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Professional Coating Systems

Corrosion Protection

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INTRODUCTION

Corrosion preoccupies humankind since the usage of metals. Today the scope of corrosion protection ranges from the protection of a yard gate to famous examples of architecture like the Eiffel Tower or the Golden Gate Bridge. These examples show that an appropriate anti-corrosion treatment extends substantially the lifetime of objects that are prone to corrosion.

Economic and ecological aspects are the driving factors in the selection of protective coatings. Our protective coatings are contributing considerably to a long-lasting protection and reduction of damages amounting to billions.

For more than 50 years, corrosion protection has been one of the core businesses of the Mipa Group. Thanks to our extensive experience and our modern research laboratories we are developing innovative and reliable products that are user-oriented for very different application areas. From synthetic resin primers through solvent-free coating systems – we offer a perfect solution for your requirements.

Factory coating or maintenance and renovation of corrosion protection:
Our products comply with various national and international standards and factory standards. This is first and foremost the standard DIN EN ISO 12944 as well as the regulation ZTV-ING part 4 (Additional technical conditions of contract and guidelines for the civil engineering works, part 4: steel constructions).

This brochure serves as a guide to the successful execution of your corrosion protection project. In case of further question please don't hesitate to contact us. Our team will be happy to advise you individually.

Substrate Preparation

The accurate substrate preparation, the selection of the right coating system and the professional application of the coating are the most important factors affecting the total success of a corrosion protection system.

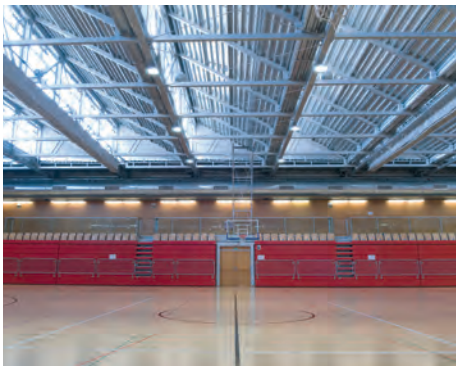
The most important information and details can be found in the European standard DIN EN ISO 12944 "corrosion protection of steel constructions by protective paint systems".

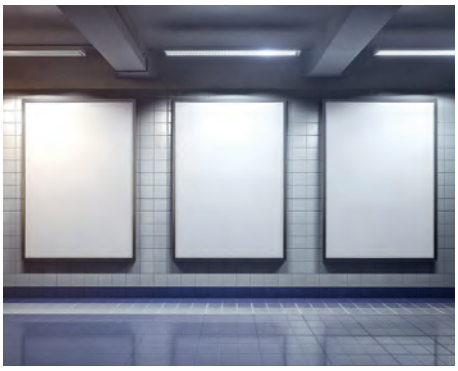
A thorough substrate pre-treatment is an important requirement for a long-term corrosion protection. Regardless of the contamination level we always recommend to clean the steel surfaces thoroughly i.e. mill scale, rust, old coatings and foreign matters must be removed. Any residual contamination must be adherent and may remain only as slight stains in the form of spots or stripes.

Depending on the intended use, suitable procedures are dry blasting, wet blasting, flame cleaning, high pressure water jetting, spot blasting, sweep blasting, acid pickling or alkaline cleaning. After the cleaning, the substrate must have the minimum surface preparation level of Sa 2,5 according to DIN EN ISO 12944-4 as well as an average maximum roughness depth of 40 - 80 µm.

Corrosivity categories	Exterior	Interior
C1 very low		Heated buildings with clean atmosphere, e.g. offices, shops, schools, hotels
C2 low	Atmospheres with low level of pollution, dry climate, rural areas	Unheated buildings where condensation may occur e.g. depots, sport halls
C3 medium	Urban and industrial atmospheres with moderate sulphur dioxide pollution and low salinity	Production rooms with high humidity, e.g. laundries, breweries
C4 stark	Industrial areas and coastal areas with moderate salinity	Swimming pools, boathouse, chemical plants
C5-I very high	Industrial areas with high humidity and aggressive atmosphere	Buildings or areas with almost permanent condensation and high pollution
C5-M very high	Coastal and offshore areas with high salinity	Buildings or areas with almost permanent condensation and high pollution

CORROSION PROTECTION C2





From the **corrosion protection classification C2** and onwards, commence the regulations which stipulate the protective period, the resin base and the dry film thickness.

The category C2 specifies the following corrosive environments:

Exterior:
· Dry climate
· Low pollution

Interior:
· Unheated buildings
· Temporary condensation
· Depots
· Sports halls
· Production halls

Coating system for corrosivity category C2

System number	Primer			Topcoat			Complete coating		Anticipated durability		
	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Layer	NDFT µm	L	M	H
Table A2	Corrosion category C2 for low-alloy steel, surface preparation: blast cleaning to Sa 2,5, rust degree A, B or C (see ISO 8501-1)										
A2.01	1K AK Primer	1	40	1K AK Topcoat 1K AK MIO	1	40	2	80			
A2.02	1K AK Primer	1 – 2	80	1K AK Topcoat 1K AK MIO	1	40	2 – 3	120			
A2.03	1K AK Primer	1 – 2	80	1K AK Topcoat 1K AK MIO	1 – 2	80	2 – 4	160			
A2.04	1K AK DTM	1 – 2	100				1 – 2	100			
A2.06	2K EP Primer	1 – 2	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	40	2 – 3	120			
A2.07	2K EP Primer	1 – 2	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	80	2 – 4	160			

NDFT = Nominal Dry Film Thickness L = Low M = Medium H = High

CORROSION PROTECTION C3

C3 is the first category of high-quality corrosion protection. In this category two-component products are preferably used which meet the increasing requirements.

The category C3 specifies the following corrosive environments:

Exterior:
· Urban and industrial atmospheres with moderate sulphur dioxide pollution
· Coastal areas further from the sea with low salinity

Interior:
· Production rooms with high humidity and slight air pollution, e. g. facilities for food production, laundries, breweries, dairies
· Industrial buildings
· Residential building
· Roofs

Coating system for corrosivity category C3

System number	Primer			Topcoat			Complete coating		Anticipated durability		
	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Layer	NDFT µm	L	M	H
Table A3	**Corrosion category C3 for low-alloy steel, Surface preparation: blast cleaning to Sa 2,5, rust degree A, B or C (see ISO 8501-1)**										
A3.01	1K AK Primer	1 – 2	80	1K AK Topcoat 1K AK MIO	1	40	2 – 3	120			
A3.02	1K AK Primer	1 – 2	80	1K AK Topcoat 1K AK MIO	1 – 2	80	2 – 4	160			
A3.03	1K AK Primer	1 – 2	80	1K AK Topcoat 1K AK MIO	1 – 2	120	2 – 4	200			
A3.07	2K EP Primer	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	40	2	120			
A3.08	2K EP Primer	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	80	2 – 3	160			
A3.09	2K EP Primer	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	120	2 – 3	200			
A3.11	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	100	2 – 3	160			
Table A7	**Corrosion category C3 for hot-dip galvanized steel**										
A7.09				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	1	80			
A7.10	2K EP Primer	1	60	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	2	120			

NDFT = Nominal Dry Film Thickness L = Low M = Medium H = High

CORROSION PROTECTION C4

The **corrosion protection classification C4** stands for excellent corrosion protection at the highest level. For these areas of application only three-coat systems or two-coat high-build systems are used.

The category C4 specifies the following corrosive environments:

Exterior:
· Industrial areas with permanent exposure as well as coastal areas with moderate salinity
· Industrial areas, industrial buildings and residential buildings in coastal areas with moderate salinity, chemical plants, bridges

Interior:
· Chemical plants
· Swimming pools

Coating systems for corrosivity category C4

System number	Primer			Intermediate coat			Topcoat			Complete coating		Anticipated durability		
	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Layer	NDFT µm	L	M	H
Table A4	**Corrosivity category C4 for low-alloy steel, Surface preparation: blast cleaning to Sa 2,5, rust degree A, B or C (see ISO 8501-1)**													
A4.01	1K AK Primer	1 – 2	80				1K AK Topcoat 1K AK MIO	2 – 3	120	3 – 5	200			
A4.08	2K EP Primer	1 – 2	80	2K EP Primer 2K EP MIO	1 – 2	100	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	2 – 3	240			
A4.09	2K EP Primer	1 – 2	80	2K EP Primer 2K EP MIO	1 – 2	140	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	3 – 5	280			
A4.13	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	100	2 – 3	160			
A4.14	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Primer 2K EP MIO	1	120	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	3	200			
A4.15	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Primer 2K EP MIO	1 – 2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	3 – 4	240			
Table A7	**Corrosivity category C4 for hit-dip galvanized steel**													
A7.10	2K EP Primer	1	60				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	2	120			
A7.11	2K EP Primer	1	80				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	2	160			
A7.12	2K EP Primer	1	80	2K EP Primer 2K EP MIO	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	3	240			

NDFT = Nominal Dry Film Thickness L = Low M = Medium H = High

CORROSION PROTECTION C5-I

C5 is subdivided into **C5-I for industrial areas** and **C5-M for marine areas**. Both subcategories correspond to the highest corrosion protection in very aggressive environments. High coat thickness and high-quality two-component coating systems have to be used.

The category C5-I specifies the following corrosive environments:

Exterior:
· Industrial areas with high humidity and aggressive atmosphere

Interior:
· Buildings and areas with almost permanent condensation and with high pollution.

Coating system for corrosivity category C5-I

System number	Primer			Intermediate coat			Topcoat			Complete coating		Anticipated durability		
	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Layer	NDFT µm	L	M	H
Table A5-I	**Corrosivity category C5-I for low-alloy steel, surface preparation: blast cleaning to Sa 2,5, rust degree A, B or C (see ISO 8501-1)**													
A5I.02	2K EP Primer	1	80	2K EP Primer 2K EP MIO	2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	2 – 4	320			
A5I.04	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Primer 2K EP MIO	1 – 2	120	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	3 – 4	240			
A5I.05	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP MIO	1 – 2	160	2K PU Topcoat 2K PU MIO	1 – 2	100	3 – 5	320			
Table A7	**Corrosivity category C5-I for hot-dip galvanized steel**													
A7.10	2K EP Primer	1	60				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	2	120			
A7.11	2K EP Primer	1	80				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	2	160			
A7.12	2K EP Primer	1	80	2K EP Primer 2K EP MIO	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	3	240			
A7.13	2K EP Primer	1	80	2K EP Primer 2K EP MIO	1 – 2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	3 – 4	320			

NDFT = Nominal Dry Film Thickness L = Low M = Medium H = High

CORROSION PROTECTION C5-M

C5 is subdivided into **C5-I for industrial areas** and **C5-M for marine areas.** Both subcategories correspond to the highest corrosion protection in very aggressive environments. High coat thickness and high-quality two-component coating systems have to be used.

The category C5-M specifies the following corrosive environments:

Exterior:
· Coastal and offshore areas with high salinity

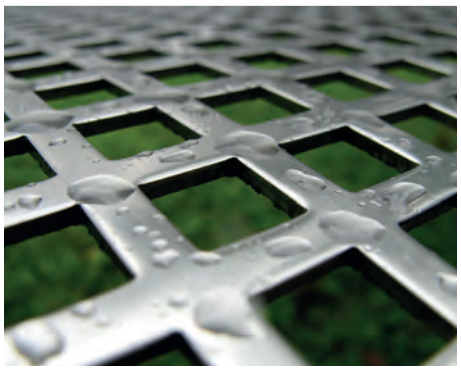
Interior:
· Buildings and areas with almost permanent condensation and with high pollution.

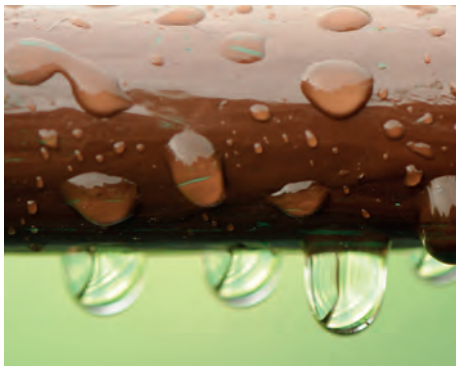
Coating system for corrosivity category C5-M

System number	Primer			Intermediate coat			Topcoat			Complete coating		Anticipated durability		
	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Product group	Layer	NDFT µm	Layer	NDFT µm	L	M	H
Table A5-M	**Corrosivity category C5-M for low-alloy steel, surface preparation: blast cleaning to Sa 2,5, rust degree A, B or C (see ISO 8501-1)**													
A5M.01	2K EP Primer	1	150				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	150	2	300			
A5M.02	2K EP Primer	1	80	2K EP Primer 2K EP MIO	2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	4	320			
A5M.05	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Primer 2K EP MIO	2	120	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	4	240			
A5M.06	2K EP Zinc rich primer 1K ESI Zinc rich primer	1	60	2K EP Primer 2K EP MIO	2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1 – 2	100	4 – 5	320			
Table A7	**Corrosivity category C5-M for hot-dip galvanized steel**													
A7.10	2K EP Primer	1	60				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	60	2	120			
A7.11	2K EP Primer	1	80				2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	2	160			
A7.12	2K EP Primer	1	80	2K EP Primer 2K EP MIO	1	80	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	3	240			
A7.13	2K EP Primer	1	80	2K EP Primer 2K EP MIO	1 – 2	160	2K EP Topcoat 2K PU Topcoat 2K PU MIO	1	80	3 – 4	320			

NDFT = Nominal Dry Film Thickness L = Low M = Medium H = High

TABLE OF DEW POINT





The dew point (in °C)

The dew point temperature is the temperature at which the air is saturated with water vapour. The lower the temperature the less water vapour can be absorbed by the air. The water vapour condenses when the temperature decreases to the dew point temperature e. g. on cold substrates.

Air humidity = amount of water vapour in the air
Absolute air humidity = water in grams per cubic meter of air
Maximal air humidity = highest amount of absolute air humidity without precipitation of water in liquid form
Relative air humidity = depending on the variable ratio of absolute and maximal air humidity

Microscopically dispersed humidity due to e. g. dew, fog or condensing air humidity on substrates may affect the adhesion and performance of any paint coating applied.

The moisture content of the air has furthermore an impact on the drying process of paint and coating materials.

Dew point table

The dew point table shows at which substrate temperatures dependent on air temperature and relative air humidity condensate appears on the surface.
Example: At an air temperature of 22 °C and a relative air humidity of 65 %, condensate emerges on non-absorbent substrates that have a substrate temperature of less than 15 °C. Generally, the substrate temperature should be at least 3 °C above the dew point during the application process, in this case at 18 °C.

The detailed dew point table gives you an overview. See next page.

Selecting an appropriate paint system

After preparing the substrate the right coating system must be selected according to the requirement categories of DIN EN ISO 12944. The key to success lies firstly in recognising the corrosivity of the environment to which the surface will be exposed. To determine this criteria please see the tables "Corrosivity categories C2 to C5" on pages 4-13. Subsequently, the desired durability has to be specified.

The standard defines the following three durability ranges:

L(ow)	2 - 5 years
M(edium)	5 - 15 years
H(igh)	more than 15 years

Note:
The durability range is not a warranty period. Durability is a technical consideration that can help the owner set up a maintenance program.

Once the corrosivity category and the durability are specified, the question of an appropriate paint system must be considered. Commonly, a three-coat paint system consisting of priming, intermediate and finishing coat is selected.

The priming coat is of vital importance because the primer contains pigments that assure the cathodic protection. The priming coat is furthermore the base, provides adhesion to the substrate and acts as adhesion promoter for subsequent coats.
The following intermediate coating forms a barrier against penetrating corrosive substances. This effect is achieved by high dry film thicknesses and often supported by lamellar pigments. This layer, which varies depending on the requirements, evens also minor irregularities on the surface.
The topcoat provides the final touch to the object. It offers another barrier against corrosive substances and gives the required appearance. The topcoat also provides the first line of defence against sunlight and weather, aggressive atmosphere as well as chemical and/or mechanical stress.

In this brochure you will find different recommendations for coating systems according to tables A2-A5 as well as A7 of DIN EN ISO 12944-5. In general, the following application recommendations are possibilities that have to be considered eventually in terms of individual requirements. Customer specific requirements such as special mechanical, chemical and weather resistance or other demands concerning e.g. gloss and tactile sensation may be better fulfilled by other products. Please contact us and we will offer you the coating solution for your specific requirements.

Application of paint coatings

In order to apply the coating correctly, please see product specifications in our technical data sheet. In case of any further question our application engineers will be happy to support you.

Product group	Product
1K AK Primer	Mipa AK 105-20
1K ESI Zinc rich primer	Mipa 1K-ESI-Zinkstaubprimer High Zinc
2K EP Primer	Mipa EP 100-20 | Mipa EP 164-20 | Mipa EP 140-30 | Mipa EP 564-20
2K EP Zinc rich primer	Mipa 2K-Zinkstaubfarbe
1K AK DTM	Mipa AK 225-30 | Mipa AK 231-50
1K AK MIO	Mipa AK 555-20
1K AK Topcoat	Mipa AK 230-30 | Mipa AK 235-90 | Mipa AK 240-90 | Mipa AK 255-xx | Mipa AK 260-70 | Mipa AK 232-xx
2K EP Topcoat	Mipa EP 200-xx
2K EP MIO	Mipa EP 500-20
2K PU Topcoat	Mipa PU 240-xx | Mipa PU 250-xx | Mipa PU 255-xx | Mipa PU 264-xx | Mipa PU 265-xx | Mipa PU 266-xx | Mipa PU 300-xx
2K PU MIO	Mipa PU 500-20

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Air temperature in °C	Dew point temperature (rounded) in °C at a relative air humidity of														
	30 %	35 %	40 %	45 %	50 %	55 %	60 %	65 %	70 %	75 %	80 %	85 %	90 %	95 %	100 %
50	28	30	33	35	37	39	40	42	43	44	46	47	48	49	50
45	23	26	28	30	32	34	35	37	38	40	41	42	43	44	45
40	19	22	24	26	28	29	31	32	34	35	36	37	38	39	40
35	15	17	19	21	23	25	26	27	29	30	31	32	33	34	35
30	11	13	15	17	18	20	21	23	24	25	26	27	28	29	30
29	10	12	14	16	18	19	20	22	23	24	25	26	27	28	29
28	9	11	13	15	17	18	20	21	22	23	24	25	26	27	28
27	8	10	12	14	16	17	19	20	21	22	23	24	25	26	27
26	7	9	11	13	15	16	18	19	20	21	22	23	24	25	26
25	6	9	11	12	14	15	17	18	19	20	21	22	23	24	25
24	5	8	10	11	13	14	16	17	18	19	20	21	22	23	24
23	5	7	9	10	12	14	15	16	17	18	19	20	21	22	23
22	4	6	8	10	11	13	14	15	16	17	18	19	20	21	22
21	3	5	7	9	10	12	13	14	15	16	17	18	19	20	21
20	2	4	6	8	9	11	12	13	14	15	16	17	18	19	20
19	1	3	5	7	8	10	11	12	13	15	16	16	17	18	19
18	0	2	4	6	7	9	10	11	13	14	15	15	16	17	18
17	-1	1	3	5	7	8	9	10	12	13	14	15	15	16	17
16	-1	1	2	4	6	7	8	9	11	12	13	14	14	15	16
15	-2	0	2	3	5	6	7	9	10	11	12	13	13	14	15
14	-3	-1	1	2	4	5	6	8	9	10	11	12	12	13	14
13	-4	-2	0	1	3	4	6	7	8	9	10	11	11	12	13
12	-5	-3	0	0	2	3	5	6	7	8	9	10	10	11	12
11	-5	-3	-2	0	1	2	4	5	6	7	8	9	9	10	11
10	-6	-4	-3	-1	0	1	3	4	5	6	7	8	8	9	10
8	-8	-7	-5	-3	-2	0	1	2	3	4	5	6	6	7	8
6	-10	-8	-7	-5	-3	-2	-1	0	1	2	3	4	4	5	6
4	-12	-10	-8	-7	-5	-4	-3	-2	-1	0	1	2	2	3	4
2	-14	-12	-10	-9	-7	-5	-4	-3	-3	-2	-1	0	1	1	2
0	-15	-14	-12	-10	-8	-7	-6	-5	-4	-3	-2	-2	-1	0	0

typical temperatures during processing

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