ROCK BAG® FILTER UNITS

Contact Details

Unit 15/18 Hinkler Court, Brendale, Qld 4500

design@rockbagfilterunits.com

www.rockbagfilterunits.com

ROCK BAG FILTER UNITS

Coastline | Ports | Harbours | Rivers

What are Rock Bag Filter Units?

Rock Bag Filter Units also known as Rock Bag Armour Units, Sac Gabions, Stone Filled Nets, or Rock Bags are a relatively new technology initially developed for keeping deep sea power transmission cables in place. Over the last decade or so, Rock Bag Filter Units have become increasingly utilised in erosion control and other civil applications. Expanding Rock Filter Units into applications other than deep sea cable anchors has seen ongoing research and development. Project Material has conducted the worlds first full scale stability trial of Rock Bag Filter Units

What materials are Rock Bag Filter Units made from?

Currently there are two prominent materials used for the manufacture of Rock Bag Filter Units; these are Polyethylene (PE) and High Density Polyethylene (HDPE), Though PE and HDPE can be made from recycled materials, Project Material only use virgin feed materials to ensure purity of the finished product.

How are Rock Bag Filter Units made?

The Rock Bag Filter Unit manufacturing process utilises "Warp" knits exclusively manufactured on a Chain Loom, with each warp controlled by a separate needle. Warp Knits produce run-resistant, closer, flatter, and less elastic knits. Common Warp Knits are Tricot, Milanese, and Raschel. Project Material are Joint Venture partners with the manufacturer, producing bags to strict specifications utilising "Raschel Warp Knits". Our joint venture enables the complete chain of custody and Quality Management Systems

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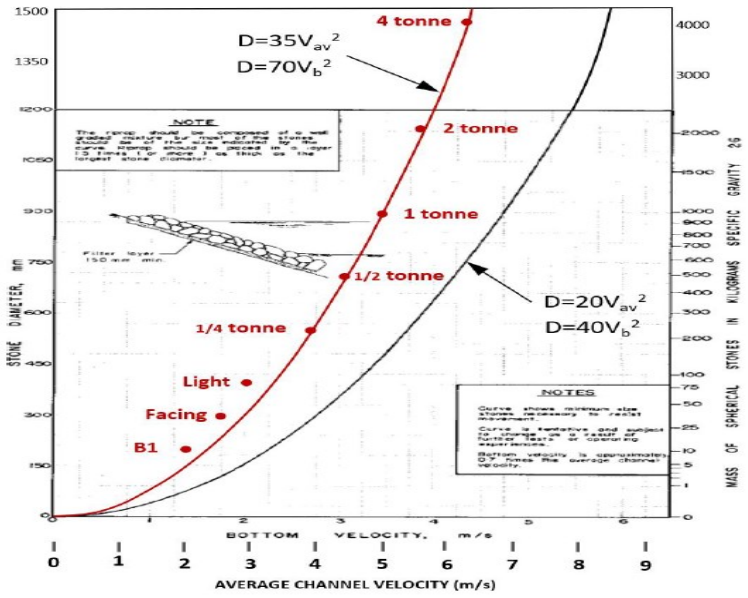
How do Rock Bag Filter Units work?

When we think of armour units for erosion control and revetments in general; one of the primary factors is the ability for the mass of a unit to resist overturning moments against wave attack or high water velocities. The conventional protection approach is to deploy items with a high mass to area attribute (riprap) or other singular mass armours. (*image on right Comparison of riprap sizing in Austroads Part 5 (2013a) and Part 5B (2013b*), (Price. K. 2021) Following these guidelines if we were to overcome velocities of 6m/s or greater one would need rocks at 1500mm in diameter or greater.

Rock Bag Filter Units are a **Rock, Bag, Composite;** creating a single mass by encapsulating smaller rocks into a high strength synthetic bag. The Rock Bag Filter Unit keeps the rock under tension substantially restricting movement of the media within the bag while maintaining flexibility during placement. When placed, Rock Bag Filter Units tightly mould to their environment, with subsequent placements tightly moulding and interlocking with the previous. Initial settling of the bag will occur which only serves to consolidate the entire structure.

For the composite to work correctly Rock Bag Filter Units are filled by volume not weight. The term "ton" to describe the size is merely an identifier that on average the finished product will be within that weight range. When filled correctly, Rock Bag Filter Units will not allow rocks to move liberally, though mobilisation of some fines will migrate to the centre without effecting performance. To-date scale modelling has failed to replicate the composite attributes of Rock Bag Filter Units.



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What sizes do Rock Bag Filter Units come in?

Rock Bag Filter Units in a standard offer come in 1, 2, 4, 6, and 8 t configurations in either Polyethylene (PE) or High Density Polyethylene (HDPE). However, Rock Bag Filter Units can be supplied up to 12 t, and dependant on the quantity other sizes are available.

The table below is a guide only; rock grading may vary the bag sizes by +/- 10%				
Average Weight	Rock Grading	Average Height	Average Diameter	Volume Cubic Metre
1 ton	50 — 100 mm	400 to 500 mm	1700 to 1900 mm	0.65
2 ton	75 — 150 mm	500 to 600 mm	1900 to 2100 mm	1.3
4 ton	75 — 150 mm	700 to 800 mm	2400 to 2700 mm	2.7
6 ton	100 — 200 mm	800 to 900 mm	2700 to 3000 mm	4.1
8 ton	150 — 250 mm	1000 to 11000 mm	3100 to 3400 mm	5.4

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What tests do Rock Bag Filter Units go through?

Rock Bag Filter Units as with all Geosynthetics used in the built environment are subject to a series of internationally recognised tests. Rock Bag Filter Units are not only subject to these tests but as part of our internal quality control measures Rock Bag Filter Units are subjected to a suspension test where the bags are filled to capacity and suspended for 30 minutes and inspected for degradation. The test are done in house under the supervision of a certified testing authority; further Rock Bag Filter Units only use stamped load rated lift rings ensuring operator safety.

Standard testing inputs	Applied Standard
Tensile strength MD Tensile strength CMD	EN ISO 10319
Elongation at Maximum load, MD Elongation at Maximum load, CMD	EN ISO 10319
Mass/ unit area, Minimum	ISO 9864
Static Puncture strength (CBR)	EN ISO 12236
Vertical permeability	EN ISO 11058
Resistance to hydrolysis test	NF EN 12447
Resistance to chemical degradation Sulfuric acid	ISO TR 12960
Resistance to chemical degradation calcium hydroxide	ISO TR 12960
Resistance to weathering test	EN 12224

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How long do Rock Bag Filter Units last?

Degradation of polyolefins is a complex chemical process and equally complex to measure. Literature on plastics degradation under environmental conditions is scant at best. Questions of "How quickly do plastics degrade in the environment? What are the degradation pathways? and, What are the factors affecting the degradation processes?" (Chamas, A. et.al 2020, 3504) are often answered with widely varying ranges.

The weathering test under EN 12224 do provide benchmarks of performance to compare like for like; however, these results have little correlation to actual degradation under environmental conditions. Tests to establish first half-life, or the time in which the material loss equals 50% of its original mass, on a flat surface compared to a spherical surface of equal area resulted in a variance of 200 to 600 years. (Chamas, A. et.al 2020)

There is however, consensus on two significant factors impacting plastics degradation; **UV** exposure and **impurities** within the polyolefin strands. Rock Bag Filter Units use Carbon Black as a UV Blocker and only use the purest of virgin feed material to produce a most durable product , with life expectancies between 25 to over 100 years dependant on application

MARINE

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Where can Rock Bag Filter Units be utilised in coastal and marine applications?

Rock Bag Filter Units can be utilised in almost any application for erosion control in coastal or marine applications. The protection measures maybe direct physical barriers against wave actions as demonstrated below.

More discreate protection from erosion by Rock Bag Filter Units may also extend to the creation sub surface structures to encourage coastline sand replenishment and river sediment abatements.

Globally, Rock Bag Filter Units have been successfully deployed to prevent erosion of coastlines and rivers; in fact the uptake of Rock Bag Filter Units for the protection of coastlines, ports, harbours and rivers with is now in the many tens of thousands.

MARINE

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Where can Rock Bag Filter Units be utilised in coastal and marine applications?

Rock Bag Filter Units can be utilised for permanent and temporary works in costal protection and construction applications. Rock Bag Filter Units have been successfully implemented for temporary applications including protection of decaying infrastructure and wave breaks to protect civil construction and for the creation of working platforms.

MARINE

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Where can Rock Bag Filter Units be utilised in coastal and marine applications?

Ships' Bow Thrusters can severely scour birthing pockets; (image below) some port operators are limiting the use of bow thrusters within the pocket because of the damage caused. The challenges of conducting full size testing has resulted in only scale model bow thrust tests. In 2022 Project Material conducted a world first full scale stability trial of Rock Bag Filter Units against bow thrusters; monitored and reported by the Australian Maritime College (AMC Search) No movement of the bags were detected under various bag configurations and water velocities. (image bottom) . ***Please ask us for a copy of the report and accompanying video.***

INFRASTRUCTURE

ROCK BAG FILTER UNITS

Roads | Rail | Bridges | Dams | Revetments

Can Rock Bag Filter Units be utilised in other civil applications?

Yes! Rock Bag Filter Units are successfully used to prevent scour around bridge columns and pile caps, bridge abutments, causeways, and culverts. Rock Bag Filter Units allow for rapid deployment to prevent further damage of existing infrastructure. Rock Bag Filter Units can be utilised where damage infrastructure prevents access by heavy equipment; the below images depicts the repair of a spillway constructed in 1954 and severely damage in recent flooding. Rock Bag Filter Units were selected because of their ability to be accurately placed by crane and in the event of further spillway flows the Rock Bag Filter Units would remain in place and prevent further scour. The works were completed in five days.

Can Rock Bag Filter Units be utilised in other civil applications?

Yes! Rock Bag Filter Units are successfully used in emergency recovery applications such as landslips or washouts from floodwaters overtopping culverts. As seen below, the entire riprap revetment was washed away together with substantial loss of the roadside verge. Sitting centrally underneath and in the direction of the roadway lay a 1200mm watermains which with further flooding could potentially expose the pipe and risk failure. Rock Bag Filter Units were used to rapidly provide bank stabilisation and can remain in service for many years until significant infrastructure repairs can be carried out. Total time onsite to place the Rock Bag Filter Units was 14 hours.

Can Rock Bag Filter Units be utilised in other civil applications?

Yes! Rock Bag Filter Units are successfully used in new bridge construction or existing structures requiring scour protection. For new construction where heavier equipment is available Rock Bag Filter Unit sizes up to 8 ton can be utilised to protect from the most severe flooding. In more remote areas and on aging timber bridges 1 ton Rock Bag Filter Units can be utilised and when overlapped Rock Bag Filter Units nest and interlock to create an integral armour.

ENVIRONMENTAL

ROCK BAG FILTER UNITS

Landscapes | Waterways | Mangroves

Can Rock Bag Filter Units be utilised in the natural environment

Yes! Rock Bag Filter Units are safe to use in the environment Polyolefins polymers are a durable compound which make Polyethylene (PE) and High Density Polyethylene (HDPE) so why have both? Rock Bag Filter Units made from PE are a cost effective durable product that can be used in all applications. However, HDPE possesses greater durability than PE alone. Rock Bag Filter Units made from HDPE can reduce microplastic release into our environment by 85% or more

ENVIRONMENTAL

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Landscapes | Waterways | Mangroves

Are Rock Bag Filter Units safe to use in the natural environment

Yes! Microplastics in our oceans is an ever increasing problem and although geosynthetics is a comparatively minor contributor, we should always look to reduce microplastic release where possible! Project Material Rock Bag Filter Units manufactured in High Density Polyethylene (HDPE) are safer for the environment than rock bags made from Polyester (PE). Rock Bag Filter Units manufactured from virgin HDPE can reduce microplastic release by 85% or more. Rock Bag Filter Units quickly become habitat for aquatic life; we can choose to make their new home a little safer into the future.

Can Rock Bag Filter Units be utilised in the natural environment

Yes! Rock Bag Filter Units are safe to use in the environment utilising locally available media like river stone, quarried rock, and even coral. With very little disturbance to embankments or riverbeds during placement Rock Bag Filter Units can be deployed with minimal environmental impact of noise, dust, silt, or clearing.

In fact many applications are deployed directly from the back of a trucks, eliminating the need for onsite filling or large laydown areas. Other applications for environmental protections are to fill Rock Bag Filter Units with limestone rock and when placed in watercourses can naturally reduce acidity improving water quality. Rock Bag Filter Units used in conjunction with our Water Restore ECO Velocity Bags which passively remove up to 99% of PHAS and other contaminates from our waterways.

PROJECT MATERIAL

GABION CAGES & BASKETS

BARRIER BAG

WATER RESTORE
Passive Barrier Filters