A COMPLETE BRIDGE DECK WATERPROOFING SYSTEM

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ALCHIMICA® BUILDING CHEMICALS

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WHY CHOOSE ALCHIMICA IN BRIDGE DECK WATERPROOFING PROJECTS?

ALCHIMICA has developed HYPERDESMO-300, a single-component waterproofing membrane for bridge decks that exceeds the requirements of the European Technical Approval Guideline for Liquid Applied Bridge Deck Waterproofing Kits (ETAG 033) and meets the international industry standards.

ALCHIMICA conducted thorough market research and needs assessment to understand the specific requirements and challenges associated with bridge deck waterproofing, considering factors such as traffic loads, temperature variations, chemical resistance and exposure from road salts and vehicle emissions, and mechanical stresses from traffic loads. The bridge deck waterproofing system based on HYPERDESMO-300, was designed to be compatible with the overall bridge design, accommodating structural movements and expansion joints.

HYPERDESMO-300 underwent rigorous testing to ensure it met the performance criteria outlined in ETAG 033. The product was designed to be user-friendly and easy to apply by professionals, minimizing downtime during application.

Single-component and two-component liquid-applied materials are both popular choices for waterproofing works. Single-component materials are easier to work with when compared to multiple-component systems, as they reduce the need for precise measurements, equipment, and concerns about pot life. Using single-component materials reduces the risk of errors, such as adding too much or too little of one component, hence minimizing the chances of the waterproofing not performing as expected. The main advantage of HYPERDESMO-300 as a single-component waterproofing membrane is that it is user-friendly by easily

being mixed with a 1KW slow-speed drill inside the pail and can be applied with standard tools like brushes, rollers, or trowels but it is also suitable for applications with an airless spray machine. Also, it provides consistent quality due to its precise formulations, reducing the risk of mixing errors. Single-component materials can save time by avoiding extra time spent mixing and preparing the material, especially in busy construction sites and in conditions with critical weather. Overall, single-component materials offer a more efficient and effective solution for waterproofing projects.

ALCHIMICA is a pioneer and a global leader in polyurethane waterproofing technologies. With pedigree and expertise in this field, ALCHIMICA overcomes the challenges that others deem impossible. The technological depth and know-how allowed the formulation of a single-component PU membrane that can achieve performance levels that are typically met by multiple-component systems.

ALCHIMICA has been active in the research, development, and production of liquid building chemicals for 41 years providing solutions for liquid waterproofing, reparations, sealing, flooring, and ETICs. The know-how of ALCHIMICA in Research and Development laboratories in construction, repair, and renovation solutions of buildings and infrastructure meets international industry standards. ALCHIMICA responds to the needs of a single-component bridge deck waterproofing system by launching HYPERDESMO-300, the new innovative single-component polyurethane waterproofing membrane, based on HYPERDESMO® technology.

EXPLAINING ETAG 033 IN SIMPLE WORDS

ETAG 033 is a European technical guideline for liquid-applied bridge deck waterproofing systems (kits). These kits are designed for concrete bridge decks and consist of in-situ liquids based on polymers. These kits can be poured, spread, or sprayed onto existing surfaces to create a continuous watertight membrane. Available chemistries and technologies, at the moment, include acrylics, epoxies, polyesters, polyurea, polyurethanes, and water-dispersible polymers. Systems based on bitumen and polymer-modified mortars and kits with polymeric overlays are not covered under this ETAG. Once cured, these kits must provide a continuous watertight membrane.

Liquid-applied bridge deck waterproofing kits and systems may include protective layers, reinforcements, and ancillary products. These kits are not intended for direct vehicular traffic and are used beneath overlays of asphalt or concrete, which may have protective or additional waterproofing functions. These overlays are not part of the scope of this guideline but will be considered if they affect the performance of the waterproofing layer. Bridge deck waterproofing kits may remain uncovered when subject to pedestrian or cyclist traffic or in non-trafficked areas. The main goal of this guideline is to approve the suitability of the product as a waterproofing system for bridge decks applied in liquid form – under the asphalt.

A suitable system for bridge deck waterproofing must meet several key parameters, including product approval, material composition, membrane thickness, adhesion and bond strength, flexibility, crack bridging, permeability and water tightness, chemical resistance, temperature tolerance, curing time and conditions, compatibility with other bridge components, quality control and testing, maintenance

requirements, service life expectations, regulatory compliance, and safety considerations are all crucial factors in ensuring its performance. The membrane thickness determines the minimum and maximum thickness of the waterproofing membrane, while adhesion and bond strength verify its strong adhesion to the bridge deck substrate. Quality control and testing ensure the system meets specified standards during installation and testing.

Bond strength is crucial for ensuring sufficient adhesion to the concrete support, preventing chloride ion penetration, dynamic actions, heat impact, perforation, shear forces, and water tightness. It must also resist chloride ion penetration, dynamic actions during overlay application and use, and heat impact resulting from hot-applied overlays. Perforation resistance is essential for resisting perforation both before and during overlay application and when exposed during use. The shear resistance is necessary for resisting shear forces between the system and support due to traffic or thermal movement. Watertightness is essential for protecting the concrete bridge deck by preventing water passage. Compatibility of materials in contact is also crucial for system performance.

By following ETAG 033 parameters and choosing the correct BRIDGE DECK WATERPROOFING SYSTEM, engineers and project managers can select and install liquid-applied bridge deck waterproofing systems that meet required standards and provide long-term protection against water penetration, extending the bridge's service life.

ALCHIMICA's BRIDGE DECK WATERPROOFING SYSTEM BUILD-UP

Primer: GEODESMO-50 (or AQUASMART DUR)

Sealant: HYPERSEAL-EXPERT-150

Main Membrane: HYPERDESMO-300

Additional Materials:

- HYGROSMART-FIX&FINISH,
- HYGROSMART-BUILDING-45-THIXO,
- HYGROSMART-MAK-FLOW

PREPARATION:

Minimum application equipment required includes protective clothing, a 1KW slow-speed drill, and a brush, roller, or airless spray machine for mixing and application.

Weather: The application temperature range is 5°C to 35°C, with no dew point conditions, 95% relative humidity, and substrate temperature above 3°C. Store materials cool, tools dry, and avoid application during hot hours.

Substate: To ensure successful application, substrate preparation is crucial. New concrete should be at least 28 days old, clean, dry, and free of substances that could reduce adhesion. Dust removal is recommended, and primer application can be done over damp concrete.

PRIMING

Priming: GEODESMO-50 is a single-component, solvent-based polyurethane primer suitable for a variety of substrates, including porous and non-porous ones. It can be easily applied using a brush, roller, or airless spraying. GEODESMO-50 has exceptional adhesion to cement (> 4 mPa, ASTM D1640) offering strong adhesion to the main HYPERDESMO waterproofing membrane (> 5 mPa, ASTM D1640). Its low viscosity (60-100cP, ASTM D2196-86 @ 25 °C) and balanced curing time ensure excellent wetting, impregnation, and paint-overtime on most substrates, including glass and metals. The primer's elongation properties (> 150% @ 23 °C, ASTM D412 / EN-ISO-527-3) offer flexibility and crack-bridging, allowing it to accommodate substrate movements and maintain a watertight barrier. Its tensile strength (Tensile strength at break @ 23 °C 35 Kg/cm^2 (3,5 N/mm^2), ASTM D412 / EN-ISO-527-3) ensures strong adhesion to the substrate and resistance to external forces, resulting in a durable, reliable waterproofing system. It can be used on dry and wet concrete, even green concrete, as a primer and low-cost sealing solution, increasing substrate durability. Its same-day, fast-curing profile makes it suitable for colder climates and unpredictable weather and rain conditions. GEODESMO-50 is dry to touch on cement after 1-2 hours and on WET cement after 1 hour. This dry-to-touch time allows the application of HYPERDESMO-300 after 2-24 hours. The material also has good memory, allowing for application up to 48 hours after application.

For priming the substrate, you apply GEODESMO-50 primer with a consumption of 0.1-0.3 kg/m^2 on concrete, subject to substrate porosity.

SEALING

Sealing: HYPERSEAL-EXPERT-150 is a low-modulus expansion joint PU sealant designed to ensure a bubble-free cure even in high temperature and humidity conditions. It exhibits excellent thixotropy, making it suitable for large expansion joints. The ratio width to depth should be 2:1 subject to a minimum depth of 10mm. It cures by reacting with atmospheric humidity, producing a joint sealant with a 50% joint movement accommodation factor, elongation >700% (ASTM D412 / EN-ISO-527-3), and excellent adhesion to a variety of substrates (Adhesion to concrete >20 kg/cm2 (>2 N/mm2) ASTM D4541) with or without the use of special primers. The sealant's extrusion rate and tooling remain consistent across various temperature and humidity conditions. HYPERSEAL-EXPERT-150 is CE certified according to EN 15651-1:2012 (Sealants for Facades) and 15651-4:2012 (Sealants for Floor Joints with Foot traffic).

Polyurethane (PU) sealants are widely used for sealing bridge deck joints due to their excellent properties. HYPERSEAL-EXPERT-150 is a highly flexible PU sealant, with elastic recovery of >70% (EN ISO 7389) allowing for the movement and expansion of bridge components, preventing cracks, and ensuring a lasting seal. It adheres to various substrates, making it durable and able to withstand harsh environmental conditions and heavy traffic loads. As a PU sealant, it is also chemically resistant, protecting the bridge structure from corrosion. Because of its excellent chemical and hydrolysis resistance, it is widely used for sealing joints in swimming pools and chemically treated water environments. HYPERSEAL-EXPERT-150 provides excellent waterproofing, preventing moisture ingress, and has high elasticity, allowing for flexibility and elasticity. It does not shrink as it

cures, ensuring no gaps or openings in the sealed joint. Its Excellent heat resistance makes it suitable for application where exposure to temperatures >60°C takes place and its resistance to cold allows the sealant to remain elastic even down to -40 °C (service temperature range -40 to +80°C). Having Tack free time, (@ 77 °F (25°C) & 55% RH) of 2.5-3.5 hours and a cure rate of 2-3 Mm/day, low VOC content, and remaining resistant and unaffected by microorganisms, fungi, and algae growth, making it the most applied PU sealant in a variety of projects.

HYPERSEAL-EXPERT-150 is available in various colors and compatible with a wide range of construction materials in general. Can be easily applied using standard caulking or gun techniques.

Selecting HYPERSEAL-EXPERT-150 for a bridge project, factors such as environmental conditions, traffic loads, etc. are considered and crucial industry standards for optimal performance and longevity are being met in protecting the bridge structure.

REPAIRING

In case any spots on the concrete surface need repair, filling, and smoothing, like large cracks, cavities, or level the surface, you could either use:

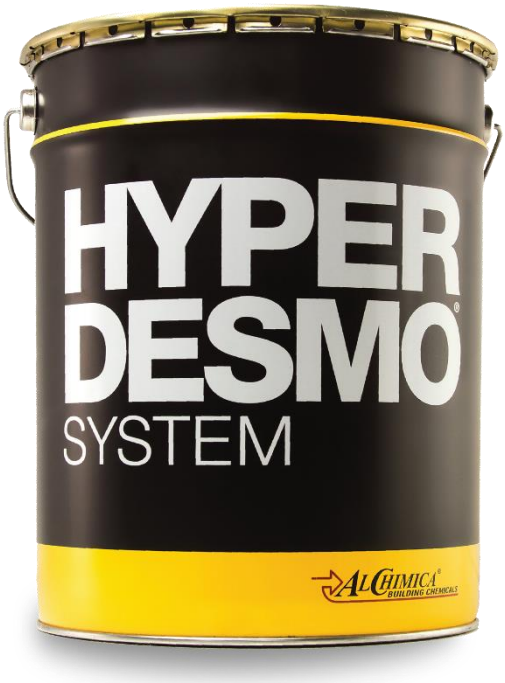
HYGRO SMART® SYSTEM Advanced Cementitious Technologies

1. HYGROSMART-FIX&FINISH (Single-component, rapid-setting shrinkage-compensated, thixotropic, fiber-reinforced, cementitious mortar applied in a single layer from 3 to 40 mm thick, for repairing and smoothing concrete, certified according to EN1504-03, Type R4 CLASS III), or

2. HYGROSMART-BUILDING-45-THIXO (single-component, shrinkage-compensated, thixotropic, fiber-reinforced cementitious repair mortar, certified according to EN1504-03, Type R4 CLASS III), or
3. HYGROSMART-MAK-FLOW (single-component, highly flowable and shrinkage compensated mortar for structural repairs and anchoring, certified according to EN 1504-6: 2006 (Anchoring cementitious mortar for strengthening concrete by installing reinforcing steel) and EN 1504-3: 2005, Class R4(Hydraulic mortar (R4-CC) for structural repair of concrete in building and civil engineering works).

WATERPROOFING

HYPERDESMO-300 is a liquid-applied polyurethane waterproofing system used in construction and infrastructure projects and is specially developed for bridge deck waterproofing. It offers several advantages, including excellent waterproofing, strong adhesion to various substrates, flexibility, crack bridging, chemical and hydrolysis resistance, ease of application, versatility, low maintenance, long service life, cost-effectiveness, compliance with industry standards, and a proven track record.



The HYPERDESMO-300 is the world's first single component liquid applied polyurethane waterproofing membrane certified according to ETAG 033 and bearing a CE Mark, with an expected working life of 25 years. When an assessment is made following the ETAG provision, and this working life has elapsed, the real working life may be significantly longer in normal use

conditions without major degradation affecting the ETAG 033 Essential Requirements.

The HYPERDESMO-300 liquid-applied bridge deck waterproofing kit is designed for use beneath asphalt overlays (Bond Strength to overlay 0,9 MPa, EN 13596) providing protection and additional waterproofing functions. It has excellent thermal resistance (passed: 100 days @ 80 °C, EOTA TR011) with a service temperature >80°C and can withstand a shock temperature of 220°C. It never turns soft and remains elastic even down to -40°C. Having high tensile (>70 Kg/cm2 (>7N/mm2), ASTM D412) and tear strength, makes it suitable for heavy asphalt application machinery.

The material and system build-up provides a seamless, durable, and watertight membrane that prevents water infiltration, protecting structures from water damage. It exhibits exceptional adhesion to concrete substrates and strong adhesion to various substrates, ensuring optimal adhesion and reducing the risk of delamination. In order to secure adhesion, the surface must be prepared appropriately, and primer selection should be according to the substrate type, characteristics, and condition (the rate and size of porosity, the type of exposed aggregates in concrete, etc.). Additional primers are available for special cases, surfaces, and weather conditions. For additional information, contact the ALCHIMICA technical assistance team.

Another advantage is that HYPERDESMO-300 is exceptionally flexible and displays excellent elongation (>250%, ASTM D412) and crack bridging properties over a wide range of extremely high or low temperatures (service temperatures range -40°C - >80°C). It can accommodate structural movements, temperature fluctuations, and substrate settlement without cracking or losing its waterproofing integrity. It can bridge and seal small cracks in the substrate, maintaining waterproofing performance over time. It offers excellent resistance to a variety of chemicals including petrochemicals and salts that commonly attack

bridge decks, as well as to chlorine ion penetration (<0.01%, TR 22). Chemical resistance is essential for bridge decks to protect the underlying substrate from exposure to harsh chemicals, pollutants, and contaminants while being able to withstand petrochemicals, salts, and chlorine and being compatible with asphalt.

The system's liquid form and ease of application allow for the use of various methods, such as spraying, rolling, or brushing while allowing it to conform to irregular surfaces and intricate details, ensuring thorough coverage. The product has thixotropic rheology allowing it to be applied on sloped but also on vertical substrates without any sagging offering ease of detailing and can cope with the uneven surfaces usually encountered on bridge decks. For the main waterproofing membrane on bridges, you apply HYPERDESMO-300 in one or two successive coats with total consumption +/- 2.5 kg/m^2 (total coat thickness +/- 2.0 mm). In the case of two coats, it is recommended for 2 different colors to be chosen for each coat, for consumption control purposes.

The anti-slippery and wear coat is optional for less than 80mm main asphalt concrete thickness or steeper bridge deck slopes. It can be achieved by applying above the final coat of HYPERDESMO-300, and GEODESMO-50 primer at a consumption of 200g/m^2. When the primer is still wet and tacky, quartz sand should be broadcasted on the final coat. After curing, loose quartz particles should be removed, and a second coat of GEODESMO-50 applied at 200g/m^2.

The versatility of ALCHIMICA's bridge beck waterproofing system allows it to be used in various applications, such as roofs, decks, balconies, parking garages, and tunnels. It could also be used in heavy-duty roofing applications such as heavy traffic exposed car parks etc. as an alternative to the classical HYPERDESMO System with the addition of the proper topcoat. Once properly applied, HYPERDESMO-300 requires minimal maintenance, with routine inspections and minor repairs necessary over

time for long-lasting performance. Its long service life reduces the need for frequent reapplications and minimizes life cycle costs. Maintenance and Repairs should be done by removing deteriorated layers and assembling the new product following installation instructions and the new coats must overlap, at least 3 cm, on the non-deteriorated coat.

In conclusion, HYPERDESMO-300 is a reliable choice for construction professionals and engineers due to its consistent performance and widespread use in various projects. Its longevity, ease of application, and low maintenance requirements contribute to cost-effectiveness over the life of the waterproofing system. However, it is crucial to consult the manufacturer's technical data sheets, guidelines, and recommendations for proper application and performance, and always follow local building codes and regulations when using waterproofing systems in construction projects. Also, The product contains a very low amount of solvents, rendering it non-flammable and non-IMO during transportation.

REFERENCES

ALCHIMICA throughout the years, has a collection of completed projects from around the world. On our website, you can find where we have provided a variety of solutions and expert know-how, in case studies ranging from the smallest roof to the largest project.

www.alchimica.com

ABOUT THE AUTHOR

TUDAKOVA FOTINI-SVETLANA is an export sales account manager at ALCHIMICA. Her primary goal is to ensure that the appropriate materials are used for specific applications and that customers receive adequate support throughout the purchasing process. She bridges the technical expertise and salesmanship gap by providing technical support and guidance while having a thorough understanding of PU liquid-applied waterproofing membranes. She helps customers choose the best building materials for their specific needs and projects by highlighting their features and benefits. She also assists in troubleshooting and problem-solving, project consultation, and the development of effective sales strategies. She maintains strong relationships with customers and industry stakeholders, and she stays current on industry trends. In addition, she conducts customer and internal sales team training sessions and actively participates in international fairs, workshops, seminars, and exhibitions representing ALCHIMICA Building Chemicals.

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PRECAUTIONS AND VARIATIONS.

Please consult the above-referred products' technical data sheets (TDS) and safety data sheets (SDS). Under any circumstances, ALCHIMICA does not assume any responsibility for the performance of the waterproofing system given the conceptual flaws of the existing build-up. Imperative for the performance of the system is the correct cleaning, inspection, and maintenance of the waterproofing system.

For projects' particularities and more precise technical support, please contact ALCHIMICA at: alchimica@alchimica.com

Where alternative systems are to be used, these must be submitted to ALCHIMICA for approval. ALCHIMICA will not accept responsibility or liability for variations to the above under any other condition.

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