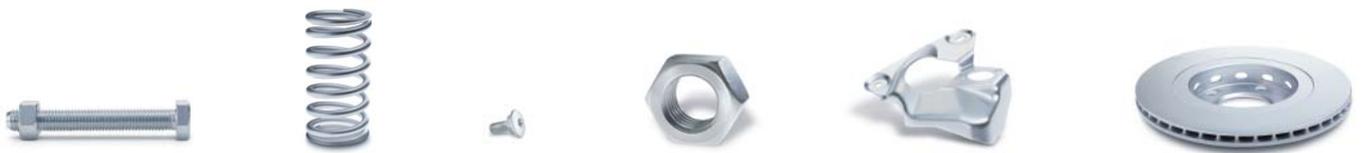


That's what we see as a polished job.

An overview of the Dörken MKS micro-layer corrosion protection systems.



The only alternative to our coatings:

No more rain.

Maybe it is the weather in Herdecke that has led Dörken to specialising in corrosion protection, thus becoming the leading provider of micro-layer corrosion protection systems (which we abbreviate in German to MKS).

Corrosion occurs everywhere wherever steel or iron are at the mercy of environmental influences. As the automotive industry works with high-grade but corrosion-prone steel, rust is not just a visual problem, but – in the case of springs or wheel bolts for example – it also affects safety.

Because previous anticorrosive coatings such as e.g. electroplating with a chromating process contained hazardous chrome (VI), Dörken MKS-Systeme developed chrome (VI)-free alternatives over 25 years ago.

In addition, the requirements of the modern automotive industry (e.g. in terms of chemical resistance, friction resistance and heat resistance) are fulfilled.

Our innovative DELTA-MKS® brand zinc flake systems are environmentally friendly, harmless from a health point of view and at the same time extremely resilient and

durable. DELTA-MKS® sets new standards in the market and fulfils the ever-more complex demands of the automotive, electrical, building and aviation industries to the highest extent.



With DELTA-MKS[®], some speak of innovation.

We just call it quality.

As thin as necessary and as resilient as possible: Micro-layer corrosion protection systems have to meet very high standards. Between 1 and 18 µm in thickness, they are particularly required where high-performance corrosion protection is called for and really put to the test.

DELTA-MKS[®] systems consist of a basecoat and topcoat. This makes them just as robust as they are varied. Here it is the basecoat that defines the corrosion protection quality properties of the system, while providing the cathodic protection. Topcoats complement the properties of the basecoat, influence the chemical or mechanical resilience of the whole system and thus permit a broad range of application. It is by means of

the topcoat, that the properties are set which are required for the specific application. Depending upon the required application, both organic and inorganic topcoats are available.



Standards in the automotive industry are particularly high.

Fortunately.

Corrosion is not just a visual problem, but it also affects safety. After all, coatings today have to do so much more than just providing corrosion protection. The technological wish list of the automotive industry continues to grow. With DELTA-MKS[®], we have succeeded in combining all the properties required from a particularly durable corrosion protection:

- low coating thickness
- high corrosion protection and cathodic protection
- resistance to chemicals (against petrol, diesel, brake fluid, transmission oil etc.)
- temperature resistance (e.g. against temperatures in the engine compartment)
- mechanical resistance
- no hydrogen embrittlement of high-tensile steels that is associated with the application
- moderate curing temperatures (energy saving)
- narrow range of friction/antifrictional property
- colourfulness
- cost efficiency/economy



We know:

Each metal is only as good as its corrosion protection.

The DELTA-MKS® basecoat contains zinc and in fact protects the base metal from corrosion by means of the active decomposition of the zinc. Because zinc is more of a base metal than steel, for example, corrosion first attacks the zinc, thus protecting the more noble metal.

The DELTA-MKS® basecoat consists of zinc flakes, which are connected by an inorganic matrix. If the coating is damaged by a scratch, for example, then it is not the steel that corrodes, but rather the zinc.

Zinc flake systems do not cause the hydrogen-induced cracking corrosion (hydrogen embrittlement) inevitable with electroplating, which is of particular importance in the case of screws and high-tensile steels.

A further benefit of flakes is that they facilitate micro-layer coating with extremely low coat thicknesses. With the DELTA-MKS® topcoat, the zinc flake coating is further protected, thus increasing the corrosion protection even more. The

basecoats and topcoats of the DELTA-MKS® systems do not contain any health hazards or ecologically harmful heavy metals such as chrome, lead, nickel, molybdenum or cadmium and can be processed without hesitation.



Honestly:

Is "thickness" the right word, when you are talking about a millionth of a metre?

Zinc flake coatings are used worldwide in the automotive, building, electrical and aviation industries as cathodic corrosion protection coatings. In combination with thin topcoats, they also offer colour, chemical resistance and specific friction qualities. The zinc flake coating serves as a basecoat for the topcoat. A difference is made between inorganic and organic topcoats.

Inorganic transparent topcoats are preferred for bolts, because of their low coating thickness. It is only with thin coats of 1-3 µm that the high requirements for screwability, as well as the function of the bolt as a connecting element can be fulfilled. The coefficients of friction are set specifically to automotive require-

ments. Because of their outstanding heat resistance, they are highly suited to use in the engine compartments of modern cars.

For parts that are subject to deformation, such as springs or clips, DELTA-MKS® basecoats in combination with organic DELTA-MKS® topcoats are more suitable as they are more ductile. Also where permanent lubrication is required, such as in the case of locking wedges and seatbelt tracks, a thicker organic coating is needed as this contains a higher amount of lubricant.



Really a shame:

Our best ideas remain invisible.

DELTA-MKS® zinc flake systems are the best solution in most operational cases. Despite the thinnest coating thickness, they provide high-performance corrosion protection. Apart from that, they also give outstanding protection for high-tensile materials, as any associated hydrogen-induced cracking corrosion can be excluded. By using low curing temperatures, energy costs can be saved and sensitive parts such as clips and clamps can be coated.

Yet our concept of quality is by no means defined by the product alone, but also by our global service and support. We see ourselves as a partner and a problem solver for our customers. We advise you in all areas of application technology, support you with the set-up of your plant and are there to answer your questions. This is how you can be sure that – together – we will always achieve the optimal result.



Don't just save on time and money.



Save on energy and stress as well.

Benefits by comparison with electroplating:

Unlike in the case of electroplating, zinc flake systems by their nature do not lead to the hydrogen-induced cracking corrosion (hydrogen embrittlement) that is a cause of the fracturing of high-tensile steels.

Zinc yellow chromatisation:

- high ecological pollution and health hazard because of chrome (VI)
- relatively low corrosion protection
- low temperature resistance

Zinc nickel coating:

- cost-intensive because of the high proportion of nickel
- complex process technology conceals the risk of quality fluctuation
- may cause allergies

Benefits by comparison with hot-dip galvanizing:

A prerequisite for the coating of high tensile steel is the low curing temperature of our zinc lamella systems (200 – 250 °C), since steel loses strength from the high temperatures required in hot dip galvanizing. Hot dip galvanizing is therefore unsuitable for high tensile steel and also has the following disadvantages:

- high energy costs from high bath temperatures (over 400 °C)
- no micro-layering is possible (standard thread rolling diameters cannot be used for screws and nuts)

The DELTA-MKS® System Summary.

DELTA-MKS® basecoat + inorganic topcoat

The optimal system for screws within the range of M4 – M18. Depending upon the build-up of coats, geometry and type of application, a corrosion resistance endurance life (SST) of over 1,000 hours can be reached.

System	Properties		
Basecoat + Topcoat	Coefficient of friction* in μ_{tot}	Systems specified for (extract)	Remarks
DELTA-PROTEKT® KL 100 + DELTA-PROTEKT® VH 3xx	DELTA-PROTEKT® VH 300 (without defined coefficient of friction setting)	Bosch Continental Teves DaimlerChrysler GM VW	High-performance system Extremely thin layers of topcoat as low as 1–3 μm are possible
	0,09 – 0,14 DELTA-PROTEKT® VH 301 GZ	BMW Bosch Continental Teves DaimlerChrysler Deutz Fiat MAN Porsche VDA VW	High-performance system with specific automotive coefficient of friction adaptation
	0,10 – 0,18 DELTA-PROTEKT® VH 302 GZ	Ford/GM/Volvo	
	0,12 – 0,18 DELTA-PROTEKT® VH 315	PSA/Renault RVI/Volvo Truck	
DELTA-PROTEKT® KL 105	0,10 – 0,18	Fiat/Iveco Renault (in preparation)	Basecoat with integrated lubricant, no necessity for additional topcoat, particularly cost-effective, awarded the German Material Efficiency Award 2006
DELTA-PROTEKT® KL 108	~ 0,30	Toyota (in preparation)	Basecoat with integrated lubricant, specific adaptation for the Asian automotive market

* Depending upon the respective customer norms

Electroplated base + DELTA-MKS® topcoat

Multifunctional topcoats for diverse applications on electroplated bases. Depending upon the build-up of coats, geometry and type of application, a corrosion resistance endurance life (SST) of over 720 hours can be reached.

System	Properties			
Basecoat + Topcoat	Coefficient of friction* in μ_{tot}	Systems specified for (extract)	Remarks	
Electroplated zinc or zinc alloy	+ DELTA-PROTEKT® VH 35x-series	Specific automotive adaptations	BMW DaimlerChrysler Ford TRW Volvo VW	Aqueous sealants, curing system
	+ DELTA-PROTEKT® VH 36x-series	Specific automotive adaptations	TRW	Aqueous sealants, inline product, force dryable
	+ DELTACOLL®	DELTACOLL® 80 black (without defined coefficient of friction setting)	BMW GM VW	Solvent-based topcoat, curing system
		0,09 – 0,14 DELTACOLL® 80 GZ black	BMW GM VDA VW	
		DELTACOLL® 80 uncoloured (without defined coefficient of friction setting)	BMW GM TRW VW ZF	
		0,09 – 0,14 DELTACOLL® 80 GZ uncoloured	BMW Bosch DaimlerChrysler GM TRW VDA VW ZF	
	+ DELTA-PROTEKT® EK-800-series	0,09 – 0,14 DELTA-PROTEKT® EK 800/801	VW	Suitable for the EC-Automat 2000+, the innovative coating process for complex workpieces and smallest components
	+ DELTA®-SEAL series	0,09 – 0,14 DELTA®-SEAL GZ		Varying colour adaptations possible

* Depending upon the respective customer norms

DELTA-MKS® basecoat + organic topcoat

The versatile system for springs, clips, clamps and bolts. Depending upon the build-up of coats, geometry and type of application, a corrosion resistance endurance life (SST) of over 1,000 hours can be reached.

System	Properties		
Basecoat + Topcoat	Coefficient of friction* in μ_{tot}	Systems specified for (extract)	Remarks
DELTA®-TONE 9000 + DELTA®-SEAL	DELTA®-SEAL (without defined coefficient of friction setting)	Bosch Continental Teves DaimlerChrysler Enron Fiat Ford GM Kamax Knorr-Bremse MAN Porsche Renault Truck Suzlon TRW VDA Vestas Volvo VW ZF	Highly cross-linked organic topcoat: - varying colour adaptations possible - excellent chemical resistance - particularly suitable for multiple screw fixing
	0,09 – 0,14 DELTA®-SEAL GZ	BMW Bosch Continental Teves DaimlerChrysler Fiat GM Knorr-Bremse Porsche TRW VDA VW	Highly cross-linked organic topcoat: - varying colour adaptations possible - excellent chemical resistance - particularly suitable for multiple screw fixing - specific automotive coefficient of friction
DELTA-PROTEKT® KL 100 /KL 101 + DELTA®-SEAL	DELTA®-SEAL (without defined coefficient of friction setting)	Bosch Continental Teves DaimlerChrysler GM Hyundai/Kia VW	Highly cross-linked organic topcoat: - varying colour adaptations possible - improved corrosion protection - excellent chemical and temperature resistance - particularly suitable for multiple screw fixing Alternative to DELTA-PROTEKT® KL 100 basecoat: - DELTA-PROTEKT® KL 101 with optimised resistance to white rust formation, e.g. ideal for black surfaces
	0,09 – 0,14 DELTA®-SEAL GZ	Bosch Continental Teves DaimlerChrysler Delphi Fiat Ford GM VDA VW Yale	Highly cross-linked organic topcoat: - varying colour adaptations possible - improved corrosion protection - excellent chemical and temperature resistance - particularly suitable for multiple screw fixing - specific automotive coefficient of friction Alternative to DELTA-PROTEKT® KL 100 basecoat: - DELTA-PROTEKT® KL 101 with optimised resistance to white rust formation, e.g. ideal for black surfaces
	> 0,20 DELTA®-SEAL RZ		For applications with increased friction resistance
DELTA-PROTEKT® KL 100 HC+DELTA®-SEAL HC	–		Optimised for springs, spring-loaded band-type clamps and clips
DELTA-PROTEKT® KL 100 + DELTA-PROTEKT® VL 450	–		Black, high-gloss topcoat, UV-resistant in compliance with SAE J1960
DELTA-PROTEKT® KL 100 + EK-800-series	0,09 – 0,14 DELTA-PROTEKT® EK 800/801		Suitable for the EC-Automat 2000+, the innovative coating process for complex workpieces and smallest components
DELTA-PROTEKT® KL 110 + DELTA®-SEAL	Specific automotive adaptations		Black basecoat ideal in combination with DELTA®-SEAL in black

* Depending upon the respective customer norms

Application possibilities: e.g. dip spin, dip coating, spray immersion or spin coating.

You can find detailed information about individual DELTA-MKS® systems in our product brochures.

The details stated in this technical leaflet are based upon our current knowledge and experience. They do not release the user from the testing that is inevitable, given the diversity of possible influences in the processing and application of our products. Any legal guarantee of specific properties of suitability for any concrete operational purpose may not be assumed from the information provided.



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