Federal Ministry for Digital and Transport

Additional technical terms of contract and guidelines for Civil Engineering Works

ZTV-ING

Part 4

Steel Construction, Composite Steel Construction

Section 3

Corrosion Protection of Steel Structures

Notified in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council dated 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of regulations on Information Society services (OJ L 241 dated 17 September 2015, p. 1).

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1 General information

1.1 Basic information

(1) Part 4(3) applies only in conjunction with Part 1 General information.

(2) The following apply: DIN EN ISO 12944, DIN 55634, the technical delivery terms for coatings for the corrosion protection of steel structures (TL KOR-Stahlbauten) and the technical test specifications for coatings for the corrosion protection of steel structures (TP KOR-Stahlbauten) as well as the technical delivery terms and technical test specifications for ballast trough coatings (sheet 84) (TL 889.0084).

(3) These regulations apply mutatis mutandis for the coating of weather-resistant steel (WT steel) in partial areas.

1.2 Definitions

(1) DIN EN ISO 12944-1 shall apply. In addition, the following definitions apply:

(1) **Waste disposal**

Recovery or removal of waste.

(2) **Tarpaulin containment**

All-round protection of the work area with leakproof, rigid floors, and walls and ceilings made of leakproof, tear-resistant tarpaulin with seam overlaps and connections to the structure.

(3) **Repair**

Local repair (including surface preparation) of a defective corrosion protection system (DIN EN ISO 12944-1).

(4) **Instructions for execution**

Technical document of the coating material manufacturer on the use of the coating materials in the area of application pursuant to Part 4, Section 3.

(5) **Coating material**

Liquid or paste-like or powder product which, when applied to a substrate, provides an adhesive coating with protective, decorative and/or other specific properties (DIN EN ISO 4618).

(6) **Enclosure**

All-round dust-proof protection of the work area with solid floors, walls and ceilings and dust-proof connections to the structure.

(7) **Manufacturing instruction**

Technical document of the Contractor for the production of thermally sprayed coatings within the scope of Part 4 Section 3.

(8) **Hot-dip galvanisation**

Metallic coating made by hot-dip galvanising (galvanising of individual pieces) according to DIN EN ISO 1461 by immersion of prepared iron and steel components.

(9) **Total layer thickness**

Organic layers of a corrosion protection system as the sum of the individual layers without edge protection and without clear coat (dry layer thickness). Non-organic layers such as metallic coatings made of zinc (in the case of thermal spray galvanisation plus sealing) are not taken into account.

(10) **Control surface**

Representative and precisely defined area of a component, which is coated with the specified corrosion protection system under the supervision of the client and the contractor as part of the ongoing coating process. Establishing control surfaces is a works supervision measure. Control surfaces are used as a reference surfaces in the investigation of the causes of any defects in corrosion protection (see form B 4.3.6).

(11) **Corrosion protection plan**

The graphical and textual representation of the corrosion protection measure, consisting of an overview drawing and the necessary detailed information.

(12) **Service life**

Period during which a structure can be used for operational purposes.

(13) **Test areas**

Areas on which certain properties of a coating are tested under specific boundary conditions.

(14) **Duration of protection**

Service life of a coating system, except for duplex systems, until the first partial renewal. This is usually the case if the coated surface has a rust grade Ri 3 on about 10 % of the surface of the structure or a component. The duration of protection achievable by coating systems is usually lower than the service life of a structure.

(15) **Extremely long duration of protection**

A duration of protection of at least 50 years.

(16) **Spray galvanisation**

Thermally sprayed, metallic coating with zinc (Zn99,99) or zinc-aluminium (ZnAl15) according to DIN EN ISO 2063.

(17) **Spray water area**

Area which may be splashed by de-icing salt solution. In addition, it can be subject to mechanical stress from the impact of solid bodies (e.g. stone chippings).

(18) **Spray zone**

Area that can be exposed to de-icing salt spray, but not splashes of water.

(19) **Blast-cleaning**

Impact of an abrasive of high kinetic energy on the surface being prepared.

(20) **Blasting abrasive**

Auxiliary substance used for blast-cleaning.

(21) **Blasting residue**

Residue consisting of old coatings, rust and used abrasive occurring during mechanical surface preparation. Blasting residue produced by the use of non-metallic blasting abrasives is referred to as 'non-metallic blasting residue' and blasting residue produced by the use of metallic blasting abrasives is referred to as 'metallic blasting residue'. Similarly, this includes the residue resulting from manual and mechanical rust removal.

(22) **Partial refurbishment**

Restoration of the corrosion protection by the application of suitable coating systems to defects and a minimum of one complete top coat.

(23) **Total refurbishment**

Complete removal of the old coating and application of a new coating system.

2 Planning and construction

2.1 Basic principles

(1) *Nos 3 to 11 contain further information relevant to the planning of corrosion protection, which must also be observed.*

(2) The corrosion protection systems pursuant to Annex A are to be used.

(3) *If, in exceptional cases, coating materials are to be used which are not mentioned in the TL KOR-Stahlbauten or in the TL 889.0084, their suitability for the intended use must be proven. Approval from the building supervisory authorities is required for use in individual cases.*

(4) *For initial coatings and total refurbishment, the specifications shall require corrosion protection systems to comply with TL KOR-Stahlbauten, Table 1, for an extremely long duration of protection for the corrosivity category C5.*

(5) All external surfaces of structures which are part of carriageways or are located directly above them are to be classified within the spray zone unless they are in the water splash zone.

(6) It is recommended to use the colour 'dyed ed' for the zinc dust base coat. For repairs it is recommended to use the colour 'grey'.

(7) Edge protection in accordance with No 5.3.3, temporary coatings, e.g. after welding of construction site welding joints in accordance with No 6.5, and the coating of fasteners are special services.

(8) The application procedure must be specified for all layers of the corrosion protection system in the specifications.

(9) *When coating larger areas, it is preferable to use airless spraying rather than rolling even for coats which are to be applied on site.*

(10) *For new constructions it is recommended to apply all the coatings at the factory, including the top coat. The repair of damage caused during transport and assembly may result in visual imperfections.*

(11) *In the case of construction work with site welded joints, the top coat can be applied on site for visual reasons.*

(12) *If the top coat is applied on the construction site, the moment when this is done must also be specified separately, e.g. after producing the carriageway deck (in the case of composite bridges) or after the completed assembly of the steel structure and must be stated in the specifications.*

(13) *It is recommended to apply the top coat of the transition area to the concrete in accordance with No 5.3.7 paragraphs (1) and (2) already in the factory. If the top coat is applied on the construction site, the time for producing the top coat in the transition area must be indicated in the specifications.*

(14) *It is recommended to use paints containing micaceous iron oxide (Deutsche Bahn colour chart). This particularly applies to initial protective measures in which the top coat is applied at the site.*

(15) *In the case of special architectural requirements for the appearance of the top coat, there may be higher requirements for the visual effect, which may have to be tested and verified separately. The time required, e.g. for the tests, must be taken into account in the planning and execution.*

(16) *If there are special requirements for the colour accuracy and colour stability of the micaceous iron oxide-free topcoat materials (RAL colours), they must be agreed and verified between the client and the contractor.*

(17) *If colours other than those mentioned in the TL KOR-Stahlbauten are also to be used for micaceous iron oxide-free top coats, corresponding provisions for colour accuracy and colour stability must be included in the specifications.*

(18) The measurement of colour accuracy and the testing of colour stability must be carried out in accordance with TP KOR-Stahlbauten, No 6.2.5.

(19) *The test duration for measuring the colour accuracy and testing the colour stability, including the production of the test plates, is at least 20 weeks.*

(20) *If there are requirements for the gloss retention of the top coat, e.g. ≥ 50 % of the unweathered base value after 3,000 hours of weathering can be used as an evaluation criterion.*

(21) *The use of a clear lacquer on the top coat can improve colour stability.*

(22) *In order to improve the opacity of light top coats, it is recommended to apply the last intermediate coating in a light colour.*

(23) *The opacity (hiding power) is often not sufficient for top coats with a dry layer thickness of 80 µm or less for light or brilliant colours, e.g. white, orange and red. In this case, it is recommended to apply two such top coats, in derogation from Annex A, or to apply an additional intermediate coat in a corresponding colour to support the opacity.*

(24) *The evenness and colour uniformity of the coating surface must be agreed separately.*

(25) *Coating materials for top coats on exterior surfaces can be ordered by batches per material colour to ensure a uniform colour.*

(26) *In the case of longer service life to be expected until the final protection and to avoid rust streaks, a temporary coating can be provided, for example, after completion of factory production. A specification item must be provided for the application and removal of a temporary coating.*

(27) Temporary coatings must be made with a non-mistakeable paint and completely removed by grinding or blast-cleaning before welding or final protection.

2.2 Designing in compliance with corrosion protection requirements

(1) The structural design of new structures must also take into account the measures required to protect the environment in the event of subsequent repair of the corrosion protection, e.g.

- *by ensuring that external surfaces are as smooth as possible to facilitate sealing to the structure in the case of enclosures or tarpaulin containment,*
- *planned interchangeability of components whose subsequent corrosion protection repair would cause extremely high costs.*

(2) Non-accessible box girders and cavities whose dimensions do not provide for accessibility, such as trapezoidal stiffeners or safety curbs, must be welded airtight. No internal coating is necessary.

(1) Airtight box girders, which generally do not exclude accessibility (box girders with limited accessibility), must be provided with an internal coating (see Table A 4.3.2, component No 1.2.3).

(2) The structural design of the components that are to be hot-dip galvanised requires compliance with the DASt Guideline 022 and DIN EN SO 14713.

2.3 Specific aspects of repair

(1) It must be assessed whether a repair or partial refurbishment of the corrosion protection is technically and economically reasonable instead of total refurbishment. This assessment is subject to the guidelines for the maintenance of the corrosion protection of steel structures (RI-ERH-KOR) and the guidelines for the economic calculation (RI-WI-BRÜ).

(2) In the case of repairs and partial refurbishment of the coating, the surface preparation process must be defined according to the object and condition (RI-ERH-KOR).

(3) If only manual (P St 3) or mechanical rust removal (P Ma) is possible due to local conditions or special requirements, only coating materials according to sheet 100 module B of the TL KOR-Stahlbauten, Annex A, may be used for partial refurbishment and repairs of old coating.

(4) In the case of partial or total refurbishment, the surface and the old coating must be examined for possible salt contamination during the planning of the measure. The results must be attached to the invitation to tender.

(5) In the case of partial or total refurbishment with high salt contamination of the old coating, additional washing of the surfaces before blast-cleaning may be necessary. In the case of salt contamination within the old coating, reusable abrasives are unsuitable without further measures (e.g. re-washing and dry re-blasting with non-contaminated abrasive).

(6) In the case of partial or full refurbishment of screwed and riveted constructions, washing the surface is not expedient. Instead of washing, dry blasting with disposable abrasives should be used here. If necessary, the surface must be re-blasted several times. The cleaning procedure must be included in the specifications.

(7) In the case of older structures, the removal of a still existing mill scale, as well as the presence of saponification products or corrosion pits under the old coating may require increased expenditure. If necessary, this must be stated in the specifications.

(8) For partial and total refurbishment, it is recommended applying all the coats within an enclosure.

3 Preparation of corrosion protection measures

(1) The contractor is the operator of the coating plant within the meaning of the 4th and 31st Ordinances on the Implementation of the Federal Immission Control Act (BImSchV) both for corrosion protection work at the plant and at the construction site. The contractor shall ensure that the annex of the 4th and 31st BImSchV is complied with and that all the conditions resulting from these ordinances are fulfilled.

(2) If, in the case of plants not requiring licences, the consumption of solvents exceeds the threshold of 5 t/a, then according to the 31st BImSchV, the competent authority must be notified of the relevant plant. As a rule it is not necessary to collect and treat the exhaust gases if the coating materials are selected appropriately, as the requirements of the 31st BImSchV can be fulfilled by establishing a reduction plan in accordance with Annex IV to the Ordinance.

(3) Coating plants that are operated for more than 12 months and in which the solvent consumption exceeds 15 t/a or 25 kg/h are subject to licensing pursuant to the 4. BImSchV.

(1) Before issuing a call for tenders it should be verified whether it is possible to comply with the 31st BImSchV by introducing a reduction scheme. If this is impossible, the coating facility must be suitable for collecting and treating the exhaust gases. This must be included in the specifications.

(2) Other parties who may be directly affected by the construction project are to be notified in good time before the work is due to commence. If necessary, measures are to be provided for collecting evidence (e.g. taking soil samples).

4 Surface preparation

4.1 General information

(1) It is not permissible to use greases, oils, formwork or sealants containing silicone or other materials containing silicone on steel constructions, concrete constructions and when erecting temporary structures such as scaffolding and enclosures.

(2) The surface preparation method and the protective measures taken in relation to it must be adapted to suit the particular protection requirements of the surrounding environment.

(3) The surfaces are tested according to DIN EN ISO 8502-2 to -6 and -9 and DIN/TR 55684.

(4) The use of reusable abrasives requires a plant in which the reusable abrasive is separated from particles of paint, rust and dirt.

(5) When removing contaminated old coatings with reusable abrasives, the treatment plant must be able to separate the contaminants from the abrasive.

4.2 Requirements

(1) Before deciding on a surface preparation, the surface to be coated must be checked for contaminants and any contaminants found must be removed.

(2) Surface preparation by blast-cleaning shall be carried out with a sharp-edged blasting agent in accordance with DIN EN ISO 11124 or DIN EN ISO 11126.

(3) Unless otherwise agreed, surface preparation by blast-cleaning must be at least equivalent to surface preparation grade Sa 2½ in accordance with DIN EN ISO 12944-4. This also applies to the post-treatment of welds.

(4) Where manual or power-driven tools are used for the surface preparation, the surface preparation grade must be P St 3 or P Ma.

(5) The roughness grade of surfaces prepared by blast-cleaning must be at least medium (G) in accordance with DIN EN ISO 8503-1 and -2.

(6) Where components of new structures are to be coated, edges, welds and other areas on steel surfaces which feature irregularities should be treated to preparation grade P3 in compliance with DIN EN ISO 8501-3. For fluted/profiled welds, the preparation grade P3 applies if an extremely long duration of protection of the corrosion protection is required, otherwise the preparation grade P2 is sufficient. Edges must be rounded in accordance with DIN EN ISO 8501-3. With the consent of the client, a threefold chamfering of the edges is permitted as an alternative (see Figure A 4.3.1). For components receiving metallic coatings (e.g. hot-dip galvanisation or spray galvanisation), the preparation grades P2 and No 5.3.4.

(7) Curing areas of thermally cut edges must be removed by grinding both before surface preparation during coating and before galvanising.

(8) Steel surfaces for coverings in contact with crushed stone as well as for thermally sprayed zinc coatings must have a coarse roughness grade (G) in accordance with DIN EN ISO 8503-1 and -2.

(9) The dust load of the blasted surface shall be tested by the contractor with 5 dust tests according to DIN EN ISO 8502-3 per 100 m² of coating surface. The tests shall be recorded. The amount of dust and particle size shall not exceed the values of Class 2.

(10) The salt contamination of the surface must not exceed 80 mg/m² in accordance with DIN/TR 55684, DIN EN ISO 8502-9 before the coating is applied. If this limit value is exceeded, the surfaces in question will need to be prepared by cleaning with water at a minimum pressure of at least 150 bar and using water with a temperature of at least 50 °C.

(11) When using coating materials of sheets 81 and 100 on hot-dip galvanised surfaces, sweep blasting must be carried out as surface preparation.

(12) When sweeping blasting hot-dip galvanised surfaces, no more than 15 µm of the zinc coating may be removed.

(13) Before the base coat is applied, the prepared surfaces must also be approved by the client or a suitably commissioned test centre (see Annex E) at the factory.

4.3 Requirements prior to application of subsequent coats

(1) Before applying subsequent coats the contractor must ensure that the surface is free of contaminants, and surface preparation must be carried out if necessary.

(2) In the case of composite bridges, care must be taken to ensure that the coating is not contaminated by concrete and cement slurries. Any contaminants must be removed completely.

(3) In the case of weathered undercoats, at least one cleaning should be performed with water, using a rotating jet, applied at a minimum pressure of 150 bar, with a water temperature of at least 80 °C and at a distance of not more than 30 cm from the surface. The effectiveness of the cleaning must be tested in consultation with the client.

(4) If the cleaning described is not sufficient, the surface preparation process must be agreed with the manufacturer of the coating material. The procedure requires the consent of the client.

5 Coating materials and corrosion protection systems

5.1 General information

When bulk packs are used, the removal of 2-component coatings must be effected using a metering unit, a 2-component spray unit or scales with an accuracy of at least 1 %. The individual mixtures and metered total quantity must be documented.

5.2 Coating materials

(1) Coating materials according to TL KOR-Stahlbauten (TL KOR Steel Structures), Annex A or for railway bridges according to TL 889.0084 must be used,which are included in the listing of tested coatings for use on structures and components of the federal highways (‘BASt-Zusammenstellung der geprüften Beschichtungsstoffe für die Anwendung an Bauwerken und Bauteilen der Bundesverkehrswege’), which is managed by the Federal Highway Research Institute (Bundesanstalt für Straßenwesen).

(2) Coating materials exposed to mechanical stress in water must comply with the requirements of the Additional Technical Terms of Contract - Hydraulic Engineering (ZTV-W) for corrosion protection in hydraulic steel construction (performance range 218).

(3) For components in inland waters, systems I, and in seawater systems II must be used in accordance with the lists of approved coating systems of the Federal Institute for Hydraulic Engineering (Bundesanstalt für Wasserbau, BAW).

(4) For improved control the individual coats must be clearly distinguished from one another by their colours.

5.3 Corrosion protection systems

5.3.1 General information

(1) Within a single coating system the materials of not more than one manufacturer may be processed.

(2) *For components that are completely coated in the factory, as well as components that are completely coated under enclosure during a total refurbishment, all intermediate coatings may be carried out with the material No 100.2.1. The prerequisite is the listing of sheet 100, module B, in the list of tested coatings for use on structures and components of the federal highways (‘BASt-Zusammenstellung der geprüften Beschichtungsstoffe für die Anwendung an Bauwerken und Bauteilen der Bundesverkehrswege’).*

(3) The film thicknesses given in Annex A are nominal film thicknesses as defined in DIN EN ISO 12944-5 (see also 9.2.1 (5)).

(4) Unless otherwise specified by the client, in the case of corrosion protection systems with coating materials of sheet 100, the nominal film thicknesses (single film thicknesses and their sum) specified in the execution instructions of the material manufacturer in accordance with the TL KOR-Stahlbauten shall apply.

(5) During execution, the nominal film thickness is regarded as achieved when not more than 20 % of the single values are below the target value by not more than 20 %, but the average of all measurements on one measured surface equals at least the nominal film thickness.

(6) Deviating from DIN EN ISO 12944-5, the measured film thicknesses must generally not be more than twice the nominal film thickness, and only at single points, e.g. fillets, must not exceed three times the nominal film thickness.

(7) In the case of zinc dust base coating materials, the dry film thickness must not exceed 160 µm.

(8) Fasteners must be protected as effectively as the surfaces of the steel components.

(9) Hot-dip galvanised fasteners in accordance with DIN EN ISO 10684 are to be used. Fasteners on external surfaces (exposed to weather) must be coated in accordance with Table A 4.3.2, component No 5.2.4.

(10) Hot-dip galvanised fasteners on interior surfaces do not need to be additionally coated.

(11) Hot-dip galvanised fasteners on sub-assemblies of traffic sign gantries, such as ladder or railing connections to the stiles and rungs, do not have to be additionally coated. As an alternative to a coating in accordance with Table A 4.3.2, component No 5.2.4, base point anchorages can also be protected with a corrosion protection paste (acid-free and at least temperature-resistant from -30 °C to 130 °C) and one-piece plastic protective caps. Specific provisions for the corrosion protection of hot-dip galvanised fasteners on traffic sign gantries must be specified in the specifications.

5.3.2 Shop primers

(1) Welding over shop primers is not permitted.

(2) Any existing shop primer must be removed by dry blasting prior to the application of the base coat of the coating system.

5.3.3 Edge protection

(1) All edges and welds must be additionally provided with edge protection according to Table A 4.3.2, component No 5.2.1 after the base coat with the materials of sheets 100 and 81 has been applied. For edge protection, the corresponding coating materials of the respective sheet must be used.

(2) Where application is by spraying, areas such as corners, screw and rivet heads or other difficult-to-reach areas are to be painted beforehand with the respective coating material.

5.3.4 Galvanising

DIN EN ISO 14713 applies to the design of components which are to be galvanised.

5.3.4.1 Hot-dip galvanising

(1) DIN EN ISO 1461 and the DASt Guideline 022 apply to hot-dip galvanising (galvanising of individual pieces).

(2) All surfaces to be galvanised are treated as key areas in accordance with DIN EN ISO 1461.

(3) Flux residues and zinc ash must be removed.

(4) The hot-dip galvanised surface must meet the requirements for execution of a visually and technically perfect coating. Surface irregularities such as slag inclusions, hard zinc crystals, so-called ‘shark’s teeth’, etc. must be removed.

(5) When coating at a galvanising plant, the requirement ‘t Zn b’ in accordance with DIN EN ISO 1461 must be met. If components to be galvanised individually are coated outside the galvanising plant (duplex systems), the requirement ‘t Zn k’ must be met.

(6) In the case of galvanised components with bolted fastenings a factory certificate in compliance with DIN EN ISO 1461 is required.

5.3.4.2 Zinc spraying

(1) DIN EN ISO 2063-1 and -2 apply in the case of zinc spraying (zinc thermal spraying).

(2) Before execution, all parameters required for the coating process as well as monitoring and testing must be specified in a manufacturing instruction.

(3) Thermal spray zinc coatings must be provided with a sealing coat (closing the pores) immediately after being applied. The coating system according to sheet 81 or sheet 100 module D must be used.

5.3.4.3 Repairs of hot-dip galvanised and spray galvanised surfaces

(1) If the sum of all defects exceeds 0,5 % of the total surface area of a component or 10 cm² in the case of a single defect, the component must be re-galvanised.

(2) Minor defects up to 10 cm² must be repaired with a base coating material according to the TL KOR-Stahlbauten, sheet 100, material number 100.1.1 or 100.1.2 with a film thickness of at least 100 µm or by spray galvanisation with a film thickness corresponding to the surrounding areas. If the thickness of the zinc film is more than 100 µm and the film is not part of a duplex system, the intermediate and top coats according to sheet 100 must also be applied when repairing with coating materials according to sheet 100. For the last film, a zinc-like colour must be used.

(3) The surface preparation must comply with P Sa 2 ½ or P Ma in accordance with DIN EN ISO 12944-4. The overlapping zinc areas must be prepared by sweep blasting.

(4) Repairs must be carried out with an overlapping (approx. 2 cm) of the intact zinc coating.

(5) Zinc solders, zinc pastes, coating materials with lamellar zinc pigments and zinc sprays may not be used for the repair of defects in galvanised components. For repairs with coating materials, coating materials according to sheet 100 are to be used, which are included in the listing of tested coatings for use on structures and components of the federal highways (‘BASt-Zusammenstellung der geprüften Beschichtungsstoffe für die Anwendung an Bauwerken und Bauteilen der Bundesverkehrswege’), which is managed by the Federal Highway Research Institute (Bundesanstalt für Straßenwesen).

5.3.5 Contact surfaces for bolted fastenings

(1) Contact surfaces of bolted fastenings must be coated.

(1) In the case of fastenings which are not pretensioned, the contact surfaces of all components to be connected must be protected with the same coating system used on the other surfaces.

(2) In the case of pretensioned fastenings, the contact surfaces must be coated in accordance with

Table 4.3.1. If other coating systems are used, their suitability must be evidenced.

(3) For friction surfaces of non-slip fastenings, the dry film thickness of the coating must not be less than 40 µm and not more than 80 µm.

Table 4.3.1: Notes on suitability for the corrosion protection of pretensioned fastener contact surfaces.

Suitability class	Corrosion protection systems	
Non-slip fasteners (see Annex A)	ASI-Zn ESI-Zn	Sheet 85 Sheet 86
Loss of pre-tensioning strength in two clamped coated contact surfaces ≤ 10 % Suitable for tensile connections and for shear load/bearing stress fastenings with pre-tensioning for usability In the case of hot-dip galvanising, refer to 5.3.4.1(5)	ASI-Zn ESI-Zn ER Zn (R) Hot-dip galvanising	Sheet 85 Sheet 86 Sheet 100 DIN EN ISO 1461
Loss of pre-tensioning strength in two clamped coated contact surfaces ≤ 30 % Suitable for shear load/bearing stress fastenings with pre-tensioning for usability	ER/PUR system 1. BC: ER Zn (R) 2. IC: ER/PUR 3. IC: ER/PUR (optional) 4. TC: PUR	Sheet 100

5.3.6 Thin coatings and reactive resin-bonded mortar coatings

(1) For surfaces which are accessible on foot or by vehicle only thin coatings may be used which meet the requirements of TL-RHD-ST and are included in the ‘Compilation of tested thin coatings produced in accordance with ZTV-ING Part 6(5) (ZTV-RHD-ST) for use on structures and components of the federal highways‘ (Zusammenstellung der geprüften Dünnbeläge nach den ZTV-ING Teil 6 Abschnitt 5 (ZTV-RHD-ST) für die Anwendung an Bauwerken und Bauteilen der Bundesverkehrswege) kept by the BASt.

(2) TL/TP-ING Part 6(5) (TL RHD-ST) and TL 889.0084 apply to thin coatings and mortar coatings beneath a bed of ballast.

(3) Areas around site weld joints are to be treated in accordance with No 6.5.

(4) The joint between a coating system and a reactive resin-bonded thin coating (RHD) in accordance with Part 6(5), and/or a seal in accordance with Part 6(4) must be designed in accordance with Figure A 4.3.2 and/or Figure A 4.3.3.

(5) Coating systems as per sheet 100 of the TL KOR-Stahlbauten are compatible with RHD coatings.

(1) In cases other than those described in (5), compatibility must be ensured.

5.3.7 Coating in contact with concrete

(1) At the transition of the surface to be coated to the concrete, the adjacent coating system must overlap the area in contact with concrete by at least 5 cm.

(2) In composite areas, the adjacent coating system must be continued to the outermost fasteners (usually headed anchor bolts).

(3) Instead of the top coating, a further intermediate coating can be applied in the area in contact with concrete.

5.3.8 Coating of drainage systems

(1) For coatings according to DIN EN 877 in contact with other coatings according to Table A 4.3.2 component No 3.3.1, it must be ensured that the coatings are compatible with each other and that the coating materials according to DIN EN 877 can be overcoated with the other coatings according to Table A 4.3.2 component No 3.3.1.

(2) The compatibility and overcoatability of the coating materials according to DIN EN 877 with other coating materials according to Table A 4.3.2 component No 3.3.1 must be proven to the client in the case of application.

6 Execution of corrosion protection work

6.1 General information

(1) The contractor must notify the client immediately of any damage to the steel structure and any cracks in welds, loose fastenings, cross-sectional weaknesses and similar found during surface preparation.

(2) Corrosion protection measures may only be executed in compliance with corrosion protection plans approved by the client#. These must be available at the

relevant place of execution (factory and/or construction site).

(3) The technical data sheets, safety data sheets and test certificates according to DGUV regulation 100-500, chapter 2.24 must be available for all abrasives at the respective place of execution (plant or construction site).

(4) The execution instructions of the material manufacturer in accordance with the TL KOR-Stahlbauten, the safety data sheets and the technical data sheets must be available for all materials of the coating system at the place of execution (plant or construction site) and must be complied with.

(5) Layers which are overcoated by the factory must not be exposed to the weather meanwhile.

(6) Coating materials must be homogenised by mechanical agitation directly before and - if necessary - also during processing. Viscosity adjustments are only permitted within the framework of the technical data sheets or the execution instructions of the material manufacturer. The type and quantity of the diluent must be indicated to the contractor before execution. No other changes may be made by the processor, e.g. by additives.

(7) Each individual layer may only be applied if the surface to be coated has been approved by the client.

(8) The base coat must be applied immediately to prepared surfaces.

(9) The information on the minimum and maximum waiting time for overcoating can be found in the execution instructions of the material manufacturer. It is basically prohibited to work wet on wet. Exceptions are set out in Annexes A and C.

(10) The measured values of the self-monitoring tests during execution must be entered in test reports in accordance with Annex B.

(11) It is not permitted to use rollers for applying base coats. In the case of intermediate and top coats, this method is only permitted if it is permitted in accordance with the execution instructions.

(12) When using a roller, two passes diagonal to one another are required for each coat within the over-coating times to achieve a coating quality comparable to that of a spray application. Areas which cannot be reached by using a roller must be dealt with using a paintbrush.

(13) In the case of duplex systems (hot-dip galvanisation or zinc spraying), only the top coat may be applied with rollers.

(14) Standing water on the coating during the construction period is inadmissible and must be prevented by suitable measures. For films and tarpaulins, it must be ensured that they do not come into contact with the coating for the duration of protection. Temporary auxiliary constructions on the coating must be designed in such a way that no moisture or waterlogging forms on the coating. Adequate ventilation of the coating surface must be ensured. The protective measures provided for must be notified to the client in good time. These measures are not remunerated separately and are not required for components that are designed for permanent exposure to water.

(1) The corrosion protection coating (e.g. on a pavement construction) may only be subjected to thermal stress from 14 days after completion. If for compelling reasons this period must be shortened, the thermal resistance of the coating system has to be demonstrated in advance by a test of suitability (TP KOR-Stahlbauten, 6.2.7). 7 days is the minimum period, however.

(16) The appearance of the top coat must provide coverage and be of uniform colour (shade, brightness and saturation).

(17) Defects in the coating, e.g. wrinkling, craters, blistering, streaks, flaking and cracks are not permissible.

6.2 Requirements for the staff

(1) The work may only be carried out by staff in possession of the necessary qualifications. Evidence must be provided.

(2) In the case of corrosion protection work, the foreman must demonstrably have passed an examination. This is to be demonstrated:

— in the case of domestic bidders by a certificate issued by the training advisory board of the Bundesverband Korrosionsschutz eV (KOR certificate),

— in the case of foreign bidders by means of an equivalent certificate of qualification

. At intervals of no more than 5 years, retraining must be carried out in accordance with the requirements of the training advisory board.

(3) The foreman must be permanently present at the place of work during the execution of the work.

(1) Proof of qualification for other staff can be provided, for example, the successful completion of a basic course in corrosion protection (minimum duration 2 weeks), and for the staff responsible for blast-cleaning a course in abrasive blast-cleaning (minimum duration 1 week), and for the coaters a course in applying coatings (minimum duration 1 week).

6.3 Processing conditions

(1) A safety margin of at least 3 K must be maintained between the object temperature and the dew point temperature of the surrounding air.

(2) The minimum object temperature in accordance with Annex C (planning aids for the TL sheets) must be adhered to.

(3) Protocols can be found in Annex B.

6.4 Storage conditions and duration

Coating materials must be stored in accordance with the instructions of the material manufacturer. The contractor must take appropriate precautions and provide the necessary equipment and facilities.

6.5 Site weld joints

(1) When coating components in the factory, the areas around site weld joints are to be treated as follows in accordance with Figure A 4.3.4:

— Areas around welds are to be masked on both sides from the edge of the weld.

— The base coat is to be continued up to the edge of the masking retaining the nominal film thickness (leave masking in the area of the weld seam).

— The first undercoat is to be applied only up to 250 mm away from the edge of the weld. Additional coats are each to be set off 50 mm from the edge of the previous coat.

— On site, the masking tape must be removed completely prior to welding. Any alternative, more temporary coating must be completely removed by blast-cleaning or grinding before welding.

— After welding, unprotected surfaces at site weld joints must be mechanically cleaned to avoid rust streaks and temporarily protected for the remaining construction time without further preparation with a base coating according to sheet 100 module B. Before the final coating, the temporary protection must be completely removed by blast-cleaning and the grade of surface preparation for the final protection must be accomplished.

(2) When coating components with thin coatings or mortar coatings in the factory, the area of the site weld joints must be treated in accordance with Figure A 4.3.5, as follows:

— Areas around welds are to be masked on both sides from the edge of the weld.

— The masking must be completely removed before welding. Any existing, more temporary coating must be completely removed by blast-cleaning or grinding.

— The exposed area is to be mechanically cleaned and temporarily protected after welding without further preparation with a basic coat according to sheet 100 module B in order to avoid rust streaks during the construction period.

— After welding and before applying the final coating, the agreed grade of surface preparation must be restored in the omitted area. The existing coating edges must be bevelled and roughened to a width of 50 mm, e.g. by blasting.

(1) In heat-affected zones of more than 200 mm, the width of the area to be kept clear of intermediate and top coat or thin coating or mortar coating and to be blasted before the final coating is applied must be adjusted and shown in the execution documents.

(2) To improve adhesion, the existing coating in the overlap area must be roughened, e.g. by careful grinding or sweep blasting.

6.6 Control surfaces

(1) Control surfaces are to be provided:

— *independently of the size of the object in the case of structures and in areas of structures where a repair of the corrosion protection coating under the warranty is associated with accompanying high costs (e.g. for scaffolding, measures to protect the environment) or significant interruptions of operation.*

— *in the case of structures entailing more than 1 000 m² area to be coated.*

(2) In the case of control surfaces on bridges, areas should be defined which are characteristic of the local corrosion stresses and were crucial in the choice of coating system, e.g. areas above the carriageway on roads treated with de-icing salt. The amount and locations of the control surfaces have to be stated in the specifications.

(3) The amount of control surfaces in relation to the size of the structure is to be found in Table 4.3.2.

Table 4.3.2: Number and total area of control surfaces

Size of the structure (coated area) [m²]	Number of control surfaces	Total area of control surfaces (maximum) [m²]
1,000 to 5,000	1	10
5,000 to 10,000	2	20
10,000 to 25,000	3	30
25,000 to 50,000	4	40
more than 50,000	5	50

(1) Control surfaces must be marked according to type, size and location in the corrosion protection plan.

(1) The client is to be notified in good time of the date the control surfaces were established. The control surface protocol is to be maintained in accordance with Annex B.

(2) The forms shown in Annex B are to be used for analysing the control surfaces.

6.7 Markings

(1) On bridges, the main features of the corrosion protection system according to the sample as in Annex B, form 4.3.7, must be posted on the structure in such a way that they can be easily read.

(2) The cross-beams or bulkheads of a steel bridge must be numbered as specified by the client. These markings are to be attached on or in the structure so that they can be read from the areas on which vehicles are driven, people walk and where there is mobile bridge inspection equipment.

7 Protective measures during execution

7.1 General information

(1) Part 5(3) applies to protective equipment.

(2) Protective measures are to be taken for surface preparation and coating work in order to avoid injuring or damaging persons, the environment, traffic installations, third-party installations, etc. and to ensure the protection of the corrosion protection measures. Containment tarpaulins and enclosures must be so leakproof that there is no risk to the environment.

(1) When removing layers containing hazardous substances (tar, asbestos, lead, etc.), special measures are to be set out in the specifications.

7.2 Protective measures during blasting work

7.2.1 General information

The measures for the protection of the environment from any abrasive residues and dust are to be included in the specifications as follows depending on the blast-cleaning method and abrasives used:

— *For dry blast-cleaning of coatings containing pollutants using reusable abrasives, an enclosure is needed which is leakproof and closed on all sides.*

The technical regulations for hazardous substances (including TRGS 524) must be observed.

— *For dry blast-cleaning when using non-reusable abrasives, the minimum required is tarpaulin containment which is leakproof on all sides. In an environment requiring particular levels of protection, e.g. a water conservation zone, a leakproof enclosure round the component to be worked on may also become necessary depending on the nature of the abrasive residues produced.*

— *Wet blast-cleaning permits there to be less stringent requirements for the leakproofing of the enclosure; However, the addition of water must be metered so as to keep the environment free from damaging levels of blasting dust. As a minimum, a pipe- or trough-type screening of adequate length should be provided for the blast-cleaning area. Precautions must be taken to collect, treat and dispose of waste water and filtered pollutants. Dry re-blasting is required in the event of a rust film forming and is to be specified in the specifications. In the case of dry re-blasting, the requirements of the previous indent must be observed.*

— *Blasting, cleaning or washing with water in accordance with DIN EN ISO 12944-4 without abrasive additive requires the same precautions as wet blast-cleaning. The waste water must not be released to the environment.*

— *Shot-blasting is only permissible on the upper side of horizontal or slightly inclined surfaces. With this method it is possible to dispense with an enclosure. Vertical surfaces are to be reworked using vacuum or suction head blasting.*

— *Vacuum and suction head blasting do not necessitate any special protective measures. This type of blast-cleaning is only suitable for small, integral surfaces.*

7.2.2 Scaffolding requirements

(1) The type, amount and dimensions of the scaffolding must be in conformity with the method of processing, the object, the local conditions and the processing time.

(1) Service platforms, working platforms and falsework, including the necessary scaffolding, must be designed so as not to exceed the permissible stress on the structural parts caused by the additional loads from the scaffolding and not to endanger the structure's stability.

(1) During blast-cleaning and coating work inside the scaffolding, suitable partitioning (e.g. chambers) must be provided for protection from the dust which collects on areas that have already been treated. Suction equipment is to be used in the blast-cleaned areas.

(2) Adequate air circulation and filtering of the interior volume is necessary for the removal of dust and contaminating elements from the ambient air. The suction openings are to be evenly distributed in order to prevent strong turbulence.

(3) Floors, ceilings and walls of scaffolding must be leakproof.

(4) Any floors not made of continuously welded, weight-bearing, smooth sheet metal must be executed in three layers. The bottom layer is to be constructed as the bearing element (e.g. built from planks or slabs). The middle layer acts as an insulating layer (e.g. made of foil or tarpaulins). The upper layer is constructed as a flat working space (e.g. made of hardboard or thin metal sheets).

(5) If the insulating layer of the floor is sufficiently tear-resistant not to be susceptible to damage from the building work or the collection of abrasive residue (e.g. using shovels), the upper layer (work surface) may be omitted. This is subject to permission from the client.

(1) The requirements for the insulating layer concerning tear resistance are fulfilled by, for example, a PVC film of at least 0.80 mm thickness whose seams are continuously welded or bonded.

(1) Walls and ceilings of enclosures must be executed as a solid and weather-resistant cladding.

(1) Walls and ceilings of containment tarpaulins must be tear-resistant and have seam overlaps.

(2) Seals for joints are to be made by welding, gluing, as zips or velcro fastenings.

(3) The wear resistance of the materials must be adapted in particular to the expected stresses in the blast-cleaning area.

(4) Remaining gaps (e.g. at penetrations) must be sealed tightly with foam or by other means of equal effectiveness.

(5) The connection of the sealing to the structure must be based on the specified air balance and the construction of the structure. Suitable sealing elements may be, for example, adhesive strips, magnetic rubber strips, inflatable rubber strips and expanding foam.

(6) Owing to the high wear resulting from operational activities (e.g. treading on the area, blast-cleaning, transport), as well as through frequent shifting, the machines and construction components of the scaffolding need to be designed or replaced in good time, so that the protective effect is not impaired over the entire scaffolding period.

7.3 Protective measures during application

When painting or rolling, precautions need to be taken against drips from coating materials, and also against the dispersal of spray.

8 Disposal of blasting residue

(1) Blasting residue produced when carrying out corrosion protection measures constitutes waste within the definition of the Waste Management and Product Recycling Act (Kreislaufwirtschaftsgesetz, KrWG).

(1) Annex D contains information on the disposal of blasting residue.

(2) In the case of on-site repairs, the client is the waste producer pursuant to the KrWG.

(1) In the case of new constructions and repairs of dismantled components in the factory, the contractor is the waste producer pursuant to the KrWG.

(1) The waste producer carries responsibility until the final, proper disposal of the blasting residue, even if third parties have been contracted to fulfil these obligations.

(2) Blasting residue may only be disposed of after corresponding written evidence has been presented.

(1) The blasting residue is classified depending on the pollutant content as waste codes 120 116 (hazardous waste) or 120 117 (non-hazardous waste) in accordance with the European Waste Catalogue (Abfallverzeichnis-Verordnung, AVV).*

(1) Immediately the blast-cleaning work commences, the contractor must take a representative sample of the blasting residue and have a declaration analysis performed in consultation with the waste management facility and client. The declaration analysis must include the waste code number classification. This rule may only be deviated from in the case of small quantities in accordance with the Ordinance on Waste Recovery and Disposal Records (Nachweisverordnung, NachwV) subject to consultation with the waste management facility and client.

(1) Blasting residue must be recorded, collected and disposed of at appropriate intervals depending on the locality (operating conditions, weather, wind conditions, resilience of the scaffolding).

(2) When reusable abrasives are used, the blasting residue must be separated from reusable abrasives in circulation and collected.

(3) It is not permissible for blasting residue from different sources (type of abrasive and built structure) to be mixed before disposal or added to other waste.

(4) If the client does not prescribe the conditions for interim storage (location, quantity, duration, and the nature of the containers), they must be agreed by the contractor and the authority responsible for the waste producer.

(5) The disposal of blasting residue is to be assigned to waste management facilities which are certified for all or individual steps of the disposal procedure.

(6) Provision of evidence of disposal having been completed is regulated in the Ordinance on Waste Recovery and Disposal Records (Nachweisverordnung, NachwV).

(7) Waste producers, carriers and disposal facilities must all document the completed disposal procedure in the register (§ 49 KrWG).

(8) In the case of hazardous waste, the electronic waste verification procedure (Abfall-Nachweis-Verfahren, eANV) must always be applied in relation to the necessary prior inspection and confirmation of disposal.

(9) In the case of hazardous waste (waste code 120 116*) the waste producer fills out the section of the disposal certificate entitled 'Declaration of Responsibility' based on the results of the analysis and hands the disposal certificate to the waste management facility for their declaration of acceptance. The waste management facility forwards the disposal certificate to the competent authority for approval.

(10) Collectors, carriers, processors and agents for hazardous waste require a permit from the competent authority (§ 54 KrWG).

9 Quality assurance/monitoring

9.1 Quality assurance regarding coating materials

9.1.1 General information

(1) The requirements of the TL KOR/Stahlbauten and the TL 889.0084 apply.

(2) For coating materials not listed in Annex A of the TL KOR-Stahlbauten a test for suitability must be performed by a testing facility in accordance with the TL KOR-Stahlbauten. The test programme on dry film must correspond to a coating system from Annex A of the TL KOR-Stahlbauten designated by the client. Additional tests may be agreed by the client and contractor. The material properties must be recorded by identity checks based on the TL KOR-Stahlbauten Table A 5.1, 1.6.

9.1.2 Inspection certificates

(1) Acceptance test certificates 3.2 according to DIN EN 10204 are recommended for structures with a coating area of 5,000 m² or more as well as in other justified cases. If several batches are manufactured for the envisaged purpose, agreement has to be reached with the contractor on which batches are to be subjected to testing. It is recommendable to require type 3.2 certification for not more than three batches per coating material. Type 3.2 inspection certificates and the quantity required are to be stated in the specifications.

(1) The contractor must provide the client with the acceptance test certificates 3.1 or, if required, 3.2 in accordance with DIN EN 10204 for all coating materials before they are applied.

(2) The test scope for acceptance test certificates 3.1 and 3.2 and the requirements are defined in the TL KOR-Stahlbauten.

(3) If several batches are manufactured for the intended purpose, the tests for acceptance test certificates 3.1 are to be performed on samples from each batch.

(4) The acceptance test certificate 3.2 must be issued by a testing facility in accordance with the TL KOR-Stahlbauten.

9.2 Supervision of execution

9.2.1 Internal quality control inspection

(1) As part of internal quality control inspections, the surface preparation, application conditions and film thicknesses of each coat are to be tested and recorded.

(2) The forms in Annex B are to be used for the inspection reports. The measuring instruments used must be indicated.

(3) The determination of the external conditions as per Part 1(3) must be done to the extent necessary considering the locality, but at least twice a day.

(4) The scope of the film thickness measurements is governed by the size of the coated area in accordance with Table 4.3.3.

(5) DIN EN ISO 2808 applies to the measurement of dry film thickness. To measure dry film thickness on steel, it is necessary to use instruments that work using magnetic induction methods. The measured results have to be printed out.

(6) The client is to be notified immediately of any inadmissible deviations of the dry film thickness from the nominal dry film thickness as per No 5.3.1 and they are to be corrected in consultation with the client.

(7) Before each measuring session, the instruments are to be calibrated on a smooth steel plate according to the manufacturer's instructions.

(8) Testing of roughness is to be performed in accordance with DIN EN ISO 8503-2.

(9) Destructive measurements require the consent of the client. The destroyed coating must be reinstated. No separate compensation is to be made.

9.2.2 Check tests

(1) The scope and details for performing check tests are governed by Annex E and the results must be documented. This also applies to corrosion protection work at the factory.

(2) Regarding the coating materials, the check tests should particularly concentrate on checking the delivered materials for compliance with the contract, checking for the presence of the conformity mark on the packaging,

making a visual check on the condition of the materials in the container and of the suitability for processing under the local conditions.

(1) A representative sample of the delivered unused abrasive is to be taken and provided to the client.

10 Acceptance

The documentation of the corrosion protection measure in accordance with Annex B must be submitted to the client in good time before acceptance.

11 Warranty claims

Warranty claims for repairs and partial refurbishment are to be regulated individually in the building contract.

Table 4.3.3: Scope of measurement of film thickness; Intermediate values shall be linearly interpolated.

Size of the coating surface			For each			respective measuring area	Single measurement/	Total amount of measurements		
		≤ 5,000 m²			100 m²	10 m²	20 measurements			≤1,000
5,000	to	10,000 m²	100	to	150 m²			1,000	to	1,333
10,000	to	20,000 m²	150	to	200 m²			1,333	to	2,000
20,000	to	50,000 m²	200	to	250 m²			2,000	to	4,000
50,000	to	100,000 m²	250	to	300 m²			4,000	to	6,667
100,000	to	150,000 m²	300	to	350 m²			6,667	to	8,570
150,000	to	200,000 m²	350	to	400 m²			8,570	to	10,000

Annex A
Corrosion protection systems

A 1 General information

(1) Table A 4.3.2 contains suitable corrosion protection systems for important components of road, foot and railway bridges.

(2) When selecting corrosion protection systems, the recommendations of Annex C ‘Planning aids for corrosion protection work on steel structures’ shall be taken into account.

(3) The total film thickness specified in conjunction with sheet 100 is a minimum requirement to be met by all coating material manufacturers. The individual system structure plus the sealing for thermally sprayed zinc coatings is left to the coating material manufacturer. The corrosion protection systems listed at the Federal Highway Research Institute in the ‘BASt listing of tested coatings for use on structures and components of the federal highways’ may therefore contain higher requirements for the total film thickness.

Table A 4.3.1: Acronyms for binders

Abbreviations	Binders
ASI	Alkali silicate
ESI	Ethyl silicate
ER	Epoxy resin
EP-combi	Epoxy resin combination
ER HS	Epoxy resin, low solvent (high solids)
PUR	Polyurethane (2-component polyurethane)
1K-PUR	1-component polyurethane, humidity-curing

A 2 Corrosion protection systems

(For explanatory notes on part numbers see figures A 4.3.2 to A 4.3.16)

Table A 4.3.2: Corrosion protection systems

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KOR-Stahlbauten, Annex A sheet No-	other information
1	**Superstructure girders, pylons, arches, supports**						
1.1	Track plate upper sides						
1.1.1	Welded and riveted cover plates for railway bridges (with ballast), see Figures A 4.3.6 and 7						
	Load from rail traffic and maintenance equipment is determining factor	1	BC (optional) Thin coating ER silica sand 0.4-0.7 mm	(80) 4,000 (4,080) 4,000	Sa 2½ roughness grade coarse (G)		Sheet 84 according to TL 889.0084
		2	BC (optional) Thin coat of PUR	(80) 4	Sa 2½ roughness grade coarse (G)		Sheet 84 according to TL 889.0084
1.1.2	Vertical surfaces touching ballast (ballast edge)						
	Load from rail traffic and maintenance equipment is determining factor	1	BC (optional) Thin coat of ER/PUR Silica sand 0.4-0.7 mm	(80) 2,000 (2,080) 2,000	Sa 2½ roughness grade coarse (G)		Sheet 84 according to TL 889.0084
		2	BC (optional) Thin coat of PUR	(80) 2,000 (2,080) 2,000	Sa 2½ roughness grade coarse (G)		Sheet 84 according to TL 889.0084
1.1.3	Cover plates with/without deck surface						

	a) Occasional pedestrian access Splash water area, (humidity, dirt), exposure to weather: Corrosivity category up to C5	1	BC ER Zn (R) 1. IC ER combi/ER HS 2. IC ER combi/ER HS quartz sand 0,4-0,7 mm TC ER combi	80 120 120 120 440	Sa 2½	100-A 81 81 81	Quartz sand according to TL 889.0084
		2	BC ER Zn (R) 1. UC ER 2. Silica sand 0.4-0.7 mm TC PUR	80 120 160 804 440	Sa 2½	100-A 100-A 100-A 100-A	if colour scheme required; Quartz sand according to TL 889.0084

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KOR-Stahlbauten, Annex A sheet No-	other information
1.1.3	Cover plates with/without deck surface						
	b) frequent pedestrian access or bicycle traffic, de-icing salt Splash water area, (humidity, dirt), exposure to weather: Corrosivity category up to C5	1	Systems in accordance with TL/TP-ING Part 6 Section 5 (TL RHD-ST)				See compilation of building materials for reactive-resin bonded thin coatings on steel (‘Zusammenstellung der Baustoffe für reaktionsharzgebundenen Dünnbeläge auf Stahl’), www.bast.de
	c) Stress from road traffic is the determining factor	1	Systems in accordance with TL/TP-ING Part 6 Section 4 (TL BEL-ST)				for bridge equipment, temporary and movable bridge systems according to TL/TP-ING Part 6 Section 5
1.2	box girders, solid wall girders, trusses, bracing, track plate undersides; see Figure A 4.3.9 and 10						
1.2.1	Exterior surfaces, surface exposed to weather for the edges of the belts of composite girders, see 5.3.7 (2) and (3)						
	Water splash zone, stone/chip impact and/or outdoor exposure: Corrosivity category up to C5	1	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	observe 2.1 (9), 4.3 (3)
1.2.2	Internal surfaces of airtight welded, non-accessible box girders No corrosion protection necessary, see No 2.2 (2)						
1.2.3	Internal surfaces of airtight welded, box girders with limited accessibility, which generally do not exclude accessibility						
	not defined	1	BC ER DB EP/PUR	100 100 ~~200~~	Sa 2	50 50	no edge protection required; In the case of track plate undersides subject to thermal stress due to the installation of the road pavement, such as component No 1.2.4
1.2.4	Internal surfaces of open, ventilated box girders						
	not defined	Inside accessible box girders, light colours, e.g. RAL 9002, must be chosen to facilitate inspections.					
		1	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~320~~	Sa 2½	100-A 100-A 100-A 100-A	observe 4.3 (3); For the marginal areas of the chords of composite girders refer to part no. 5.4.1

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KOR-Stahlbauten, Annex A sheet No-	other information
1.2.5	Wind bracings with screw connections						
	Water splash zone, stone/chip impact and/or outdoor exposure: Corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Sweep blasting	-- 100-C 100-C 100-C	
1.3	Inaccessible and no longer accessible surfaces (as a rule, such surfaces are to be avoided by a corrosion-protection-compliant design)						
	a) not specified, maximum corrosion protection value sought	1	Zinc spraying sealing 1. UC ER-Combi 2. TC ER-Combi	100 ~~120~~	Sa 3	-- 81 81 81 81	Hot-dip galvanising possible with suitable construction
		2	BC ER Zn (R) 1. UC ER-Combi 2. TC ER-Combi	80 ~~120~~	Sa 2½	100-A 81 81 81	
		3	BC ER Zn (R) 1. UC ER 2. IC ER optional: 3. IC ER TC PUR	80 480	Sa 2½	100-A 100-A 100-A 100-A 100-A	
		4	Use of corrosion-resistant materials (DIN EN ISO 12944-2 and -3)				
	b) outdoor exposure: Corrosivity category up to C5	1	as a), but for load-bearing components with additional static consideration of a thickness loss on all sides in accordance with DIN EN 1993-5				
		2	Use of corrosion-resistant materials (DIN EN ISO 12944-2 and -3)				
1.4	Rolled girders in concrete (WIB construction) (see Figure A 4.3.16)						
	Water splash zone, chip impact and/or outdoor exposure: Corrosivity category up to C5	1	Zinc spraying sealing 1. IC ER optional: 2. IC ER or PUR TC PUR	100 ~~240~~	Sa 3	-- 100-D 100-D 100-D 100-	observe 2.1 (9), 4.3 (3)
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	observe 4.3 (3)

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] ——— Total film thickness [µm]	OV	Materials according to TL KOR-Stahlbauten, Annex A	other information
2	**Sheet pile walls and corrugated steel structures**						
2.1	sheet pile walls see Figure A 04/03/2011						
2.1.1	surfaces exposed to weather						
	Water splash zone, stone/chip impact and/or outdoor exposure: Corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	———240	Sweep blasting	-- 100-C 100-C 100-C	
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	
		3	Zinc spraying sealing 1. IC ER optional: 2. IC ER or PUR TC PUR	100 ~~240~~	Sa 3	-- 100-D 100-D 100-D 100-D	
2.1.2	Surfaces in contact with the ground						
	Corrosion load depending on soil type	1	Thickness loss according to DIN EN 1993-5				Statically consider thickness loss even with hot-dip galvanising
2.1.3	Transition areas air/soil up to 0.50 m below and above the future ground level						
	as 2.1.1/2.1.2 with changing humidity and ventilation	1	as 2.1.1, but with additional intermediate coating, i.e. the total film thickness specified for component No 2.1.1 shall be increased by 80 µm				
2.1.4	Interlock sealing as for component No 5.3						
2.2	Corrugated steel structures						
2.2.1	Surfaces in contact with the ground Corrosion load not defined	1	Hot-dip galvanising IC ER-combi TC ER-combi	1 2 0	Sweep blasting	-- 81 81	Do not select corrosively aggressive soil material for the backfill
2.2.2	surfaces exposed to weather Water splash zone, stone/chip impact and/or outdoor exposure: Corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Sweep blasting	-- 100-C 100-C 100-C	
		2	Hot-dip galvanising IC ER-combi TC ER-combi	1 2 0	Sweep blasting	-- 81 81	Only if colour stability is not required

continued on next page

Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] ——— Total film thickness [µm]	OV	Materials according to TL KOR-Stahlbauten, Annex A sheet No-module	other information
3	**Equipment of the structure**						
3.1	Parapet (including base slabs)						
	a) In closed spaces	1	Hot-dip galvanisation		--	--	With required colouring such as component No 3.1 b) with a total film thickness of 160 µm
	b) Exposure to weather	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Sweep blasting	-- 100-C 100-C 100-C	
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	Also for initial protection when hot-dip galvanising is not possible
3.2	Bearings, parts of bearings, anchor and packing plates						
	a) outdoor exposure: Corrosivity category up to C5	1	Zinc spraying sealing 1. IC ER optional: 2. IC ER or PUR TC PUR	100 ~~320~~	Sa 3	-- 100-D 100-D 100-D 100-D	For surfaces in contact with concrete, coat an edge strip of approx. 5 cm. If colour stability is required, then system No 1 or 3
		2	Zinc spraying sealing IC ER-combi TC ER-combi	100 —— 12	Sa 3	-- 81 81 81	
		3	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	
	b) Contact surfaces, e.g. between anchor and bearing plates	1	as for component No 5.1.1				
	c) Rolling and sliding surfaces	1	stainless steel				

continued on next page

Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
3.3	Drainage parts						
3.3.1	Cast iron drain pipes and pipe fittings in accordance with ZTV-ING 6-10						
	a) Pipes (outside)	1	Zinc spraying sealing 1. IC ER optional: 2. IC ER or PUR TC PUR	100 240	Sa 3	-- 100-D 100-D 100-D 100-D	
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 400	Sa 2½	100-A 100-A 100-A 100-A	primarily for repairs only
	b) Pipes (inside incl. edges)	1	TC ER-Combi	150	Sa 2½	81	
		2	DIN EN 877	150	DIN EN 877	DIN EN 877	
	c) Pipes (cutting edges)	1	BC ER diverse TC ER combi	≥ 80 120 200	P Sa 2, St 3, P Ma	100-B 81	base coat in accordance with the execution instructions of the material manufacturer; Apply the coating on the inside and outside of the pipe at the cutting edge over a width of 50 mm each.
		2	DIN EN 877	150	DIN EN 877	DIN EN 877	
	d) Fittings (inside/outside)	1	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 400	Sa 2½	100-A 100-A 100-A 100-A	Execution: inside and outside or only outside
		2	DIN EN 877	150	DIN EN 877	DIN EN 877	Execution: only inside
3.3.2	Accessories (e.g. pipe mounts/suspension/connection)						
	ZTV-ING 6-10 and the reference drawings RIZ WAS apply						
3.3.3	Internal surfaces of gutters, flashings						
	Splash water area,	1	Hot-dip galvanising		Sweep	--	

	(humidity, dirt), exposure to weather: Corrosivity category up to C5		IC ER-combi TC ER-combi	1 2 0 1 2 0 240	blasting	81 81	

continued on next page

Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
3.3.3	Internal surfaces of gutters, flashings						
	Splash water area, (humidity, dirt), exposure to weather: Corrosivity category up to C5	2	BC ER Zn (R) 1. UC ER-Combi 2. TC ER-Combi	80 1 2 0	Sa 2½	100-A 81 81 81	
3.3.4	External surfaces of gutters						
	Splash water area, (humidity, dirt), exposure to weather: corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	320	Sweep blasting	100-C 100-C 100-C	
		2	BC ER Zn (R) 1. UC ER 2. IC ER optional: 3. IC ER TC PUR	80 480	Sa 2½	100-A 100-A 100-A 100-A 100-A	
3.4	Transitions						
3.4.1	Carriageway edges						
	heavy mechanical load, splash water area, (humidity, dirt), exposure to weather: corrosivity category C5	1	Hot-dip galvanising 1 UC ER-Combi TC ER-Combi	1 2 0	Sweep blasting	-- 81 81	On concrete bridges, surfaces in contact with concrete without coating
3.4.2	Transition constructions, joint constructions, TMFÜ						
	heavy mechanical load, splash water area, (humidity, dirt), exposure to weather: corrosivity category C5	1	BC ER Zn (R) 1. IC ER 2. IC ER optional: 3. IC ER TC ER	80	Sa 2½	100-A 100-A 100-A 100-A 100-A	
		2	BC ER Zn (R) 1. UC ER-Combi 2. TC ER-Combi	80 1 2 0	Sa 2½	100-A 81 81 81	
	Apart from the above coating materials, solvent-reduced substances may be applied by the hot method if there is proven suitability.						
3.4.3	Anchors: - Surfaces encased in concrete - a margin of approx. 5 cm with a base coat, - otherwise with no particular protection, Otherwise as in 3.4.2						
3.5	Passive protection Corrosion protection in accordance with the Additional Technical Contractual Conditions and Guidelines for Vehicle Restraint Systems (ZTV-FRS)						

continued on next page

Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
3.6	Noise barriers, protection against contact						
3.6.1	Steel driven piles for foundation, foundation pipes						
	Corrosion load depending on soil type	1	Thickness loss according to DIN EN 1993-5 BC ESI-Zn	100	Sa 2½	86	BC ESI-Zn on pile head up to at least 0.75 m below ground level (inside and outside)
3.6.2	Support structure (posts, supporting structures and substructures of sound absorbing panelling), protection against contact						
	Splash water area, impact of stones/loose chippings or exposure to weather: corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	240	Sweep blasting	-- 100-C 100-C 100-C	
	For components embedded in the ground or set in concrete, an additional IC (≥ 80 µm) of 50 cm below to 50 cm above ground level						
3.6.3	Noise barrier elements of aluminium, including supporting structures and substructures of sound absorbing panelling						
	Splash water area, impact of stones/loose chippings or exposure to weather: corrosivity category up to C5	1	TC polyester powder or PUR liquid coating with forced drying	60	chromatise or prepare with an equivalent chromate-free process		Quality assurance according to the quality guidelines GSB AL 631 of the quality community GSB international e.V. The coatings may only be applied after mechanical working (roll-forming, folding, etc.). Damaged areas must be repaired with a PUR wet layer. Repairs to the damaged areas are to be agreed with the coil-coater.
		2	two-layer polvyinylide fluoride (PVdF) baked coating in accordance with DIN EN 1396	25			
		3	IC ER liquid coating TC PUR liquid coating	100			Construction site coating
		Internal surfaces of noise protection components (e.g. Noise protection cassettes) may be left uncoated. If the external coating is also dispensed with, the minimum sheet thickness has to be 1.25 mm					

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
3.7	Safety curbs, caps and safety thresholds						
3.7.1	Safety curbs and caps						
	a) Occasional pedestrian access	1	as component No 1.1.3 (a)				
	b) frequent pedestrian use, heavy mechanical load	1	Systems in accordance with TL/TP-ING Part 6 Section 5 (TL RHD-ST)				the specifications of the ZTV-ING 6-5 for the execution at safety curbs must be observed
3.7.2	Safety thresholds						
	Splash water area, (humidity, dirt), exposure to weather: corrosivity category up to C5	1	as component No 1.1.3 (a) as a rule without addition of quartz sand				accessible safety thresholds according to component No 3.8.3; suitable for confined spaces
3.8	Inspection facilities (e.g. ladders, doors, inspection trolleys, inspection walkways, installations), rails and service walkways						
3.8.1	Inspection installations						
	a) In closed spaces	1	Hot-dip galvanisation		--	--	Not in the event of risk of warping
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~3~~ 2	Sa 2½	100-A 100-A 100-A 100-A	In the event of risk of warping, e.g. doors
	b) Exposure to weather	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Sweep blasting	100-C 100-C 100-C	Not in the event of risk of warping
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	In the event of risk of warping, e.g. doors
3.8.2	Inspection trolley rails: tread surface only						
	Relevant for a tread surface: Wheel pressure of the inspection trolley	1	Hot-dip galvanisation		--		Other surfaces such as adjacent components
		2	Stainless steel		--		Fastening by screws or welding (see also DIN 12944-3). Material No 1.4401 or 1.4571 in accordance with DIN EN 10088, other surfaces similar to adjacent components

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
3.8.2	Inspection trolley rails: tread surface only						
	Relevant for a tread surface: Wheel pressure of the inspection trolley	3	BC ESI-Zn	100	Sa 2½	86	Other surfaces as adjacent components
3.8.3	Service bridges						
	a) Occasional pedestrian access	1	as component No 1.1.3 (a)				also suitable for splash water areas (humidity, dirt) and exposure to weather (corrosivity category up to C5)
	b) Frequent pedestrian use	1	as component No 1.1.3 (b)				
4	**Bridge installations**						
4.1	Fixed bridge devices (e.g. S 80, service bridges, Bailey bridges)						
	Splash water area, high mechanical load, exposure to weather: Corrosivity category up to C5.	1	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	
4.2	Small temporary bridges, temporary bridges and pier installations						
	Corrosivity category C2 and long duration of protection, or Corrosivity category C3 and medium duration of protection, or Corrosivity category C4 and short duration of protection	1	BC ESI-Zn	100	Sa 2½	86	Spray two coats wet in wet
5	**Surfaces requiring special treatment**						
5.1	Friction surfaces of threaded and of riveted connections; see Figure A 04/03/2012						
5.1.1	non-slip screwed connections of categories B and C according to DIN EN 1993-1-8						
	if coefficient of static friction of µ = 0.5 is required	1	BC ASI-Zn	60	Sa 3	85	sheet 86 is also admissible if coefficient of static friction µ ≥ 0.5 is proven
	if coefficient of static friction of µ = 0.3 is sufficient	2	BC ESI-Zn	60	Sa 2½	86	
	The dry film thickness must not be less than 40 µm or more than 80 µm.						
5.1.2	screwed connections of category E according to DIN EN 1993-1-8 and rivet connections						
	The same base coat as on the adjacent components is to be used. The dry film thickness must not exceed 125 µm. Surface preparation grade: Sa 2½						
5.1.3	screwed connections of categories A and D according to DIN EN 1993-1-8						
	Use the same corrosion protection system as for adjacent components						

continued on next page

Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
5.2	Edges, site weld joints, temporary protection, fasteners						
5.2.1	Edges and weld seams (edge protection)						
	not defined	1	Edge protection	80		100-A, 100-B, 81	Continue to build up the IC and TC in accordance with the system
		The edge protection is part of the respective corrosion protection system and must also be taken into account there, it serves to compensate for thinning at the edges, is not included in the calculations of the total film thickness and must be applied to edges and welds as well as in a range of about 25 mm on both sides of them following the BC.					
5.2.2	Site weld joints (final protection)						
	not defined	1	BC ER	100	P Sa 2, P Ma, P St 3	50	Continue to build up the TC in accordance with the system (see Figure A 4.3.4)
		2	BC ER Zn (R)	80	Sa 2½	81, 100-A	Continue to build up edge protection, IC and TC in accordance with the system (see Figure A 4.3.4)
5.2.2	Site weld joints (continued)						
	not defined	3	BC (optional)	(80)	Sa 2½ roughness grade coarse (G)	84	Sheet 84 according to TL 889.0084, Continue to build up the TC in accordance with the system (see Figure A 4.3.5)
		The coatings of site weld joints up to the substrate are to be planned as separate systems. The BC of site weld joints is part of the respective corrosion protection system and must also be taken into account in the total film thickness.					
5.2.3	Temporary protection, e.g. track plate topsides, site weld joints in the factory, etc.						
	Corrosivity category C2 and long duration of protection, or Corrosivity category C3 and medium duration of protection, or Corrosivity category C4 and short duration of protection	1	BC ER-diverse	100 100	Sa 2, P Sa 2, St 3, P Ma	100-B	Provide temporary coatings with an unmistakeable colour
		Temporary protection on surfaces with longer expected service life and to avoid rust streaks on the surrounding coating before the final protection is applied. Temporary protection shall be removed without residue by grinding or blasting prior to welding and final protection. Execution at site weld joints in the factory as a replacement for gluing according to Figure A 4.3.4 until the welding on the construction site can be specified if necessary.					
5.2.4	Hot-dip galvanised fasteners						
	Splash water area, impact of stones/loose chippings or exposure to weather: corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Cleaning + degreasing	100-C 100-C 100-C	Coat fasteners after tightening and, if necessary, retensioning and coating must overlap the surrounding coating

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
5.3	Joins and crevices (for the avoidance of crevice corrosion and/or contact corrosion)						
	not defined		Joint sealing. Sealing compound must correspond to the selected protection system (sealing before or after top coat), see also DIN EN ISO 12944-3, Section 5.2				Requirements for the materials in accordance with the technical delivery conditions for the external corrosion protection of fully sealed ropes and cables (TL Kor-VVS) 1K-PUR / PUR sealants, overcoatable
5.4	Composite construction, contact surfaces with concrete						
5.4.1	Belts of composite girders; see Figures A 4.3.13, A 4.3.14						
	All cases are based on maximum load: corrosivity category C5	1	BC ER Zn (R)	80 80	Sa 2½	100-A	see also 5.3.7 (2) and 2.1 (11)
	In the case of a carriageway deck with a difference in thickness at the margin of the upper chord as per Figure A 4.3.14, a permanently flexible filled crevice is to be formed for repairs at the margin of the flange. The elastic sealants must be compatible with the adjacent corrosion protection coating and must be overcoatable in case of necessity. On a new construction the standard solution should be for there to be no joint at the edge of the flange as in the detail. However, it is permissible to do so.						
5.4.2	Contact surfaces between steel and fresh concrete; e.g. base or anchor plates set in concrete						
	All cases are based on maximum load: corrosivity category C5	1	BC ER Zn (R)	80 80	Sa 2½	100-A	see also 5.3.7 (1) and 2.1 (11)
5.4.3	Contact surfaces between steel and hardened concrete, e.g. base plates or anchor plates to be built in subsequently; see Figure A 04/03/2015						
	All cases are based on maximum load: corrosivity category C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	 240	Sweep blasting	-- 100-C 100-C 100-C	
		2	Zinc spraying sealing 1. IC ER optional: 2. IC ER or PUR TC PUR	100 ~~240~~	Sa 3	-- 100-D 100-D 100-D 100-D	
		3	BC ER Zn (R) 1. UC ER 2. IC ER 3. IC ER TC ER or PUR	80 ~~480~~	Sa 2½	100-A 100-A 100-A 100-A 100-A	

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Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
5.5	Upper chords of rolled girders with direct sleeper support						
	corrosivity category C5	1	BC ER-Zn (R) TC ER	80 320 400	Sa 2½	100-A 84	in the case of repairs
6	**Road signs and signal gantries, road traffic signal systems and traffic masts**						
6.1	Road signs and signal gantries						
6.1.1	Support structure with ladders and railings						
	Water splash zone, chip impact and/or outdoor exposure: corrosivity category up to C5	1	Hot dip galvanising 1. IC ER optional: 2. IC ER or PUR TC PUR	~~240~~	Sweep blasting	-- 100-C 100-C 100-C	
		2	BC ER Zn (R) 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	80 ~~400~~	Sa 2½	100-A 100-A 100-A 100-A	applies only to repairs
6.1.2	accessible inspection walkways						
	anti-slip coating for inspection walkways on transoms of traffic sign and signal gantries	1	Hot-dip galvanising IC ER Thin coating PUR or ER-PUR quartz sand 0.4-0.7 mm	80 4,000 4,080	Sweep blasting	100-C	Thin coating according to TL/TP-ING Part 6 Section 5 (TL RHD-ST)
		2	Systems according to TL/TP-ING Part 6 Section 5 (TL RHD-ST)				applies only to repairs
6.2	Traffic lights and traffic masts						
	Water splash zone, chip impact and/or outdoor exposure: corrosivity category up to C5	1	as component No 6.1.1				
6.3	Overhead line masts						
		Corrosion protection must be agreed with the transport companies					

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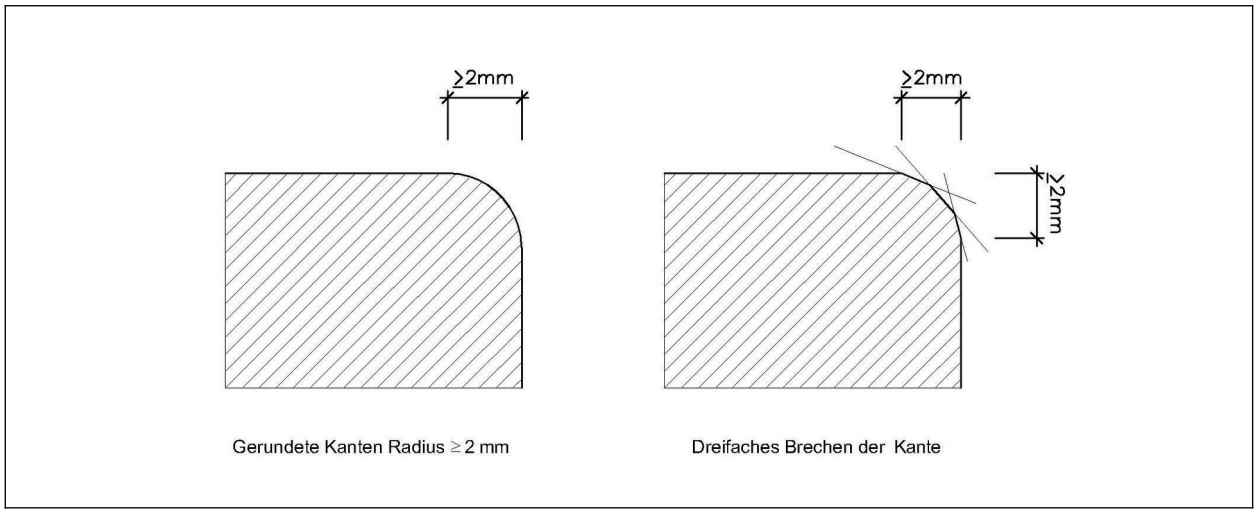
Table A 4.3.2 continued

1	2	3		4	5	6	7
Part no.	Assumed corrosion stress	Corrosion protection system No		NDFT [µm] Total film thickness [µm]	OV	Materials according to TL KO-Stahlbauten, Annex A, sheet No, module	other information
7	**Riveted constructions**						
	a) Water splash zone, chip impact and/or outdoor exposure: corrosivity category up to C5	1	BC ER-diverse 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	~~440~~	P Sa 2, Sa 2, St 3, P Ma	100-A 100-A 100-A 100-A	
	b) inside of accessible box girders	2	BC ER-diverse 1. IC ER or PUR optional: 2. IC ER or PUR TC PUR	~~360~~	P Sa 2, Sa 2, St 3, P Ma	100-A 100-A 100-A 100-A	

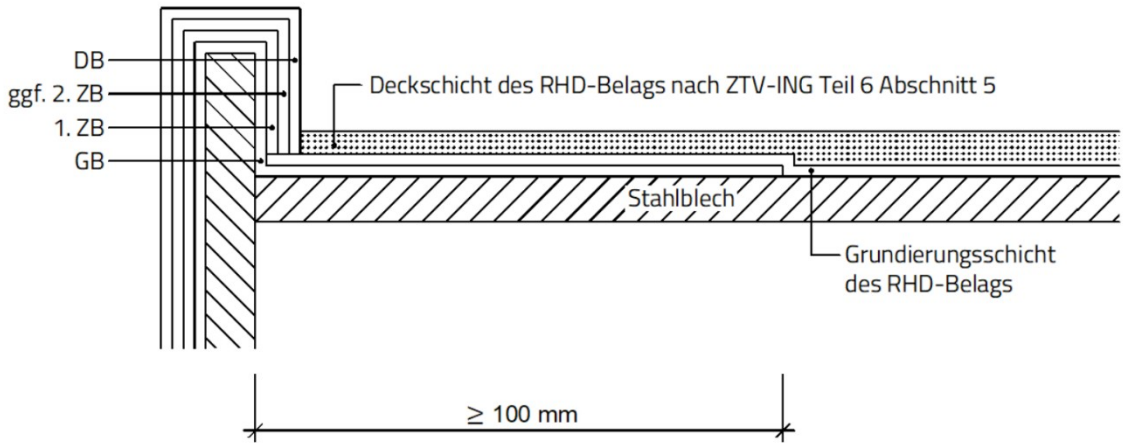
A 3 Figures

Explanatory notes on component numbers in accordance with Table A 4.3.2 (examples) and schematic representations of selected details



Gerundete Kanten Radius ≥ 2 mm	Rounded edges Radius ≥ 2 mm
Dreifaches Brechen der Kante	Threefold chamfering of the edge

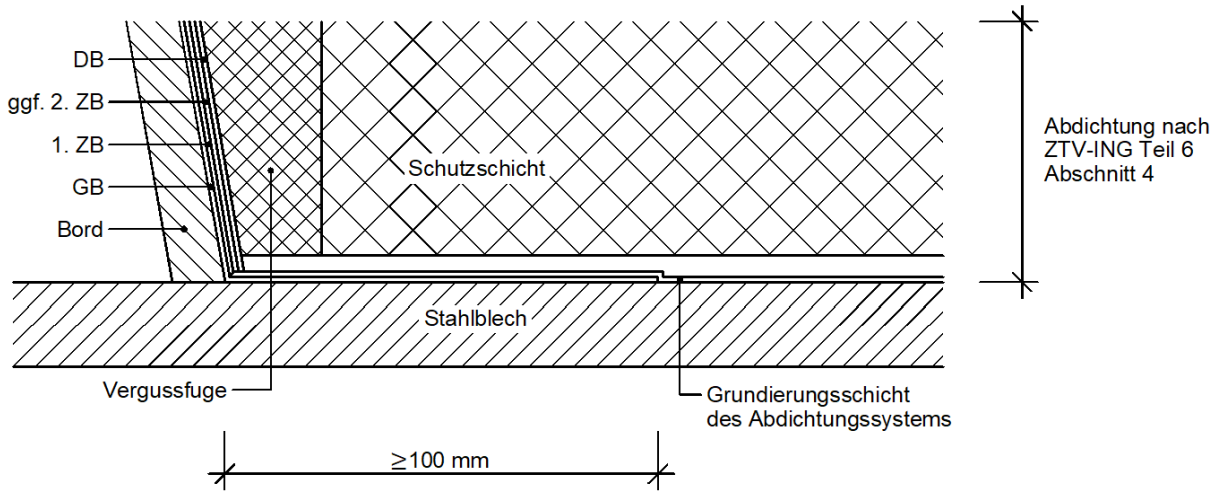
Figure A 4.3.1: Schematic illustration of permissible preliminary treatment of edges



Die Deckbeschichtung des Korrosionsschutzsystems im Überlappungsbereich kann entfallen, wenn mindestens 2 Zwischenbeschichtungen vorhanden sind.
Alternativ kann auch die GB über die Grundierungsschicht gezogen werden.

Deckschicht des RHD-Belags nach ZTV-ING Teil 6 Abschnitt 5	Topcoat of the reaction-resin based thin deck pavement according to ZTV-ING Part 6 Section 5
Grundierungsschicht des RHD-Belags	Priming coat of the reaction-resin based thin deck pavements
Die Deckbeschichtung des Korrosionsschutzsystems im Überlappungsbereich kann entfallen, wenn mindestens 2 Zwischenbeschichtungen vorhanden sind.	The top coat of the corrosion protection system in the overlap area can be omitted if there are at least 2 intermediate coatings.
Alternativ kann auch die GB über die Grundierungsschicht gezogen werden.	Alternatively, the BC can also be applied on the priming coat.

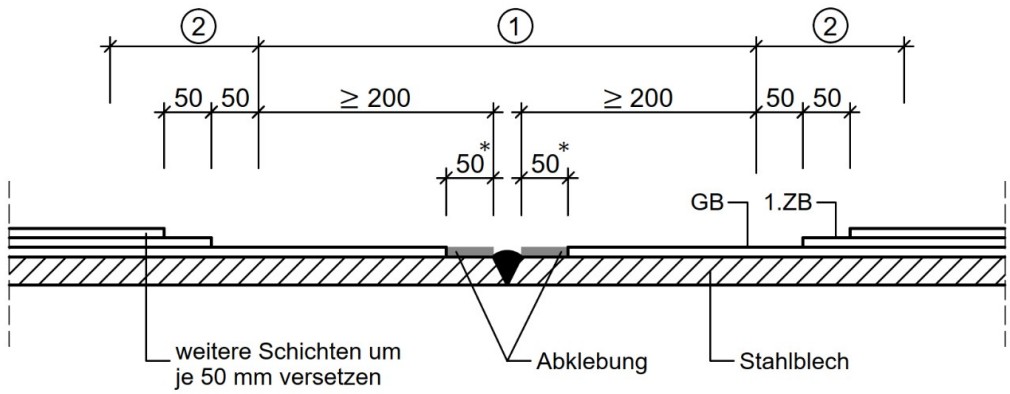
Figure A 4.3.2: Corrosion protection system of the reaction-resin based thin deck pavements in accordance with Part 6, Section 5 (schematic diagram)



Die Deckbeschichtung des Korrosionsschutzsystems im Überlappungsbereich kann entfallen, wenn mindestens 2 Zwischenbeschichtungen vorhanden sind.
Alternativ kann auch die GB über die Grundierungsschicht (Bauart 1 und Bauart 3) gezogen werden.

Abdichtung nach ZTV-ING Teil 6 Abschnitt 4	Sealing according to ZTV-ING Part 6 Section 4
Schutzschicht	Protective coat
Stahlblech	Sheet steel
Vergussfuge	Grouting joint
Grundierungsschicht des Abdichtungssystems	Priming coat of the waterproofing system
Die Deckbeschichtung des Korrosionsschutzsystems im Überlappungsbereich kann entfallen, wenn mindestens 2 Zwischenbeschichtungen vorhanden sind.	The top coat of the corrosion protection system in the overlap area can be omitted if there are at least 2 intermediate coatings.
Alternativ kann auch die GB über die Grundierungsschicht (Bauart 1 und Bauart 3) gezogen werden.	Alternatively, the BC can also be applied on the priming coat (type 1 and type 3).

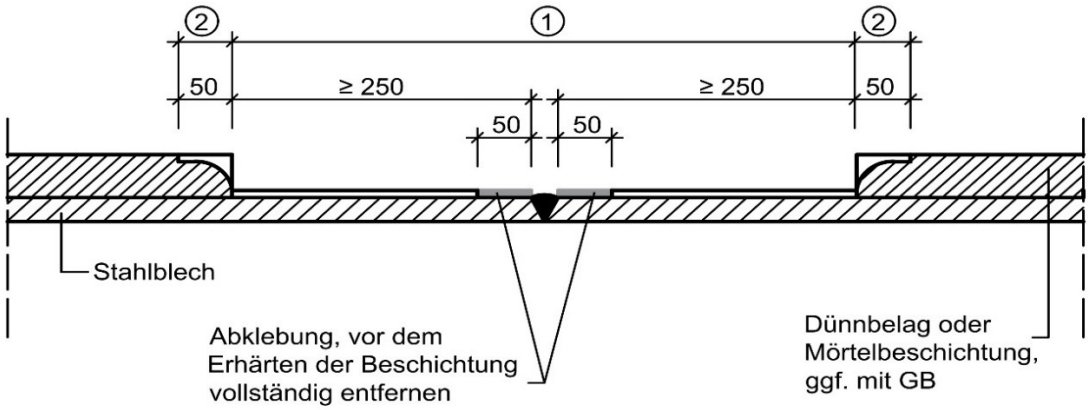
Figure A 4.3.3: Joint of the corrosion protection system according to Part 6, Section 4 (schematic diagram)



Im Bereich 1 vor dem Beschichten bis Oberflächenvorbereitungsgrad Sa 2½ strahlen.
Im Bereich 2 durch Strahlen die Kanten brechen und die vorhandene Beschichtung aufrauen.
*: Bei Blatt 50 ist die Breite der Abklebung in Abhängigkeit der Größe der Wärmeeinflusszone anzupassen.

weitere Schichten um je 50 mm versetzen	Offset further layers by 50 mm each
Abklebung	Masking
Stahlblech	Sheet steel
Im Bereich 1 vor dem Beschichten bis Oberflächenvorbereitungsgrad Sa 214 strahlen.	In area 1 before coating blast-clean to surface preparation grade Sa 214.
Im Bereich 2 durch Strahlen die Kanten brechen und die vorhandene Beschichtung aufrauen.	In area 2 chamfer the edges by blasting and roughen the existing coating.
*: Bei Blatt 50 ist die Breite der Abklebung in Abhängigkeit der Größe der Wärmeeinflusszone anzupassen.	*: In the case of Sheet 50, the width of the masking must be adjusted according to the size of the heat-affected zone.

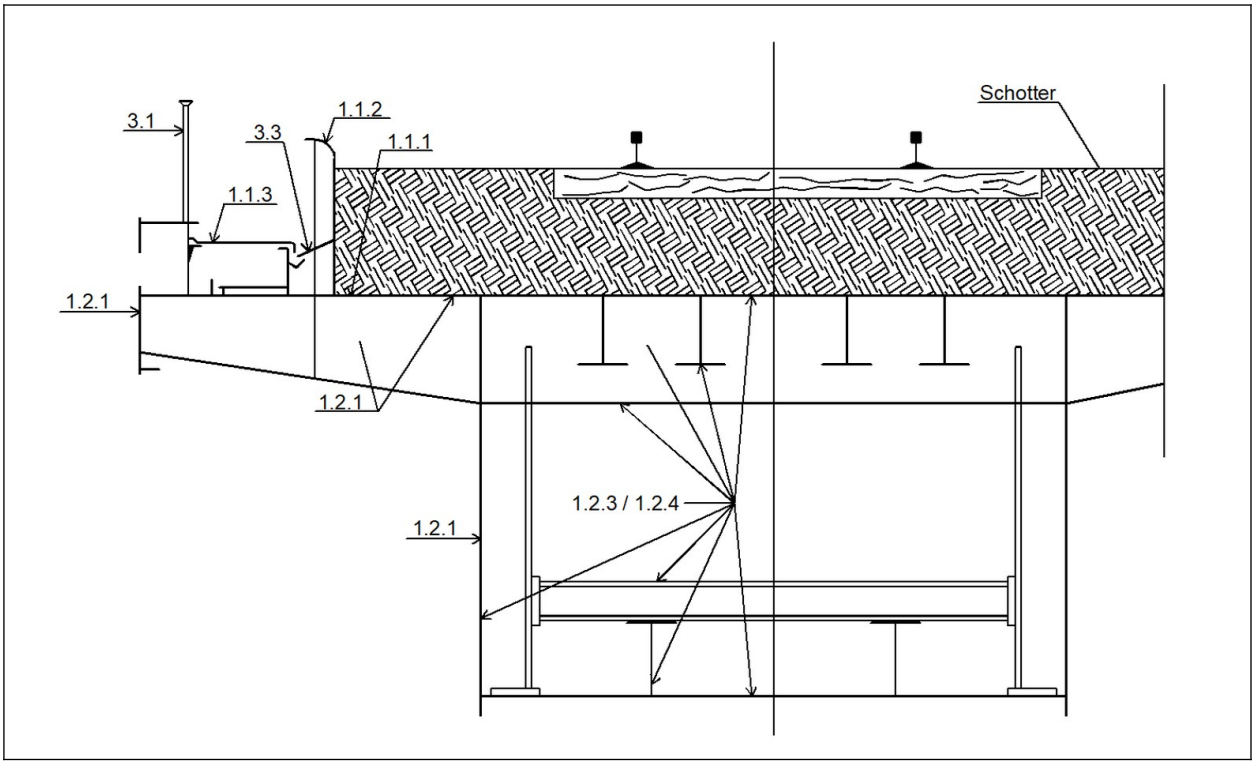
Figure A 4.3.4: Schematic illustration of construction of corrosion protection layer in the region of site weld joints in heat-affected zones of not more than 200 mm width. Refer to 6.5(5) in the case of broader heat-affected zones



Im Bereich 1 vor dem Beschichten bis Oberflächenvorbereitungsgrad Sa 2½ strahlen
Im Bereich 2 durch Strahlen die Kanten brechen und die vorhandene Beschichtung aufrauen

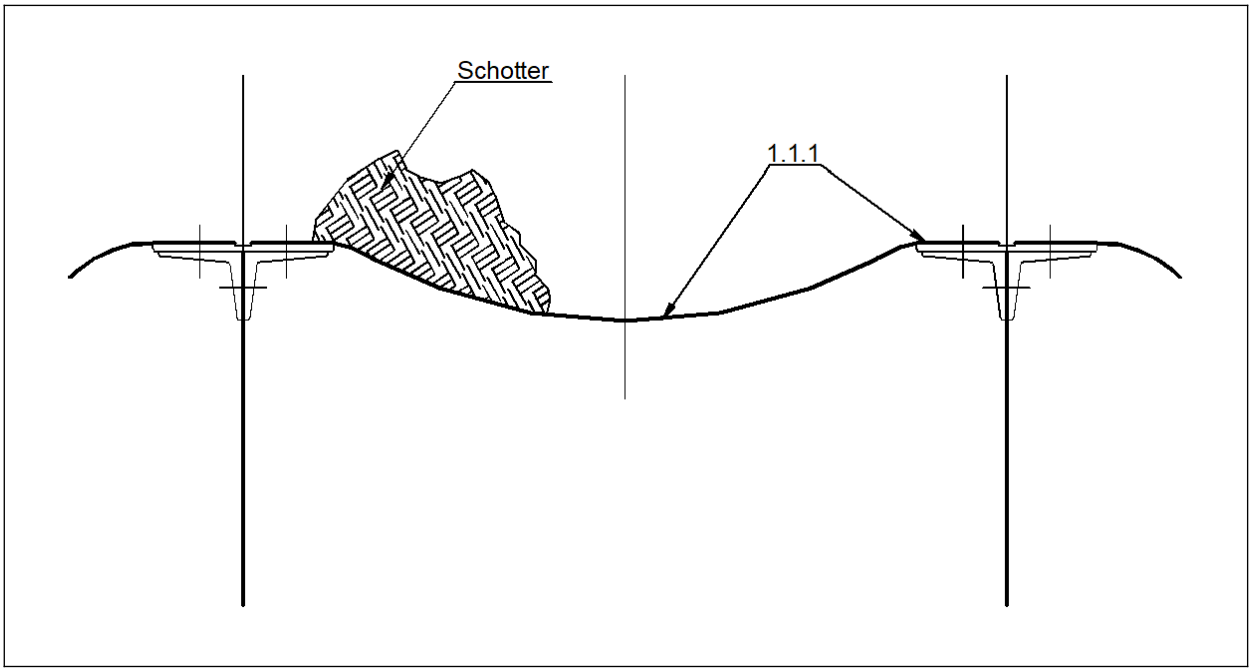
Stahlblech	Sheet steel
Abklebung, vor dem Erhärten der Beschichtung V vollständig entfernen	Masking, remove completely before the coating hardens
Dünnbelag oder Mörtelbeschichtung, ggf. mit GB	Thin coating or mortar coating, if necessary, with BC
Im Bereich 1 vor dem Beschichten bis Oberflächenvorbereitungsgrad Sa 2% strahlen	In area 1, blast-clean to surface preparation grade Sa 2 % before coating
Im Bereich 2 durch Strahlen die Kanten brechen und die vorhandene Beschichtung aufrauen	In area 2, chamfer the edges by blasting and roughen the existing coating

Figure A 4.3.5: Schematic representation of the design of thin coatings and mortar coatings in the area of site weld joints with heat-affected zones of a maximum width of 200 mm. Refer to 6.5(5) in the case of broader heat-affected zones



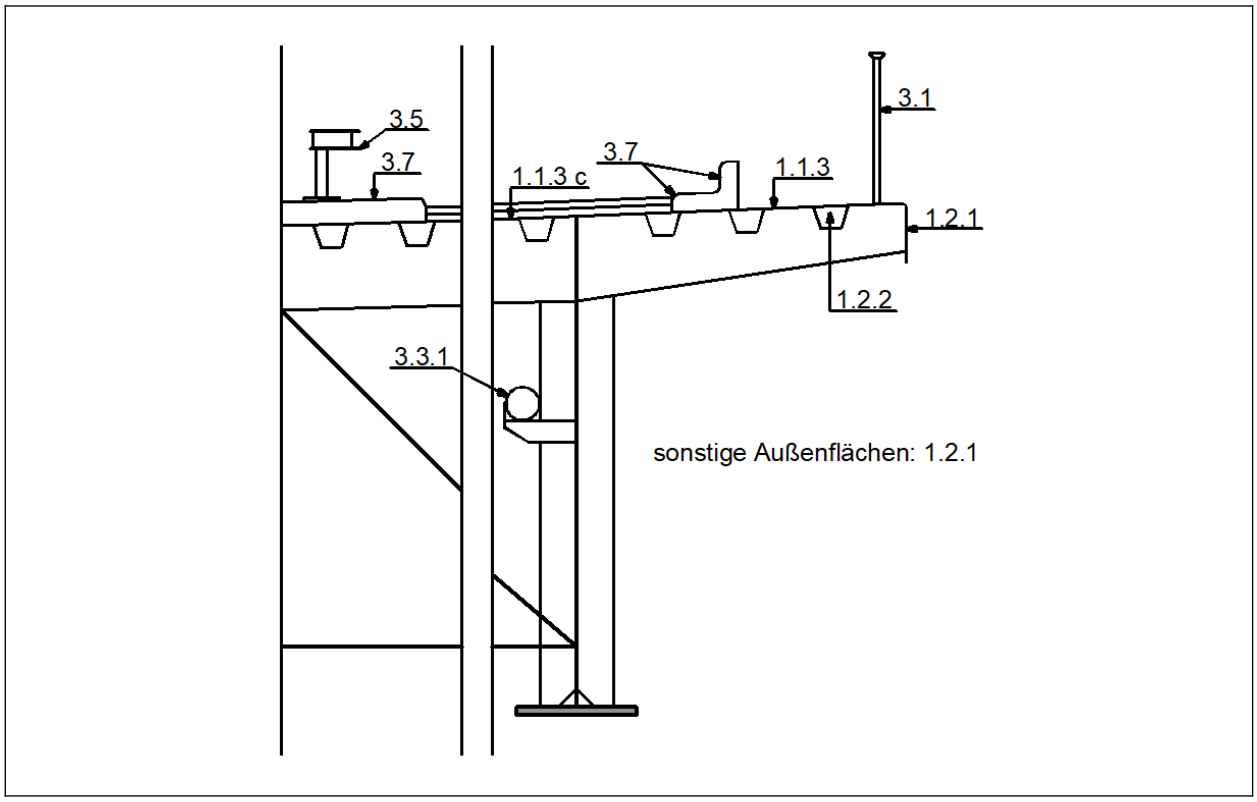
Schotter	Crushed stone

Figure A 4.3.6: Cross-section of a box girder superstructure for railway bridge with ballast



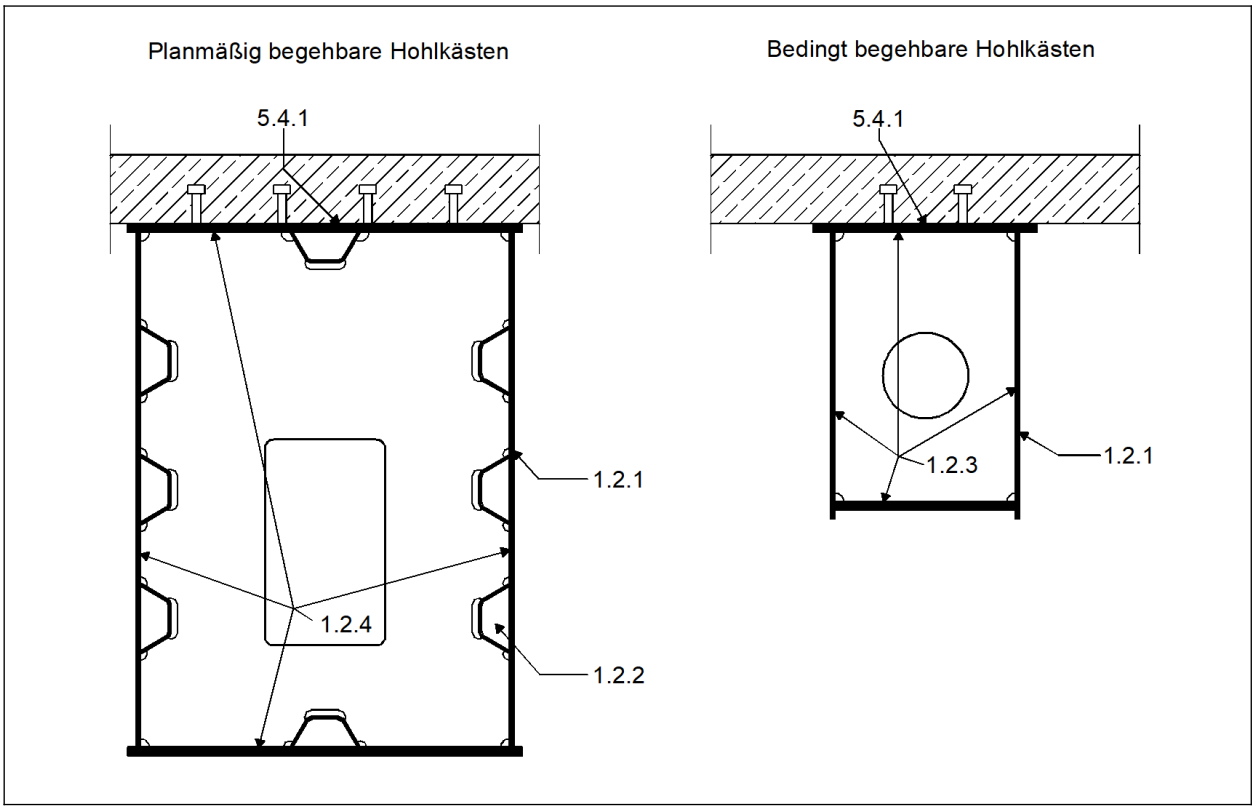
Schotter	Crushed stone

Figure A 4.3.7: Idealised cross-section through a riveted buckle plate superstructure with ballast



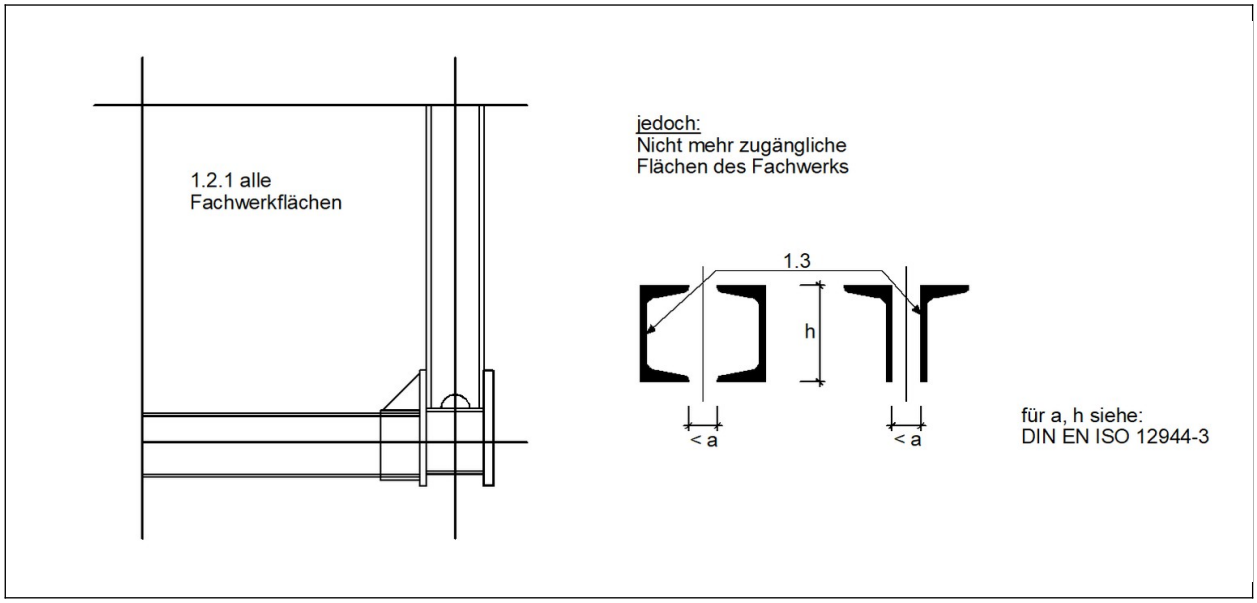
sonstige Außenflächen: 1.2.1	other external surfaces: 1.2.1

Figure A 4.3.8: Partial cross-section of a road bridge with open cross-section



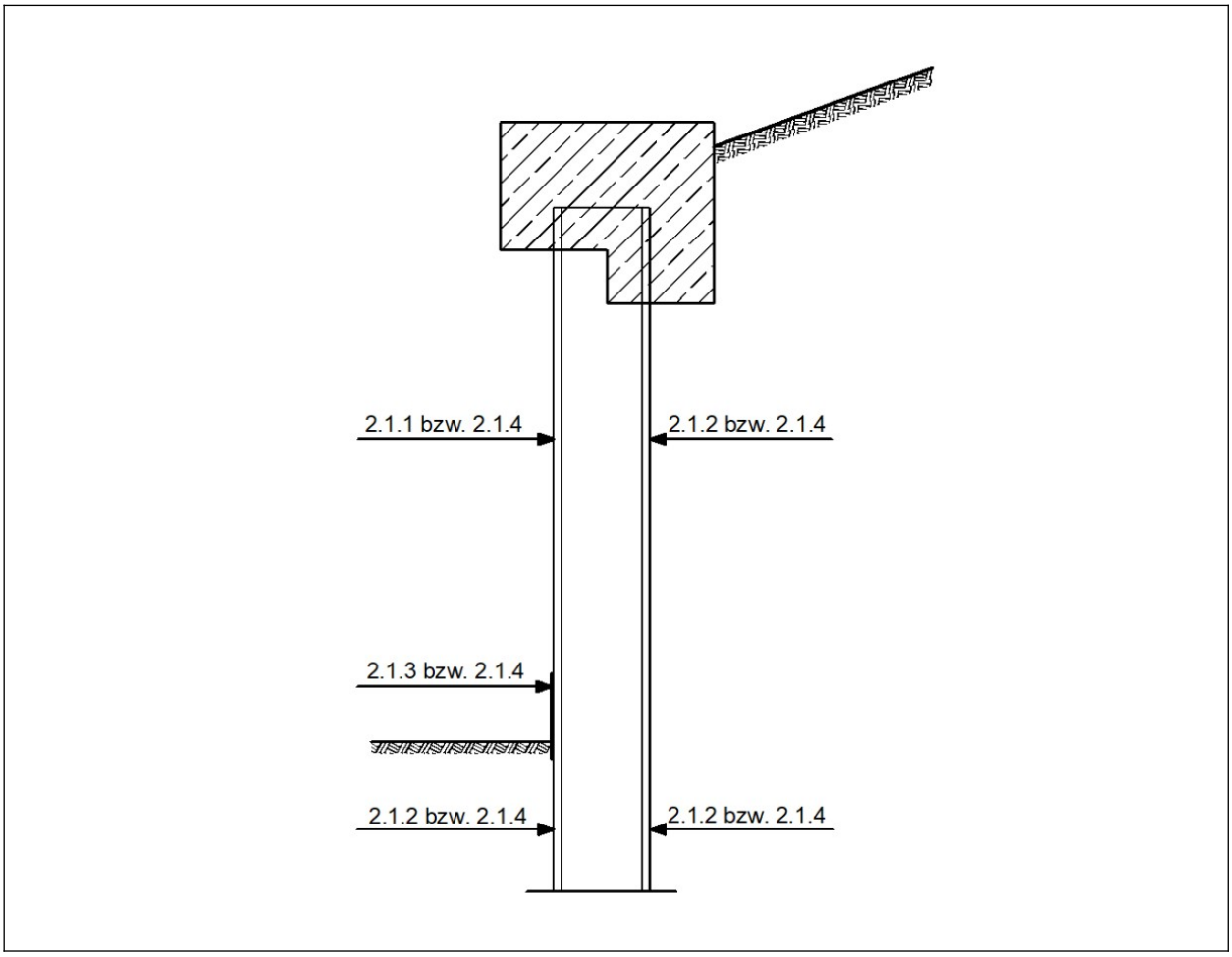
Planmäßig begehbare Hohlkästen	Accessible box girders
Bedingt begehbare Hohlkästen	Box girders with limited accessibility

Figure A 4.3.9: Corrosion protection in box girders



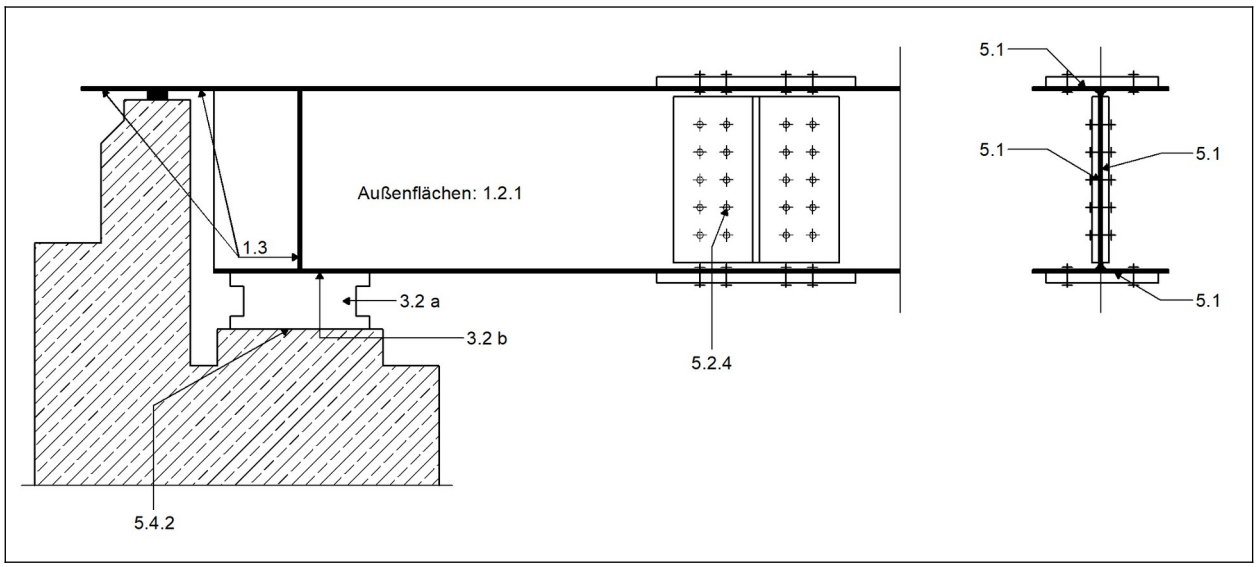
1.2,1 alle Fachwerkflächen	1.2.1 all truss surfaces
jedoch:	however:
Nicht mehr zugängliche	No longer accessible
Flächen des Fachwerks	surfaces of the truss
für a, h siehe: DIN EN ISO 12944-3	for a, h see DIN EN ISO 12944-3

Figure A 4.3.10: Partial cross-section of a lattice construction



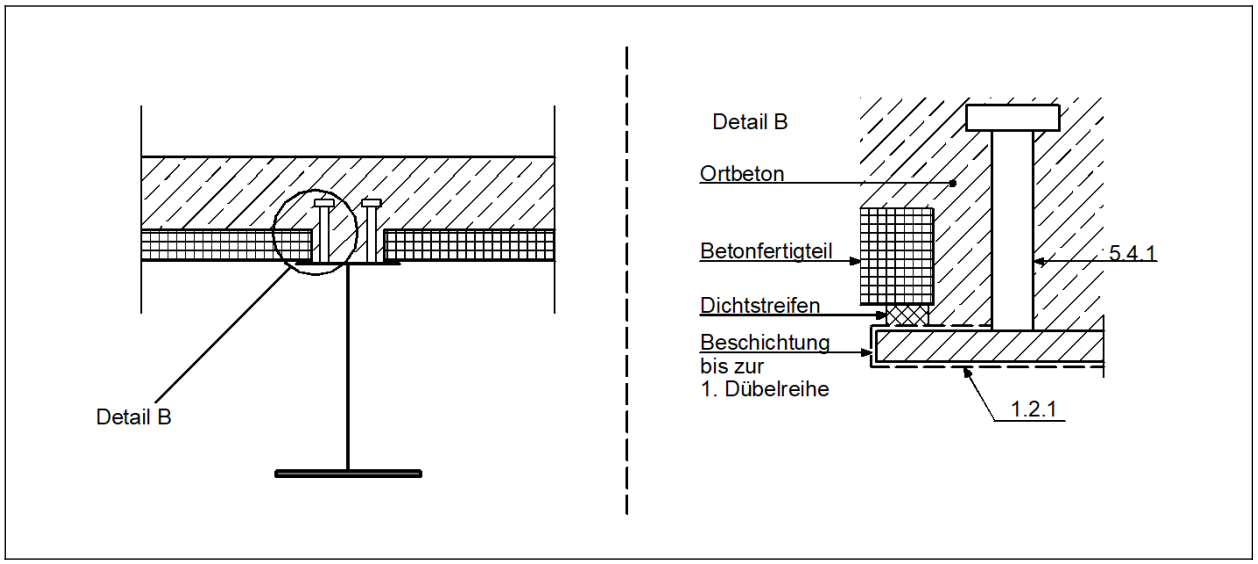
2.1.1 bzw. 2.1.4	2.1.1 and 2.1.4, respectively

Figure A 4.3.11: Cross-section of sheet pile



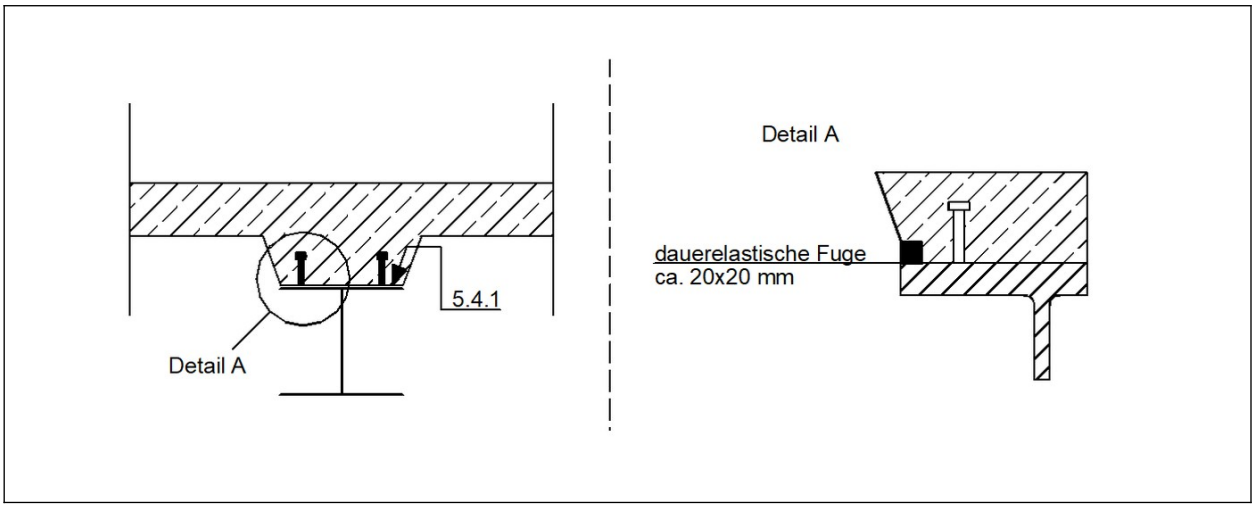
Außenflächen: 1.2.1	External surfaces: 1.2.1

Figure A 4.3.12: Idealised longitudinal section through a supported girder with screwed butt strap joint and cover plate



Detail B	Detail B
Ortbeton	In-situ concrete
Betonfertigteil	Precast concrete part
Dichtstreifen	Sealing strips
Beschichtung bis zur	Coating up to the
1. Dübelreihe	1. row of dowels
Detail B	Detail B

Figure A 4.3.13: Detail cross-section in composite construction with prefabricated concrete parts and in-situ concrete addition



Detail A	Detail A
dauerelastische Fuge ca. 20x20 mm	Permanently elastic joint approx. 20x20 mm

Figure A 4.3.14: Detail cross-section in composite construction with refabricated concrete part

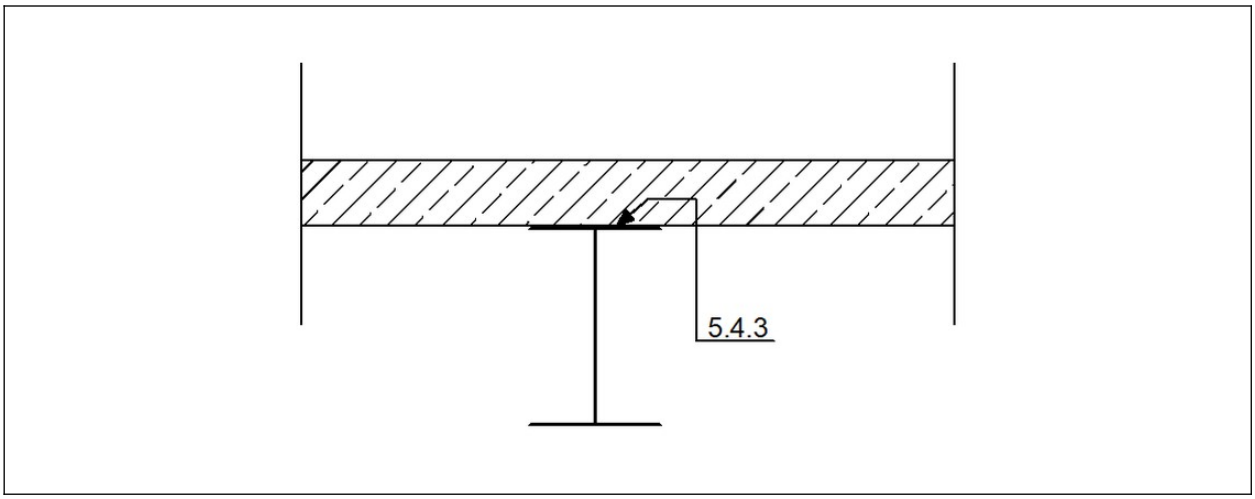
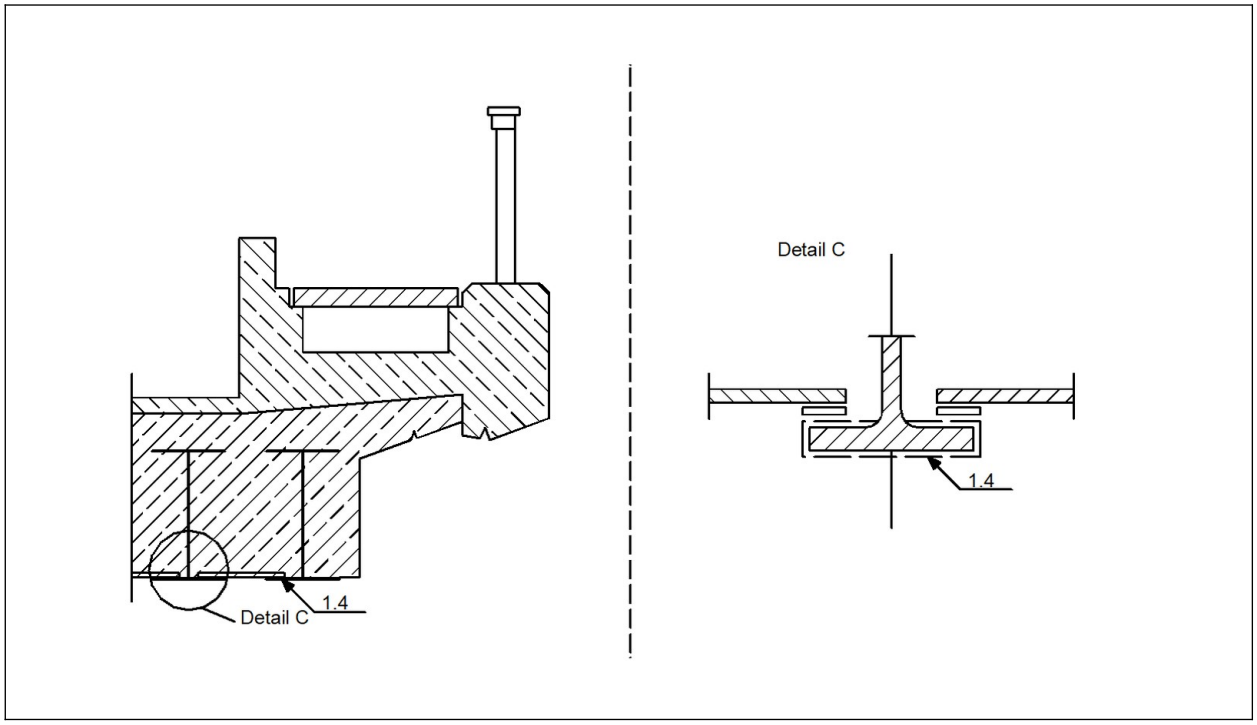


Figure A 4.3.15: Detailed cross-section of precast concrete elements lying on steel girders without bond



Detail C	Detail C

Figure A 4.3.16: Detailed cross-section of a bridge superstructure with rolled girders in concrete

Annex B
Test reports

Form B 4.3.1

Test report for the corrosion protection, General information			**Page**
Building project			**Works number (ASB)**
Construction phase			
Contracting authority			**Name of the construction project**
Testing facility			**top**
Sheet			**bottom**
Initial coating ☐	Total refurbishment ☐	Partial refurbishment ☐	Repair ☐
Contractor for: Surface preparation: ..... Coating at factory: ..... Coating on site:			
Supplier of materials:			
Corrosion protection plan No		Total surface area approx. .....m^2	
Control surface protocols no. ..... Number of single protocols in accordance with Form B 4.3.2 ..... and B 4.3.3:			
System drawing: Longitudinal view / Top view / Cross-section		with partial allocation to a zone or cross-reference to other documents	
Note: (Place) (Date) (name, signature, test body)			

Form B 4.3.2

Test protocol for corrosion protection: conditions for application — **Page**

Structure number (ASB) — **Building project**

Construction phase (factory ☐ Construction site ☐) — **Building component**

Contractor — **Contractor**

Measuring instruments (for columns 6-9):

Component (subarea no.)	1												
Date / time	2												
Working process (e.g. surface preparation, BC, IC, TC)	3												
Application method	4												
Weather conditions	5												
Temperature [°C]	Air	6											
	Building component	7											
Relative air humidity [%]		8											
Dew point [°C]		9											
Coating material (/material no.)		10											
Colour		11											
Batch No:		12											
Degree of preparation/radiation (standard designation, trade name)		13											
Comments (special phenomena, irregularities)		14											

Signatures:

(Contractor)(Place)(Date)(Client)(Place)(Date)

Form B 4.3.3

Test protocol for the corrosion protection: film thickness measurement	**Page**
Building project	**Works number (ASB)**
Construction phase	
Contracting authority	**Name of the construction project**
Testing facility	**top**
Sheet	**bottom**

Building component: ..... Subarea No .....
..

Corrosion protection plan no. …… Size: .....m^2

Measurement of film thicknesses:
(areas measured are 10 m^2 each)

Base coat is hot-dip galvanised, if necessary	☐	Nominal film thickness: .....µm
Partial coating (e.g. factory coat)	☐	Nominal film thickness: .....µm
of the entire corrosion protection system (if required)	☐	Nominal film thickness: .....µm

Measuring instrument: ..... Date of measurement: ……

Extent of measurements:

a) as specified by the client ☐

b) according to Table 4.3.3: (20 measurements per sub-area) ☐

Measurement values:

Comments:

(Place) (Date) (name, signature, test body)

Form B.4.3.4

Control surfaces protocol: general information	**Page**
Building project	**Works number (ASB)**
Construction phase	
Contracting authority	**Name of the construction project**
Testing facility	**top**
Sheet	**bottom**

	Company	Person responsible
Surface preparation:		
Coating tasks:		
Supplier of materials:		
Control surface: Position and designation		Size in m^2

Initial condition of surface:

Uncoated steel surface (details in accordance with DIN EN ISO 8501-1)

Degree of rusting: ☐ A ☐ B ☐ C ☐ D

Additional information:

uncoated zinc surface ☐ hot-dip galvanised ☐ thermally sprayed

Zinc corrosion (e.g. white rust) ☐ yes ☐ no

additional information:

coated surface (e.g. partial coating, old coating):

Corrosion protection system, film thickness, age of coating

Assessment pursuant to the 'Guideline for the Preservation of Corrosion Protection of Steel Structures (RI-ERH-KOR)', if necessary:

Additional information:

Blasting agents (standard designation, trade name):

Surface preparation:

Surface preparation grade (details in accordance with DIN EN ISO 8501-1 and -2):

☐ Sa 1 ☐ Sa 2 ☐ Sa 2½ ☐ Sa 3 ☐ St 2 ☐ St 3

☐ P Sa 2 ☐ P Sa 2½ □ P Sa 3 ☐ P Ma ☐ P St 2 ☐ P St 3

further details on the method and degree of preparation:

Dust test according to DIN EN ISO 8502-3: m …. G ……

Salt content according to DIN EN ISO 8502-6 and -9: mg/m²

Comment

(Place) (Date) (Signature of the Client)

(Signature of the Contractor)

Form B.4.3.5

Control surface protocol: information when creating the control surface	**Page**
Building project	**Works number (ASB)**
Construction phase	
Contracting authority	**Name of the construction project**
Testing facility	**top**
Sheet	**bottom**

Work cycle	1	2	3	4	5
Coating material no.					
Manufacturer					
Designation					
Colour					
Application method					
Air temperature °C					
Relative air humidity %					
Surface temperature °C					
Dew point °C					
Weather (description)					
Thinner (type and quantity)					
Wet film thickness µm [1])					
Measuring device					
Dry film thickness[2])					
Measuring device					
Date					
Time					
Coating site [2])					
Coating facility					
Comment					
(Place) (Date) Signature					

[1]) average value, single values on form B 4.3.3
[2]) e.g. factory or construction site

Form B.4.3.6

Control surface protocol: explanatory notes on analysis		Page
	Occurrence of defects[1])	Possible causes of defects
1 full corrosion protection system originating from a single source on a prepared surface (with no coating applied during manufacture)	1.1 on control surfaces and other surfaces	There are several possible causes for such defects, e.g.: 1.1.1 The object's corrosion stress from the environment and/or business operation has changed unexpectedly 1.1.2 The coating materials are defective 1.1.3 The coating materials are free of defects, but are incompatible with the system or inadequate for the corrosion stress due to the nature and/or structure of the coating 1.1.4 Incorrect technical advice and/or incorrect information from a contract partner who was aware of the technical details
	1.2 on other surfaces, not on control surfaces	Initially it should be assumed that the defects are caused by poor execution of the surface preparation and/or the coating. The defect-free control surfaces support the argument that the corrosion protection system fulfils its purpose subject to contractual and skilled execution.
2 Partial coating, e.g. base coating. Undercoat, top coat or a combination thereof	Similar to 1	
3 Subsequent coating applied to coats applied by others — also in the case of partial refurbishment	3.1 on other areas and on control surfaces A[2]) and B[3])	Similar to 1.1.1 to 1.1.4
	3.2 only on other surfaces, not on control surfaces A and B	The defect-free control surfaces support the assumption that the defects originated during the preparation of the existing partial coat or during the subsequent coating application.
	3.3 on other surfaces and on control surface A, but not on control surface B	The defect-free control surface B supports the assumption that the defects originated from, for example, imperfect preparation of the steel surface (e.g. mill scale, rust film not removed) or from an unsuitable previous partial coating or the incompatibility of the materials used in the partial and subsequent coats.

[1]) Unavoidable material-related changes in the degree of gloss and colour of a coating are not regarded as defects, unless this was specifically agreed.

[2]) Control surface A: The intended subsequent coat is applied to the existing partial coat after preparation subject to contract.

[3]) Control surface B: After removing the existing partial coat and achieving the originally intended surface preparation grade of the steel surface, the complete corrosion protection system is applied; this initially involves applying a partial coating equivalent to the coating which has been removed

Marking of the corrosion protection on the building structure									Page
Structure number (ASB)	**Building project**								
Construction phase (factory ☐ Construction site ☐)	**Building component**								
Contractor	**Contractor**								
Surface preparation	Execution of corrosion protection work								
Surface preparation grade		1st base coat	2nd base coat	1. Intermediate coat	2. Intermediate coat	Edge protection	Top coat	*)	
	Manufacturer of the material								
	Manufacturer's designation of								
Contractor	Material No according to								
	Contractor								
	Execution period from until								
	*) free column, e.g. for hot-dip galvanising or sprayed metal coatings								

Form B.4.3.7

Form B 4.3.8

Documentation of partial refurbishment	**Page**
Building project	**Works number (ASB)**
Construction phase	
Contracting authority	**Name of the construction project**
Testing facility	**top**
	bottom

Old coating

Completion: Firm of contractors: Manufacturer of the material:					
Description of the coating system:			Surface preparation grade:		
System design	1. BC	2. BC	1. IC	2. IC	TC
Material number					
Film thickness (µm)					
Application at factory					
Application on site					
Status of entire system (see RI-ERH-KOR)					
Film thicknesses (µm)					
Adhesion and bond (Gt): Pull-off test values (MPa):					
Degree of rusting (Ri):			Edges:		
Other defects (e.g. blisters, flaking, cracks):					
Estimated damaged surface (%)					

Partial refurbishment

Completion: Expiry of guarantee: Firm of contractors: Manufacturer of the material:						
Surface preparation	on damaged areas:			on old coat:		
Blasting agents (standard designation, trade name):						
Description of the coating system:						
System design	on damaged areas:			over the entire area:		
	1. BC	2. GB/1. IC	2. IC	1. IC	2. IC	TC
Material number						
Film thickness (µm)						
Application method						
Application conditions:						
Date work carried out:	Outside:	Inside:		Pylon:	Cables:	
Completed damaged surface (%)						
Total area (m^2)	Total cost (Euro):					
Condition after the warranty period:						

The measure shall be broken down and the scope indicated by ticking the areas/components. The coating surfaces shall be indicated separately. If necessary, one form must be completed for each of the above areas/components

Annex C
Planning aids

C 1 Preliminary remarks

(1) The planning aids serve as a decision aid for planning the corrosion protection of steel structures with coating materials in accordance with TL KOR-Stahlbauten.

(2) Since special conditions and loads of the respective structure cannot be addressed, the planning aids have a recommending character.

(3) The planning aids describe the applications to which the coating materials are predominantly suited.

(4) A separate table with planning aids is presented for each sheet of the TL KOR-Stahlbauten. The planning aids are structured as follows:

- Description of the material with information on binders and pigments which determine the characteristics (each one is subdivided into base coat, undercoat and top coat coating materials) as well as solvent content and thinners. In the case of high-solids substances, the volumes of the solids are also stated.
- The main areas of application, taking account of the specific characteristics of each group of substances.
- Protection systems with coating structure taking into account the compatibility of different coating materials with each other and the required surface preparation as a prerequisite for a lasting corrosion protection effect.
- Nominal film thicknesses in the dry film state.
- Type of application, with preference given to airless spraying (maximum pressure spraying) or painting.
- Minimum waiting time until next coat. The corresponding times are stated for an object temperature of approx. 20 °C.
- Additional indications with information about precautionary measures and processing rules which have to be observed during application, as well as information on the non-suitability of the particular protective system for certain exposures or applications.

(5) Depending on the length of the service life until the next coating, which may comprise a period of several hours up to several months or years, interim cleaning must take place before the next coating is applied. The interim cleaning should be included as a separate item of the agreed specifications with the executing contractor in the case of longer service life.

(6) Also to be considered is the problem of uneven paint covering of edges where there are small edge radii of up to 4 mm maximum. The coating materials when still wet will flow away from the edge into the marginal zones. To even out the reduced film thickness which results, once the coating materials set for higher viscosity are ready for overcoating they can be applied to the edge zone in a second application. The coating materials suitable for this are referred to specifically in the corresponding sheets of the TL KOR-Stahlbauten. In the case of lower object temperatures, longer times must be assumed until the next coating is applied (see execution instruction).

(7) In the case of top coats containing micaceous iron oxide, changes in colour may occur after longer exposure to weather in the case of the colours DB 301, DB 310, DB 510, DB 602 and DB 610.

C 2 Planning aids for sheet 50

Coating material based on epoxy resin (ER) for the inner coating of air-tight, welded box girders with limited accessibility

C 2.1 Use and purpose

The coating in a light colour described in this sheet is an inner coating for airtight closed box girders with limited accessibility and which, if necessary, can be opened to allow an inspection of the structure. This coating is designed to make cracks easier to detect under close examination. A refurbishment of the coating is not envisaged during the service life of the structure.

C 2.2 Coating

(1) The coating system according to sheet 50 consists of two coats, each with a nominal film thickness of at least 100 µm. Areas which are difficult to coat, e.g. corners and edges, are to be treated beforehand.

(2) Areas of application:

- for coating at the factory,
- for coating prepared weld seams,
- and for repairing damage sustained at the building site through transport or installation activities.

(3) The surface preparation grade must be at least Sa 2 or P Sa 2 medium (G) or P Ma, P St 3 in accordance with DIN EN ISO 12944 and DIN EN ISO 8503-1 and -2.

(4) Transport and installation damage must be repaired.

Table C 4.3.1: Composition of coating materials in accordance with sheet 50

ER coating materials (in accordance with DIN EN ISO 12944-5)	cold setting epoxy resins (predominant proportion), epoxy resins are permitted	at the manufacturer's discretion

(5)

(6)

Table C 4.3.2: Planning aids for substances in accordance with sheet 50

Area of application	System design				Surface preparation depending on state of surface and soiling, but at least	Application	Minimum waiting time before next coat at approx. 20 °C
	Coat	Designation	Material No	NDFT [µm]			
Structure A							
in the factory	BC	Sheet 50 ER	650.02	100	Sa 2	Spraying painting	16 h
	TC	Sheet 50 ER/PUR	650.97	100		Spraying painting	
Structure B							
on the construction site - Coating of site weld joints - Repair of the factory coating	BC	Sheet 50 ER	650.02	100	P Sa 2 P Ma P St 3	Painting	16 h
	TC	Sheet 50 ER/PUR	650.97	100		Painting	

Notes:

- Objec t

temperature at least 5 °C, but not less than 3 K above dew point

C 3 Planning aids for sheet 81

Coating materials based on epoxy resin combination (ER-combi)

General material description:
2-component coating material

Binder: UC and TC: Modifiers, epoxy resin + hardener

Pigments: Tinting pigments

Solvent content: maximum 25 %

Thinner: Substance no. 681.90, addition max. 5 %

Table C 4.3.3: Planning aids for substances in accordance with sheet 81

Area of application	System design				Surface preparation depending on state of surface and soiling, but at least	Application	Minimum waiting time before next coat at approx. 20 °C
	Coat	Designation	Material No	NDFT [µm]			
- Track plate topsides - Corrugated steel structures and other steel surfaces in contact with soil, such as: piles, supports, sheet pile walls - Surfaces no longer accessible which cannot be reached - Inner coatings of drainage rings and drainage pipes - Bearings and parts of bearings - Carriageway edges - Crossing structures, - Safety curbs - Inspection facilities	**Structure A**						
	BC	Sheet 100-A ER-Zn (R)	100.1.1	80	Sa 2½	Spraying painting	
	Edge protection	Sheet 81 ER-combi	681.11 681.12 681.94 681.97	80		Spraying, painting	16 h
	IC 1. IC	Sheet 81 ER-combi		120 - 150		Spraying, painting, rolling	16 h
	if appropriate 2. IC	Sheet 81 ER-combi		120		Spraying, painting, rolling	16 h
	TC	Sheet 81 ER-combi		120		Spraying, painting, rolling	
		or Sheet 100-A PUR	100-A	80			
	Structure B						
	Hot-dip galvanisation in accordance with DIN EN ISO 1461 - t Zn k; Sweep blasting before coating						
	UC, TC: see structure A						
	Structure C						
	Thermal spraying in accordance with DIN EN 2063 with sealant			100	Sa 3	Spraying	None
	UC, TC: see structure A						

Notes:

a) during coating, object temperature at least 5 °C, but at least 3 K above dew point,

b) in direct sunshine it is likely there will be high chalking of top coats in accordance with sheet 81,

c) minimum waiting time until next coat with BC according to sheet 100-A, as specified by the coating material manufacturer,

d) the coating materials according to sheet 81 are intended for areas with "long-term exposure to water",

e) Materials in accordance with sheet 81 are unsuitable:

- for surfaces in contact with drinking water,
- on hot-dip galvanising without surface preparation by sweep blasting
- in case of longer exposure to oils and greases.

C 4 Planning aids for sheet 84

see Deutsche Bahn standard
‘Technical delivery terms and technical test specifications for coating materials for ballast trough coatings (sheet 84) (TL 889.0084).

C 5 Planning aids for sheet 85

Coating material for non-slip screwed connections (GV connections) of categories B and C according to DIN EN 1993-1-8 on an alkali silicate basis with Zn (ASI)

General material description: 2-component coating material
Binder: Aqueous solution of sodium or potassium silicate or mixtures thereof (ASI)
Pigments: at least 94 % zinc dust
Solvent content: none
Thinner: none

alternatively refer to sheet 86

Table C 4.3.4: Planning aids for substances in accordance with sheet 85

Area of application	System design				Surface preparation depending on state of surface and soiling, but at least	Application	Minimum waiting time before next coat at approx. 20 °C
	Coat	Designation	Material No	NDFT [µm]			
Friction surfaces of non-slip threaded connections	BC	Sheet 85 ASI-Zn	685.03	60	Sa 3	Spraying painting	

Notes:

a) Under direct weathering the edge joints of non-slip pre-stressed connections must be sealed to prevent penetration of moisture (using suitable joint sealing materials).

b) The dry film thickness may not be less than 40 µm and may not exceed 80 µm.

c) Object temperature at least 10 °C, but at least 3 K above dew point,

d) no overcoating with other coatings,

e) minimum of 24 hours between coating and installation

f) Materials in accordance with sheet 85 are unsuitable:
   - as base coat for other TL materials

C 6 Planning aids for sheet 86

Coating materials based on ethyl silicate with Zn (ESI)

General material description:
1- or 2-component coating material
Binder: Ethyl silicate (ESI)
Pigments: at least 94 % Zn (as a separate component)
Solvent content: maximum 21 %
Thinner: Substance no. 686.91, addition max. 3 %

Table C 4.3.5: Planning aids for substances in accordance with sheet 86

Area of application	System design				Surface preparation depending on state of surface and soiling, but at least	Application	Minimum waiting time before next coat at approx. 20 °C
	Coat	Designation	Material No	NDFT [µm]			
Structure A							
Single-coat corrosion protection for: - small temporary bridges, - Auxiliary bridges, pillar device, etc.	BC	Sheet 86 ESI-Zn	686.03	100	Sa 2½	Spraying painting	24
Structure B							
Friction surfaces of non-slip threaded connections	BC	Sheet 86 ESI-Zn	686.03	60	Sa 2½	Spraying painting	

Notes:

- Object temperature at least 5°C, but at least 3 K above dew point,
- inadequate curing (silicification) at dry film thicknesses exceeding 120 µm may result in brittle fractures of the coating,
- substance no. 686.03 corresponds to surface slip class C with a coefficient of static friction of 0.3. If a higher coefficient of static friction is set, this must be determined within the basic or repeat test in accordance with TL-Kor-Stahlbauten.
- for friction surfaces of non-slip screwed connections (GV connections) of categories B and C according to DIN EN 1993-1-8: the dry film thickness may not be less than 40 µm and may not exceed 80 µm,
- to achieve a nominal film thickness of 100 µm with one-coat corrosion protection, two wet in wet work cycles may be required,
- Substance no. 686.03 requires moisture in order to form silicate; at low air humidity and/or a subsequent coating, spray with water after approx. 30 min.
- ESI-Zn can be stacked after 5 hours
- Under direct weathering the edge joints of non-slip pre-stressed connections must be sealed to prevent penetration of moisture (using suitable joint sealing materials).
- Materials in accordance with sheet 86 are unsuitable:
  - for dry film thicknesses greater than 120 µm

C 7 Planning aids for sheet 100

Coating materials based on epoxy resin and polyurethane (ER/PUR) on steel (initial protection, total and partial refurbishment, repair) and hot-dip galvanised / zinc sprayed steel
Further development of previous coating systems according to sheets 87, 94, 95 and 97

C 7.1 Use and purpose

The coating system described in this sheet is a further development of the coating systems according to the earlier sheets 87, 94, 95 and 97. Especially the demands for sustainable and environmentally friendly products, processes and applications have led to the consideration that an extremely long duration of protection of at least 50 years is the best approach to resource conservation. Furthermore, the solvent content was limited to ≤ 200 g/m² for modules A and B and to ≤ 150 g/m² for modules C and D.

After the refurbishment interval has passed, total refurbishment is expected. Based on the existing experience with coating systems based on epoxy resin and polyurethane binders, an extended catalogue of requirements for this sheet was therefore developed.

C 7.2 Coating system

Sheet 100 is modular and applies to the following applications:

Module A: Corrosion protection system on steel

- Initial protection
- Total refurbishment, partial refurbishment and repair of existing structures that can be prepared to surface preparation grade Sa 2 ½
- Overcoating of weathered intermediate coatings
- Welding joints and repair of transport and installation damage

MODULE B: Corrosion protection system on steel with surface-tolerant base coating

- Repairs (repair, partial refurbishment and total refurbishment) of existing structures in which the basic coating must have a penetrating and rust-binding effect, such as old, riveted steel components that cannot be prepared for surface preparation grade Sa 2 ½
- Due to the design and the resulting poorer surface preparation, a shorter duration of protection (about 25 years) is to be assumed than for sheet 100 module A

Module C: Corrosion protection system on hot-dip galvanisation

- Factory coating, total refurbishment for hot-dip galvanised components (duplex systems)

MODULE D: Corrosion protection system on zinc spraying (thermally sprayed zinc coatings)

- Factory coating, total refurbishment for zinc sprayed components (duplex systems)

The surface preparation grade must be at least Sa 2 1⁄2 or P Sa 2 ½ medium (G) for module A and at least Sa 2, P Sa 2 ½ medium (G) or P St 3, P Ma for module B in accordance with DIN EN ISO 12944 and DIN EN ISO 8503-1 and -2.

The coating system consists of at least three layers. It shall be determined by the manufacturer in accordance with Table C 4.3.6. The completed table is included in the execution instructions.

Note:

Object temperature at least 5 °C, but not less than 3 K above dew point

C 7.3 Material numbering system

The material number is assigned to a coating material in sheet 100 and consists of three groups of numbers delimited by dots. The first group of numbers indicates with the number "100" a coating material pursuant to sheet 100 according to the TL KOR-Stahlbauten. The second group of numbers can indicate the values "1", "2" or "3" and describes the position of the coating material within the coating system pursuant to sheet 100. "1" stands for the base coat, "2" for the intermediate coat(s) and "3" for the top coat. The following information shall be derived from the third group of numbers for the base and intermediate coat(s) in the context of the second group of numbers:

- 100.1.1: zinc-dust-rich base coat for module A,
- 100.1.2: surface-tolerant base coat for module B,
- 100.2.1: edge protection and 1. intermediate coat for modules A and B as well as optional 2. intermediate coat for modules C and D,
- 100.2.2: optional 2. intermediate coat for modules A and B as well as optional 3. intermediate coat for modules C and D,
- 100.2.3: 1. intermediate coating on hot-dip galvanisation for module C,
- 100.2.4: sealing on the zinc spraying for module D,
- 100.2.5: 1. intermediate coating on the sealing for module D.

In the case of the top coat, the third group of numbers indicates the colour of the coating material according to the TL KOR-Stahlbauten, Annex C:

- 100.3.xy: top coat for modules A to D.

Table C 4.3.6: Planning aids for substances in accordance with sheet 100

Area of application	System design		Application	

	Coat	Designation	Material No	NDFT [µm]	Surface preparation depending on state of surface and soiling, but at least		Minimum waiting time before next coat at approx. 20 °C
Module A: Corrosion protection system on steel							
External surfaces - complete corrosion protection in the factory - Total refurbishment of existing structures - Overcoating of weathered intermediate coatings	BC	Sheet 100 ER-Zn (R)	100.1.1	80	Sa 2½	Spraying painting	3)
	Edge protection	Sheet 100 ER or PUR	100.2.1	80		Spraying painting	
	one optionally two IC [1]	Sheet 100 ER or PUR	100.2.1	[2]		Spraying painting	
			optional 100.2.2	[2]		Spraying painting	
	TC	Sheet 100 ER	100.3.xy [4]	[2]		Spraying rolling painting	
	if appropriate Clear varnish	Sheet 100 ER	100.3.00	[2]		Spraying rolling painting	
	Total film thickness: min. 400 µm (without edge protection and without clear coat)						
Internal surfaces - complete corrosion protection in the factory - Total refurbishment of existing structures - Overcoating of weathered intermediate coatings	BC	Sheet 100 ER-Zn (R)	100.1.1	80	Sa 2½	Spraying painting	3)
	Edge protection	Sheet 100 ER or PUR	100.2.1	80		Spraying painting	
	one optionally two IC [1]	Sheet 100 ER or PUR	100.2.1	[2]		Spraying painting	
			optional 100.2.2	[2]		Spraying painting	
	TC	Sheet 100 ER	100.3.xy [4]	[2]		Spraying rolling painting	
	Total film thickness: min. 320 µm (without edge protection) The difference of the total film thickness of 80 µm compared to the outer surfaces may only be made in the intermediate coat(s).						
- Weld joints and repairs of transport and installation damage.	BC	Sheet 100 ER-Zn (R)	100.1.1	80	P Sa 2½	Spraying painting	3)
	Form intermediate coat(s) and a TC as in the adjacent surfaces.						
MODULE B: Corrosion protection system on steel with surface-tolerant base coating							
- Repair, partial refurbishment, total refurbishment of existing buildings [5] [6]	BC	Sheet 100 ER diverse	100.1.2	[2]	Sa 2, P Sa 2 or St 3, P Ma	Spraying painting	3)
	Edge protection, IC, TC and, if applicable, clear coat: see module A External surfaces, total film thickness: min. 440 µm (without edge protection and without clear coat) Internal surfaces, total film thickness: min. 360 µm (without edge protection) The difference between the total film thickness of 80 µm and the outer surfaces shall be limited to the intermediate coat(s).						

continued on next page

Table C 4.3.6: Planning aids for substances in accordance with sheet 100 (continuation)

Area of application	System design				Surface preparation depending on state of surface and soiling, but at least	Application	Minimum waiting time before next coat at approx. 20 °C
	Coat	Designation	Material No	NDFT [µm]			
Module C: Corrosion protection system on hot-dip galvanisation							
– on hot-dip galvanisation	Hot-dip galvanisation in accordance with DIN EN ISO 1461 — t Zn k; Sweep blasting before coating						none
	ZB[1]	Sheet 100 ER	100.2.3	[2]	Sweep blasting of the hot dip galvanisation	Spraying painting	[3]
		Sheet 100 ER or PUR	optional 100.2.1 / 100.2.2	[2]		Spraying painting	
	optional 2. IC, TC and, if applicable, clear coat: see module A Total film thickness: min. 240 µm (without edge protection and without clear coat)						
MODULE D: Corrosion protection system on zinc spraying (thermally sprayed zinc coatings)							
– on zinc spraying	Thermal spraying according to DIN EN ISO 2063			100	Sa 3	Spraying	none
	Sealant [7]	Sheet 100 ER (diluted)	100.2.4	[2]		Spraying painting	[3]
	ZB[1]	Sheet 100 ER	100.2.5	[2]		Spraying painting	
		Sheet 100 ER or PUR	optional 100.2.1 / 100.2.2	[2]		Spraying painting	
	optional 2. IC, TC and, if applicable, clear coat: see module A Total film thickness: min. 240 µm (without edge protection and without clear coat)						

[1] Amount of coats according to the manufacturer of the coating material

[2] NDFT of the individual coats and minimum waiting times until the next coat can be applied according to the coating material manufacturer

[3] According to the coating material manufacturer

[4] y: see TL KOR-Stahlbauten: Table C 1 for DB colours and Table C 2 for RAL colours

[5] Existing structures that cannot be prepared for surface preparation grade Sa 2½, such as old, riveted steel components

[6] The test for heat resistance according to TP KOR-Stahlbauten, No 6.2.7 is not part of the material tests for module B. If necessary, a suitability for application with heat load, e.g. on the underside of steel track plates during mastic asphalt installation, must be additionally tested. Alternatively, sheet 100, module A can be used.

[7] Thermal spray zinc coatings must be provided with a sealing coat (closing the pores) immediately after being applied. The sealing must be adapted to the subsequent coating.

Annex D
Disposal of blasting residue

D 1 Preliminary remarks

(1) The disposal (recovery or disposal) of waste is carried out in accordance with the Recycling Economy Act (KrWG).

(2) Already during the preparation of corrosion protection measures, the design of work processes and the procurement / use of products, it should be examined whether and to what extent products can be used that are characterised by durability, good repairability and renewability as well as recyclability or lead to less polluting waste.

(3) According to § 6 KrWG, the main issue is to minimise waste. If it is impossible to avoid producing waste, it should be recovered. During recovery, preparation for reuse should take precedence over recycling and over other utilisation, particularly recovery for energy purposes and landfill. Only when it is impossible to avoid and recover waste should it be disposed of. The technical possibilities, the economic reasonableness and the social consequences must be taken into account.

(4) Specialised waste management companies often offer services (e.g. advice) in connection with the formal handling of disposal procedures. A third party may be authorised to issue disposal certificates and accompanying documents and to handle charges. It has to be noted that the producer of the waste is responsible up to the harmless recovery or disposal of the waste.

(5) For the disposal of small quantities of blasting residue (less than 2 t/year and producer) rated as ‘hazardous waste’, the waste producer has a simplified obligation to provide evidence. The waste producer must have the waste transfer to a waste disposal company certified by a transfer certificate.

(6) Additional rules apply if abrasive residues are to be disposed of outside the Federal Republic.

D 2 Procedure

(1) The disposal of the abrasive residues originating in the client’s domain should be arranged in the specifications of work together with the corrosion protection measure.

(2) Table D 4.3.1, Table D 4.3.2 and Table D 4.3.3 provide information on the assignment to the waste codes and the typification of corrosion protection control systems. This information is intended merely for planning purposes. The inclusion of the waste code in the ‘Responsible Declaration’ is not permitted on the basis of the type analysis in accordance with Table D 4.3.1, Table D 4.3.2 and Table D 4.3.3. A declaration analysis is required for this.

(3) The specifications shall specify the expected composition of the blasting residue, including the assigned waste code number, on the basis of the blasting residue type analyses in accordance with Annex D. If no type analysis is available to the client, a blasting residue sample must be taken and analysed in accordance with the ‘Information sheet on the taking of representative blasting residue samples’ (MES 93) before tendering for the use of non-metallic abrasives in order to obtain information on possible disposal methods. The characteristic values to be determined during the declaration analysis depend on the disposal plant.

(4) All waste must be assigned to a waste code in accordance with the European Waste Catalogue (Abfallverzeichnis-Verordnung, AVV). In principle, the types of waste marked with an asterisk (*) in the waste catalogue are hazardous within the meaning of § 48 KrWG. For the classification of waste as hazardous or non-hazardous, the regulations applicable in the respective federal states (place of waste generation) must also be observed.

(5) Before disposing of blasting residue with the waste code 120 116*, the client has to check whether there is a notification obligation in the relevant federal state. If there is no such obligation, and also in the case of waste code 120 117, the bidder is required to submit details of the envisaged method of disposal. The presentation of the certificate of the intended waste disposal company (including the types of waste / waste code numbers) is to be demanded at the time of submission of the offer.

(6) The provision of a declaration analysis must be included in the specification of works.

(7) If metallic reusable abrasives are used, regulations must be made that are tailored to the individual case. As a rule, the composition of the blasting residue can only be verified by the declaration analysis of a sample from the ongoing measure.

D 3 Registration obligations and the furnishing of proof

(1) Waste producers, collectors, carriers and disposers of blasting residue with the waste code 120 116* must keep a register of the waste disposal operations.

(2) Blasting residue with the waste code 120 117 is not subject to notification, but the waste disposal company must document the disposal process in the register.

D 4 Disposal of blasting residue

D 4.1 Recovery

D 4.1.1 Preliminary remarks

The recovery possibilities are regulated by the market. The recovery procedure or the recovery firm must be

determined on a case-by-case basis (in accordance with No 8).

D 4.1.2 Non-metallic disposable abrasives

(1) It is permissible to commission the manufacturer of the abrasives with the disposal of the blasting residue if it takes back the residues from abrasives supplied by it under the voluntary product return arrangements pursuant to the KrWG.

(2) Melting chamber slag (MSK) may be used for, say, rock filling in salt, coal and ore mining and as an aggregate for the manufacture of asphalt base layers (previously only to a limited extent).

(3) The only current possibility of recovery is through the smelting of copper mill slag (MCU) provided the iron content of the abrasives residues is at least 50 %.

D 4.1.3 Reusable abrasives

(1) As a rule, blasting residue from reusable abrasives must be assigned to the waste code 120 116* and must therefore be classified as ‘hazardous waste’.

(2) Blasting residue from metallic reusable abrasives can be recycled by smelting. Owing to the technically complex blasting technique, it is not possible to remove a representative sample of the residues before executing the operation. The proof of disposal can therefore only be supplied after blast-cleaning starts.

(3) Electrocorundum is preferably used as a non-metallic reusable abrasive. The resulting blasting residue can be freed from contaminants, e.g. by adding suitable chemicals, and the remaining mineral material can be recovered for the production of abrasives by sieving.

D 4.2 Disposal

(1) The basic obligations and requirements of waste disposal are set out in §§ 15 and 16 KrWG.

(2) Depending on the contaminants contained in the blasting residue (type and quantity) according to the declaration analysis, a suitable landfill (take note of the landfill’s particular terms of acceptance) must be chosen.

(3) Surface and underground landfills are available for the disposal of blasting residue.

Table D 4.3.1: Classification of protection systems to groups of abrasives residues with the probable waste code for planning purposes (see D 2 (2))

Abrasives residue group/probable waste code	Characterisation of protection systems	Comments
1 **120 117**	**Coatings with coal tar pitch based on solutions and emulsions** Substance No 4637, types No 21,22, 23, 24 according to the RoSt, DV of DR, issue 1940 Substance no. 638.21/22/23/31/32 according to TL 918 374, issue January 1960/May 1972 Substance no. 674.21/22/23/24 according to TL 918 300, sheet 74, issue 1976	Application of coal tar pitch based on solutions and emulsions up to 1980
2 **120 116***	**Coatings based on oil-red lead as base coat and oil-white lead as top coat** Substance no. 4634 types 12 and 13 for base coat (with red lead) according to RoSt, issue 1940 Substance no. 4635 types 11 to 15 and 31 to 35 for top coat (with white lead for grey and white shades) according to RoSt, issue 1940 Substance no. 4636 types 11 to 15 and 21, 22, 25 for top coat (with white lead for colourful shades) according to RoSt, issue 1940 Substance no. 634.01/11/05/15/21/31/25/35 for base coat (with red lead) according to TL 918 371, issue 1972 and RoSt, DV of TC, issue 1960 Substance no. 635.11/15/31/35 for top coat (with white lead for grey shades) according to TL 918 371, issue 1972 and RoSt, issue 1960 Substance no. 636.11/12/13/14/15/31/32/34/35 for top coat (with white lead for colourful shades) according to TL 918 371, issue 1972 and RoSt, issue 1960 **Coatings based on oil- or AK-red lead as base coat and AK-white lead as top coat** Substances No 635.79 and 636.65 to 69 and 636.85/88/89 according to TL 918 372, issue 1972 and the RoSt, issue 1960 (substance numbers for AK white lead top coat)	Application of white lead in coatings up to about 1974
3 **120 116*** **continued on next page**	**Coatings based on oil-red lead as base coat and oil-micaceous iron oxide as top coat as well as oil-red lead as base coat and AK-micaceous iron oxide as top coat** Substance no. 634.01/11/05/15/21/31/25/35 for base coat with red lead according to TL 918 371, issue 1972 and RoSt, issue 1960 Substance no. 635.18/38 and 636.36 as top coat with micaceous iron oxide according to TL 918 371, issue 1972 and RoSt, issue 1960 Substance no. 635.18/38/39; 636.36/39/40 as top coat with micaceous iron oxide according to TL 918 371, issue 1972 Substance No 671.01/05 for base coat with red lead according to TL 918 300, sheet 71, issue 1976 Substance no. 671.11(12) to 671.52(74) for top coat with micaceous iron oxide according to TL 918 300, sheet 71, issue 1976 and/or 1980 Coatings with red lead on oil basis KmGO and KfGO according to RoSt, DV 807 of DR, issue 1984	Application of red lead based on alkyd or oil up to 1991, based on ER up to 1985

continued on next page

Table D 4.3.1 (continued)

Abrasives residue group/probable waste code	Characterisation of protection systems	Comments
Continued **3** **120 116***	**Coatings based on AK-red lead as base coat and AK-micaceous iron oxide as top coat** Substance no. 634.51/61/55/65/71/81/75/85 as base coat with red lead according to TL 918 372 and RoSt, issue 1960 Substance no. 635.58/78 and 636.90 as top coat with micaceous iron oxide according to TL 918 372 and RoSt, January 1960 Substance no. 634.51/55/65/71/75/85 as base coat with red lead according to TL 918 372, issue 1972 Substance no. 635.58/78 and 636.90/91/92 as top coat with micaceous iron oxide according to TL 918 372, issue 1972 Substance no. 672.01/05 as base coat with red lead according to TL 918 300, sheet 72, issue 1976 Substance no. 672.07 as joint sealing with red lead according to TL 918 300, sheet 72, issue 1985 Substance no. 672.11(12) to 672.52(74) as top coat with micaceous iron oxide according to TL 918 300 sheet 72 , issue 1976 and/or 1980 Coatings based on alkyd resin KmGA and KfGA according to RoSt, DV 807 of DR, issue 1984 **Coatings based on ER-red lead as base coat and ER- and PUR-micaceous iron oxide as top coat** Substance no. 687.01/05 as base coat with red lead according to TL 918 300, sheet 87, issue 1975 Substance no. 687.11/12/21/22/23/24/31/32/33/34/41/42/43/44/51/52 as top coat with ER-micaceous iron oxide according to TL 918 300, sheet 87, issue 1980 Substance no. 687.30/31/50/51/52/53/60/61/62/63/71/72/73/74 as top coat with PUR-micaceous iron oxide according to TL 918 300, sheet 87, issue 1980	Application of red lead based on alkyd or oil up to 1991, based on ER up to 1985
4 **120 116***	**Coatings based on PVC/AK-red lead/PVC/AK-micaceous iron oxide** Substance no. 677/01/05 as base coat with red lead according to TL 918 300, sheet 77 issue 1980, substances for intermediate and top coats according to sheet 77 same issue **Coatings based on CPVC-red lead/CPVC** KmGV/KaGV/CxDV according to RoSt, DV 807 of DR, issue 1984 ***Coatings based on CPVC-red lead/PVC/chlorinated polyethylene*** KmGV/KtGV/KtDI according to RoSt, DV 807 of DR, issue 1984 **Coatings based on CPVC-red lead/vinyl resin** KmGV/CIGV/CIDV according to RoSt, DV 807 of DR, issue 1984	Application of red lead based on PVC/alkyd up to 1985, based on CPVC-red lead up to 1991
5 **120 116***	***Coatings based on AK red lead/coal tar pitch*** Substances with AK red lead: Blasting residue group 3, substances with coal tar pitch: Blasting residue group 1	Application of protection systems up to 1980

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Table D 4.3.1 (continued)

Abrasives residue group/probable waste code	Characterisation of protection systems	Comments
6 **120 116***	***Coatings based on ER-red lead/ER tar pitch*** Substance no. 687.01/05/06 as base coat with red lead according to TL 918 300, sheet 87, issue 1975 Substance no. 639.01/02/11/12 as top coat with tar or tar pitch according to TL 918 382, issue 1972 Substance no. 682.11/12 as top coat with tar pitch according to TL 918 300, sheet 82, issue 1976	Application of protection systems up to 1985
7 **120 116***	***Coatings based on oil-red lead/BKF (bitumen combination) and AK-red lead/BKF (bitumen combination)*** *Substances based on oil and AK red lead: Blasting residue group 3* *Substance no. 4637.34/35/37/41/42/44 as top coat based on BKF according to TL 918 376, (RoSt), issue 1960* *Substance no. 637.37/41/42/34 as top coat based on BKF according to TL 918 376, issue 1972* *Substance no. 676.37/41/42/34 as top coat based on BKF according to TL 918 300, sheet 76, issue 1976* ***Substances based on oil-red lead/bitumen AK-red lead/bitumen*** *Substances based on oil and AK red lead as above, substances based on bitumen: Blasting residue group 8*	Application of protection systems up to 1985
8 **120 116***	***Coatings based on bitumen solutions*** *Substance no. 637.11/12/13 according to TL 918 373, issue 1972 and RoSt, issue 1960* *Substance no. 673.11/12/13/14/ according to TL 918 300, sheet 73, issue 1976 K 441/442/443 according to RoSt, DV 807 of DR, issue 1984*	
9 **120 117**	***Coatings based on PVC-combi-ZnPh/PVC-combi with/without micaceous iron oxide*** *Materials according to TL 918 300,sheet 77 and according to TL/TP KOR-Stahlbauten, sheet 77, issue 2002* ***Coatings based on CPVC*** *SuGV/CvDV according to RoSt, DV 807 of DR, issue 1984*	
10 **120 117**	Coatings based on alkyd resins Substances according to TL 918 300, sheet 72, issue 1985 excluding substance no. 672.01/05/07 but with substance no. 672.06 (sheet 72, issue 1992) and KaGA/KrVA/KrDA according to RoSt, DV 807 of DR, issue 1984 ***Single-component coatings (polyvinyl and polyvinylidene chloride-free, e.g. urethane-alkyd)*** Materials according to TL/TP KOR-Stahlbauten, sheet 93, issue 2002 ***Coatings based on epoxy resins and polyurethane*** Materials according to TL 918 300, sheet 87, issue 1985 (only material No 687.02/06 as base coat) and TL/TP KOR-Stahlbauten, issue 2002, sheet 87 (base coat only material No 687.02/06) as well as sheets 94 and 95	

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Table D 4.3.1 (continued)

Abrasives residue group/probable waste code	Characterisation of protection systems	Comments
11 **120 116***	***Coatings based on AK-zinc chromate and AK-micaceous iron oxide*** Substance no. 634.95/98 BC with zinc chromate according to TL 918 372, issue 1972 Substance no. 672.03/07 BC with zinc chromate according to TL 918 300, sheet 72, issue 1976 **Coatings based on ER-zinc chromate and ER- and PUR-micaceous iron oxide** Substance no. 687.03/07/08, base coat with zinc chromate according to TL 918 300, sheet 87, issue 1975	Application of protection systems up to 1980
12 **120 117**	***Coatings based on ER-Zn/ER-micaceous iron oxide/PUR with/without micaceous iron oxide*** Substances according to TL 918 300, sheet 87 (base coat only substance no. 687.03), issue 1985 and according to TL/TP KOR-Stahlbauten, issue 2002, sheet 87 (base coat only substance no. 687.03/04/05) or combination of substances according to sheet 87 (only substance no. 687.03; 687.04 and 687.05) with undercoat and top coat according to sheet 94 or 95 **Coatings based on ESI (ethyl silicate)-Zn/PVC-combi-micaceous iron oxide** Substances according to TL 918 300, sheet 86, issue 1985 and substances according to TL 918 300, sheet 77 (only top coat) issue 1985 and TL/TP KOR-Stahlbauten, issue 2002, sheets 77 and 86 ***Coatings based on ER-Zn/PVC/post-chlorinated polyethylene and ER-Zn/CPVC/CPVC*** KzGE/KtGV/KtDI or KzGE/KxGV/KxDV according to Rost, DV 807 of DR, issue 1984 ***Coatings based on ER-Zn/PVC-combi-micaceous iron oxide*** Substances according to TL 918 300, sheet 87 (base coat only substance No 687.03) issue 1985 and sheet 77 (only top coat), issue 1985 and TL/TP KOR-Stahlbauten, issue 2002, sheet 87 (only substance No 687.03; 687.04 and 687.05) as base coat and sheet 77 as undercoat and top coat **Coatings based on ER-Zn/PUR- base coat paint, pre-spray paint, paint** KzGE/KaGU/KaVU/KaLU according to Rost, DV 807 of DR, issue 1984 ***Coatings based on 1C-PUR-Zn as base coat/1C-PUR-micaceous iron oxide as undercoat and 2C-PUR-micaceous iron oxide as top coat*** Substances according to TL 918 300, sheet 89, issue 1996 as base coat and undercoat and sheet 87, issue 1996 as top coat and according to TL/TP KOR-Stahlbauten, issue 2002, sheet 89 as base coat and undercoat and sheet 87 as top coat ***Coatings based on epoxy ester-Zn/PVC-combi*** Substances according to TL 918 300, issue 1996, substance no. 677.03 in combination with top coat according to sheet 77	Application of epoxy ester (ERE)-Zn up to 1998

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Table D 4.3.1 (continued)

Abrasives residue group/probable waste code	Characterisation of protection systems	Comments
13 **120 117**	***Coatings based on ER-Zn and tar epoxy resin*** Substance no. 687.03 according to TL 918 300, sheet 87, issue 1985 as base coat in combination with substance no. 682.11/12 according to TL 918 300, sheet 82 issue 1976 as top coat KzGE/CwDE according to RoSt, DV 807 of DR, issue 1984 **Coatings based on ER-Zn and modified epoxy resins** Substances according to TL 918 300 sheet 87 (only substance No 687.03 as base coat), issue 1992 and sheet 81 as top coat, issue 1992 and TL/TP KOR-Stahlbauten, issue 2002 Substance no. 687.03/04/05 as base coat with top coat and/or undercoat and top coat according to sheet 81 (hydrocarbon resins or modified coal tars with restricted polycyclic content)	Application of protection systems with tar epoxy resin according to sheet 82 up to 1996 (according to RoSt up to 1991)
14 **120 117**	***Coatings on hot-dip or spray galvanising based on PVC/PVC-combi*** Substances according to TL 918 300, sheet 75, issue 1980 and sheet 77 (only top coat), issue 1980 and TL/TP KOR-Stahlbauten, sheets 75 and 77, issue 2002, ***Coatings on hot-dip or spray galvanising based on PVC/post-chlorinated polyethylene*** *KtGV/KtDI according to RoSt, DV 807 of DR, issue 1984* ***Coatings on hot-dip or spray galvanising based on aqueous acrylic emulsions*** *Substances according to TL 918 300, sheet 91, issue 1996 and TL/TP KOR-Stahlbauten, sheet 91, issue 2002*	
15 **120 116***	**Coatings on hot-dip or spray galvanising with modified epoxy resins** Substances according to TL 918 300, sheet 81, issue 1992 and TL/TP KOR-Stahlbauten, sheet 81, issue 2002 (substances contain hydrocarbon resins or modified coal tars with restricted polycyclic content) **Coatings on hot-dip or spray galvanising with additional substances listed below** Coatings with BKF (substances according to abrasives residue group 7) Coatings with coal tar pitch (substances according to abrasives residue group 1) Coatings with ER tar pitch (substances according to abrasives residue group 6)	

Table D 4.3.2: Probable results of eluate analysis in different blasting residue groups with the use of mineral abrasives. The characteristic values of the steel residue sample to be calculated are to be agreed with the waste disposal facility.

Characteristic values		Blasting residue groups				
		1	**2**	**3**	**4**	**5**
pH value		7.2 ± 0.2				
Conductivity	µS/cm	< 42				
Filtrate dry residues	mg/l	< 34				
AOX		0.02				
COD		< 35				
TOC		< 13				
Phenol index		0.1	0.02			0.1
Total PCB (according to Ballschm.)	µg/l	< 0.06				
Total PAH (EPA)		< 475	0.15			< 475
Cyanide, total	mg/l	< 0.01				
Cyanide, easily released						
Fluoride		0.01				
Chloride		< 1.0				
Phosphate		< 0.1				
Sulphate		< 3.0				
Nitrate		< 1.0				
Nitrite		< 0.05				
Ammonium		< 0.1				
Chromium (VI)		< 0.025				
Antimony		< 0.1				
Arsenic		< 0.01				
Barium		< 0.8				
Lead		< 0.02	< 4.5	< 0.2		
Cadmium		< 0.002				
Chromium, total		< 0.01				
Iron		< 0.02				
Cobalt		< 0.01				
Copper		< 0.01				
Manganese		< 0.03				
Nickel		< 0.02				
Mercury		< 0.0002				
Selenium		< 0.1				
Thallium		< 0.001				
Vanadium		< 0.1	< 0.01			< 0.1
Zinc		< 1.0				

continued on next page

Table D 4.3.2 (continued)

Characteristic values		Blasting residue groups				
		6	**7**	**8**	**9**	**10**
pH value		7.2 ± 0.2				
Conductivity	µS/cm	< 42				
Filtrate dry residues	mg/l	< 34				
AOX		0.02				
COD		< 35				
TOC		< 13				
Phenol index		0.1	0.02			
Total PCB (according to Ballschm.)	µg/l	< 0.6				
Total PAH (EPA)		< 130	< 0.15			
Cyanide, total	mg/l	< 0.01				
Cyanide, easily released						
Fluoride		0.01				
Chloride		< 1.0				
Phosphate		< 0.1				
Sulphate		< 3.0				
Nitrate		< 1.0				
Nitrite		< 0.05				
Ammonium		< 0.1				
Chromium (VI)		< 0.025				
Antimony		< 0.1				
Arsenic		< 0.01				
Barium		< 0.8				
Lead		< 0.2		< 0.02		
Cadmium		< 0.002				
Chromium, total		< 0.01				
Iron		< 0.02				
Cobalt		< 0.01				
Copper		< 0.01				
Manganese		< 0.03				
Nickel		< 0.02				
Mercury		< 0.0002				
Selenium		< 0.1				
Thallium		< 0.001				
Vanadium		0.1	0.01			
Zinc		< 1.0				

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Table D 4.3.2 (continued)

Characteristic values		Blasting residue groups				
		11	**12**	**13**	**14**	**15**
pH value		7.2 ± 0.2				
Conductivity	µS/cm	< 42				
Filtrate dry residues	mg/l	< 42				
AOX		0.02				
COD		< 35				
TOC		< 13				
Phenol index		0.02		0.1	0.02	0.1
Total PCB (according to Ballschm.)	µg/l	< 0.6				
Total PAH (EPA)		< 0.15		< 130	< 0.15	< 0.15[1]) / < 130[2])
Cyanide, total	mg/l	< 0.01				
Cyanide, easily released						
Fluoride		0.01				
Chloride		< 1.0				
Phosphate		< 0.1				
Sulphate		< 3.0				
Nitrate		< 1.0				
Nitrite		< 0.05				
Ammonium		< 0.1				
Chromium (VI)		< 1.1	< 0.025			
Antimony		< 0.1				
Arsenic		< 0.01				
Barium		< 0.8				
Lead		< 0.02				
Cadmium		< 0.002				
Chromium, total		< 1.1	< 0.01			
Iron		< 0.02				
Cobalt		< 0.01				
Copper		< 0.01				
Manganese		< 0.03				
Nickel		< 0.02				
Mercury		< 0.0002				
Selenium		< 0.1				
Thallium		< 0.001				
Vanadium		0.01		0.1	0.01	0.1
Zinc		< 1.0				

[1]) assumed in the case of coating materials with modifiers since 1995
[2]) possible in the case of coating materials with modifiers until 1995

Table D 4.3.3: Probable results of solids analyses from different steel residues groups when using melting chamber slag (MSK) and copper mill slag (MCU) as the abrasive. The characteristic values of the steel residue sample to be calculated are to be agreed with the waste disposal facility.

Blasting residue groups		1		2		3		4	
		MSK	MCU	MSK	MCU	MSK	MCU	MSK	MCU
Mass %		100							
mg/kg dry matter [1]		≤ 50							
		≤ 2,000		≤ 170		≤ 250		≤ 1,000	
		≤ 17							
µg/kg dry		≤ 6							
mg/kg		≤ 0.5							
		≤ 0.1							
mg/kg dry matter [1]		≤ 620					≤ 0.15		
		≤ 0.5							
	Arsenic	≤ 200	≤ 2,500	≤ 200	approx. 25,000	approx. 200	≤ 2,500	≤ 200	≤ 2,500
	Barium	approx.	approx. 25,000	approx.	approx. 25,000	approx.	approx. 25,000	approx.	approx.
	Beryllium	≤ 2.2	≤ 200	≤ 2.2	≤ 200	≤ 2.2	≤ 200	≤ 2.2	≤ 200
	Boron	≤ 6.5	≤ 72	≤ 6.5	≤ 72	≤ 6.5	≤ 72	≤ 6.5	≤ 72
	Cadmium	≤ 1,400	≤ 220	≤ 1,400	≤ 220	≤ 1,400	≤ 220	≤ 1,400	≤ 220
	Chromium	≤ 41	≤ 7	≤ 41	≤ 7	≤ 41	≤ 7	≤ 41	≤ 7
	Cobalt	< 150	< 3,200	< 11,000 [3] < 4,300 [4]	< 16,000	< 11,000 [3] < 4,300 [4]	< 14,000 [3] < 7,400 [4]	< 2,800	< 5,800
	Copper	≤ 45	≤ 21	≤ 45	≤ 21	≤ 45	≤ 21	≤ 45	≤ 21
	Lead	≤ 170	≤ 290	≤ 170	≤ 290	≤ 170	≤ 290	≤ 170	≤ 290
	Molybdenum	≤ 250	≤ 7,000	≤ 250	≤ 7,000	≤ 250	≤ 7,000	≤ 250	≤ 7,000
	Nickel	≤ 290	≤ 220	≤ 290	≤ 220	≤ 290	≤ 220	≤ 290	≤ 220
	Selenium	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.2
	Tin	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]
	Vanadium	≤ 220	≤ 12,000	≤ 220	≤ 12,000	≤ 220	≤ 12,000	≤ 220	≤ 12,000
	Zinc	≤ 10	≤ 1,800	≤ 10	≤ 1,800	≤ 10	≤ 1,800	≤ 10	≤ 1,800

continued on next page

Characteristic values		Blasting residue groups									
		5			6			7			8
	Blasting abrasive	MSK	MGH	MSK	MGH	MSK	MGH	MSK	MGH	MSK	MGH
Mass %	Dry residue	100									
	Annealing residue of dry residue	> 99.5									
mg/kg dry matter [1]	Petroleum hydrocarbons	< 50									
	Extractable substances	< 2,000									
	EOX	--									
mg/kg dry	Total PCB (according to Ballschmiter)	< 5									
mg/kg	Total BTEX	< 0.5									
	Total VHH	< 0.1									
	Total PAH (EPA)	< 20			< 2,500	< 300	< 2,800	< 300	< 2,500	< 300	< 2,500
	Chromium (VI)	< 0.5			approx. 25,000	approx.	approx.	approx.	approx. 25,000	approx.	approx.
	Sulphur, total	< 0.5			< 300	< 2.2	< 2,300	< 2.2	< 300	< 2.2	< 300
	Aluminium				< 72	< 6.5	< 72	< 6.5	< 72	< 6.5	< 72
	Antimony				< 220	< 1.400	< 220	< 1.400	< 220	< 1.400	< 220
	Arsenic				< 7	< 11	< 7	< 11	< 7	< 11	< 7
	Barium				< 5,400	< 2,300	< 5,800	< 11,000 [3]	< 11,000 [3]	< 150	< 3,200
	Beryllium				< 21	< 1.5	< 21	< 1.5	< 21	< 1.5	< 21
	Lead				< 200	< 170	< 200	< 170	< 200	< 170	< 200
	Cadmium				< 7,000	< 250	< 7,000	< 250	< 7,000	< 250	< 7,000
	Chromium				< 220	< 200	< 220	< 200	< 220	< 200	< 220
	Copper				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Nickel				n.a. [4]	n.a. [4]	n.a. [4]	n.a. [4]	n.a. [4]	n.a. [4]	n.a. [4]
	Mercury				< 12,000	< 220	< 12,000	< 220	< 12,000	< 220	< 12,000
	Thallium				< 1,800	< 10	< 1,800	< 10	< 1,800	< 10	< 1,800
	Zinc										
	Tin										

Table D 4.3.3 (continued)

Characteristic values		Blasting residue groups											
		9		10		11		12					
		MSK	MCII	MSK	MCII	MSK	MCII	MSK	MCII				
Blasting abrasive													
Dry residue		100											
		> 99.5											
Petroleum hydrocarbons		< 50											
Extractable substances		< 1,040		< 1,040		< 1,040		< 470	< 1,040	< 470	< 1,040		
EOX		< 250		< 250		< 250		< 250	< 250	< 250	< 250		
Total PCB (according to Bellecham)		< 5		< 5		< 5							
Total BTEX		< 0.5		< 0.5		< 0.5							
Total VHH		< 1.0		< 1.0		< 1.0							
Total PAH (EPA)		< 15		< 15		< 15							
Chromium (VI)		< 0.5		< 0.5		< 120							
Sulphur, total		< 2,500	approx. 25,000	< 300	< 2,500	< 300	< 2,500	< 300	approx. 25,000	< 2,500	approx. 25,000		
Aluminium		approx. 25,000	< 300	approx. 25,000	< 300	approx. 25,000	< 300	approx. 25,000	< 300	approx. 25,000	< 300		
Antimony		< 3.3	< 73	< 3.3	< 73	< 3.3	< 73	< 3.3	< 73	< 3.3	< 73		
Arsenic		< 6.5	< 230	< 6.5	< 230	< 6.5	< 230	< 6.5	< 230	< 6.5	< 230		
Barium		< 1,400	< 7	< 1,400	< 7	< 1,400	< 7	< 1,400	< 7	< 1,400	< 7		
Beryllium		< 11	< 2,200	< 11	< 2,200	< 11	< 2,200	< 11	< 2,200	< 11	< 2,200		
Lead		< 150	< 31	< 150	< 31	< 150	< 31	< 45	< 31	< 45	< 31		
Cadmium		< 45	< 230	< 45	< 230	< 45	< 230	< 170	< 230	< 170	< 230		
Chromium		< 170	< 7,000	< 170	< 7,000	< 170	< 7,000	< 250	< 7,000	< 250	< 7,000		
Copper		< 250	< 230	< 250	< 230	< 250	< 230	< 280	< 230	< 280	< 230		
Nickel		< 280	< 2.2	< 280	< 2.2	< 280	< 2.2	< 2.2	< 2.2	< 2.2	< 2.2		
Mercury		< 2.2	n.a. [6]	< 2.2	n.a. [6]	< 2.2	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]	n.a. [6]		
Thallium		n.a. [6]	< 12,400	n.a. [6]	< 12,400	n.a. [6]	< 12,400	< 12,400	< 12,400	< 12,400	< 12,400		
Zinc		< 800	< 1,800	< 800	< 1,800	< 800	< 1,800	< 10	< 1,800	< 10	< 1,800		
Tin		< 10		< 10		< 10							

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Table D 4.3.3 (continued)

Characteristic values	
Blasting abrasive	
Dry residue	Mass %
Petroleum hydrocarbons	mg/kg dry matter 1)
Extractable substances	
EOX	
Total PCB (according to Ballschm.)	µg/kg dry
Total BTEX	mg/kg
Total VHH	
Total PAH (EPA)	mg/kg dry matter 1)
Chromium (VI)	
Sulphur, total	
Aluminium	
Antimony	
Arsenic	
Barium	
Beryllium	
Lead	
Cadmium	
Chromium	
Copper	
Nickel	
Mercury	
Thallium	
Zinc	
Tin	

continued on next page

Table D 4.3.3 (continued)

	13		14		15	
	MSK	MCU	MSK	MCU	MSK	MCU
Mass %	100					
	> 99.5					
mg/kg dry matter 1)						
	< 2,300				< 2,300	
	< 17	< 17			< 17	< 17
µg/kg dry	< 6					
mg/kg	< 0.5					
	< 0.1					
mg/kg dry matter 1)		< 0.15 9) < 620 11)	< 0.15			< 0.15 9), 12) < 620 11) < 1,100 10)
	< 0.5					
	< 200	< 2,500	< 200	< 2,500	< 200	< 2,500
	approx.	approx. 25,000	approx.	approx. 25,000	approx.	approx. 25,000
	< 2.2	< 200	< 2.2	< 200	< 2.2	< 200
	< 6.5	< 72	< 6.5	< 72	< 6.5	< 72
	< 1,400	< 220	< 1,400	< 220	< 1,400	< 220
	< 41	< 7	< 41	< 7	< 41	< 7
	< 150	< 2,200	< 150	< 2,200	< 150	< 2,200
	< 4.5	< 21	< 4.5	< 21	< 4.5	< 21
	200 7)	420 7)	< 170	< 200	< 170	< 200
	< 250	< 7,000	< 250	< 7,000	< 250	< 7,000
	< 280	< 220	< 280	< 220	< 280	< 220
	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	n.a. 6	n.a. 6)	n.a. 6)	n.a. 6)	n.a. 6)	n.a. 6)
	< 6,200	< 18,200	< 6,500	< 19,200	< 6,500	< 19,200
	6.4 ± 2.5	1,642 ± 194	6.4 ± 2.5	1,642 ± 194	6.4 ± 2.5	1,642 ± 194

Characteristic values	Blasting abrasive	Dry residue		Petroleum hydrocarbons	Extractable substances	EOX	Total PCB (according to	Total BTEX	Total VHH	Total PAH (EPA)	Chromium (VI)	Sulphur, total	Aluminium	Antimony	Arsenic	Barium	Beryllium	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Thallium	Zinc	Tin

[1]) Dry residue

[2]) depending on origin of abrasives

[3]) oil-red lead

[4]) AK-red lead

[5]) EP-red lead

[6]) due to matrix effects cannot be determined

[7]) Chromium, total

[8]) only in the case of PVC and CPVC-containing coatings and chlorinated resins

[9]) only to be assumed in the case of coatings according to sheet 81 with modifiers since 1995

[10]) only possible in the case of coatings according to sheet 81 with modifiers up to 1995

[11]) only in the case of tar pitch epoxy resin

[12]) only for BKF

Annex E Inspection Guidelines

E 1 General information

(1) Annex E deals with the scope and performance of control checks during the monitoring of corrosion protection work by the client at the factory and on site.

(2) The client may assign the task of monitoring corrosion protection work and sub-operations to suitable testing facilities (see E 2).

(3) In cases in which the client does not perform acceptance testing itself, the testing facility — subject to a corresponding contractual arrangement — may simultaneously perform manufacturing supervision of the steel construction and inspect the welding work.

E 2 Testing facilities

E 2.1 General information

Only testing facilities may be contracted to perform checks on corrosion protection work if they satisfy the requirements of E 2.2 and E 2.3. Proof of this must be furnished.

E 2.2 Manpower

(1) A testing facility must have at least two employees with expertise and experience in the field of corrosion protection, in particular with regard to:

- Causes of corrosion and corrosion mechanisms,
- methods of corrosion protection,
- corrosion protection by means of coatings,
- surface preparation methods,
- Coating materials and their application areas,
- application techniques,
- corrosion protection using metallic coatings,
- test technology for corrosion protection,
- test technology for environmental conditions,
- environmentally-compliant execution of the work and disposal of waste.

(2) These requirements fulfil e.g.:

- certified coating inspectors,
- government-recognised corrosion protection technicians,
- Engineers with an additional completed training as corrosion protection engineer.

(3) As support, other employees of the testing facility with knowledge of corrosion protection may be deployed.

(4) An additional training in welding in line with the requirements of the welding supervisory institution pursuant to DIN EN 1090-2 is required if the testing facility is also to carry out manufacturing acceptance testing of steel structures and checks on welding work (E 1 (3)).

E 2.3 Test equipment and documentation

(1) The testing facilities must hold at least the following equipment and documents:

- Photographic reference samples (pursuant to DIN EN ISO 8501-1),
- Roughness reference samples (pursuant to DIN EN ISO 8503-1 to -4) for the determination of surface roughness,
- Digital measuring equipment with data storage and printout of air temperature, object temperature and

relative humidity in order to determine the dew point temperature,

- Dry film thickness measuring equipment with data storage and data printout for ferromagnetic and non-ferromagnetic substrates,
- Magnifying glass with illumination (at least 8× magnification),
- Wet film thickness measuring equipment,
- Instruments with hydraulic drive for pull-off testing pursuant to DIN EN ISO 16276 1,
- Instruments for lattice-pattern/cross-cut testing pursuant to DIN EN ISO 2409
- Wedge cutting instrument for determining the number of coats pursuant to DIN 50986 (e.g. paint inspection gauge),
- Test instruments and auxiliaries for testing surface purity pursuant to DIN/TR 55684.

E 3 Inspection of corrosion protection work

E 3.1 Required inspection activities

(1) The scope of inspection and test activities can be seen in Tables E 4.3.1 and E 4.3.2. This does not affect the contractor's internal quality control.

(2) Before applying an additional coat the existing coat must be checked to ensure it has the condition stipulated in the contract (Table E 4.3.2).

(3) Table E 4.3.3 contains work aids relating to the nature and requirements of the inspections to be performed.

Table E 4.3.1: Necessary testing activities in connection with surface preparation

Testing	Scope of testing
Blasting abrasive: – according to DIN EN ISO 11124 or DIN EN ISO 11126 (detection) – Removal of reference sample and handover to the client	Documentation – Product data sheet, – Safety data sheet, – Audit certificate BGR 500, Part 2, Chapter 2.24
Surface preparation grade	Before coating, all surfaces must be checked for the agreed surface preparation (surface preparation level, dust and salt coating).
Roughness of surface	To be inspected if necessary (particularly in the case of spray galvanising)
Condition of surface condition for defects, e.g. notches, over-rolling, welding defects (splashes, ignition points) and burrs	To be inspected
Coverage of surfaces to be kept free (e.g. at joints)	To be inspected
Adhesion of existing coats on initial protection measures	To be inspected if necessary
Adhesion and residual film thickness of remaining old coats in the case of partial refurbishment	Samples to be inspected at random after surface preparation prior to applying new coats

E 3.2 Documentation

(1) The testing facility must be present at the creation of control surfaces and supervise the proper implementation, including the preparation of control surface protocols.

(2) The testing facility is to use the protocol forms from Annex B to document the tests performed.

(3) After completing the corrosion protection works, the testing facility must hand over the protocols to the client with a final report.

(4) If the testing facility is to provide the information necessary for the structure book ('Bauwerksbuch') as per DIN 1076, this must be agreed separately.

Table E 4.3.2: Necessary inspection activities in connection with the application of each coat

Testing	Scope of testing
Dew point and surface temperature	Measurement of single values for release of application
Coating materials, e.g. – conformity mark. – agreement with the purchase order, in case of doubt by taking a	Random sample

sample and verifying identity, – compliance with processing instructions from manufacture in accordance with directions for use,, – blending, – determining the flow time due to workability under site conditions.	
Wet film thickness:	Random samples to be inspected if necessary
Working conditions, weather conditions during the curing period	Random sample
Dry film thickness: – Minimum film thickness, – Maximum film thickness	– Film thickness of the individual coats in the system taking into account the tolerance limits according to 5.3.1 – Film thickness of the entire system in accordance with Table 4.3.3
Finished coating for – Uniformity, – coverage, – coating defects, – Contaminants.	Random sample

Table E 4.3.3: Working aid for checking corrosion protection works

Tasks		Type of test (relevant equipment)	Requirement/characteristic	dealt with in:
1. Sites and working conditions				
1.1	Access to surfaces to be treated, adequate lighting	Inspections on-site	Adequate safety, good working conditions	DIN EN ISO 12944-7
1.2	Punctual provision of necessary protection from weather (tents, heating, ventilation)		According to the information in the specification of works or the generally valid statutory provisions	7 and DIN EN ISO 12944-1, DIN EN ISO 12944-4, DIN EN ISO 12944-7
1.3	Compliance with requirement for environmental and occupational protection, for disposal			
2. Blasting abrasive				
2.1	Conformity	Comparison	as indicated by the Contractor	4.2, 6.1 and DIN EN ISO 11124, DIN EN ISO 11126
3. Coating materials prior to processing				
3.1	Agreement with the purchase order	Comparison	corresponding to the order	5.2, 9.2.2 and TL/TP ING 4-3
3.2	Correct storage	Visual digital thermometer	5°C to 30°C	6.4 and DIN EN ISO 12944-5, DIN EN ISO 12944-7, TL/TP ING 4-3
3.3	Skinning, sediment	visual	Generally skin formation is not permissible, any possible sediment must be soft and easily agitated	6.1 and DIN EN ISO 12944-7
3.4	Ability to stir in case of tendency to settle	machine or mechanical stirring, decanting several times for homogenisation		
3.5	Workability under the given site conditions in the prescribed application method	Work sample	necessary viscosity testing as an exception subject to the client's approval and following manufacturer's instructions	9.2.2 and DIN EN ISO 12944-7, TL KOR-Stahlbauten
4. Characteristics of the surface to be coated				
4.1	Removal of foreign contaminants (e.g. dust, moisture, salts, oil, grease, concrete slurry)	visual Investigation is necessary	by suitable cleaning methods	4.2, 4.3 and DIN EN ISO 12944-4, DIN/TR 55684
4.1.1	Dust	Dust test	not more than class 2 (Quantity of dust m0, m1 or m2, particle size G0, G1 or G2)	4.2 and DIN EN ISO 8502-3 DIN/TR 55684
4.1.2	Soluble salts	if necessary, wipe test, procedure with self-adhesive cell, alternative methods	Salt load not more than 80 mg/m²	4.2 and DIN/TR 55684, DIN EN ISO 8502-6
4.2	Removal of characteristic layers, e.g. mill scale, rust	visual if necessary compare with photographic reference samples	Surface preparation grade corresponding to requirements in specification of works	2.3, 4.2 and DIN EN ISO 12944-4
4.3	Roughness of the blasted surface	Visual comparison (e.g. ISO reference samples)	Roughness: medium (grit)	4.2 and, DIN EN ISO 8503-1 DIN EN ISO 8503-2

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Table E 4.3.3 continued**:** Working aid for checking corrosion protection works

Tasks		Type of test (relevant equipment)	Requirement/characteristic	dealt with in:
4. Characteristics of the surface to be coated (continuation)				
4.4	Adhesion of old coatings, in the case of new coatings only where there is justifiable suspicion	Lattice-pattern, and cross-cut testing where appropriate Pull-off testing	Gt 0 to Gt 2 or Kt 0 to Kt 2 Empirical value	DIN EN ISO 16276-2 DIN EN ISO 16276-1
4.5	Under-film rusting of existing coatings	visual	with no visible rust	
5. Weather conditions during execution of the work and film formation				
5.1	Compliance with the processing conditions specified in the regulations and by the manufacturer	Measurement of relative humidity and air and surface temperature (digital thermometer, dew point hygrometer)	according to information provided by the manufacturer	DIN EN ISO 12944-7 and execution instructions
5.2	Avoidance of condensation		Object temperature: at least 3 K above dew point of the surrounding air	6.3 and DIN EN ISO 12944-7
6. Application of coating materials				
6.1	skilled use of the prescribed application method; possible pre-coating of edges, screws, rivets and especially difficult to access parts of the surface	Observation on site, preparation of the coating material for application (such as mix ratio and mixing time)	Crosswise strokes when coating; correct nozzle distance when spraying, no thickening on normal components, rolling only if the specifications provide for preliminary painting of edges	5.3 and 6.1 as well as DIN EN ISO 12944-7
6.2	Homogenisation before and during processing		No settling out, no separation	6.1 and DIN EN ISO 12944-7
6.3	Adherence to prescribed mixing ratios for 2-component substances	Mixing control, type of mixing, etc.	According to manufacturer's directions; careful mixing	DIN EN ISO 12944-7 and execution instructions
6.4	Performance of the coating with correct processing in the correct film thickness	visual	Good flow, no sagging, no wrinkling or blistering	6.1 and DIN EN ISO 12944-7 as well as execution instructions
6.5	Compliance with prescribed wet film thicknesses	Wet film thickness test ('comb' or 'roller')	Depending on type of binder and solvent content 1.5--2.5 × subsequent dry film thickness according to manufacturer's directions or Annex C	DIN EN ISO 12944-7
6.6	Compatibility with existing old coating (mostly in advance of actual work being carried out)	If in doubt, set up test area	Pull-off test, Gt≤2 or Kt ≤ 2, no visual anomalies	RI-ERH-KOR
7. Creation of control surfaces/production of sample plates				
7.1	Correct position, size and quantity	visual	in areas typical of the structure; size and quantity according to specifications	6.6
7.2	permissible processing conditions	air temperature, relative humidity, dew point, surface temperature (digital thermometers, hygrometers)	according to information provided by the manufacturer	6.3 and DIN EN ISO 12944-7 execution instructions
7.3	Compliance with all conditions of above points 1-5	All the prerequisites and conditions necessary for correct provision of the work must also be present for the creation of the control surface.		

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Table E 4.3.3: Working aid for checking corrosion protection works (continued)

Tasks		Type of test (relevant equipment)	Requirement/characteristic	dealt with in:
8. Finished coatings				
8.1	Uniformity and appearance	visual	Smooth application, uniform colour, no runs, wrinkles, blisters, pores, voids, inclusions	6.1 and DIN EN ISO 12944-7
8.2	Compliance with the required nominal film thicknesses	Measurements of dry layer thicknesses using magnetic inductive devices and documenting the results directly	Nominal film thicknesses according to specifications	5.3.1, 9.2.2 and Annex A as well as DIN EN ISO 12944-5, DIN EN ISO 12944-7
8.3	Adhesion and bonding (generally only if there is cause for doubt)	Lattice pattern, where appropriate cross-cut testing pull-off method	Equally good results as on control surfaces/sample boards; no bonding faults	DIN EN ISO 16276-2, DIN EN ISO 16276-1
8.4	Marking of the coating	visual		6.7

Annex F
Explanation of acronyms

Table F 4.3.1: Explanation of acronyms

Acronym	Explanation
1 C	One-component coating material
2 C	Two-component coating material
AfA	Ausführungsanweisung (execution instructions)
ASI	Alkali silicate
BASt	Federal Highway Research Institute [German designation: BASt]
DB	Top coat
DB colours	Colours for interim and top coatings containing micaceous iron oxide (previously: in accordance with the colour chart of the **G**erman **F**ederal Railways)
EG	Eisenglimmer (pigmented with micaceous iron oxide)
ER	Epoxy resin
ER HS	Epoxy resin, low solvent (high solids)
EP-combi	Epoxy resin combination
ER diverse	Other types of base coat materials according to DIN EN ISO 12944-5
ESI	Ethyl silicate
BC	Base coat according to DIN EN ISO 12944-5
GSD	Gesamtschichtdicke (total film thickness of the organic coats, for definition see No 1.2)
Edge protection	Edge protection
NDFT	**n**ominal **d**ry **f**ilm **t**hickness
OV	Surface preparation
PUR	Polyurethane (2-component polyurethane)
RAL colours	Micaceous iron oxide-free colours made and administered by RAL GmbH (a subsidiary of the RAL Institute); RAL Deutsches Institut für Gütesicherung und Kennzeichnung e. V. (abbreviation for ‘Reichs-Ausschuss für Lieferbedingungen’)
Sa 2½, Sa 3, P Ma	Surface preparation grades in accordance with DIN EN ISO 12944-4

Table F 4.3.1: Explanation of acronyms (continued)

Acronym	Explanation
t Zn k	Hot-dip galvanisation for duplex systems, no post-treatment according to DIN EN ISO 1461, National Annex NB
VOC	**V**olatile **o**rganic **c**ompound(s)
VOC $_{m^2}$	Solvent content per m² of the total system
ZB	Intermediate coating
Zn	pigmented with zinc dust
Zn (R)	primer materials rich in zinc dust in accordance with DIN EN ISO 12944-5
ZnPh	Zinc phosphate pigmented