MEDITERRANEAN GREEN ROOF

incipit
A specific approach must be taken when realizing green roofs in a Mediterranean climate, due to the specific climatic conditions and the different possible benefits.

Mediterranean climate systems must deliver high performance results in terms of:

- passive cooling in summer
- low maintenance
- energy saving
- lightness
- low thickness
- increased usability
- water demand in relation to plants typical of the mediterranean area
DEFINING A SCOPE STATEMENT

Supply and installation of a green roof system [TYPE AND VEGETATION] made up by felt accumulation and mechanical protection, drainage and aeration accumulation element, filtering geotextile and the substrate, according to UNI 11235 standards.

Performance characteristics that will be required:

- THICKNESS (total): cm
- SUBSTRATE THICKNESS: cm occurred compaction
- WEIGHT AT MAXIMUM WATER SATURATION: ≤ kg / m²
- RUNOFF COEFFICIENT certified by an independent organization: indicates the system’s ability to handle precipitations and temporarily retaining the water so as to delay the discharge peak and contribute to the decongestion of the treatment installation, (the quality increases with decreasing runoff coefficient)
- WATER VOLUME AVAILABLE [AD ≥ l / m²] for plants (with potential between 0 and -1.5 MPa): it indicates the potential water autonomy that the system provides to the plants
- REPORT OF USABILITY [UT ≥%]: effectiveness with which a system makes the accumulated water available
- EFFICIENCY RATIO [EF ≥]: indicates which available accumulated water percentage can provide a physiological signal that stimulates the plants to bulk up, indicating by how much a plant is able to perceive water stress conditions

SYSTEM AND PERFORMANCE

Trieste is geographically located in one of the areas where species among the most diverse in the world converge. There are in fact three contingents of species: Mediterranean, Illyrian and European. Here they overlap, making this region extremely biodiverse. Trieste has the potential of becoming the leading city in the Mediterranean green roof industry and is a “natural bridge” between the more experienced continental endeavors and newly started Mediterranean ones.

Mediterranean climate characteristics:

- low maintenance
- low irrigation needs
- passive cooling in summer, resulting in lower costs for winter heating and summer cooling
- lowering peak summer temperatures.

TRIESTE: THE MEDITERRANEAN GREEN ROOF CITY

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Terra Mediterranea
MediFilter MF 1
Filter sheet
MediDrain MD
Drainage accumulation and aeration element
MediPro MP
PvT water retention
HarpoPlan ZD UV
Root-repellent waterproofing layer

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DRAINAGE CAPACITY: ≥ l / (m²s) of the drainage element (EN ISO 129589), a fundamental parameter to conduct hydraulic tests and prevent flooding

THERMAL RESISTANCE OF THE SYSTEM [R: ≥ (m² K) / W] in operating conditions, according to test report of independent institutions

SUBSTRATE PERMEABILITY ≥ 15 mm / min

SUBSTRATE CATIONIC EXCHANGE CAPACITY ≥ 15 mEq / 100 g.
PHILOSOPHY, RESEARCH AND INNOVATION

The special climatic conditions in a Mediterranean climate are completely different from those of the countries beyond the Alps, and they make it necessary to develop green roof technologies that offer the best growth conditions for vegetation, but that at the same time make it possible to save on irrigation water, fertilizers and maintenance operations, offering ideal technical performance concerning thermal insulation and rainwater management.

In order to develop high performance-sophisticated systems Harpo cooperates with the best Italian Universities in the botanical, thermal engineering and hydraulic engineering fields.

Following Harpo’s centuries-old tradition we focus greatly on the designer by offering a timely and effective technical support.

Finally, we also think about the manufacturer, finding solutions that optimize site management and easily solve the main technical issues.

ENVIRONMENTAL AND ECONOMIC BENEFITS

The Harpo technology used to create green roofs, technically allows you to live with a vegetable garden or a garden above your head with the safety of being able to rely on certified and properly-installed systems.

The following propositions are addressed to individuals, investors, big companies and to the ever-growing number of designers and landscapers who look to these solutions for their clients.
BENEFITS AND ADVANTAGES

Green roofs provide unquestionable economic and environmental benefits:

- They are beautiful and environmentally-friendly.
- They improve the microclimate and the urban temperature: attenuation of the heat island effect.
- They are energy-saving for the summer and the winter.
- They reduce CO2 emissions.
- Fine dust and noise absorption.
- They hold and slow rainwater down, limiting flooding in the cities.
- Stormwater retention can reach peaks of 70-90%, draining the water load using a rainwater-disposal network.
- Biodiversity conservation for the protection of many animal species and plants that go unnoticed at times but that are extremely important to the ecosystem’s balance.
- They develop degraded urban areas through green construction and sustainable building.
- Reduced irrigation.

We are committed in researching systems that exploit the natural precipitation of the area in the best way possible, greatly reducing the water volume necessary. We have therefore developed a specific line: Line RIC (Risparmio Idrico Controllato, monitored water saving).

LEISURE AND FREE TIME

There are numerous benefits for the consumer:

- Creating accessible areas: flat roofs that cannot be used in the summer due to extreme heat can be transformed into small relaxation oasises. Large public surfaces may instead become city parks for the locals or turned into urban vegetable gardens.
- Mental and physical well-being: even the mere visual access to a green area offers great psychological benefits. Creating therapeutic, recreational or educational gardens. Hospitals, rehabilitation centers, nursing homes, schools and kindergartens now regularly install roof gardens.
- Privacy: a roof garden becomes a secluded and remote oasis, a small natural world all to ourselves.
- Comfort: hotels, restaurants, wineries, shops can create ideal environments for their clients to relax or enjoy themselves.

TECHNICAL AND ECONOMIC OPPORTUNITIES NOW

- UNI 11235 standard systems.
- Tax deductions: in Italy the current legislation on energy saving, provides tax deductions in case of energy-performance improvement actions on building units. A recent resolution of the Ministry of the Environment (Resolution 1/2014) allows green roof systems to benefit of a 50% tax deduction on the expenses.
TECHNICAL AND PROJECT OPPORTUNITIES

- A full range of solutions enable designers to deal with extensive green roof projects (low maintenance), intensive green roof projects (medium-high maintenance), pitched roofs, driveways.

- Knowing the hydraulic performance of our systems in terms of runoff coefficients we can help the designer or builder to optimize rainwater management by reducing the amount of drains and placing them in places easily linked to drainage systems.

- By using techniques to continuously drain water, waterproofing and masonry can be highly reduced, saving money and reducing the risk of seepage.

- Lightness. The lightest system only weighs 130 kg/m² at full water saturation. A walkable lawn can be made with only 200-250 kg/m².

ACCESSORY RANGE

- A wide range of accessories allows you to solve technical issues in a professional and elegant way, guaranteeing high functionality of the draining complex: manholes, ducts, separation profiles.

- Everything is supplied in aluminum, steel, or sometimes even in Corten. There is an interesting possibility of using our integrated systems for photovoltaic panels. We can also provide systems for the safety of the maintenance operators.
Suitable for highly urbanized areas such as industrial and commercial areas with high soil sealing. It helps to restore the water cycle and to mitigate climate and air pollution.

**EXTENSIVE SEDUM**
These plants do not develop in height, are frost, drought and wind resistant, with high regeneration capacity. A thorough study of the species applied depending on the climatic characteristics makes these systems the best “green” alternative to traditional inert covers.

**EXTENSIVE PERENNIAL / COMPOSITE / HERBS**
A mixture of different herbaceous perennials or mixture of sedum, herbaceous perennials and small shrubs. It is ideal for instances where, in addition to mitigation and compensation performance an aesthetic / landscape integration is required.

**EXTENSIVE AROMATIC**
This solution is suitable for applications where, in addition to mitigation and compensation performance an aesthetic performance and of great originality is required, thanks to the aromas and the unique scents of aromatic herbs.

**EXTENSIVE NATURAL LAWN**
Obtainable for sowing (mixture of “Semenostrum” seeds), it is a tool suitable to the construction of roofs with high ecological value and when a value of landscape integration is required. The solution combines the technical features suitable to recreate a highly biodiverse system.

**EXTENSIVE SYSTEM**

**Features:**
- versatility
- extremely thin (about 12-15 cm)
- light (180-220 kg / m²)
- low maintenance
- emergency irrigation
- limited usage
- economical.

**Purposes and benefits**
In these contexts, extensive green roofs perform the following functions:
- increasing waterproofing duration
- outflow reduction
- passive cooling in the summer
- environmental mitigation.
They are the ideal solution when the roof stratigraphy must offer a completely usable space with limited thickness and weight.

It is possible to create a walkable lawn and a surface covered with medium-sized bushes and trees, integrating continuous drainage paved surfaces.

**LIGHT INTENSIVE**

The lawn allows the formation of an extremely “tamed” natural space, fully operational, and the addition of low-shrubs allows you to liven up and balance the space.

**ROOF GARDEN INTENSIVE**

System designed to enable the realization of any type of roof garden, integrating shrubs of large size and trees, heavy furniture and flooring to the lawn surface. It is preferable to always use variable thicknesses for environmental sustainability issues.

**SOLID AND VEGETABLE GARDEN INTENSIVE**

The system is designed to ensure maximum protection of water tightness. In urban vegetable gardens, thanks to the very high fertility of Terra Mediterranea substrate, cultivating various vegetables and horticultural operations are possible without the risk of damaging the waterproofing.

**INTENSIVE SYSTEM**

<table>
<thead>
<tr>
<th>Features:</th>
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<tbody>
<tr>
<td>total usability</td>
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<tr>
<td>high aesthetic value</td>
</tr>
<tr>
<td>weight &gt; 225 kg / m²</td>
</tr>
<tr>
<td>thickness &gt; 20 cm</td>
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<tr>
<td>medium to high maintenance</td>
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<td>water needs to be assessed on the basis of vegetation.</td>
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<table>
<thead>
<tr>
<th>Purposes and Benefits:</th>
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<tbody>
<tr>
<td>increase in the real estate value</td>
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<tr>
<td>creation of accessible areas</td>
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<tr>
<td>creation of urban vegetable gardens</td>
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<tr>
<td>impactful image</td>
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<tr>
<td>passive summer cooling</td>
</tr>
<tr>
<td>outflow reduction</td>
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<tr>
<td>increasing waterproofing duration.</td>
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It is possible to create a sloped green roof with the right design features from a technical and design point of view:

- correct stratigraphy
- study of executive details
- suitable containment perimeter
- testing cross-piece necessity to support the load delivered by the above stratigraphy.

Upon completion of the execution phase the need to insert cross-piece elements will be verified. The elements will be dimensioned, located and defined and will support the stratigraphy developed pressure, planned according to the details of the green roof’s specific design. The cross-pieces will act as a support for the vegetable substrate retaining panels. On the length of the cross-piece interruptions must be included to ensure water outflow.
Thanks to the continuous drainage option it is possible to create any type of draining and non-draining, pedestrian pavement or driveway, flooring over the MediDrain drainage.

**PEDESTRIAN FLOORING**

**Continuous drainage:**
- simplifies architectural design
- guarantees waterproofing continuity
- reduces waterproofing expenses
- reduces risks of leaching.

**Features:**
- versatile: minimum thickness
- moderate weight
- durable
- easily installed and easily removed.

**PEDESTRIAN DRAINAGE SYSTEM IN WOOD**

It is a system used to make passageways on roof gardens with non-walkable vegetation or in proximity of exits, to create relaxing and comfortable areas facing the green. The excellent drainage and aeration guaranteed by the Harpo system prevent the planking from rotting and ensures excellent preservation.

**PEDESTRIAN DRAINAGE SYSTEM IN STONE SLABS**

The wide variety of stone finishes or blocks gives the designer great composition and aesthetics freedom. Stability, high compressive strength and frost resistance of Lapillo no-crush ensure excellent preservation and durability of the pedestrian stratigraphy.

**PEDESTRIAN DRAINAGE SYSTEM MADE WITH INERT**

The use of inert materials for the realization of pedestrian paths in green areas may look interesting and choreographic. The flooring thus made must be properly confined. Such confinement can be achieved with curbs in concrete or draining metal sections PPD or PPD-FLEX (curvilinear), adaptable to sinuous and curved paths.

**PEDESTRIAN SYSTEM WITH STONE TILES OR SLABS PLACED ON REINFORCED SCREED ON CONTINUOUS DRAINAGE**

On tile/slab stone flooring, flattened stone with mortar on the screed. The screed includes a welded mesh that can be placed directly on the MediDrain draining panel, which in this specific case will then be used as a disposable formwork.
DRIVEWAY ON CONTINUOUS DRAINAGE

DRAINING DRIVE-OVER LAWN, PARKING AREAS AND TRANSIT LANES IN SELF-LOCKING TILES

If the surface is devoted to parking, the option that integrates the use of lawn driveway for parking areas as well as self-locking tiles of drainage for transit lanes is ideal. The advantage of the option is the integration of different solutions, ensuring continuity of drainage and permeability of the surface. The use of three-dimensional geostructure NeoWeb is interesting, and allows you to create a contained and stable background with little thickness.

FLOORING AND CONTINUOUS DRAINAGE

PAVEMENT IN REINFORCED SCREED ON MEDIDRAIN AND FINISHES IN CONCRETE / ASPHALT / SLABS OF STONE / POSSIBLE GRAVEL PARKING AREAS

The driveway on reinforced slab: in case of driveways subject to passage of heavy vehicles, or with a high frequency, high speed and low thickness availability for the realization of other stratigraphies. There will be a driveway finishing above the slab suitable to the intended use. With this type of waterproof finish runoff water must be directed into drains (see PK-GS grilled wells, channels slit CLF-C) or to permeable seeping areas (gravel parking area or driveway).
APPLICATION AREAS

WINE CELLARS

The cellars are the heart of the vineyard and the green roof, with its ability to balance the surrounding landscape can have an important aesthetic role. Here the green roof can resemble a traditional garden, from a lawn and flowerbed intensive green roof system, up to an extensive wildflower lawn.

But the cellar is not only the business card for a wine producer, it also aims to highlight their consciousness to the environment and landscape. The green roof is a leading technique for its unrivaled ability to soften the diurnal and annual temperature variations, reducing the impact of the urban heat island effect. Thanks to their ability to balance the surrounding landscape, green roofs can play a dedicated function to the people staying in these facilities.

The use of Medi Watersafe controlled irrigation systems, Harpo verdepensile systems’ runoff coefficients, certified by the University of Genoa, can drastically reduce the size of the tanks that must be provided for the meteoric water retention and detention basin.

BEAUTIFUL TERRACES OR GREEN ROOF SYSTEM

City farms on the roofs of buildings and shopping centers can softn the urban heat island effect, providing a partial seal against outdoor noise. This has an important aesthetic role.

HOTELS, TOURIST ACCOMMODATIONS

Green roofs have incredible potential in improving the image of hotel facilities and services in urban areas. The roofs and the highest terraces are far from the noise and a light intensive system or an intensive green roof can turn them into an oasis of relaxation for the guests. These systems are designed to diversify the garden vegetation, from the lawn, to roses, to hedges of various sizes, up to arboreal elements. The green roof can also become a tool to improve the comfort of the rooms if placed in the attic. A perennial extensive is enough to bring the thermal lag of the roof to over 14 hours, with an outgoing heat flow from the roof during the summer. In hotels located close to infrastructures such as airports or motorway viaducts, (with loud noises) the green roof increases the mass of the coverage area and reduces the noise transmission inside the building.

In schooling a garden can have a didactic value, as a vegetable garden to provide students with a hint to those, now alien to most, rural plant essences and perfumes that are typical of youth, give a substantial boost to memory. The conversion of flat rooftops representing architectural solutions of great interest, since their use as accessible areas increases the building value and often allows to improve its appearance.

HOUSING AND OFFICES

The industry is showing great interest in the new technologies that allow to deliver professional roof gardens. Accessible terraces, green areas, are examples of garden roofs representing architectural solutions of great interest, since their use as accessible areas increases the building value and often allows to improve its appearance.

A recent resolution of the Italian Ministry of the Environment clarifies that green roofs are among the interventions that legitimize to obtain tax incentives for improving the energy consumption of the building, following the conversion of flat roofs in green roofs. It is therefore an excellent opportunity in the real estate industry as green roof systems can obtain tax deductions from the incurred expenses.

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PRODUCTION STRUCTURES

BUILDINGS, SHOPPING CENTERS AND PRODUCTION STRUCTURES

These types of buildings are often subject to an EIS procedure because of their large size. Turn a similarly sized lot of land in a waterproof surface affects the water cycle and the urban water management in an absolutely significant way. The green roof was then proposed as a possible measure to limit the environmental impact. Thanks to their ability to balance the surrounding landscape, green roofs can play a dedicated function to the people staying in these facilities.

The importance of seeing or having access to green areas has acquired a prominent role. Harpo verdepensile systems in these areas offer the following advantages:

- revitalizing the urban ecosystem
- the design of greener and usable public spaces allows to intervene with contemporary solutions in historical centers as well, bringing an added value in a winning perspective of urban marketing
- because of "unsustainable" lifestyles, the urban environment today has become unpleasant. If not quite unhealthy, which is why reintroducing green environment in urban areas, requiring more and more stratigraphies and permeable solutions, becomes the aim of an ecofriendly and green design.

HOSPITALS, REHABILITATION HOMES, SCHOOLS

The importance of seeing or having access to green areas in the process of recovery and rehabilitation of people in treatment is now highly documented. Terraces or green roof projects in hospitals, rehabilitation homes and schools can play a dedicated function to the people staying in these facilities.

In retirement homes for example the use of furnishings, plant essences and perfumes that are typical of youth, give a substantial boost to memory. In schooling a garden can have a didactic value, as a botanical garden or even as a vegetable garden to provide students with a hint to those, now alien to most, rural activities.

The green roof system will be predominantly of variable thickness, to range from herbaceous plants to shrubs or trees, thus optimizing the thickness. Interesting solutions are: in addition to classic lawn, the vegetable garden intensive system and the extensive aromatic system for the opportunity of in olfactory perspective as well.

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But the cellar is not only the business card for a wine producer, it also aims to highlight their consciousness to the environment and landscape. The green roof is a leading technique for its unrivaled ability to soften the diurnal and annual temperature variations, cooling in the summer and protecting from frost in the winter.
The solid experience of the Harpo verdepen sile technical department provides the designer with a competent and reliable point of view that allows optimization of the project and construction costs. One of the fundamental aspects in green roof designing and construction is in the care and the solution of technical issues through the use of specific accessories. The green roof is to be considered, in fact, still a cover, and as such should be designed, in order to provide as a first priority, adequate performance management and rainwater drainage. Attention to detail is particularly important at the drains, in close proximity to thresholds and facades, skylights, perimeters and around paved areas interfacing with the green areas. There must be refined accessories, suitable for green roof stratigraphy integration that offer the designer the most reliable technical solution without neglecting the aesthetics, in order to offer a finished product in a skillfully executed manner.

Harpo verdepen sile accessories:
- control chambers
- drainage channels
- draining / gravel retainer / containment / protection profiles
- anchors for safe maintenance.
**TECHNOGENIC MINERAL SUBSTRATES**

**TERRA MEDITERRANEA HARPO**

The normal universal soil cannot be used on a roof because after a couple of years it should be replaced as it is done in the home vases. A mineral mix must be used instead, which us specialists call substrate. The **Terra Mediterranea TM** substrate is the true heart of the system, where the plants live and grow. It’s a technogenic substrate made from controlled raw materials.

**Terra Mediterranea** was developed for roof gardens, orchards and other ground applications where the high usability, durability and low maintenance are essential requirements. A strict quality control of all its raw materials and the constant performance monitoring offer an excellent product to the customer and the designers.

**Fields:**
- green roofs
- orchards
- planters
- ground level gardens.

To develop the substrate **Harpo verdепensile** cooperates with leading research institutions. It’s a mostly mineral based product (volcanic lapilli, pumice, zeolites …); the organic substance is reduced to a minimum, since it would mean a decrease in thickness over time, a structural variation of the substrate and it would make it easily attacked by pests.

The functions of the individual components:
- volcanic lapilli: the skeleton, the structure of the substrate. It must be light and maintain its physical structure over time. It must be chemically neutral and have a great capacity to retain water and release it in the “right way” to plants
- pumice: it retains a lot of water and gives lightness to the substrate
- organic components: peat and compost are necessary for the development of micro-fauna but we keep their use to the smallest amount possible.

**Harpo verdепensile** is able to produce substrates for specific situations or needs, customized to the green roof project in question.

In its range of substrates **Harpo** also provides the substrate **Terra Mediterranea TMT** (acronym for Terra Mediterranea a Terra, Mediterranean Earth to Earth) for ground uses.

It is the result of a careful study aimed at maintaining an extremely high quality standard at a competitive price. The **TMT substrate** is a valid alternative to commonly used soils containing modified sand or earth.

**Advantages:**
- lightness
- high durability
- excellent overall properties of the substrate
- high drainage capacity (workability and coating even in rainy days when saturated)
- permeability ≥ 30 mm / min: excellent ventilation of the roots
- high cation exchange capacity
- ability to retain nutrients
- less fertilization
- less watering
- no toxicity
- the substrate does not generate mud and keeps the usability intact. Finally it remains loose and easy to work even if it is saturated with water (shutter speed)
- delivery speed
- the material is a manufactured product, so it does not follow the law on earth and rock excavation, which makes for immediate delivery.
REFERENCES

Authorized applicators teams that will ensure the installation of the Harpo verdensile stratigraphy and synthetic lawn be done in a skillful and professional manner.

Installers constantly cooperate with the Harpo technical department to monitor specific projects and to provide detailed technical information to the designers in the design phase and during construction, combining their specific knowledge applicable to all facets of the different green systems with the know-how of our Technical Department. This close collaboration ensures the customer a careful analysis of all aspects relating to the project by allowing proper planning and completion of the works by interfacing step by step.

For us, the applicator is a partner with which to forge a working relationship that will last.

Our fiduciary applicators are given a personal stamp showing the year of appointment, which they can use in their documentation, in their estimates.

COURSES AND CONSULTING

Harpo verdensile constantly organizes training and refresher courses for applicators trustees. Our courses mean that the teams of fiduciary applicators are able to install the green roof stratigraphy in a skillful and professional manner.

Moreover, our Technical Department constantly cooperates with our applicators for the analysis of specific projects in order to provide detailed technical guidance to designers from the design stage up to implementation.
REFERENCES

Some of Our Most Prestigious References

- Schools: Sala di conferenze internazionale, Gorizia (GO). International English School, Padova (PD).
  Scuola di Agliana, Pistoia (PT). Scuola di Cinema ex Manifesta Tabacco, Milano (MI). Scuola materna
  Scuola Pieve di Soligo, Treviso (TV).
- Hydroelectric Power Station: Villa Lagarina (TN).
- Wine cellars: Capitaneria diporto, Catania (CT). Centro direzionale
  Littoria Torna (AL). Fiat Mirafiore, ex - Officina 82, Torino (TO).
- Capitaneria diporto, Catania (CT). Centro direzionale Littoria Torna (AL). Fiat Mirafiore, ex - Officina 82, Torino (TO).
- Squares: Cinisello Balsamo, Milano (MI). Ater
  Campo della Marta della Portello, Padua (PD). IPES
  Viale B. Partisian (River Bisagno), Genova (GE).
- Social Housing: Cenisio Balsamo, Milano (MI). Ater Campo della Marta della Portello, Padua (PD). IPES
  Village of roofing ...
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