

WACKER ETHYL SILICATES – A TOUCH OF ETERNITY

Zinc-rich paints based on ethyl silicates combine outstanding, long-term corrosion protection of ferrous surfaces with resistance to high temperatures. The benefits are best seen in aggressive environments where there is exposure to severe weather and chemicals. Typical application areas are bridges, ships and structural steel. Tetraethyl orthosilicate (WACKER® Silicate TES 28) also serves as feedstock for numerous industrial sol-gel processes, which yield coatings that are very thin, yet extremely durable.

A Comprehensive Portfolio

Ethyl silicates from WACKER for use in zinc-rich paints are available as:

- Basic binders, requiring hydrolysis and further processing
- Ready-to-use binders, available either prehydrolyzed or ready formulated

Whereas basic binders provide coatings manufacturers with full formulation flexibility, the benefits of prehydrolyzed and formulated binders are:

- Shorter time to market, as little or no R&D is required to develop the binder
- Lower R&D and production costs
- Fewer raw materials to be coordinated



Product Information					
	WACKER® Silicate TES 28	WACKER® Silicate TES 40 WN	SILESTER® XAR	WACKER® Silicate MKS	WACKER® Silicate S100
Binder Type					
Basic binder	•	•			
Prehydrolyzed binder			•		
Formulated binder				•	•
Binder for					
1-Pack systems	•	•		•	•
2-Pack systems	•	•	•		
Recommended use of zinc-rich paint as					
Shop primer	•	•	•		
Primer	•	•	•	•	•
Single coating	•	•		•	•





Performance You can Rely on: Basic Binders for Zinc-Rich Coatings

WACKER offers WACKER® Silicate TES 40 WN and Silicate TES 28 as basic binders. The main differences between these two products are to be found in their SiO₂ content and molecular structure. WACKER® Silicate TES 28 is a tetraethoxysilane (28.8% SiO₂) and WACKER® TES 40 WN is an ethyl silicate polymer (41% SiO₂). WACKER's longstanding experience in the production of ethyl silicates guarantees high product quality and a long shelf life. The proportion of free ethanol in WACKER® Silicate TES 40 WN is so low that the product has a flash point above 62 °C. As a result, the binder is not classified as a hazardous chemical under transport regulations.

Basic binders are the standard solution for formulating 2-pack zinc-rich paints. However, they must be activated by a chemical reaction (hydrolysis) before use – this requires additional processing steps.



Customized and Ready to Use: Prehydrolyzed Binder for Two-Pack Zinc-Rich Paints

The main components of a two-pack zinc-rich coating are the binder and the pigment. These two components are to be kept separate until shortly before use. Once mixed, the paint must be used within 24 to 48 h. WACKER sells prehydrolyzed

binder under the name SILESTER® XAR. The degree of hydrolysis and the pH of the binder have been optimized to ensure both the necessary reactivity and adequate storage stability. pH changes caused by the addition of zinc dust or various additives, or even solvent evaporation, will promote ethyl silicate condensation and will accelerate the curing process.

Characteristics of SILESTER® XAR

Chemical name	Ethyl silicate hybrid binder (hydrolyzate)
Solvents	Ethanol, 2-propanol
SiO ₂ content, approx.	20%
Flash point	< 21 °C
Use	Shop primer, primer
Characteristics	Fast drying and easy handling

These figures are intended as a guide and should not be used in preparing specifications.





Characteristics of WACKER® Silicate MKS and WACKER® Silicate S100

	WACKER® Silicate MKS	WACKER® Silicate S100
Chemical name	Ethyl silicate formulation	Ethyl silicate formulation
Solvents	Aromatic hydrocarbons, white spirit	Aliphatic and aromatic hydrocarbons
SiO ₂ content	20%	20.5 %
Flash point	< 21 °C	> 21 °C
Use	Primer, single coating	Primer, single coating
Characteristics	Contains anti-settling additives	Contains anti-settling additives. Dries somewhat more slowly than WACKER® Silicate MKS

These figures are intended as a guide and should not be used in preparing specifications.

Excellent and Durable: Formulated Binders for One-Pack Zinc-Rich Paints

One-pack zinc-rich paints are fully formulated systems containing all the necessary components. Provided that moisture is excluded, they generally have a shelf life of six to twelve months.

WACKER's ethyl silicate binders for one-pack zinc-rich coatings are completely anhydrous. Handling of these products needs to exclude the incorporation of moisture – typically found in pigments or additives – during the production of zinc-rich paints. Care must be taken when adding the zinc pigment to the ready formulated ethyl silicate.

Once the one-pack zinc-rich paint has been applied to a substrate, the binder will hydrolyze in the presence of atmospheric moisture and cure rapidly to produce a hard coating. WACKER® Silicate MKS and WACKER® Silicate S100 binders for one-pack zinc-rich paints are characterized by outstanding anti-settling properties. Paints formulated with zinc pigments can be easily mixed in, even after being stored for long periods of time.



Scientific and Comprehensive: WACKER's Experience Ensures Optimum Processing

Zinc-rich paints based on ethyl silicate typically consist of:

- Ethyl silicate binder
- Zinc dust or paste
- Extenders, additives

General considerations for choosing zinc dust or paste:

- The excellent anti-corrosive effect of zinc-rich paint is largely due to its cathodic protection, which requires close contact between the zinc and the iron surface. For excellent performance, dry films must contain at least 90% zinc.
- Zinc is available in different grades: whether in the form of dust or paste, shop primers require a particle size of 2 – 4 µm (superfine) whereas medium/thick coats need slightly coarser grades of zinc dust (5 – 7 µm).
- For 2-pack systems, the zinc is to be supplied in separate packaging and stirred into the binder immediately before use.

Extenders and additives are used in order to obtain specific properties:

- Talcum, mica, polyvinyl butyral, and acrylates increase film adhesion and flexibility and also reduce the risk of mud-cracking.
- Fumed silica (HDK®) improves anti-settling and rheology properties.
- Zinc chloride is often used to accelerate the curing process.

It is important to note that most extenders and additives reduce the shelf life of the ethyl silicate hydrolyzate.

Sample Formulation for Two-Pack Zinc-Rich Paints

	[g]	Material	Supplier
1	18.8	SILESTER® XAR	Wacker Chemie AG
2	1.4	Bentone paste 38 (10 pbw Bentone powder 38 + 10 pbw Antiterra U + 80 pbw xylene)	Elementis Specialities, Inc. BYK-Chemie GmbH
3	0.2	HDK® H 15	Wacker Chemie AG
4	4.5	Mica TM	Aspanger Bergbau und Mineralwerke GmbH & Co KG
5	75.1	HZO paint zinc dust superfine	Norzinco GmbH
Specific gravity (DIN 53217)			2.96 g/ml
Dry-to-touch (100 µm wet)			4 min

Sample Formulation for One-Pack Zinc-Rich Paints with WACKER® Silicate MKS

	[g]	Material	Supplier
1	17.1	WACKER® Silicate MKS	Wacker Chemie AG
2	0.5	HDK® H 15	Wacker Chemie AG
3	77.5	HZO paint zinc dust superfine	Norzinco GmbH
4	1.0	Solvesso 100	ExxonMobil Chemical Company
5	1.9	Xylene	Different suppliers
6	2.0	White spirit 140/165	Different suppliers
Viscosity (DIN 4 Cup)			31.6 s
Specific gravity (DIN 53217)			2.86 g/ml
Dry-to-touch (100 µm wet)			30 min

Sample Formulation for One-Pack Zinc-Rich Paints with WACKER® Silicate MKS

	[g]	Material	Supplier
1	15	WACKER® Silicate S100	Wacker Chemie AG
2	1.2	Talcum EL 10	Imerys French Limited
3	1.2	Colortherm Green GN	Lanxess AG
4	1.6	MICA TM	Aspanger Bergbau und Mineralwerke GmbH & Co. KG
5	76.0	HZO paint zinc dust superfine	Norzinco GmbH
6	2.5	White spirit 140/165	Different suppliers
7	2.5	Solvesso 100	ExxonMobil Chemical Company
Viscosity (DIN 4 Cup)			35 s
Specific gravity (DIN 53217)			2.96 g/ml
Dry-to-touch (100 µm wet)			90 min

Characteristics of Zinc-Rich Ethyl Silicate Binders

- Fast curing, even under extreme conditions
- Excellent adhesion to clean surfaces
- Excellent protection against undercoat rusting
- Easy welding
- Resistance to most solvents, UV radiation and biological attack
- Heat resistance up to 400 °C and briefly up to 600 °C, with a topcoat containing aluminum pigment (remember that the melting point of zinc is 420 °C)
- Thermal shock resistance
- Easy overpainting with any standard paint

Application Areas for WACKER Ethyl Silicates

- Shop primers (10 – 20 µm dry film thickness)
- Primers (50 – 70 µm dry film thickness)
- Thick-film coatings (~100 µm dry film thickness)
- Industrial and marine environments, e.g. shipbuilding, bridges, refineries, chemical plants, chimneys

Advantages of WACKER Ethyl Silicates

- Manufactured by a leading global producer
- Available as basic binders and ready-to-use binders
- WACKER® Silicate TES 40 WN meets the criteria for non-hazardous labeling – this reduces transport costs

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