealing such gaps prior to galvanizing?	10.5 10.6		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
6. A procedure exists to identify cold formed components to be galvanized and agree any additional requirements for procedure qualification	F.6.3		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Inspection and Testing			
7. A procedure exists for the repair of galvanized surfaces that have been removed prior to welding or damaged by the welding process.	10.9		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
8. Training and equipment, including suitable calibration procedures, for coating thickness testing. <i>[Note – this is not normally required when coating thickness measurement is carried out by galvanizer and a certificate of conformity is supplied]</i>	F. 7.2 (b) (3)		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:

Requirement	EN 1090-2 Reference	Comments/References <i>To be completed by Steelwork Contractor</i>	Audit Results <i>To be completed by Notified Body</i>
9. A procedure exists for checking surface preparation of the components to be galvanized meets EN ISO 1461? <i>[Note – EN ISO 8501 is not relevant for surfaces to be galvanized. Refer to EN ISO 1461]</i>	F.7.2 (a)		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
10. A procedure exists to determine the need for post galvanizing inspection and, if appropriate, define the procedures and responsibility for such inspection?	F.7.4		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Traceability			
11. A procedure exists to establish a system of traceability of batches of components to be galvanized? <i>[Note – for EXC3 and EXC 4 only]</i>	5.2		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Tolerances			
12. A procedure exists to take account of the thickness of the zinc coating on mating surfaces and to agree any additional requirements on tolerances with galvanizer?	4.1.4		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:

Annex II

Requirements for Galvanizer to Support the FPC System Operated by the Steelwork Contractor – Checklist for Galvanizer

Note – this check list is intended for galvanizers wishing to support the FPC system of the steelwork contractor. It can also be suitable as a checklist for certification of that activity.

Requirement	EN 1090-2 Reference	To be completed by Galvanizer
Quality and Standards		
1. A quality management system is in place to: ISO 9001:2008 or Equivalent management system		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
2. Galvanizing is carried out to EN ISO 1461 and a Certificate of Conformity is available on request	F.6.3	<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Traceability		
3. A suitable marking, identification and tracking system is in place to meet the traceability requirements defined by Execution Class (EXC) within EN 1090-2	5.2	<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Tolerances		
4. A system to visually assess signs of distortion, beyond agreed tolerances, and communicate any variations to Steelwork Contractor is in place		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Cold formed components		
5. A procedure qualification for galvanizing of cold-formed components is in place, where specified	F.6.3	<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:
Inspection and testing		
6. Records of processing of the components (date, batch, main process parameters) are kept for a minimum of 5 years, with additional reference to the requirements for traceability defined by Execution Class of EN 1090.		<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks:

Requirement	EN 1090-2 Reference	To be completed by Galvanizer
7. Personnel are suitably trained to carry out post-galvanizing inspection at the level as agreed with Steelwork Contractor – <i>only required when inspection is carried out by galvanizer</i>	F7.4	<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks/Level:
8. Equipment is available to carry out post-galvanizing inspection at the level as agreed with Steelwork Contractor – <i>only required when inspection is carried out by galvanizer</i>	F7.4	<input type="checkbox"/> Yes <input type="checkbox"/> No Remarks/Level:

Annex III

Post Galvanizing Inspection

Any requirement for post galvanizing inspection and/or certificate of compliance with EN ISO 1461 should be agreed at the time of order (as set out in EN 1090-2: 2011, F7.4). EN 1090-2 requires that post galvanizing inspection is carried out unless it is otherwise agreed.

Visual inspection should be applied unless otherwise agreed between steelwork contractor and galvanizer. Inspections should be carried out by suitably qualified personnel.

Where there is a particularly critical or susceptible detail or when the consequences of structural failure of a single member is sufficiently high, the Engineer should consider whether the risk of LMAC is such as to warrant any post-galvanizing inspection in addition to the visual inspection. Any additional inspection required by the Engineer should form part of the Project Specification.

The Steelwork Contractor must ensure that any agreed post galvanizing inspection is completed, although it may be delegated to a subcontractor, the galvanizer or some other competent agency. The detailed inspection regime on the post-galvanized structure should be as detailed in the Project Specification.

The recommended inspection regime, which should take place as soon as possible after galvanizing, is shown in table 1. As a minimum, visual inspection of all accessible surfaces is recommended. This may be followed by a more detailed inspection using non-destructive testing if cracks are identified during the visual inspection.

The choice of inspection regime should be made with reference to Figure 1.

The areas to be visually inspected should be defined by the Engineer taking into account the type of structure and the

criticality of the members. Particular attention should be paid to inspecting likely crack initiation sites such as welds, corners, gas-cut edges, holes etc.

Consideration should be given in the quality plan, to critical or sensitive areas of the fabrication that might be subject to higher levels of post-galvanizing inspection in the event that defects are found. This should be specified by the Engineer in the Project Specification.

Visual inspection is very effective for identification of significant cracking but for smaller cracks that cannot be detected by visual inspection, NDT systems are required. The use of additional NDT would not normally be considered unless there is evidence of a susceptibility to cracking and then it should be targeted at the areas where cracks have been identified.

The most suitable NDT techniques are magnetic flux tests (MT) according to EN ISO 9934-1 to 3 that take account of:

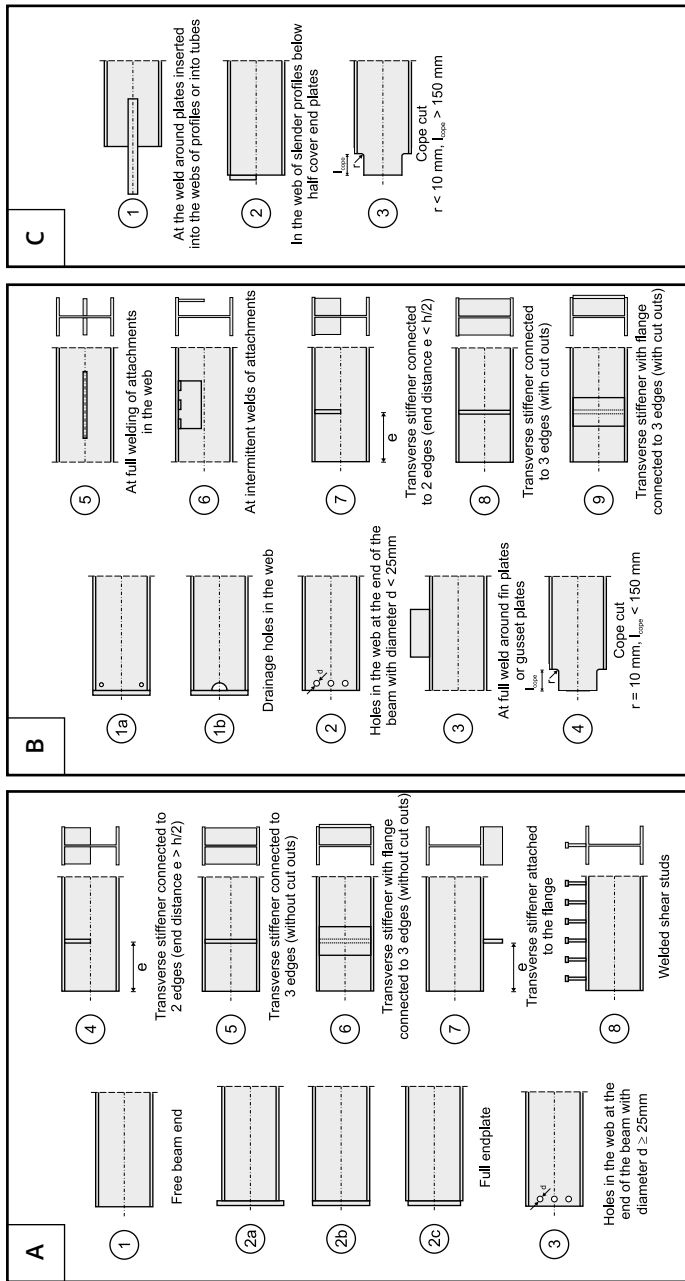
- The reduced sensitivity from coat thicknesses $t_{zn} \geq 50 \mu\text{m}$ (Section 7, EN ISO 9934-1)
- Limited accessibility in the area of spandrels from web, flange and endplates.

Satisfactory MT-Testing, for typical hot dip galvanized coating thicknesses as normally observed on structural steelwork, can be achieved by magnetization with electric flux, magnetic yoke or by hand-magnets. A sufficient magnetization time of 6 s and a subsequent post magnetization time of 6 s would provide sufficient time for the formation of indications. The magnetization should be checked by measuring the tangential magnetic field strength as closely as possible at the surface on the basis of the Hall-effect, which should attain a value of 4 kA/m (40 A/cm). The documentation of the tests should comply with the requirements in EN ISO 9934-1.

Table 1. Post-Galvanizing Inspection

Post Galvanizing Inspection Reference	Level of Inspection
Level 1	Visual inspection of all accessible surfaces of components and joints. The inspector should be suitably qualified and should be familiar with the fabrication details and possible crack initiation sites. Inspection records should be produced and made available to the Engineer when requested. Any further defects or indications shall be reported immediately and further inspection (NDT) used to verify the report. If cracking is confirmed then an inspection schedule shall be developed for all steelwork to ensure that other members are free of cracks.
Level 2	Non-destructive testing (NDT) generally on areas where defects have been found through visual inspection or other areas identified by the Engineer either in the Project Specification or noted on drawings.
Level 3	Systematic non-destructive testing (NDT) for areas identified by the Engineer either in the Project Specification or noted on drawings.

Selection of Detail Class



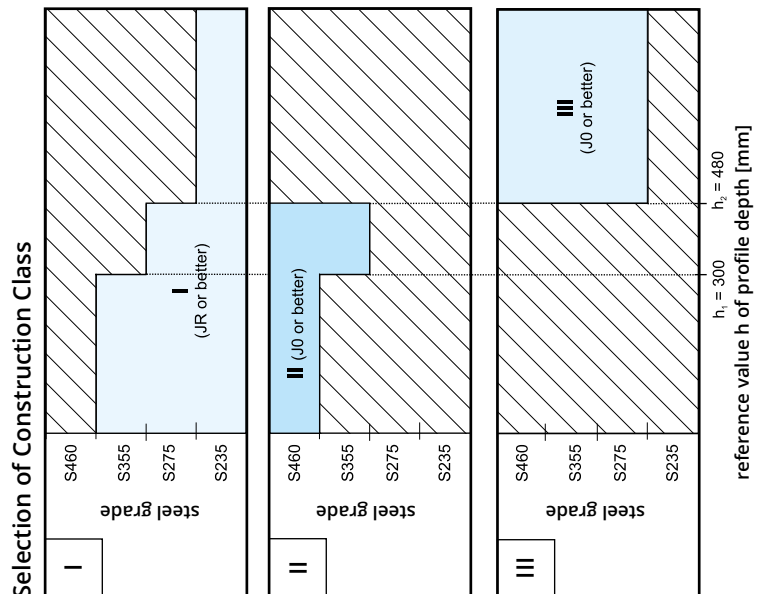
Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary
Inspection Zone 2 in addition to visual inspection spot checks using the MT-method are necessary	Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary
Inspection Zone 3 in addition to visual inspection a systematic check of steel components using the MT-method	Inspection Zone 2 in addition to visual inspection spot checks using the MT-method are necessary	Inspection Zone 1 only visual inspections are necessary	Inspection Zone 1 only visual inspections are necessary

Figure 1 – Guidance on selection of post-galvanizing inspection requirements

The designer or fabricator should classify the prefabricated steel component to be zinc coated, according to the strain requirement during dipping into:

- Construction Class I, II or III (related to profile depth, material strength and toughness of material).
- Detail Class A, B or C (related to peak values of local strain requirements)

For complex prefabricated structural components, the 'Detail Classification' may be performed considering all details of connection by using the class for the most onerous detail as representative for the whole steel component.



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