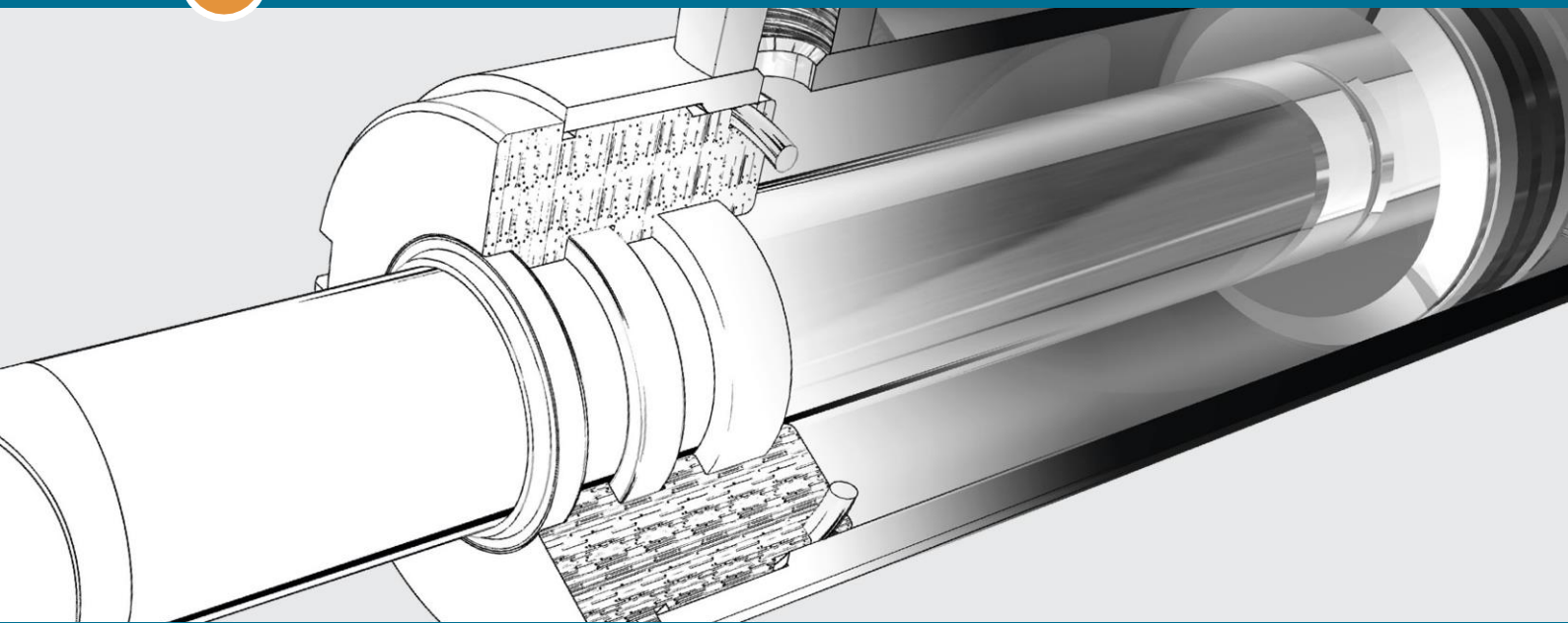


# On point

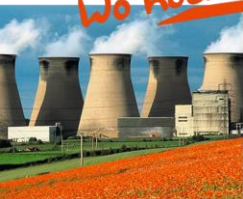


## COATINGS FOR THE HYDRAULICS INDUSTRY

**The high performance coatings  
of Karl Schumacher:**

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

*Wo Höchstleistung zählt!*



**Karl Schumacher**  
Maschinenbau und Metallspritzwerk

# COATING SOLUTIONS FOR THE OPTIMAL USEFUL LIFE RESTORATION OF HYDRAULIC CYLINDERS

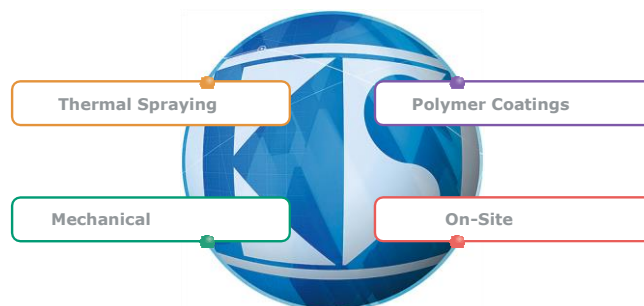
## When maximum performance matters!

Karl Schumacher GmbH is the specialist for solution-oriented coating technologies in the areas of corrosion and wear protection. Apart from solutions based on thermal spraying, we also support you with sophisticated 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.

We are in principle set up in such a way, that, depending on the 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 generation, chemical/refinery, waste water treatment, as well as heavy, and rail engineering industries.



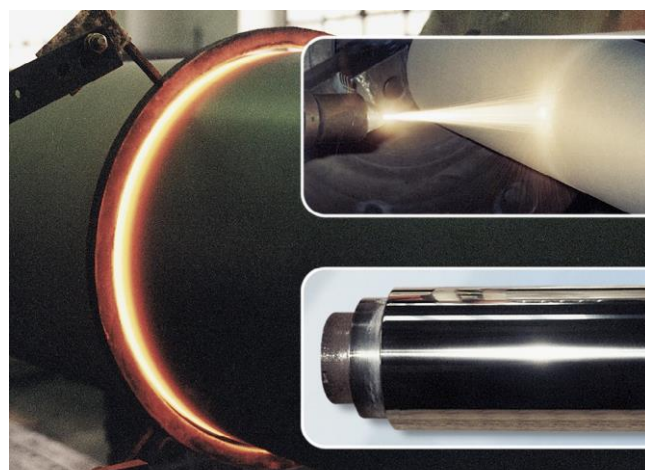
## MORE INTELLIGENT PROTECTION WITH SUPERIOR TECHNICAL PROPERTIES

### 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 therefore offer outstanding protection from corrosion and offer maximum reliability, since the layers offer excellent wear protection and are 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).



The original - inductive enamel bond of Karl Schumacher!

### BENEFITS: KS-InductiveCoat

- + excellent corrosion and wear resistance
- + 100% moisture 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



KS-COATINGS - When high performance matters!

# 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- and corrosion protection, but also offer 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 approx. 460 °C. Special spray material based on tungsten and chrome carbides are used.



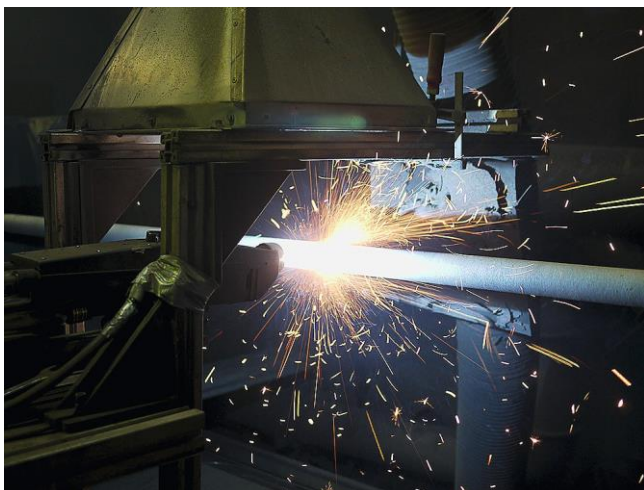
KS-HardCoat - Extremely long useful lives!

## KS-MetalCoat - The VERSATILE ONE!

The KS-MetalCoat coatings are known for their versatile alloy compositions. Depending on 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 are 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 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
- Sealing tightness (for example WDR)

### 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 / eccentric shafts)
- Guide / Protective bushes

# IT'S THE SURFACE THAT MATTERS!

| KS-COATINGS                                                                                                                             | KS-InductiveCoat                                                                                                                      | KS-HardCoat                                                                         | 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 - 1 400 HRC                                                                     | up to approx. 60 HRC                                                                                            |
| Layer Thickness                                                                                                                         | up to 1.5 mm                                                                                                                          | 0.1 - 0.3 mm                                                                        | up to 5 mm                                                                                                      |
| Corrosion resistance <sup>1)</sup>                                                                                                      | excellent                                                                                                                             | very good                                                                           | moderate - very good                                                                                            |
| Wear Resistance                                                                                                                         | excellent                                                                                                                             | excellent                                                                           | good - very good                                                                                                |
| Scratch Resistance                                                                                                                      | very good                                                                                                                             | excellent                                                                           | moderate - very good                                                                                            |
| Sealing compatibility <sup>2)</sup>                                                                                                     | 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 sealing seats (for example WDR)                     | 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<br>KS-SC                                                                      | KS-MC Bz<br>KS-MC005   KS-MC006 KS-MC082<br>KS-MCW14                                                            |
| <sup>1)</sup> very good 1 000 h (NSS DIN EN ISO 9227)                                                                                   |                                                                                                                                       |                                                                                     |                                                                                                                 |
| <sup>2)</sup> 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 would love to send you the following documents upon request:

- KS-Konstruktionsempfehlungen
- KS-Schichtbeschreibungen (specified)
- KS coating overview (current)



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