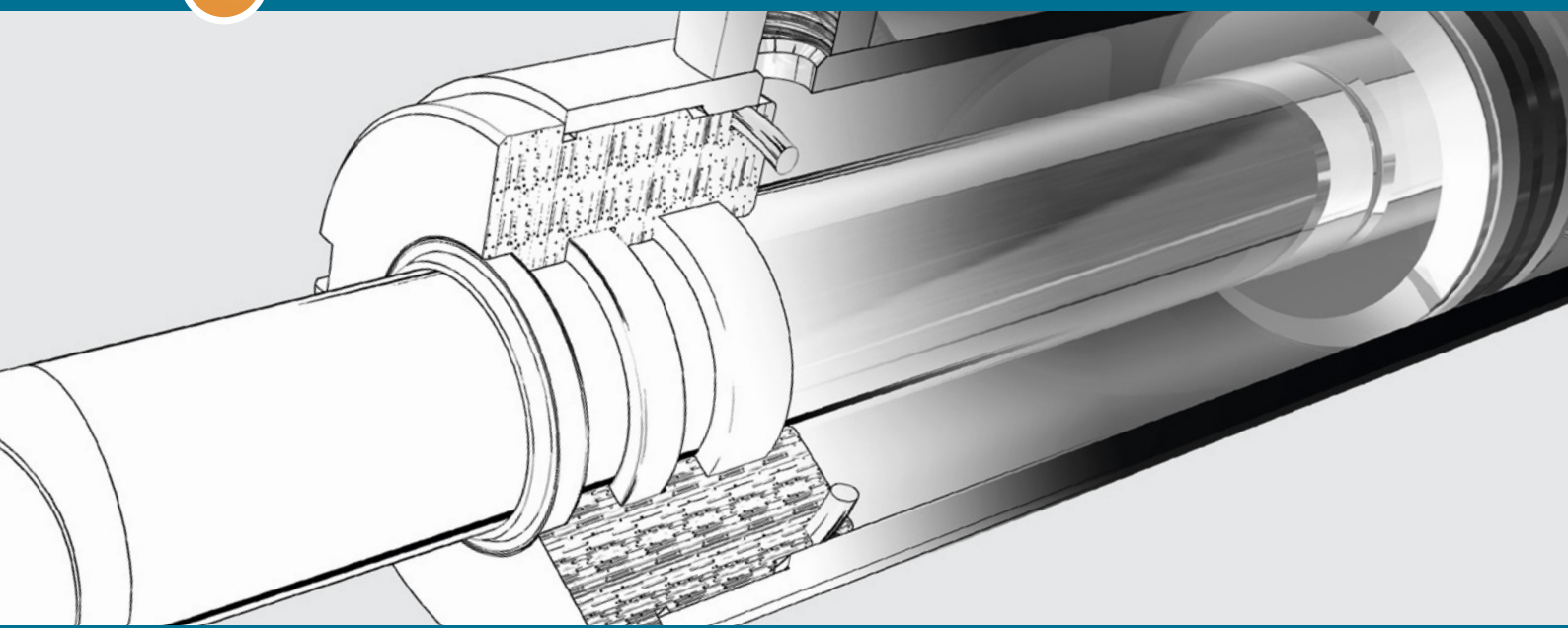


ON POINT



COATINGS FOR THE HYDRAULICS INDUSTRY

The high performance coatings of
Karl Schumacher:

- KS-InductiveCoat
- KS-HardCoat
- KS-SuperCoat
- KS-MetalCoat

Highest performance for your business!



COATING SOLUTIONS FOR THE OPTIMAL USEFUL LIFE RESTORATION OF HYDRAULIC CYLINDERS

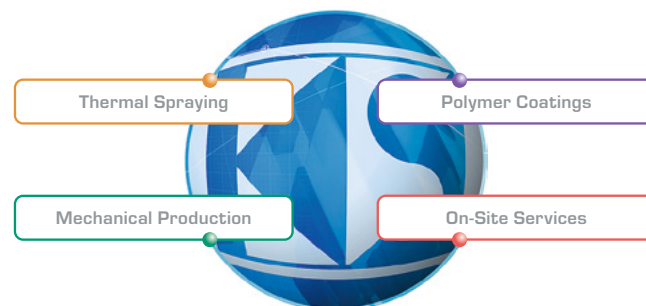
When high performance matters!

Karl Schumacher GmbH is the specialist for solution-oriented coating technologies in the areas of corrosion and wear protection. In addition to solutions based on thermal spraying, we also support you with advanced polymer coatings.

Our mechanical production processes restore your damaged components so that they are ready to install and usually technically improved. Otherwise, we simply produce entirely new parts with optimised features for wear and tear and/or corrosion. In principle, we are set up so that depending on requirements, we are also able to provide the above services through our on-site service right where you are.

Our clients are predominantly from the hydraulics, power gener-

ation, chemical/refinery, waste water treatment, as well as heavy and rail engineering industries.



MORE INTELLIGENT PROTECTION WITH SUPERIOR TECHNICAL PROPERTIES

KS-InductiveCoat - The BEST!

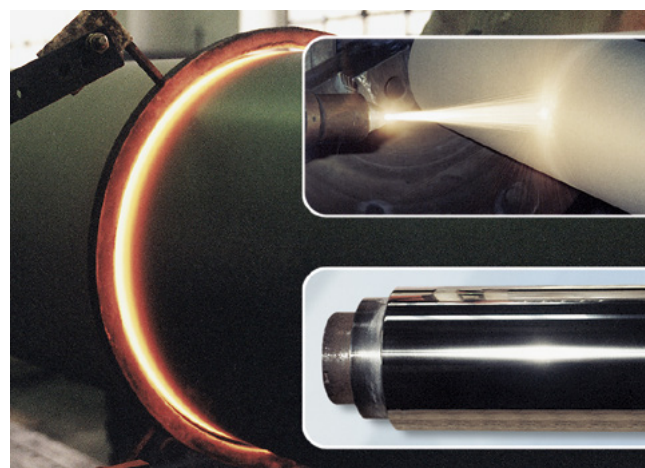
The inductively melted down KS-InductiveCoat enamel bond coatings protect your piston rods in extreme environments, sustainably and hassle-free: **Over 250.000 piston rods installed worldwide and operating under the toughest possible conditions ... and no known warranty claims!**

These coatings are 100% moisture and gas-proof and metallurgically connected with the ground. They offer outstanding protection from corrosion with maximum reliability since the layers are wear-protected flake-resistant. The inductive melting down of the coatings ensure that the heat treatment properties of the basic materials are not weakened in any way.

The KS-InductiveCoat meets the requirements of the DNV standard "DNV-Guideline for wear and corrosion protection surface materials for offshore piston rods" (Guideline of DET NORSKE VERITAS for the suitability of coatings as wear and corrosion protection on piston rods for hydraulic cylinders - for use on offshore platforms and systems).



KS-COATINGS - When high performance matters!



The original - Inductive enamel bond of Karl Schumacher!

BENEFITS: KS-InductiveCoat

- + Excellent corrosion and wear resistance
- + 100% steam and gas-proof
- + Maximum dynamic resilience
- + Flake-resistant, also with impact
- + Layer thicknesses of up to 1.5 mm
- + Excellent sealing compatibility
- + Very good repair capacity (in situ)

TYPICAL APPLICATIONS

- Piston rods
- Guide / Protective bushes
- Axial sealing / Sliding surfaces

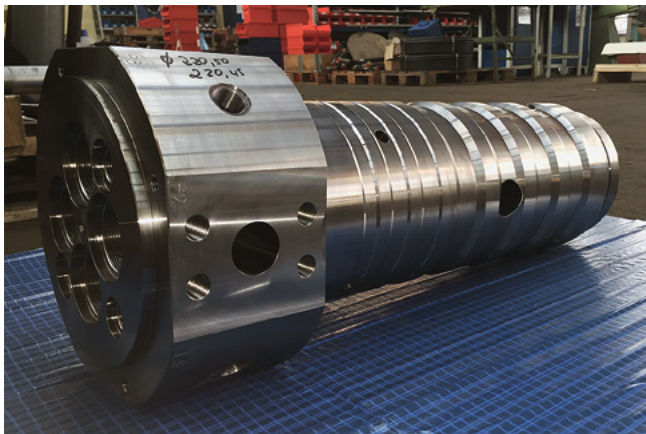
THE PERFECT SOLUTIONS FOR CHALLENGING APPLICATIONS

KS-HardCoat / KS-SuperCoat - The EXTREME!

The hard and extremely dense HVOF layers, KS-HardCoat and KS-SuperCoat, not only offer excellent wear and tear but also provide corrosion protection, protection for abrasion, erosion and sliding abrasion as well as for damage from cavitation.

Because of the low component heating while coating, the temperature-sensitive components can be coated hassle-free with either KS-HardCoat or KS-SuperCoat.

Various alloy compositions enable the problem-free use, in operating temperatures of up to approximately 460 °C. Special spray material based on tungsten and chrome carbides are used.



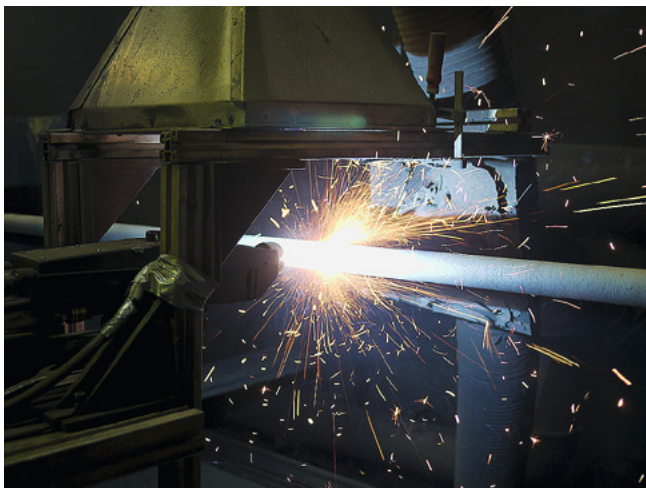
KS-HardCoat - Extremely long useful lives!

KS-MetalCoat - The VERSATILE ONE!

The KS-MetalCoat coatings are known for their versatile alloy compositions. Subject the requirement, chrome or chrome-nickel steel, white metal, molybdenum or bronze alloys are used.

Depending on the application and the type of alloy used, layer thicknesses of up to multiple millimeters can be sprayed. The achievable layer hardness is then adapted to the requirements of the sprayed surfaces.

Especially when it comes to repair applications, the KS-HardCoat or KS-SuperCoat can be combined as a functional layer along with the KS-MetalCoat.



KS-MetalCoat - Versatile and efficient!

BENEFITS: KS-HardCoat/KS-SuperCoat

- + Extreme coating hardness of up to ~ 1.400 HV
- + Excellent abrasion, scratch and wear resistance
- + Very good corrosion resistance
- + High level of dynamic resilience
- + Excellent sealing compatibility
- + Very broad range of application

TYPICAL APPLICATIONS

- Piston rods
- Rotary feedthroughs
- Seal seats (e.g. Shaft seals)

BENEFITS: KS-MetalCoat

- + High (repair) layer thickness of up to 5 mm
- + Good to very good corrosion and wear and tear resistance
- + Very good machinability
- + Excellent anti-friction properties
- + Individual layer properties
- + Versatile range of application

TYPICAL APPLICATIONS

- Piston rods / Pistons
- Guide bushes / Cylinder tubes
- Bearing hubs / Casing partitions

APPLICATIONS: KS-COATINGS

HYDRAULIC CYLINDERS

- Piston rods
- Pistons
- Guide bushes
- Cylinder tubes

HYDRAULIC DRIVES

- Rotary feedthroughs
- Bearing seats
- Sealing seats
- Case dividers
- Shafts / Axles (Drive, Pinion and Eccentric shafts)
- Guide / Protective bushes

IT'S THE SURFACE THAT MATTERS!

KS-COATINGS	KS-InductiveCoat	KS-HardCoat KS-SuperCoat	KS-MetalCoat
PROCESS	TS with subsequently inductively melted down	HVOF (High-Velocity-Oxygen-Fuel)	Electric arc flame spraying (powder/wire)
Composition	Nickel-base-alloy	CrC + Matrix / WC + Matrix	Iron Base, Bronze, NiCr, Molybdenum
Layer hardness	45 - 60 HRC	900 HV / 1.400 HV	up to approx. 60 HRC
Layer thickness	up to 1.5 mm	0.1 - 0.3 mm	up to 5 mm
Corrosion resistance ¹⁾	excellent	very good	moderate - very good
Wear resistance	excellent	excellent	good - very good
Scratch resistance	very good	excellent	moderate - very good
Sealing compatibility ²⁾	very good	very good	good - very good
Repairability	very good	conditional	moderate - good
TYPICAL APPLICATIONS	Piston rods Guide / Protective bushes Axial sealing / Sliding surfaces	Piston rods Rotary feedthroughs Seal seats (e.g. Shaft seals)	Piston rods / Pistons Guide bushes Cylinder tubes Bearing hubs / Casing partitions
FURTHER BENEFITS	100 % moisture and gas-proof Maximum dynamic resilience Flake-resistant, also in the case of impact Very good repairability (in situ)	High dynamic resilience Very broad range of application Application specific alloys	Very good machinability Outstanding slip properties Individual layer properties Versatile range of applications
KS-DESIGNATIONS	KS-IC45 KS-IC55 (KS-IC60)	KS-HC KS-SC	KS-MC Bz KS-MC005 KS-MC006 KS-MC082 KS-MCW14
¹⁾ very good \triangleq 1.000 h (NSS DIN EN ISO 9227)			
²⁾ Range of surface roughness values: Ra 0.05-0.2 Rz 0.3-1.5 Rpk 0.03-0.15 Rvk 0.05-0.3 Rmr* 70-90 % (*C = 0.25 x Rz)			

We are pleased to send the following documents on request:

- KS - recommendation for coating
- KS - description of coating (specified)
- KS - coating overview (current)



Karl Schumacher GmbH
Engineering and Thermal Spraying

Hohensteinstraße 52
44866 Bochum / Germany

Member of the BOMAF A Group.

Phone: +49 (0)2327 / 992-600

Fax: +49 (0)2327 / 992-679

e-mail: info@schumacher-bochum.de

Internet: www.schumacher-bochum.de



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