Federal Ministry for Digital and Transport

Technical delivery terms and technical test requirements for civil engineering works

TL/TP-ING

Part 4 Section 3

Technical delivery conditions for coating materials for the 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. ...

TL KOR-Stahlbauten

As of: 2024/07

Content

1 General information

(1) The technical delivery conditions for coating materials for the corrosion protection of steel structures [German designation: TL KOR-Stahlbauten] contain provisions relating to the requirements and quality assurance of coating materials and systems for the corrosion protection of steel structures.

(2) The TL KOR-Stahlbauten shall apply in conjunction with the technical test specifications for coating materials for the corrosion protection of steel structures [TP KOR-Stahlbauten].

(3) Coating materials and systems for the corrosion protection of steel structures which have been lawfully manufactured and/or placed on the market in another EU Member State or in Turkey or in an EFTA state which is a party to the EEA Agreement are permitted in Germany if they consistently guarantee a protection level which satisfies the requirements laid out in the ZTV-ING. In this case, the conformity mark (Ü-sign) as shown in Figure 1 on the packaging/container may be waived.

2 Scope of application

The TL KOR-Stahlbauten shall apply to the delivery of coating materials for the corrosion protection of steel structures in accordance with ZTV-ING Part 4, Section 3.

3 Definitions

(1) The definitions of ZTV-ING Part 4, Section 3 shall apply.

(2) P-authority: in accordance with ZTV-ING Part 1, Section 1 Annex A 4-2a accredited conformity assessment authority (KBS).

4 Requirements

4.1 General requirements

(1) The coating materials used must be workable, repairable and recoatable in accordance with the execution instructions.

(2) Annex A contains requirements for coating materials as well as the type and scope of tests as part of their quality assurance, the practical suitability of which has been proven for the application for structures and structural components of federal transport routes.

(3) The suitability of the coating systems for use in environments with corrosivity categories according to DIN EN ISO 12944-2 and duration of protection according to DIN EN ISO 12944-1 is proven by the continuous condensation and salt spray test with a specified test duration (see Table 1).

(4) The requirements for sheet 100 and its modules A, C and D (see Annex A 5) go beyond the requirements of DIN EN ISO 12944-6. Coating systems according to sheet 100, module A are designed for an extremely long duration of protection of at least 50 years.

(5) The requirements for pigments set out in Annex B must be observed. Other pigments are allowed.

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

(7) In special applications, the coating materials and systems may be subject to special requirements, the fulfilment of which must be proven by additional tests (suitability tests).

(8) Annex C contains the information on the colours of the intermediate and top coatings as well as the requirements for colour resistance of the micaceous iron oxide-free top coatings.

Table 1: TL Sheets and tested coating systems as well as their assignment to corrosivity categories and duration of protection pursuant to DIN EN ISO 12944 and ZTV-ING Part 4, Section 3.

Corrosivity category, duration of protection		Testing procedure according to TP KOR-Stahlbauten	Duration
Substrate, OV	TL Sheet	tested coating systems	
C2, very high C3, high, C4, medium C5, low		continuous condensation (TP 6.2.1) salt spray (TP 6.2.3)	240 h 480 h
Steel Sa 2 medium (G), PSa 2 medium (G), PMa, PSt 3	50	GB: EP, DB: EP or PUR	
C3, very high, C4, high, C5, medium		continuous condensation (TP 6.2.1) salt spray (TP 6.2.3)	480 h 720 h
Steel Sa 2½ medium (G)	86	GB: ESI-Zn	
C4, very high, C5, high		continuous condensation (TP 6.2.1) 720 h salt mist (TP 6.2.3)	1 440 h
Steel Sa 2½ medium (G), Sa 2 medium (G), PSa 2 medium (G), St 3, PMa	100-B	GB: EP Divers ZB, DB: as specified by the manufacturer	
C5, very high		continuous condensation (TP 6.2.1) 1 200 h salt mist (TP 6.2.3)	2160 h
Steel Sa 2½ medium (G)	81	GB EP-Zn ZB: EP-combi DB: EP-combi	
Hot dip galvanising Sweep blast cleaning	81	ZB: EP-combi DB: EP-combi	
C5, extremely high		continuous condensation (TP 6.2.1) 1 440 h salt mist (TP 6.2.3)	3 000 h
Steel Sa 2½ medium (G)	100 A	GB: EP Zn (R) ZB, DB: as specified by the manufacturer	

continued on next page

Table 1 (continued)

Corrosivity category, duration of protection		Testing procedure according to TP KOR-Stahlbauten	Duration
Substrate, OV	TL Sheet	tested coating systems	
Special load		continuous condensation (TP 6.2.1) 1 200 h salt mist (TP 6.2.3) Resistance to fluids (TP 6.2.2)	 2160 h 3 000 h
Steel Sa 2½ medium (G)	81	GB: EP-Zn ZB: EP-combi DB: EP-combi	
Hot dip galvanising Sweep blast cleaning	81	ZB: EP-combi DB: EP-combi	

4.2 Form of delivery and packaging

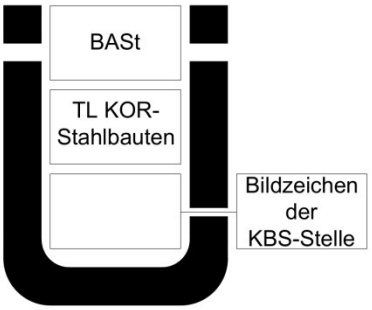
(1) The coating materials or their components must have a shelf life of at least 6 months in a seasonal temperature range of 5 °C and 30 °C in a closed original container.

(2) The components for the 2K fabrics must be supplied in containers which are coordinated in terms of the mixing ratio.

4.3 Information on packaging/ container

The packaging/container must be permanently marked with the following information:

- name and address of the manufacturer/distributor of the materials,
- trade name of the coating material,
- designation of the coating material according to the TL KOR-Stahlbauten (sheet, substance No) in accordance with Annex A,
- designation of the component in the container (component A or component B) for two-component substances,
- in the case of multi-component materials, associated further components with mixing ratio given as proportions of weight and volume on the container with component A,
- Colour (RAL or DB No.),
- Batch No.,
- Conformity mark according to Figure 1 (Ü-Mark)
- accompanying thinners,
- labelling in accordance with chemicals legislation,
- instruction to observe the execution instruction,
- nominal quantity in kg or L in the delivery container,
- Indication of storage conditions and
- Indication of permissible storage period (workable at least up to: month and year).



BASt	BASt
TL KOR-Stahlbauten	TL KOR-Stahlbauten
Bildzeichender KBS-Stelle	Symbol of the KBS

Figure 1: Conformity mark (see 5.3.3)

4.4 Execution instructions

(1) Execution instructions (AfA) must be drawn up by the manufacturer/distributor for each TL sheet. They must be structured in accordance with the form set out in Annex D and contain all the information necessary for the executing the works.

(2) The AfA must not contain any information that contradicts ZTV-ING 4-3.

(3) During the processing of the application for inclusion in the BASt compilation, the AfA shall be checked and endorsed by the BASt.

(4) If changes are made to the information on execution, the AfA must be adjusted accordingly and sent to the BASt for inspection and approval via an endorsement.

5 Quality assurance

5.1 General information

(1) An overview of the components of quality assurance, including timing, object, responsible bodies and documentation, is provided in Table 2.

(2) Quality assurance includes the following:

a) Suitability testing of the coating materials and systems (basic inspection or repeat test, see 5.2),

b) Conformity mark (see 5.3)

- Factory production control (WPK) (see 5.3.1),
- External monitoring (see 5.3.2)
- Declaration of conformity (see 5.3.3),

c) BASt compilation of the tested coating materials (see 5.4) and

d) Quality control on delivery of the coating materials (acceptance test certificates 3.1, see 5.3.1, if applicable acceptance test certificates 3.2, see 5.5).

(3) The test methods are described in the TP KOR-Stahlbauten.

5.2 Basic test and repeat test

(1) Basic and repeat tests must be carried out for all TL sheets of Annex A. The tests may only be carried out by one P-authority. Outsourcing of individual tests is only permitted by testing institutes accredited to the Deutsche Akkreditierungsstelle GmbH (DAkkS).

(2) The results of the basic test or repeat test must be documented in a test report containing all the material-related information, information on the tests conducted and the evaluation of the results with the exception of long-term stability. The test results must be presented in a photo documentation.

(3) When testing the 12-month or 60-month long-term stability (see TL Sheet), the coating materials may be entered into the BASt compilation before said test concludes under the condition that all other requirements have been met.

(4) In the case of a weathering period of 60 months, the test of long-term stability is a component of the first repeat test. Only in the case of positive results of this test and the repeat test can the listing in the BASt compilation continue.

5.3 Certificate of conformity

5.3.1 Factory production control (WPK) and acceptance test certificate 3.1

(1) A WPK must be set up and conducted at each factory where materials are manufactured, in accordance with DIN 18200, 3.1.

(2) In the case of micaceous iron oxide-containing coating materials, the lamellarity of the iron mica used (see Annex B) must be regularly tested and documented as part of the WPK.

(3) As part of the WPK and in the case of acceptance test certificates 3.1 in accordance with DIN EN 10204, at least the characteristic values or properties must be tested and documented in accordance with Annex A for each batch, depending on the TL sheet.

(4) In the case of iron mica pigments in a coating material, the coating material manufacturer shall certify compliance with Annex B in the acceptance test certificates.

(5) The tests shall be carried out in accordance with the testing procedures and schedules of the manufacturer.

5.3.2 External monitoring

(1) Each manufacturer must conclude an external monitoring agreement (see model monitoring agreement on www.bast.de) with a conformity assessment authority (KBS) listed in the ‘BASt-compilation of listed conformity assessment bodies for corrosion protection of steel structures’.

(2) At each manufacturer's factory, the WPK must be checked at least once per year by the KBS.

(3) The external monitoring report must be sent to the BASt and, upon request, must be submitted to the Federal road construction authorities. An initial monitoring of the manufacturer's plant by the KBS must be carried out at the beginning of production. The task is to check the general suitability of the manufacturer's factory and its WPK on the manufacture of products under these TL KOR-Stahlbauten.

Table 2: Elements of the quality assurance for coating materials

Components of quality assurance			Time	Object	by	Document	
Basic test			any	Coating materials of the relevant sheet of the TL KOR-Stahlbauten	P-authority	Test report for the basic test	
Certificate of conformity	**Factory production control (WPK)**		Start after positive basic inspection	all production batches of the coating materials having undergone a basic test	Manufacturer of the material	Documentation of the manufacturer of the material	Declaration of conformity after the basic and each repeat test
	External monitoring	**Initial monitoring**	Start after positive basic inspection	technical equipment and personnel at the factory where the material is manufactured, WPK	KBS (Konformitätsbewertungsstelle)	External monitoring report	
		Regular monitoring	on a yearly basis after completion of the initial monitoring	all production batches of the listed coating materials, as applicable, technical equipment	KBS	External monitoring report	
Repeat test			5 years after basic test or repeat test (expiration date of the listing)	Coating materials of the respective sheet with positive basic test or repeat test	P-authority	Test report for the repeat test	
BASt compilation			Processing of the application under 5.4(2) or (3)	Coating materials of the relevant sheet of the TL KOR-Stahlbauten	BASt	updated edition of the BASt compilation of the tested coating materials	
Acceptance tests		**3.1**	as necessary	all delivery batches for one measure	Manufacturer of the material	Acceptance test certificate 3.1	
		3.2	as agreed	as agreed	Client representative for acceptance e.g. a P-authority	Acceptance test certificate 3.2	

5.3.3 Declaration of conformity

(1) A declaration of conformity shall be issued by a KBS if:

- there is a certificate from the coating material manufacturer that the coating materials/coating systems meet the requirements of the TL KOR steel structures,
- The basic test(s) have been passed, if applicable, repeat test(s) in accordance with 5.2;
- the coating materials are subject to a WPK in accordance with 5.3.1; and
- a third-party monitoring of the manufacturing plant is carried out by the relevant KBS in accordance with 5.3.2.

(2) If a declaration of conformity is issued, the material manufacturer shall apply the conformity mark in accordance with Figure 1 on the container.

(3) The revocation of the declaration of conformity must be notified to the BASt by the KBS.

5.4 Composition of the coating materials tested

(1) The inclusion in the ‘BASt compilation of the tested coating materials for use in structures and structural components of federal traffic routes’ (BASt compilation) must be requested at the BASt by the manufacturer of the material.

(2) The application must contain the following documents:

— Test report on basic inspection according to 5.2,

— External monitoring agreement according to 5.3.2,

— Declaration of conformity according to 5.3.3

— the execution instructions according to Annex D; and

— Sample labelling for packaging according to 4.3.

(3) Inclusion in the BASt compilation is limited to five years. Before the expiry of the registration, an application for extension can be submitted to the BASt on a regular basis. This application shall be accompanied by a repeat test report. If the repeat test is successful, the entry in the BASt compilation can be extended for a further five years.

5.5 Acceptance test certificate 3.2

(1) If contractually specified, the acceptance test certificates 3.2 must be presented when delivering the tested materials, in accordance with DIN EN 10204.

(2) The nature and scope of the tests, depending on the TL sheet, can be found in Annex A.

(3) The acceptance test certificate 3.2 must be signed by the manufacturer and the P-authority.

6 Standards and other technical regulations

DIN 16945: Testing of resins, hardeners and accelerators, and catalyzed resins Test method

DIN 18200: Assessment of conformity for construction products - Factory production control, third-party monitoring and certification

DIN EN 1090-2: Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures

DIN EN 10204: Metallic products - Types of inspection documents

DIN EN ISO 10601: Micaceous iron oxide pigments for paints - Specifications and test methods

DIN EN ISO 12944-1: Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General Introduction

DIN EN ISO 12944-2: Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 2: Classification of environments

DIN EN ISO 12944-4: Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 4: Types of surface and surface preparation

DIN EN ISO 12944-5: Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems

DIN EN ISO 12944-6: Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 6: Laboratory performance test methods

DIN EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods

DIN EN ISO 2063: Thermal spraying - Zinc, aluminium and their alloys - Part 1: Design considerations and quality requirements for corrosion protection systems

DIN EN 23270: Paints, varnishes and their raw materials; temperatures and humidities for conditioning and testing

DIN EN ISO 2811-1: Paints and varnishes - Determination of density - Part 1: Pycnometer method

DIN EN ISO 3549: Zinc dust pigments for paints - Specifications and test methods

DIN ISO 6745: Zinc phosphate pigments for paints - Specifications and methods of test

DIN EN ISO 8501-1: Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings

DIN EN ISO 8501-2: Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness - Part 2: Preparation grades of previously coated steel substrates after localized removal of previous coatings

DIN EN ISO 8503-1: Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces

DIN EN ISO 8503-2: Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates - Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel - Comparator procedure

DIN EN ISO 9117-3: Paints and varnishes - Drying tests - Part 3: Surface-drying test using ballotini

DIN EN ISO 9117-5: Paints and varnishes - Drying tests - Part 5: Modified Bandow-Wolff test

TP KOR-Stahlbauten: Technical test specifications for coating materials for the corrosion protection of steel structures [TP KOR – Stahlbauten]

ZTV-ING 4-3: Additional Technical Terms and Conditions of Contract and Guidelines for Civil Engineering Works, Part 4: Steel construction, composite steel construction, Section 3: Corrosion Protection of Steel Structures

Annex A
TL sheets

Annex A 1

Sheet 50: Coating material based on epoxy resin (EP) for the inner coating of air-tight, welded box girders with limited accessibility

Table A 1.1: Technical delivery conditions for the coating materials under Sheet 50

1	**Composition in the condition as delivered**			
Material No		RAL colour or designation	Composition	
1.1	Coating material for primer and top coat			
650.02		coloured yellow	EP (surface tolerant)	
650.97		grey white RAL 9002	EP or PUR	
1.2	Solvent content per m² of the total system (VOC_{m^2})			
Requirements / characteristics				Test method
≤ 100 g/m² with a dry-film thickness of 200 µm				TP 4.8 (2) and (3)
1.3	Identity tests			
	Testing	Test method	Unit	permissible tolerance
1.3.1	Non-volatile content (nfA)	TP 4.2.	percentage by mass	± 2.5 based on the manufacturer's specifications
1.3.2	Thickness (p)	Pycnometer method according to DIN EN ISO 2811-1	g/cm^3	±0,05 based on the manufacturer's specifications
1.3.3	Tendency to run	TP 5.2 or method as agreed	µm	≥ DFT specified by the manufacturer
1.3.4	IR spectrum	TP 4.10(1)(a) and TP 4.10(1)(b)	-	≥ 90 % correspondence with the IR spectrum of the last test

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Table A 1.1 Technical delivery conditions for the coating materials under Sheet 50 continued

1.4 Binders		
Coating material	Binder (confirmed by the manufacturer)	
	Base component	Curing agents
EP coating materials (see DIN EN ISO 12944-5)	cold setting epoxy resins (predominant proportion), combination resins are permitted	at the manufacturer's discretion
PUR coating materials (see DIN EN ISO 12944-5)	at the manufacturer's discretion	Polyfunction, aliphatic isocyanate
Mixing ratio of the base components / curing agents: as specified by the manufacturer		
2 Sample production for tests in the dry-film state		
2.1 Coating system		
Substrate: Steel sheet with uniform rusting as a result of at least three years of natural weathering,100 x 150 mm Surface preparation: Manual rust removal St 2 under DIN EN ISO 8501-1		System 1 1 x GB Material No 650.02100 µm 1 x DB Material No 650.97100 µm
Substrate: Stainless steel or aluminium sheet, Type and dimension of the sample plates according to the type of weathering device Surface preparation: e.g. sanding		System 2 1 x DB Material No 650.97100 µm

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Table A 1.1 Technical delivery conditions for the coating materials under Sheet 50 continued

3 Testing procedure in dry-film state					
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Testing procedure for evaluation		
			Parameter	Procedure	Requirement
3.1	Evaluation of the coating system, unstrained	-	Cross-cut	TP 6.3.4	≤ 2
			Pull-off value	TP 6.3.5	≥ 5 MPa
3.2	Resistance to moisture (continuous condensation)	TP 6.2.1 <u>System 1</u> Duration: 240 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Pull-off value	TP 6.3.5	≥ 2.5 MPa
3.3	Resistance to salt mist	TP 6.2.3 <u>System 1</u> Duration: 480 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.4	≤ 2
			if lattice section >2, then tear-off value	TP 6.3.5	≥ 2.5 MPa
3.4	Colour resistance	TP 6.2.5 <u>System 2</u> Duration: 168 h	Colour distance ΔE*from non-weathered / weathered	TP 6.2.5	≤ 3.5

Table A 1.2: Type and scope of tests as well as the materials to be submitted to the tests under Sheet 50

Sheet 50 **Tests**	Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test	Requirements / characteristics of Sheet 50	Test procedure for basic inspection, acceptance test 3.2 and repeat test
Solvent content per m² of the total system (VOC_{m^2})	X			X	1.2	TP 4.8 (2) and (3)
Non-volatile content (nfA)	X		X	X	1.3.1	TP 4.2.
Density (ρ)	X	X	X	X	1.3.2	Pycnometer method according to DIN EN ISO 2811 -1
Tendency to run	X	X	X	X	1.3.3	TP 5.2 or as agreed
Viscosity		X	X			as specified by the manufacturer
Processing time (pot life)		X	X			as specified by the manufacturer
Drying time		X	X			as specified by the manufacturer
IR spectrum	X			X	1.3.4	TP 4.10(1)(a)
IR spectrum	X			X	1.3.4	TP 4.10(1)(b)
Evaluation of the coating system, unstrained	X				3.1	-
Resistance to moisture	X			X	3.2	TP 6.2.1
Resistance to salt mist	X			X	3.3	TP 6.2.3
Colour resistance	X			X	3.4	TP 6.2.5
Materials to be submitted for the test (Material No)	650.02 650.97	all delivery batches for one measure	as agreed	650.02 650.97		

Annex A 2

Sheet 81: Coating material based on epoxy resin combination (EP combi)

Table A 2.1: Technical delivery conditions for the coating materials under Sheet 81

1	**Composition in the condition as delivered**				
	Material No	RAL colour or designation	Composition	Percentage by mass [%] Testing procedure	
				Binder (B) TP 4.4	VOC TP 4.8(1)
1.1	Coating materials for intermediate / top coating (ZB/DB)				
	681.11	Black	at the manufacturer's discretion	24-45	≤ 25
	681.12	black red RAL 3007	at the manufacturer's discretion		
	681.94	pebble grey RAL 7032	at the manufacturer's discretion		
	681.97	grey white RAL 9002	at the manufacturer's discretion		
	Further material numbers according to Annex C, Table C 1, are possible. For higher demands relating to colour resistance, a top coating in accordance with Sheet 100-A must be applied.				
1.2	Binder for ZB/DB				
	Material No	Composition: Binding agent based on 100 percentage by mass (confirmed by the manufacturer)			
	681.11, 681.12 681.94, 681.97	50-60 Modifier in % by mass, epoxy resin and curing component 40-50 % by mass			
1.3	Mixing ratio of the base components / curing agents: as specified by the manufacturer				
1.4	Solvents: Composition is at the discretion of the manufacturer				
1.5	Thinners:	Material No 681.150, composition is at the discretion of the manufacturer			
1.6	IR spectrum	Requirement			
		≥90 % correspondence with the IR spectrum of the last test		TP 4.10(1)(a)	

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Table A 2.1 Technical delivery conditions for the coating materials under Sheet 81 continued

<table>
<tr><td colspan="2">2</td><td colspan="4">Specific values for property in the processing state</td></tr>
<tr><td colspan="5">Requirements / characteristics</td><td>Test method</td></tr>
<tr><td>2.1</td><td colspan="4">Drying time</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Coating material</td><td rowspan="2">Degree of dryness</td><td colspan="2">Climate</td><td rowspan="2">DIN EN ISO 9117-3:
DIN EN ISO 9117-5</td></tr>
<tr><td>NK 23 / 50 under DIN EN 23270</td><td>7 °C,85 % rel.humidity</td></tr>
<tr><td colspan="2">Material Nos. 681.11, 681.12
dry-film thickness: 150 µm</td><td>1
6</td><td>≤ 6 h
≤ 24 h</td><td>≤ 8 h
≤ 120 h</td><td></td></tr>
<tr><td>2.2</td><td colspan="4">Processability
spreadable and sprayable</td><td>TP 5.1</td></tr>
<tr><td>2.3</td><td colspan="4">Tendency to run
achievable dry film thickness with material no, all material nos.: 150 µm</td><td>TP 5.2</td></tr>
<tr><td>2.4</td><td colspan="4">Processing time (pot life)
for ZB/DB: ≥ 4h</td><td>TP 5.3</td></tr>
<tr><td>2.5</td><td colspan="4">Suitability for repainting or respraying
possible after a drying time for ZB/DB: ≤ 16 h
dry film thickness: 150 µm</td><td>TP 5.4</td></tr>
<tr><td colspan="2">3</td><td colspan="4">Sample production for tests in the dry-film state</td></tr>
<tr><td>3.1</td><td colspan="4">Coating systems on steel</td><td></td></tr>
<tr><td colspan="3">Substrate:
Sheet steel, 100 x 150 mm

Surface preparation:
Minimum surface preparation grade Sa 2½
under DIN EN ISO 12944-4
Roughness medium (G)
under DIN EN ISO 8503-1 and -2</td><td colspan="3">System 1
1 x GB Material No 100.1.1 80 µm
1 x DB Material No 681.11 120 µm
1 x DB Material No 681.12 120 µm</td></tr>
<tr><td colspan="3">Substrate:
Steel sheet: bending sheet metal for the bending tests

Surface preparation:
sand lightly</td><td colspan="3">System 3
1 x DB Material No 681.11 150 µm
or
1 x DB Material No 681.12 150 µm</td></tr>
<tr><td>3.2</td><td colspan="5">Coating systems on hot dip galvanised steel</td></tr>
<tr><td colspan="3">Substrate:
non-weathered, individually galvanised, non-post treated sheet steel under DIN EN ISO 1461 (quality ‘t ZN k’)
100 x 150 mm

Surface preparation:
Sweep blast cleaning under DIN EN ISO 12944-4</td><td colspan="3">System 2
1 x DB Material No 681.11 120 µm
1 x DB Material No 681.12 120 µm</td></tr>
</table>

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Table A 2.1 Technical delivery conditions for the coating materials under Sheet 81 continued

4 Testing procedure in dry-film state					
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Testing procedure for evaluation		
			Parameter	Procedure	Requirement
4.1	Resistance to moisture (continuous condensation)	TP 6.2.1 Systems 1 and 2 Duration: 1,200 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			only System 1 Pull-off value	TP 6.3.5	≥ 5 MPa and no adhesion failure with substrate
			only System 1 X-cut	TP 6.3.2	≤ 1
			only System 2: Wet adhesion through X-cuts	TP 6.3.3	≤ 1
			only System 2: Cross-cut	TP 6.3.4	≤ 1
4.2	Resistance to salt mist	TP 6.2.3 Systems 1 and 2: Duration: 2,160 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			only System 1 Pull-off value	TP 6.3.5	≥ 5 MPa and no adhesion failure with substrate
			only System 1 X-cut	TP 6.3.2	≤ 1
			only System 1 Corrosion on the milled groove	TP 6.3.6	≤ 3 mm
			only System 2: Cross-cut	TP 6.3.4	≤ 1
4.3	Resistance to fluids	TP 6.2.2 Systems 1 und 2: Duration: 3,000 h	Degree of blistering	TP 6.3.1	0 (S0)
			other changes		no changes
4.4	Ductility	TP 6.2.9 System 3	Cracks		No cracking

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Table A 2.1 Technical delivery conditions for the coating materials under Sheet 81 continued

5 Testing procedure in dry-film state (continued)					
No:	Test designation	Testing procedure for straining, systems and test duration, as applicable	Testing procedure for evaluation		
			Parameter	Procedure	Requirement
4.5	Long-term stability	TP 6.2.6 Systems 1 und 2: Duration: 12 months	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			only System 1 Pull-off value	TP 6.3.5	≥ 5 MPa and no adhesion failure with substrate
			only System 1 X-cut	TP 6.3.2	≤ 1
			only with System 2 Cross-cut	TP 6.3.4	≤ 1

Table A 2.2: Type and scope of tests as well as the materials to be submitted to the tests under Sheet 81

Sheet 81 **Tests**		Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test	Requirements / characteristic values of Sheet 81	Test procedure for basic inspection, acceptance test 3.2 and repeat test
percentage by mass	Binder content (B)	X			X	1.1	TP 4.4
	Solvent content (VOC)	X			X	1.1	TP 4.8(1)
IR spectrum		X			X	1.6	TP 4.10(1)(a)
Drying time		X	X	X	X	2.1	DIN EN ISO 9117-3: DIN EN ISO 9117-5
Processability		X		X	X	2.2	TP 5.1
Tendency to run		X	X	X	X	2.3	TP 5.2
Processing time (pot life)		X	X	X	X	2.4	TP 5.3
Density			X	X			as specified by the manufacturer
Viscosity			X	X			as specified by the manufacturer
Suitability for repainting or respraying		X		X	X	2.5	TP 5.4
Resistance to moisture		X			X	4.1	TP 6.2.1
Resistance to salt mist		X			X	4.2	TP 6.2.3
Resistance to fluids		X			X	4.3	TP 6.2.2
Ductility		X			X	4.4	TP 6.2.9
Long-term stability		X				4.5	TP 6.2.6
Materials to be submitted for the test (Material No)		100.1.1 681.11 681.12	all delivery batches	as agreed	100.1.1 681.11 681.12		

Annex A 3

Sheet 85: Coating materials for slip-resistant, bolted joints

Table A 3.1: Technical delivery conditions for the coating materials under Sheet 85

1	**Composition in the condition as delivered**			
1.1	Coating material			
	Material No	RAL colour or designation	Composition of the pigments based on 100 % by mass of the pigment/filler mixture (confirmed by the manufacturer)	
1.2	Alkali silicate-based binders (ASI)			
	685.03	grey	≥ 94 % Zn	
	aqueous solution of sodium or potassium silicate or mixtures thereof (confirmed by the manufacturer) ratio of metal oxide to SiO_2 for sodium silicate ≥ 1: 3.8 for potassium silicate ≥ 1: 2.6			
1.3	Mixing ratio binder			
	as applicable, mixing ratio of the base components / curing agents: as specified by the manufacturer			
2	**Specific values for property in the processing state**			
	Requirements / characteristics			Test method
2.1	Drying time at NK 23 / 50 according to DIN EN 23270			
	Dry film thickness: 40 µm	Degree of dryness 1	≤ 15 min	DIN EN ISO 9117-3
2.2	Processability: spreadable and sprayable			TP 5.1
3	**Sample production for tests in the dry-film state**			
	Substrate: Sheet steel 100 x 150 mm and Samples for testing the slip resistance of bolted joints in accordance with DIN EN 1090-2 Surface preparation: Surface preparation grade Sa 3 according to DIN EN ISO 12944-4 Roughness medium (G) according to DIN EN ISO 8503-1 and -2			System 1 1 x GB Material No 685.03 60 µm (Dry film thickness may not be less than 40 µm and may not exceed 80 µm)

continued on next page

Table A 3.1 Technical delivery conditions for the coating materials under Sheet 85 continued

4 Testing procedure in dry-film state					
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Testing procedure for evaluation		
			Parameter	Procedure	Requirement
4.1	Water resistance	TP 6.2.10 System 1: Duration: 12 d	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
4.2	Heat resistance	TP 6.2.11 System 1: Duration: 1 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of cracking	TP 6.3.1 with 10-fold magnification	0 (S0)
4.3	Slip resistance of bolted joints	DIN EN 1090-2 System 1	Static friction coefficient	DIN EN 1090-2	≥0,5

Table A 3.2: Type and scope of tests as well as the materials to be submitted to the tests under Sheet 85

Sheet 85 **Tests**	Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test	Requirements / characteristic values of Sheet 85	Test procedure for basic inspection, acceptance test 3.2 and repeat test
Drying time	X	X	X	X	2.1	DIN EN ISO 9117-3
Viscosity		X	X			as specified by the manufacturer
Tendency to run		X	X			as specified by the manufacturer
Processing time (pot life)		X	X			as specified by the manufacturer
Density		X	X			as specified by the manufacturer
Processability	X		X	X	2.2	TP 5.1
Water resistance	X		X [1]	X	4.1	TP 6.2.10
Heat resistance	X		X [2]	X	4.2	TP 6.2.11
Slip resistance of bolted joints	X			X	4.3	DIN EN 1090-2
Materials to be submitted for the test (Material No)	685.03	all delivery batches for one measure	as agreed	685.03		

[1] test duration approx. 15 days
[2] test duration approx. 4 days

Annex A 4

Sheet 86: Coating materials based on ethyl silicate with zinc (ESI)

Table A 4.1: Technical delivery conditions for the coating materials under Sheet 86

<table>
<tr><td colspan="2">1</td><td colspan="6">Composition in the condition as delivered</td></tr>
<tr><td>1.1</td><td colspan="7">Coating material</td></tr>
<tr><td></td><td rowspan="2">Material No</td><td rowspan="2">RAL colour or designation</td><td colspan="3" rowspan="2">Composition of the pigment / filler mixture (confirmed by the manufacturer)</td><td colspan="2">Percentage by mass [M.-%] Testing procedure</td></tr>
<tr><td>Binders (B) TP 4.4</td><td>VOC TP 4.8(1)</td></tr>
<tr><td></td><td>686.03</td><td>grey</td><td colspan="3">≥ 94 % Zn</td><td>9-11</td><td>≤ 21</td></tr>
<tr><td>1.2</td><td colspan="7">Binder: Ethyl silicate</td></tr>
<tr><td>1.3</td><td colspan="7">Mixing ratio
if 2K, then as specified by the manufacturer</td></tr>
<tr><td>1.4</td><td colspan="7">Thinners:
Material No. 686.150; Composition is at the discretion of the manufacturer</td></tr>
<tr><td colspan="2">2</td><td colspan="6">Specific values for property in the processing state</td></tr>
<tr><td colspan="7">Requirements / characteristics</td><td>Test method</td></tr>
<tr><td>2.1</td><td colspan="7">Drying time</td></tr>
<tr><td></td><td rowspan="2">Coating material</td><td rowspan="2">Degree of dryness</td><td colspan="3">Climate</td><td rowspan="2">DIN EN ISO 9117-3:
DIN EN ISO 9117-5</td></tr>
<tr><td>NK 23 / 50 under DIN EN 23270</td><td>7 °C,85 % rel.humidity</td><td>30 °C, 50 % rel. humidity</td></tr>
<tr><td></td><td>Material No 686.03
with dry film thickness:
100 µm</td><td>1
6</td><td>≤ 0.5 h
≤ 1 h</td><td>≤ 1 h
≤ 2 h</td><td>≤ 0.5 h
≤ 2 h</td><td></td></tr>
<tr><td>2.2</td><td colspan="6">Processability
spreadable and sprayable at a temperature range from 0 ° to 50 °C</td><td>TP 5.1</td></tr>
<tr><td>2.3</td><td colspan="6">Tendency to run
achievable dry film thickness without formation of runs or hairline cracks: 100 µm</td><td>TP 5.2</td></tr>
</table>

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Table A 4.1 Technical delivery conditions for the coating materials under Sheet 86 continued

3	**Sample production for tests in the dry-film state**				
3.1	Coating systems				
	Substrate: Sheet steel 100 x 150 mm and/or Samples for testing the slip resistance of bolted joints in accordance with DIN EN 1090-2 Surface preparation: Minimum surface preparation grade Sa 2½ under DIN EN ISO 12944-4 Roughness medium (G) under DIN EN ISO 8503-1 and -2		System 1 1 x GB Material No 686.03 100 µm System 2 (optional) 1 x GB Material No 686.03 60 µm (Dry film thickness may not be less than 40 µm and may not exceed 80 µm)		
4	**Testing procedure in dry-film state**				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Testing procedure for evaluation		
			Parameter	Procedure	Requirement
4.1	Resistance to moisture (continuous condensation)	TP 6.2.1 System 1: Duration: 480 h	~~Degree of blistering~~	TP 6.3.1	~~0 (S0)~~
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.4	≤ 2
4.2	Resistance to salt mist	TP 6.2.3 System 1: Duration: 720 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.4	≤ 2
			Corrosion on the milled groove	TP 6.3.6	≤ 3 mm
4.3	Water resistance	TP 6.2.10 System 1: Duration: 12 d	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
4.4	Heat resistance	TP 6.2.11 System 1: Duration: 1 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of cracking	TP 6.3.1 with 10-fold magnification	0 (S0)
4.5	Slip resistance of bolted joints (optional)	DIN EN 1090-2 System 2	Static friction coefficient	DIN EN 1090-2	≥0,5

Table A 4.2: Type and scope of tests as well as the materials to be submitted to the tests under Sheet 86

Sheet 86 **Tests**		Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test	Requirements / characteristics of Sheet 86	Test procedure for basic inspection, acceptance test 3.2 and repeat test
percentage by mass	Non-volatile component (NVC)	X			X	1.1	TP 4.4
	Solvent content (VOC)	X			X	1.1	TP 4.8(1)
Drying time		X	X	X	X	2.1	DIN EN ISO 9117-3 DIN EN ISO 9117-5
Processability		X		X	X	2.2	TP 5.1
Tendency to run		X	X	X	X	2.3	TP 5.2
Density			X	X			as specified by the manufacturer
Viscosity			X	X			as specified by the manufacturer
Processing time (pot life)			X	X			as specified by the manufacturer
Resistance to moisture		X			X	4.1	TP 6.2.1
Resistance to salt mist		X			X	4.2	TP 6.2.3
Water resistance		X		X [3]	X	4.3	TP 6.2.10
Heat resistance		X		X [4]	X	4.4	TP 6.2.11
Slip resistance of bolted joints (optional)		X			X	4.5	DIN EN 1090-2
Materials to be submitted for the test (Material No)		686.03	all delivery batches for one measure	as agreed	686.03		

[3] test duration approx. 15 days
[4] test duration approx. 4 days

Annex A 5

Sheet 100: Coating materials based on epoxy resin and polyurethane (EP/PUR) on steel (new construction and repair) and hot-dip galvanised/zinc sprayed steel
Further development of coating systems according to former sheets 87, 94, 95 and 97

The corrosion protection system sheet 100 is modular and consists of the following modules:

Module A: Corrosion protection system on steel

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

Module C: Corrosion protection system on hot-dip galvanisation

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

The individual modules differ only in the material composition of the base coating (modules A and B) or the intermediate coating (modules C and D) and the corresponding test requirements. Otherwise, the same coating materials shall be used for all modules.

The testing of module A is mandatory. Modules B, C and/or D can be tested optionally and, if necessary, at a later date. Module B can only be tested if the first intermediate coating (100.2.1) with the binder EP has been tested in module A. If modules B, C and D do not use the same batch as in module A, an identity test in accordance with section 1.6 is required. This shall be based on the manufacturer's specifications in accordance with module A. If the requirements for module A are met, only the tests listed under modules B, C and D are to be carried out for these modules.

Table A 5.1: Technical delivery conditions for coating materials according to sheet 100

1	**Composition**		
	Material No	Designation of the binder and, if applicable, the pigment	Colour: RAL or designation
1.1	Coating materials for primer (GB)		
	100.1.1	EP Zn (R) see DIN EN ISO 12944-5	coloured red and grey; only one colour is tested
	100.1.2 (surface tolerant)	EP Divers see DIN EN ISO 12944-5	
1.2	Coating materials for intermediate coating (ZB) and edge protection (KS)		
	100.2.1 (Edge protection and intermediate coating, 1st ZB for modules A and B, 2nd ZB for modules C and D)	EP or PUR	at least 2 different colours; only one colour is tested
	100.2.2 (optional ZB, 2nd ZB for modules A and B, 3rd ZB for modules C and D)	EP or PUR	at least 2 different colours; only one colour is tested
	100.2.3 (1st ZB on hot dip galvanisation)	EP	

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

1	**Composition (continued)**			
	Material No		Designation of the binder and, if applicable, the pigment	Colour: RAL or designation
1.2	Coating materials for intermediate coating (ZB) and edge protection (KS) (continued)			
	100.2.4 (Sealing on zinc spraying)		EP (diluted, as specified by the manufacturer)	
	100.2.5 (1st ZB on sealing in case of zinc spraying)		EP	
1.3	Coating materials for top coating (DB)			
	100.3.51		PUR	DB 501, blue
	100.3.82		PUR	RAL 5015, sky blue
	100.3.89		PUR	RAL 3031, orient red
	100.3.xy		PUR	Colours pursuant to Annex C: DB or RAL colours
	100.3.00 (clear coat, optional)		PUR	
1.4	Binders			
	Coating material	Binder (confirmed by the manufacturer)		
		Base component	Curing agents	
	EP coating materials (see DIN EN ISO 12944-5)	cold setting epoxy resins (predominant proportion), epoxy resins are permitted	at the manufacturer's discretion	
	PUR coating materials (see DIN EN ISO 12944-5)	at the manufacturer's discretion	Polyfunction, aliphatic isocyanate	
	Mixing ratio of the base components / curing agents: as specified by the manufacturer			
1.5	Micaceous iron oxide content of the intermediate and top coating			
	The proportion of micaceous iron oxide pigments (pigment/filler mixture) and the proportion of pigment/filler mixture in the cured coating material shall be expressed in % by mass.			
1.6	Solvent content per m² of the total system (VOC_{m^2})			
	Requirements / characteristics			Test method
	Modules A and B: ≤ 200 g/m² for each tested coating system Modules C and D: ≤ 150 g/m² for each tested coating system			TP 4.8(3)
1.7	Identity tests			
No.	Examination	Test method	Unit	permissible tolerance
1.7.1	Non-volatile content (nfA)	TP 4.2.	percentage by mass	± 2.5 based on the manufacturer's specifications
1.7.2	Thickness (p)	Pycnometer method according to DIN EN ISO 2811-1	g/cm^3	± 0.05 based on the manufacturer's specifications

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

1	**Composition (continued)**			
1.7	Identity tests (continued)			
No.	Examination	Test method	Unit	permissible tolerance
1.7.3	Tendency to run	TP 5.2 or method as agreed	µm	≥ DFT specified by the manufacturer
1.7.4	IR spectrum	TP 4.10(1)(a) and TP 4.10(1)(b)	-	≥ 90 % correspondence with the IR spectrum of the most recent test
1.8	Manufacturer's declaration on product properties			
	The material manufacturer must indicate that the product properties of the execution instructions are complied with within the permitted film thickness limits in accordance with ZTV-ING 4-3.			

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

2 Sample production for tests in the dry-film state	
2.1 **Module A:** Corrosion protection system on steel	
2.1.1 Samples for the test in the dry-film state	
Substrate: Sheet steel, 100 x 150 mm (for recoatability 200 x 150 x 5 mm) (for thermal resistance 200 x 150 x 5 mm) (for mechanical strength 100 x 150 x 10 mm) Surface preparation: Minimum preparation grade Sa 2½ under DIN EN ISO 12944-4 Roughness medium (G) under DIN EN ISO 8503-1 and -2	Coating structure for systems 1.1 and 1.2 as specified by the manufacturer according to the system to be listed (minimum 3 coats, minimum 400 µm) In the event that a clear coat is to be part of the corrosion protection system, the system 1.1 with the clear coat (100.3.00) must also be submitted for testing. System 1.1 GB: 100.1.1 80 µm ZB: 100.2.1 / 100.2.2 DB: 100.3.82 System 1.2 GB: 100.1.1 80 µm ZB: 100.2.1 / 100.2.2 DB: 100.3.51
2.1.2 Samples for the test of the colour resistance	
Substrate: Stainless steel sheet, dimensions of sample plates according to type of the weathering device Surface preparation: e.g. sanding	In the event that a clear coat is to be part of the corrosion protection system, system 2 and 3 with the clear coat (100.3.00) must also be submitted for testing. System 2 1 x adhesion promoter at the choice of the manufacturer of the coating material 1 x DB Material No 100.3.82 100 µm System 3 1 x adhesion promoter at the choice of the manufacturer of the coating material 1 x DB Material No 100.3.89 100 µm

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

2	**Sample production for tests in the dry-film state (continued)**	
2.2	**Module B:** Corrosion protection system on steel with surface-tolerant base coating	
2.2.1	Samples for the test in the dry-film state	
	Substrate: Steel sheet with uniform rusting due to a natural weathering of at least three years, 100 x 150 mm (for thermal resistance 200 x 150 x 5 mm) Surface preparation: Manual rust removal St 2 under DIN EN ISO 8501-1	System 1.3 GB: 100.1.2 ZB: 2 x 100.2.1 (EP) DB: 100.3.82 Coating structure as specified by the manufacturer according to the system to be listed (minimum 4 coats, minimum 440 µm)
2.3	**Module C:** Corrosion protection system on hot-dip galvanisation	
2.3.1	Samples for the test in the dry-film state	
	Substrate: Sheet steel, 100 x 150 x 6 mm non-weathered, individually galvanised, non-post treated sheet steel under DIN EN ISO 1461 (quality ‘t ZN k’) Surface preparation: Sweep blast cleaning under DIN EN ISO 12944-4	System 1.4 1. ZB: 100.2.3 2. ZB (optional): 100.2.1/100.2.2 DB: 100.3.82 Coating structure as specified by the manufacturer according to the system to be listed (minimum 2 coats, minimum 240 µm)
2.4	**Module D:** Corrosion protection system on zinc spraying (thermally sprayed zinc coatings)	
2.4.1	Samples for the test in the dry-film state	
	Substrate: Sheet steel, 100 x 150 mm Steel Sa 3 + zinc spraying 100 µm (Zn99,99 or ZnAl15) according to DIN EN ISO 2063-1:2019-07	System 1.5 Sealing: 100.2.4 1. ZB: 100.2.5 2. ZB (optional): 100.2.1/100.2.2 DB: 100.3.82 Coating structure as specified by the manufacturer according to the system to be listed (minimum 2 coats, minimum 240 µm)

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

3	**Tests in dry-film state**				
3.1	**Module A:** Corrosion protection system on steel				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.1.1	Evaluation of the coating system, unstrained	System 1.1, system 1.2	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	no adhesion failure with substrate and ≥ 5 MPa
			Measurement of colour	TP 6.2.5	Base value (only for system 1.1)
			Measurement of gloss	TP 6.2.5	Base value (only for system 1.1)
3.1.2	Resistance to moisture (continuous condensation)	TP 6.2.1 System 1.1, system 1.2, if applicable system 1.1 with clear coat Duration: 1,440 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate
3.1.3	Resistance to salt mist	TP 6.2.3 System 1.1, system 1.2 Duration: 3,000 h The testing of System 1.2 may be omitted if the binder of material no 100.3.51 is identical to material no 100.3.82	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate
			Corrosion on the milled groove	TP 6.3.6	≤ 3 mm
			Delamination on the milled groove	TP 6.3.6	≤ 8 mm
3.1.4	Bond 5 Adhesion of subsequent coatings on 5 days of artificially weathered coatings	TP 6.2.4 System 1.1, system 1.2 with 5 d weathering	Degree of blistering	TP 6.3.1	0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure between existing coating structure and new coating.

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

3	**Tests in dry-film state**				
3.1	**Module A:** Corrosion protection system on steel				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.1.5	Bond 30 Adhesion of subsequent coatings on 30 days of artificially weathered coatings	TP 6.2.4 System 1.1, system 1.2 with 30 d weathering	Degree of blistering	TP 6.3.1	0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure between existing coating structure and new coating.
3.1.6	Recoatability (e.g.: welding joints)	TP 6.2.8 System 1.1, system 1.2 Duration: 720 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure between existing coating structure and new coating.
3.1.7	Colour resistance and gloss durability	TP 6.2.5 System 2, system 3, if applicable system 2 or 3 with clear coat Duration: 3,000 h	Colour distance ΔE^*_{from} non-weathered / RAL chart	TP 6.2.5	≤ 3.5
			Colour distance ΔE^*_{from} non-weathered / weathered		≤ 3.5 with the exception of the acceptance test certificate, see Annex C, Table C 3 or agreement
			Gloss value		informative
3.1.8	Thermal resistance	TP 6.2.7 System 1.1, system 1.2 Duration: 2 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 2
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

3	**Tests in dry-film state**				
3.1	**Module A:** Corrosion protection system on steel				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.1.9	Long-term stability	TP 6.2.6 <u>System 1.1, system 1.2</u> Duration: 60 months	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate
			Colour distance	TP 6.2.5	to base value ≤ 3.5 (only for system 1.1)
			Gloss value	TP 6.2.5	informative (only for system 1.1)
			Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
3.1.10	Mechanical strength	TP 6.2.13 <u>System 1.1, system 1.2</u> The testing of System 1.2 may be omitted if the binder of material no 100.3.51 is identical to material no 100.3.82	no cracks or flaking (visual assessment without magnification)		
			Pore test at 90 V	no penetrations to the substrate	
			Cross-cut	TP 6.3.2	informative

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

3	**Tests in dry film condition (continued)**				
3.2	**Module B:** Corrosion protection system on steel with surface-tolerant base coating				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.2.1	Evaluation of the coating system, unstrained	System 1.3	Cross-cut	TP 6.3.2	≤ 2
			Pull-off value	TP 6.3.5	≥ 2.5 MPa, breakage in the residual rust layer permissible
3.2.2	Resistance to moisture (continuous condensation)	TP 6.2.1 System 1.3 Duration: 720 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 2
			Pull-off value	TP 6.3.5	≥ 2.5 MPa, breakage in the residual rust layer permissible
3.2.3	Resistance to salt mist	TP 6.2.3 System 1.3 Duration: 1,440 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 2
			Pull-off value	TP 6.3.5	≥ 2.5 MPa, breakage in the residual rust layer permissible
			Corrosion on the milled groove	TP 6.3.6	≤ 3 mm
			Delamination on the milled groove	TP 6.3.6	≤ 8 mm

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100

3	**Tests in dry film condition (continued)**				
3.2	**Module B:** Corrosion protection system on steel with surface-tolerant base coating				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.2.4	Long-term stability	TP 6.2.6 System 1.3 Duration: 60 months	Cross-cut	TP 6.3.2	≤ 2
			Pull-off value	TP 6.3.5	≥ 2.5 MPa, breakage in the residual rust layer permissible
			Colour distance	TP 6.2.5	to the base value ≤ 3.5
			Gloss value	TP 6.2.5	informative
			Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100 (continued)

3	**Tests in dry film condition (continued)**				
3.3	**Module C:** Corrosion protection system on hot-dip galvanisation				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.3.1	Evaluation of the coating system, unstrained	System 1.4	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate and zinc coat
3.3.2	Resistance to moisture (continuous condensation)	TP 6.2.1 System 1.4 Duration: 1,440 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Wet adhesion through X-cuts	TP 6.3.3	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, on hot dip galvanisation adhesion failure is permissible
3.3.3	Resistance to salt mist	TP 6.2.3 System 1.4 Duration: 3,000 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, on hot dip galvanisation adhesion failure is permissible
3.3.4	Long-term stability	TP 6.2.6 System 1.4 Duration: 60 months	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, on hot dip galvanisation adhesion failure is permissible
			Colour distance	TP 6.2.5	to the base value ≤ 3.5
			Gloss value	TP 6.2.5	informative
			Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100

3	**Tests in dry film condition (continued)**				
3.4	**Module D:** Corrosion protection system on zinc spraying (thermally sprayed zinc coatings)				
No:	Test designation	Testing procedure for stress, system and test duration, as applicable	Evaluation		
			Parameter	Procedure	Requirement
3.4.1	Evaluation of the coating system, unstrained	System 1.5	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	Pull-off value ≥ 5 MPa and no adhesion failure with substrate and zinc coat
3.4.2	Resistance to moisture (continuous condensation)	TP 6.2.1 System 1.5 Duration: 1,440 h	Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Wet adhesion through X-cuts	TP 6.3.3	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, adhesion failure on zinc spraying is permissible
3.4.3	Resistance to salt mist	TP 6.2.3 System 1.5 Duration: 3,000 h	Degree of blistering	TP 6.3.1	0 S(0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)
			Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, adhesion failure on zinc spraying is permissible
3.4.4	Long-term stability	TP 6.2.6 System 1.5 Duration: 60 months	Cross-cut	TP 6.3.2	≤ 1
			Pull-off value	TP 6.3.5	≥ 5 MPa, adhesion failure on zinc spraying is permissible
			Colour distance	TP 6.2.5	to the base value ≤ 3.5
			Gloss value	TP 6.2.5	informative
			Degree of blistering	TP 6.3.1	0 (S0)
			Degree of rusting		Ri 0
			Degree of cracking		0 (S0)
			Degree of peeling		0 (S0)

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Table A 5.1 Technical delivery conditions for coating materials according to sheet 100

4	**Examination of the practical applicability of the coating system**
The practical applicability of the coating system shall only be verified for module A by means of suitable pilot projects or a component test.	
a.)	Verification by a pilot project in accordance with TP 6.4.1 Verification must be provided by means of at least one pilot project in the course of a building supervisory approval in individual cases of a measure in the area of federal highways. The following properties must be checked: • Stability or tendency to run • Wet and dry film thicknesses according to DIN EN ISO 2808 The following acceptance criteria apply: • The appearance of the coating from a viewing distance of 1.0 m from the component surface shall be opaque and uniform in colour (hue, brightness and saturation). Defects in the coating, e.g. wrinkles, craters, blisters, runners, flaking and cracks are not permitted. • The wet and dry film thicknesses correspond to the AfA. An experience report must be submitted by the client to the BASt. The report must contain the processing conditions and must confirm that the application has been carried out in accordance with the AfA. As a result, it must be confirmed that the application has been successfully carried out.
b.)	Verification by a component test according to TP 6.4.2 The following properties must be checked: • Stability or tendency to run • Wet and dry film thicknesses according to DIN EN ISO 2808 The following acceptance criteria apply: • The appearance of the coating from a viewing distance of 1.0 m from the component surface shall be opaque and uniform in colour (hue, brightness and saturation). Defects in the coating, e.g. wrinkles, craters, blisters, runners, flaking and cracks are not permitted. • The wet and dry film thicknesses correspond to the AfA.

Table A 5.2: Type and scope of the tests according to sheet 100

Sheet 100 **Tests**	Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test	Requirements / characteristics of Sheet 100	Test procedure for basic inspection, acceptance test 3.2 and repeat test
Non-volatile content (nfA)	X		X	X	1.7.1	TP 4.2.
Density (ρ)	X	X	X	X	1.7.2	TP 4.5
Tendency to run	X	X	X	X	1.7.3	TP 5.2
Viscosity		X	X			as specified by the manufacturer
Processing time (pot life)		X	X			as specified by the manufacturer
Drying time		X	X			as specified by the manufacturer
IR spectrum [5]	X		X [6]	X	1.7.4	TP 4.10(1)(a)
IR spectrum [5]	X		X [6]	X	1.7.4	TP 4.10(1)(b)
Solvent content per m² of the total system ($VOC_{m²}$)	X			X	1.6	TP 4.8 (2) and (3)
Evaluation of the coating system, unstrained	X				3.1.1 3.2.1 3.3.1 3.4.1	-
Resistance to moisture	X			X	3.1.2 3.2.2 3.3.2 3.4.2	TP 6.2.1
Resistance to salt mist	X			X	3.1.3 3.2.3 3.3.3 3.4.3	TP 6.2.3
Bond 5	X			X	3.1.4	TP 6.2.4
Bond 30	X			X	3.1.5	TP 6.2.4
Recoatability	X				3.1.6	TP 6.2.8
Colour resistance and gloss durability	X			X	3.1.7	TP 6.2.5
Thermal resistance	X			X	3.1.8	TP 6.2.7
Long-term stability	X				3.1.9 3.2.4 3.3.4 3.4.4	TP 6.2.6
Mechanical strength	X			X	3.1.10	TP 6.2.13

Table A 5.3: Materials to be submitted for testing in accordance with sheet 100

[5] not material no 100.1.1
[6] as agreed

Sheet 100 **Materials to be submitted**	Basic test	WPK and acceptance test 3.1	Acceptance test 3.2	Repeat test
Module A	100.1.1 100.2.1 100.2.2 (optional) 100.3.51 100.3.82 100.3.89 100.3.00 (optional)	all delivery batches for one measure	as agreed	100.1.1 100.2.1 100.2.2 (optional) 100.3.51 100.3.82 100.3.89 100.3.00 (optional)
Module B	100.1.2 100.2.1 100.2.2 (optional) 100.3.89	all delivery batches for one measure	as agreed	100.1.2 100.2.1 100.2.2 (optional) 100.3.89
Module C	100.2.3 100.2.1 (optional) 100.2.2 (optional) 100.3.82	all delivery batches for one measure	as agreed	100.2.3 100.2.1 (optional) 100.2.2 (optional) 100.3.82
Module D	100.2.4 100.2.5 100.2.1 (optional) 100.2.2 (optional) 100.3.82	all delivery batches for one measure	as agreed	100.2.4 100.2.5 100.2.1 (optional) 100.2.2 (optional) 100.3.82

Annex B
Characteristic pigments

Quality and composition

The pigments must meet the following requirements:

— Micaceous iron oxide according to DIN EN ISO 10601, lamellar content > 65 % (grade A), sieve residue type 1 and/or type 2

— Titanium dioxide under RAL 844 H 2 type rutile with at least 90 % TiO2

— Zinc oxide under RAL 844 C 3 Type ‘low lead’

— ZnPh under DIN ISO 6745

— Zn under DIN ISO 3549

Annex C
Colours

(1) Table C 1 shows the DB colours and their material numbers.

(2) The DB colour charts as well as colour charts of selected micaceous iron oxide-free colours can be obtained, for example, from Muster-Schmidt Farbkartenverlag, Torso-Verlag or Verkehrsblatt-Verlag. No colour distance may be measured using these colour charts. They are for guidance only.

(3) Table C 2 shows the selected RAL colours and their material numbers.

(4) Table C 3 contains permitted colour distances of unweathered samples to the RAL colour charts (colour register RAL 840-HR not older than 2 years) as well as of weathered samples to the unweathered colour samples from Table C 2. For other RAL colours, the permissible colour distances must be agreed separately if required.

Table C 1: Assignment of paints for micaceous iron oxide-containing top coatings of sheet 81 and sheet 100

Last two digits for material numbers 681. and 100.3.	DB colours, Colour designation
30	DB 310, red
31	DB 301, red
50	DB 510, blue
51	DB 501, blue
52	DB 502, blue
53	DB 503, blue
60	DB 610, green
61	DB 601, green
62	DB 602, green
63	DB 603, green
71	DB 701, grey
72	DB 702, grey
73	DB 703, grey
74	DB 704, grey

Table C 2: Assignment of colours for micaceous iron oxide-free top coatings of sheet 100

Last two digits for material no 100.3.	RAL colours, Colour designation
75	RAL 1011, brown beige
76	RAL 6000, patina green
77	RAL 6009, fir green
78	RAL 8000, green brown
79	RAL 8004, copper brown
80	RAL 5000, violet blue
81	RAL 5010, gentian blue
82	RAL 5015, sky blue
83	RAL 5017, traffic blue
84	RAL 5021, water blue
85	RAL 2000, yellow orange
86	RAL 2002, vermilion
87	RAL 3000, flame red
88	RAL 3003, ruby red
89	RAL 3031, orient red
90	RAL 6011, reseda green
91	RAL 6017, may green
93	RAL 7001, silver grey
94	RAL 7032, pebble grey
95	RAL 7037, dusty grey
96	RAL 9001, cream
97	RAL 9002, grey white
98	RAL 9003, signal white
99	RAL 9010, pure white

Table C 3: Requirements for colour distances

Last two digits for material No 100.3.	Designation RAL chart	permissible colour distances ΔE^*_{from}: non-weathered sample for the RAL colour chart (colour register RAL 840 HR) and weathered sample to the non-weathered sample		
		Basic test	Repeat test	Acceptance test 3.2
75	brown beige RAL 1011			≤ 3.5
76	patina green RAL 6000			≤ 3.5
77	fir green RAL 6009			≤ 3.5
78	green brown RAL 8000			≤ 3.5
79	copper brown RAL 8004			≤ 3.5
80	violet blue RAL 5000			≤ 3.5
81	gentian blue RAL 5010			≤ 3.5
82	sky blue RAL 5015	≤ 3.5	≤ 3.5	≤ 3.5
83	traffic blue RAL 5017			≤ 3.5
84	water blue RAL 5021			≤ 3.5
85	yellow orange RAL 2000			≤ 3.5
86	vermilion RAL 2002			≤ 3.5
87	flame red RAL 3000			≤ 3.5
88	ruby red RAL 3003			≤ 3.5
89	orient red RAL 3031	≤ 3.5	≤ 3.5	≤ 3.5
90	reseda green RAL 6011			≤ 3.5
91	may green RAL 6017			≤ 3.5
93	silver grey RAL 7001			≤ 3.5
94	pebble grey RAL 7032			≤ 1.5
95	dusty grey RAL 7037			≤ 1.5
96	cream RAL 9001			≤ 1.5
97	grey white RAL 9002			≤ 1.5
98	signal white RAL 9003			≤ 1.5
99	pure white RAL 9010			≤ 1.5

Annex D
Execution instructions (AfA)

D 1 General information

(1) Annex E contains a form for the AfA for Sheet 100 with required information. The white fields must be completed by the manufacturer.

(2) For other TL sheets, the AfAs must be adapted accordingly.

(3) In the AfA, the manufacturer is obliged to include further information relating to the execution if this is necessary for proper execution.

(4) The template for the AfA may be found as a Word document on the BASt homepage.

D 2 Form: Execution instructions (AfA) for sheet 100

Execution instructions of the manufacturer of the material for coating systems under TL KOR-Stahlbauten (AfA)

Sheet 100
(according to Annex A, TL KOR-Stahlbauten)

Edition of the AfA:
(month/year) ……

1 General information

Manufacturer of the material	**Address**
External monitoring authority	**Address**

General description of the material	**Material No**	**Material designation**	**Mixing ratio**
Module A			
Base coating material with zinc dust (GB) based on epoxy resin	100.1.1	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:
Intermediate coating material (1st ZB) [7] + Edge protection (KS) based on	100.2.1	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:
Top coating materials (DB) containing micaceous iron oxide based on polyurethane	100.3.30-74	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:
Top coating materials (DB) without micaceous iron oxide based on polyurethane	100.3.75-99	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:
Clear coat (optional)	100.3.00	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:

[7] In the case of an optional additional intermediate coating (material no 100.2.2), this must also be indicated.

Dilution for coating materials		see 4.1, 4.2, 4.3 and 4.4	
Sealing	100.2.4	*Component A:* *Component B:*	A:B Weight %:
Intermediate coating material (1st ZB) based on epoxy resin	100.2.5	**Designation:** *Component A:* *Component B:*	A:B Vol. %: A:B Weight %:

2 Properties of the coating materials

Material No	Proportion of solids non-volatile content		Density	Viscosity (Individual components)	Permissible storage conditions (duration, temperature)
	percentage	percentage			
Module A					
100.1.1					
100.2.1 [8]					
100.3.30-74					
100.3.75-99					
Module B (Edge protection, 1st ZB, optional 2nd ZB and DB as module A)					
100.1.2					
Module C (optional additional ZB and DB as module A)					
100.2.3					
Module D (optional additional ZB and DB as module A)					
100.2.4					
100.2.5					

3 Execution

3.1 General information

(1) The specifications of the construction contract (e.g. corrosion protection plan) are authoritative.

(2) Mixing and homogenizing of coating materials must be performed by a machine for a duration of at least 3 min.

(3) All coatings which are painted over must be free from bond-damaging, foreign materials such as dust, oil, grease as well as other characteristic materials (e.g. EP degradation products).

(4) When using coating materials on individually galvanised surfaces, sweep blasting according to ZTV-ING 4-3 must be performed as surface preparation.

(5) The object temperature during coating must be at least 3 K above the dew point temperature.

(6) 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.

(7) 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.

[8] In the case of an optional additional intermediate coating (material no 100.2.2), this must also be indicated

3.2 Module 100-A: Corrosion protection system on steel

3.2.1 Structure 1, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 400 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.1	80 µm	Spraying, painting	Sa 2½
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB		100.2.1	µm	Spraying, painting	
optionally 2nd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.2.2 Structure 2, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 320 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.1	80 µm	Spraying, painting	Sa 2½
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB		100.2.1	µm	Spraying, painting	
optionally 2nd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.2.3 Structure 3, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 480 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.1	80 µm	Spraying, painting	Sa 2½
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB (EP)		100.2.1	µm	Spraying, painting	
2. ZB (EP)		100.2.1 / 100.2.2	µm	Spraying, painting	
optional 3rd ZB (EP)		100.2.1 / 100.2.2	µm	Spraying, painting	
DB (EP)		100.2.1 / 100.2.2	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.2.4 Structure 4, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 480 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.1	80 µm	Spraying, painting	Sa 2½
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB (EP)		100.2.1	µm	Spraying, painting	
2. ZB (EP)		100.2.1 / 100.2.2	µm	Spraying, painting	
optional 3rd ZB (EP)		100.2.1 / 100.2.2	µm	Spraying, painting	
DB (PUR)		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.3 Module 100-B: Corrosion protection system on steel with surface-tolerant base coating

3.3.1 Structure 1, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 440 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.2	µm	Spraying, painting	
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB		100.2.1	µm	Spraying, painting	
optionally 2nd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.3.2 Structure 2, minimum total film thickness without edge protection according to ZTV-ING 4-3 (GSD): 360 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
GB		100.1.2	µm	Spraying, painting	
Edge protection		100.2.1	80 µm	Spraying, painting	
1. ZB		100.2.1	µm	Spraying, painting	
optionally 2nd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without edge protection):			**µm**		

3.4 Module 100-C: Corrosion protection system on hot-dip galvanisation

3.4.1 Structure 1, minimum total film thickness without hot-dip galvanisation according to ZTV-ING 4-3 (GSD): 240 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
Hot-dip galvanisation					
1. ZB		100.2.3	µm	Spraying, painting	Sweep blasting
optionally 2nd ZB		100.2.1	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (excluding hot-dip galvanisation):			**µm**		

3.4.2 Structure 2, minimum total film thickness without hot-dip galvanisation according to ZTV-ING 4-3 (GSD): 320 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
Hot-dip galvanisation					
1. ZB		100.2.3	µm	Spraying, painting	Sweep blasting
optionally 2nd ZB		100.2.1	µm	Spraying, painting	
optionally 3rd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (excluding hot-dip galvanisation):			**µm**		

3.5 Module 100-D: Corrosion protection system on zinc spraying (thermally sprayed zinc coatings)

3.5.1 Structure 1, minimum total film thickness without zinc spraying, sealing according to ZTV-ING 4-3 (GSD): 240 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
Zink spraying			100 µm	Spraying	Sa 3
Sealing		100.2.4	µm	Spraying, painting	
	execute within ..... h				
1. ZB		100.2.5	µm	Spraying, painting	
optionally 2nd ZB		100.2.1	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without zinc spraying, sealing):			**µm**		

3.5.2 Structure 2, minimum total film thickness without zinc spraying, sealing according to ZTV-ING 4-3 (GSD): 320 µm

Coat	Material designation	Material No	NDFT	Type of application	OV
Zink spraying			100 µm	Spraying	Sa 3
Sealing		100.2.4	µm	Spraying, painting	
	execute within ..... h				
1. ZB		100.2.5	µm	Spraying, painting	
optionally 2nd ZB		100.2.1	µm	Spraying, painting	
optionally 3rd ZB		100.2.2	µm	Spraying, painting	
DB		100.3.30-74, 100.3.75-99	µm	Spraying, rolling, painting	
Sum (without zinc spraying, sealing):			**µm**		

3.6 Clear coat (optional)

If a clear coat (100.3.00) was also tested in the basic test, a coating material manufacturer can formulate information in accordance with the above-mentioned tables.

4 Processing conditions

4.1 Module 100-A

Name of the material					
Material No			100.1.1	100.2.1	optional 100. 2.2
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet			
		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [9]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [9]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [9]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

[9] if different, enter the lowest permissible object temperature

4.1 Module 100-A (continued)

Name of the material					
Material No			100.3.30-74	100.3.75-99	optional 100.3 .00
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet			
		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [10]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [10]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [10]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

[10] if different, enter the lowest permissible object temperature

4.2 Module 100-B

Name of the material					
Material No			100.1.2	100.2.1	optional 100. 2.2
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet			
		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [11]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [11]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [11]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

4.1 Module 100-B (continued)

Name of the material			

[11] if different, enter the lowest permissible object temperature

Material No			100.3.30-74	100.3.75-99	optional 100.3 .00
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet			
		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [12]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [12]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [12]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

4.2 Module 100-C

Name of the material		
Material No	100.2.3	optional 100.2.1 / 100.2.2

[12] if different, enter the lowest permissible object temperature

Name of the thinner				
Theoretical use with 100 µm dry film thickness [kg/m²]				
Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet		
		dry		
	Painting/rolling	wet		
		dry		
Permitted **processing conditions**	Object temperature [°C]	minimum		
		maximum		
	Relative air humidity [%]	minimum		
		maximum		
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C		
		15 °C		
		30 °C		
	large container von …. kg at a temperature of	5 °C		
		15 °C		
		30 °C		
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]				
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [13]		
		15 °C		
		30 °C		
	Degree of dryness 6 (dry to the touch)	5 °C [13]		
		15 °C		
		30 °C		
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [13]		
		15 °C		
		30 °C		
Maximum permissible waiting time [d] until the subsequent coating				
Specific requirements e.g. for spray application: Pressure, nozzle diameter, transmssion ratio, distance object/spray nozzle, maximum hose length, etc.				

4.1 Module 100-C (continued)

Name of the material					
Material No			100.3.30-74	100.3.75-99	optional 100.3 .00
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
	Spraying	wet			

[13] if different, enter the lowest permissible object temperature

Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [14]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [14]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [14]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

4.2 Module 100-D

Name of the material			
Material No	100.2.4	100.2.5	optional 100.2.1 / 100.2.2
Name of the thinner			
Theoretical use with 100 µm dry film thickness [kg/m²]			

[14] if different, enter the lowest permissible object temperature

Stability [µm] with one-time application on a vertical surface (at a temperature of 23 °C)	Spraying	wet			
		dry			
	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [15]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [15]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [15]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

4.1 Module 100-D (continued)

Name of the material					
Material No			100.3.30-74	100.3.75-99	optional 100.3 .00
Name of the thinner					
Theoretical use with 100 µm dry film thickness [kg/m²]					
Stability [µm] with one-time	Spraying	wet			
		dry			

[15] if different, enter the lowest permissible object temperature

application on a vertical surface	Painting/rolling	wet			
		dry			
Permitted **processing conditions**	Object temperature [°C]	minimum			
		maximum			
	Relative air humidity [%]	minimum			
		maximum			
Processing time (pot life) after mixing [h] (Time period within which the mixed coating material must be processed for the guaranteed properties to be achieved)	small container of …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
	large container von …. kg at a temperature of	5 °C			
		15 °C			
		30 °C			
Maximum permissible addition of thinner, if necessary, to improve applicability [% by mass]					
Drying times for the nominal film thicknesses of the structures under No 3	Degree of dryness 1 (dust-dry)	5 °C [16]			
		15 °C			
		30 °C			
	Degree of dryness 6 (dry to the touch)	5 °C [16]			
		15 °C			
		30 °C			
Minimum waiting times [h] until the subsequent coating at the dry film thicknesses of the structures under No 3 and an object temperature of		5 °C [16]			
		15 °C			
		30 °C			
Maximum permissible waiting time [d] until the subsequent coating					
Further requirements e.g. for spray application: Pressure, nozzle diameter, transmission ratio, distance object/spray nozzle, maximum hose length, etc.					

[16] if different, enter the lowest permissible object temperature

Annex E
Explanation of abbreviations

Abbreviation	Explanation
1 K	One-component coating material
2 K	Two-component coating material
AfA	(Ausführungsanweisung) Execution instructions
ASI	Alkali silicate
BASt	Federal Highway Research Institute [German designation: BASt]
DB	(Deckbeschichtung) Top coating under DIN EN ISO 12944-5
DAkkS	Deutsche Akkreditierungsstelle GmbH (German Accreditation Authority)
DB colours	Colours for intermediate and top coatings containing micaceous iron oxide (previously: in accordance with the colour chart of the **D**eutsche **B**undesbahn (German Federal Railway)
EG	pigmented with micaceous iron oxide (Eisenglimmer)
EP	Epoxy resin (2-component epoxy resin)
EP Divers	Other types of base coat materials according to DIN EN ISO 12944-5
EP-combi	Epoxy resin combination
ESI	Ethyl silicate
GB	Primer coat
IR spectrum	Infrared spectrum
KBS	Conformity assessment authority
KS (Kantenschutz)	Edge protection
NDFT	**n**ominal **d**ry **f**ilm **t**hickness
non-volatile content	Non-volatile content
NK 23 / 50	Standard climate under DIN EN 23270 with an air temperature of 23 °C and a relative humidity of 50 %
OV	(Oberflächenvorbereitung) Surface preparation
P-authority	see 3(2)
PUR	Polyurethane (2-component polyurethane)

Abbreviation	Explanation
RAL colours	standardised micaceous iron oxide-free colours which are generated and managed by the RAL GmbH (a subsidiary of the RAL Institut); 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
t Zn k	Hot dip galvanising for duplex system, no post-treatment under DIN EN ISO 1461, National Annex NB
TP	Testing procedure under TP KOR-Stahlbauten
Ü-Mark	conformity mark
VOC	**V**olatile **o**rganic **c**ompound(s)
VOC $_{m^2}$	Solvent content per m² of the total system
WPK	Factory production control
ZB (Zwischenbeschichtung)	Intermediate coating under DIN EN ISO 12944-5
Zn	pigmented with zinc dust
Zn (R)	primer materials rich in zinc dust in accordance with DIN EN ISO 12944-5
ZnPh	pigmented with zinc phosphate