Paints and Coatings

pcc

More than Chemistry

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The high quality and chemical purity of PCC Group products guarantees stability and repeatability of production processes for our customers.

Introduction

We provide professional, high quality additives for the paint and coating industry.

One of PCC Group's objectives is to solve problems that occur in the formulation of paints and coatings. We offer technical support for all of our customers, no matter how large or small. Thanks to the use of our additives and PCC Group's technical support, we can provide optimal solutions to our customers from the paint and coating industry.

Paints

Many structures around us in our everyday life are coated with a proper type paint. The main reasons for using these coatings are decorative function and surface protection.

Coating products have a long history and modern coatings have many functions. The fundamental components of a typical coating product include polymer resin, pigments and fillers, as well as a dispersing medium.

The polymer resin is responsible for creating a homogenous coating which results in the permanent coverage of the coated surface. Pigments and fillers provide colour and suitable hiding power when creating non-transparent coats. A dispersing medium, which may be water or an organic solvent, is necessary to dissolve or dilute the resin and to disperse the pigment in order to make the product's manufacture and its application easier.

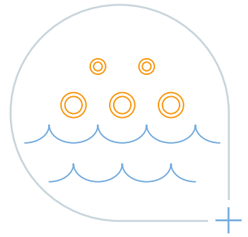
In order to assure the paint's proper stability and its functional properties, it is necessary to use auxiliary compounds. Their concentration is usually a seemingly insignificant 0.01-5.0% of the total formulation, but they have an strong influence on the applicability of paint products. The group of compounds include:

- dispersing and wetting agents
- rheology modifiers
- defoamers
- surface improving additives
- humectants
- other (biocides, gloss improving agents, adhesion improving agents, UV stabilisers and others).

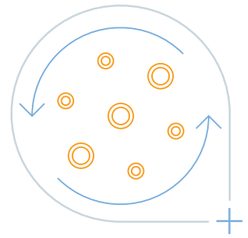
01 / WETTING AND DISPERSING AGENTS

Wetting and dispersing additives

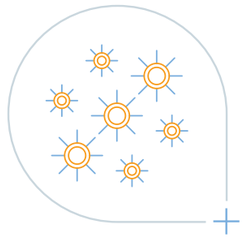
The best quality high gloss coats and high feature coverage power, with perfectly dispersed pigments, require an optimal size of pigment particles as well as long-term stabilisation of dispersed particles in the composition of the whole formulation. The pigment dispersing process, performed in order to create a stable, timely suspension with paint or ink formulations, consists of three stages:



Pigment wetting
all of the air is removed from the surface of pigment and from the space between the pigment, as well as from pigment agglomerates, and is replaced by the resin solution. The pigment/air interface is transformed into a solid/liquid (pigment/resin solution).



Pigment grinding (pigment milling)
through mechanical energy (impact and shear forces), the pigment agglomerates are broken up and disrupted into smaller particles and dispersed (uniformly distributed).



Stabilisation of the pigment suspension
pigment dispersion is stabilised by dispersing agents in order to prevent the formation of flocculates and agglomerates. The resultant suspension is stabilised due to the adsorption of the binder or dispersing agents on the pigment's surface.

The choice of a more efficient dispersing agent is strongly related to the chemical nature of the pigment (organic or inorganic pigments) and the type of applied resin.

PRODUCT NAME	ACTIVE, %	SOLVENT	DESCRIPTION	FEATURES AND BENEFITS	DOSAGE	WB	SB	IN	OR
EXOdis PC40	42 – 44	water	poliacrylic acid, sodium salt	standard dispersing agent for inorganic pigments, especially for TiO2 and mineral fillers, excellent dispersing properties	0.1-0.6% in coatings; 5.0-15.0% in pigment concentrate for inorganic pigments	●		●	
EXOdis PC40A	42 – 46	water	poliacrylic acid, ammonium salt	standard dispersing agent for inorganic pigments, especially for TiO2 and mineral fillers, excellent dispersing properties	0.1-0.6% in coatings; 5.0-15.0% in pigment concentrate for inorganic pigments	●		●	
EXOdis PC540i	38 – 42	water	acrylic copolymer, sodium salt solution	hydrophobized dispersing agent for inorganic pigments, especially for TiO2 and mineral fillers, improves water resistance	0.1-1.5% in coatings	●		●	
EXOdis PC540P	min. 90	water	acrylic copolymer, sodium salt solution	hydrophobized dispersing agent for inorganic pigments, especially for TiO2 and mineral fillers, improves water resistance	0.1-0.5% in coatings	●		●	
EXOdis PC540A	24 – 26	water	acrylic copolymer, ammonium salt solution	hydrophobized dispersing agent for inorganic pigments, especially for TiO2 and mineral fillers, improves water resistance	0.2 - 2.0% in coatings	●		●	
EXOdis PC105	49 – 51	water	mixture of W&D agents with anionic character	in pigments concentrates wetting and dispersing agent for inorganic pigments mainly, in WB/ SB coatings to improve colour acceptance	5.0-10.0% active in pigment concentrate for inorganic pigments	●		●	
EXOdis PC185	min. 99	–	mixture of W&D agents	Wetting agent for inorganic pigments and fillers in white paints, excellent synergy with polyacrylates	0.1 – 0.5 % in coatings	●		○	○
EXOdis PC416	88 – 91	water	nonionic wetting and dispersing agent with pigment affinic groups	in WB pigments concentrates wetting and dispersing agent for organic pigment and carbon black, dedicated for POS and in-plant colourant; product provides excellent tinting strength and colour stability of colourant	5.0-30.0% active in pigment concentrate for organic pigments and carbon blacks	●			●
EXOdis PC417	min. 99	–	phosphate ester with pigment affinic groups	in WB pigments concentrates wetting and dispersing agent for organic pigment and carbon black, dedicated for POS and in-plant colourants; product provides excellent tinting strength and colour stability of colourant	5.0-30.0% active in pigment concentrate for organic pigments and carbon blacks	●		○	●
EXOdis PC418	min. 97.5	–	phosphate ester with pigment affinic groups, alkylamonium salt	in WB pigments concentrates wetting and dispersing agent for organic pigment and carbon black, dedicated for POS and in-plant colourants; product provides excellent tinting strength and colour stability of colourant	5.0-30.0% active in pigment concentrate for organic pigments and carbon blacks	●		○	●
EXOdis PC480	79 – 81	water	phosphate ester with pigment affinic groups, alkylamonium salt	in WB pigments concentrates wetting and dispersing agent for organic pigment and carbon black, dedicated for POS and in-plant colourants; product provides excellent tinting strength and colour stability of colourant	5.0-30.0% active in pigment concentrate for organic pigments and carbon blacks	●		○	●
EXOdis PC440	88 – 91	water	nonionic, vegetable oils alkoxylated	in WB pigments concentrates wetting and dispersing agent for organic pigment, gives low viscosity and let for very high pigment load; in WB coatings to improve compatibility with organic pigments; product based on natural and sustainable feedstock	5.0-25.0% active in pigment concentrate for organic pigments; 0.1 ÷ 1.0% in ready-to-use paint formulation	●			●
EXOdis PC950	88 – 91	water	nonionic dispersant	in pigments concentrates wetting and dispersing agent for organic pigment, in WB coatings to improve compatibility with organic pigments wide compatibility with most of WB resins, for Uni POS colourants	5.0-25.0% in pigment concentrate for organic pigments; 0.1 ÷ 1.0% in ready-to-use paint formulation	●			●

PRODUCT NAME	ACTIVE, %	SOLVENT	DESCRIPTION	FEATURES AND BENEFITS	DOSAGE	WB	SB	IN	OR
ROKAdis 900	min. 98.5	–	anionic, phosphate ester of fatty alcohols ethoxylated	in pigments concentrates wetting and dispersing agent for inorganic pigments mainly, in WB/SB coatings to improve colour acceptance, in combination with PC950 for Uni POS colourants	5.0-10.0% active in pigment concentrate for inorganic pigments	●		●	
EXOdis PC800	78 – 82	water	mixture of W&D agents	in pigments concentrates universal wetting and dispersing agent for inorganic and organic pigments, provides very good compability with WB and SB coatings; for production of Uni POS colourants; product based on natural and sustainable feedstock	5.0-10.0% active in pigment concentrate for inorganic pigments 5.0-25.0% active in pigment concentrate for organic pigments	●		●	●
EXOdis PC250	34 - 36	water	mixture of surface-active polymers	In pigments concentrates wetting and dispersing agent for carbon blacks and organic pigments; especially recommended for resin-containing colourants	1.0% - 5.0 % in resin-containing pigment concentrates 5.0-25.0 % active in pigment concentrate for organic pigments	●			●
EXOdis PC220	min. 99	–	polyether copolymer	dispersing agent for organic pigments and carbon black in SB systems especially for high and medium polarity systems	1.0% - 10% in coatings		●		●
EXOdis PC230	min. 97	–	phosphate ester	specifically designed for dispersing and stabilising inorganic particle dispersions in SB systems, especially for high and medium polarity systems; also recommended as dipersing agent for pigments concentrates in polyols for PU systems	5.0-10.0% active in pigment concentrate for inorganic pigments		●	●	

● highly recommended
○ suitable

WB - waterborne
SB- solventborne

IN - inorganic pigments
OR - organic pigments

EXOdis PC540i – new hydrophobic polymeric dispersing agent for water-borne coating systems

Key features:

- 40% solution of hydrophobic anionic dispersant in water
- APEO-free
- VOC-free
- for WB Acrylic 1K anticorrosion matt/gloss
- for Inorganic pigments and fillers

Key benefits:

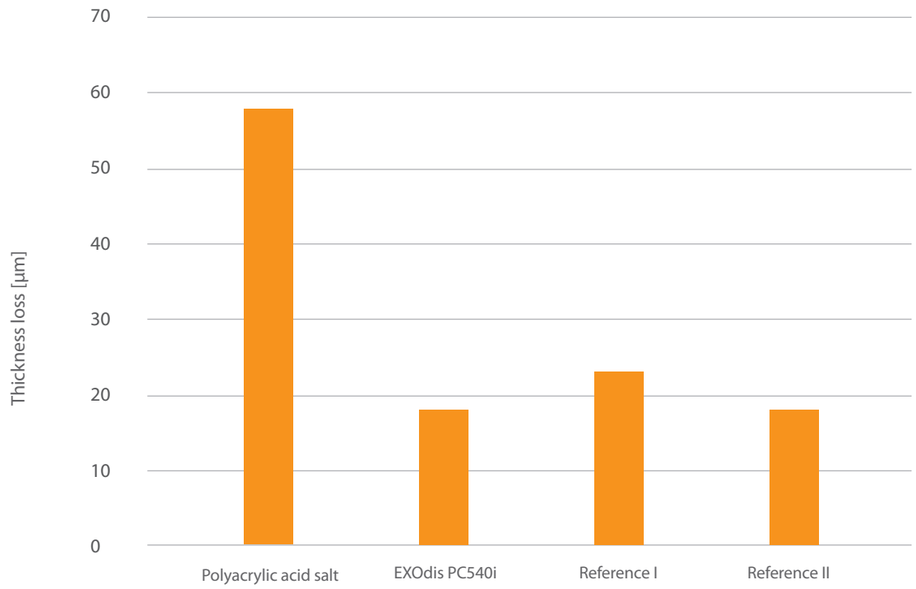
- cost effective
- high stability of pigments can be achieved
- improves corrosion resistance
- improves water resistance
- label-free

Recommended usage (dependent on PVC):
0.1 ÷ 1.5 % by weight in ready-to-use paint formulation

Interior white paint formulation PVC= 83%

RAW MATERIAL	POLYACRYLIC ACID SALT (40% ACTIVE)	EXOdis PC540i HYDROPHOBIC DISP.	REFERENCE I (25% ACTIVE)	REFERENCE II (25% ACTIVE)
Water	34.55	34.3	33.9	33.5
Hydroxyethylcellulose	0.5	0.5	0.5	0.5
Wetting and dispersing agent	0.35	0.6	1	1.4
Titanium white	7	7	7	7
Calcium carbonate, 2µm	23	23	23	23
Calcium carbonate, 5µm	18	18	18	18
Calcium carbonate, precipitated	7	7	7	7
Low MFFT styrene-acrylic dispersion	9	9	9	9
Defoamer	0.4	0.4	0.4	0.4
Biocide	0.2	0.2	0.2	0.2
Total %	100	100	100	100

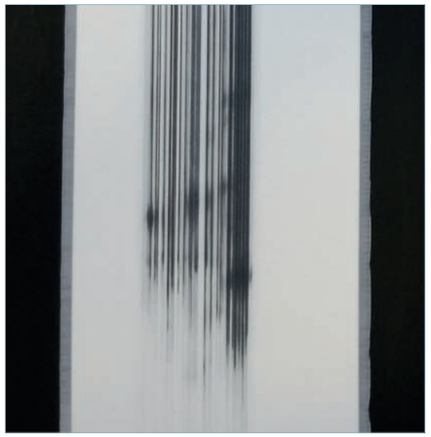
Wet-scrub resistance of samples



EXOdis PC540i is more effective than Reference I and Reference II - gives good stability in lower concentration.

EXOdis PC540i significantly improves wet scrub-resistance vs standard polyacrylic dispersant and gives similar results as Reference I and Reference II.

Polyacrylic acid salt



EXOdis PC 540i

EXOdis PC416 and **PC417** are wetting and dispersing additives with superior performance

Key features:

- dispersants with pigment anchoring groups
- APEO-free
- VOC-free
- for WB pigment concentrates
- for organic pigments and carbon blacks

Key benefits:

- high TS
- low viscosity
- improved colour development
- improved compatibility with WB paint
- improved colour stability

Recommended usage

5.0 ÷ 30.0% in pigment concentrate

0.1 ÷ 1.0% in ready-to-use paint formulation

Formulation of Pigment Yellow 74 concentrate

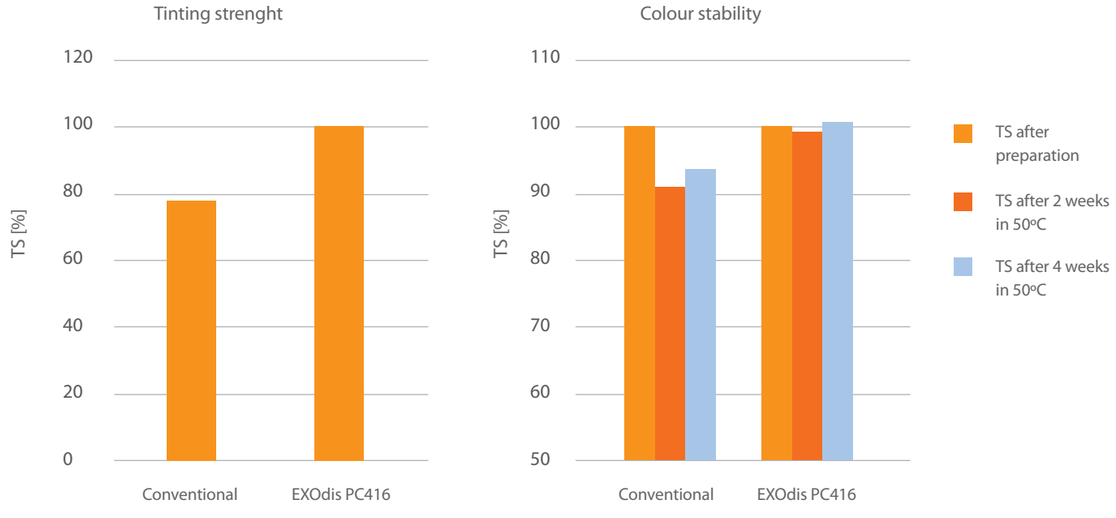
RAW MATERIAL	EXODIS PC416	CONTROL*
Water	39.2	39.2
EXOplast OTE3	5	5
Wetting and dispersing agent	5	5
Defoamer	0.7	0.7
Biocide	0.1	0.1
Pigment Yellow 74	50	50
Total	100	100
Active dispersant/pigment, %	9	9

Formulation of Pigment Blue 15:3 concentrate

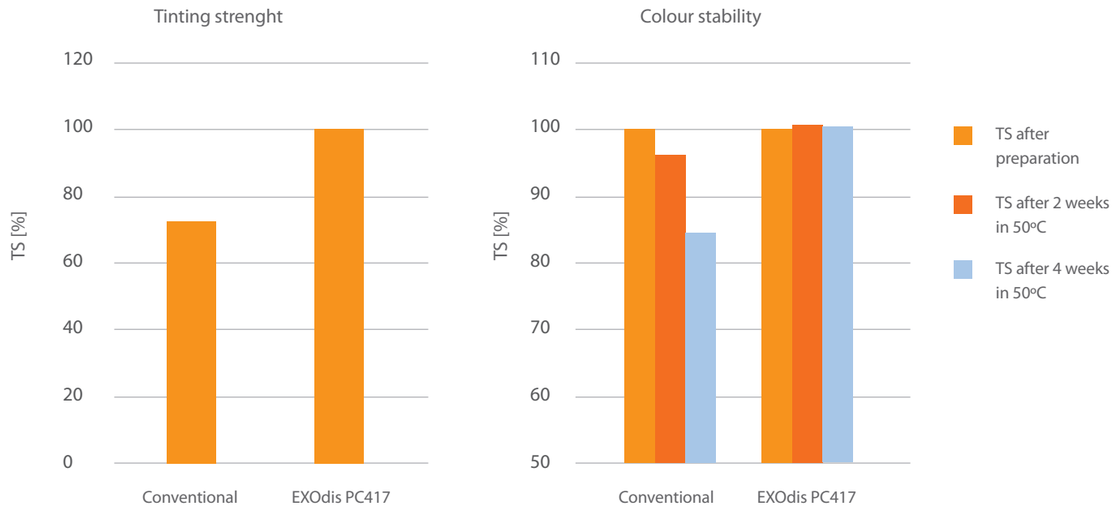
RAW MATERIAL	EXODIS PC417	CONTROL*
Water	42.2	41.7
EXOplast OTE3	5	5
Wetting and dispersing agent	7	7.5
Defoamer	0.7	0.7
Biocide	0.1	0.1
Pigment Blue 15:3	45	45
Total	100	100
Active dispersant/pigment, %	15.6	15

*conventional wetting&dispersing agent (90% of active)

Tinting strength and colour stability of Pigment Yellow 74 concentrate



Tinting strength and colour stability of Pigment Blue 15:3 concentrate



Effect on colour development

EXOdis PC416 and **PC417** significantly improve colour strength of pigment concentrates.

Effect on colour stability

EXOdis PC416 and **PC417** provide excellent colour stability during long-term storage time.

02

FLAME RETARDANTS FOR PERFORMANCE COATINGS

Flame retardants for performance coatings

Roflam series – phosphate ester-based flame retardants are recommended for the paint and coating industry, especially for epoxy intumescent coatings and polyurethane based varnishes.

Typical properties

PRODUCT NAME	CHEMICAL NAME	CAS NO	PARAMETERS		APPLICATIONS	FEATURES
Roflam B7	*t*-Butylated triaryl phosphate	68937-40-6	Appearance: Viscosity, at 25°C [mPa·s]: Density, at 25°C [g/cm³]: Phosphorus content [% (w/w)]:	homogenous, clear liquid 72 1.18 8.5	Roflam series are recommended for epoxy and polyurethane coatings. Excellent fire resistant properties of phosphate ester based products, provide impressive performance in passive fire protect systems advised to protection of steel structural elements from hydrocarbon and jet fire exposure. This range of products is used in petrochemical, power generation, oil and gas industry (e.g. offshore installation) as well as any industrial installation and architectural applications, e.g. buildings, airports, bridges etc. Roflam series are also dedicated to unsaturated polyester resins, formaldehyde resins as well as polyurea resins.	• Excellent flame retardant profile • Halogen free • Provide plasticizing performance
Roflam B7L*	*t*-Butylated triaryl phosphate	n/a	Appearance Viscosity at 25°C, [mPa·s] Density at 25°C, [g/cm³] Phosphorus content [% (w/w)] TPP content, [% (w/w)]	homogenous, clear liquid 310 1.12 7.4 max. 0.25		• No labelling • Eco-friendly • Halogen free

* available upon request

Roflam B7 1K water-based intumescent coating

Key applications:

- 1K water-based thin film intumescent coatings
- Internal & on-site protective coatings

Key benefits:

- Improves fire resistance with char barrier
- Enhances performance, aesthetic and environmental demands
- Provides synergistic effect with solid FRs

Typical properties

PRODUCT NAME	CHEMICAL NAME	DENSITY AT 25°C [g/cm³]	VISCOSITY AT 25°C [mPa*s]	PHOSPHOROUS CONTENT [wt. %]	FEATURE
Roflam B7	*t*-butylated triaryl phosphate	1.18	72	8.5	Safe to human life
Roflam B7L		1.12	310	7.4	No-labelling

General 1K WB intumescent coating formulation

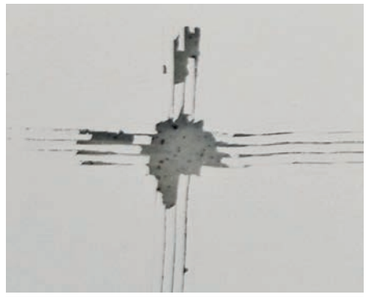
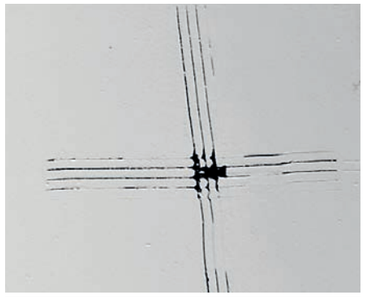
RAW MATERIAL	ROLE	LOADINGS [wt. %]
Water	–	26.85
Hydroxyethylcellulose	Rheology modifier	0.05
EXOdis PC540i	Wetting and dispersing agent	0.6
EXOdis PC416	Wetting and dispersing agent	0.2
Defoamers	Antifoaming agents	0.5
Titanium oxide	Pigment	7
APP	Phosphorus source	22
Pentaerythritol	Carbon source	8
Melamine	Blowing agent	8
Fumed silica	Antisettling agent	0.1
Osakryl OB	Binder	25
Coalescing solvent	–	1.5
Biocide	–	0.2

Test results

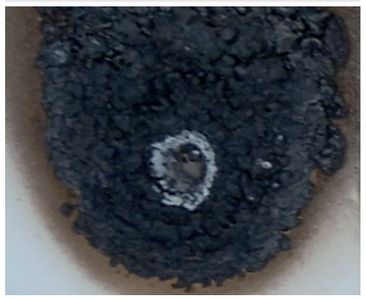
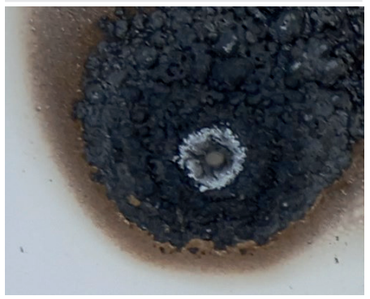
FLAME RETARDANT	LOADINGS [wt.%]	PENDULUM DAMPING TEST ISO 1522 –	BUCHHOLZ INDENTATION TEST ISO 2815 [mm]	CROSS-CUT TEST ISO 2409 class
Control*	–	0.22	1.6	5
Roflam B7	1	0.19	2.6	3
Roflam B7L	1	0.17	2.6	0

* no liquid form phosphates in formulation

Cross-cut test

Control	Roflam B7	Roflam B7L
		
Class 5	Class 3	Class 0

Fire test

Control	Roflam B7	Roflam B7L
		

Roflam functions

Flame retardancy	←
Coating flexibility	↑
Adhesion	↑

03 / OPEN TIME EXTENDERS AND HUMECTANTS

Open time extenders and humectants

EXOplast OTE series are used as humectants and open time extenders for water-borne paint with low VOC content. They improve paint open time, which translates into an improvement in rheological properties during application. The recommended amount for use is 1-20% depending on the type of a product (colourant, paint).

PRODUCT NAME	ACTIVE, %	CHEMISTRY	VOC, %	SVOC, %	FEATURES AND BENEFITS	DOSAGE	WB	SB
Exoplast OTE2	100	polymer	<0.1	<0.1	humectant in pigments concentrates, to prevent drying; open time extender in WB coatings	1.0-5.0% in coatings 4.0-10.0% in pigment concentrates	•	
Exoplast OTE3	100	polymer	0.1	2.8	humectant in pigments concentrates, to prevent drying; open time extender in WB coatings	1.0-5.0% in coatings 4.0-10.0% in pigment concentrates	•	
Exoplast OTE4	100	polymer	1.0	8.3	humectant in pigments concentrates, to prevent drying; open time extender in WB coatings	1.0-5.0% in coatings 4.0-10.0% in pigment concentrates	•	

EXOplast OTE series are VOC-free open time extenders and humectants for waterborne

Key features:

- non-ionic polymers
- APEO-free
- VOC-free
- for WB paints and pigment concentrates

Key benefits:

- products don't increase VOC value of coatings
- high performance, similar to propylene glycol
- prevents fast-drying of colourant
- improved compatibility with WB paint

Recommended usage:
4.0 ÷ 10.0% in pigment concentrates
0.1 ÷ 5.0% in ready-to-use paint formulation

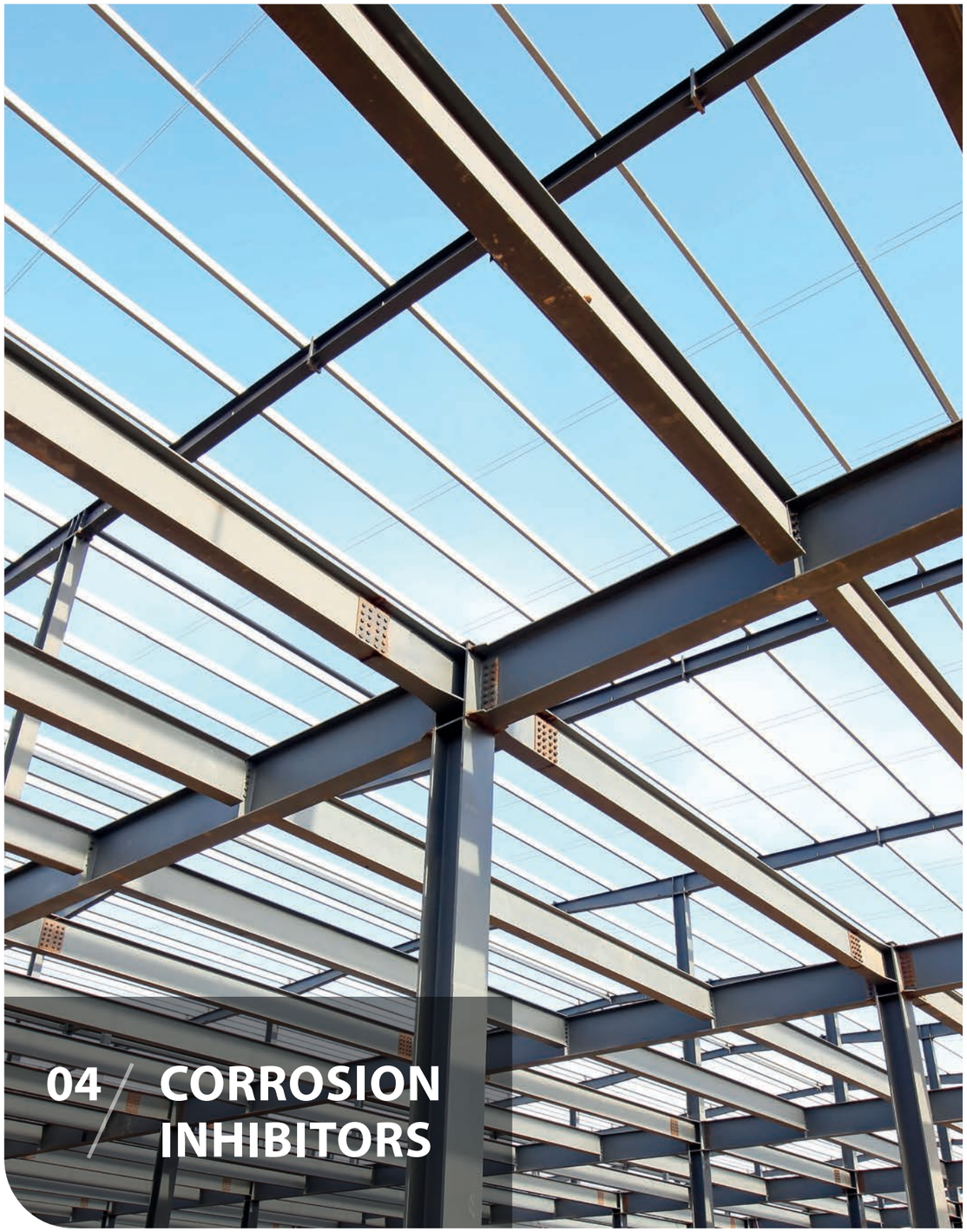
Interior matt paint formulation PVC=83%

RAW MATERIAL	PROPYLENE GLYCOL	EXOplast OTE2	EXOplast OTE3	EXOplast OTE4
Water	31.65	31.65	31.65	31.65
Hydroxyethylcellulose	0.5	0.5	0.5	0.5
EXOdis PC40	0.35	0.35	0.35	0.35
Titanium white	7	7	7	7
Calcium carbonate, 2µm	29	29	29	29
Calcium carbonate, 5µm	18	18	18	18
Styrene-acrylic dispersion	12	12	12	12
Defoamer	0.3	0.3	0.3	0.3
Biocide	0.2	0.2	0.2	0.2
OTE additive	1	1	1	1
Total. %	100	100	100	100

Influence on open time

TEST METHOD	PROPYLENE GLYCOL	EXOplast OTE2	EXOplast OTE3	EXOplast OTE4
ASTM D7488-11	36 min	30 min	30 min	36 min

EXOplast OTE improve open time in a similar way as propylene glycol, and do not generate VOC in final coating formulation.



04 / CORROSION INHIBITORS

Corrosion inhibitors

Today's waterborne anticorrosive paints are high-performance modern coatings prepared to protect metal and construction elements. They must be formulated to comply with new VOC and environmental regulations. In waterborne systems, there are two types of corrosion inhibitors: main and anti-flash rust. Main corrosion inhibitors prevent corrosion processes during exposure of the coat in corrosive environments, providing long-lasting anticorrosive protection. The flash rust phenomenon occurs when a waterborne coating is applied to a steel surface and causes immediate corrosion of the steel during the first stage of drying. To inhibit this phenomenon, an anti-flash rust inhibitor should be utilized. PCC Exol corrosion inhibitors are modern and specialized products ready to use in water-borne anticorrosive coatings. These products are in liquid form and do not contain inorganic phosphates or nitrites.

PRODUCT NAME	ACTIVE, %	SOLVENT	CHEMISTRY	TYPE	FEATURES AND BENEFITS	DOSAGE	WB	SB
EXOhib PC400	approx. 70	water	mixture of amine borate	anti-flash rust	anti-flash rust agent dedicated for use in WB; effective in low conc.; nitrite free	0.3 - 0.6% in paints on total formulation	•	
EXOhib PC500	48 – 52	water	mixture of corrosion inhibiting compounds	anti-flash rust	anti-flash rust agent dedicated for use in WB; effective in low conc.; aminoborate and nitrite free	0.3 - 0.6% in paints on total formulation	•	
EXOhib PC108	approx. 50	methoxydipropanol	mixture of corrosion inhibiting compounds	main	prevents corrosion process and provides long-lasting effect, improves adhesion of WB coatings; extremely effective in relatively low-concentration	0.5 – 2.0% in paints on total formulation	•	

EXOhib PC400 and **PC500** – anti-flash rust inhibitors for waterborne coating systems and industrial fluids

Key applications:

- WB coating systems and industrial fluids
- especially for the protection of ferrous metals

Key benefits:

- DEA, nitrite and phosphate free
- low foaming
- low usage of anti-flash rust agents
- improve corrosion resistance
- replacements of sodium nitrite
- cost effective

General 1K matt primer formulation

RAW MATERIAL	LOADINGS [WT. %]			
Water	14.1	14	14.2	13.95
Wetting and dispersing agent	1.2	1.2	1.2	1.2
Defoamer I	0.3	0.3	0.3	0.3
Titanium white	16	16	16	16
Talc	7	7	7	7
Fumed silica	0.1	0.1	0.1	0.1
Acrylic dispersion	55	55	55	55
Coalescent	2.2	2.2	2.2	2.2
EXOhib PC400	**0.3**	–	–	–
EXOhib PC500	–	**0.4**	–	–
Sodium nitrite	–	–	**0.2**	–
Reference	–	–	–	**0.45**
Surface wetting agent	0.2	0.2	0.2	0.2
Defoamer II	0.1	0.1	0.1	0.1
HEUR additive I, (50% solution)	3	3	3	3
HEUR additive II, (50% solution)	0.1	0.1	0.1	0.1
Biocide	0.2	0.2	0.2	0.2
Defoamer III	0.2	0.2	0.2	0.2
Total, %	100	100	100	100
Active, %	**0.21**	**0.2**	**0.2**	**0.2**

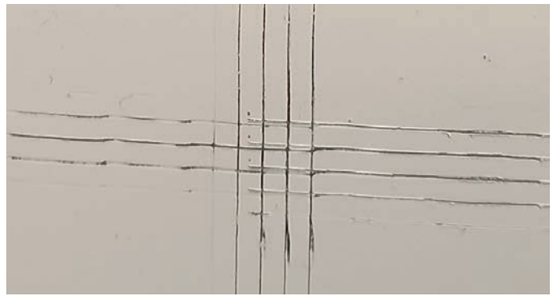
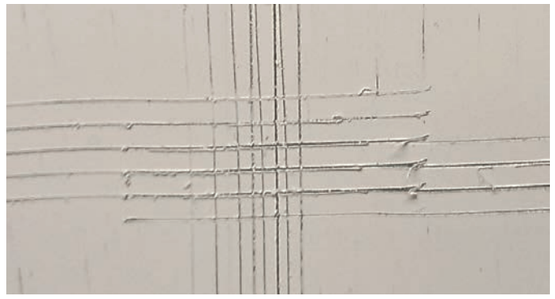
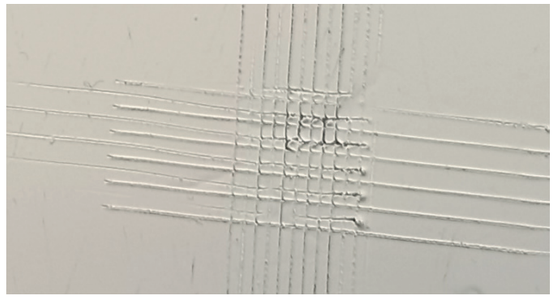
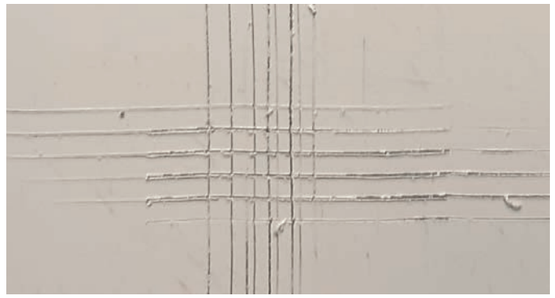
Influence on flash rust prevention

Samples applied on the steel plates. Visual evaluation of dry films.

Without ant-flash rust	EXOhib PC400	EXOhib PC500	Sodium nitrite	Reference
				

Influence on adhesion

Samples applied on the steel plates. Evaluation by cross-cut method.

EXOhib PC400	EXOhib PC500
	
Sodium nitrite	Reference
	

EXOhib PC serie benefits

EXOhib PC400 and PC500 provide very good protection against flash-rust. No negative effect on adhesion is observed.

PCC Exol products performance in WB DTM coating formulation

The DTM (direct to metal) coatings are modern anticorrosive solutions for the metal protection, which are increasingly gaining their popularity. The main reason is that they combine the properties of primers and top-coat, hence they are easy to handle. DTM coating also provide several additional benefits, such as strong adhesion or excellent anticorrosive resistance. PCC Exol products, including corrosion inhibitors – EXOhib PC108 and PC500 as well as wetting and dispersing additives – EXOdis PC540A and ROKAdis 900A/25 exhibit outstanding synergy and performance in WB DTM coatings.

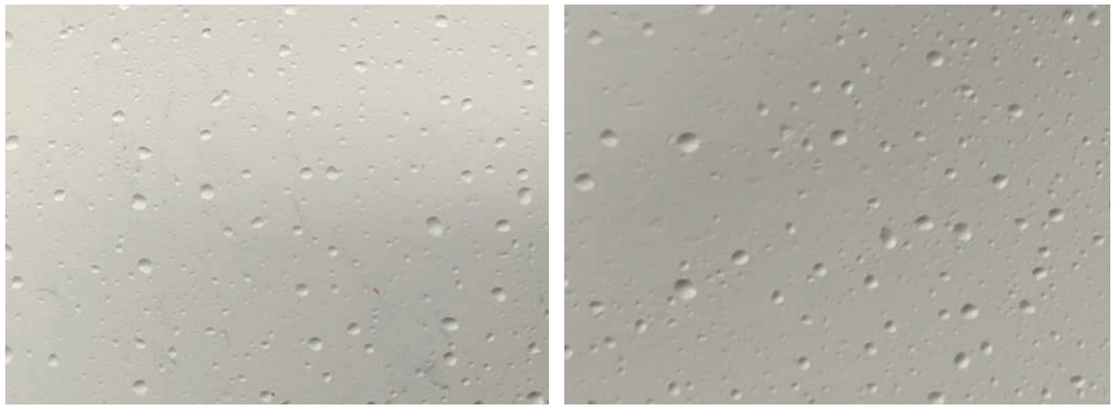
	PCC EXOL DTM	REFERENCE DTM
RAW MATERIAL	LOADINGS (%WT)	
Water	11	10.85
EXOdis PC540A	**0.8**	–
ROKAdis 900A/25	**0.8**	–
Reference dispersant	–	**1.2**
Defoamer	0.6	0.6
Titanium white	16	16
Talc	7	7
Fumed silica	0.2	0.2
EXOhib PC108	**1.6**	–
Reference inhibitor	–	**2**
AMP90	–	0.15
Alberdingk AC 2403	55	55
Coalescent	2.2	2.2
Surface wetting agent	0.2	0.2
EXOhib PC500	**0.4**	**0.4**
HEUR additive I (50% solution)	4	4
HEUR additive II (50% solution)	0.1	0.1
Biocide	0.1	0.1

Results of the application Evaluation

The application evaluation was performed using the Machu test. Samples of the coatings applied on steel plates were immersed for 48 hours at 40°C in a solution of 50 g NaCl, 10 g of acetic acid, and 5 g of 30% H_2O_2 dissolved in 1L of distilled water. Immediately after the 48-hour immersion, the degree of rusting and blistering was determined. After the next 24 hours, when the blisters disappeared, adhesion was examined. The results are exhibited in the following pictures.

PCC Exol DTM	Reference DTM

Appearance of the coats after 48h of the Machu test



Adhesion 24h after completing the test

PCC Exol products benefits

There is no visible rust in both formulations and they exhibit similar tendency to blistering (blisters disappearing after 24 h of completing the Machu test). Adhesion of PCC Exol DTM formulation is still excellent after the Machu and is far better than in case of reference DTM.

Guidance concerning the functional parameters and notation used in the catalogue

HLB (Hydrophilic-Lipophilic Balance)

The hydrophilic-hydrophobic balance is a parameter that determines the ratio of the content of the hydrophilic group and that of the hydrophobic group in a particle. The validity scope of the HLB number for non-ionic surface-active compounds is included within the range of 0 to 20 and is the measure of the share of the hydrophilic group in the particle.

$$HLB=20 \cdot \frac{\text{molecular mass of hydrophilic part}}{\text{molecular mass of compound}}$$

On the other hand, aqueous solutions of ionic surface-active agents acquire additional transformations increasing their degree of hydrophilicity, and the value of the HLB number goes up to 40.

HLB for ester type compounds (polyoxyethylenated fatty acids):

$$HLB=20 \cdot \left(1-\frac{LZ}{LK}\right)$$

where:

LZ saponification number of oxyethylenation product, mgKOH/g

LK acid number of acids subjected to oxyethylenation, mgKOH/g

On the basis of the HLB scale, the range of the utility fitness of surface-active agents can be determined.

HLB NUMBER	EO CONTENTS IN PRODUCT, %	PRODUCT APPLICATION
1-3	5-15	Anti-foaming agent
4-6	20-30	Emulsifier W/O
7-11	35-55	Wetting agent
8-18	40-90	Emulsifier O/W
10-15	50-75	Detergent
10-18	50-90	Solubilizer

Cloud point

Cloud point is an indicator determining the behaviour of water or other organic solutions of non-ionic surfactants. Solutions of surfactants become cloudy during heating and revert to a clear solution at a certain temperature when cooled. This temperature is defined as 'cloud point'.

Depending on the temperature range at which the solution becomes cloudy, five determination methods are set out:

Method A – aqueous solution (10 - 90°C)
Method B – solution of NaCl 50g/l (>90°C)
Method C – solution of NaCl 100g/l (>90°C)
Method D – solution 45g of butyl diglycol/water (<10°C)
Method E – solution 25 g of butyl diglycol/water (<10°C)

PCC Group
We build value through sustainable innovation

Each project or venture with a long-term success story shares one common thing – it's based on in-depth market research and knowledge acquired through years of experience. It is knowledge and experience that enable us to constantly aim higher and deliver greater value through dynamic and sustainable world-wide development of the PCC Group.
The companies, operating as a part of the PCC Group, act with responsibility and care. We only embark on new business challenges when we are certain that we have the skills and knowledge to achieve success. We operate in three major markets: chemicals, energy and logistics. Several dozen business units, managed by PCC SE, work in synergy to generate the greatest possible competitive advantage inboth local and international markets. Each day nearly three thousand professionals contribute their energy and effort to secure the sustainable development of the PCC Group. The key element of our strategy is to ensure the development of each individual business unit through taking advantage of innovative technology and new market applications. We achieve our goals in a sustainable and responsible way – we care about the environment and the society within which we operate.
We are always ready to reach our strategic goals. Efficient and dynamic management helps our employees to fully develop their potential and therefore enhances the overall PCC Group value. Joint enterprises and individual initiatives of our companies are the results of the entrepreneurship culture promoted within the PCC Group. Our philosophy is built on simple values - integrity, trust and reliability. We believe that following those principles is the only way to build a long-term competitive advantage.

The PCC Group currently employs nearly 3300 people. We operate in 17 countries, in 39 different locations around the world. Sales of PCC Group is generated in 3 areas: Chemicals, Logistics, Holding & Projects. Our portfolio includes five segments: Polyols & derivatives, Surfactants & derivatives, Chlorine & derivatives, Silicon & derivatives, Trade & service.

Segments of PCC Group

Chemicals 83%

Polyols & derivatives
- Polyether polyols
- Polyester polyols
- Polyurethane systems
- Prepolymers
- Acryl phenols

Surfactants & derivatives
- Anionic surfactants
- Non-ionic surfactants
- Amphoteric surfactants (betaines)
- Household and industrial cleaners, detergents, personal care products

Chlorine & derivatives
- Chlorine
- Chlorine derivatives
- MCAA
- Phosphorus and naphthalene derivatives

Silicon & derivatives
- Quartzite
- Metallic silicon

Trade & service
- Trade
- Services

Logistics 12%

Logistics
- Intermodal transport
- Road transport
- Rail transport
- Container terminal in Kutno

Holding & projects 5%

Holding & projects
- Investment management
- Projects
- Renewable energy
- Conventional energy

In accordance with our environmental concerns, this publication from the PCC Group was printed on Cocoon Silk - an ecological double-sided-coated matt paper. This paper is made of 100% waste paper via environment-friendly technology. The FSC® Certificate confirms that the raw materials used during the paper production process come from well-managed forests or other certified and controlled sources.

TEXT PAGES	
Brand	Cocoon Silk
Grammage	135
Number of pages	28

COVER PAGES	
Brand	Cocoon Silk
Grammage	250
Number of pages	4

PUBLICATION	
Size (cm)	21 x 29.7
Quantity	250

By using Cocoon Silk rather than non-recycled paper, the environmental impact was reduced by:

42	kg of landfill
5	kg CO_2 and greenhouse gases
56	km travel in the average European car
1 640	litres of water
91	kWh of energy
68	kg of wood

Carbon footprint data evaluated by Labelia Conseil in accordance with the Bilan Carbone® methodology. Calculations are based on a comparison between recycled paper used versus a virgin fibre paper - according to the latest European BREF data (virgin fibre paper) available.

PCC Group
Sienkiewicza 4
56-120, Brzeg Dolny, Polska
products@pcc.eu

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