APPLICATION GUIDE.

Rayston Proof System **PU 2K M Radon Gas Shield**

by Krypton Chemical

Contents

1. General conditions

RECOMMENDATIONS

MANUFACTURER

The manufacturer of the products used in the works described in this specification shall demonstrate in writing that its Quality Assurance system complies with the requirements of the Spanish Standard UNE-ISO 9001.

APPLICATOR

To ensure the correct application of the systems specified in this report, it is recommended that the application company has successfully completed a training programme on their installation or application and the appropriate methods for preparing the substrate; furthermore, it must have the necessary equipment for the correct application of the product.
The application company must have the necessary resources and equipment, in suitable condition, for the correct application of the system.

APPLICATION PROCEDURE:

ENVIRONMENTAL CONDITIONS

Before commencing the work described in this specification, it must be verified that the environmental conditions, site conditions and substrate conditions are suitable for application.
Ultimate responsibility for any decision regarding the application of the system on site shall lie with the site manager, works manager and/or contractor, and under no circumstances with the product supplier.

PREPARATION

Proper preparation of the substrate is vital for the correct application of the products. The technical instructions recommended by the manufacturer must therefore be followed.

APPLICATION

It is recommended that the products described in this report be applied or installed in accordance with the manufacturer's instructions and in compliance with current regulations.

PROTECTION SYSTEMS

Before commencing the application work, the necessary measures will be taken to protect workers in accordance with health and safety regulations, and appropriate steps will be taken to ensure that personnel not involved in the works are not affected by the application.

2. Proposed solution

This document is intended to assist you and the applicator during the application of the **RAYSTON PROOF PU 2K M RADÓN GAS SHIELD** system. A high-performance bonded or floating liquid waterproofing system, applied cold onto concrete. It is an ideal option for creating a barrier capable of preventing the ingress of **radon gas**, in compliance with CTE DB-HS-6 regulations. Section 3.1 – Barrier characteristics.

Radon is a noble gas, radioactive and imperceptible to the human senses (odourless, colourless and tasteless), slightly soluble in water, and highly mobile. It is generated naturally in the Earth's crust through the decay of uranium and, due to the porosity and fissures in the ground, rises to the surface, particularly in siliceous soils.

The problem lies in the fact that radon seeps in through cracks in the floors, at the junction of the floor and walls, in the spaces around pipes or cables passing through, through the porosity of walls and floors, and also via drains and sewers.
In enclosed or poorly ventilated spaces, it tends to accumulate, posing a health risk to occupants (lung cancer). This is particularly true in basements and ground floors, where living areas are in direct contact with the ground. Around 50% of the natural radiation a person is exposed to over their lifetime comes from radon gas.

Therefore, a protective barrier must be created using Impermax 2K M with the following characteristics:

- It must be continuous: joints and interfaces must be sealed.
- Sealed junctions with elements that interrupt it.
- Must not have cracks that allow radon from the ground to pass through by convection.
- It must have a durability appropriate to the building's lifespan, its conditions and the planned maintenance.

To this end, the preliminary work to be carried out on the wall must be defined in order to mitigate the risk of future damage. Furthermore, we will take into account the minimum properties that the substrate must meet to mitigate future risks.

3. System steps

The system must follow the following steps:

- Primer: Rayston Epoxy 100.
- Main membrane: Impermax 2K M (option to reinforce with Geomax).

  FT coating

4. Substrate requirements and treatment of details and specific areas

1 Requirements to be met by the substrate

The concrete substrate must meet the following properties:

- Compressive strength (minimum 25 N/mm²)
- Minimum cohesion (tear/tensile strength) of 1.5 N/mm²

- HR <4%
- No cracks
- Cohesive
- Uncontaminated
- Levelled

(Otherwise, the covering will highlight any existing unevenness)

2 Moisture content, ambient temperatures and substrate.

It is important to monitor ambient temperatures and humidity levels throughout the application cycle to prevent accelerated reactions.

The substrate must be as dry as possible.

Recommended ambient temperature conditions: Min. +10°C, Max. +30°C.

Always apply (each coat of the treatment) to a substrate whose temperature is 3°C above the dew point (to prevent condensation of ambient moisture on the substrate).

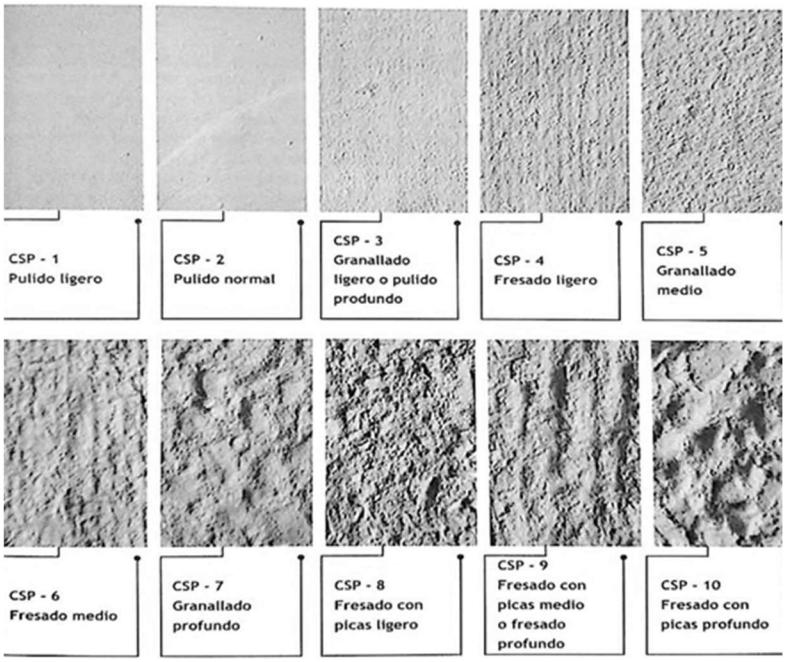
3 Substrate preparation:

To ensure good compatibility of the system with the existing substrate and to achieve good adhesion, it is very important that the substrate meets the following minimum requirements and properties:

1. Cohesive.
2. Even and uniform.
3. Completely continuous.
4. Free from fissures, cracks and potholes (which must be treated beforehand).
5. Clean and free from dust, grease, liquids and any other type of chemical contaminant.
6. Fully cured.
7. Free from particles and other materials not fully adhered to the substrate.
8. As dry as possible (with no risk of negative pressure).

The substrate must be washed with a high-pressure water jet to remove dirt (degreasing) and impurities. It is important that no material residues remain, as these may affect the membrane's adhesion to the substrate.

The degree of roughness in the concrete must be CSP1–CSP3 in accordance with Technical Guide No. 03732 of the ICRI (International Concrete Repair Institute) 'Selection and Specification of Concrete Surface Preparation for Polymer Coatings, Sealants and Linings'.



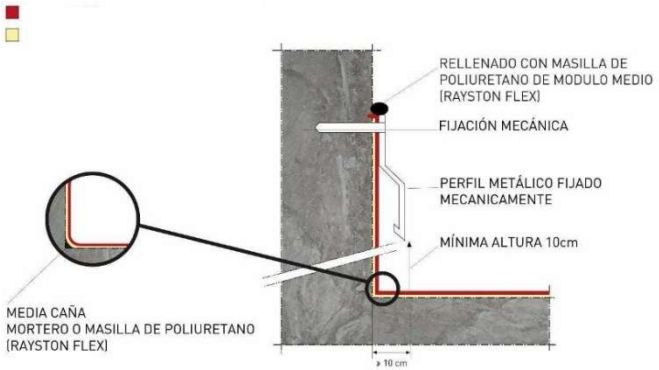
4 Treatment of damage and impact marks:

Before priming the surface, local repairs shall be carried out using dry mortar based on Rayston Epoxy 100 resin, with aggregate of 0.4 to 0.9 mm particle size or equivalent, or with R4-type cementitious repair mortar, ensuring complete aesthetic uniformity with the existing surface. Any cracks or small cavities shall be filled with a polyurethane filler such as Rayston Flex or equivalent.

5 Treatment of details and specific areas:

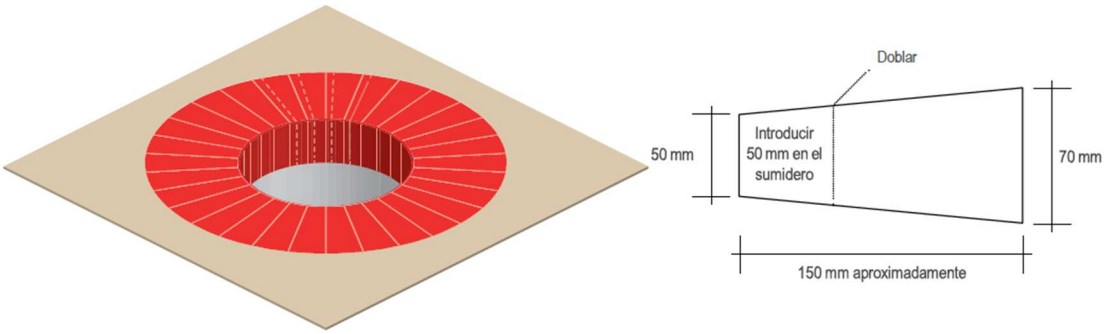
Right angles should be avoided at horizontal-vertical junctions, corners and other parts of the structure; in other words, it is advisable to round off these areas of the surface with mortar **(quarter-rounding)**.

To **prevent delamination** of the polyurethane membrane at the edges of the treatment, it must extend down to approximately 15–20 cm from the floor on the vertical side. At this point, a groove must be cut using a radial saw. The edge of the membrane will end inside this groove. Subsequently, this edge of the membrane must be protected with a polyurethane sealant such as Rayston Flex. Fitting an aluminium protective profile will prevent any potential detachment of the membrane edge in the medium to long term.

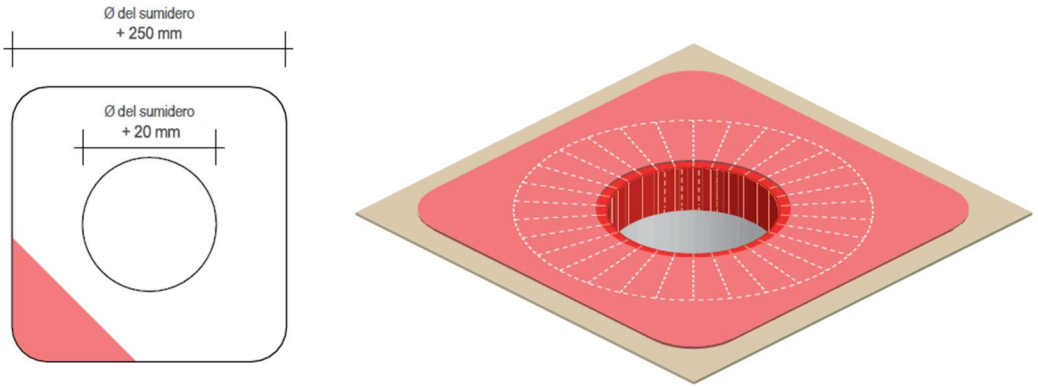


For **drains**, the following steps must be followed:

1. Cut sufficient wedge-shaped reinforcement strips to cover the drain in overlapping layers.
2. Dip the individual strips in waterproofing resin, ensuring each one is thoroughly saturated.
3. Apply waterproofing resin to the top and also inside the drain, ensuring that no resin drips down the drain.



4. Remove any excess resin from the strips and lay them in an overlapping pattern until the entire drain is covered.
5. Remove any air bubbles or creases and apply additional resin to the reinforcement (if necessary), taking care to lift the overlapping edges.
6. Cut a square piece of reinforcement with rounded corners, cut a circular hole in the centre of the piece with a diameter = Drain diameter + 20mm, and saturate it with waterproofing resin, then squeeze out the excess resin and place it over the drain, ensuring that the hole in the piece sits directly over the drain.
7. Use a brush or roller to remove any air bubbles or wrinkles and to ensure that the square reinforcement piece is completely saturated and pressed firmly down.



With regard to the structure's **expansion joints**, if they experience movement exceeding 50% of the joint's width, mechanical joints must be installed (for example, a joint with a minimum width of 10 cm must be able to open to a maximum of 15 cm). To ensure the system remains watertight, these mechanical joints must be installed in accordance with the manufacturer's specific recommendations.

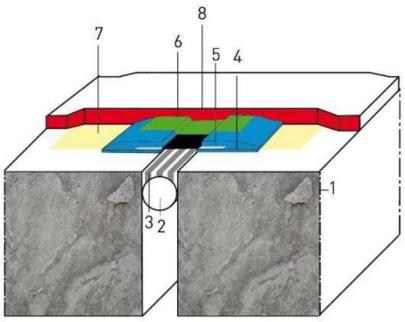
If the movement is smaller, they can be treated with the highly elastic Rayston Joint Geo tape, after filling them appropriately (polyethylene foam cylinder and polyurethane mastic such as Rayston Flex). Rayston Joint Geo adheres to the primed substrate using an adhesive (2K PU Adhesive) or an epoxy resin such as Rayston Epoxy 100, applied to the geotextile bonded to the tape. Polyurea membranes do not adhere well to the Rayston Flex Joint Geo strip; therefore, in the event of movement in the joint, this movement will not be transferred to the polyurea membrane, or at any rate the movement will be dampened by this polyurea membrane, reducing the risk of cracking in the membrane.

Rayston Joint Geo is available in various widths; it is advisable to always use a strip of the appropriate width.

For small-scale applications, the single-component polyurethane mastic Rayston Flex 3040 should be applied manually. For greater productivity, the highly elastic polyurea-based sealant (two-component, curing in a few seconds), Rayston Flex 70, can alternatively be applied using the portable Rayston Spray Gun. Where a large number of linear metres of joint need to be filled, application will be more efficient using the Rayston G-1 machine.

A similar treatment should be carried out on cracks wider than 2 mm, or even narrower ones if it is suspected that they are moving and/or continuing to open over time (unstabilised cracks or fissures).

1. SUPERFICIE REGULAR, SECA TOTALMENTE CURADA DE HORMIGÓN
2. FONDO DE JUNTA: CILINDRO DE ESPUMA DE POLIETILENO (PE)
3. RAYSTON FLEX 3040 / RAYSTON FLEX 70
4. ADHESIVO PU 2K O IMPRIMACIÓN EPOXY 100
5. RAYSTON FLEX JOINT GEO
6. BANDA DE SEPARACIÓN (PE) - RAYSTON FLEX JOINT (OPCIONAL)
7. IMPRIMACIÓN
8. MEMBRANA IMPERMEABILIZANTE APLICADA EN FORMA LÍQUIDA



Important: Treatment carried out in winter (at the lowest possible temperatures) will always be more effective than treatment carried out in summer. In winter, at low temperatures, the materials will be contracted and the edges of the joint will be further apart. In summer, at high temperatures, the materials will be expanded and the edges of the joints will be closer together. If the treatment is carried out in summer, without leaving any slack in the membrane, when winter arrives and the temperature drops, the edges of the joints will separate and the membrane will become taut, with the risk of cracking.

5. Steps and application of the system

5.1 Primer

RAYSTON EPOXY 100 is a high-viscosity, high-solids epoxy system consisting of two pre-measured components. Depending on the porosity of the substrate, it can be diluted with Rayston solvent to improve liquid penetration and adhesion performance. Ideally applied in two stages to achieve maximum adhesion.

Apply 0.5 kg/m² of Rayston Epoxy 100 in two coats. The first primer coat may be diluted with 10–15% Rayston Solvent to ensure it penetrates (bonds) into the surface and aids consolidation. A total of 0.2 kg/m²should be applied in this first coat.

Next, once the first coat has cured, apply the second coat with a light wet dusting of aggregate with a grain size of 0.3–0.8 mm. A total of 0.3 kg/m² should be applied.

When applying the product, spread it evenly, avoiding any build-up, and ensure application takes place within the product's pot life (see technical data sheet).

Important: The primer is applied to seal the porosity of a surface and must never be applied when there is rising damp, i.e. when direct sunlight is hitting a porous exterior surface that is gradually heating up. The product recommended for this system, EPOXY PRIMER 100, may only be used if the substrate's moisture content is less than 4%. (If it is higher, please contact the technical department for a list of primers).

Application tools for Rayston Epoxy 100:

5.2 Main membrane

IMPERMAX 2K M is a two-component, aromatic polyurethane resin with crack-bridging properties, applied cold using a trowel or roller. Impermax 2KM has two certificates for the DETERMINATION OF THE RADON DIFFUSION COEFFICIENT in accordance with the accredited methods described in standard ISO/DTS 11665-13, carried out by the LaRUC laboratory, yielding a result of 1.4×10^{-12} for a 2 mm thick membrane and 1.5×10^{-12} for an Impermax 2K M membrane reinforced with **GEOMAX**.

Therefore, we have two options: to create the membrane with or without Geomax reinforcement:

- Impermax 2K M without reinforcement: Apply using a roller, brush or airless equipment, totalling 3 kg/m². Application should preferably be carried out in two coats of 1.5 kg/m²on horizontal surfaces and three coats of 1 $^{kg/m^2}$each on vertical surfaces.

- Impermax 2K M with Geomax: Application must be carried out in two coats of 1.5 kg/m² each, bearing in mind that as soon as the first coat has been applied (while it is still fresh), the GEOMAX reinforcement must be laid, rolling it in until it is fully embedded, ensuring that the reinforcement does not separate from the resin at any point. Once this has dried, any loose fibres must be sanded down, and after 'repairing' the membrane, the second coat of Impermax 2K M should be applied. Use a spiked roller afterwards to prevent the formation of bubbles.

Note: Depending on the type of project, a layer of Geomax reinforcement may be required over the Impermax 2K M membrane to provide greater protection to the membrane during the installation of subsequent layers or coatings.

6. Certificates

Impermax 2K M

The Impermax 2K M product has been extensively tested by the laboratories Applus, UC LaRUC and BETA in the following tests:

- Direct tensile adhesion, UNE-EN 1542:1999
- Water vapour permeability, UNE-EN ISO 7783:2012
- Liquid water permeability, UNE-EN 1062-3:2008
- % of renewable raw material of plant origin, EN/TS 16137:2011
- Determination of the radon diffusion coefficient

7. Maintenance

It is advisable to maintain the installations and carry out regular cleaning, removing surface debris and dirt prior to cleaning.

A minimum of two visual inspections per year is recommended, one at the start of spring and the other at the start of autumn.

In addition, the roof must always be inspected after other professionals have carried out work such as building works, the installation of new equipment or the repair of existing equipment.

8. Conclusions

The **RAYSTON PROOF PU 2K M RADON GAS SHIELD** system proposed by Krypton Chemical has been used in a large number of construction and roof renovation projects in Spain and other countries. It has a long track record of success.

This system is completely seamless (no joints), remains firmly bonded to the treated surface and offers excellent long-term durability. Furthermore, it is a system that easily and effectively addresses all the specific issues that may arise in a project of this nature.

This system, applied on-site by a company approved by Krypton Chemical, bears the CE mark, based on tests carried out by the APPLUS laboratory.

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