GENERAL MEMBRANE

HAIL-SHIELD RANGE

CERTIFIED ANTI-HAIL WATERPROOFING MEMBRANES

STRENGTHS

OF THE GENERAL MEMBRANE HS RANGE

THE PRODUCTS

EXCEPTIONAL PERFORMANCE

Best **resistance** to **impact** and to **hail certified by VKF HW5**

Can also be applied in a **single layer**

Can also be used on **soft supports**

Increases the **durability** of the covering

Available with **Reflect Protection** high-reflectance finishes

Available with Broof (t2) external fire resistance technology

Available with the General Solar PV waterproof-photovoltaic system

Applicable to the N.E.W. system

THE COMPANY

TECHNICAL ASSISTANCE

Our Technical Department on hand throughout all phases of the design, application and maintenance of the waterproof systems

Drawing up of ***specific*** **Statements of Work**

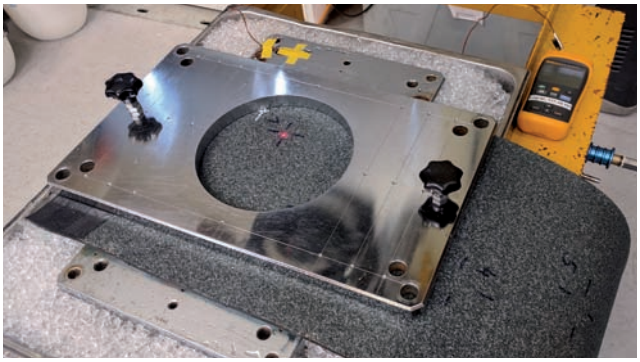
Supply of the **Application Manual** and **Maintenance Manual**

tecnico@generalmembrane.com

WHY USE A HAIL-SHIELD WATERPROOFING MEMBRANE?

The effects of **climate change** in recent years have transformed violent phenomena once regarded as exceptional, like hail, into ordinary seasonal events. The only effective protection for waterproofing membranes is to adopt **fixed heavy protections** (screeds, tiles, etc.) or **mobile heavy protections** (gravel, floating floors, terrain with vegetation, etc.). However, not all structures are designed for withstanding these loads.

The factors that most influence a membrane's resistance to hail impact include the **material's elasticity**, the **protective surface finish**, **dynamic puncture resistance**, the **thickness of the material**, the **rigidity of the support** and the **method used to apply** the membrane (fully adhered membranes are more resistant to impact compared to semi-adhered or fully independent membranes).
It often occurs that "exposed" waterproofing systems that have been struck by hail have significant fractures and dents. *The damages caused by hail are sometimes difficult to identify with a simple visual inspection*. In certain cases, the membrane may have micro-damages on its bottom side without any visible signs on the surface. Although the damaged points may still be watertight, their airtightness may only be verified with a **vacuum tightness test**; this test, however, cannot be carried out without removing the damaged portion of the membrane.
Hail-related damages are so widespread that making localised repairs on each affected point would be very costly. *In most cases, refurbishing the covering by laying a new waterproof layer directly above the damaged layer is a more viable option.*



Test on rigid support according to VKF Test Protocol no. 09.

As no membrane is unpierceable, a **test** is used **to measure the resistance** to hail and classify it according to a pre-defined scale: known as **Test Protocol no. 09**, it was developed by the Swiss insurance association for public buildings **VKF** (Vereinigung Kantonaler Feuerversicherungen) and was carried out at the Swiss **EMPA** laboratories. The General Membrane Hail-Shield products subjected to this test obtained the **HW 5 class on rigid and soft supports**.

Test on soft support according to VKF Test Protocol no. 09.

VKF TP09 Hail Resistance Classification Table.

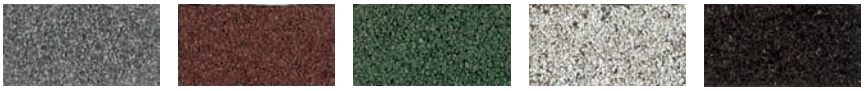
Resistance Class	Diameter (mm)	Mass (g)	Speed (m/s)	Energy (J)
HW 1	10	0.46	13.8	≥ 0.04
HW 2	20	3.64	19.5	≥ 0.69
HW 3	30	12.3	23.9	≥ 3.50
HW 4	40	29.2	27.5	≥ 11.10
HW 5	**50**	**56.9**	**30.8**	**≥ 27.00**

HAIL-SHIELD

POLYMER-BITUMEN MEMBRANES
WITH CERTIFIED HIGH RESISTANCE TO HAIL

HW5 VKF AEAI CERTIFIED

CHARACTERISTICS OF HS RANGE PRODUCTS

	PHOENIX FC MINERAL HS	URANUS FC MINERAL HS	PHOENIX SUPER MINERAL HS NEW
Mix	A specific formula based on modified bitumen, boasting excellent resistance to hail, specially formulated by the General Membrane R&D laboratory		
	APP modifying polymers that guarantee good cold flexibility and hot shape stability to heat resistant	SBS modifying polymers that guarantee excellent cold flexibility and elasticity	APAO modifying polymers that guarantee excellent cold flexibility, hot shape stability to heat resistant and insensitivity to thermal ageing
Reinforcement	Special polyester reinforcement boasting high resistance to hail impact		
Top finish	Mineral self-protection with slate chips; available versions:  Grey Red Green White Black		
	The function of mineral self-protections is to protect the surface against mechanical damage and the action of UV rays, by slowing down the natural ageing process of the compound		
Bottom finish	Polyethylene polymer film  With General Membrane logo	Polypropylene polymer film  Neutral	Polyethylene polymer film  With General Membrane logo
	The finishes perform a non-stick function by preventing the coils from sticking during the process of production, rolling up, storage and transport		

AVAILABLE VARIANTS

All products of the **Hail Shield** range are also available in the following versions:

- **Reflect Protection** with a solar reflectance index (SRI) of 80% certified according to the ASTM E-1980 standard
- Broof (t2) with resistance to external fire certified in accordance with the EN 13501-5 standard
- **Reflect Protection Broof (t2)**

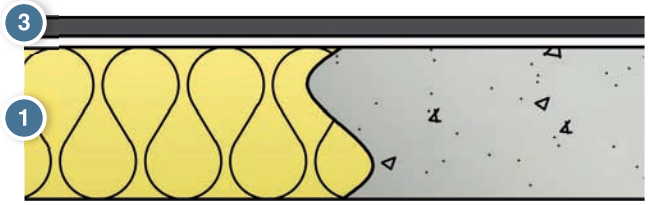
GUIDELINES FOR COVERING PACKAGES

General Membrane aims to satisfy all the requirements of modern coverings, while guaranteeing **durability**. In particular, the **Hail-Shield** range offers a wide variety of **certified anti-hail technical solutions**, compatible with all stratigraphies in fully exposed conditions: Hail-Shield membranes can be used on **flat, sloping and complex geometry coverings**, on both **soft** and **rigid** supports, and can be applied in a **single layer** or as a top layer in **multi-layer** systems.
The tests, carried out at the **EMPA** laboratories in Zurich, were effected in accordance with the **VKF TP09** standard. All **12 covering packages** that were tested passed the hail-resistance test, obtaining the *maximum class* – **HW5**.

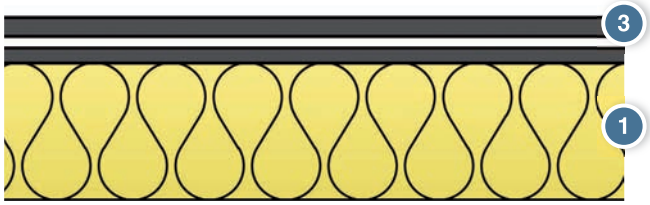
STANDARD SUPPORTS

SUPPORTS WIHT PRE-COUPLING

Single-layer

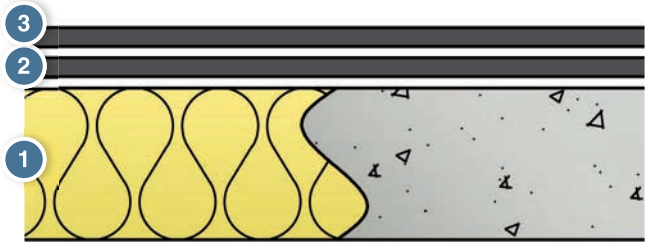


LOW COMPRESSIVE STRENGHT SUPPORT / RIGID SUPPORT

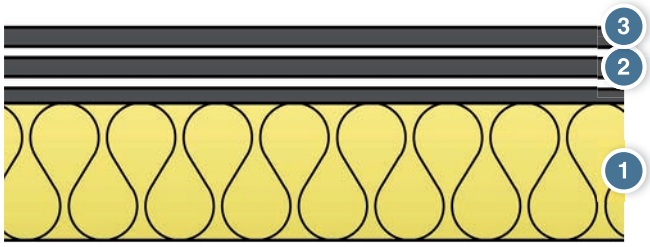


LOW COMPRESSIVE STRENGHT SUPPORT

Multi-layer



LOW COMPRESSIVE STRENGHT SUPPORT / RIGID SUPPORT



LOW COMPRESSIVE STRENGHT SUPPORT

1. Low compressive strenght support or rigid support
2. Waterproof **underlay** *membrane: Phoenix FC 4 mm* or *Uranus FC 4 mm* or *Phoenix Super 4 mm* (*)
3. Anti-hail waterproof membrane as a **top layer**: *Phoenix FC Mineral HS* or *Uranus FC Mineral HS* or *Phoenix Super Mineral HS*

1. Low compressive strenght support pre-coupled with *Gemini FC-B HS 3 o 4 mm*
2. Waterproof **underlay** *membrane: Phoenix FC 4 mm* or *Uranus FC 4 mm* or *Phoenix Super 4 mm* (*)
3. Anti-hail waterproof membrane as a **top layer**: *Phoenix FC Mineral HS* or *Uranus FC Mineral HS* or *Phoenix Super Mineral HS*

(*) *The underlay must belong to the same product family as the top layer.*

The layer structures shown above are examples of how Hail-Shield products can be used and must be placed in the proper context when choosing the laying system (fully adhered, semi-adhered, fully independent) and the binding system (fastening, gluing) to be adopted.

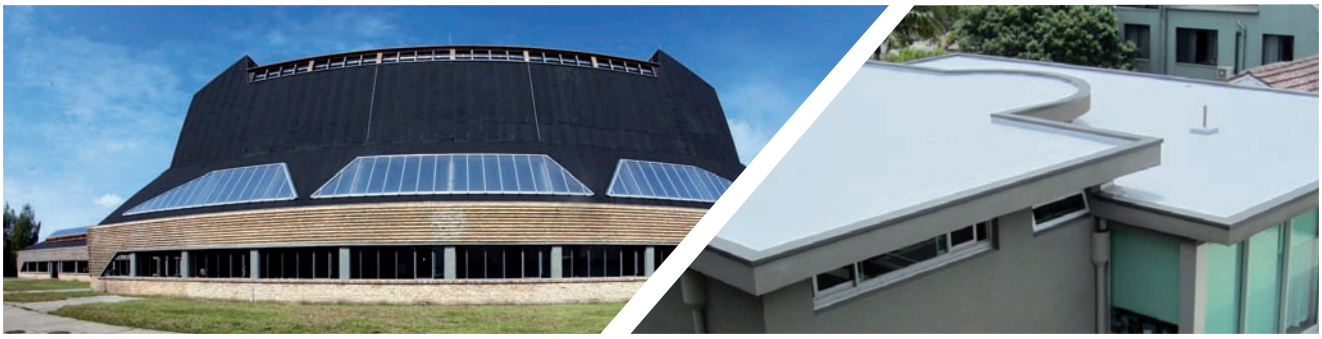
DESIGN ASSISTANCE

Contact our Technical Department
for comprehensive design information
and for **customised specifications**:
tecnico@generalmembrane.com

A GOOD DESIGN

The design of the covering is crucial to optimise the waterproofing system's resistance to hail impact. Several precautions can be adopted to enhance durability:

- *fully adhered* application to the support;
- *multi-layer* waterproofing, the final layer of which self-protected with slate chips;
- in case of *warm roof covering system, we recommend using panels having a compressive strength ≥ 150 kPa.* If laid with a torch on thermo-sensitive materials, the heat-insulating material must be pre-coupled with the *Gemini FC-B HS* membrane;
- *avoid air gaps forming between the membrane and the underlying elements*. Be very careful to fill any gaps where the horizontal and vertical surfaces join (prefabricated shells, panels not perfectly aligned, etc.). Make sure that the membranes are not subject to any tension and check that every part of the membrane adheres firmly to its underlay.



REFURBISHMENTS

Refurbishment refers to the creation of a new waterproofing system above an existing system that has ceased to work efficiently. **When designing a refurbishment project of the roofing, the guidelines described above apply**, in addition to the following indications.

Existing bituminous membranes

Any undulated or corrugated parts of the membrane must be removed, by restoring the affected zones with new patches. If the old membrane no longer adheres to the support, it must be cut at the base of the vertical elements and its lapped part removed. The new layers specified in the project can then be applied.

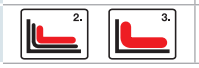
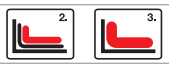
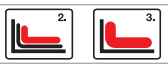
Existing synthetic membranes (PVC/TPO/EPDM)

All laps must completely removed starting from the base of the vertical element. Due to incompatibility between materials, separation elements must be included to prevent contact between the old and new membranes (for example, *Pegasus P*, heat-insulating slabs, wooden layers, etc.).

In both cases, depending on the conditions of the relevant area, an overall assessment must be made in order to:

- Detect the defects of the old waterproofing membrane
- Determine which functional elements can be retained
- Identify all the functional layers required to create the new waterproof layer structure
- Identify the laying system (and binding system) to be adopted

HS RANGE PRODUCTS: TECHNICAL DATA

TEST DESCRIPTION	REFERENCE STANDARD	UOM	PHOENIX FC MINERAL HS	URANUS FC MINERAL HS	PHOENIX SUPER MINERAL HS NEW	TOL-ER.
Visible defects	UNI EN 1850-1	Visible	No defects	No defects	No defects	
Length	UNI EN 1848-1	m	7,50 -1%	7,50 -1%	7,50 -1%	min. value
Width	UNI EN 1848-1	m	1,000 -1%	1,000 -1%	1,000 -1%	min. value
Straightness	UNI EN 1848-1	mm	20 mm x 10 m	20 mm x 10 m	20 mm x 10 m	max. value
Aeric mass	UNI EN 1849-1	Kg/sqm	5,4	5,4	5,4	± 10%
Impermeability to water - Method A	UNI EN 1928	kPa	60	60	60	min. value
Reaction to external fire	EN 13501-5	B roof	F Roof	F Roof	F Roof	
Fire reaction	EN 13501-1	Class	E	E	E	pass
Longitudinal / transversal tensile strength of the joints with maximum load	UNI EN 12317-1	N/50 mm	850 / 650	850 / 650	850 / 650	± 20%
Longitudinal / transversal tensile strength with maximum load	UNI EN 12311-1	N/50 mm	1200 / 960	1200 / 960	1200 / 960	± 20%
Longitudinal / transversal elongation at break	UNI EN 12311-1	%	45 / 50	45 / 50	45 / 50	–15 absolute
Impact resistance - Method A	UNI EN 12691	mm	1750	1750	1750	min. value
Static puncture resistance	UNI EN 12730	Kg	25	25	25	min. value
Longitudinal / transversal tear strength	UNI EN 12310-1	N	250 / 250	250 / 250	250 / 250	–30%
Longitudinal / transversal dimensional stability	UNI EN 1107-1 met. A	%	± 0,3 %	± 0,3 %	± 0,3 %	min. value
Cold flexibility	UNI EN 1109	°C	-20	-25	-35	min. value
Hot shape stability to heat resistant	UNI EN 1110	°C	140	100	140	min. value
Flexibility after thermal ageing	UNI EN 1296 / UNI EN 1109	°C	-20	-15	-35	+10
Hot shape stability after thermal ageing	UNI EN 1296 / UNI EN 1110	°C	140	100	140	–10
Adhesion of mineral self-protection	UNI EN 12039	%	Max 30 %	Max 30 %	Max 30 %	max. value
Hail Resistance	VFK-09	Level	5	5	5	
Intended Use*						

*Intended use 2: *Top layer in multi-layer systems* | Intended use 3: *Single layer*

CORRECT USE

Application method

Hail-Shield membranes can be applied using propane gas blow torches or hot-air instruments.

Storage

Store the material in a covered location.
Keep the rolls in the vertical position on pallets or on raised flat surfaces.
Do not place the pallets on top of one another.
Be careful to avoid strong impacts.
In case of extremely low temperatures, move the material to environments with temperature ≥ 5°C and store it for at least 24 hours before proceeding with the application.

Warnings and instructions

Make sure that the laying surfaces are clean and dry, free of oils or chalking. The support must not have any signs of subsidence and must be sufficiently inclined to allow for rain to drain properly. Cement-based surfaces must be pre-treated with the *General Rapid Primer* bituminous primer, in the measure of 250/350 g/m^2.

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