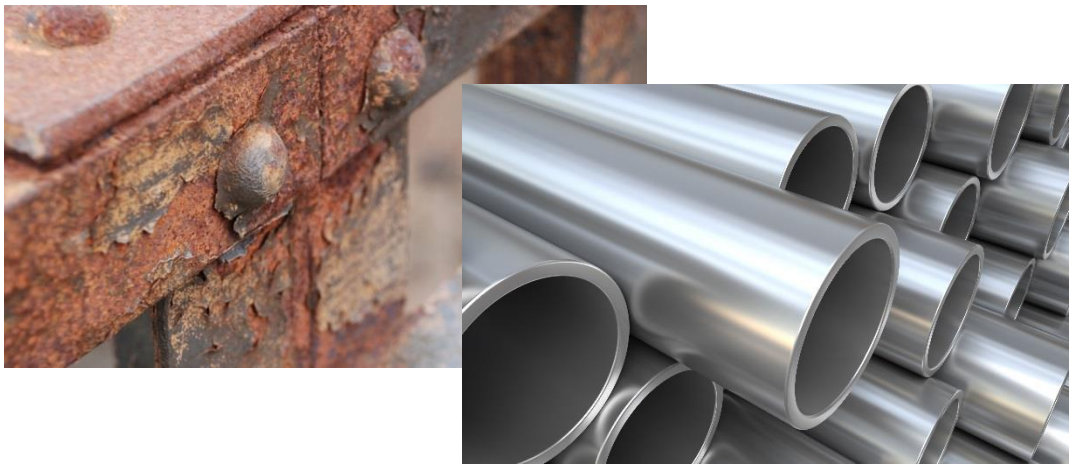
ALBERDINGK BOLEY

Technology Information



# Metal & Corrosion Protection Coatings

ALBERDINGK BOLEY

# Content



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## ALBERDINGK BOLEY in a nutshell

| | | |
|---|---|---|
|  <br>Leading international manufacturer of environmentally friendly water-based binders and oils with unique properties to refine, refurbish, bind and protect multiple types of substrates |  <br>Medium sized, privately owned company<br><br>> a partner to our customers for more than 250 years |  <br>> 500 employees |
|  <br>Dynamic,<br>Innovative<br>and flexible<br><br>Pioneers in biobased polymer dispersions |  <br>Dispersions:<br>Acrylic, Vinyl acetate, Polyurethane and hybrid dispersions<br><br>Oils:<br>Linseed oil,<br>Castor oil,<br>Derivatives |  <br>Locations:<br><br>• Krefeld, Germany<br>• Kerpen, Germany<br>• Leuna, Germany<br>• Treviso, Italy<br>• Congleton, UK<br>• Greensboro, USA<br>• Shenzhen, China<br>• Zhuhai, China |

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



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## 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 |
| **Ren AC 8003** | 49.0-51.0 | 20-2,000 | 7.0-9.0 | 3 | Biobased version of AC 2003 |
| **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 |



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## 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 |
| **Ren AC 8003** | 49.0-51.0 | 20-2,000 | 7.0-9.0 | 3 | Biobased version of AC 2003 |
| **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 |
| **Ren AC 8403** | 46.0-48.0 | 200-2,000 | 8.0-9.0 | 20 | Biobased version of AC 2403 |
| **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 |



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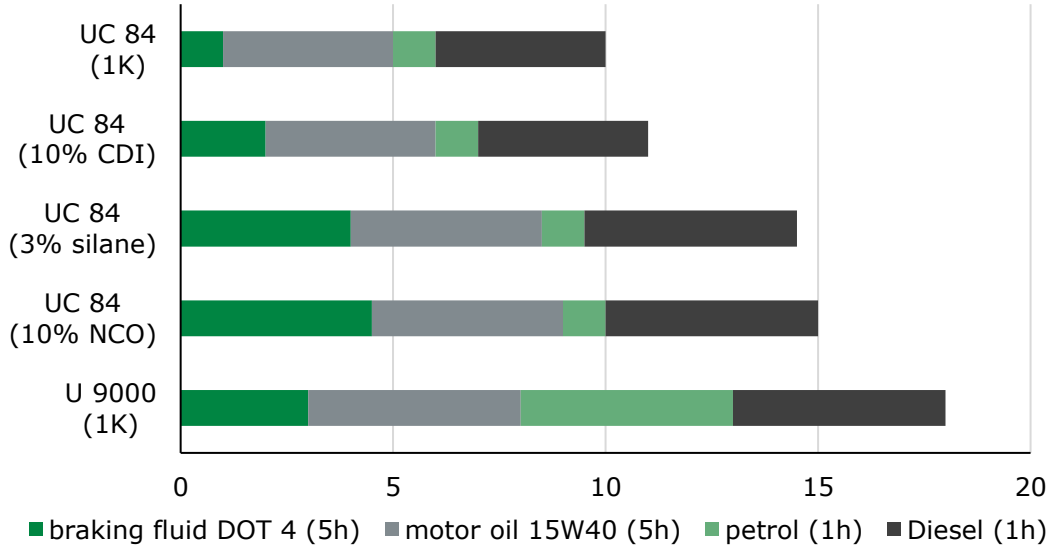
## Topcoats

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:**



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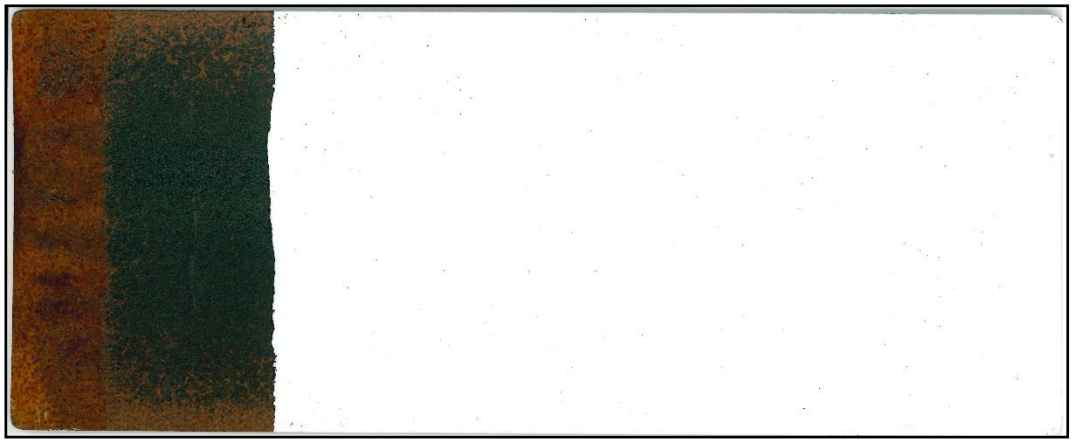
## Rust converter

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 |
| **Ren AC 8403** | 46.0-48.0 | 200-2,000 | 8.0-9.0 | 20 | Biobased version of AC 2403 |

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



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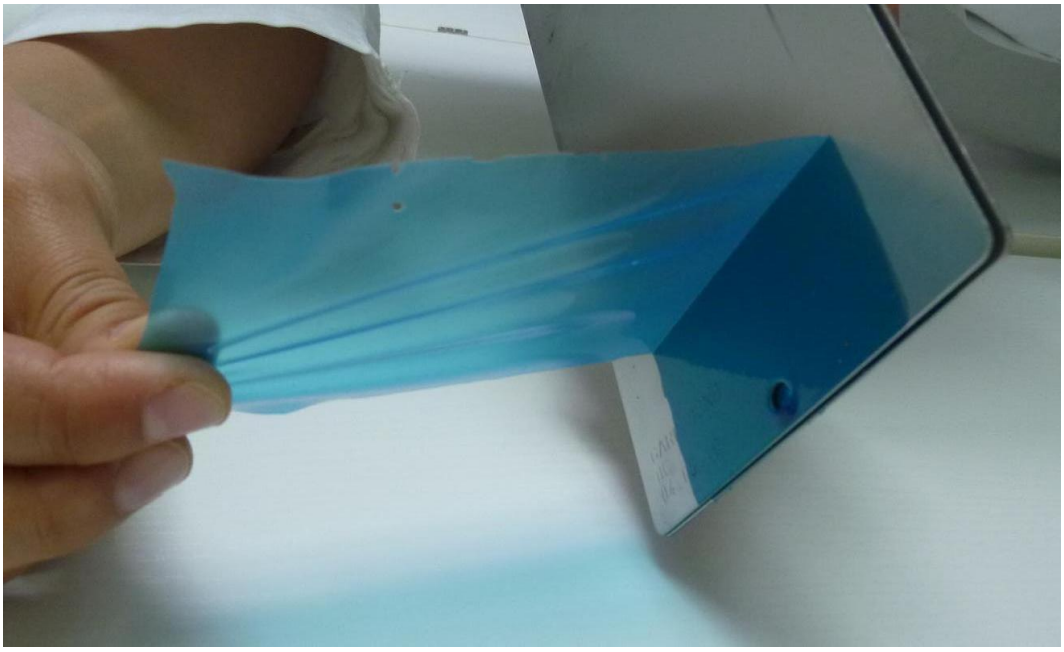
## Peelable coatings

**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 |
| **Ren AC 8003** | 49.0-51.0 | 20-2,000 | 7.0-9.0 | 3 | Biobased version of AC 2003 |





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## 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 |



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## Metal pre-treatement

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.



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## Chrome free metal pre-treatement

### 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 |
| **Ren AC 8403** | 46.0-48.0 | 200-2,000 | 8.0-9.0 | 20 | Biobased version of AC 2403 |
| **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 |



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## 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 |



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## 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.

| | | |
|---|---|---|
| $2\ Fe + O_2 + 2\ H_20$ | -> | $2\ Fe\ (OH)_2$ |
| $2\ Fe\ (OH)_2 + ½\ O_2 + H_2O$ | -> | $2\ Fe\ (OH)_3$ |
| $Fe\ (OH)_3$ | -> | $FeO(OH) + H_2O$ |
| $2\ FeO(OH) + O_2$ | -> | $Fe_2O_3 + H_2O$ |

Illustration of corrosion of iron with NaCl solution:

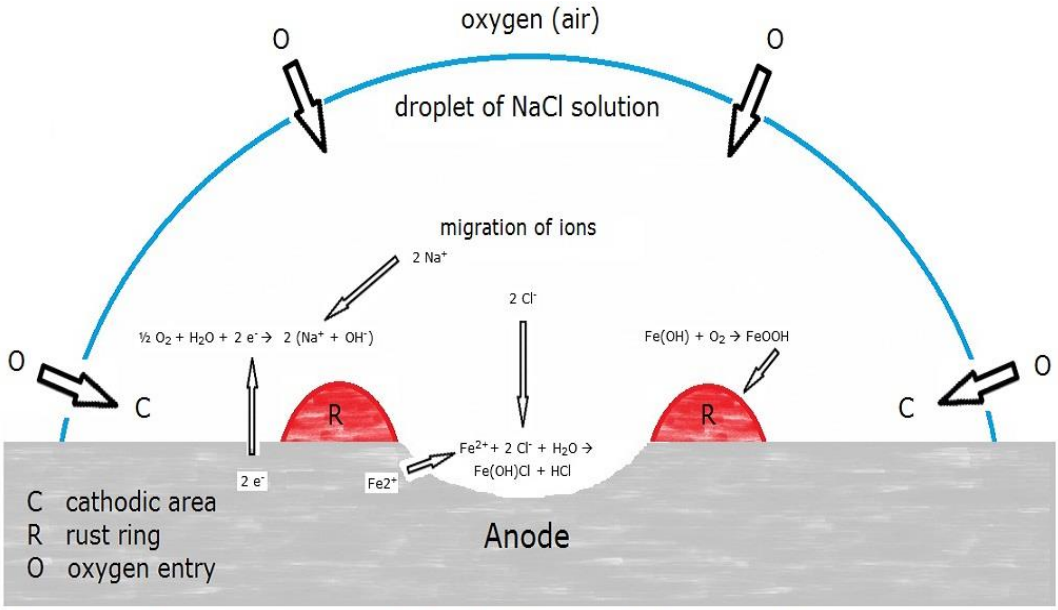


Illustration of corrosion on iron with NaCl solution (U. R. Evans model)



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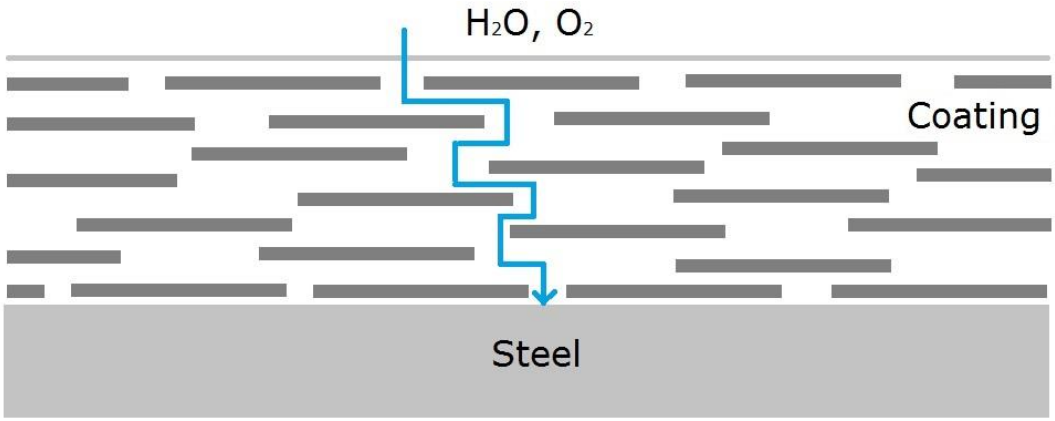
## Ways to protect metal?

**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 led (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.



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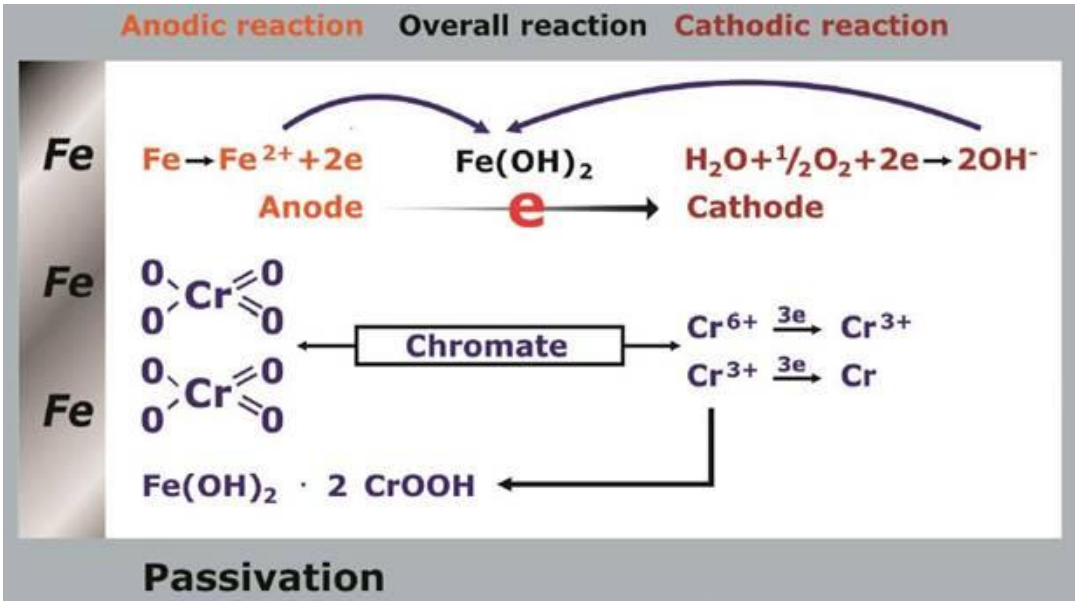


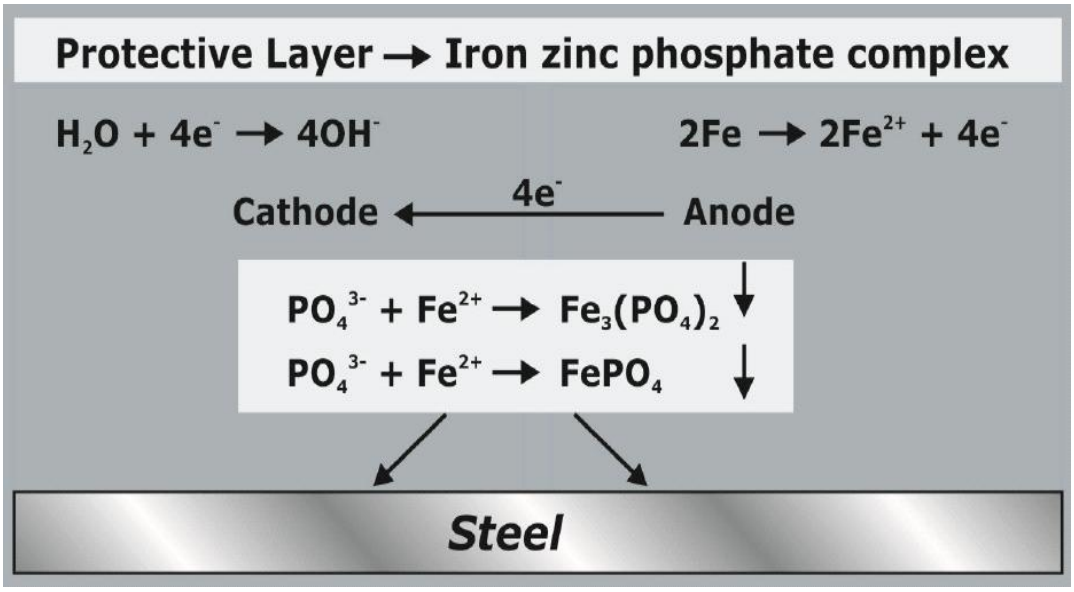


Source: Heubach



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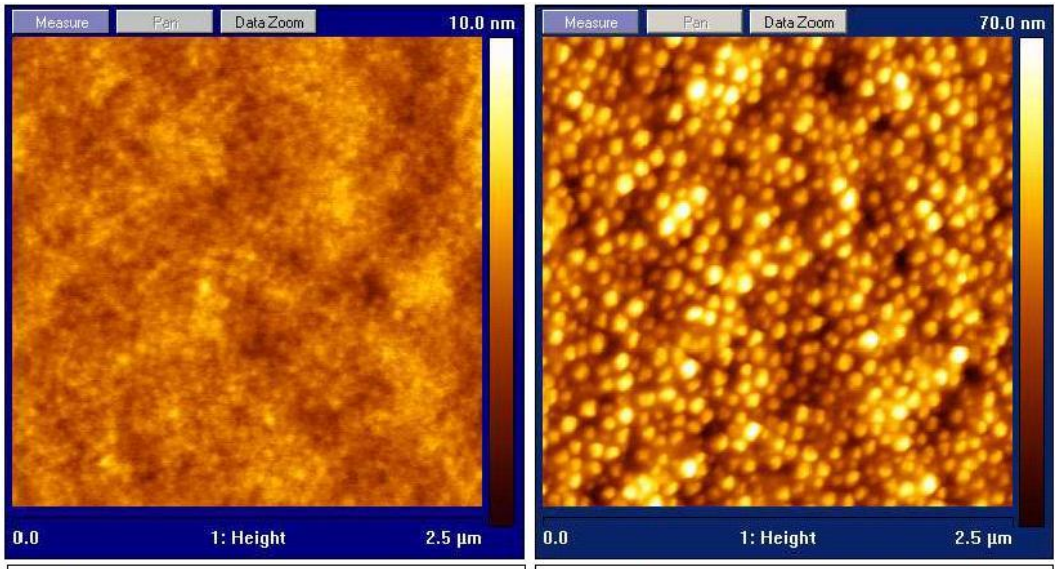
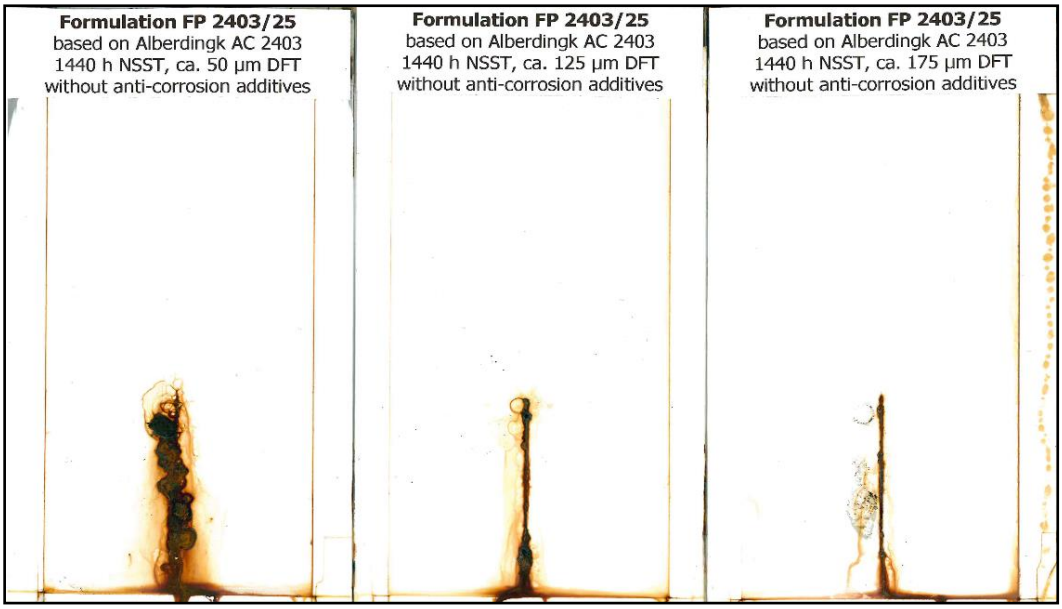
**Binders with water barrier effect due to extreme hydrophobic and compact polymer matrix:**

**ALBERDINGK® AC 2403**, 2K PU- and epoxy systems
Illustration of particle size of **ALBERDINGK® AC 2403** and a conventional multi-phase acrylic binder




Alberdingk AC 2403 – approx. 5 nm | Conventional „CS " Acrylic – approx. 50 nm



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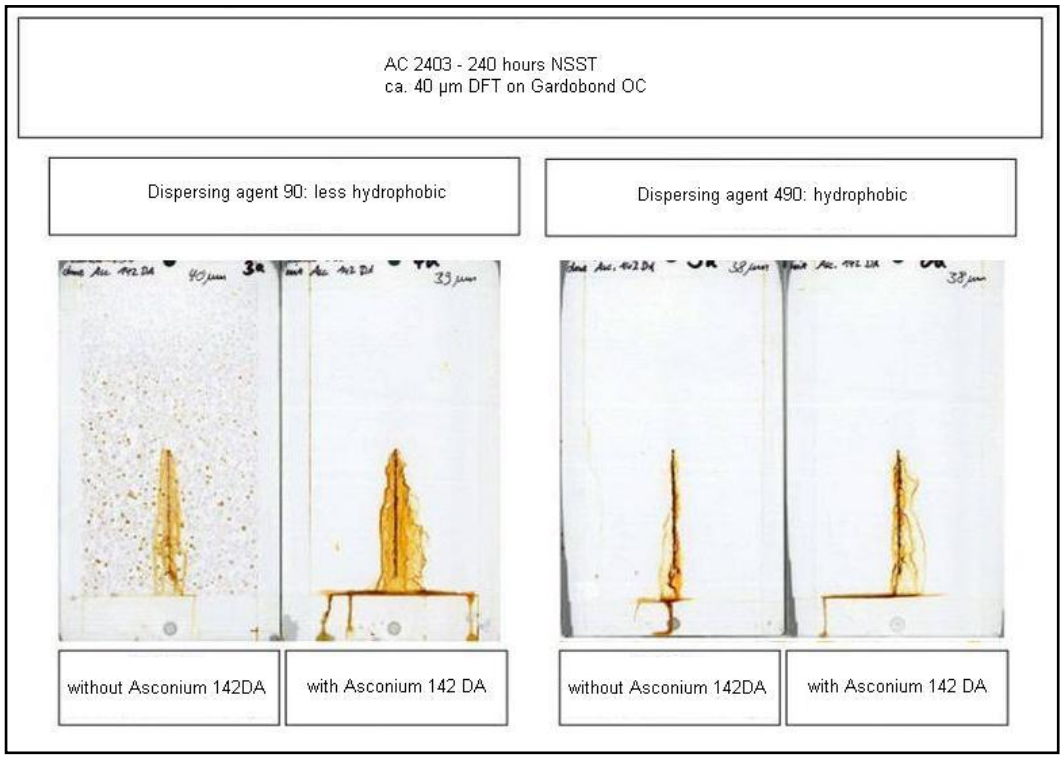
## Right choice of dispersing agents

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.



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## 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] | Conden-sation 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 | 200-40 | 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 | |



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## Important test standards for corrosion protection coatings:

| | |
|---|---|
| DIN EN ISO 12944-5 | Paints and varnishes – corrosion protection of steel structures by protective paint systems.<br>Part 5: Protective paint systems |
| DIN EN ISO 12944-6 | Paints and varnishes – corrosion protection of steel structures by protective paint systems.<br>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<br>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<br>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<br>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<br>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."



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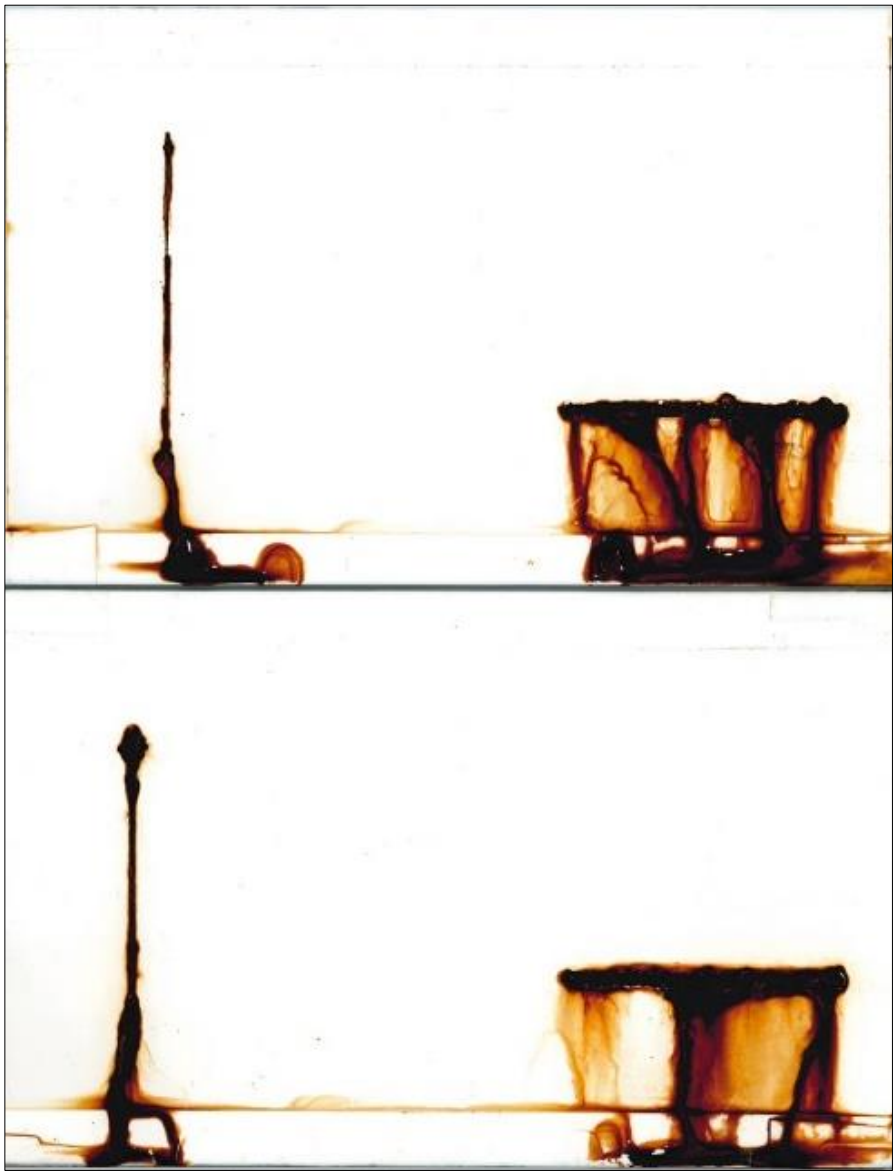
## New scribe according to DIN EN ISO 12944-6:2018

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)





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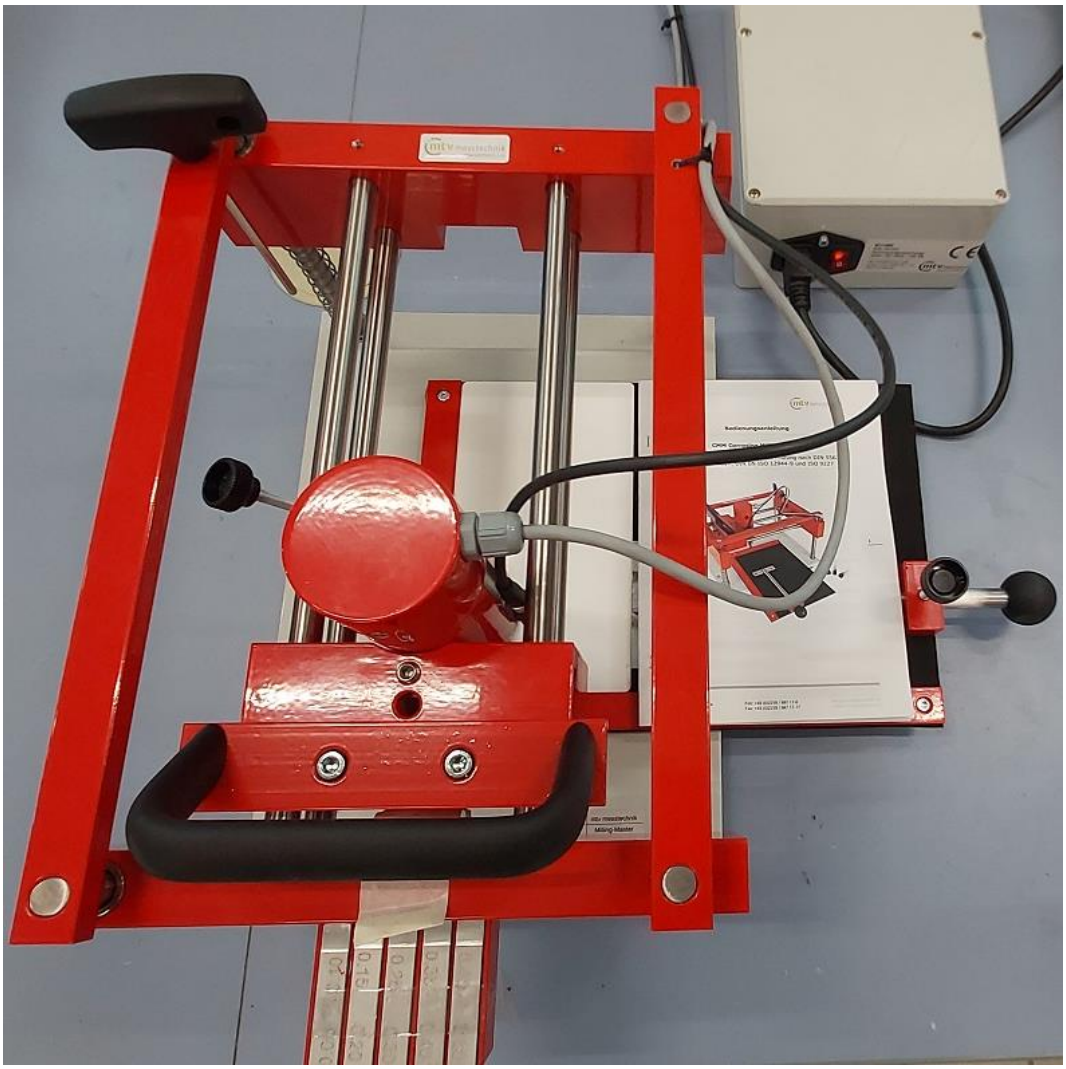
**MTV Milling Master**





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## Choices of Alberdingk binders for anti corrosion paints

- **ALBERDINGK® AC 2403 / Ren AC 8403**
- **ALBERDINGK® AC 2420**
- **ALBERDINGK® AC 2433**
- **ALBERDINGK® AC 2003 / Ren AC 8003**
- **ALBERDINGK® SC 48**

| Binder | Solids [%] | MFFT [°C] | Type of binder | Properties |
|---|---|---|---|---|
| **AC 2403 / Ren AC 8403** | 47 | 16 / 20 | 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 / Ren AC 8003** | 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 / Ren AC 8403** | multi phase | X | X | O | - |
| **AC 2420** | multi-phase | X | X | O | - |
| **AC 2433** | single phase | X | X | X | O |
| **AC 2003 / Ren AC 8003** | single phase | X | O | X | X |
| **SC 48** | single phase | - | O | X | X |

X = recommended

O = suitable

- = not suitable



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| 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 | 60µm | 1440 | C5-I long | 320 - 500µm |
| FP 2403/67 | 22 | Asconium | 80µm | 1440 | C5-I long | 320 – 500µm |
| FP 2403/75 | 35 | Asconium | 150µm | 720 | C5-I long | 320 – 500µm |
| FP 2420/10 | 11 | Asconium | 110µm | 1440 | C5-I long | 320 – 500µm |
| FP 2433/01 | 11 | Asconium | 100µm | 480 | C4 long / C5-I middle | 240 – 400µm |
| FP 2003/08 | 11 | Asconium | 110µm | 1440 | C5-I long | 320 - 500µm |
| FP 48/02 | 30 | Zn-pigments | 150µm | 720 | C4 long / C5-I middle | 240 – 400µm |
| FP 48/05 | 35 | Asconium | 200µm | 1000 | C4 long / C5-I middle | 240 – 400µm |

## 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 phos-phated steel | Alu-minum | 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 2420/10 | 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 2003/08 | 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



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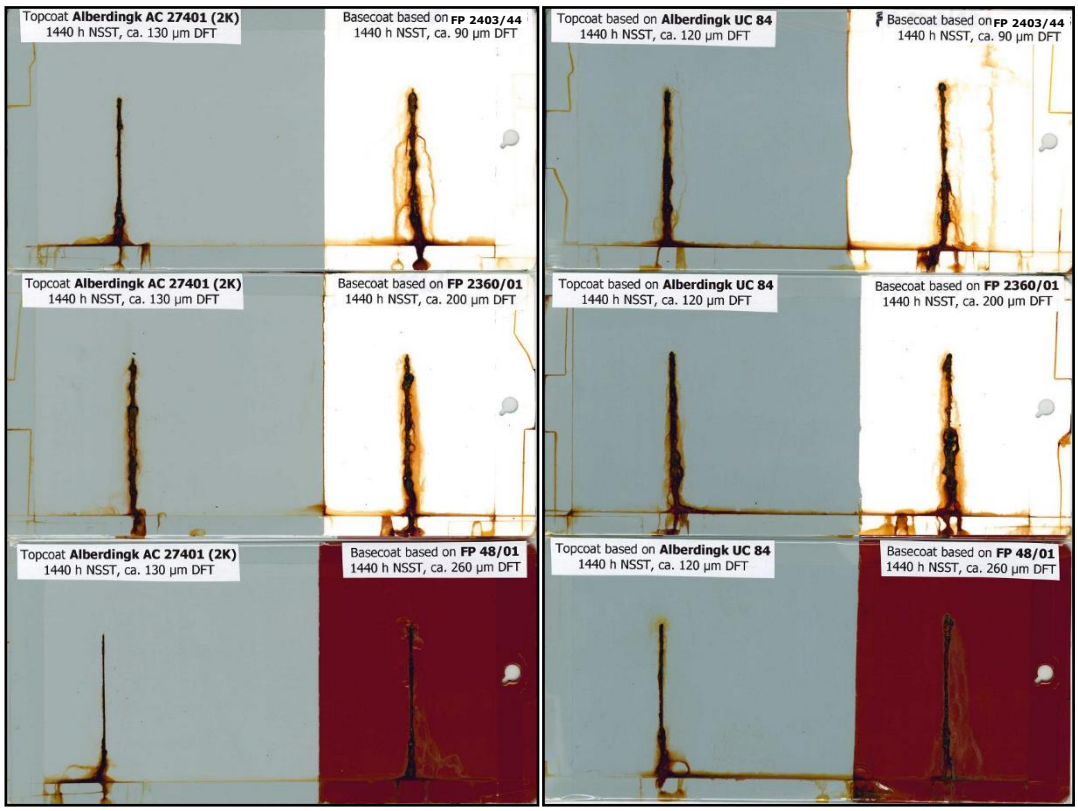
## Multi-layer systems

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** |



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## 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<br>or Borchi Gen 1750 | 1.00 | dispersing agent | Münzing Chemie<br>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<br>(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**



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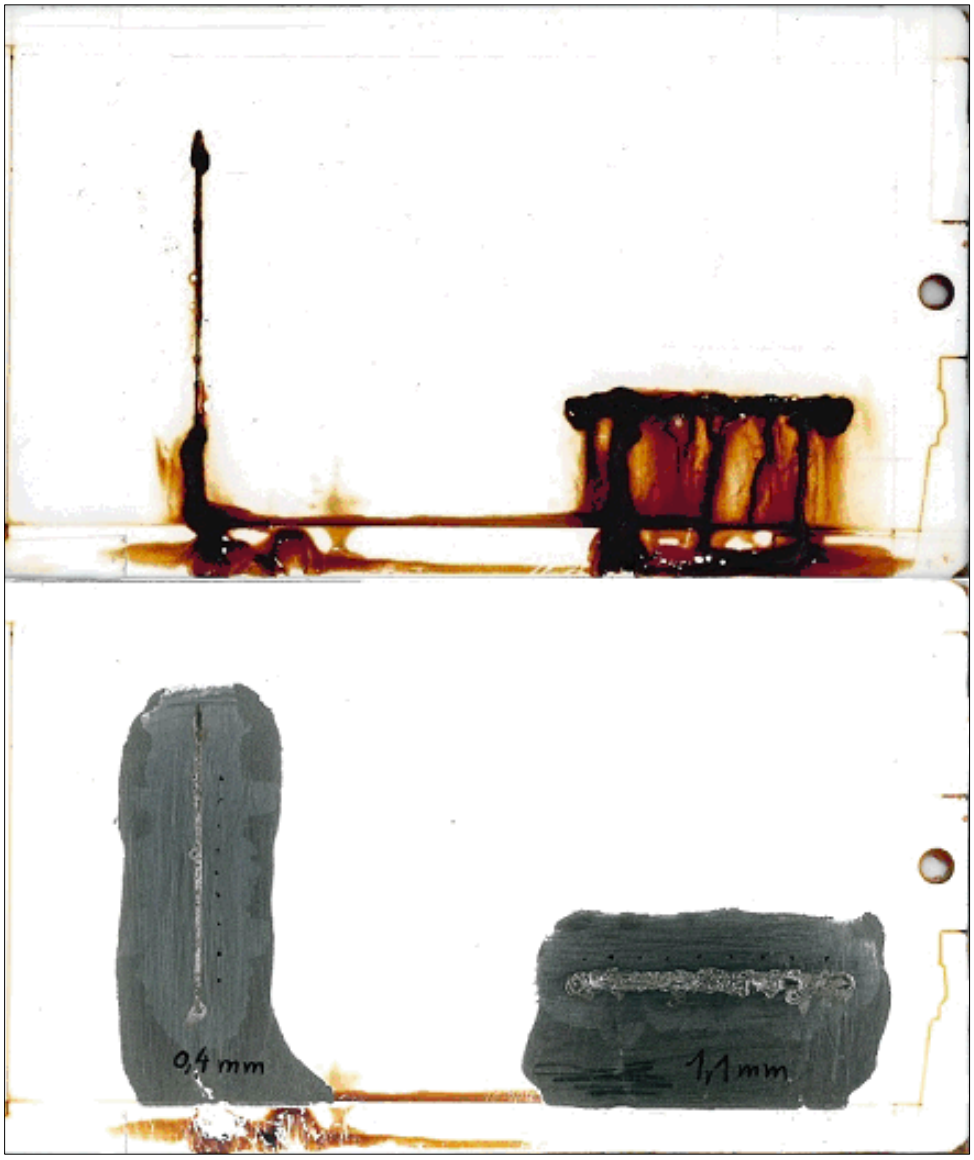
## Test Results (Gardobond OC panel, DFT 100-109 µm, 1440 hours NSST)

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)



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## 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)



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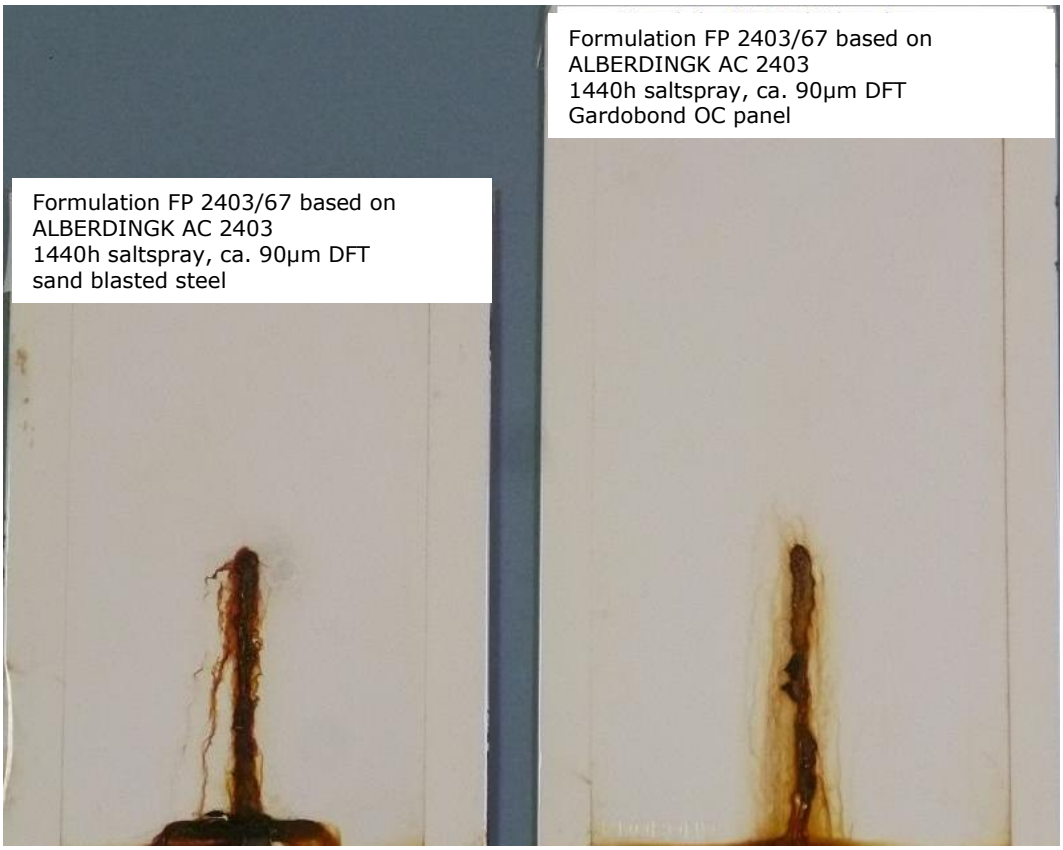
## Test Results (after 1440 hours salt-spray test)

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/m² per day] | wet cup method | approx. 29 |



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## 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.



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## Formulation Proposal

FP 2420-10 anti-corrosion coatings, PVC approx. 11%, solids approx. 50%

| Pos. | Raw Material | Amount | Product | Supplier |
|---|---|---|---|---|
| 1 | Water (deion.) | 3.00 | | |
| 2 | Edaplan 490 | 1.00 | dispersing agent | Münzing Chemie |
| 3 | Ammonia (12,5%) | *Some drops* | 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.)* | 1.50 | | |
| 7 | Dowanol DPM* | 5.00 | co-solvent | Dow Chemical |
| **8** | **ALBERDINGK® AC 2420** | **68.90** | **acrylic dispersion** | **Alberdingk Boley** |
| 9 | BYK-024 | 0.15 | defoamer | BYK-Chemie |
| 10 | BYK-349 | 0.20 | wetting agent | BYK-Chemie |
| 11 | Asconium-142DA** | 1.90 | corrosion inhibitor | Ascotec |
| 12 | Water (deion.)** | 1.90 | | |
| 13 | DMEA** | 0.15 | neutralizing agent | Angus Chemie / Evonik |
| 14 | Ascotran-H10 | 0.80 | flash rust inhibitor | Ascotec |
| 15 | Tafigel PUR 61 solution (20 % PUR 61 : 20 % Dowanol DPM: 60 % water) | 0.30 | rheology modifier | Münzing Chemie |
| 16 | Tafigel PUR 41 | 0.10 | rheology modifier | Münzing Chemie |
| | **Total** | **100.00** | | |

* Premix pos. 6 + 7

** Premix pos. 11 - 13. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days.



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## Formulation Proposal

FP 2420-10 anti-corrosion coatings, PVC approx. 11%, solids approx. 50%

1440h NSST,
Gardobond OC panel,
approx. 110µm DFT



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## 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)



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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/m² per day] | wet cup method | approx. 29 |

## Test Results (after 672 hours salt-spray test)

Formulation FP 2433/02 based on
**ALBERDINGK® AC 2433 VP**
672h salt-spray, ca. 100µm DFT, 40°C drying



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## Formulation Proposal

FP 2003-08 anti-corrosion coating, PVC 11%, solids approx. 48%

| Pos. | Raw Material | Amount | Product | Supplier |
|---|---|---|---|---|
| 1 | Water (deion.) | 5.10 | | |
| 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.) | 9.88 | | **Alberdingk Boley** |
| **7** | **Alberdingk® AC 2003** | **64.00** | defoamer | BYK Chemie |
| 8 | BYK-024 | 0.20 | wetting agent | BYK Chemie |
| 9 | BYK-349 | 0.15 | | |
| 10 | AMP 90 or DMEA* | 0.15 | neutralizing agent | Angus Chemie / Evonik |
| 11 | Asconium-142DA* | 1.90 | corrosion inhibitor | Ascotec |
| 12 | Dowanol DPM* | 1.50 | co-solvent | Eastman |
| 13 | Ascotran-H 10 | 0.80 | flash rust inhibitor | Ascotec |
| 14 | Tafigel PUR 41 | 0.20 | rheology modifier | Münzing Chemie |
| | **Total** | **100.00** | | |

* Premix pos. 10 - 12. Use the Asconium 142DA / AMP 90 blend within 1 day or the Asconium 142DA / DMEA blend within 5 days

Drain time DIN 6 mm cup: approx. 35 seconds



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## Formulation Proposal

FP 2003-08 anti-corrosion coating, PVC 11%, solids approx. 48%




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## 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)



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## 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.



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## 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 | Tafigel 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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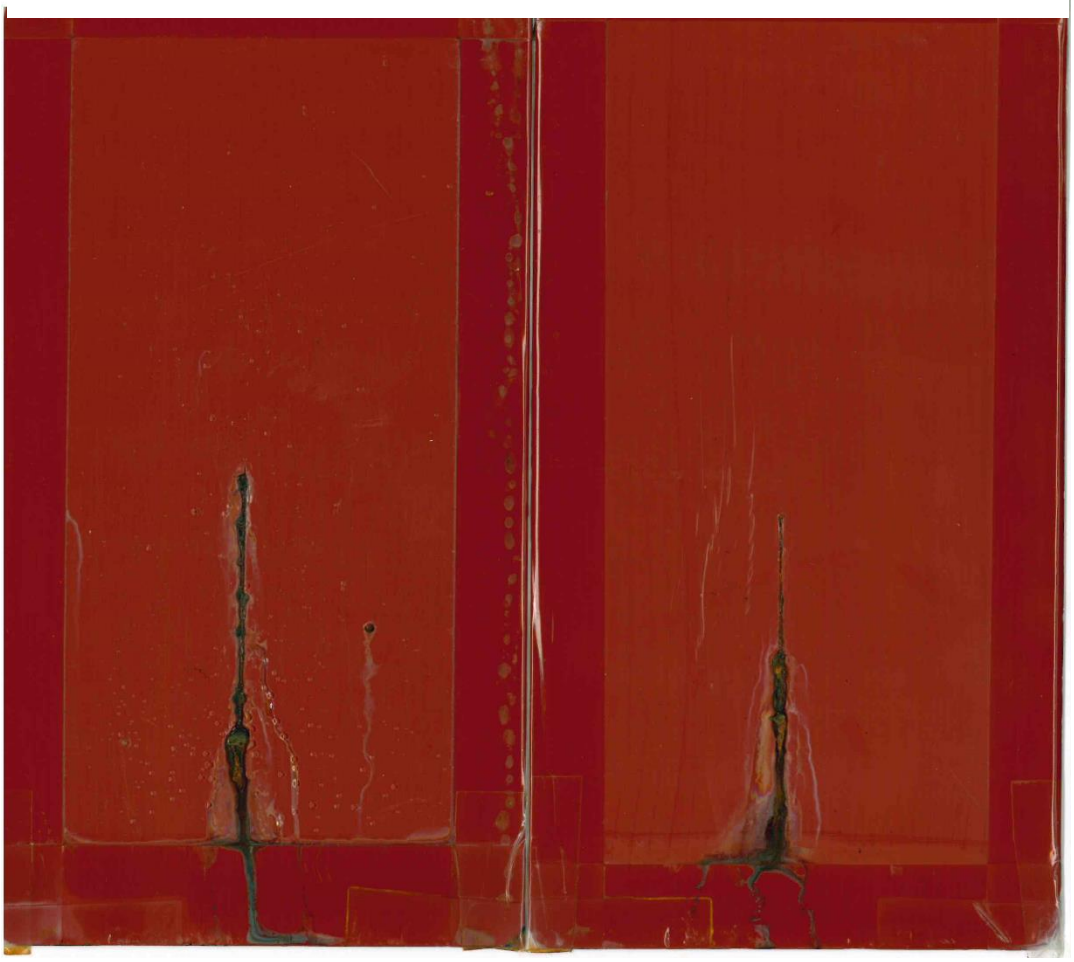
## Formulation Proposal

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





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## 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.



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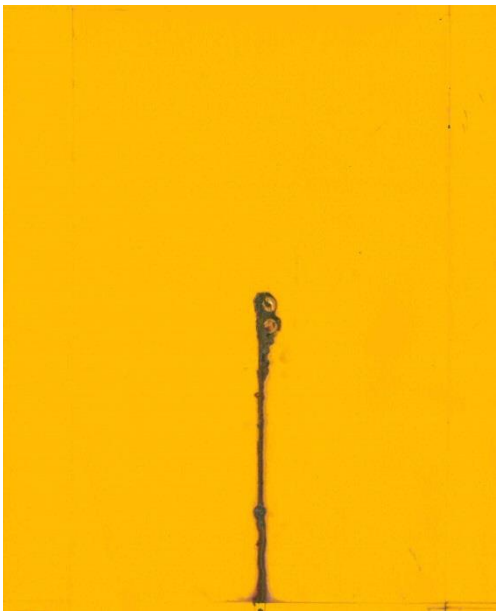
Pigment preparation RAL 1007 Daffodil yellow / Narzissengelb

| 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



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## 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 | | *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.



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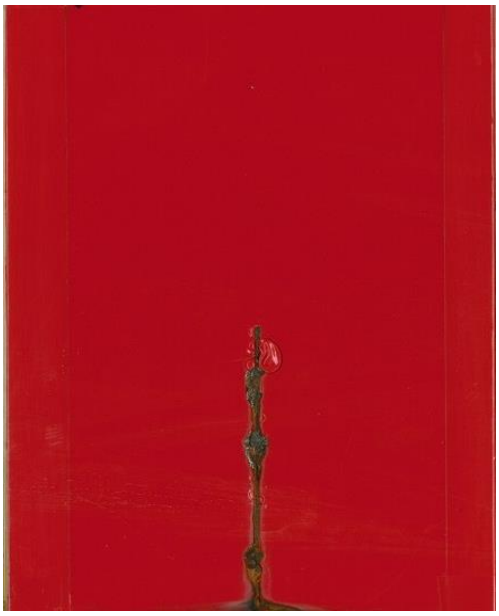
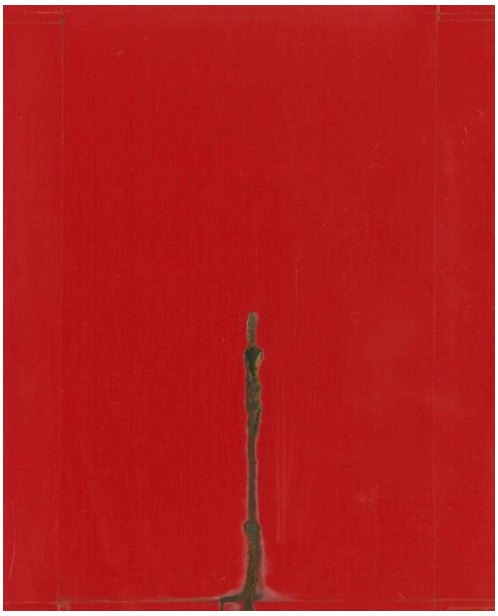
Pigment preparation RAL 3001 Signal red / Signalrot

| 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



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ALBERDINGK BOLEY

## 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.



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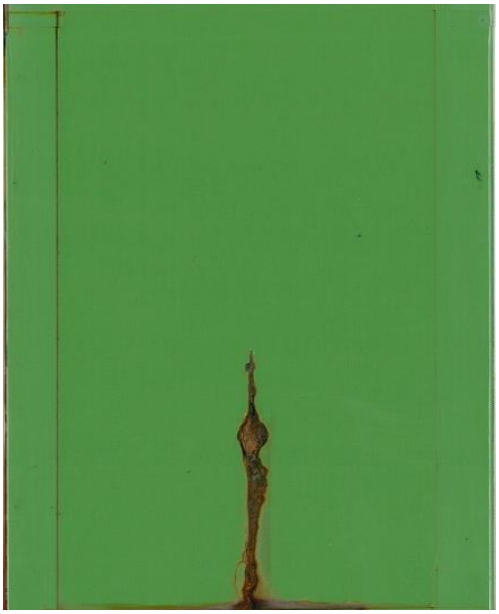
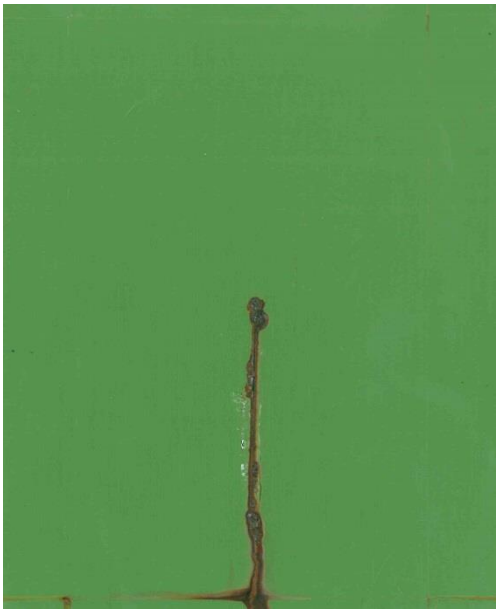
Pigment preparation RAL 6011 Reseda green / Resedagrün

| 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



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ALBERDINGK BOLEY

## 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.



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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



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## 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.



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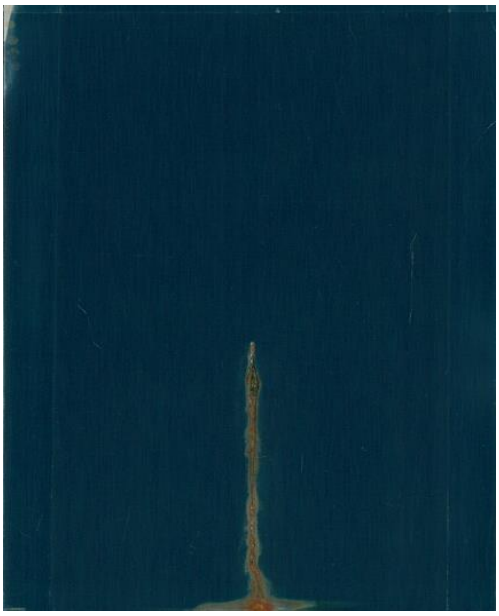
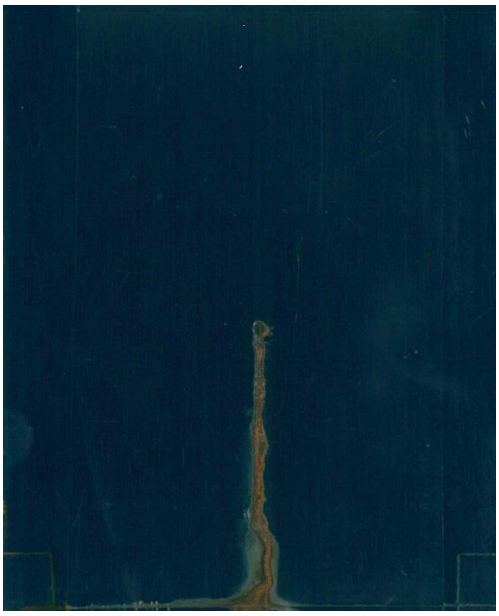
Pigment preparation RAL 5011 steel blue

| 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



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## 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 | Habicor 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.



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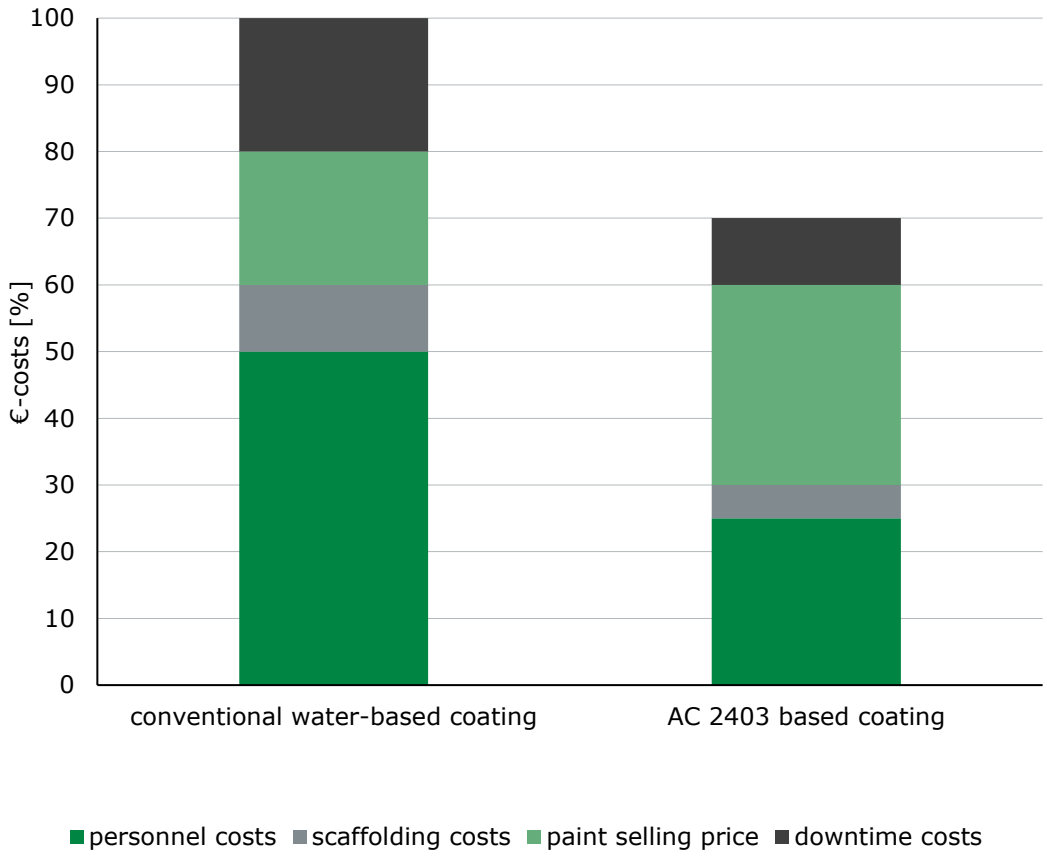
## Conclusion

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 $Zn^{2+}$-ions), low VOC
- Less weight due to lower dry film thickness



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# External test results ALBERDINGK® AC 2403

kiwa
Partner for progress

**Test report-no. 16/10794/01**

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Düsseldorfer Straße 53
47829 Krefeld

| | |
|---|---|
| Project: | Corrosion protection testing of a coating system on steel |
| Production facility: | Krefeld |
| Date of order: | November the 28th, 2016 |
| Content of testing: | • Condensation testing according to EN ISO 6270-1:2002-02<br>• 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)"<br>• 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 mm³)<br>→ coating: aqueous coating "FP 2403/47" (2 layers) on the basis of Alberdingk® AC 2403<br>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 1st, 2016 |
| Test period: | December 2016 – February 2017 |

Berlin, 02.03.2017

By proxy

Kiwa GmbH kiwa

Robert Stascheit, M.Sc.
Testing





Managing Director:
Prof. Dr. Roland Hüttl

District Court Hamburg
HRB 130568,
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**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).





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## 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 |

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**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)

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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.

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Appendix

## Appendix

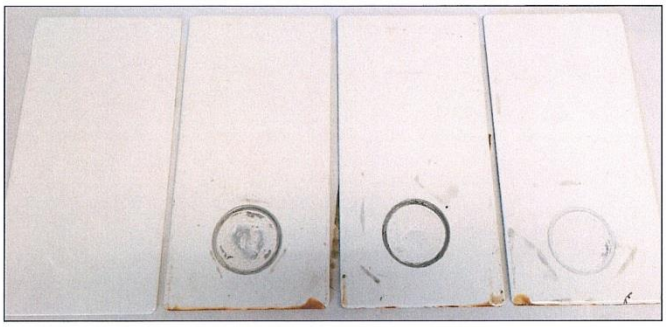

Figure 1: comparison before and after the continuous condensation

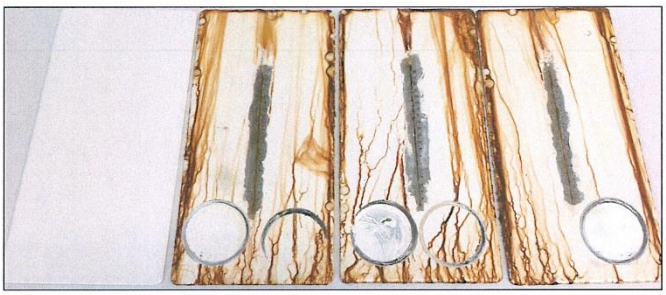

Figure 2: comparison before and after the neutral salt spray (fog)
*brown colored due to draining rusty water because of an insufficient sealing of the edges, the coating is not affected*

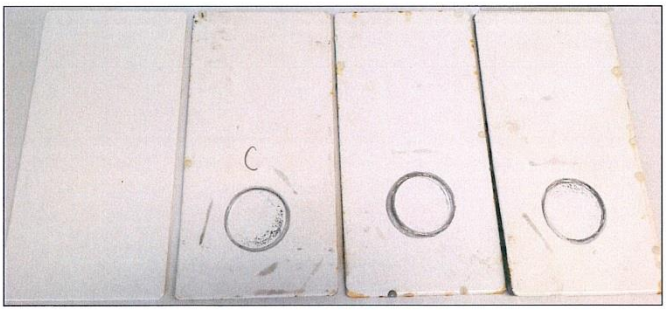

Figure 3: comparison before and after the testing of resistance to humid atmospheres containing sulfur dioxide

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