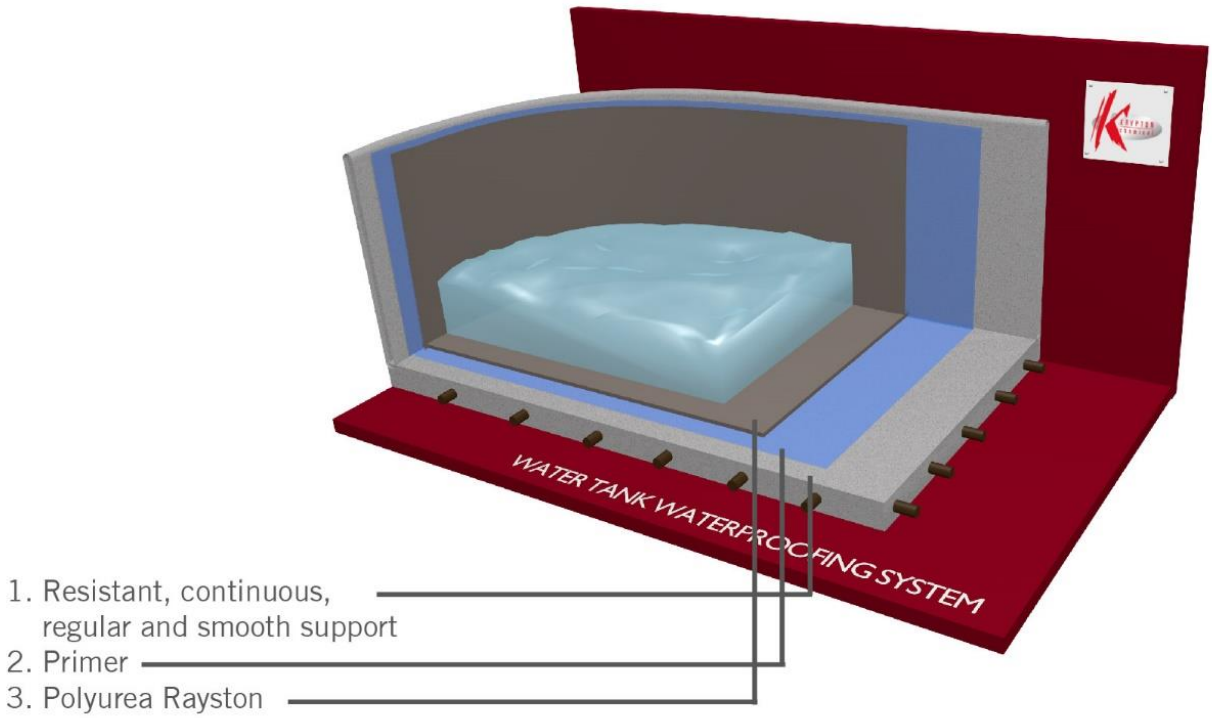
INSTALLATION MANUAL FOR THE WATERPROOFING OF WATER TANKS WITH POLYUREA RAYSTON

1. Introduction

This document explains the guidelines for the liquid waterproofing of either a closed or or an open concrete tank that contains water permanently. The goal is to obtain a continuous and seamless waterproofing membrane, applied with a hot spraying plural component machine, with the ability to bridge over cracks that may appear in the tank structure over time. For this purpose, a solvent-free, pure resin of pure polyurea (POLYUREA RAYSTON) is applied. The system is designed for the waterproofing of new tanks and also for the refurbishment of tanks already in operation, with water leaks due to cracks in concrete. This system is valid for closed tanks containing drinking water and open or closed tanks containing fire fighting water, sea water and salty water in general (even brine), chlorinated water, sewage (wastewater treatment plants), septic tanks, leachates, digesters (biogas plants), treated water for chemical and power generation industries ... The specific system for the waterproofing of swimming pools is described in a different manual.



2. Description of the main components of the system

Epoxy 100 Primer is a very low viscosity, two-component, colourless, 100% solids epoxy resin without solvents or mineral fillers. Designed to be applied on a completely dry porous concrete surface. It can be applied in very thick layers over horizontal surfaces. On a vertical surface, Rayston Thickening Additive (powder) can be added to prevent it from sagging if it is applied in a thick layer (1%).

Humidity Primer is a two-component, water-based epoxy resin, without mineral fillers and high resin content, which can be applied to a surface with traces of moisture. When the resin is applied, it has a milky appearance that loses as it dries and the water evaporates. A perfectly cured Humidity Primer must be completely clear and colourless. White spots that may appear when the resin is cured are a consequence of the fact that the water in the resin has not been able to evaporate completely, usually due to excess coating (product accumulation) at some points of the application (voids).

If applied in a closed tank, a forced ventilation system should be designed to allow the water it contains to evaporate completely.

Being a water-based product, it dries very slowly in conditions of low temperatures and high environmental humidity. It should always be applied in thin layers, to facilitate the evaporation of water. Always avoiding its accumulation in surface cavities.

The curing time of Primer H and Epoxy Primer 100 can be reduced when working at low temperatures with the addition of Rayston Epoxy Accelerator.

Primer GC is a fast curing, 100% solids, two-component grey colour epoxy resin designed to be applied onto a porous concrete surface with a moisture content larger than 4%. It can be applied in thick layers of up to 0.5 - 0.6 kg/m^2 per layer over horizontal surfaces.

On a vertical surface, Rayston Thickening Additive (powder) can be added to prevent it from sagging if it is applied in a thick layer (1%).

Tecnocem is a three component, epoxy-cement system designed to be applied on porous substrates with high moisture content or on surfaces exposed to negative hydrostatic pressures. In addition, it can be used as a self-levelling mortar to obtain a regular and smooth surface. A 2 kg/m^2 layer providing a thickness of 1 mm can withstand a negative pressure of up to 10 bars.

Polyurea Rayston

Three component, pure polyurea resin, free of fillers, plasticizers and solvents, designed for application with a hot spray high pressure equipment (1:1 in volume). The third component is a small amount of pigment paste. It allows to create a continuous waterproofing membrane (without joints or overlaps), with a very high chemical resistance, flexible and elastic, with the ability to bridge over cracks and fissures from the support. Cures in a few seconds, although the final mechanical resistance properties are obtained after about 1-2 hours (see Shore hardness evolution table in the technical data sheet).

List of certificates available:

- European certificate for roof waterproofing (ETA, European Technical Assessment nº 16/0148) for an estimated durability of 25 years (W3, P4 at TH4 (90ºC), severe climatic zone).
- BBA Certificate (UK) for roof waterproofing with an estimated durability of 25 years, number 18/5582.
- External fire performance in roofs B_{roof} (t1) and B_{roof} (t4). Reaction to Fire, Euroclasse E.
- CE quality marking, according to EN-1504-2 standard for coatings used in the protection of concrete structures, which includes, among others, a test of the ability to bridge cracks in the concrete support in unfavourable conditions (-10ºC), according to European standard EN-1062-7, with a favourable result for cracks of up to about 5.12 mm. wide.
- Polyurea Rayston has a very good chemical resistance in permanent contact with water, neutral, basic or even acidic (see table of chemical resistance in the technical data sheet of the product). It presents a certificate of continuous contact with drinking water (light grey colour) according to European standard 98/83/CE.
- Certificate of continuous contact with drinking water WRAS, Water Regulations Advisory Scheme, Ltd. (United Kingdom) number 1709541.

Applied on a concrete pipe, it allows to significantly increase the flow of water, as demonstrated by the Manning Coefficient tests carried out by Applus laboratory.

It has a high resistance to abrasion, which means that, in tanks with liquid movement, even containing solid particles, the surface loss of the abrasion coating is minimized. (Applus Test Certificate Determination of Taber Abrasion Resistance according to ASTM D 4060).

Certificate of resistance to continuous contact with leachates, issued by the independent laboratory Aitex.

In short, it can be used for the coating and waterproofing of closed drinking water tanks and open or closed wastewater tanks (very good resistance to H_2S and biogenic sulfuric acid), chlorinated, salty, leachate and industrial processing water. (Acidic or basic pH's).

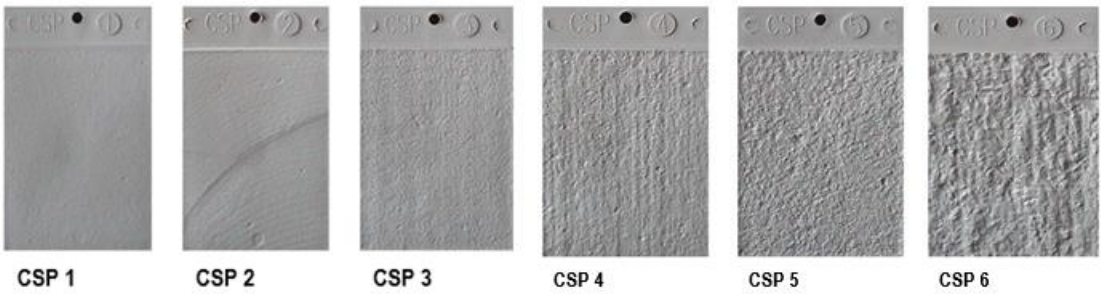
Overview of the application process

This system is 100% free of organic solvents

Primer GC, Tecnocem, Humidity Primer and Primer Epoxy 100 will be applied by roller.

The surface where the system is applied must be smooth, dry, cohesive, homogeneous, continuous, free of dust and loose particles, clean, free of cracks or cavities, free of mould and mosses, free of concrete release agents, surface grouts, oils greases and silicones. In the case of a new tank, the concrete must be fully cured.

The recommended degree of roughness of the concrete must be a CSP1- CSP2 grade according to ICRI Technical Guide No. 03732 (INTERNATIONAL CONCRETE REPAIR INSTITUTE): "Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers and Polymer Overlays."



Always apply the resins, first on the vertical areas and then on the horizontal ones.

In the technical sheet of each product there is an explanation of how the two components should be mixed, for products applied manually and also advice on their application, especially in reference to the environmental conditions of temperature and humidity.

Photo: Treatment of a concrete surface with diamond grinding machine, as part of the preparation of the substrate, in a waterproofing process with Polyurea Rayston.

Photo: Forced ventilation in a drinking water tank in the town of Killone (Ireland) with the aim of drying completely the concrete surface, before proceeding with the application of the primer, after having properly prepared beforehand the said surface.

STAGES IN THE APPLICATION PROCESS

0-Substrate preparation. Fill and repair cracks and small voids with a polyurethane mastic (type Rayston Flex 3040), larger voids can be repaired with a putty prepared with Epoxy 100 Primer and quartz sand. Materials not well adhered to the surface must be removed.

If the horizontal surface is very uneven, it can be previously treated with a self-levelling mortar or even Tecnocem.

Square angles should be avoided in horizontal-vertical encounters, corners, and other parts of the structure, these zones should be rounded with the help of a mortar.

Photos: Water tanks in Andalusia, south of Spain, refurbished with Polyurea Rayston. The right angles were rounded before the application of the system, as described in this document.

1-Primer

1.1: If the surface is new concrete, completely dry and fully cured (humidity less than 4%), apply about 0.4-0.5 kg/m^2 of Epoxy 100 Primer in order to completely seal the porosity of the surface. Applied in two layers on a vertical surface and one layer on a horizontal surface.

Once the primer is cured, it should have a glossy appearance, if the appearance is matt, it means that the porosity of the surface is not well sealed and an additional layer of resin is needed.

A good alternative to Epoxy 100 Primer (dry substrates), especially on vertical surfaces is Epoxy Gel 100 Primer (high thixotropic behaviour), applied by trowel, which allows to regularize a concrete support as well as priming it, in a single operation.

1.2: If the surface belongs to a tank that has contained water in the past, and hence there are traces of moisture on the surface (humidity up to 6-8%), apply about 0.4-0.5 kg/m^2 of Primer GC in order to completely seal the porosity of the surface. Applied in two layers on a vertical surface and one layer on a horizontal surface.

1.3: If the water tank is below ground level and there is a risk of negative hydrostatic pressures, apply a first coat of Tecnocem (minimum 2 kg/m^2). If the moisture content of the concrete is much higher than 6-8% and it is not possible to reduce it, a first coat of Tecnocem will also be essential.

Tecnocem, being a coating that is applied in high thickness, can also be used to regularize the surface.

Rayston Thickening additive will help Tecnocem to not drip on vertical surfaces (approximately 2% thickener additive on vertical surfaces).

Once Tecnocem cures (minimum 48 h), apply a layer of Humidity Primer (open tanks) of about 0.3-0.4 kg/m^2 or Primer GC 0.3 - 0.4 kg/m^2 (the latter in the case of tanks closed or in unfavourable conditions for the drying of a water-based resin, that is, high environmental humidity or low temperatures). In a closed space, for the water contained in the Tecnocem to be able to evaporate completely, a forced ventilation system will be necessary.

Important: In open tanks, the walls of which are exposed to direct sunlight, never apply the primer in the late morning, when the surfaces gradually heat up and there is rising air. This air could cause pinholes in the primer that could then reproduce in the Polyurea Rayston membrane.

Photo: Application of Humidity Primer by roller in a drinking water tank in the town of Killone (Ireland). When applied, the resin has a whitish, milky appearance, which loses (becomes transparent) when it cures and the water it contains evaporates completely.

2- Treatment of details and critical points.

Areas where a significant relative movement is expected between two surfaces (passing metallic pipes that behave with temperature changes differently from concrete, cracks with risk of expansion-contraction...) will be treated with and adhesive tape (Rayston Tape) on the previously primed concrete surface, so that the membrane can move freely at these points.

Some details, where it is difficult to access with the gun of the hot application machine, can be treated with the solvent-free, manually applied two-component polyurethane resin, applied by roller, Impermax Aqua 2K, reinforced with non-woven fabric (Geomax). Before applying Impermax Aqua 2K resin, the surface must always be suitably primed. Impermax Aqua 2K has a certificate of continuous contact with drinking water and a CE marking according to EN-1504-2 standard for the protection of concrete structures.

3- Application of the waterproofing membrane.

Application (in the absence of wind, in the case of open tanks) of a minimum of 2 kg/m^2 of the pure polyurea resin Polyurea Rayston with a hot spraying machine.

An alternative to Polyurea Rayston, especially in tanks with high vertical walls, is Polyurea Rayston Fast, with a much shorter curing time, which will avoid the resin from sagging under these conditions.

In open tanks, it is recommended to finish the treatment, about 15-20 cm. (measured from above) on the outer wall of the tank (the end of the treatment should never be submerged in water). A groove will be cut in the concrete with a cutting disk and the membrane will end there, inside the slot.

Finally, this point will be sealed with a polyurethane mastic (Rayston Flex 3040). That will prevent the detachment of the Polyurea Rayston membrane at this point.

The internal surface of closed tanks must be completely covered by the treatment, including the tank ceiling.

Photo: Application of Polyurea Rayston inside a digester, at a wastewater treatment plant in Vigo (Spain).

Photo: Drinking water tank waterproofed with Polyurea Rayston in Guadalajara (Spain).

4 – Possible top coat layers.

In closed water tanks (potable, wastewater...) an aliphatic finish will never be applied. In open tanks, a finish protective top coat may be required to keep the aesthetic appearance of the membrane exposed to sunlight. In this case, depending on the chemical composition of the water contained in the tank, two-three layers of 0.25 kg/m^2 of Paintchlore 2K will be applied.

5- Commissioning the tank

Once the Polyurea Rayston membrane has been applied and its continuity and absence of small pores have been visually verified, the tank can be filled up with water after three hours.

In closed drinking water tanks, before commissioning, wash the tank thoroughly with clean water and a mild detergent and then rinse before filling.

Photo: Filling a drinking water tank in Killone, Ireland after treatment with Polyurea Rayston.

Photo: Process water tank, already in service, refurbished with Polyurea Rayston at the Seat automotive plant in Martorell (nearby Barcelona).

Notes:

In tanks containing water in continuous movement, mostly with solids in suspension, the wear of the waterproofing membrane will be higher and it will be necessary to consider a greater thickness of product to compensate for the loss due to abrasion (in total 3-4 kg/m^2) .

The chemical resistance of coatings increases with their thickness. In the case of sewage water tanks, septic tanks, tanks with slightly acidic or basic water ..., the recommendation will be to apply at least 3-4 kg/m^2, even higher if the water is also in motion and contains solid particles that can wear down the membrane by abrasion.

Polyurea Rayston, if exposed, is resistant to sunlight, but its colour may change (yellowing). For this reason, in open tanks, a colour whose yellowing is not easily perceived is proposed, such as dark grey 7011 or a beige colour 1001.

Photos: Final aspect of treatments with Polyurea Rayston. Digester in a WWTP in Seville and in a paper mill in Tortosa (Tarragona). Polyurea Rayston can be applied on supports other than concrete (metal, PVC pipes ...). In each case, a different primer compatible with each material must be applied.

Photos: Application of Polyurea Rayston inside a tank at the WWTP of Itaperuçu - Sanepar (Brazil).

Photos: Application of Polyurea Rayston inside an anaerobic digester in a treatment plant in Italy (Lecce).

The information contained in this document, as well as the advice given by the professionals of Krypton Chemical, SL, both written and provided verbally or through tests, are given in good faith based on our experience and the results obtained through tests carried out by independent laboratories, and without serving as a guarantee for the applicator, who should take them as merely indicative references and with strictly informative value. We recommend studying this information in depth before proceeding with the use and application of any of these products, although it is advisable to carry out on-site tests to determine the suitability of a treatment in place, for the purpose and under the specific conditions. that occur in each case.
Our recommendations do not exempt from the obligation that the applicator has to know in depth, the correct method of application of these systems before proceeding to their use, as well as to carry out as many tests as appropriate if there is doubt as to their suitability for any work. , installation or repair, taking into account the specific circumstances in which the product will be used.
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