







Metal & Corrosion Protection Coatings



Content

ALBERDINGK BOLEY in a nutshell	4
Metal Coatings	5
General Metal Coatings	5
Primer	5
1K DTM coatings	6
1K DTM coatings for galvanized steel	6
Topcoats	7
Rust converter	8
Peelable coatings.....	9
Topcoats for electroplated surfaces	10
Neutral pH-range	10
Metal pre-treatment.....	11
Chrome free metal pre-treatment	12
Neutral pH	12
Acidic	13
Heavy Corrosion Protection (Tubes / Pipelines)	13
Trivia about the corrosion of iron.....	14
Corrosion categories according to DIN EN ISO 12944-5:2008	19
Important test standards for corrosion protection coatings:	20
Choices of Alberdingk binders for anti corrosion paints	23
Multi-layer systems	25
Formulation Proposal.....	26
Conclusion	52
External test results ALBERDINGK® AC 2403	53

ALBERDINGK BOLEY in a nutshell

 <p>Leading international manufacturer of environmentally friendly water-based binders and oils with unique properties to refine, refurbish, bind and protect multiple types of substrates</p>	 <p>Medium sized, privately owned company > 250 million Euro group turnover in 2021 > a partner to our customers for 250 years</p>	 <p>> 500 employees</p>
 <p>Dynamic, Innovative and flexible</p> <p>Pioneers in biobased polymer dispersions</p>	 <p>Dispersions: Acrylic, Vinyl acetate, Polyurethane and hybrid dispersions</p> <p>Oils: Linseed oil, Castor oil, Derivatives</p>	 <p>Locations:</p> <ul style="list-style-type: none"> • Krefeld, Germany • Kerpen, Germany • Leuna, Germany • Treviso, Italy • Greensboro, USA • Shenzhen, China • Zhuhai, China

For more information about ALBERDINGK BOLEY and our product offerings, visit www.alberdingk-boley.de.



Metal Coatings

Metal coatings protect values - experts from the NACE (National Association of Corrosion Engineers) estimated the global cost of corrosion to be approx. \$2.5 trillion!

At ALBERDINGK BOLEY we try to help protecting metal with novel waterbased products which can reach the highest protection levels.

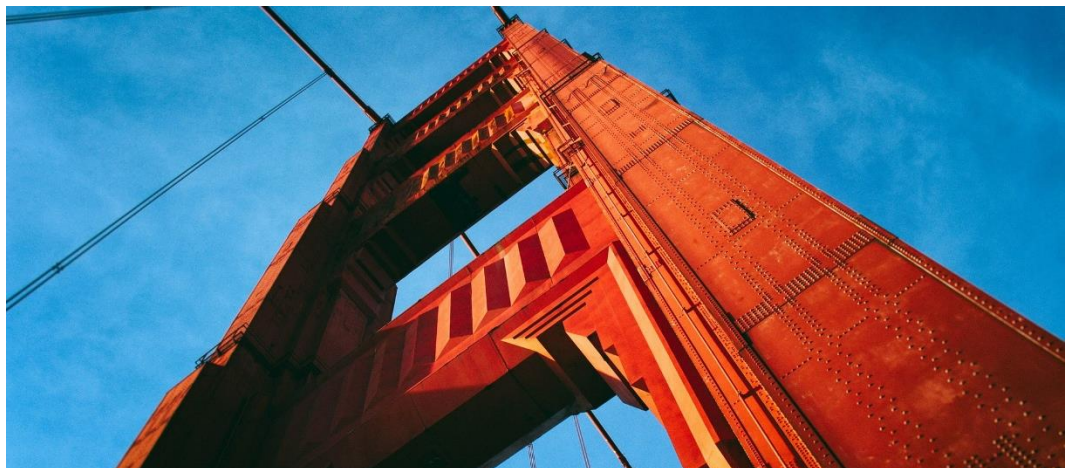
Our portfolio covers a lot of different applications, reaching from 100% solids, 2-pack heavy duty to ultra-thin film protections of < 1µm DFT.

General Metal Coatings

Primer

For primer we offer economic styrene acrylic dispersions such as **ALBERDINGK® SC 48** or pure acrylics like **ALBERDINGK® AC 2003**.

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
AC 2003	49.0-51.0	20-2,000	7.0-9.0	3	Economic acrylic with excellent corrosion resistance, high PVC possible
SC 48	49.0-51.0	3,000-5,000	7.0-7.5	14	Economic styrene-acrylic, Zn-pigment compatible
AC 2433	43.0-45.0	100-1,000	8.5-9.5	20	Hard acrylic with excellent corrosion resistance





1K DTM coatings

For DTM our offer reaches from **ALBERDINGK® AC 2403** for very high demanding corrosion protection in low DFT to economic products like **ALBERDINGK® AC 2003** and **ALBERDINGK® AC 2433**.

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
AC 2003	49.0-51.0	20-2,000	7.0-9.0	3	Economic acrylic for low VOC DTM coatings
AC 2433	43.0-45.0	100-1,000	8.5-9.5	20	Economic, hard acrylic for coatings with C3/C4-resistance
AC 2403	46.0-48.0	200-2,000	8.0-9.0	16	Best in class corrosion resistance, meets C5I-L, super hydrophobic
AC 2420	45.0-47.0	1,000-3,000	8.0-9.0	22	Harder version of ALBERDINGK® AC 2403 , optimized for galvanized surfaces

1K DTM coatings for galvanized steel

1K DTM coatings for galvanized require specific polymers which ensure the best possible adhesion and corrosion protection.

Our latest development **ALBERDINGK® AC 2420** offers best possible corrosion protection on steel and galvanized surfaces.

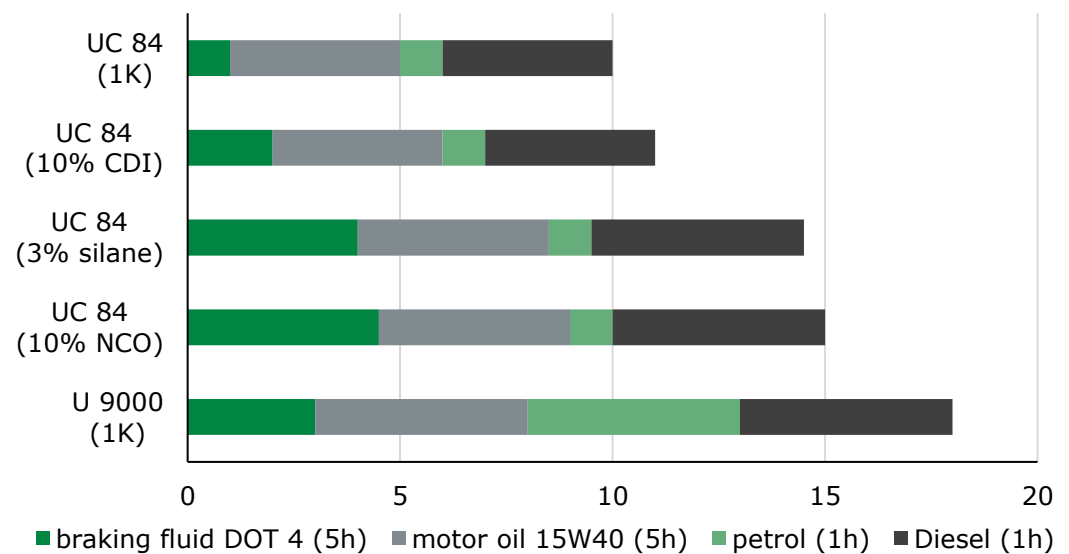
Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
AC 2420	45.0-47.0	1,000-3,000	8.0-9.0	22	Harder version of ALBERDINGK® AC 2403 , optimized for galvanized surfaces

Topcoats

Our products for topcoats can be used to obtain better oil and grease resistance by maintaining the anticorrosion properties of the coating underneath. Products for 1K, 2K isocyanate as well as 2K non-isocyanate are available

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
AC 27401	37.0-39.0	100-1,500	7.5-8.5	15	Very high chemical resistances, especially for matt systems
PUR-MATT 910	34.0-36.0	20-2,000	7.0-9.0	15	Inherent matt PUD for low gloss coatings with high resistances
UC 84	34.0-36.0	20-200	7.5-8.5	42	Hard PC-Copolymer, for 1K, 2K and 2K-non isocyanate topcoats, superior weathering resistance
UC 8400	39.0-41.0	20-200	7.0-8.5	50	Hard PES-Copolymer
U 9000	28.0-30.0	50-1,000	7.0-8.5	0	Very hard PC-PUD with superior chemical and weathering resistance

Chemical resistances with different x-linking technologies:

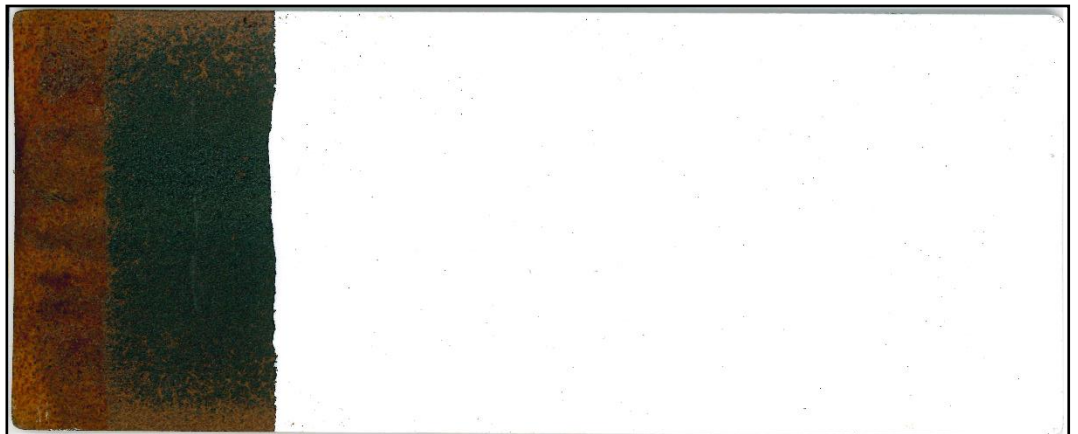


Rust converter

Rust converters can be formulated by mixing tannic acid and polymer, **ALBERDINGK® AC 2403** is an ideal choice for this kind of product. Novel rust converters such as ASCOTRUST® offer the ability to formulate with high performance resins such as **ALBERDINGK® AC 2403**.

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
AC 2403	46.0-48.0	200-2,000	8.0-9.0	16	For rust converters with ASCOTRUST®, super hydrophobic and excellent corrosion resistance

Rust converter based on **ALBERDINGK® AC 2403**:



0 | 1 | 2 | 3

Build-up:

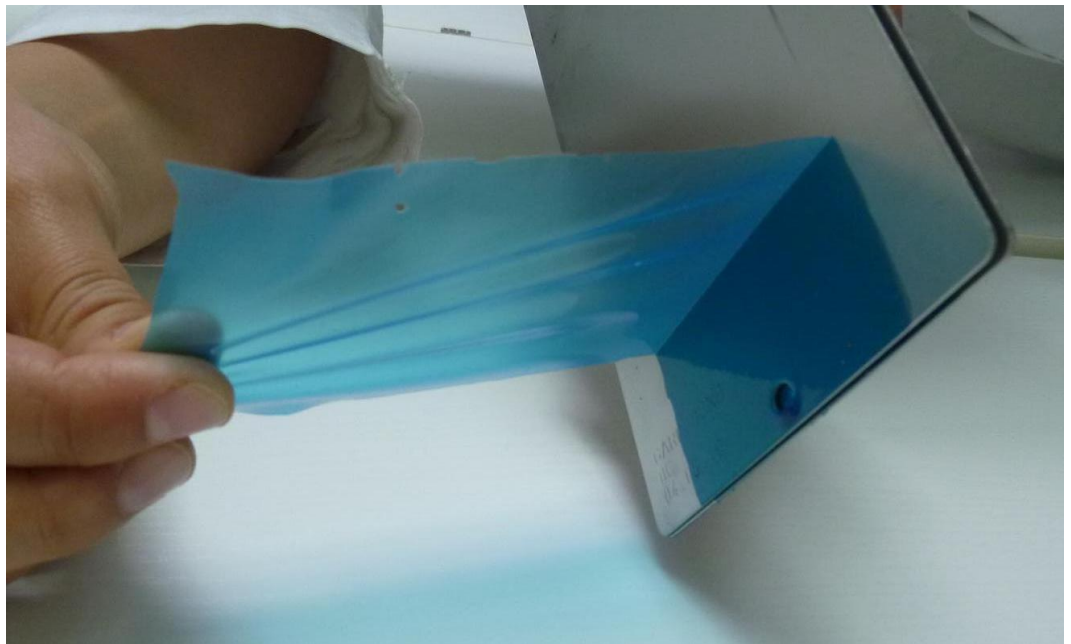
- 0: Rusty steel-panel, covered with:
- 1: 1 layer of rust converter based on **ALBERDINGK® AC 2403** brush applied
- 2: 1 layer of FP 2403-35 (white pigm. anti-corrosive primer), brush applied
- 3: 1 layer of FP 27401-18 (2k-topcoat), brush applied



Peelable coatings

ALBERDINGK® U 502 offers excellent peel properties thank to its high tensile strength in combination with good corrosion protection.

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
U 502	39.0-41.0	10-800	7.0-8.0	0	High tensile strength, easy to peel, excellent corrosion resistance
AC 2003	49.0-51.0	20-2,000	7.0-9.0	3	Economic acrylic with good corrosion resistance





Topcoats for electroplated surfaces

Topcoats for electroplated materials can offer improved corrosion resistance and non-iridescent surfaces.

Neutral pH-range

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
U 6300	32.0-34.0	10-2,000	7.5-8.5	0	Excellent corrosion & chemical resistance
U 9000	28.0-30.0	50-1,000	7.0-8.5	0	Highest corrosion & chemical resistance
AC 25352	50.0-52.0	300-800	7.0-8.0	20	Economic acrylic with very good corrosion resistance
PUR-MATT 910	34.0-36.0	20-2,000	7.0-9.0	15	Inherent matt PUD for low gloss / phosphated look



Metal pre-treatment

Metal pre-treatments or thin organic coatings are permanent materials which offer excellent corrosion protection, very good intercoat adhesion and blocking resistance. Our offer ranges from polymer dispersions for highly acidic media (chrome-free) to non-chrome systems with neutral pH level. Due to environmental concerns chrome needs to be replaced by non-chrome alternatives without sacrificing the final properties.





Chrome free metal pre-treatment

Neutral pH

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
U 6300	32.0-34.0	10-2,000	7.5-8.5	0	Excellent corrosion & good chemical resistance
U 9000	28.0-30.0	50-1,000	7.0-8.5	0	Highest level of chemical & corrosion resistance, superior alkaline resistance
U 9380	31.0-34.0	10-250	7.5-9.0	25	For low VOC, high chemical resistance, outstanding flexibility
PUR-MATT 910	34.0-36.0	20-2,000	7.0-9.0	15	Inherent matt PUD for phosphate look
AC 2360	46.0-48.0	100-3,000	7.0-9.0	0	Economic, multiphase, self-x-linking acrylic with very good corrosion resistance
AC 2403	46.0-48.0	200-2,000	8.0-9.0	16	Super hydrophobic, multiphase acrylic with superior corrosion resistance
AC 2420	45.0-47.0	1,000-3,000	8.0-9.0	22	Harder version of ALBERDINGK® AC 2403 , optimized for galvanized surfaces



Acidic

Alberdingk®-product	Solids [%]	Viscosity [mPas]	pH-value	MFFT [°C]	Features
CUD 4820	34.0-36.0	20-200	4.0-6.0	21	Cationic PC-PUD with high hardness and excellent compatibility to acids
CUD 4835	34.0-36.0	20-200	4.0-5.5	35	Harder version of ALBERDINGK® CUD 4820 , higher chemical resistance

Heavy Corrosion Protection (Tubes / Pipelines)

ALBODUR® polyols are suitable for 100% solids, 2pack coatings for heavy duty applications such as pipeline coatings.

Alberdingk®-product	Solids [%]	Viscosity [mPas]	OH-value [mg KOH/g]	Features
ALBODUR® 921	100	600	218	used in combination with ALBODUR® 942 for 2-pack aromatic pipe coatings
ALBODUR® 942	100	500	318	polyol which forms epoxy like hard films with highest hardness and chemical resistance
ALBODUR® 1054	100	2,700-3,200	210	For aliphatic topcoats with excellent UV and chemical resistance



Trivia about the corrosion of iron

Corrosion is an oxidation of iron or other metals and requires a presence of oxygen, an electrolyte and water. The known "red rust" is the result of intermediate reactions of iron hydroxide with oxygen.

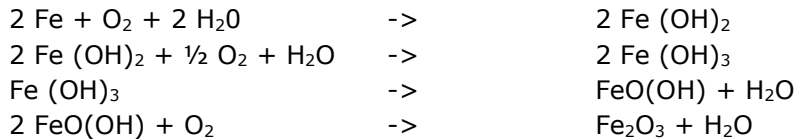


Illustration of corrosion of iron with NaCl solution:

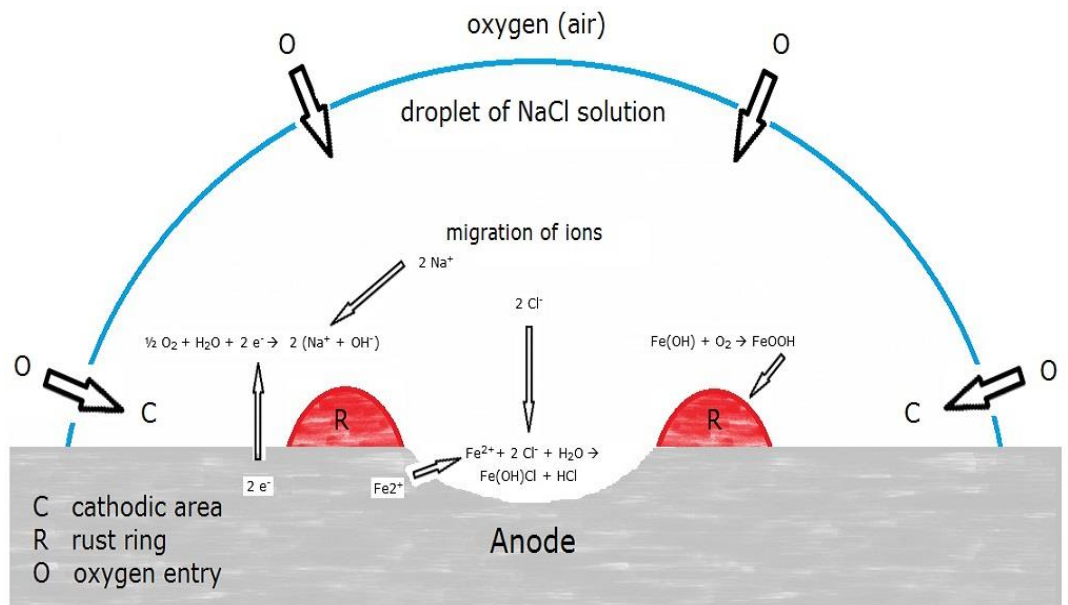


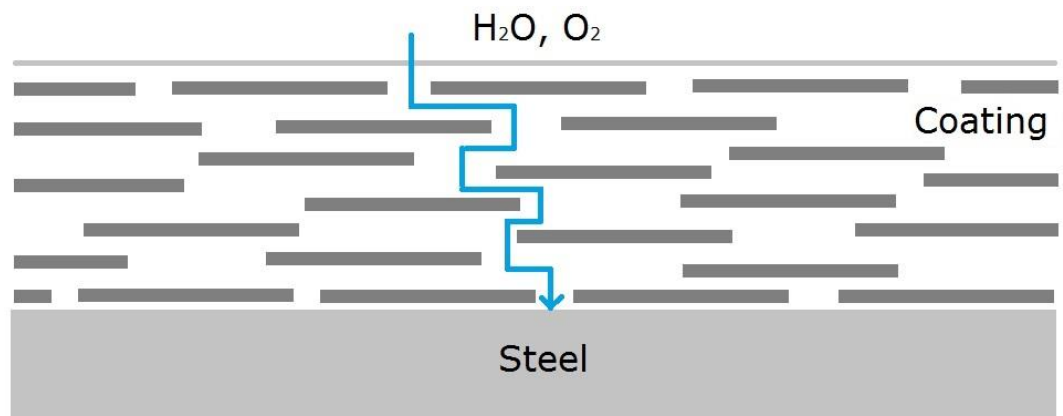
Illustration of corrosion on iron with NaCl solution (U. R. Evans model)

Ways to protect metal?

Passive anti-corrosion pigments (barrier effect, increased diffusion path):

E.g. Disc-shaped pigments like Iron-Glimmer, Calcium-silicate.

Some of these fillers have a tendency to dissociate into bivalent cations; therefore the binder requires a stable polymer, due to possible interactions of bivalent cations with the particle's surface charge. To counteract these cations the polymer needs more surfactant and surface charge, hence it will be less water resistant.

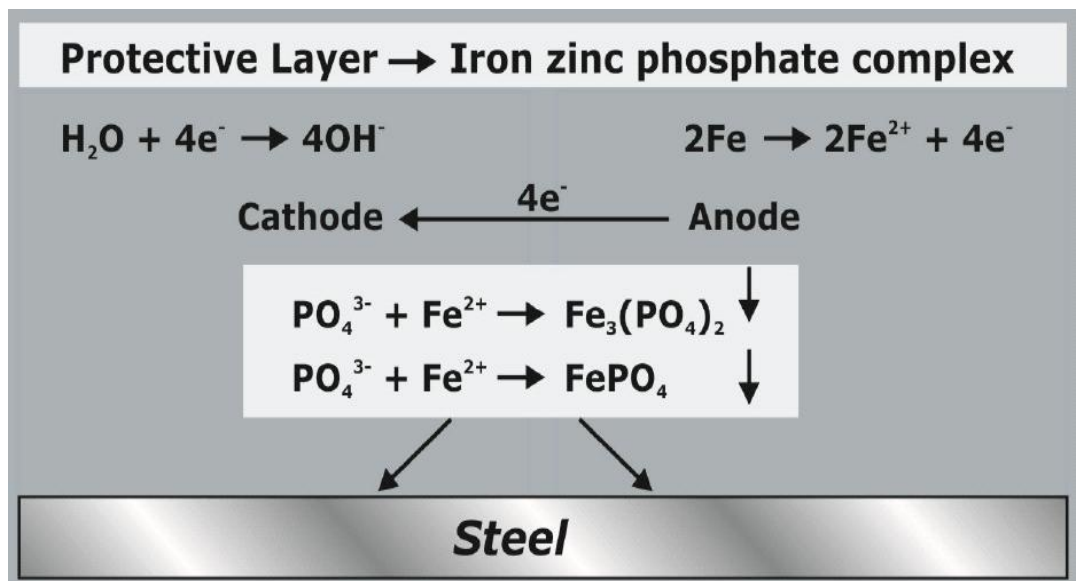
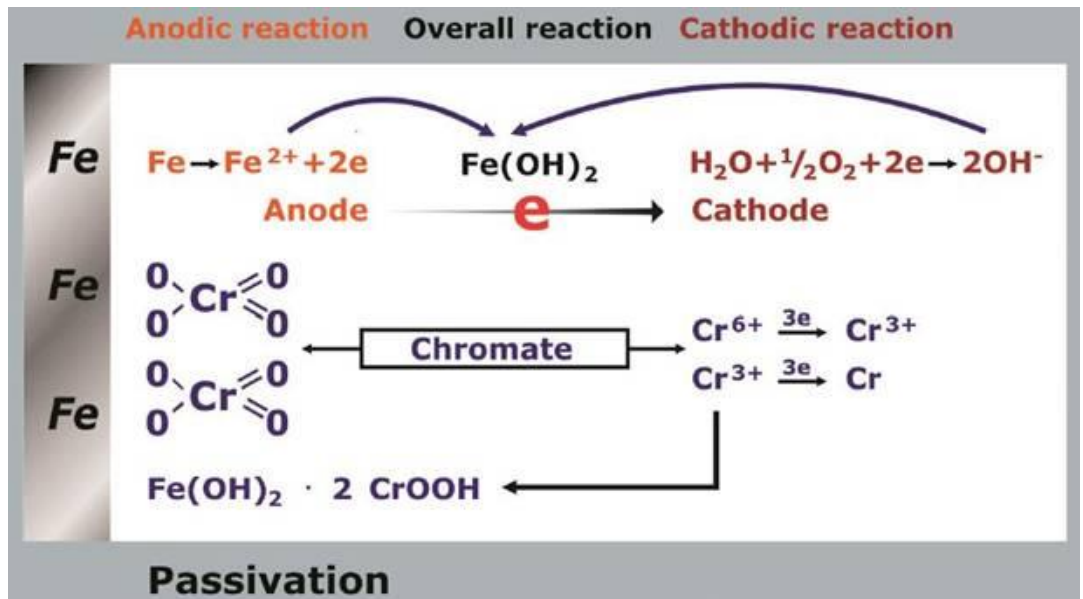


Active anti-corrosion pigments:

Zinc dust (donator-anode), zinc chromate (passivation), zinc phosphate (precipitation), red lead (saponification with alkyd resins) or nitrite salts (reducing agent -> flash rust protection).

Analog to the passive anti-corrosion pigments the active pigments can also dissociate into bi- or multivalent cations, weakening the binders polymer stabilization. Labelling of these phosphates or oxides are also an issue and cans have to be classified with the phrase H 410: Very toxic to aquatic life with long lasting effects.

To get the full potential of phosphate pigments the polymer needs to have certain hydrophilic properties to ensure electro chemical reactions between the pigment with the metal surface.



Source: Heubach

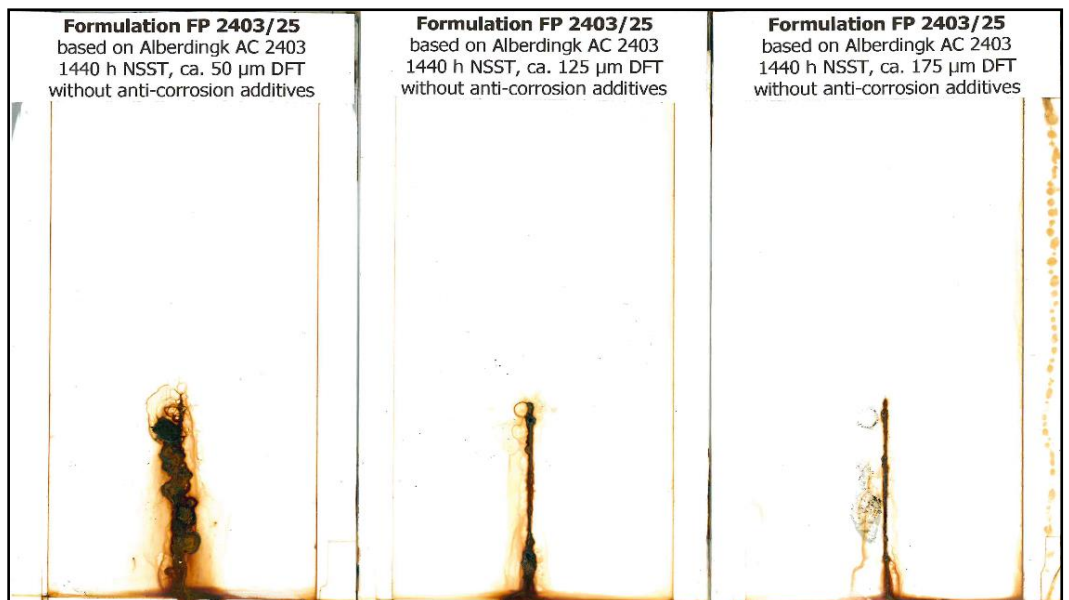
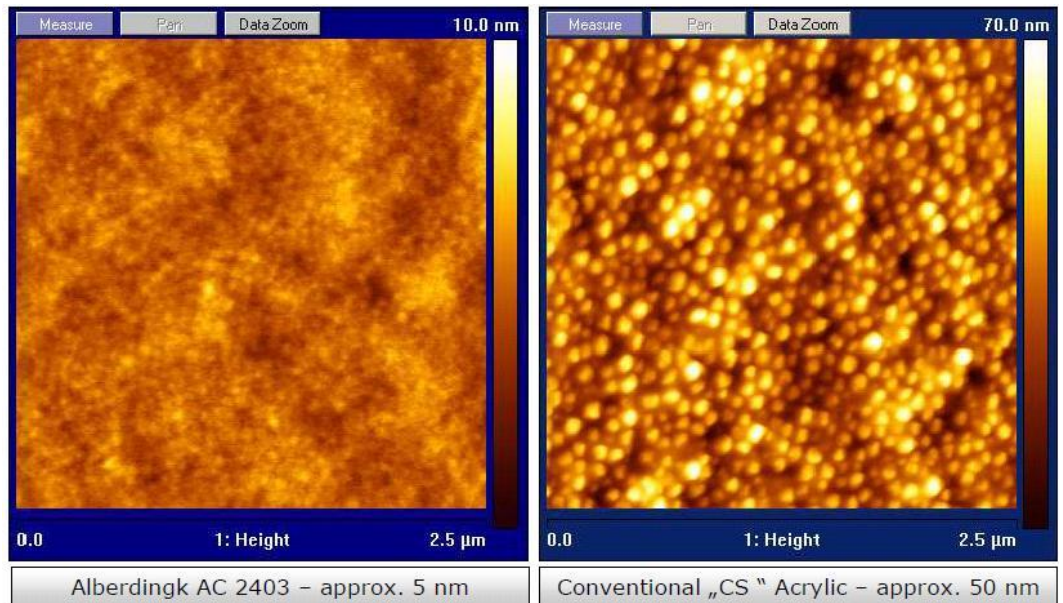


ALBERDINGK BOLEY

Binders with water barrier effect due to extreme hydrophobic and compact polymer matrix:

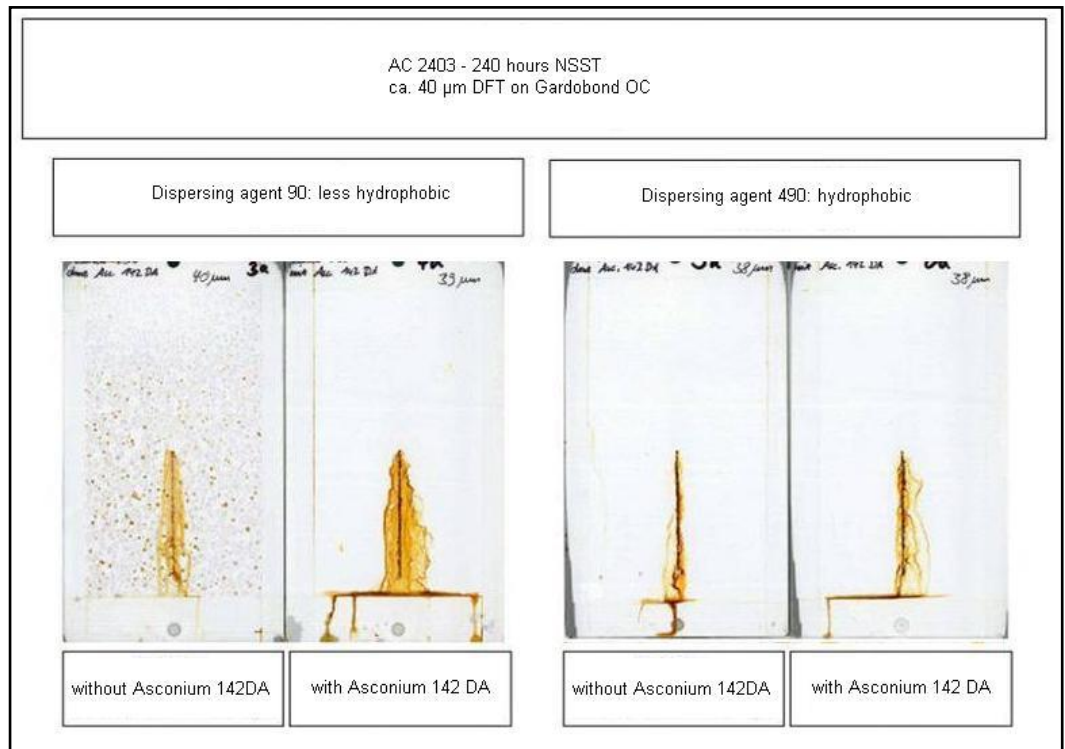
ALBERDINGK® AC 2403, 2K PU- and epoxy systems

Illustration of particle size of **ALBERDINGK® AC 2403** and a conventional multi-phase acrylic binder



Right choice of dispersing agents

Dispersing agents have a huge influence on the corrosion protection properties of the coating and the wrong agents can ruin the results of even the best performing binders. Very hydrophobic dispersing agents are the right choice for anti-corrosion paints.





Corrosion categories according to DIN EN ISO 12944-5:2008

Category corrosion stress	Corrosivity	Corrosion protection class	Duration of protection [years]	Required nominal DFT of whole paint system [µm]	Condensation of moisture [h]	Neutral salt spray fog [h]	Examples
C1 insignificant	very low, very low aggressivity, interior	short	2-5	70	-	-	Interior only, isolated buildings (60% rel. hum.)
		middle	5-15	70	-	-	
		long	>15	70	-	-	
C2 light	low, light aggressivity, exterior/interior	short	2-5	80	48	-	Low polluted atmosphere dry climate, e.g. rural areas
		middle	5-15	120	48	-	
		long	>15	160	120	-	
C3 medium	medium, moderate aggressivity, exterior/interior	short	2-5	120	48	120	Urban and industrial atmosphere mit moderate SO ₂ -pollution
		middle	5-15	160	120	240	
		long	>15	200	120	480	
C4 strong	high, strong aggressivity, exterior/interior	short	2-5	160-200	120	240	Industrial areas and coast atmosphere with moderate salt concentration
		middle	5-15	200-400	240	480	
		long	>15	240	480	720	
C5-I very strong (industry)	very high, high aggressivity, exterior/interior	short	2-5	200	240	480	Industrial areas with high rel. hum. and aggressive atmosphere
		middle	5-15	240-400	480	720	
		long	>15	320-500	720	1440	
C5-M very strong (marine water)	very high, marine climate, exterior/interior	short	2-5	200	240	480	Coast and off-shore areas with high salt concentration
		middle	5-15	240-400	480	720	
		long	>15	320-500	720	1440	



Important test standards for corrosion protection coatings:

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 4628-2	Paints and varnishes - evaluation of degradation of coatings - designation of quantity and size of defects, and of intensity of uniform changes in appearance Part 2: Assessment of degree of blistering
DIN EN ISO 4628-3	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance Part 3: Assessment of degree of rusting
DIN EN ISO 4628-4	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance Part 4: Assessment of degree of cracking
DIN EN ISO 4628-5	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance Part 5: Assessment of degree of flaking

For further information about test methods and interesting facts about the topic corrosion we can recommend the detailed brochure "Korrosionsschutz von Stahlbauten durch Beschichtungssysteme" of "Verband der deutschen Lack- und Druckfarbenindustrie" and „Bundesverband Korrosionsschutz e.V.“

New scribe according to DIN EN ISO 12944-6:2018

The scribe, according to outdated DIN EN ISO 12944-6:1998, e.g. with cutting knife, van Laar pen, is no longer valid.

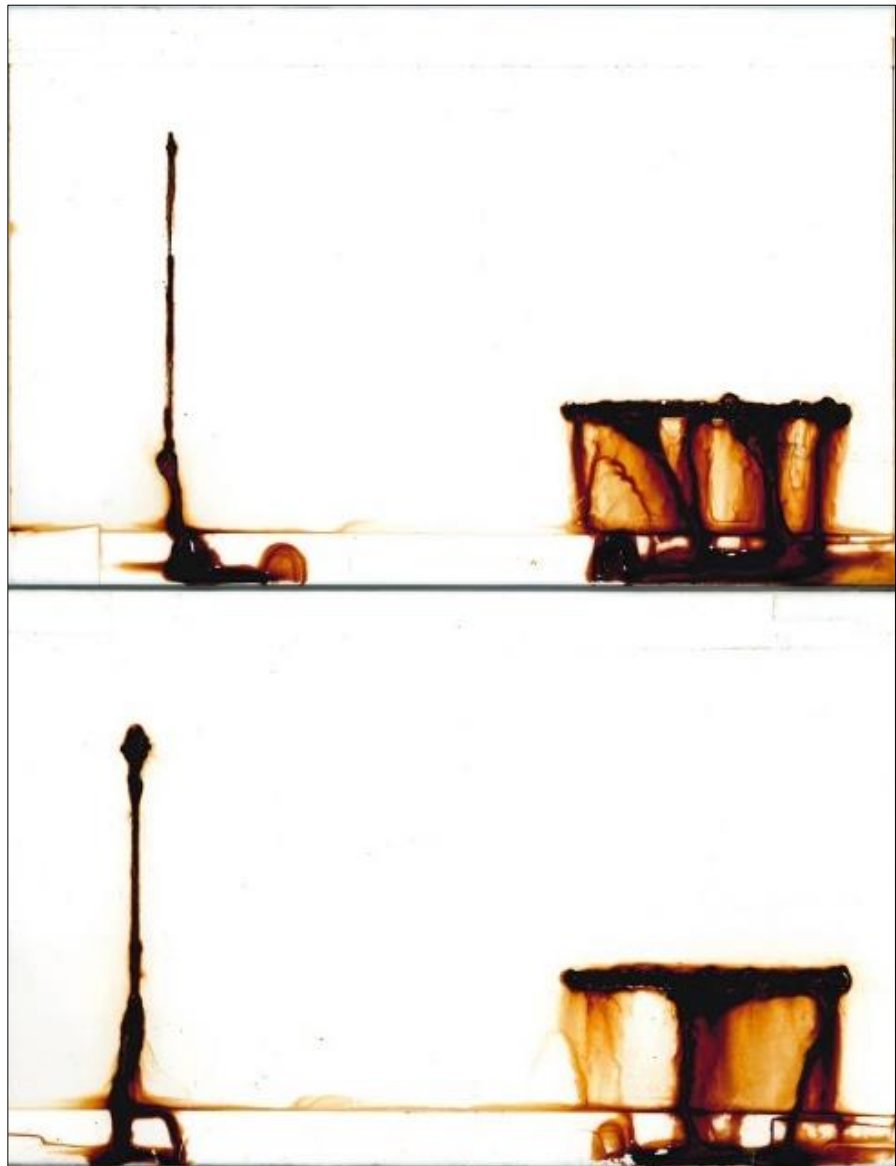
The new scribe has to be 2 mm wide and has to be put into the cabinet horizontally.

In our tests we could not see big differences in corrosion protection between the scribes.

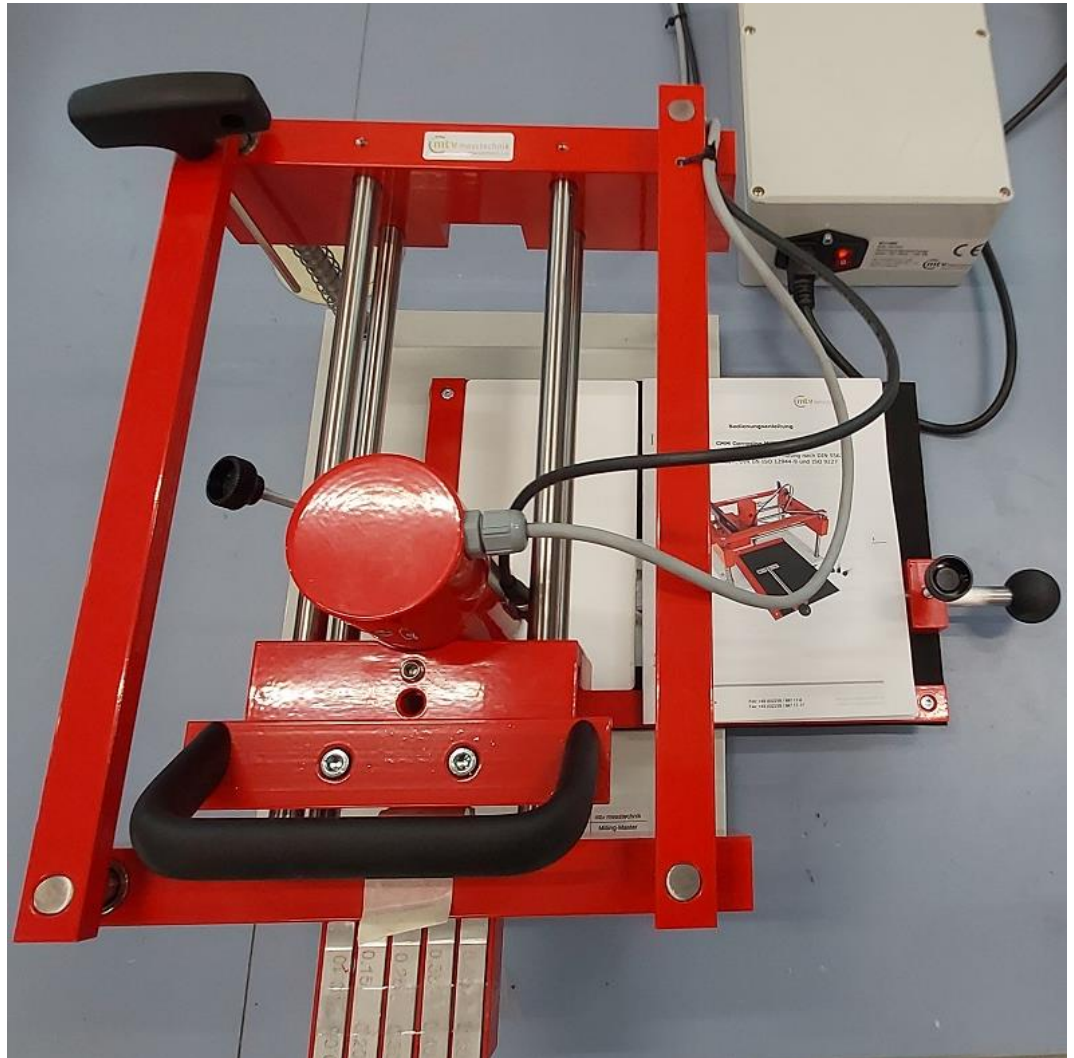
Photo below:

Left scribe with van Laar pen right scribe with 2 mm MTV Milling Master.

Top panel: Gardobond OC - **bottom panel:** Steel grade DC01 (1.0330)



MTV Milling Master





Choices of Alberdingk binders for anti corrosion paints

- **ALBERDINGK® AC 2403**
- **ALBERDINGK® AC 2420**
- **ALBERDINGK® AC 2433**
- **ALBERDINGK® AC 2003**
- **ALBERDINGK® SC 48**

Binder	Solids [%]	MFFT [°C]	Type of binder	Properties
AC 2403	47	16	multi phase	Best possible corrosion protection, very good adhesion to various substrates. Suited for low DFT applications. Recommended with Asconium anti corrosion additives
AC 2420	46	22	multi-phase	Superior water-resistance, and vapor-barrier properties, high blocking resistance
AC 2433	44	20	single phase	Binder with outstanding wet adhesion, good corrosion protection. Recommended with Asconium anti corrosion additives
AC 2003	50	3	single phase	Very good corrosion protection.
SC 48	50	14	single phase	Economic binder with good water resistance and adhesion, soft film. Compatible with Zn pigments

Binder	Type of polymer	DTM	Primer		
			PVC: < 25	PVC: 25-35	PVC: > 35
AC 2403	multi phase	X	X	O	-
AC 2420	multi-phase	X	X	O	-
AC 2433	single phase	X	X	X	O
AC 2003	single phase	X	O	X	X
SC 48	single phase	-	O	X	X

X = recommended
 O = suitable
 - = not suitable



Formulation	PVC	corrosion protection concept	DFT	achieved NSST hours	corrosion category	Required nominal DFT of whole paint system [μm] for the achieved corrosion category
FP 2403/68	11	Asconium	60 μm	1440	C5-I long	320 - 500 μm
FP 2403/67	22	Asconium	80 μm	1440	C5-I long	320 - 500 μm
FP 2403/75	35	Asconium	150 μm	720	C5-I long	320 - 500 μm
FP 2420/01	11	Asconium	110 μm	1440	C5-I long	320 - 500 μm
FP 2433/01	22	Asconium	100 μm	480	C4 long / C5-I middle	240 - 400 μm
FP 2003/06	11	Asconium	110 μm	1440	C5-I long	320 - 500 μm
FP 48/02	30	Zn-pigments	150 μm	720	C4 long / C5-I middle	240 - 400 μm
FP 48/05	35	Asconium	200 μm	1000	C4 long / C5-I middle	240 - 400 μm

Adhesion to metal:

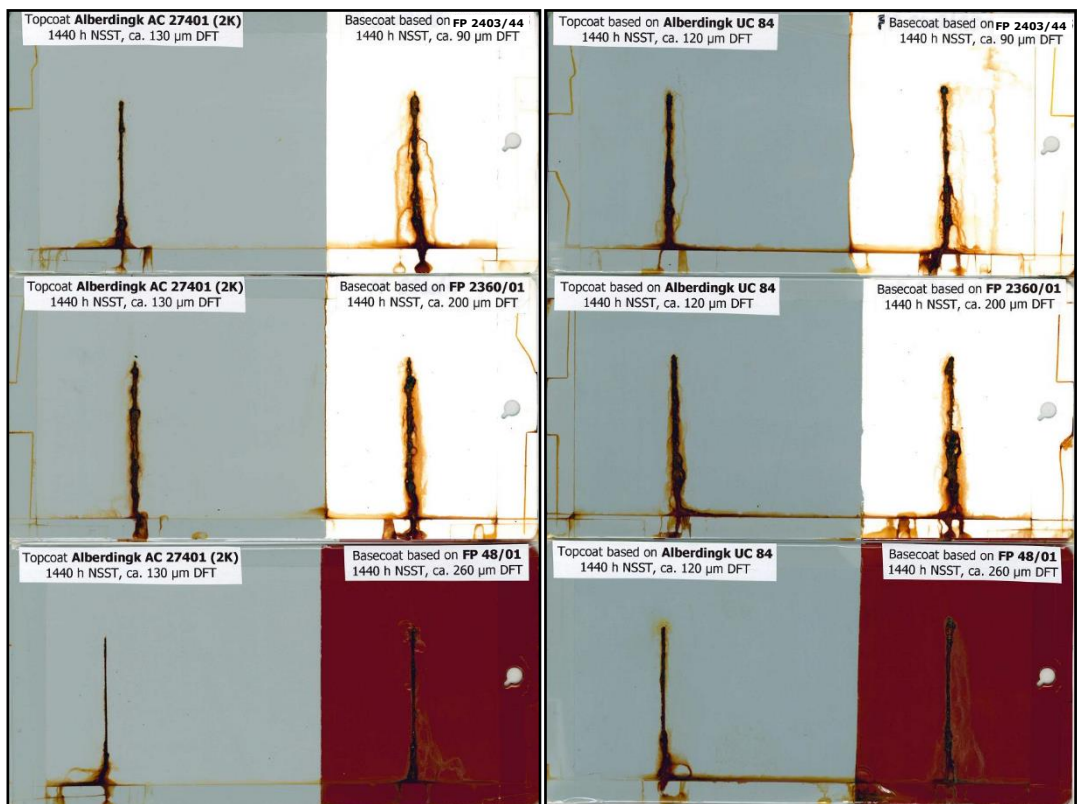
Formulation	Gardo-bond OC	Gardo-bond HDG/3	Gardo-bond 26S 6800 OG	Q-Panel R	ACT steel	Sand blasted steel	Zinc phosphated steel	Aluminum	Zinc plated steel
FP 2403/68	Gt 0	Gt 1	Gt 1	Gt 0	Gt 0	Gt 0	Gt 1	Gt 1	Gt 0
FP 2403/67	Gt 1	Gt 1	Gt 1	Gt 1	Gt 0	Gt 0	Gt 1	Gt 1	Gt 0
FP 2403/67 without Asc. 142DA	Gt 3	Gt 2	Gt 2	Gt 1	Gt 1	Gt 0	Gt 1	Gt 1	Gt 0
FP 2420/01	Gt1	n.d.	Gt 1	Gt 2	Gt 0	Gt 0	Gt 1	Gt 1	Gt 1
FP 2433/01	Gt 0	n.d.	Gt 0	Gt 0	Gt 1	Gt 0	Gt 0	Gt 1	Gt 0
FP 2003/06	Gt 1	n.d.	Gt 1	Gt 1	Gt 1	Gt 0	Gt 1	Gt 5	Gt 0
FP 48/02	Gt 0	Gt 0	Gt 0	Gt 0	Gt 0	Gt 0	Gt 0	Gt 0	Gt 0
FP 48/05	Gt 1	Gt 0	Gt 0	Gt 1	Gt 2	Gt 0	Gt 1	Gt 1	Gt 0

* Gt 0 = best / Gt 5 = worst

Multi-layer systems

Some applications require a multi-layer system, containing corrosion protection basecoat and a topcoat:
 for unique specifications of the end user
 for special colour shades or gloss levels
 if the corrosion base coat is soft or if it has poor mechanical resistance
 to improve the chemical resistance, e.g. versus solvents, oils, acids and lyes

Topcoat: FP 27401-12 FP 84-18
based on: **ALBERDINGK® AC 27401** **ALBERDINGK® UC 84**





Formulation Proposal

FP 2403-68 / -69 anti-corrosion coating, PVC approx. 11%, solids approx. 50%, spray application, recommended nozzle size > 2.0 mm, Gloss: approx. 85 @60°

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	2.50		
2	Edaplan 490 or Borch Gen 1750	1.00	dispersing agent	Münzing Chemie or Borchers
3	AMP 90	0.02	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	15.00	pigment	Kronos
Disperse with high shear rate for 10min, then proceed with pos. 6 – 15				
6	Water (deion.)*	6.40		
7	Dowanol DPM*	2.50	co-solvent	Dow Chemical
8	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
9	BYK-024	0.15	defoamer	BYK Chemie
10	BYK-349	0.18	wetting agent	BYK Chemie
11	Asconium-142DA**	1.90	corrosion inhibitor	Ascotec
12	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
13	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
14	Tafigel PUR 61 solution (20% PUR 61:20% Dowanol DPM:60% water)	0.60	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 6 + 7

** Premix pos. 11 + 12. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Corrosion Class: C5-I long (@60µm DFT)

Test report: see pages 39-44

Test Results (Gardobond OC panel, DFT 100-109 µm, 1440 hours NSST)

FP 2403-68 / -69 anti-corrosion coatings, PVC approx. 11%

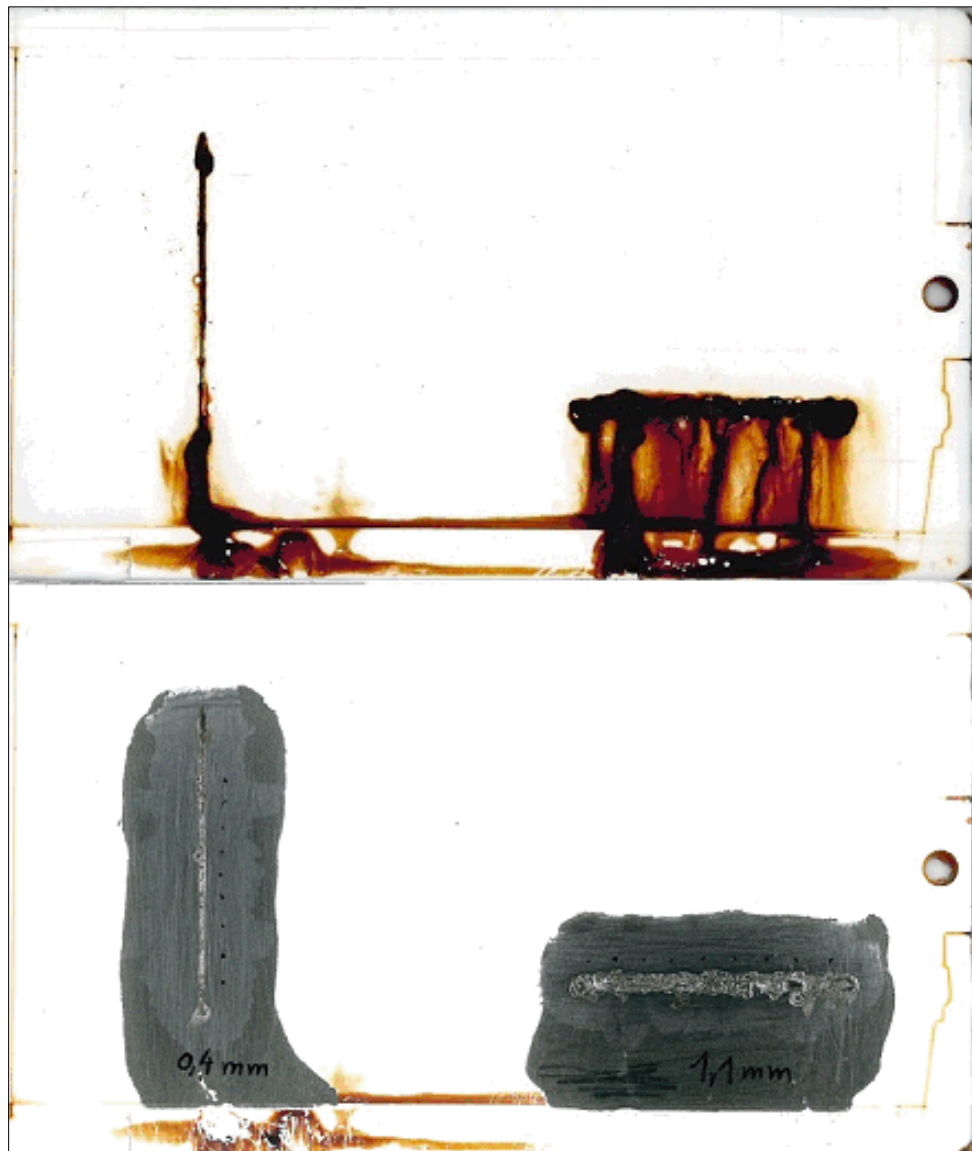
Left scribe with van Laar pen right scribe with 2 mm MTV Milling Master.

Top panel: Gardobond OC - **bottom panel:** Steel grade DC01 (1.0330)

Width of corrosion at scribe

left: DIN EN ISO 12944-6:1998 van Laar pen: width of corrosion 0,4 mm (max. tolerance 1,0 mm)

right: DIN EN ISO 12944-6:2018 scribe 2,0 mm: width of corrosion 1,1 mm (max. tolerance 1,5 mm)





Formulation Proposal

FP 2403-67

anti-corrosion coatings, PVC approx. 22%,
solids approx. 54%, spray application,
recommended nozzle size > 2.0 mm

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	5.30		
2	Edaplan 490	1.20	dispersing agent	Münzing Chemie
3	AMP 90	0.02	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	17.70	pigment	Kronos
6	Calcilit Super	7.50	extender	Alpha Calcit
Disperse with high shear rate for 10min, then proceed with pos. 7 – 16				
7	Water (deion.)*	4.30		
8	Dowanol DPM*	2.50	co-solvent	Dow Chemical
9	ALBERDINGK® AC 2403	57.90	acrylic dispersion	Alberdingk Boley
10	BYK-024	0.15	defoamer	BYK Chemie
11	BYK-349	0.18	wetting agent	BYK Chemie
12	Asconium-142DA**	1.90	corrosion inhibitor	Ascotec
13	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
14	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
15	Tafigel PUR 61 solution (20% PUR 61:20% Dowanol DPM: 60% water)	0.50	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 7 + 8

** Premix pos. 12 + 13. Use the Asconium 142DA / AMP 90 blend within 1 day or
the Asconium 142DA / DMEA blend within 5 days

Corrosion Class: C5-I long (@80µm DFT)

Latest update
April 08, 2022

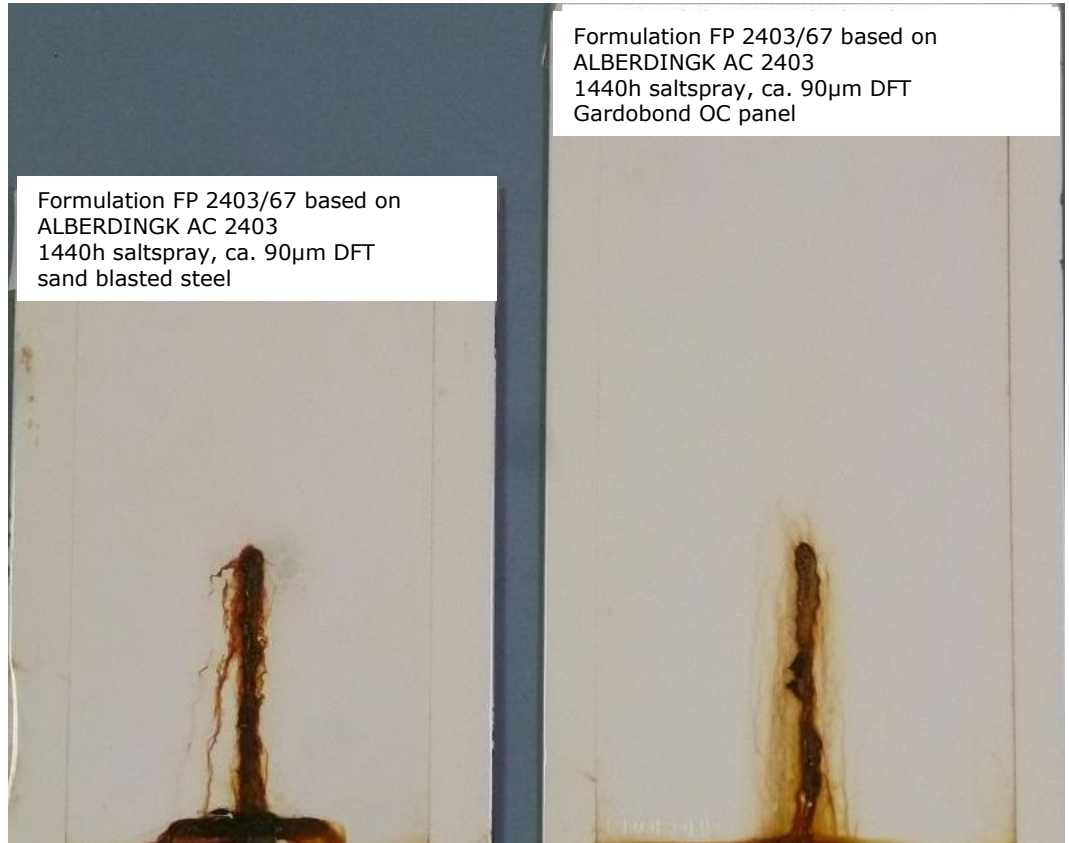
page 28 of 60

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Test Results (after 1440 hours salt-spray test)

FP 2403-67 anti-corrosion coatings, PVC approx. 22%
also suitable for sandblasted steel



Test features

Feature	Test Conditions	Test Results
Water absorption [%]		approx. 3.0
Water vapor permeability [g/m ² per day]	wet cup method	approx. 29



Formulation Proposal

FP 2403-75

anti-corrosion coating,
PVC approx. 35%, solids approx. 56%

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	8.00		
2	Edaplan 490	1.20	dispersing agent	Münzing Chemie
3	AMP 90	0.03	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	5.00	pigment	Kronos
6	Durcal 5	27.50	filler	Omya
Disperse with high shear rate for 10min, then proceed with pos. 7 – 16				
7	Water (deion.)*	5.00		
8	Dowanol DPM*	2.50	co-solvent	Dow Chemical
9	ALBERDINGK® AC 2403	46.70	acrylic dispersion	Alberdingk Boley
10	BYK-024	0.10	defoamer	BYK Chemie
11	BYK-345	0.22	wetting agent	BYK Chemie
12	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
13	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
14	Ascotran-H10	1.00	flash rust inhibitor	Ascotec
15	Tafigel PUR 61 solution (20% PUR 61:20% Dowanol DPM:60% water)	0.50	rheology modifier	Münzing
Total		100.00		

* Premix pos. 7 + 8

** Premix pos. 12 + 13. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Latest update
April 08, 2022

page 30 of 60

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Formulation Proposal

FP 2420-01 anti-corrosion coatings, PVC approx. 11%,
solids approx. 50%

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	2.50		
2	Edaplan 490	1.00	dispersing agent	Münzing Chemie
3	AMP 90	0.02	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	15.00	pigment	Kronos
Disperse with high shear rate for 10min, then proceed with pos. 6 – 14				
6	Water (deion.)*	6.70		
7	Dowanol DPM*	2.50	co-solvent	Dow Chemical
8	ALBERDINGK® AC 2420 VP	68.90	acrylic dispersion	Alberdingk Boley
9	BYK-024	0.15	defoamer	BYK Chemie
10	BYK-349	0.18	wetting agent	BYK Chemie
11	Asconium-142DA**	1.90	corrosion inhibitor	Ascotec
12	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
13	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
14	Tafigel PUR 61 solution (20% PUR 61 20% Dowanol DPM:60% water)	0.30	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 6 + 7

** Premix pos. 11 + 12. Use the Asconium 142DA / AMP 90 blend within 1 day or the
Asconium 142DA / DMEA blend within 5 days.

Formulation Proposal

FP 2420-01

anti-corrosion coatings, PVC approx. 11%,
solids approx. 50%



1440h NSST,
Gardobond OC panel,
approx. 110 μ m DFT



Formulation Proposal

FP 2433-02

anti-corrosion coatings, spray application
PVC approx. 11%, solids approx. 53%

Pos.	Raw Material	Amount	Supplier
1	Water (deion.)	2.50	
2	Edaplan 490	1.00	Münzing Chemie
3	AMP 90	0.02	Angus Chemie
4	BYK-024	0.10	BYK-Chemie
5	Kronos 2190	15.00	Kronos
Disperse with high shear rate for 10min, then proceed with pos. 6 – 14			
6	Water (deion.)*	3.90	
7	Dowanol DPM*	5.00	Dow Chemical
8	ALBERDINGK® AC 2433 VP	68.90	Alberdingk Boley
9	BYK-024	0.15	BYK-Chemie
10	BYK-349	0.18	BYK-Chemie
11	Asconium-142DA**	1.90	Ascotec
12	AMP 90 or DMEA**	0.15	Angus Chemie / Evonik
13	Ascotran-H10	0.60	Ascotec
14	Tafigel PUR 61 solution (20 % PUR 61: 20 % Dowanol DPM: 60 % water)	0.60	Münzing Chemie
Total		100.00	

* Premix pos. 8 + 9

** Premix pos. 11 & 12. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Corrosion Class: C4-I long / C5-I middle (@100µm DFT)

Latest update
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page 33 of 60

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Test Features

FP 2433-02 anti-corrosion coatings, spray application
PVC approx. 11%, solids approx. 53%

Feature	Test Conditions	Test Results
Water absorption [%]		approx. 3.0
Water vapor permeability [g/m ² per day]	wet cup method	approx. 29

Test Results (after 672 hours salt-spray test)





Formulation Proposal

FP 2003-06

anti-corrosion coatings, PVC approx. 11%
solids approx. 50%

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	6.70		
2	Edaplan 490	1.20	dispersing agent	Münzing Chemie
3	AMP 90	0.05	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	15.00	pigment	Kronos
Disperse with high shear rate for 10min, then proceed with pos. 6 – 14				
6	ALBERDINGK® AC 2003	64.00		Alberdingk Boley
7	BYK-024	0.10	defoamer	BYK Chemie
8	BYK-345	0.10	wetting agent	BYK Chemie
9	Water (deion.)	7.90		
10	AMP 90 or DMEA*	0.15	neutralizing agent	Angus Chemie / Evonik
11	Asconium-142DA*	1.90	corrosion inhibitor	Ascotec
12	Optifilm Enhancer 300	1.50	co-solvent	Eastman
13	Ascotran-H10	0.50	flash rust inhibitor	Ascotec
14	Tafigel PUR 60 solution (10% PUR 60:10% BG:80% water)	0.80	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 10 + 11.

Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Latest update
April 08, 2022

page 35 of 60

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Formulation Proposal

FP 2003-06

anti-corrosion coatings, PVC approx. 11%
solids approx. 50%





Formulation Proposal

FP 48-02

anti-corrosion coating, iron oxide red
PVC approx. 30%, solids approx. 54%

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® SC 48	40.00	acrylic dispersion	Alberdingk Boley
2	Water (deion.)	11.05		
3	Pigment preparation	41.50	see next page	
4	Optifilm Enhancer 300	1.00	co-solvent	Eastman
5	BYK-024	0.40	defoamer	BYK Chemie
6	BYK-349	0.10	substrate wetting agent	BYK Chemie
7	Ascotran H-10	0.50	flash rust inhibitor	Ascotec
8	Ammonia (25%)	0.80	neutralizing agent	
9	Resydrol AX 237 W/70 BG	4.00	epoxy-alkyd resin	Allnex
10	Borchi OXY-Coat 1101	0.05	drier	Borchers
11	Tafigel PUR 40	0.60	rheology modifier	Münzing Chemie
Total		100.00		

Adjust the pH value of the finalized paint with Ammonia to 8.5.

Corrosion Class: C4-I long / C5-I middle (@150µm DFT)



Formulation Proposal

FP 48-02

pigment preparation

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	7.00		
2	Edaplan 490	0.80	dispersing agent	Münzing Chemie
3	BYK-024	0.10	defoamer	BYK Chemie
4	Butyl Glycol (BG)	3.00	co-solvent	BASF
5	Bayferrox 130 M	9.00	pigment	Lanxess
6	Micro Talc AT 1	3.00	filler	Mondo Minerals
7	Calcilit Super	10.60	filler	Alpha Calcit
8	Heucophos ZPO	7.00	anti-corrosion pigment	Heubach
9	Heucorin RZ	1.00	anti-corrosion pigment	Heubach
Total		41.50		

Disperse with high shear rate for 10 min.



Formulation Proposal

FP 48-05

anti-corrosion coating, iron oxide red
PVC approx. 37%, solids approx. 56%

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	8.00		
2	Edaplan 490	1.20	dispersing agent	Münzing Chemie
3	AMP 90	0.02	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Bayferrox 130 M	5.00	pigment	Lanxess
6	Durcal 5	27.50	extender	Omya
Disperse with high shear rate for 10min, then proceed with pos. 7 – 16				
7	Water (deion.)	9.10		
8	ALBERDINGK® SC 48	43.90	acrylic dispersion	Alberdingk Boley
9	BYK-024	0.30	defoamer	BYK Chemie
10	Asconium-142DA*	2.00	corrosion inhibitor	Ascotec
11	AMP 90 or DMEA*	0.15	neutralizing agent	Angus Chemie / Evonik
12	Optifilm Enhancer 300	1.00	co-solvent	Eastman
13	BYK-349	0.13	wetting agent	BYK Chemie
14	Ascotran-H10	0.80	flash rust inhibitor	Ascotec
15	Tafigol PUR 61 (50% in Dowanol DPM)	0.80	rheology modifier	Münzing
Total		100.00		

* Premix pos. 10 + 11.

Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Corrosion Class: C4-I long / C5-I middle (@200µm DFT)

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page 39 of 60

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Formulation Proposal

FP 48-05

anti-corrosion coating, iron oxide red
PVC approx. 35%, solids approx. 56%

Formulation Proposal FP 48/05

Based on ALBERDINGK® SC 48
1440h NSST, ca. 170µm DFT

Formulation Proposal FP 48/05

Based on ALBERDINGK® SC 48
1440h NSST, ca. 350µm DFT





Formulation Proposal

FP 2403-70

anti corrosion, RAL 1007 daffodil yellow
solids approx. 47%, PVC approx. 9%

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
2	Water (deion.)*	4.95		
3	Dowanol DPM*	2.50	co-solvent	Dow Chemical
4	Pigment preparation	20.00		see below
5	BYK-024	0.20	defoamer	BYK Chemie
6	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
7	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
8	Ascotran-H10	0.50	flash rust inhibitor	Ascotec
9	Tego Wet KL 245	0.20	wetting agent	Evonik
10	OPTIFLO-T 1000	0.60	rheology modifier	BYK Chemie
Total		100.00		

* Premix pos. 2 + 3

** Premix pos. 6 + 7. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

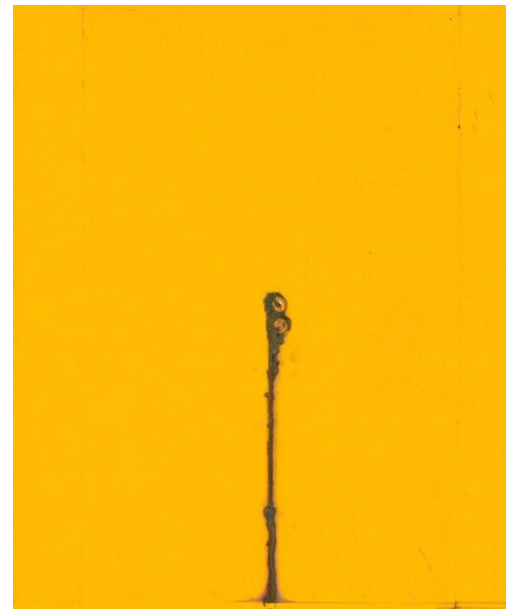


Pigment preparation RAL 1007 Daffodil yellow / Narzissengelb

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	16.40		
2	Borchi Gen 1750	4.65	dispersing agent	Borchers
3	AMP 90	0.05	neutralizing agent	Angus Chemie
4	BYK-024	0.40	defoamer	BYK Chemie
5	Brufablend E 27015 yellow	65.00	pigment	Bruchsaler Farben
6	Tafigel PUR 40	0.20	rheology modifier	Münzing Chemie
7	Water (deion.)	13.30		
Total		100.00		



FP 2403/70:
Pos. 2 = Edaplan 490



FP 2403/70:
Pos. 2 = Borchi Gen 1750

100µm DFT
1440h NSST
Brufablend Paste 20%
RAL 1007



Formulation Proposal

FP 2403-71

anti corrosion, RAL 3001 signal red
solids approx. 44%, PVC approx. 9%

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
2	Water (deion.)*	4.85		
3	Dowanol DPM*	2.50	co-solvent	Dow Chemical
4	Pigment preparation	20.00		<i>see below</i>
5	BYK-024	0.20	defoamer	BYK Chemie
6	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
7	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
8	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
9	Tego Wet KL 245	0.20	wetting agent	Evonik
10	OPTIFLO-T 1000	0.60	rheology modifier	BYK Chemie
Total		100.00		

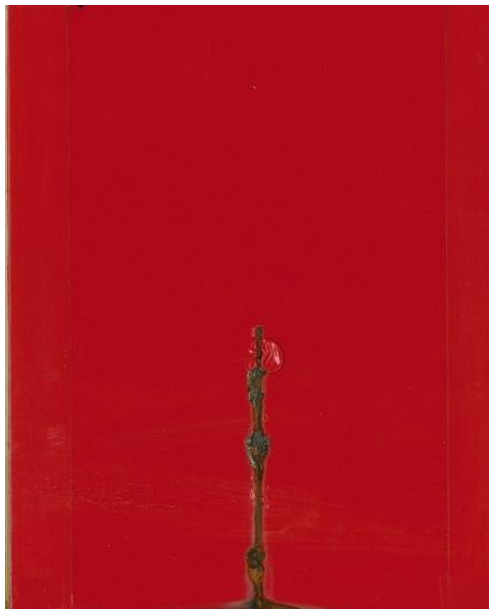
* Premix pos. 2 + 3

** Premix pos. 6 + 7. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

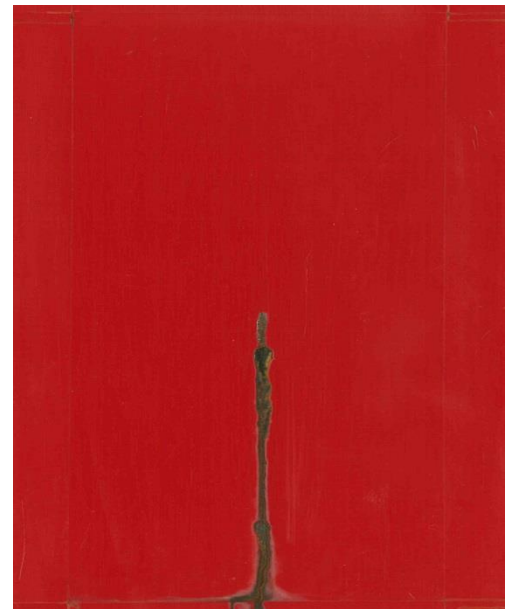


Pigment preparation RAL 3001 Signal red / Signalrot

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	18.70		
2	Borchi Gen 1750	4.65	dispersing agent	Borchers
3	AMP 90	0.05	neutralizing agent	Angus Chemie
4	BYK-024	0.40	defoamer	BYK Chemie
5	Brufablend E 27488 S red	55.00	pigment	Bruchsaler Farben
6	Tafigel PUR 40	0.10	rheology modifier	Münzing Chemie
7	Water (deion.)	21.10		
Total		100.00		



FP 2403/71:
Pos. 2 = Edaplan 490



FP 2403/71:
Pos. 2 = Borchi Gen 1750

100µm DFT
1440h NSST
Brufablend Paste 20%
RAL 3001



Formulation Proposal

FP 2403-72

anti corrosion, RAL 6011 reseda green
solids approx. 48%, PVC approx. 8%

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
2	Water (deion.)*	4.85		
3	Dowanol DPM*	2.50	co-solvent	Dow Chemical
4	Pigment preparation	20.00		see below
5	BYK-024	0.20	defoamer	BYK Chemie
6	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
7	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
8	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
9	Tego Wet KL 245	0.20	wetting agent	Evonik
10	OPTIFLO-T 1000	0.60	rheology modifier	BYK Chemie
Total		100.00		

* Premix pos. 2 + 3

** Premix pos. 6 + 7. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

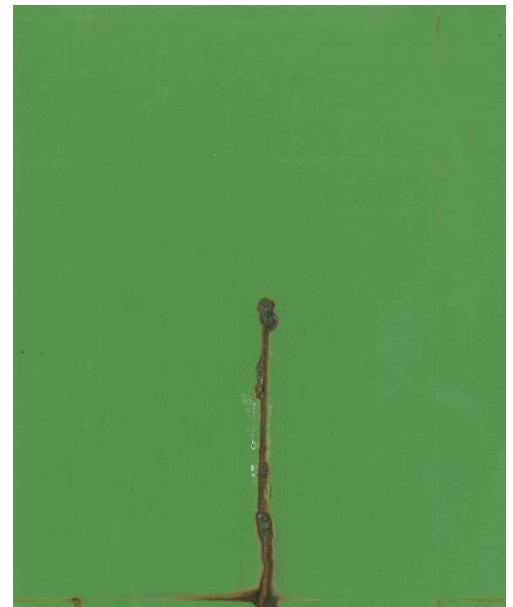


Pigment preparation RAL 6011 Reseda green / Resedagrün

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	14.00		
2	Borchi Gen 1750	4.65	dispersing agent	Borchers
3	AMP 90	0.05	neutralizing agent	Angus Chemie
4	BYK-024	0.40	defoamer	BYK Chemie
5	Brufablend E 26971 green	70.00	pigment	Bruchsaler Farben
6	Tafigel PUR 40	0.20	rheology modifier	Münzing Chemie
7	Water (deion.)	10.70		
Total		100.00		



FP 2403/72:
Pos. 2 = Edaplan 490



FP 2403/72:
Pos. 2 = Borchi Gen 1750

100µm DFT
1440h NSST
Brufablend Paste 20%
RAL 6011



Formulation Proposal

FP 2403-73

anti corrosion, RAL 9005 jet black
solids approx. 38

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® AC 2403	74.30	acrylic dispersion	Alberdingk Boley
2	Water (deion.)*	12.00		
3	Dowanol DPM*	2.50	co-solvent	Dow Chemical
4	Pigment preparation	7.50		see below
5	BYK-024	0.10	defoamer	BYK Chemie
6	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
7	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
8	Tego Wet KL 245	0.20	wetting agent	Evonik
9	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
10	Tego Glide 494	0.15	surface additive	Evonik
11	Tafigel PUR 45	0.50	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 2 + 3

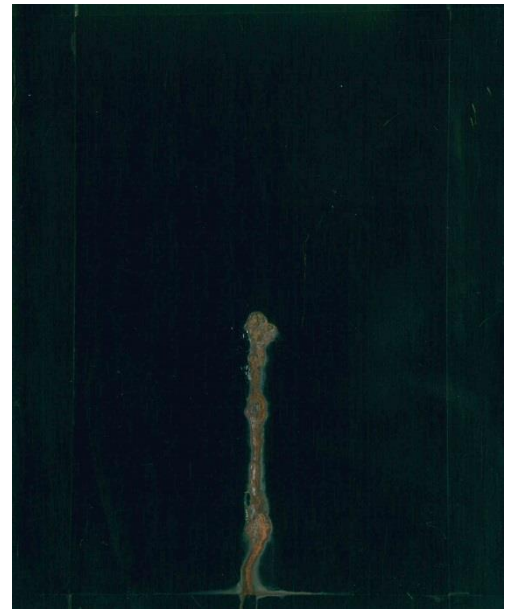
** Premix pos. 6 + 7. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Pigment preparation RAL 9005 jet black

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	68.85		
2	Borchi Gen 1750	15.00	dispersing agent	Borchers
3	Ammonia (25%)	0.65	neutralizing agent	
4	Agitan 351	0.50	defoamer	Münzing Chemie
5	Color black FW 200	15.00	pigment	Orion Engineered Carbons
Total		100.00		



FP 2403/73:
Pos. 2 = Edaplan 490



FP 2403/73:
Pos. 2 = Borchi Gen 1750

approx. 110µm DFT
1440h NSST
FW 200 Paste 7.5%
RAL 9005



Formulation Proposal

FP 2403-74

anti corrosion, RAL 5011 steel blue
solids approx. 48%, PVC approx. 8%

Pos.	Raw Material	Amount	Product	Supplier
1	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
2	Water (deion.)*	4.85		
3	Dowanol DPM*	2.50	co-solvent	Dow Chemical
4	Pigment preparation	20.00		see below
5	BYK-028	0.20	defoamer	BYK Chemie
6	Asconium-142DA**	2.00	corrosion inhibitor	Ascotec
7	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
8	Ascotran-H10	0.60	flash rust inhibitor	Ascotec
9	Tego Wet KL 245	0.20	wetting agent	Evonik
10	OPTIFLO-T 1000	0.60	rheology modifier	BYK Chemie
Total		100.00		

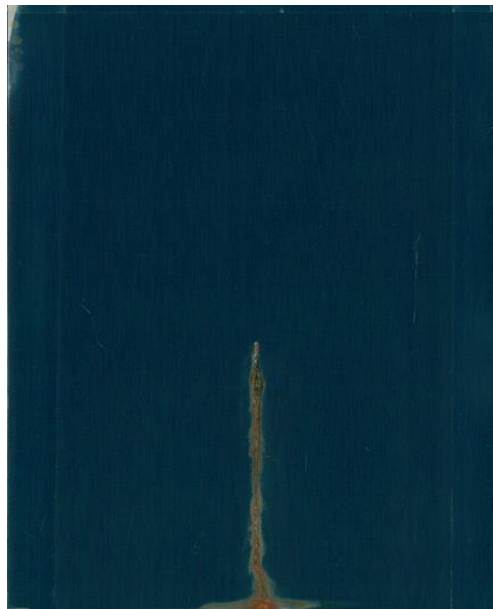
* Premix pos. 2 + 3

** Premix pos. 6 + 7. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.



Pigment preparation RAL 5011 steel blue

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	14.00		
2	Borchi Gen 1750	4.65	dispersing agent	Borchers
3	AMP 90	0.05	neutralizing agent	Angus Chemie
4	BYK-028	0.20	defoamer	BYK Chemie
5	Brufablend E 27352 blue	70.00	pigment	Bruchsaler Farben
6	Tafigel PUR 40	0.20	rheology modifier	Münzing Chemie
7	Water (deion.)	10.90		
Total		100.00		



FP 2403/74:
Pos. 2 = Edaplan 490



FP 2403/74:
Pos. 2 = Borchi Gen 1750

approx. 100µm DFT
1440h NSST
Brufablend Paste 20%
RAL 5011



Formulation Proposal

FP 2403-76

anti-corrosion coatings, PVC approx. 11%, **nitrite-free** solids approx. 50%, spray application, recommended nozzle size > 2.0mm

Pos.	Raw Material	Amount	Product	Supplier
1	Water (deion.)	2.50		
2	Borchi Gen 1750	1.00	dispersing agent	Borchers
3	AMP 90	0.02	neutralizing agent	Angus Chemie
4	BYK-024	0.10	defoamer	BYK Chemie
5	Kronos 2190	15.00	pigment	Kronos
Disperse with high shear rate for 10min, then proceed with pos. 6 – 15				
6	Water (deion.)*	6.20		
7	Dowanol DPM*	2.50	co-solvent	Dow Chemical
8	ALBERDINGK® AC 2403	68.90	acrylic dispersion	Alberdingk Boley
9	BYK-024	0.15	defoamer	BYK Chemie
10	BYK-349	0.18	wetting agent	BYK Chemie
11	Asconium-142DA**	1.90	corrosion inhibitor	Ascotec
12	AMP 90 or DMEA**	0.15	neutralizing agent	Angus Chemie / Evonik
13	Habikor FRI 1001	0.80	flash rust inhibitor	Habich GmbH
14	Tafigel PUR 61 solution (20% PUR 61: 20% Dowanol DPM:60% water)	0.60	rheology modifier	Münzing Chemie
Total		100.00		

* Premix pos. 6 + 7

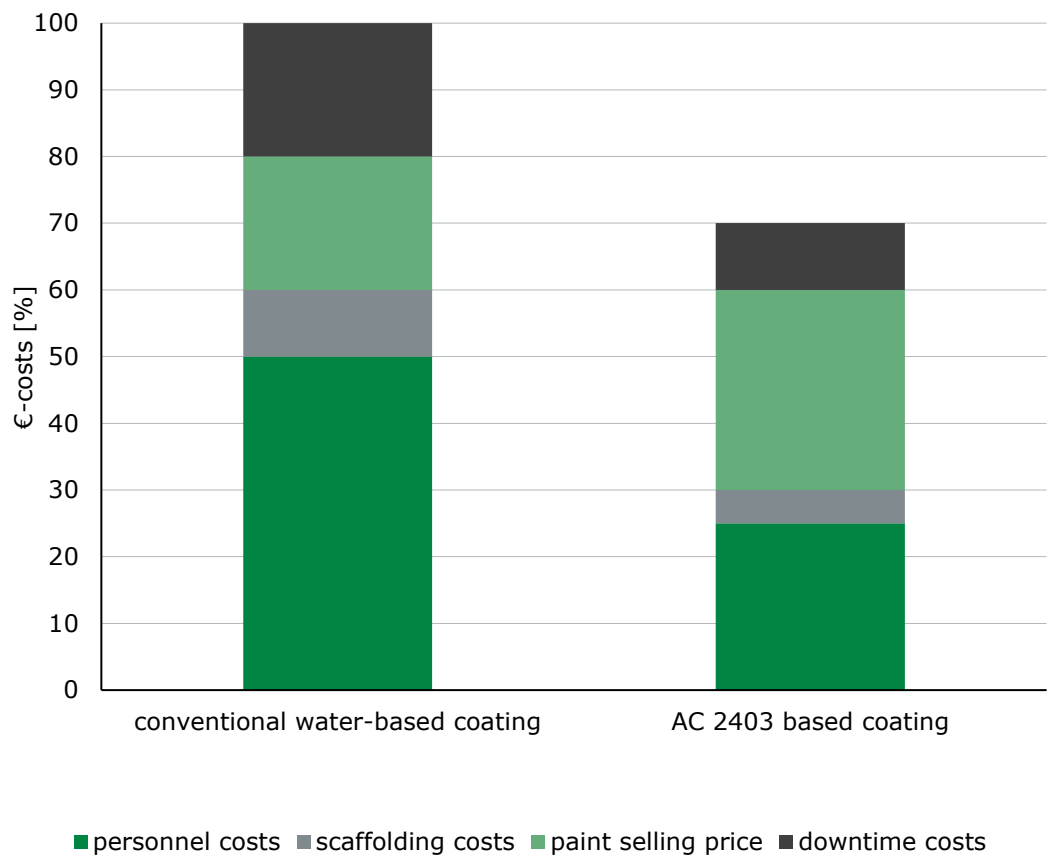
** Premix pos. 11 + 12. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.

Conclusion

Today's challenge of Paint producers are cost efficient solutions at a very high level of quality.

ALBERDINGK® AC 2403 is a prominent example for a high quality dispersion which combines all these advantages with the objective target of high corrosion protection performance at a maximum of efficiency.

Schematical cost calculation for a 1000m² corrosion protection renovation project:



ALBERDINGK® AC 2403 advantages at a glance:

- Less working hours, due to 1 coat system
- Less downtime, due to 1-coat system
- Reduced scaffolding costs
- Primer and topcoat are combined in one single coating
- Higher security due to a maximum of corrosion protection performance
- Eco-friendly (water-based, without Zn²⁺-ions), low VOC
- Less weight due to lower dry film thickness

External test results ALBERDINGK® AC 2403

Test report-no. 16/10794/01		 Partner for progress
<u>Kiwa GmbH, Voltastraße 5, 13355 Berlin</u> Alberdingk Boley GmbH Düsseldorfer Straße 53 47829 Krefeld		Kiwa GmbH MPA Berlin-Brandenburg Volta Street 5 13355 Berlin Tel. +49 (0)30 467 761-0 Fax +49 (0)30 467 761-10 Web: www.kiwa.de E-Mail: InfoKiwaBerlin@kiwa.de
Project:	Corrosion protection testing of a coating system on steel	
Production facility:	Krefeld	
Date of order:	November the 28 th , 2016	
Content of testing:	<ul style="list-style-type: none"> • Condensation testing according to EN ISO 6270-1:2002-02 • Corrosion protection testing at artificial atmospheres – salt spray testing according to EN ISO 7253:2002-04 – "Paints and varnishes - Determination of resistance to neutral salt spray (fog)" • Determination of resistance to humid atmospheres containing sulfur dioxide according to EN ISO 3231:1998-02 	
Description of samples:	coated steel plates (dimensions: 100 x 200 x 2 mm ²) → coating: aqueous coating "FP 2403/47" (2 layers) on the basis of Alberdingk® AC 2403 steel plates: hot-rolled steel (steel grade S235JR, material number 1.0038)	
Number of samples:	12	
Sampling:	by an employee of the client	
Date of sample receipt:	December the 1 st , 2016	
Test period:	December 2016 – February 2017	
Berlin, 02.03.2017		
By proxy		
 Robert Stascheit, M.Sc. Testing		
		
Publication of Inspection and Test reports, even in extracts, allusions to examinations for spot announcements and the converting of contents of the reports require the revocable written acceptance of the Kiwa GmbH for each individual case.		
Page 1 of 6 Doc: 17/86912	Managing Director: Prof. Dr. Roland Hüttl	District Court Hamburg HRB 130568, Tax.-No. 47/736/00886

Test report-no. 16/10794/01

1 General

Kiwa GmbH, MPA Berlin-Brandenburg, was commissioned by Alberdingk Boley GmbH to perform the corrosion protection testing at steel plates coated with the aqueous coating "FP 2403/47" on the basis of Alberdingk® AC 2403:

- Condensation testing according to EN ISO 6270-1:2002-02
- Corrosion protection testing at artificial atmospheres – salt spray testing according to EN ISO 7253:2002-04 – "Paints and varnishes - Determination of resistance to neutral salt spray (fog)"
- Determination of resistance to humid atmospheres containing sulfur dioxide according to EN ISO 3231:1998-02

1.1 Sample / body material

A number of hot-rolled steel plates (steel grade S235JR, material number 1.0038) with dimensions of 100 x 200 x 2 mm³ were spray-coated after a surface preparation according to EN ISO 12944-6 (blast-cleaned, surface roughness "middle", grade of surface quality min. Sa 2 ½) with the aqueous coating "FP 2403/47" on the basis of Alberdingk® AC 2403 with total layer thickness of ca. 230 – 270 µm (2 layers).

Test report-no. 16/10794/01

2 Testing and results

The testing conditions for the corrosion protection testing were as follows:

Testing parameters – Continuous condensation:

Specification: EN ISO 6270-1:2002-02 "Paints and varnishes - Determination of resistance to humidity - Part 1: Continuous condensation"
Testing equipment: water quench with coverage for the steel plates
Testing temperature: 38 °C
Test period: 1440 h
Number of specimen: 3 Plates

Testing parameters – Resistance to neutral salt spray (fog):

Specification: EN ISO 7253:2002-04 "Paints and varnishes - Determination of resistance to neutral salt spray (fog)"
Testing equipment: salt spray test chamber, System Weiss, Type SSC 450
Testing temperature: 35 °C
Test period: 1440 h
Test solution: sodium chloride, 5 % at demineralized water
Number of specimen: 3 plates

Prior to the exposition to the salt spray fog the coating was scratched with a width of 1 mm down to the metallic underground.

Testing parameters – Resistance to humid atmospheres containing sulfur dioxide:

Specification: EN ISO 3231:1998-02 "Paints and varnishes - Determination of resistance to humid atmospheres containing sulfur dioxide"
Testing equipment: salt spray test chamber, System Weiss, Type SSC 450
Testing temperature: 35 °C
Test period: 30 cycles (720 h)
Test solution: sulfur dioxide
Number of specimen: 3 Plates

Test report-no. 16/10794/01

Assessment:

After completion of the artificial ageing all transformations, cracks and blisters at the surface were assessed. The characteristic values according to EN ISO 4628:2004-01 ff. "Paints and varnishes - Valuation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 1: General introduction and designation system" were used for the assessment:

*Part 1: Assessment of the intensity of the transformations (gloss, color, swelling, shrinking)
0 = no changes and 5 = critical changes*

*Part 2: Assessment of the degree of blistering
0(S0) = no blisters and 5(S5) = many and big blisters (maximum size)*

*Part 4: Assessment of the degree of cracking
0(S0) = no cracks and 5(S5) = many and wide cracks*

*Part 5: Assessment of the degree of flaking
0(S0) = no flaking and 5(S5) = high degree of surface flaking*

Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect at the scratch, declaration in mm

Furthermore, the coating thickness has been determined according to EN ISO 2808:2007, chapter 5.5 "Paints and varnishes - Determination of film thickness".

The adhesive tensile strength of the stressed test specimens was performed with an adhesive tensile testing device according to ISO 4624:08-2003 "Paints and varnishes - Pull-off test for adhesion" with the following testing parameters:

Testing device:	firm Freundl, Type Easy M 2000
Testing speed:	50 N/s
Diameter of the stamp:	36 mm
Adhesive:	2-K epoxy resin adhesive

The adhesive tensile strength was performed at each steel plate. Three single values were determined for each aging type.

For comparison, the adhesive tensile strength was also determined at the unstressed reference test specimens.

Results of the reference test specimens:

9.7 MPa (appearance of fracture: 90 % cohesive in the coating, 10 % failure of the adhesive)

Test report-no. 16/10794/01

At the following table the results after performing the performance tests are summed up.

Kind of transformation	ageing		
	continuous condensation	resistance to neutral salt spray	resistance to humid atmospheres containing sulfur dioxide
exposition time	1440 h	1440 h	720 h (30 cycles)
State before exposure time			
coating thickness	266 µm	259 µm	260 µm
Kind of transformation after completion of the exposition time			
gloss	0	0	0
color	0	0*	0*
swelling	1	0	0
shrinking	0	0	0
degree of cracking	0(S0)	0(S0)	0(S0)
degree of blistering	0(S0)	0(S0)	0(S0)
degree of blistering	m 0 / g 0	m 0 / g 0	m 0 / g 0
degree of corrosion	Ri 0	Ri 0	Ri 0
delamination and corrosion around a scribe or other artificial defect	-	W _b < 0.1 mm	-
adhesive tensile strength	10.0 MPa	8.6 MPa	10.5 MPa
appearance of fracture	90 % cohesive in the coating, 10 % failure of the adhesive	90 % cohesive in the coating, 10 % failure of the adhesive	90 % cohesive in the coating, 10 % failure of the adhesive

* slight yellow coloring due to draining rusty water

The results were photo documented and are exemplified at representative specimen at the appendix.

Test report-no. 16/10794/01
Appendix

Appendix

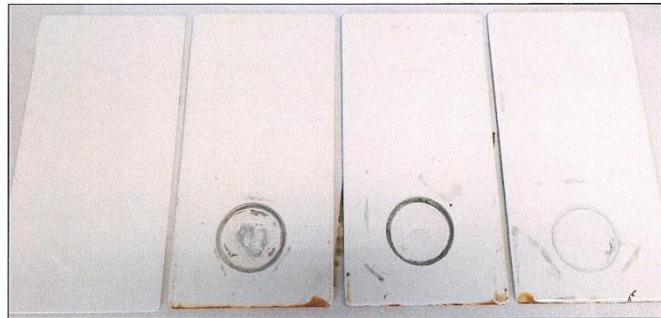


Figure 1: comparison before and after the continuous condensation

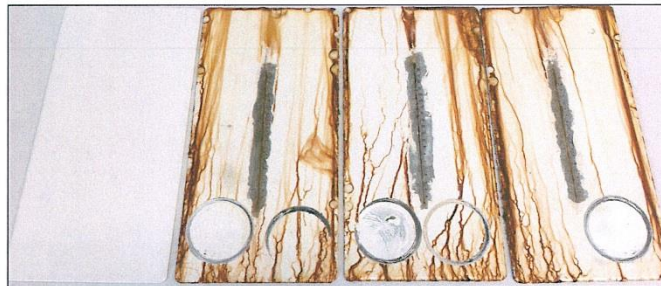


Figure 2: comparison before and after the neutral salt spray (fog)
brown colored due to draining rusty water because of an insufficient sealing of the edges, the coating is not affected

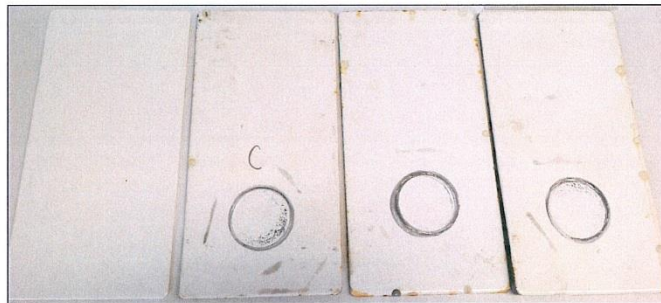


Figure 3: comparison before and after the testing of resistance to humid atmospheres containing sulfur dioxide

17/86912
Page 6 of 6

Photos: pixabay.com



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