EPIC
A314

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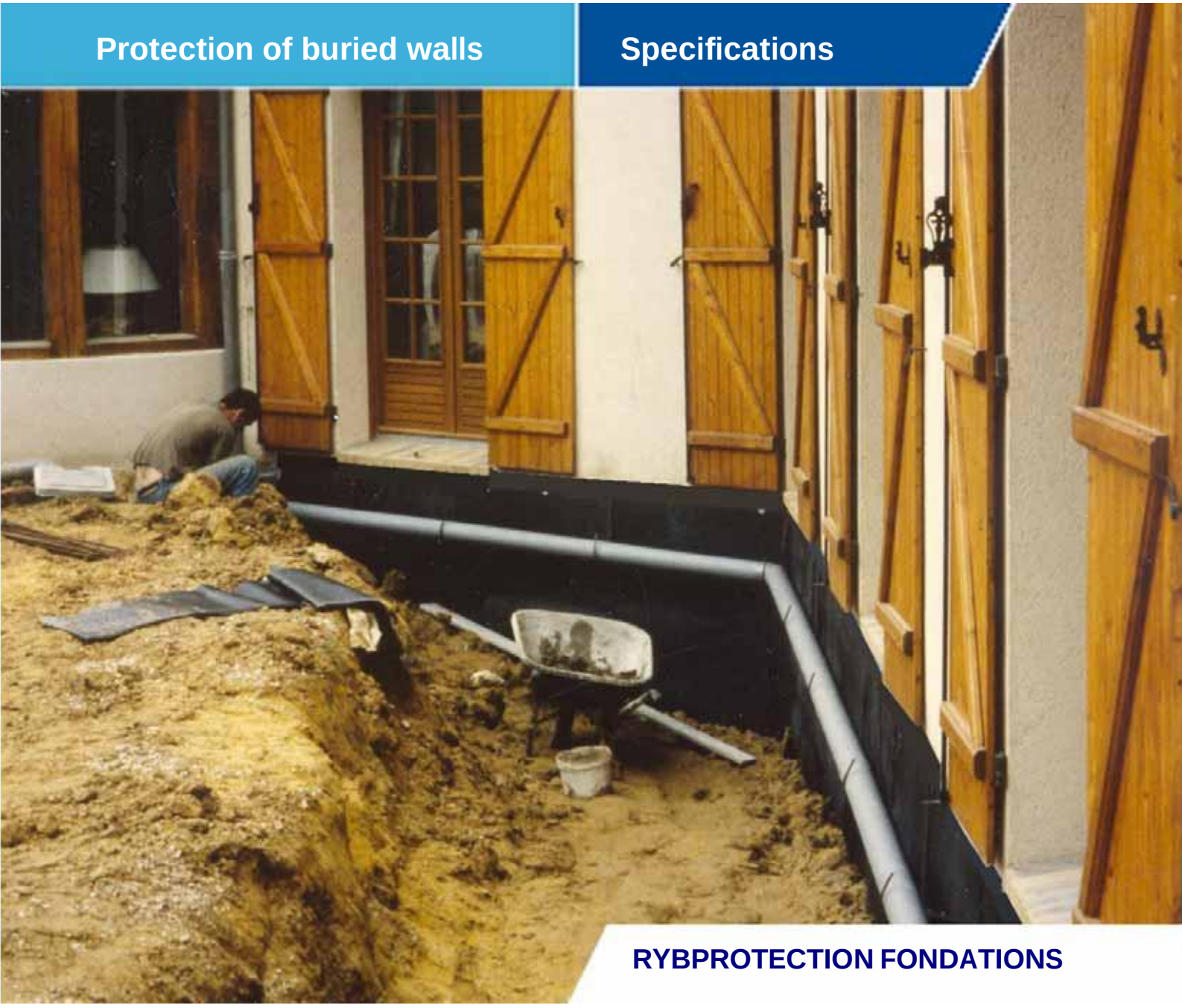
PFe-LT1-0

Protection of buried walls

Specifications



RYBPROTECTION FONDATIONS

Innovation at the service of fluid transport

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1. GENERAL DEFINITION

1.1. Purpose of process

The majority of soils used for constructions are liable to be affected by damp. Such dampness can be due to three factors: the phreatic table (in this case a waterproof tanking system is required), seepage water or leakage from underground pipe lines (especially in old buildings). Nearly 8% of accidents, all building trades included, are caused by water seepage. 77% of disorders affecting buried waterproofing works are located on buried walls and tanking *(source: Observatoire de la qualité de la construction - chiffres 2003 / Construction Quality Research body - figures for 2003).* They are especially due to isolated faults in waterproofing, to the lack or insufficiency of drainage, or to the lack of capillary breaks.
Constructive measures must therefore be implemented to fight the disastrous effects due to stagnant seepage water against buried walls (steel corrosion, crumbling or flaking facing, fissuring, insufficient heating, efflorescence, mould, development of allergies…).
Two solutions, which depend on the soil type, can be implemented to contend with such issues:

- drainage systems (cf. DTU code of practice 20.1) to evacuate water and thus prevent the exertion of water pressure against walls, such water pressure enables water to penetrate through faults in the waterproofing (fissures, badly lined joints…)
- and/or capillary break systems when the soil can maintain a high moisture content over a long period of time (presence of water even without pressure): hydraulic rendering (if a drain has not been considered necessary), rendering reinforced by two layers of cold impregnation or standard waterproofing coating (or a process of equivalent efficiency).

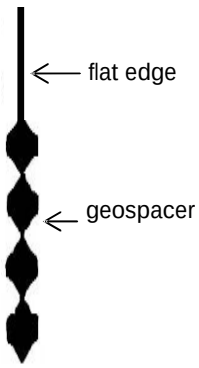
These capillary break systems require mechanical protection, particularly during the backfilling phase.

Ryb Protection Fondations is designed to protect these systems mechanically.

If the type of soil also requires a drainage system, opt for the Ryb Protection Drainage product which associates mechanical protection with drainage functions.

1.2. Ryb Protection Fondations

Ryb Protection Fondations is a high-density polyethylene, symmetric, waterproof geospacer with three-dimensional alveolar structure, with a flat edge integrated in the upper section to facilitate implementation.



Ryb Protection Fondations:
cross section

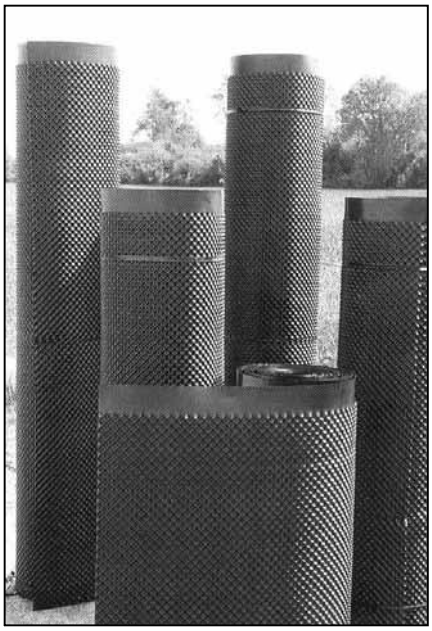
1.3. *Its functions*

Ryb Protection Fondations provides the following functions only:

- maintenance of an air space along buried walls, enabling evaporation of the water absorbed by the foundations (brought up by capillary action),
- insulation for the buried wall from damp soil by means of a waterproof structure,
- protection for rendering or waterproofing layers from mechanical distress, especially during the backfilling phase.

2. IDENTIFYING CHARACTERISTICS

Ryb Protection Fondations consists of a single element: a high-density polyethylene, three-dimensional alveolar structure called a geospacer.



- manufacturing process: extrusion of a polyethylene sheet, followed by thermoforming.
- production site: Ryb Composites -Sully sur Loire (France)
- aspect: alveolar, symmetric
- composition: high-density polyethylene (new and recycled)
- colour: black.
- thickness: 8 mm
- thickness of the geospacer: 1.0 m / 1.5 m / 2.0 m / 2.4 m (other thicknesses possible)
- width of the flat edge: approx 76 mm
- weight per m²: approx. 0.5 kg
- standard length: 20 linear metres

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3. PERFORMANCE CHARACTERISTICS

3.1. Short-term and long term compressive strength

Short-term compressive strength

Values concerning crush resistance are defined as per standard EN ISO 25619-2 at each production run.

Short-term compressive strength: 150 kPa ± 20%

Long-term compressive strength

As for all plastic products, especially those made from polyolefin, Ryb Protection Fondations is subject to creep over time.
The product's thickness decreases over time, under a constant stress. Creep tests, conducted as per standard EN ISO 25619-1, showed that, after 11 years, under 40 kPa stress, the product's thickness is greater than or equal to 90 % its initial thickness. The air space between Ryb Protection Fondations and the buried wall is therefore maintained, even in the long term.

Long-term compressive and shearing strength > 40 kPa

3.2. Long term resistance - Durability

To quantify distress, the durability tests revolve around the notion of residual force, i.e. the relation between the maximum tensile strength of a test specimen after accelerated aging (in compliance with various different test standards) and the maximum tensile strength of a control test specimen.

Resistance to weathering

Tests conducted on other products, as per standard EN 12224* “determination of the resistance to weathering”, show no significant change in the tensile strength.

Ryb Protection Fondations must not be exposed to direct sunlight for longer than four months**.

**: the accelerated aging process consists in 100 hours of exposure under xenon arc lamps, with an 18-minute spraying cycle followed by 102 minutes of UV exposure.*
***: depending on the season and region in Europe*

Resistance to chemical agents

Tests conducted as per standard ENV ISO 12960* “screening test method for determining the resistance to liquids”, show no significant change in the tensile strength.

Ryb Protection Fondations can be used in all natural soils, regardless of pH.

**: the accelerated aging process consists in a 3-day immersion at 60°C in an acid solution (method A) or in a basic solution (method B).*

Microbiological resistance

Tests conducted as per standard EN 12225* “method for determining the microbiological resistance by a soil burial test”, show no significant change in the tensile strength.

Ryb Protection Fondations is not altered by microbiological activity.

**: the accelerated aging process consists in burial in a soil with stimulated microbial activity over a 26-day period.*

Service live

Tests conducted, as per standard ISO TR 13438, method A*, “procedure for determination of resistance to oxidation” by the IFTH (report n°10758 section 1 – 10/09/02) show no significant change in the tensile strength.

Oxidation tests, following the same principle at different temperatures for longer periods of time, enabled extrapolation plotting (following the Arrhenius law – durability technical manual – November 2003 and June 2006).

Ryb Protection Fondations is predicted to be durable for a minimum of 50 years, for soil temperatures below 25°C.

**: the accelerated aging process consists in exposure to 110°C over a 28-day period.*

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USAGE SECTOR

The Ryb Protection Fondations range is designed to mechanically protect the waterproofing of buried walls in the construction sector and is specifically designed for standard underground heights of 1.0 m / 1.5 m / 2.0 m or 2.4 m.

4.1. Hydraulic design rules

According to DTU code of practice 20.1, “when a building is constructed on impermeable soil, surmounted by permeable soil, runoff water can come into contact with sub-structural walls for a long enough period to penetrate into the building via the wall, or even to channel under the foundations.” Also, because soils in contact with buried walls have been disturbed, channelling of runoff water is facilitated along buried walls.

Nevertheless if a drain is not considered necessary, simple hydraulic rendering will suffice. Ryb Protection Fondations ensures its mechanical protection.

In the more common event where implementation of a peripheral drain is recommended, the walls are covered with cold impregnation or standard waterproofing. Ryb Protection Fondations protects them mechanically and must therefore be associated to a draining backfill and a draining collector at its base, sized on the basis of hydraulic and mechanical factors. Sizing is not the purpose of this document.

4.2. Mechanical design rules

The long-term compressive strength, equal to 40 kPa (cf. § 3.1) must always be greater than the horizontal stress, known as the earth pressure, exerted by the earth backfilled along the product.

This stress is defined by the equation:

$P = K_0 . \gamma . z$ with:

K_0 = 1- sin φ: coefficient of earth pressure at rest (φ internal friction angle)

© : unit weight of ground, in kN/m^3

z: depth in m

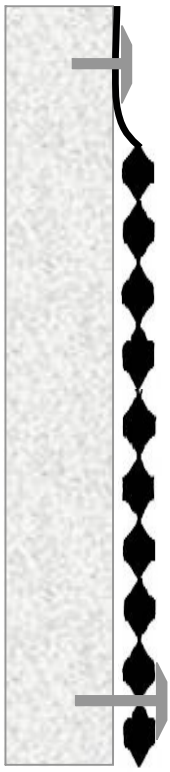
This stress is therefore even higher:

- the higher the buried wall,
- the looser the backfilled soils (compacting energy too low, channels too large, unsuitable moisture content in soils …).

Ryb Protection Fondations can be used up to a maximum nstallation depth of 3 to 6 m.

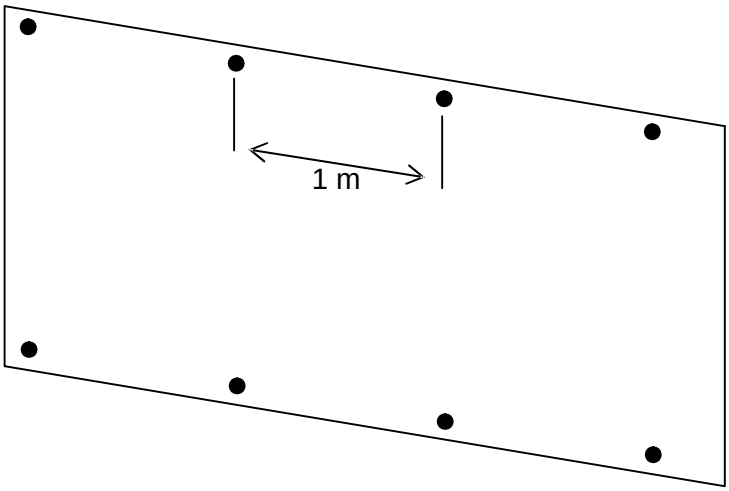
5. IMPLEMENTATION

5.1. General diagram



1 – fixing to the wall

The mat must be attached to the wall either with steel nails fitted with washers (Ø 25 minimum) or nailed slats.



Each roll of mat must be attached at the upper (flat edge) and lower section, every linear metre.

These attachments hold the product in place, preventing the backfill from uplifting the product and preventing earth from entering between the wall and the mat.

When the installation depth is greater than the height of a roll, the mat should first be installed at the lower section, then adjusted at the upper section so that the flat edge is at the correct height. The upper roll does not need to be cut in height to minimise overlap between the two rolls. This overlap must be effective on 5 motifs, so over a width of 10 cm.

The upper roll is then attached in the same way as the previous one: at the upper section and the lower section, at every linear metre

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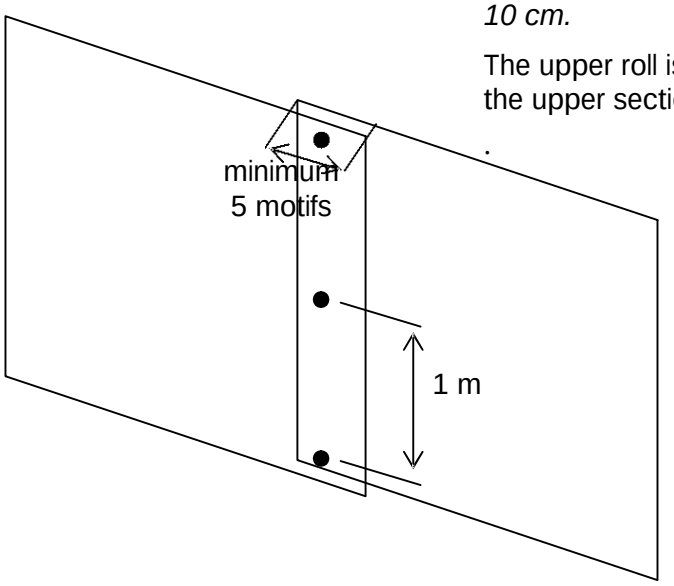

2 – lateral connections

Simply overlap the structures by interlocking them on 5 motifs, so over a width of 10 cm. The overlap can be applied in any direction. Mechanical attachments (identical to those specified in §1) must be implemented along the connections, every linear metre.

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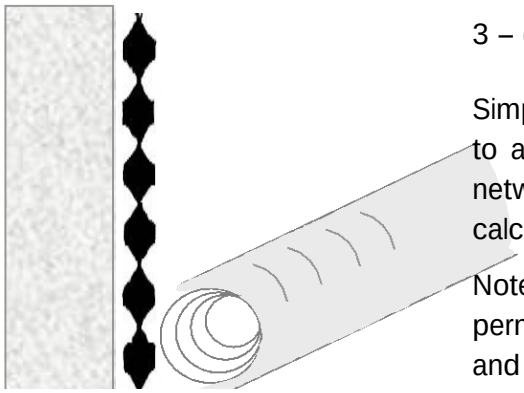
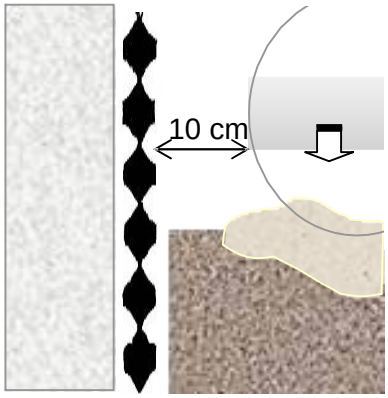


3 – drainage at the base (if a drain has been recommended)

Simply implement a drain that is wrapped at its base and associated to a draining backfill. It is also important to check that the drainage network is reliable (cf. annexe of DTU code of practice 20-1 – calculation rules).

Note: if a drain is recommended and the backfill used is not permeable, it is preferable to use a mat that provides both protection and drainage: the Ryb Protection Drainage mat is recommended.



4 – backfilling and compaction

Avoid elements that are too coarse, ensuring that sufficient distance is maintained between the compactor and the Ryb Protection Fondations. Compaction must be carried out in accordance with good engineering practice to prevent the settlement of earth over time which would cause strain and dragging on the mat.

5.2. Delivery/storage

The product is delivered in rolls on film-wrapped wooden pallets. Once off the pallet, the product must not be exposed to UVs for longer than four months.

5.3. Accessory parts

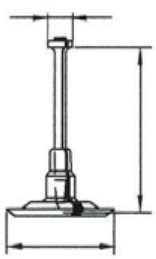
Ryb can also supply:

- draining collectors with equivalent mechanical resistance to the mat, with manholes for evacuation of the drained water,
- washer nails for direct attachment to fasten the mat. These are designed for fixing a flexible mat onto a hard structure.

Ø 8 mm

Washer nail ref. 79699999

washer: PE
rod: HRC52.5 ± 1
finish: 5 – 13 µm Zn



47 mm

Ø 36 mm

6. MANUFACTURING AND INTERNAL CHECK

Production site:

SULLY SUR LOIRE Factory
Route d'Orléans
45600 SULLY SUR LOIRE

This site's activity, the "production and marketing of geocomposites and geospacers used in civil engineering, construction and the environment", is certified ISO 9001 (n° 116949-2012-AQ-FRA-COFRAC rev1).

Ryb products are fully traceable: using the tracking label located on the pallet, the geospacer roll produced on the Sully sur Loire site can be identified, along with all the production parameters.
A "geocomposites" quality manual is used by Ryb France; it states the practices, procedures and sequences for operations concerning this product range.

7. MAINTENANCE – REPAIRS

Ryb Protection Fondations requires no specific maintenance procedures.

Repairs in the event of damage during installation: if the structure has shifted or is broken, put it back in place or replace it to ensure continuity for the protection system. It is extremely easy to cut with a standard knife.

8. REFERENCES

Several million m² of Ryb Protection Fondations have already been marketed in France since 1996.

9. THE MANUFACTURER'S COMMITMENT

9.1. Assistance for users

On request, Ryb can determine which product is best suited to the specific requirements of the site and can, if necessary, provide technical assistance for implementation.

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9.2. Distribution

Ryb keeps its products in stock on the production site and can deliver anywhere in Europe. In France, the Ryb Protection Fondations range is marketed either directly by the Ryb company, or via specialist retailers, who have been provided with technical training by the Ryb company.

10. SUMMARY OF DOCUMENTS QUOTED

- compressive strengths
- long-term creep tests
- report n° 10758 section 1 (10/09/02)
- report n° 10758 section 2 (01/10/02)
- durability technical manual (18/11/03)
- durability technical manual (08/06/06)

Protection of buried walls

Specifications

Our technical services will be pleased to provide you with any documentation or information that you may require. Information concerning dimensions and diagrams featured in this document are for reference only. Our company reserves the right to change the characteristics of products featured in this brochure. Important notice: We cannot be held responsible if our products are used in such a way that does not comply with standards or for purposes different to those specified in our trade documents.

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