

WACKER

CREATING TOMORROW'S SOLUTIONS

VINNAPAS®

CARPET | POLYMER DISPERSIONS

MAKE THE MOVE TO VAE TECHNOLOGY

High-Quality Binders for Carpet Applications



A photograph of a silver laptop open on a brown carpet. The laptop screen is tilted back. In the background, there are white planters with green plants. The right side of the image is overlaid with a solid green background containing white text.

VAE – TECHNOLOGY FOR FUTURE MARKETS

Producing poly(vinyl acetate) dispersions since 1938, WACKER pioneered the development of vinyl acetate-ethylene (VAE) copolymer dispersions in 1960. Today, WACKER is a global market leader and driving force behind innovation in VAE copolymer dispersions, which are essential components in many applications.

WACKER introduced VAE dispersions to the carpet industry in the 1980s. Since then, we have continuously developed and revised our products to ensure they continue to meet the challenges of an ever-changing market.

MAKE THE MOVE TO A RELIABLE LONG-TERM SOLUTION

VINNAPAS® dispersions based on vinyl acetate-ethylene (VAE) copolymers satisfy all technical requirements in carpet-backing applications – both for residential and commercial use. They are suitable for tufted carpet broadloom and tile production, as well as for needlefelt and woven applications. In addition, VAE copolymer dispersions excel in low odor, low emissions and flammability resistance. VINNAPAS® VAE technology also offers advantages regarding availability and predictability of competitive pricing.

Application Advantages

- Good tuft bind
- Good delamination
- Good cut-edge stability
- Excellent dimensional stability

Environmental Advantages

- Low odor
- Low emissions
- Low flammability, reduced smoke

Discover the Benefits of VINNAPAS® VAE Dispersions in Carpet Backings

General Advantages

Competitive pricing and attractive cost-in-use due to:

- Performance
- Alternate raw-material feedstocks
- Predictability of pricing

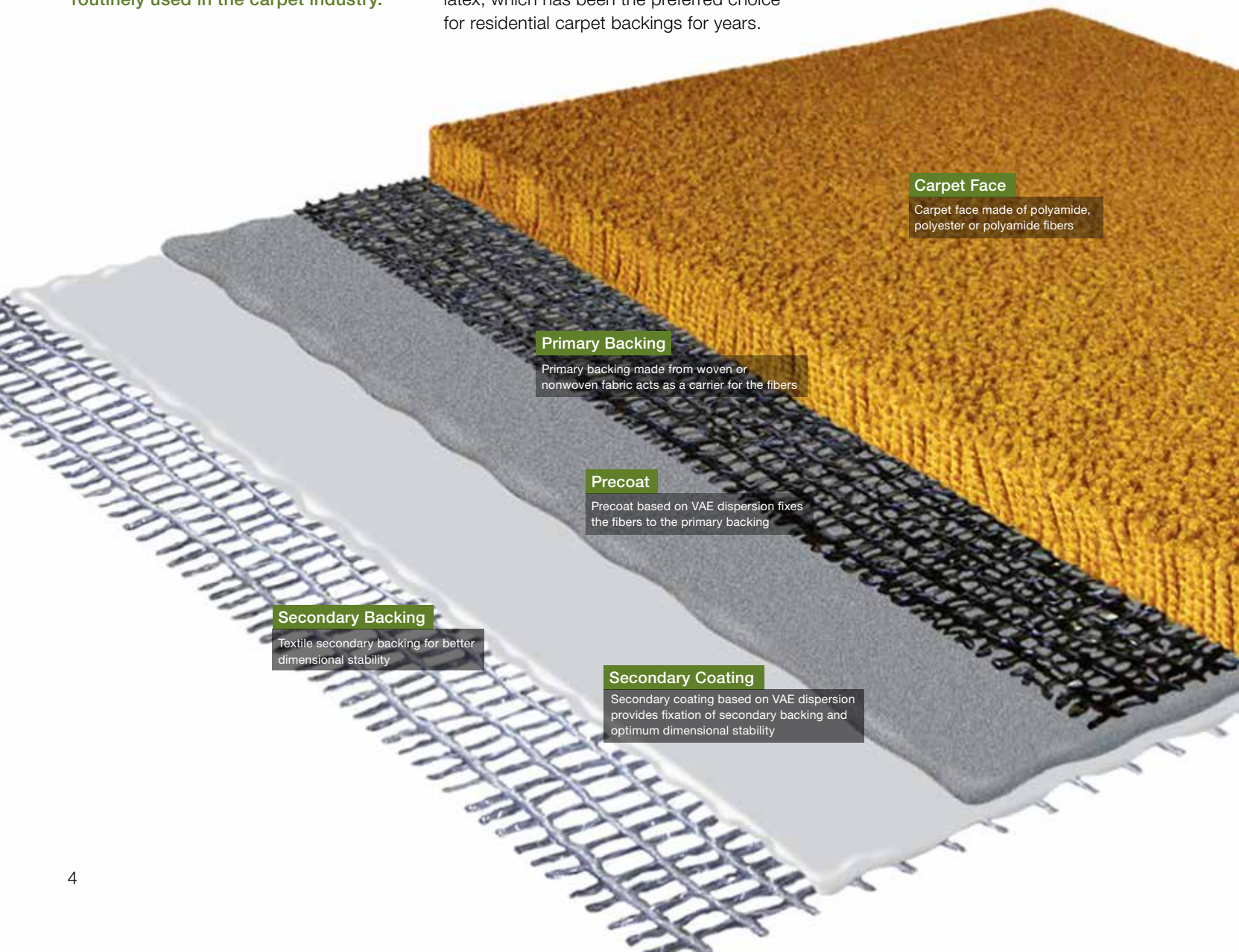
Processing Advantages

- Excellent compounding properties
- Good filler-load capacity
- Excellent foamability
- Good processability

THE FUTURE-ORIENTED SOLUTION: SUPERIOR CHEMISTRY FOR CARPET BACKINGS

For decades, our goal has been to supply our customers with excellent quality, while continuously enhancing the product's performance. VINNAPAS® dispersions based on vinyl acetate-ethylene (VAE) fulfill all technical requirements needed in carpet backings. Hence, products based on VAE copolymers are routinely used in the carpet industry.

The reason lies in the structure of VAE copolymers which allows for optimized strength and flexibility – characteristics that are especially valuable for carpet backings. Moreover, VINNAPAS® VAE technology meets sophisticated market requirements concerning low-VOC and low-odor carpets. Thus, VAE is an excellent alternative to SB latex, which has been the preferred choice for residential carpet backings for years.



Carpet Face

Carpet face made of polyamide, polyester or polyamide fibers

Primary Backing

Primary backing made from woven or nonwoven fabric acts as a carrier for the fibers

Precoat

Precoat based on VAE dispersion fixes the fibers to the primary backing

Secondary Backing

Textile secondary backing for better dimensional stability

Secondary Coating

Secondary coating based on VAE dispersion provides fixation of secondary backing and optimum dimensional stability

THE UNIQUE SOLUTION: SUPERIOR TECHNOLOGY FOR UNIQUE PROPERTIES

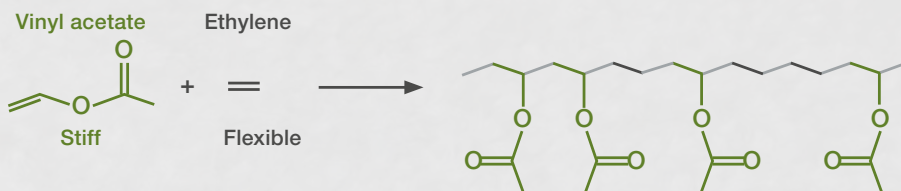
As with styrene-butadiene (SB) latex, VAE copolymers consist of two building blocks which deliver stiffness (vinyl acetate) and flexibility (ethylene).

By varying the ratio of the two monomers, it is possible to adjust specific application properties, such as handfeel. The ethylene component in the VINNAPAS® carpet backing dispersion “internally plasticizes” the product and results in inherently high adhesive strength that maintains good flexibility, allowing VAE to be used, for example, as the precoat layer and/or secondary coating in tufted carpet applications.

Advantages of VAE Technology for Dispersions

- VAE dispersions are based primarily on C1/C2 chemistry which can be derived from many feedstock options (incl. natural gas), allowing domestic supplies to be leveraged.
- Risk mitigation in today’s volatile raw-material dynamics provided by the alternative C1-/C2-based chemistry and its value stream.
- Raw materials are not reliant on oil, hence: more cost-effective and more stable pricing.

Two Monomers Create a Perfect Balance of Stiffness and Flexibility



Ethylene

- Polymer Tg approx. -100 °C (soft)
- Hydrophobicity
- Permanent flexibility
- Ideal copolymerization with VAM

Vinyl acetate

- Polymer Tg approx. 35 °C (hard)
- Polar, hydrophilic

Vinyl acetate-ethylene

(VAE) copolymer dispersion

- Handfeel depends on ethylene content
- Excellent adhesion to polypropylene, polyester and polyamide fibers
- Excellent compounding properties
- Good filler acceptance
- Excellent film-forming properties

THE HIGH-PERFORMANCE SOLUTION: SUPERIOR CHARACTERISTICS FOR YOUR PRODUCTS

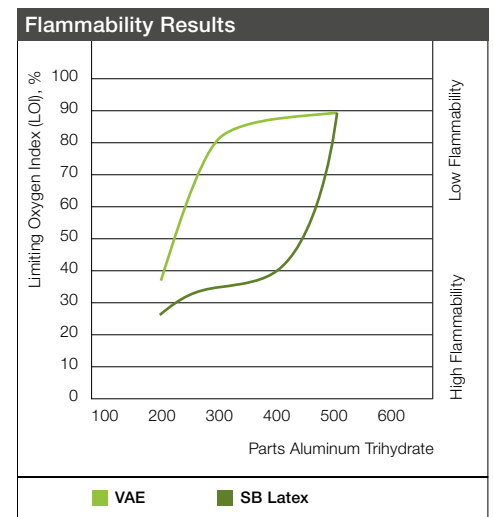
Compared to SB latex, VINNAPAS® VAE copolymer dispersions offer several additional advantages, such as flame retardancy and reduced smoke, low emissions, such as volatile organic compounds (VOCs) in particular, and low odor for better residential health.

Lower Flammability

VINNAPAS® VAE copolymers exhibit lower flammability compared to SB latex. When the flammability of polymer/calcium carbonate films is measured in a fume chamber according to DIN 4102-1, the results show that the SB latex films burn readily and emit thick black smoke while the VAE films either burn only slightly with light white smoke or are self-extinguishing. These results are confirmed by the limiting oxygen index (LOI) test results of compounds with alumina trihydrate (ATH).

ATH is used to achieve flame-retarding properties in commercial carpet applications. ATH is significantly more expensive than standard calcium carbonate fillers. The figure below shows a comparison of the flame-retarding properties of VINNAPAS® VAE versus a typical carpet-backing SB latex. The limiting oxygen index (LOI) test indicates the flammability of materials by measuring the minimum concentration of oxygen that supports combustion in a mixture of oxygen and nitrogen. The material with the higher index shows a greater resistance to burning. The results indicate that the equivalent fire retardancy can be obtained with VINNAPAS® VAE copolymer dispersions at lower cost as compared with SB latex because the VINNAPAS® dispersion formulation includes significantly less alumina trihydrate (ATH). In this example, the VAE/calcium carbonate

system can attain the same degree of fire retardancy with 150–200 parts less ATH in the formulation.



VAE/calcium carbonate film (150% filler loading according to DIN 4102-1; self-extinguishing.



SB latex/calcium carbonate film (150% filler loading) according to DIN 4102-1.

Low Odor

Newly installed carpets that use SB latex as the back-coating binder have a typical smell caused by 4-PCH (4-phenylcyclohexene) or 4-VCH (4-vinylcyclohexene) – both by-products of SB latex production. By using VAE copolymer dispersions, carpet manufacturers can produce carpets with significantly lower odor, which is an advantage to production workers as well as to consumers as regards the end product.

Low Emissions

Emission measurement of carpets with VAE back coatings can readily meet the criteria set forth by certification labels such as Green Label Plus® and Gemeinschaft Umweltfreundlicher Teppichboden (GUT). Specifically, no emissions of styrene or 4-PCH (4-phenylcyclohexene) can be detected.

GUT

The GUT seal was launched in 1990 by the Gemeinschaft umweltfreundlicher Teppichboden e. V. (Association of Environmentally Friendly Carpets), which was founded in Aachen by leading European carpet manufacturers. Since then, it has become Europe's most well-known carpet seal and an integral part of PRODIS, the European product information system for textile flooring. The carpets, which need to be odorless and non-toxic to receive the seal, are inspected by a number of testing institutes.

In this context, manufacturers are prohibited from using problematic substances and specific limits have been defined for volatile organic compounds.

Green Label Plus

Green Label Plus is an independent testing program that identifies carpets, adhesives, and cushions with very low VOC emissions to help improve indoor air quality. It is an extension and enhancement of the CRI Green Label Testing program. By selecting a Green Label Plus carpet, adhesive or cushion, you are assured one of the lowest emitting products on the market, and you may be able to earn credit under LEED, Green Globes or Green Guide for Health Care.



TAILOR-MADE SOLUTIONS: EXCELLENT SERVICES FOR THE CARPET INDUSTRY

WACKER produces VAE dispersions under the brand name VINNAPAS® at five production sites: Burghausen and Cologne (Germany), Calvert City (USA), Ulsan (South Korea) and Nanjing (China). To support carpet manufacturers, we operate dedicated state-of-the-art carpet laboratories around the globe.

This is where customer-specific formulations can be developed and carpet can be coated by foam, full-bath or back-coating (Foulard). What is more, the labs can perform in-house testing as per all relevant carpet-industry specifications. Additionally, WACKER ACADEMY offers technical training on VAE technology used for carpet applications.

Connecting the Best: WACKER ACADEMY

The WACKER ACADEMY, as a unique training center, offers discussions with local experts and cutting-edge expertise in close collaboration with our technical centers. There is a WACKER ACADEMY for all key WACKER industries and markets at 14 locations worldwide on 5 continents.

We offer knowledge via our unique seminar and training program which is industry-specific and practice-oriented – yet interdisciplinary in every way. All training sessions and seminars are tailored to practical uses in which the customers, applications, products and solutions are involved.



www.wacker.com/wacker-academy

Putting Carpets to the Test



Lisson Treadwheel Test
The treadwheel test simulates the effects of shoes to determine how well a carpet holds up to heavy foot traffic.



Delamination Test
The delamination test is used for determining the strength of the bond between the secondary carpet backing and the wearing surface.



Tuft Bind Test
The tuft bind test assesses how well the carpet fibers are adhered to the primary carpet backing material.



Furnace Chamber Test
The furnace chamber test involves setting fire to the carpet samples. Carpets bound with VAE are significantly less flammable than those based on styrene-butadiene latex.



Vettermann Drum Test
In the Vettermann drum test, a metal ball rolls around for days inside a rotating drum lined with carpet.

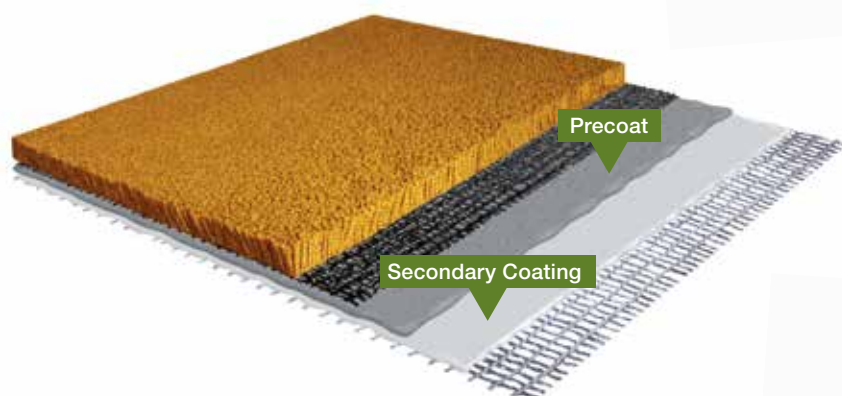


Caster Chair Test
The caster chair test simulates an office chair rolling over a carpet thousands of times.

THE OPTIMUM SOLUTION: BEST RESULTS FOR TUFTED, WOVEN AND NEEDLEFELT CARPETS

Tufted Broadloom Carpet

In tufted broadloom carpet, VINNAPAS® VAE dispersions are used in precoats and secondary coatings. Tufted broadloom carpets normally consist of a multilayered structure as shown in the drawing. Providing effective adhesion between the different layers is one of the challenges that must be met by VINNAPAS® VAE dispersions. When used in the primary coating (precoat), VINNAPAS® products provide the strength to lock the tufts of yarn in place (tuft bind). In the secondary coating, they ensure dimensional stability by bonding the secondary backing to the carpet. VINNAPAS® VAE dispersions can provide the desired level of stiffness or "hand." Moreover, they show reduced flammability.



Tufted Carpet Tile

In carpet tiles, VINNAPAS® VAE dispersions are applied as the precoat, where they bind the tufted fibers to the backing. Carpet tiles are a flexible alternative to tufted broadloom carpets. They can be laid easily and form a high-quality, comfortable flooring. Carpet tiles have a multilayered structure in which the tufted fibers are anchored onto a primary backing, which in turn is bonded to a base layer, typically PVC, polyolefin or bitumen. The requirements for tiles are chiefly dimensional stability and good "workability" of the end product.



Needlefelt Carpet

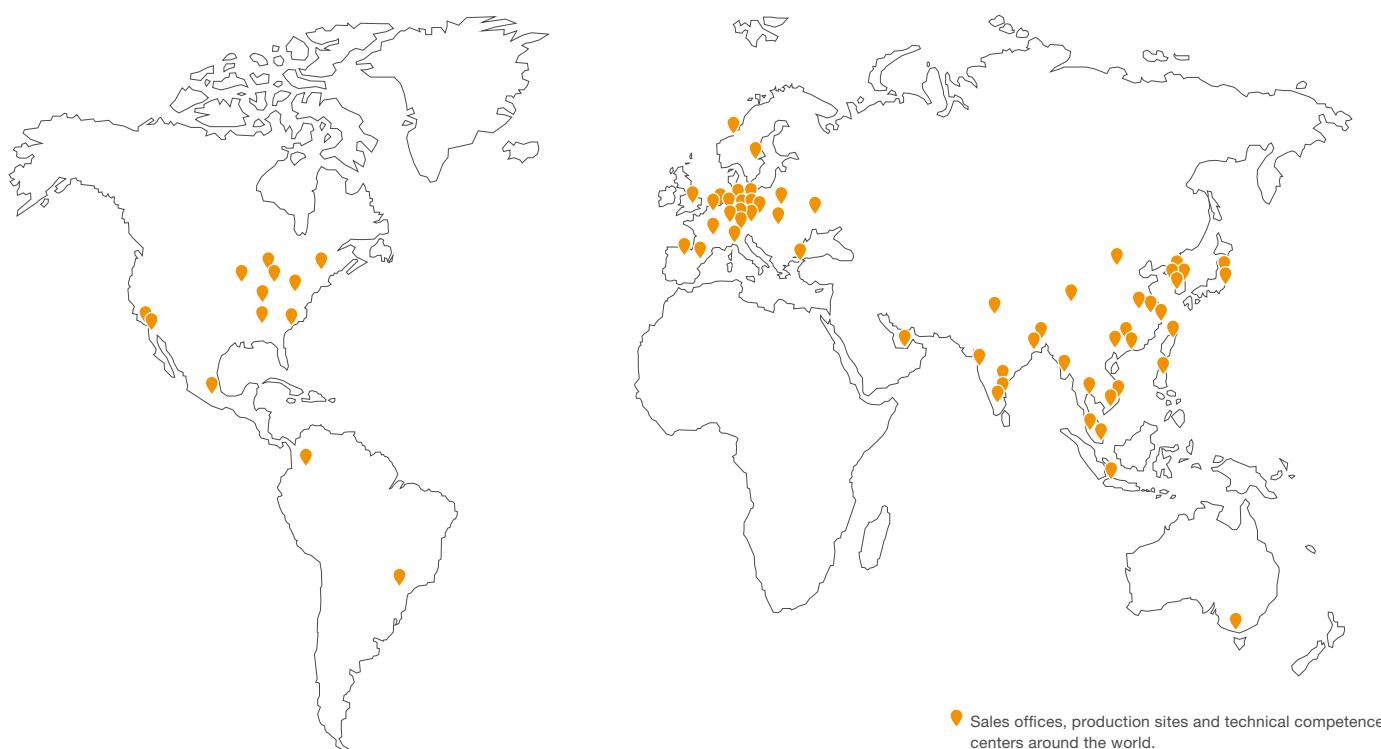
VINNAPAS® VAE dispersions are applied to needlefelt (needlepunch) carpets to stiffen the handfeel, improve flammability resistance and improve the bond between the random fibers. Increasing the bond between the fibers increases the resiliency and longevity of the carpet.



Woven Carpet

VINNAPAS® VAE dispersions serve as the coating for woven carpets because they provide a stiffer handfeel and dimensional stability. In a woven carpet, the carpet fibers are mechanically anchored to the tightly woven backing. This helps to position woven carpets at the high end of carpet production in terms of longevity and quality.

EXPERTISE AND SERVICE NETWORK ON FIVE CONTINENTS



WACKER is one of the world's leading and most research-intensive chemical companies, with total sales of €6.4bn. Products range from silicones, binders and polymer additives for diverse industrial sectors to bioengineered pharmaceutical actives and hyperpure silicon for semiconductor and solar applications. As a technology leader focusing on sustainability, WACKER promotes products and ideas that offer a high value-added potential to ensure that current and future generations enjoy a better quality of life, based on energy efficiency and protection of the climate and environment.

Spanning the globe with 4 business divisions, we offer our customers highly-specialized products and comprehensive service via 27 production sites, 22 technical competence centers, 14 WACKER ACADEMY training centers and 48 sales offices in Europe, North and South America, and Asia – including a presence in China. With a workforce of some 16,400, we see ourselves as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, our customers. We also help them boost their own success. Our technical competence centers employ local specialists, who assist




customers worldwide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required. WACKER e-solutions are online services provided via our customer portal and as integrated process solutions. Our customers and business partners thus benefit from reliable service and comprehensive information to enable projects and orders to be handled fast, reliably and highly efficiently. Visit us anywhere, anytime around the world at: www.wacker.com



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