BRITISH STANDARD

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Industrial application of powder organic coatings to hot dip galvanized or sherardized steel articles [duplex systems] — Specifications, recommendations and guidelines

ICS 25.220.60

National foreword

This British Standard is the UK implementation of EN 15773:2009.

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Industrial application of powder organic coatings to hot dip galvanized or sherardized steel articles [duplex systems] - Specifications, recommendations and guidelines

Application industrielle de revêtements en poudre organiques à des produits en acier galvanisés à chaud et shérardisés [systèmes duplex] - Spécifications, recommandations et lignes directrices

Industrielle Pulverbeschichtung von feuerverzinkten und sherardisierten Gegenständen aus Stahl [Duplex-Systeme] - Spezifikationen, Empfehlungen und Leitlinien

This European Standard was approved by CEN on 20 May 2009.

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Contents

Page

Figures

Tables

Foreword

This document (EN 15773:2009) has been prepared by Technical Committee CEN/TC 139 “Paints and varnishes”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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Introduction

In order to achieve a duplex system which satisfies the many varied aesthetic and performance requirements currently in existence in the marketplace, the following aspects of the supply and application of the systems should be controllable:

— fabrication and composition of the material (Clause 5);

— the zinc coating (Clause 6);

— surface smoothing for coating (Clause 6);

— environmental conditions during storage, transport and application (Clause 6);

— the pre-treatment of the zinc surface (Clause 7);

— instructions provided by chemical pre-treatment suppliers (Clause 7), powder manufacturers (Clause 8);

— the organic coating system (Clause 8);

— packaging, storage and movement of finished products (Clause 9);

— installation (Clause 10);

— inspection (Clause 11).

This European Standard does not incorporate the application of paint coatings according to EN ISO 12944 (parts 1 to 8) [1] when paint systems are specified. This European Standard incorporates the application of coating powders according to EN 13438 when powder coatings are specified.

Table 1 shows the relationship between this European Standard, EN 13438 and other standards relating to zinc coated articles.

Table 1 — Standards for powder organic coatings and hot dip galvanized steel or sherardized steel

Galvanizing or sherardizing	Powder organic coatings for galvanized or sherardized steel products	Communications and quality issues surrounding supply of duplex coated articles
EN ISO 1461 EN 10240 EN 10326 EN 10327 EN 13811	EN 13438 or specific product specification	**EN 15773**
Good communications in place and agreements made between galvanizer or sherardizer and client regarding general quality requirements in relation to zinc coating. NOTE prEN ISO 14713-2 and -3 also provide useful information on design for galvanizing and sherardizing respectively.	**Good communications in place and agreements made between the client and the company applying the powder organic coating regarding general quality requirements of the powder organic coating.**	**Good communications in place and agreements made between client, galvanizer or sherardizer and applicator of the powder organic coating regarding quality requirements for duplex systems in relation to quality of zinc coating, the pre-treatment and powder organic coating.**

1 Scope

This European Standard specifies the agreements to be made between the client, the galvanizer / sherardizer, the chemical suppliers and the applicators of the pre-treatment and the powder organic coating systems (if they are not one and the same). It also specifies the quality of the galvanized or sherardized articles to which the powder organic coatings are to be applied and for the pre-treatment and powder organic coatings intended for application to the galvanized or sherardized articles.

This standard applies to the application of hot dip galvanized, sherardized and powder organic coatings by controlled industrial processes to articles consisting of or manufactured from steel. The standard applies to hot dip galvanized products, galvanized in accordance with EN ISO 1461 and EN 10240 or products sherardized in accordance with EN 13811, as well as parts of these products manufactured from continuously galvanized sheet and strip galvanized in accordance with EN 10326 or EN 10327, which, after the galvanizing and/or assembly, or sherardizing, will have a powder organic coating system applied. This standard also applies to products which have been hot dip galvanized or sherardized according to specific product standards to which powder organic systems are applied.

This standard might also be useful when supplying other organic coating systems (excluding wet paint systems).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10021, *General technical delivery conditions for steel products*

EN 10130, *Cold rolled low carbon steel flat products for cold forming - Technical delivery conditions*

EN 10326, *Continuously hot-dip coated strip and sheet of structural steels — Technical delivery conditions*

EN 10327, *Continuously hot-dip coated strip and sheet of low carbon steels for cold forming — Technical delivery conditions*

EN 10163-1, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 1: General requirements*

EN 10163-2, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 2: Plate and wide flats*

EN 10163-3, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 3: Sections*

EN 10221, *Surface quality classes for hot-rolled bars and rods — Technical delivery conditions*

EN 10240, *Internal and/or external protective coatings for steel tubes — Specification for hot dip galvanized coatings applied in automatic plants*

EN 13438, *Paints and varnishes — Powder organic coatings for galvanized or sherardized steel products for construction purposes*

EN 13811, *Sherardizing — Zinc diffusion coatings on ferrous products — Specification*

EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods (ISO 1461:1999)*

EN ISO 5817*, Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003, corrected version:2005, including Technical Corrigendum 1:2006)*

prEN ISO 14713-1, *Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Zinc coatings — Part 1: General principles of design and corrosion resistance (ISO/DIS 14713-1:2008)*

prEN ISO 14713-2, *Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Zinc coatings — Part 2: Hot dip galvanizing (ISO/DIS 14713-2:2008)*

prEN ISO 14713-3, *Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Zinc coatings — Part 3: Sherardizing (ISO/DIS 14713-3:2008)*

ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
applicator
company that applies the powder organic coating

3.2
controlled industrial process
controllable and reproducible process, executed in steps under controlled conditions

NOTE Often subject to a degree of automation, carried out in industrial buildings or mobile installations.

3.3
surface smoothing of the product
reduction, usually by means of mechanical finishing, of roughness associated with the galvanized or sherardized surface such that when the galvanized or sherardized surface is pre-treated and coated with the powder organic coating system, no protrusions penetrate through the organic coating

3.4
duplex system
organic thermosetting or thermoplastic powder and hot dip galvanized or sherardized zinc coatings on steel products

3.5
designer
company / individual responsible for the design of a structure or product that will be finished with a duplex system

3.6
client
company / individual that orders the duplex system

3.7
specifier
company / individual that specifies the duplex system

3.8
sherardizer
company that applies the zinc coating by the sherardizing process

3.9
galvanizer
company that applies the zinc coating by the hot dip galvanizing process

3.10
hand dry products
products free of rain and condensation water in pores and on the surface

3.11
fabricator
company / individual manufacturing steel products that will be finished with a duplex system

3.12
powder manufacturer
company / individual producing the organic coating powder to be applied onto the galvanized or sherardized steel substrates to complete the duplex systems

3.13
transporter
company(ies) or individual(s) responsible for transportation of the hot dip galvanized or sherardized steelwork to the powder coating applicator and / or the transportation of the finished (duplex coated) work to site

3.14
installation
fitting of duplex coated articles on site

3.15
pre-treatment chemical supplier
company(ies) or individual(s) producing the pre-treatment chemicals to be used within the powder coating process

4 Ordering

4.1 General

The client shall make sure that all of the parties involved are notified that a duplex system will be applied. This requires good communication between the client, the steel purchaser, the fabricator, the galvanizer or sherardizer, and the companies applying the pre-treatment and the powder coating.

Table 2 outlines the phases of the supply process, the requirements for communications between the parties involved at different supply stages and the requirements which apply to the various phases of the supply process.

Table 2 — Duplex systems: supply phases, essential communication links between parties involved and appropriate specifications / further guidance reference sources

Supply phase	Essential communication links between parties involved	Requirements / guidance
Design	Designer Client	Clause 5 - prEN ISO 14713-2 - prEN ISO 14713-3 - EN ISO 1461 - EN 13811
Order	Client Fabricator Builder Construction company Galvanizer / sherardizer Powder manufacturer Pre-treatment chemical supplier Applicator	Clause 4 - EN 10021 - EN 10130 - EN ISO 1461 - EN 10326 - EN 10327 - EN 13811 - EN 13438
Fabrication	Client Fabricator Construction company	Clause 5 - EN 10021 - EN 10163-1, -2 and -3 - EN 10221 - EN ISO 1461 - EN ISO 5817 - prEN ISO 14713-2 - prEN ISO 14713-3
Hot dip galvanizing / sherardizing	Client Galvanizer / sherardizer	Clause 6 - EN ISO 1461 - EN 10240 - EN 13811 - prEN ISO 14713-2 - prEN ISO 14713-3
Transport and storage of galvanized or sherardized articles	Client Galvanizer / sherardizer Transporter / applicator	Clause 6.3
Pre-treatment	Galvanizer / sherardizer Chemical supplier and applicator	Clause 7 - EN 13438
Organic coating	Client Galvanizer / sherardizer Applicator(s)	Clause 6.3 and Clause 8 - EN 13438 - EN ISO 1461 - EN 10240 - EN 13811
Inspection	Client Applicator and Galvanizer / sherardizer	Clause 11 - EN 13438 - EN ISO 1461 - EN 13811 - ISO 9223

Table 2 *(continued)*

Supply phase	Essential communication links between parties involved	Requirements / guidance
Transport and storage of duplex coated articles in transit and on site	Client Applicator Transporter	Clauses 9 and 10 and - EN 13438
Installation	Client Construction company	Clause 8.3 and Clauses 9 and 10

4.2 Request for quotation

In its request for quotation to the galvanizer or the sherardizer, the client shall state to all relevant parties (see Table 1) that the hot dip galvanized or sherardized products shall be subsequently provided with a powder coating. In the event that the client has not submitted a request for quotation, the client shall state, upon delivery of the products to be hot dip galvanized or sherardized that a powder organic coating system is subsequently to be applied to these products.

Requests for quotation shall also include the following:

a) the class or classes of coating powders applied to the galvanized or sherardized steelwork – i.e. Class 1 or Class 2 of EN 13438;

b) the size and weight of individual items being sent for processing (including dimensions and steel thickness);

c) the coating powder colour and the gloss level required;

NOTE This information is important to ensure consistency of appearance of the duplex coated articles with other work that might have been similarly specified for supply to site.

d) the location of the site where the work is to be installed;

e) the product standard required by the client for the duplex system.

4.3 Information provision

The information provided by the client to the galvanizer shall be in accordance with EN ISO 1461 and Annex A.

The information provided by the client to the sherardizer shall be in accordance with EN 13811 and Annex A.

The client shall inform the applicator of the relevant specifications (and / or parts thereof) to be applied with regard to corrosion testing on the finished articles.

The client shall inform the applicator of the corrosion category the products to be treated will be exposed to, in accordance with ISO 9223 or prEN ISO 14713-1.

The client shall inform the purchaser of the steel that the steel will have a duplex coating applied and that the duplex system will include hot dip galvanizing.

NOTE See 5.1, Annex B and prEN 14713-2 for guidance on the influence of steel chemistry on surface characteristics of the galvanized article.

The client shall inform the applicator whether in the specification protective coatings are prescribed. The client shall make such specifications available for the applicator before or at the time of the request for quotation.

The client shall inform all parties about the intended use of the product.

4.4 Delivery of product prepared for coating

The responsibilities for provision of work with the required surface condition (immediately prior to pre-treatment for application of a powder organic coating) shall be agreed between the client and the galvanizer / sherardizer and applicator.

NOTE Correct selection of the steel is important to enable provision of the required surface condition of the galvanized work (see Clause 5, Annex A and Annex B).

5 Fabrication

5.1 Surface condition of the steel

The surface condition of the steel article sent for galvanizing or sherardizing (and then for application of powder coating) has a significant effect on the surface quality of the finished product. In order to achieve optimum results from the application of duplex systems, a number of characteristics of the steel substrates require attention at the earliest stages of the fabrication process (see 5.2 to 5.4 for requirements and Annex A).

NOTE For guidance on design and fabrication for galvanizing, see prEN ISO 14713-2. For Guidance on design and fabrication for sherardizing, see prEN ISO 14713-3.

5.2 Nature and composition of the raw material

The steel shall be free of any laps and irregularities such as rolling blisters and rolling faults, in accordance with the standard terms and conditions of delivery in relation to the surface quality of steel (e.g. EN 10021, EN 10163-1, EN 10163-2, EN 10163-3 and EN 10221).

5.3 Welds, markings, labels

The fabricator should ensure that all welds are sufficiently robust to withstand the stresses associated with the hot dip galvanizing and powder coating operations. Welds shall be free of welding spatter, welding slag and welding oxides. Welding spatter, welding slag and welding oxides shall be removed by appropriate methods such as blasting, grinding, sanding, de-scaling and/or brushing.

NOTE 1 Welds might appear raised after galvanizing unless weld filler metal is used that matches the parent steel.

Unless otherwise agreed, welds used in the fabrication of the article shall be smooth and continuous and shall conform to Level D in accordance with EN ISO 5817.

Any welding spray applied shall be free of silicones and be water soluble.

NOTE 2 Residual welding spray should be removable using the standard pre-treatment used at the galvanizing plant.

The construction parts to be delivered to the galvanizing / sherardizing plant shall be suitable for that process and in particular be free of markings applied in paint, varnish, stickers and/or inks.

NOTE 3 For further information regarding galvanizing, see EN ISO 1461 and prEN ISO 14713-2 and for further information regarding sherardizing, see EN 13811 and prEN ISO 14713-3.

5.4 Deviations of edges and sides

In order to prevent mechanical damage to the zinc coating and the possible development of insufficient coating of the edges and sides with powder organic coating systems, all trimming, cutting, punching, drilling

and other operations likely to damage the article shall be carried out prior to galvanizing unless repairs are carried out in accordance with guidance set out by the powder manufacturer (see also 6.2). Burrs at holes or along edges shall be removed prior to galvanizing.

NOTE 1 Any trimming, punching, sawing, cutting (including laser cutting, plasma cutting or similar methods which produce very sharp edges) and welding edges shall be chamfered to at least 1 mm or, preferably, rounded to a minimum of 2 mm.

NOTE 2 Perforated sheet and stretched steel does not as a rule fulfil this requirement. The capability to protect the duplex system will therefore be reduced.

6 Zinc coating and zinc surface

6.1 Cooling

Unless otherwise agreed the hot dip galvanized products, after hot dip galvanizing, shall be air-cooled. See Annex C.

NOTE Air-cooling is part of the sherardized process.

6.2 Quality and inspection of the zinc coating

The requirements for the quality and inspection of the zinc coating depend on the type of zinc coating process used, for example:

a) zinc coatings of hot dip galvanized products in accordance with EN ISO 1461;

b) zinc coatings for steel tubes, applied in automatic installations in accordance with EN 10240;

c) zinc coatings on steel sheet or steel strip products in accordance with EN 10326 or EN 10327;

d) sherardized coatings in accordance with EN 13811.

Other specific product standards not listed above might include their own requirements in this respect.

Where hot-dip galvanized or sherardized products have been prepared for application of powder organic coatings, the zinc surface shall, in all cases, be free from sharp points or build up of zinc that would contravene the associated supply standard. Small, sharp projections caused by steel splinters that have been rolled in (see 5.1) and other protrusions (see 3.3) shall be smoothed off from surfaces in view, for example with an abrasive cloth. The removal of zinc when preparing for organic coating shall be minimized.

A slight (sloping) thickening of the zinc coating shall be accepted provided this does not interfere with and is not damaging to the use of the product as indicated in advance by the client. Surface roughness (inherent to the galvanizing process) shall not be considered detrimental.

Small uncoated or damaged areas – not more than 10 cm^2 and maximum 0,5 % of the surface area of the article - shall be renovated in accordance with EN ISO 1461. The galvanizer shall inform the client and the applicator in advance, in order to ensure that the method of renovation used is compatible with the organic coating system to be applied and the powder coating process used to apply the system.

NOTE Renovation should be made by application of a thermal zinc spray in accordance with EN ISO 2063 or use of low melting point zinc-alloy-based filler.

When agreed between client and applicator, the requirement in EN ISO 1461 for layer thickness on renovated areas (30 µm more than the general local requirement for layer thickness) may be ignored.

Uncoated and/or damaged areas in the zinc coating on products that have been galvanized in accordance with EN 10240 or sherardized in accordance with EN 13811 are not allowed (see Annex B).

6.3 Storage, packaging and transport after galvanizing or sherardizing

NOTE 1 After cooling, the galvanized or sherardized products should be stored in a dry area. In the event of storage outside, sufficient air circulation between the products should be ensured in order to avoid the development of unwanted zinc corrosion products.

NOTE 2 Sometimes galvanized articles are passivated by the galvanizer to prevent the development of these corrosion products. Sherardized articles are normally passivated by the sherardizer.

Bare steel bands shall not be used for bundling. If the products are to be transported to the applicator they shall be kept dry.

Sherardized products shall be kept free from oil and grease and transported packed.

Before starting any mechanical pre-treatment hand dry products shall be stored in a dry, well-ventilated room.

NOTE 3 It is recommended to store the hand dry products overnight (minimum 8 h) (see Annex C).

6.4 Acceptance check

Where required by the client, the work shall be subject to an acceptance check against the requirements of 4.3.

7 Pre-treatment of the zinc surface

7.1 General

The pre-treatment shall remove any significant contamination on the zinc surface, including grease, dirt and zinc corrosion products, which could otherwise undermine the adhesion and corrosion resistance of the subsequently applied organic coating system. Methods for the pre-treatment of the zinc surface include:

a) chemical treatment; or

b) mechanical treatment; or

c) mechanical treatment followed by chemical treatment.

See Annex C for additional guidance.

NOTE Sherardized articles do not require mechanical pre-treatment. A chemical pre-treatment improves the zinc corrosion protection.

7.2 Chemical pre-treatment

Chemical pre-treatment shall be carried out in accordance with the instructions of the pre-treatment chemical supplier. The applicator shall remove any passivated surface prior to further processing.

7.3 Mechanical pre-treatment (sweep blasting)

Mechanical pre-treatment shall always be carried out in such a way that any significant impurities and corrosion products are removed from the zinc surface (see 7.1). The sweep blasting causes a slight roughening of the surface, which promotes adhesion. The sweep blasting shall be carried out evenly with regard to movement and time, using a fine-grained, sharp, inert, non-metallic or stainless steel sweep blasting

product, under low blasting (air) pressure. Alternative methods are acceptable provided their suitability can be demonstrated. The sweep blasted surface shall have an even matt finish. The following conditions shall be applicable to the sweep blasting, unless alternative process capability can be demonstrated:

a) grain size of the blasting product: up to 0,5 mm;

b) blasting (air) pressure: up to 0,3 MPa;

c) blasting distance (*X*) (see Figure 1): at least 60 cm;

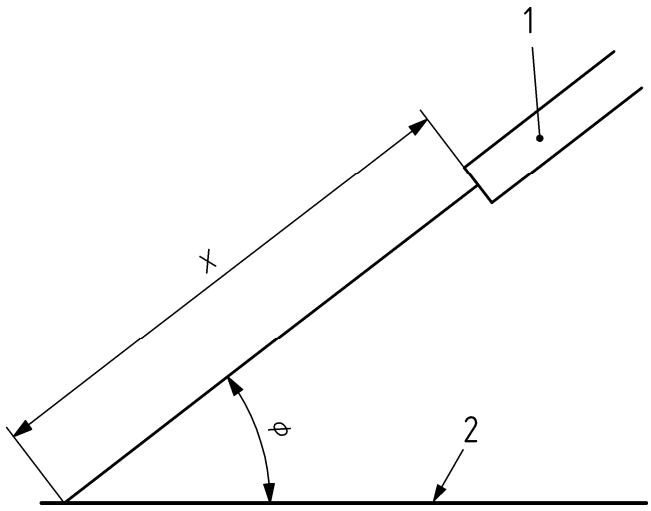
d) blasting angle Φ (the incident angle of the blasting product relative to the surface of the product being blasted, see Figure 1): 50° to 70°.

NOTE 1 Some coating systems can be applied directly to the sweep blasted surface. Often combinations of mechanical and chemical pre-treatments are used.

In the event that some defects (not larger than 10 cm^2 and maximum 0,5 % of the surface area) in the zinc coating have occurred, these shall be renovated in accordance with the relevant zinc coating supply standard.

NOTE 2 Renovation of damaged zinc coatings will normally incorporate a receding, feathering back, of the damaged and loose zinc coating edges to areas of the coating which are adherent.

NOTE 3 For sherardized surfaces, mechanical treatment is not required (see Annex D).



Key

1 Nozzle
2 Work piece
X Distance of the nozzle from the surface
ϕ Blasting angle

Figure 1 — Sweep blasting setup

8 Powder organic coating layers

8.1 General

In order to obtain a duplex system, one of the powder organic coatings referred to in section 8.2 shall be applied to pre-treated hot dip galvanized / sherardized steel under the following conditions:

a) Unless otherwise agreed, the following requirements shall apply. When the organic coating powder cannot be applied immediately after the chemical or mechanical pre-treatment, blasted hot dip galvanized steel shall be stored in a conditioned room. The organic coating powder shall be applied within 12 h after blasting. When relative humidity RH ≥ 70 %, the time between blasting and the application of the organic coating powder is limited to 3 h, because otherwise zinc corrosion product might be formed. The time limit prescribed by the chemicals supplier should be adhered to for chemically pre-treated zinc coatings.

b) The powder organic coating shall be chemically suitable for application to the pre-treated zinc coating.

c) Application shall follow the recommendations of the powder manufacturer.

d) During the powder coating process the object surface temperature shall be below 225 °C for hot dip galvanized products, in order to avoid changes to the structure of the zinc coating unless a particular time and temperature exposure regime has been specified and process capability can be demonstrated for that regime. The curing temperature shall be below 260 °C for sherardized products.

8.2 Specification of powder organic coating

The client shall take into account the environment into which the duplex coated article is to be exposed and the required life to first maintenance (of the organic coating) for the application when selecting the organic coating for application to the galvanized or sherardized articles. The selected organic coating shall be compatible with a zinc-based surface.

8.3 Repair of the coating system

Repair of the coating system shall be carried out in accordance with the instructions provided by the supplier of the organic coating powder.

9 Packaging, storage and further movement of finished products

The responsibility for adequate protection of the galvanized or sherardized and powder coated article shall be clearly identified by the client at the ordering stage.

NOTE Care should be exercised to avoid damage to the product both before and after the application of the organic powder coating. Protection against damage to the duplex coated article is vital at all stages of storage handling, transport and erection on site.

10 Installation

Care shall be taken in the installation of the duplex coated articles to avoid damage to the products. Suitable fittings shall be used when erecting the articles, such as stainless steel fittings with nylon washers. Installation shall take place avoiding tearing, scratching or biting into the duplex coated articles.

11 Inspection of finished products

Where no specific product standards have been cited for provision of the duplex coated articles, then the provisions and non-destructive tests set out in of EN 13438 shall apply.

Where specific product standards have been cited, then the provisions and non-destructive tests associated with the cited product standards shall apply in precedence over EN 13438.

12 Health and Safety

Appropriate measures shall be in place to adequately protect both workers' health and the environment during all stages of supply.

Annex A
(normative)

Considerations when designing and fabricating items for galvanizing or sherardizing and subsequent application of powder organic coatings

Guidance on design of steel articles for hot dip galvanizing as set out in prEN 14713-2 shall be taken into account when designing articles for application of a duplex system involving hot dip galvanizing (to EN ISO 1461).

NOTE Steel surface laps and other rolling defects can interfere with the development of a smooth galvanized substrate prior to application of the powder organic coating. These imperfections might not be visible until after galvanizing. When present, they can cause severe problems of durability and aesthetics.

Guidance on design of steel articles for sherardizing as set out in prEN 14713-3 shall be taken into account when designing articles for application of a duplex system involving sherardizing (to EN 13811).

Annex B
(informative)

Guidance on the influence of steel surface chemistry on the surface condition and pre-treatment of galvanized or sherardized articles prior to application of powder organic coatings

The surface chemistry of the substrate steel will have a marked effect on the composition and morphology of the coating formed when work is hot dip galvanized. Steels of certain compositions can develop dull dark grey coatings (see ref classes C and D in Table B.1 below). These ‘more reactive steels’ tend to fall into the following categories (see also prEN ISO 14713-2) and, where possible, should not be selected for hot dip galvanizing.

Preparation for application of powder organic coatings to these galvanized coatings on these ‘more reactive steels’ needs greater attention. These surfaces will affect the aesthetics of the finished product and might give less well prepared surfaces. Poorly prepared surfaces can lead to the development of pores and blisters in the organic coating.

When steel of a reactive composition has been used in manufacture of the work, the risk of lower quality of organic coating should rest with the client unless the defects in the coating are attributable to faulty processing. When galvanizing reactive steels, rougher coatings can be produced that can show an increased tendency to flake under mechanical stress.

The effect of silicon and phosphorus content in steel doesn’t apply to sherardized products.

Table B.1 — Coating characteristics related to steel composition

Ref Class	Typical Coating characteristics	Typical levels of reactive elements	Additional Information
A	Coating has shiny appearance with finer texture.	≤ 0,04 % Si and < 0,02 % P	See NOTE.
B	Coating structure includes outer zinc layer.	0,14 % to 0,25 % Si	Fe-Zn alloy may extend through to coating surface. Coating thickness increases with increasing silicon content. Other elements might also affect steel reactivity. In particular, phosphorous levels greater than 0,035 % will give increased reactivity.
C	Coating has darker appearance with coarser texture.	> 0,04 % to ≤ 0,14 % Si	Excessively thick coatings might be formed.
D	Iron-zinc alloys dominate coating structure and often extend to coating surface, with reduced resistance to handling damage.	> 0,25 % Si	Coating thickness increases with increasing silicon content.
NOTE Steels with compositions satisfying the formula Si + 2,5 P ≤ 0,09 % are also expected to exhibit these characteristics. For cold rolled steels, these characteristics are expected to be observed when steel composition satisfies the formula Si + 2,5 P ≤ 0,04 %.			

Annex C
(informative)

Guidance on treatment of hot dip galvanized or sherardized articles prior to pre-treatment for application of powder organic coatings

C.1 Cooling

Quenching of articles in water is not recommended (unless alternative process capability can be demonstrated) as in the event of thickened areas of zinc-iron alloy coatings this can cause brittleness of the coating and can also cause problems in relation to the adhesion of duplex coating system at a later stage.

NOTE 1 Where quenching takes place at a galvanizer's works, this can include a passivation treatment.

NOTE 2 The requirements for cooling of the product do not apply to sherardized products, because air-cooling is part of the sherardizing process.

C.2 Prominent welds and sharp points on the zinc coating

Prominent welds should not be ground down unless damage to the neighbouring zinc coating can be avoided.

Hard zinc and sharp points do not exist on sherardized products.

C.3 Avoidance of condensation during storage, packaging and transport after galvanizing or sherardizing

Moisture and condensation promote the formation of zinc corrosion products that can have a negative effect on the quality of the duplex system. These corrosion products might be difficult to remove during pre-treatment.

The applicator should take temperature differences between the storeroom and the workshop into account when preparing the articles for coating. Condensation might occur on a cold product brought into a warmer room.

NOTE Sherardized articles are normally passivated.

Annex D
(informative)

Guidance on pre-treatment of hot dip galvanized or sherardized articles prior to the application of powder organic coatings

D.1 General

The choice of pre-treatment depends on the volume, weight, surface area and number of the products, the shape of the parts, the steel and zinc layer thickness, the type and layer thickness of the organic coating to be applied, the end use of the work, and possible further specifications of the client and/or supplier. For the execution and the quality requirements of the pre-treatment the EN ISO 8504 series [2] can be used.

Sherardized products do not require any mechanical treatment because the surface of the zinc diffusion coating has a certain natural roughness and the product will be phosphated or chromated after sherardizing, unless the client determines differently (see EN 13811). If the client determines differently, an indication should be given regarding consequences for pre-treatment of the work.

Appropriate health and safety measures to protect workers and the environment should be in place prior to any pre-treatment process being undertaken.

D.2 Mechanical pre-treatment

It is essential that the air used for blasting is free of oil and water.

A maximum of 10 µm should be removed by the blasting action. When blasting continuously galvanized steelwork care should be taken to avoid removal of excessive amounts of zinc coating because the zinc coating on this type of steelwork is much thinner than the zinc coating normally found on after fabrication galvanized steelwork.

After sweep blasting a chemical pre-treatment can be applied, but this is not standard procedure.

Bibliography

[1] EN ISO 12944 (all parts), *Paints and varnishes — Corrosion protection of steel structures by protective paint systems (ISO 12944:1998)*

[2] EN ISO 8504 (all parts), *Preparation of steel substrates before application of paints and related products — Surface preparation methods (ISO 8504:2000)*

[3] EN ISO 2063, *Thermal spraying — Metallic and other inorganic coatings — Zinc, aluminium and their alloys (ISO 2063:2005)*

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