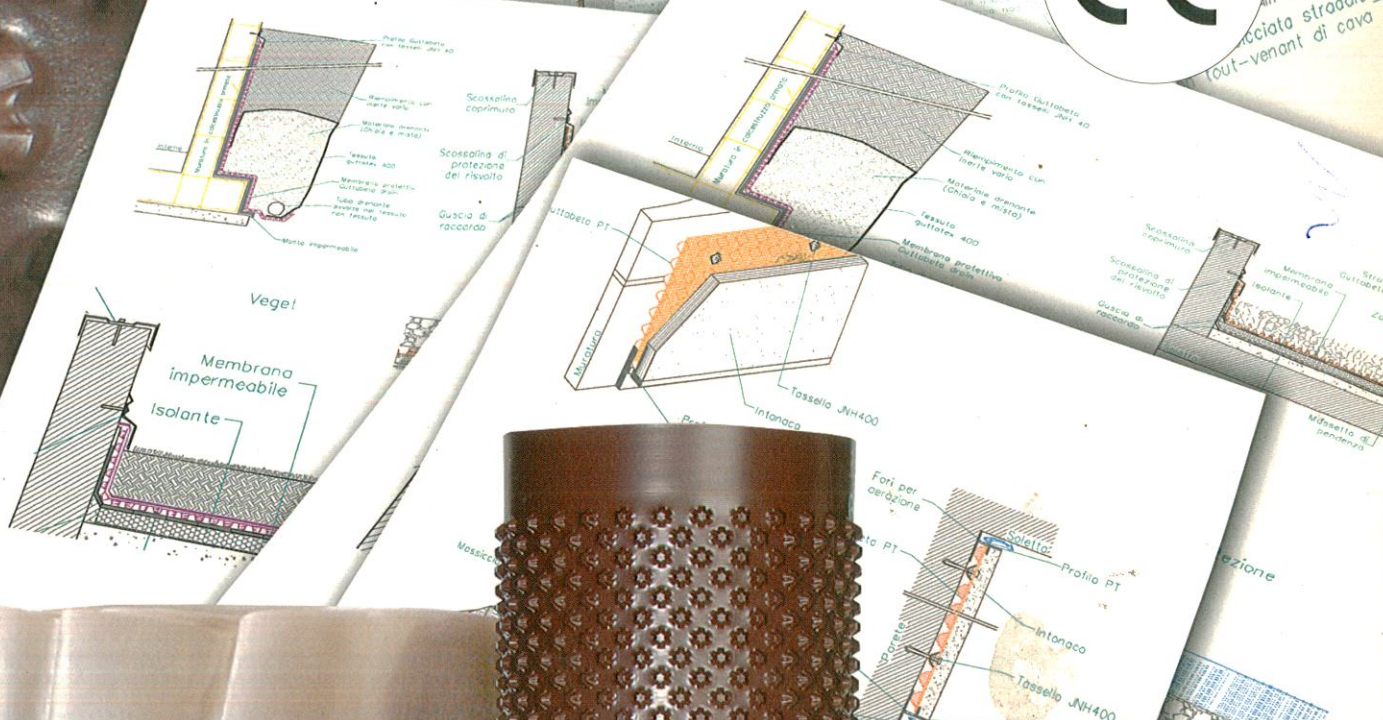


gullabeta®

Draining, protective and waterproof dimpled membranes in HDPE



TECHNICAL MANUAL

The history of the Gutta group in Italy begins with the 1989 acquisition of a legendary Italian manufacturing company by Gutta Werke. This company had been operating on the market since 1989 producing bituminous sheets under Gutta license. The new entity impose an investment program to update and revamp the installations. This provided a decisive change of pace, favoring the penetration of Gutta products on the Italian market.

Since that distant 1989, Gutta has come a long way, increasing its turnover and expanding its production facilities year after year, widening the product range and making a name for itself on the market as a trusted partner to count on for construction dealers and project managers.

Gutta Werke Spa is certified ISO 9001 and ISO 14001. Standard **UNI EN ISO 9001** defines the requirements of a **Quality System** model adopted for the purpose of proving the company's ability to provide products/services that comply with specifications and that are capable of satisfying customer requirements. Standard **UNI EN ISO 14001** provides the company with the basics for an effective **Environmental Management system** for the purpose of contributing to the protection of the environment, preventing and minimizing the impact that our activities have on soil, water and atmosphere. These certifications, integrated with other managerial requirements, help the company to achieve the predefined objectives in full observance of standards and regulations.

Gutta Werke Spa operates all over Italy through a network of construction dealers, a distribution channel that has always proved to be the basis of our success.



Plant in Filago - BG



Plant in Stradella - PV



Plant in - CT

Iso 9001:2000
Certificate



Iso 14001:2004
Certificate

CE Certificate

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Gutta works to protect the environment

Gutta Werke S.p.A. is sensitive to issues related to environmental protection, as it considers them an essential part of the quality of life and an indispensable condition for a healthy and constructive economic development.

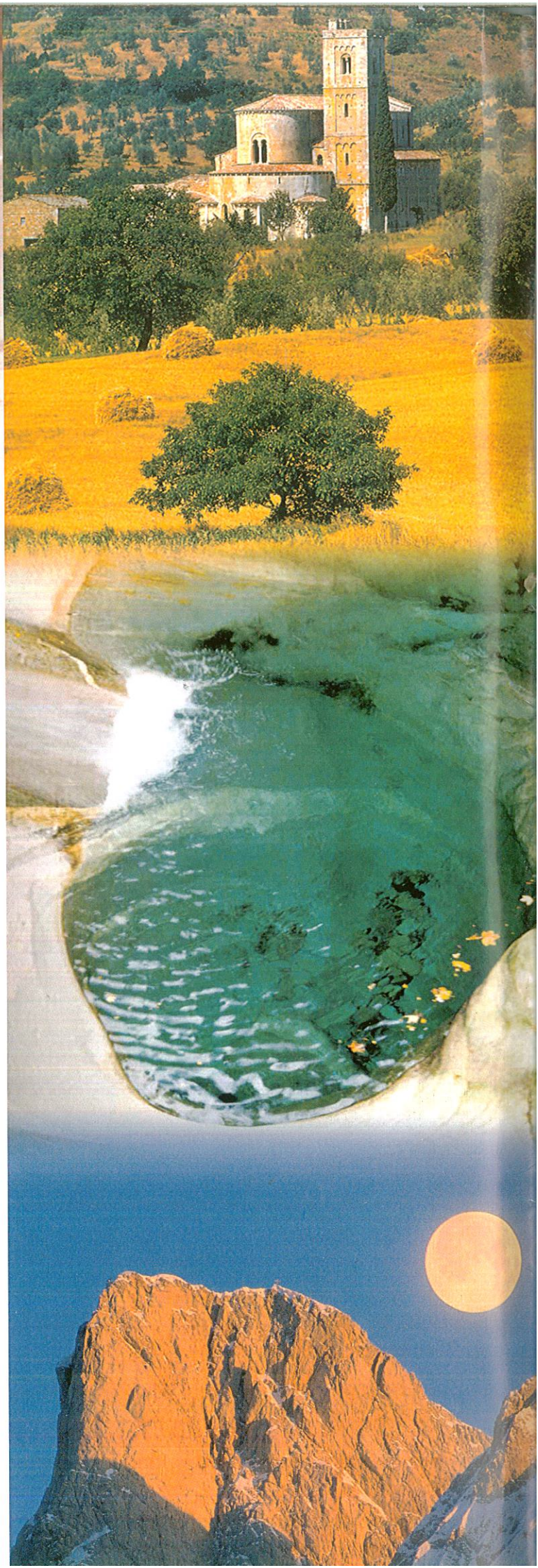
Consequently, Gutta Werke S.p.A.'s main goal is to operate so that its production activities cause the least possible impact on the environment, incorporating the principles of environmental protection and pursuing constant improvement in order to prevent pollution.

Specifically, Gutta Werke S.p.A. aims at:

1. Complying with the laws and all environmental regulations applicable to its own activities;
2. Systematically measuring the environmental impact of its own operations, understanding the effects and identifying the causes;
3. Committing itself to generating and managing waste so as to favor, anytime it is possible, its recovery and recycling instead of its disposal;
4. Minimizing the environmental impact of new products, technologies, activities and services by turning to procedures and planning systems aimed at such end;
5. Promoting the involvement and, if necessary, the training of its own associates as far as environmental issues are concerned;
6. Assessing the environmental aspects of the goods and services used by the company and notifying the suppliers about requirements pertaining to them;
7. Maintaining open and constructive relationships with Public Administration bodies, with the community where the production facilities are located, as well as with the associations and groups operating on the territory.

Gutta Werke S.p.A., driven by the moral obligation of a modern company to take environmental resources into account, and by the belief that the environment is an important economic competition factor, is committed to complying with strict environmental protection criteria.

This has translated into a constant commitment, thanks to which Gutta Werke S.p.A has achieved significant improvements in recent years in the environmental performances of all core business activities.



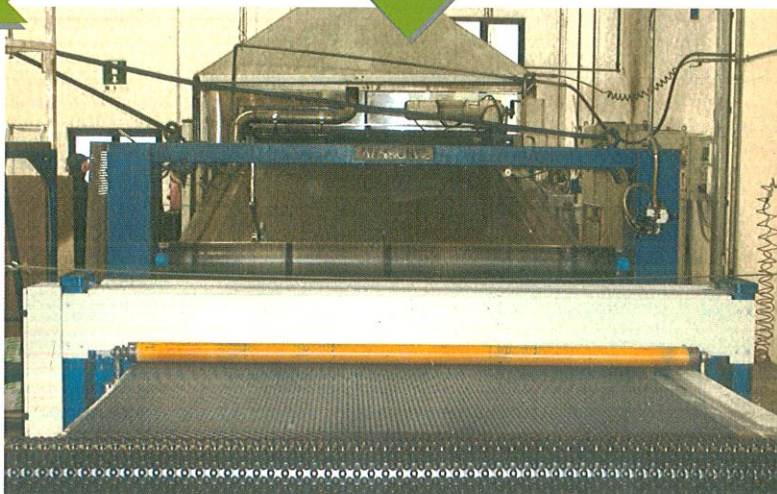
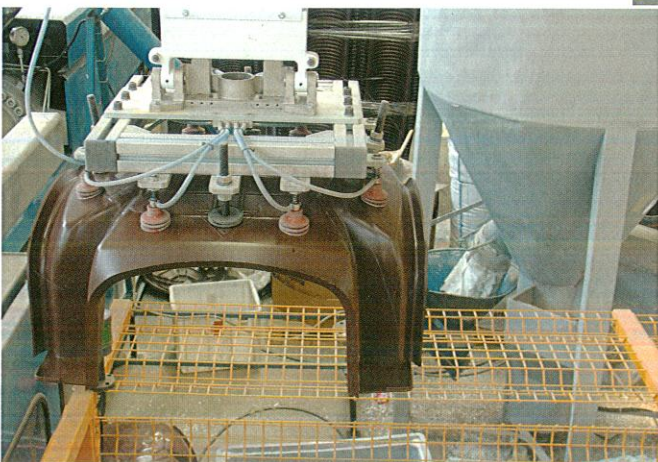
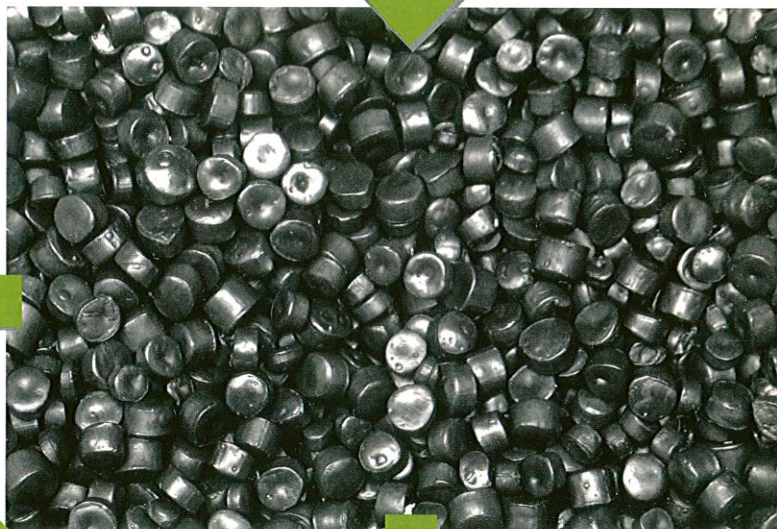
Gutta works to save environmental resources



In the past, the available resources abundantly covered the energy requirements; as a result, they were used without worrying about the consequences on the environment. Over

the years, this intensive exploitation has caused an indiscriminate increase in all types of waste and the deterioration of the planet's eco-system. We are talking about uncontrolled deforestation, soil pollution through the production of non- biodegradable elements and their dispersion in the environment, water pollution due to the disposal of untreated substances, and air pollution caused by the emission of substances dangerous to man's health into the atmosphere.

Fortunately, the growth of ecological awareness is distinguishing those European countries that, slowly and with difficulty, are trying to find solutions in order to arrive at a viable balance between ecology and production, playing on the perception that protecting the environment ultimately means protecting ourselves. Gutta has based its production on the use of recycled and recyclable materials as much as possible, creating a production process with the lowest environmental impact possible and using recycled materials in order to safeguard the environment.



Materials recycling as the primary goal

A considerable portion of the HDPE used by Gutta In its production process derives from the recycling of "post-consumption" materials.

These materials come from products that we use in our daily lives, such as containers for detergents, creams, liquids, etc., which do not self-destroy and last a long time as waste.

Consequently, it is important that the post-consumption, non-degradable product re-enter the production chain without having to use other natural resources (oil), thus contributing to reducing non-degradable materials.

After collecting and selecting the plastic packaging, they are ground and turned into scales, which are then washed and dried carefully.

After completing this phase, the scales undergo a heat treatment aimed at converting them back into a uniform and fluid mass, which is then cut in many small pellets.

A new raw material is born suitable for the production of the dimpled membrane **Guttabeta**[®]. This new material that can take on different colors, through the addition of masters, depending on the customer's requirements.

Guttabeta[®] is a product designed with the environment in mind. Furthermore, at the end of its work cycle it can be recycled once again. The advantages for the environment are clear!

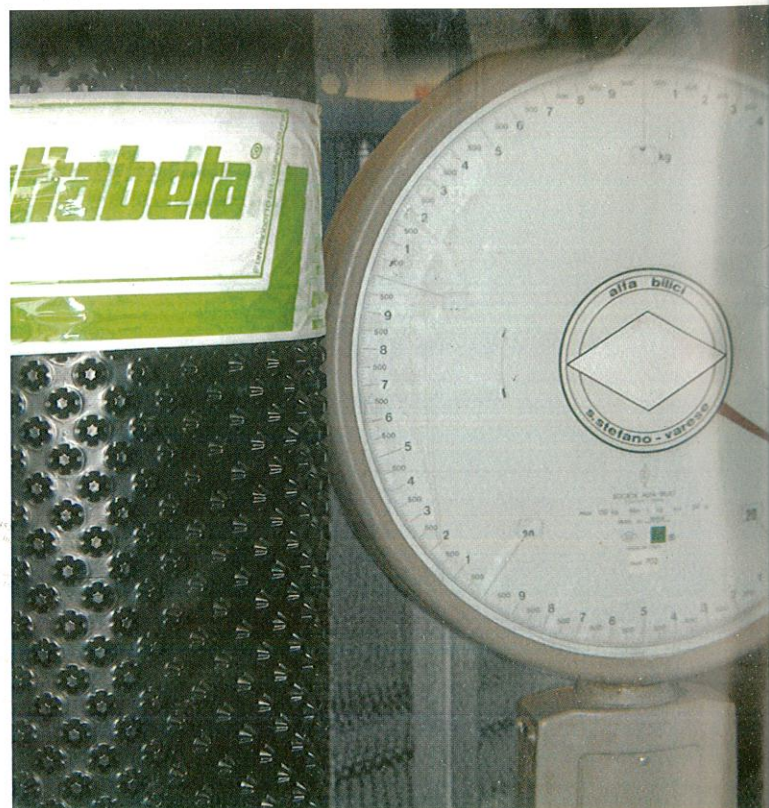
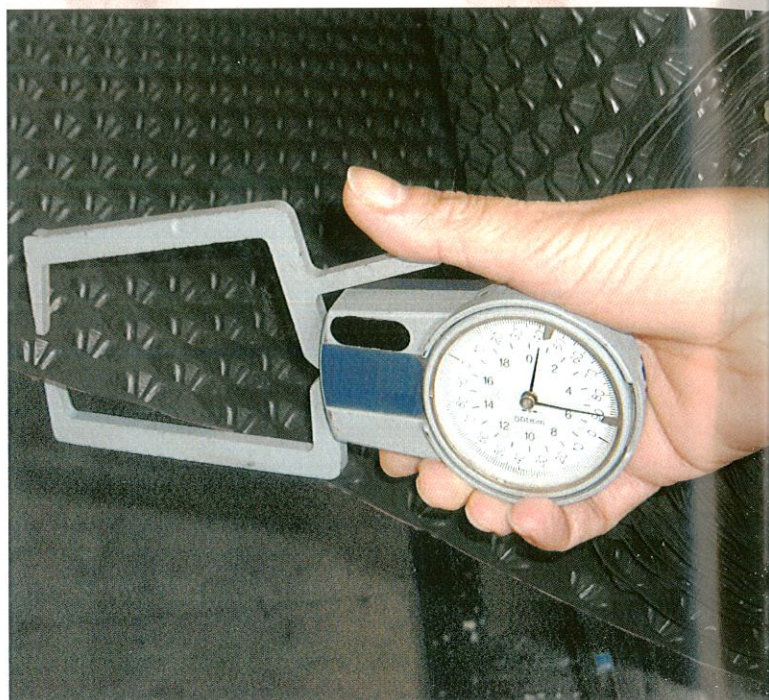
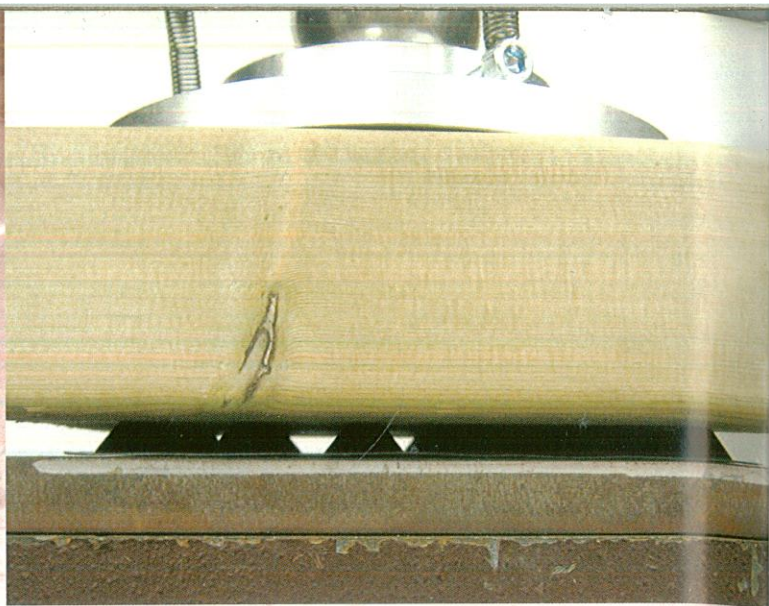
Commitment to research and control in order to achieve high quality

Care of the production processes does not end with controlling the work cycle. Instead, it continues in the careful check of the finished product.

Gutta's Swiss facilities include a testing laboratory for roofing and plastic products.

The laboratory employs professionals who follow the application of qualitative processes at the plants and quality control of the finished product. Each recipe for the composition of products is studied individually in relation to the products of the installations being used and the final application of the product.

The production processes are monitored hour by hour in order to have a history that is as precise as possible of the raw material – machine – product relationship.



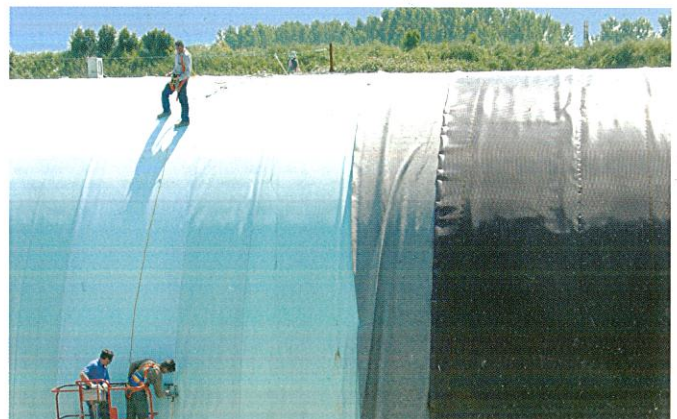
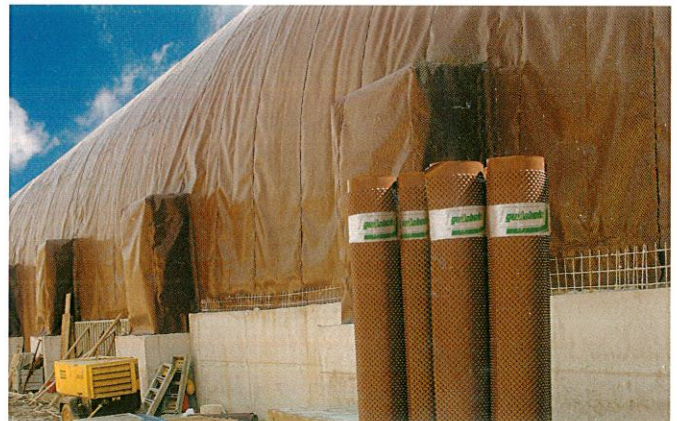
Reasons for using Guttabeta® dimpled membranes in construction works

Often the only waterproofing used to protect construction works is the bituminous sheet, either flame-laid or self-adhesive, or in some cases a double layer of cold-laid asphalt. Even if a premium quality sheath is used and laid in a workmanlike manner, the construction phases subsequent to the laying seriously jeopardize the integrity of the waterproofing carried out, as for example in the case of foundation walls filled with inert materials. The mechanical action and variety of filling materials, not to mention the possibility that large-sized materials can be used, often damage the waterproofing layer. This occurs in the form of cuts or damages that cause water infiltrations, humidity stains and moulds in interior rooms. In this case, the laying of **Guttabeta®** as a separating layer between the bituminous sheath and the filling material offers many advantages:

1. it contrasts the mechanical action carried out by the inert material, thus preventing cuts or lacerations in the sheath.
2. it increases the waterproofing function as the HDPE, the material that makes up the **Guttabeta®** membrane, is completely waterproof.
3. It acts as a draining element in case of flowing or infiltration water adjacent to the walls.

All this increases the healthiness of living quarters, the life of the structure and reduces extraordinary maintenance. The quality of **Guttabeta®** does not end with its compression resistance and waterproofing protection. With **Guttabeta® Star Drain**, a combination of membrane and geo-textile fabric, it carries out an effective draining action thanks to the drainage chamber located between the fabric and the base of the studs. This draining quality is used both in vertical walls and in flat roofings, with roof garden or gravel finishes. Another important function carried out by **Guttabeta®**, through its PT version, is the reduction of the the capillary rise of humidity in basements or in the walls of floors in contact with the soil, providing a definitive solution to humidity stains in plaster. Moreover, thanks to its plaster supporting net, **Guttabeta® PT** is also used to build ventilated external facades, as the studs allow ventilation of the wall. The waterproof membrane protects the indoor premises from humidity and beating rain, while the plaster supporting net makes it easier for the plaster to stick to the wall. Even in the presence of rising humidity in the floors, **Guttabeta®'s T20** version, with 20-mm studs, creates an air space underneath the floor with the dual function of stopping the spread of humidity inside the room and avoiding the troublesome

dew effect on floor tiles caused by the ceramic laid on the cold floor coming in contact with the higher indoors temperature. **Guttabeta® T20** prevents this phenomenon from occurring as it creates a 20-mm tempered air chamber that results in drier floors. Finally, Gutta's family of HDPE membranes includes a sheet for roof garden with water reservoir. This special product, called **Guttabeta® T20 Garden**, has the same 20-mm studded structure as the **Guttabeta® T20** but it features drainage holes for excess water between one stud and the next. In fact, by laying these sheets with the female studs facing upward, in case of rainfall or watering the small cups fill up with water and become a reservoir for the garden during dry spells. In case of water in excess of the studs filling capacity, the water flows into the special holes mentioned before and will be eliminated by means of the waterproofing. In the following pages, in addition to the technical sheets of the products that make up the family of **Guttabeta®** membranes, you will also find the design drawings, subdivided by applications, as well as the laying instructions.



Guttabeta®: a range of products designed to solve your problems

Guttabeta® Star 320kN, 400kN, 530kN



Characteristics	Star 320 kN	Star 400 kN	Star 530 kN
Material	high density polyethylene (HDPE)		
Colour	Black	Brown	Brown
Certified mechanical resistance	320 kN/m ² (32 t/m ²)	400 kN/m ² (40 t/m ²)	530 kN/m ² (53 t/m ²)
Studs height	7 mm	7 mm	7 mm
Studs n° per m ²	approx. 1860	approx. 1860	approx. 1860
Air volume between studs	approx. 5 l/m ²	approx. 5 l/m ²	approx. 5 l/m ²
Drainage capacity	4,6 l/s/m	4,6 l/s/m	4,6 l/s/m
Thermal stability	from -40°C to +80°C protect from U.V. rays	from -40°C to +80°C protect from U.V. rays	from -40°C to +80°C protect from U.V. rays
Physical-chemical properties	Resistant to chemical agents, resistant to roots, does not pollute the water-bearing stratum, resistant to contamination from fungi and bacteria, non-degradable. Cannot stand UV rays		
Combustion class	F - DM 15/03/05	F - DM 15/03/05	F - DM 15/03/05
Rolls size (m)	1,0 x 30 - 1,5 x 30 2,0 x 30 - 2,5 x 30 3,0 x 30 - 3,5 x 30 4,0 x 30	1,0 x 25 - 1,5 x 25 2,0 x 25 - 2,5 x 25 3,0 x 25 - 3,5 x 25 4,0 x 25	1,0 x 20 - 1,5 x 20 2,0 x 20 - 2,5 x 20 3,0 x 20 - 3,5 x 20 4,0 x 20
Rolls per pallet	da 1,0m: 24 rotoli da 1,5 a 2,5m: 12 rotoli da 3,0 a 4,0m: 16 rotoli	da 1,0m: 24 rotoli da 1,5 a 2,5m: 12 rotoli da 3,0 a 4,0m: 16 rotoli	da 1,0m: 24 rotoli da 1,5 a 2,5m: 12 rotoli da 3,0 a 4,0m: 16 rotoli
Dimensional tolerance	± 4%	± 4%	± 4%

Item specification

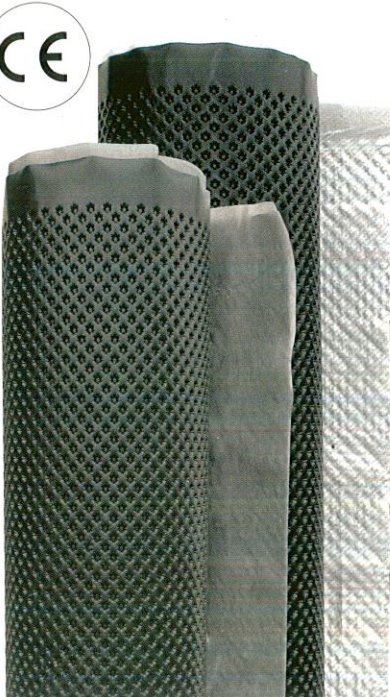
Guttabeta® Star 320 kN: dimpled membrane in high-density extruded polyethylene type **Guttabeta® Star 320 kN** with star-shaped studs, certified mechanical compression resistance of at least 320 kN/m² and a minimum of 1800 studs per m².

Guttabeta® Star 400 kN: dimpled membrane in high-density extruded polyethylene type **Guttabeta® Star 400 kN** with star-shaped studs, certified mechanical compression resistance of at least 400 kN/m² and a minimum of 1800 studs per m².

Guttabeta® Star 530 kN: dimpled membrane in high-density extruded polyethylene type **Guttabeta® Star 530 kN** with star-shaped studs, certified mechanical compression resistance of at least 530 kN/m² and a minimum of 1800 studs per m².



Guttabeta® Star drain - drain V



Characteristics	Star Drain	Star Drain V
Membrane material	High-density polyethylene (HDPE)	High-density polyethylene (HDPE)
Draining material	Continuous filament polypropylene	Needle polypropylene
Colore	Black	Black
Certified mechanical resistance	530 kN/m ² (53 t/m ²)	320 kN/m ² (32 t/m ²)
Geo-textile weight	approx. 140 g/m ²	approx. 110 g/m ²
Studs height	7 mm	7 mm
Studs n° per m ²	approx. 1860	approx. 1860
Air volume between studs	approx. 5 l/m ²	approx. 5 l/m ²
Drainage capacity	approx. 4,6 l/s/m	approx. 4,6 l/s/m
Thermal stability	from -40°C to +80°C protect from U.V. rays	from -40°C to +80°C protect from U.V. rays
Physical-chemical properties	Resistant to chemical agents, to roots, to contamination from fungi and bacteria, does not pollute the water-bearing stratum, non-degradable. Cannot stand UV rays	
Combustion class	F - DM 15/03/05	F - DM 15/03/05
Rolls size (m)	2,0 x 20 m	2,0 x 20 m
Rolls per pallet	6 rolls	6 rolls
Dimensional tolerance	± 4%	± 4%

Item specification

Guttabeta® Star drain: dimpled membrane in high-density extruded polyethylene type **Guttabeta® Star drain** with star-shaped studs, combined with a layer of geo-textile fabric in polypropylene with continuous-filament yarn, certified mechanical compression resistance of at least 530 kN/m², minimum drainage capacity of 4.6 l/s/m and a minimum of 1800 studs per m².

Guttabeta® Star drain V: Dimpled membrane in high-density extruded polyethylene type **Guttabeta® Star drain V** with star-shaped studs, combined with a polypropylene geo-textile needle fabric, certified mechanical compression resistance of at least 320 kN/m², minimum drainage capacity 4.6 l/s/m and a minimum of 1800 studs per m².

guttabeta® PT



guttabeta® PT	
Materiale	Special high-density polyethylene (HDPE)
Thickness of the material	approx. 0,6 mm
Roll size	2,0 x 10 m
Studs height	approx. 8 mm
Studs number per m ²	approx. 1150
Air volume between studs	approx. 5,5 l/m ²
Compression resistance	approx. >15 t/m ² (150 kN/m ²)
Thermal stability	from -40° to +80°C
Chemical-physical properties	Resistant to chemical agents, resistant to roots, non-degradable. Stable in time, waterproof. Cannot stand UV rays
Combustion class	F - DM 15/03/05

Item specification

guttabeta® PT: Dimpled membrane in high-density extruded polyethylene type **guttabeta® PT**, combined with a heat-welded plaster supporting net, with air volume of 5.5 l/sqm behind the studs and a mechanical compression resistance of at least 150 kN/m².

guttabeta® T20

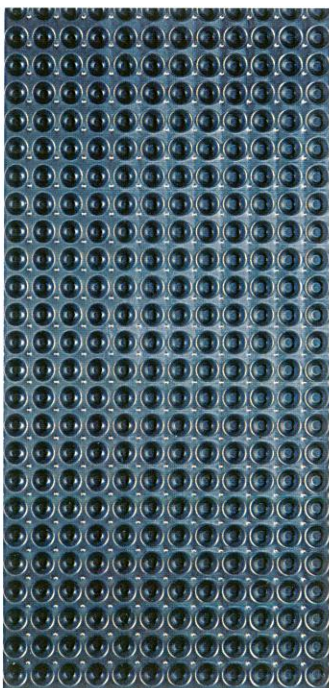


guttabeta® T20	
Material	Special high-density polyethylene (HDPE)
Thickness of the material	approx. 1,0 mm
Roll size	2,5 x 20 m
Studs height	20 mm
Studs number per m ²	approx. 400
Air volume between studs	approx. 14 l/m ²
Capacità di drenaggio	approx. 10 l/s/m
Compression resistance	approx. >15 t/m ² (150 kN/m ²)
Thermal stability	from -40° to +80°C protect from U.V. rays
Chemical-physical properties	Resistant to chemical agents, resistant to roots, does not pollute the water-bearing stratum, resistant to contamination from fungi and bacteria, non-degradable. Cannot stand UV rays.
Combustion class	F - DM 15/03/05

Item specification

guttabeta® T20: Membrana bugnata in polietilene estruso ad alta densità tipo **guttabeta® T20**, con bugne alte 20 mm, volume d'aria tra le bugne di 14 l/m² e resistenza meccanica alla compressione non inferiore a 150 kN/m².

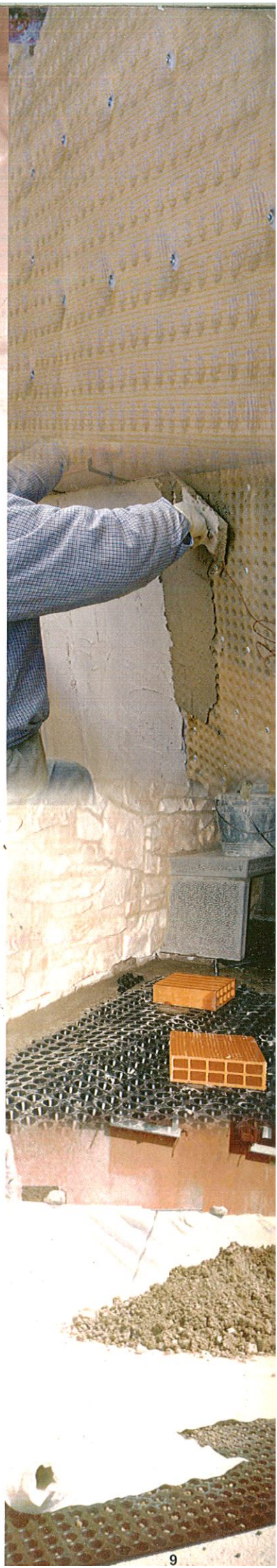
gutta® T20 garden



guttabeta® T20 garden	
Material	Special high-density polyethylene (HDPE)
Colour	Black
Thickness of the material	1,0 mm approx.
Weight	1000 gr/m ²
Sheet size	2,0 x 20 m
Studs height	20 mm
Diameter of the holes	3 mm approx.
Studs per m ²	400 approx.
Air volume between studs	14 l/m ² approx.
Certified compression resistance	> 15 t/m ² approx. (150 kN/m ²)
Drainage capacity	10 l/s/m approx.
Chemical-physical properties	Resistant to chemical agents, resistant to roots, does not pollute the water-bearing stratum, resistant to contamination from fungi and bacteria, non-degradable.
Combustion class	F - DM 15/03/05
Sheets per pallet	4 rolls

Item specification

Gutta® T20 garden: Membrane in high-density extruded polyethylene for roof gardens with water reservoir, type **Gutta® T20 garden** garden, 1 mm thick, with studs that are 20 mm high, mechanical compression resistance of at least 150 kN/m², resistant to chemical agents, compatible with drinking water, resistant to contamination by fungi and bacteria, non-degradable, featuring holes around the studs to allow drainage of excess water.



Products utilization table

CIVIL CONSTRUCTION				
	Problem	Recommended product	Product specifications page	Laying instructions on page
VERTICAL WORKS	Protection of the waterproofing layer and drainage of walls in contact with the soil	Guttabeta® Star 320 kN e 400 kN	8	12
	Protection of the waterproofing layer and drainage of walls in contact with the soil, in case of large quantities of both rainwater and ground water	Guttabeta® Star drain Guttabeta® Star drain V	8	14
	Protection of foundations without the layer of lean concrete	Guttabeta® Star 320 kN, 400kN, 530 kN	8	15
	Protection and drainage of base slabs	Guttabeta® Star 320 kN, 400kN	8	16
	Protection and drainage of walls made with casting in contact with the soil with a reduction of the hydrostatic thrust	Guttabeta® Star drain	8	18
	Restoration and ventilation of damp interior walls	Guttabeta® PT	9	20
HORIZONTAL WORKS	Air gaps for the protection of ground floor and underground rooms against capillary rise and radon gas	Guttabeta® T20, PT Guttabeta® Star 320 kN, 400 kN	9	22
	Vapor barrier in floors caused by humidity of construction materials	Guttabeta® Star 320 kN, 400kN	8	24
FLAT ROOFS	Protection of the waterproofing of flat roofings	Guttabeta® Star 530 kN Guttabeta® T20	8 9	26
	Roof gardens with (and without) water reservoir	Guttabeta® T20 garden Guttabeta® Star drain	9 8	28

Products utilization table

ROAD AND RAILWAY CONSTRUCTION

Problem	Recommended product	Product specifications page	Laying instructions on page
Stabilization of road embankments	Guttabeta® Star 530 kN	8	30
Stabilization of railway embankments	Guttabeta® Star 530 kN	8	31

WATERWORKS

Problem	Recommended product	Product specifications page	Laying instructions on page
Protection and drainage of channels in waterworks	Guttabeta® Star 530 kN	8	32
Reinforcement of banks	Guttabeta® Star 530 kN	8	33

PASSAGEWAYS AND TUNNELS

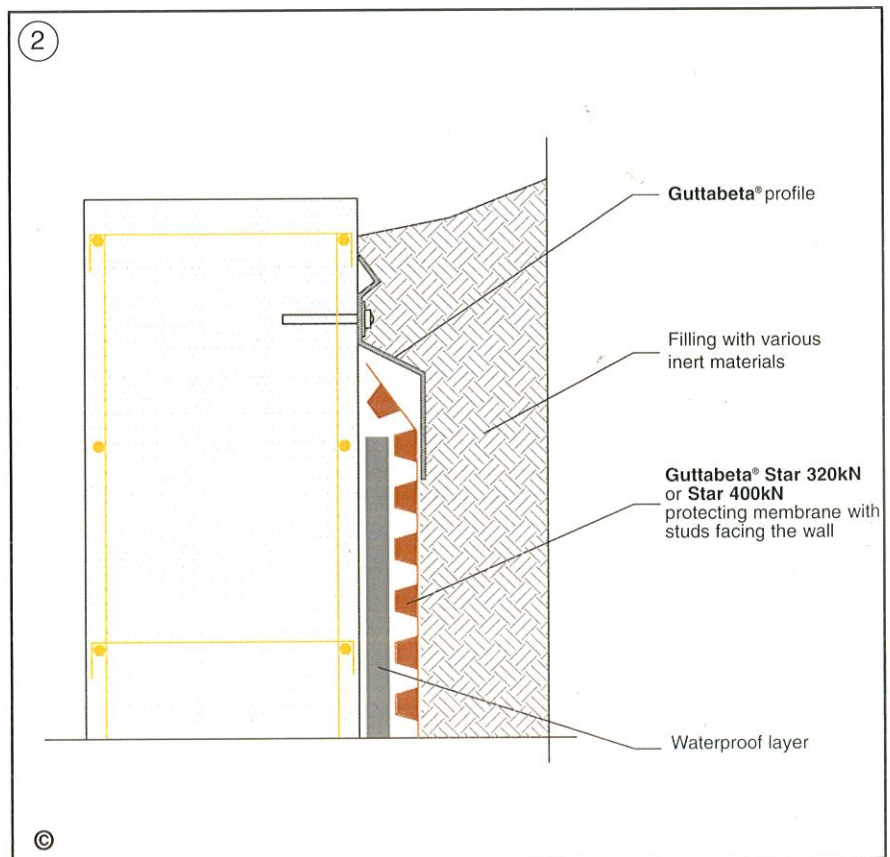
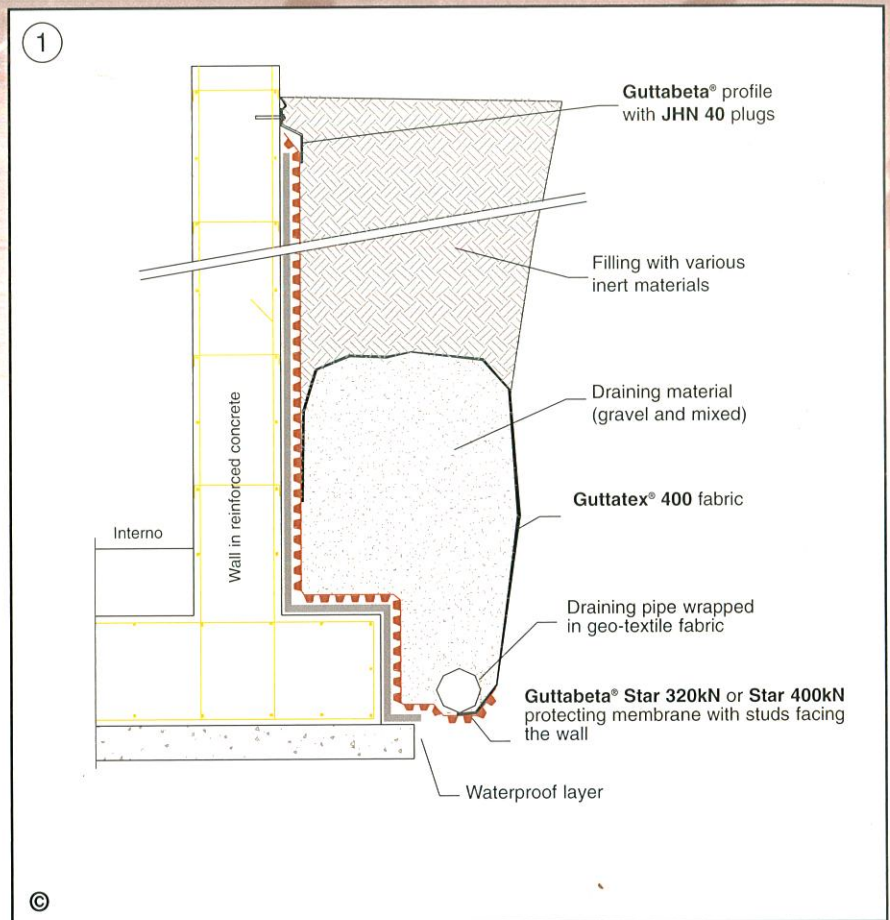
Problem	Recommended product	Product specifications page	Laying instructions on page
Drainage of tunnel vaults and tunnels	Guttabeta® Star 530 kN	8	34
Drainage of open-air tunnel vaults	Guttabeta® Star drain	8	35

Protection of the waterproofing layer and drainage of walls in contact with the soil.

Recommended products: Guttabeta® Star 320 kN, Guttabeta® Star 400 kN

The waterproofing function of walls in contact with the soil is generally assigned to one or more layers of bituminous sheath or to the application of various materials such as plasters or cold-laid asphalts. It is crucial to protect the installed waterproofing against damages caused by the backfill with inert materials. These materials, due to their intrinsic characteristics such as high grading, the fact that they derive from crushing operations instead of natural erosion combined with carelessness during the backfill operations can damage the waterproofing layer, thus thwarting the advantages provided by its use. Consequently, it is important to guarantee a protective layer next to the waterproofing which, in addition to ensuring its wholeness, also allows for rapid water flow and for the creation of a ventilated space for improved thermal insulation, consequently reducing the risk of condensate forming on the internal face of the wall.

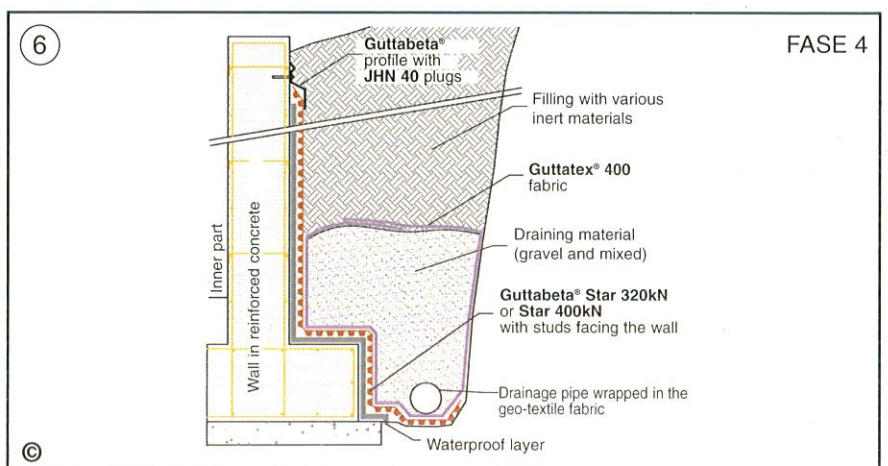
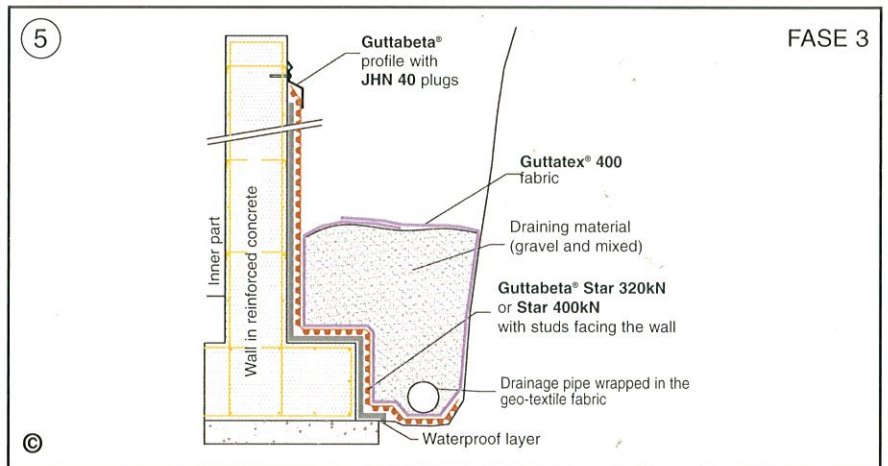
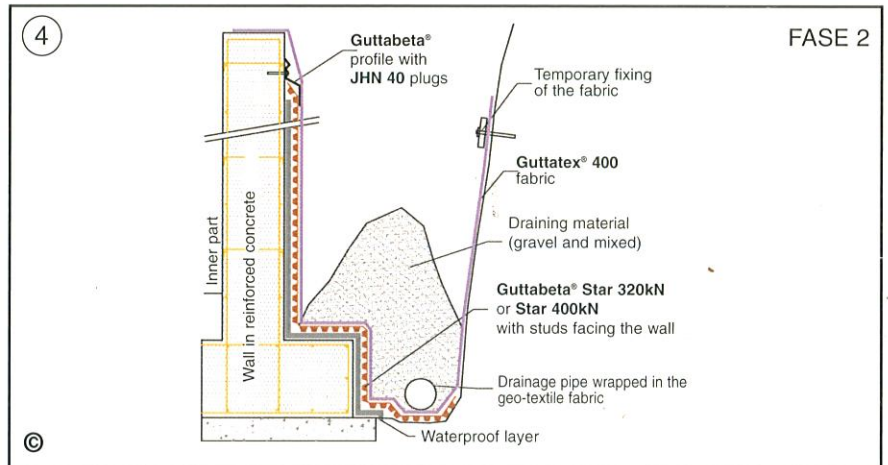
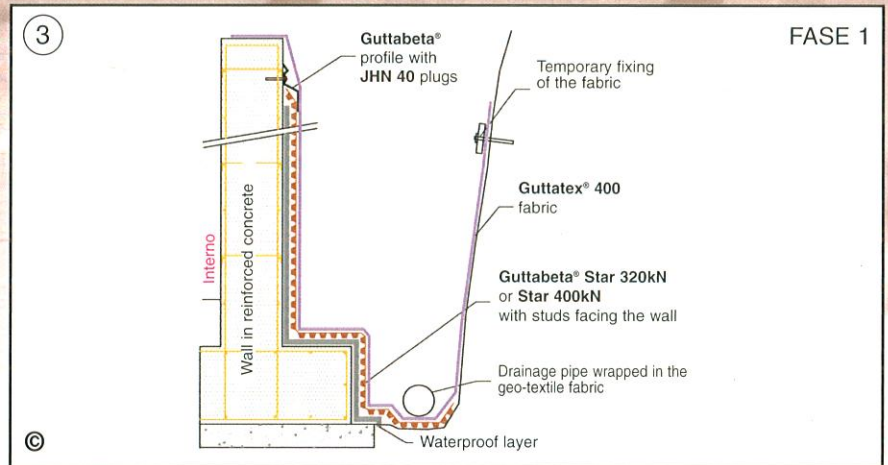
Guttabeta® Star 320 kN or 400 kN can carry out the functions described above thanks to its high compression resistance. In addition, its shape guarantees a cushion effect near the waterproof layer, and it can dampen the effects of the impact with stones and the direct contact between the sharp edges of the filler material and the waterproof layers. Moreover, if properly laid, an initial waterproof barrier is created, capable of withstanding larger quantities of water coming from the ground. Laying **Guttabeta® Star 320 kN or 400 kN** with the male studs facing the waterproof layer also creates a small air space next to the facing in contact with the soil that guarantees quick water drainage and the formation of a space filled with air at a temperature between the soil temperature and the one of the work to be protected. This air space improves the degree of overall thermal insulation of the wall, consequently increasing the temperature on the inner surface and reducing the risk of condensate, which depends on the internal degree of humidity and on the temperature of the wall surface.



Laying instructions

Guttabeta® Star 320 kN or 400 kN is laid after having positioned a uniform and complete bituminous (or other type) waterproofing on the foundation walls. Select the height of the **Guttabeta® Star** roll so that it is greater than the height of the waterproofing sheath.

Unroll **Guttabeta® Star** along the wall with the male studs facing the same wall, being careful to also cover the foundation base and leaving at least 40 centimeters beyond it. On the foundation, lay a bed of draining material in support of the water discharge pipe, positioning the final portion of **Guttabeta® Star** over it. Fix the top part of the membrane using the steel nails supplied with the membrane at an interval of 50 cm. Then position the closing plastic profile (accessory) along the flat part of the membrane, and fix it to the concrete walls using the steel nails supplied with the membrane, being careful to leave a maximum space of 50 cm between one nail and the next, and continue the job along all the foundation walls. For improved protection of the waterproofing effect and in order to guarantee a better and more even behavior of the **Guttabeta® Star 320 kN or 400 kN** layer, both during the backfill and during operation, it is advisable to position a bituminous adhesive strip, available as an accessory, between the two edges at the vertical overlapping, which should be at least 20 cm wide. After completing the laying and the fixing of the top part, and after positioning the **Guttatex® 400** fabric, carefully lay the draining material with maximum grain of 10 cm in the bottom part beyond the foundation extrados so as to guarantee sufficient adherence of the **Guttabeta® Star** layer to the wall. Then proceed as shown in the figure. It is recommended to unload the inert material foreseeing, as much as possible, its rolling against the bank, and to prevent the falling material sticking to the **Guttabeta® Star** layer from dragging the same layer downward, which can cause the top fixing to become detached.



Protection of the waterproofing layer and drainage of walls in contact with the soil in case of large quantities of both rainwater and ground water.

Recommended products: Guttabeta® Star drain, Star drain V

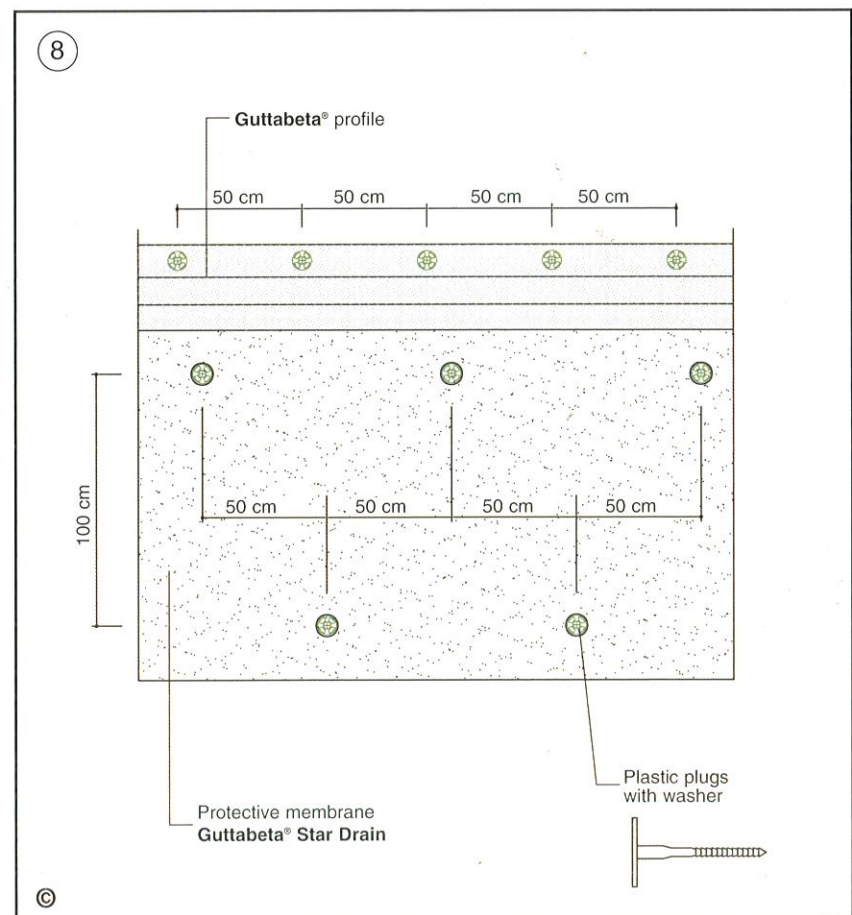
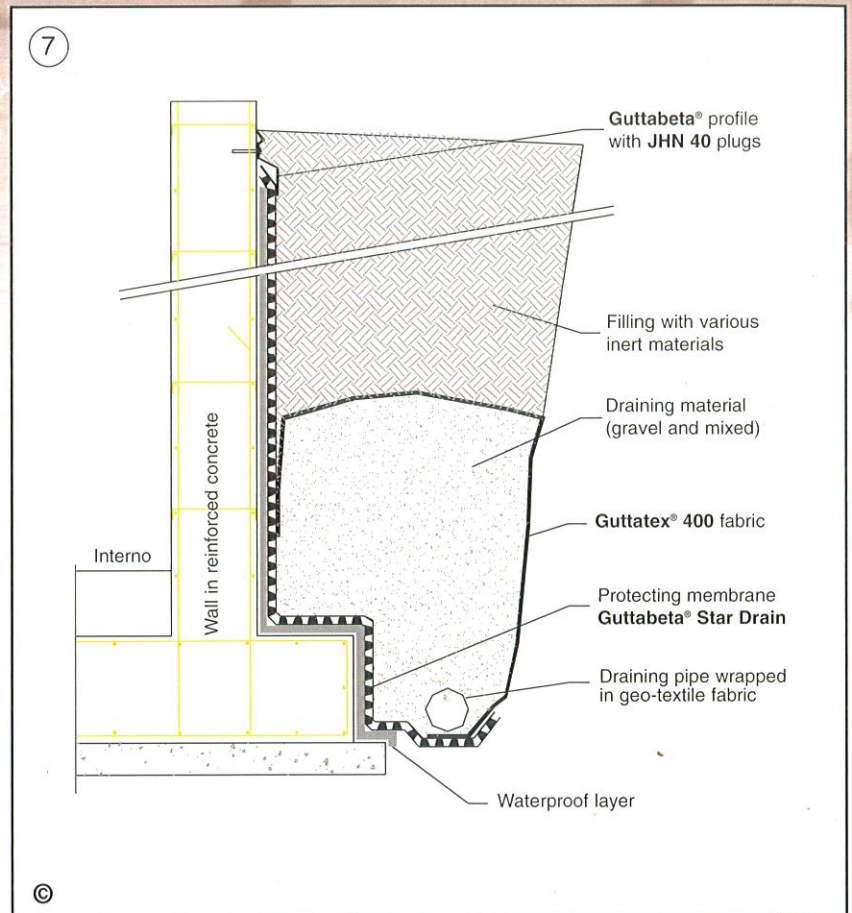
In case of large amounts of both rain and ground water, it is advisable to increase the draining capacity in order to avoid water stagnation and the presence of areas subject to hydrostatic pressure close to the wall.

In order to make this possible, an air space with constant size and guaranteed in time, must be ensured. This air space eliminates the hydrostatic pressure through the constant flow of water inside it, mainly in an downward direction, where a drainage and discharge system must be ensured.

In order to achieve this, lay **Guttabeta® Star Drain** or **Drain V**.

Laying instructions

Guttabeta® Star Drain or **Drain V** is laid after having positioned a uniform and complete bituminous waterproofing layer on the foundation wall. Unroll **Guttabeta® Star Drain** or **Drain V** along the same wall, making sure that the fabric side of the membrane faces the ground, up to the foundation foot, and leaving at least 40 cm of **Guttabeta® Star Drain** or **Drain V** beyond the same foot. Lay a bed of draining material on the foundation surface in support of the water discharge pipe, positioning it on top of the final portion of the **Guttabeta® Star Drain** or **Drain V** (see fig.7). Fix the top portion of the membrane using the nails supplied with the same membrane at an interval of 50 cm at the most (see fig. 8). Then position the plastic closing profile at the top of the membrane, fastening it to the reinforced concrete wall using steel nails. Continue along all the foundation walls. After that, fix the **Guttabeta® Star Drain** or **Drain V** using the relevant fixing kit (plastic plugs with washer) after having drilled holes in the wall, creating an anchoring mesh of 1x1 m (see fig. 8), also including the vertical overlappings that must be at least 20 cm wide. For improved protection, position a bituminous adhesive strip between the two overlapping edges of the **Guttabeta® Star Drain** or **Drain V**. After completing the fixing operations, proceed with the backfill, being careful to carry it out in uniform layers, according to diagram 3-4-5-6 on page 13.



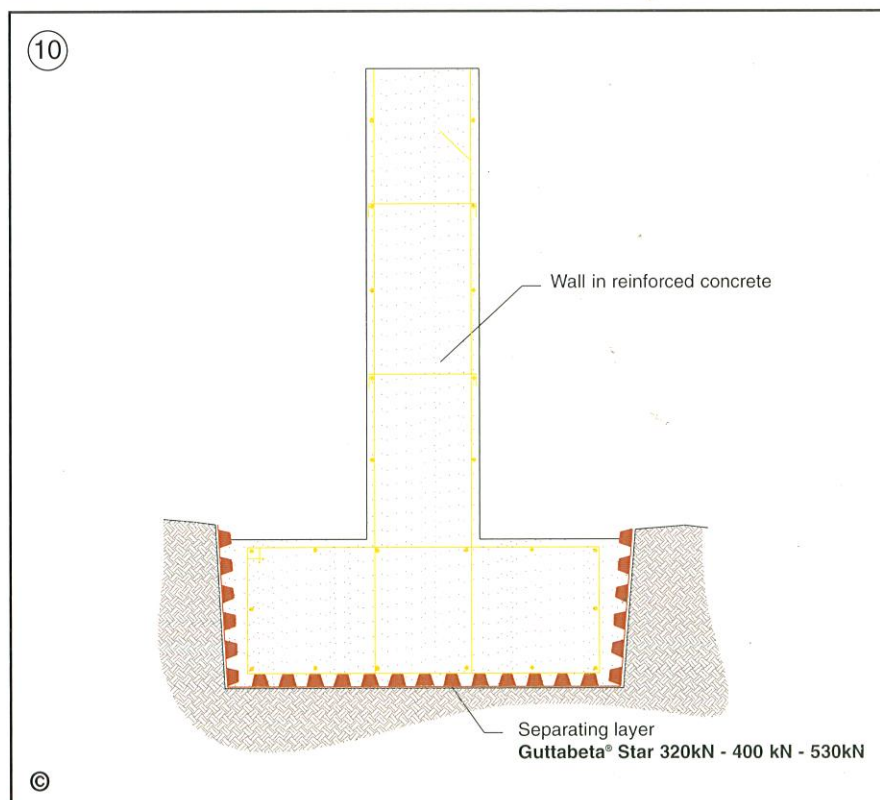
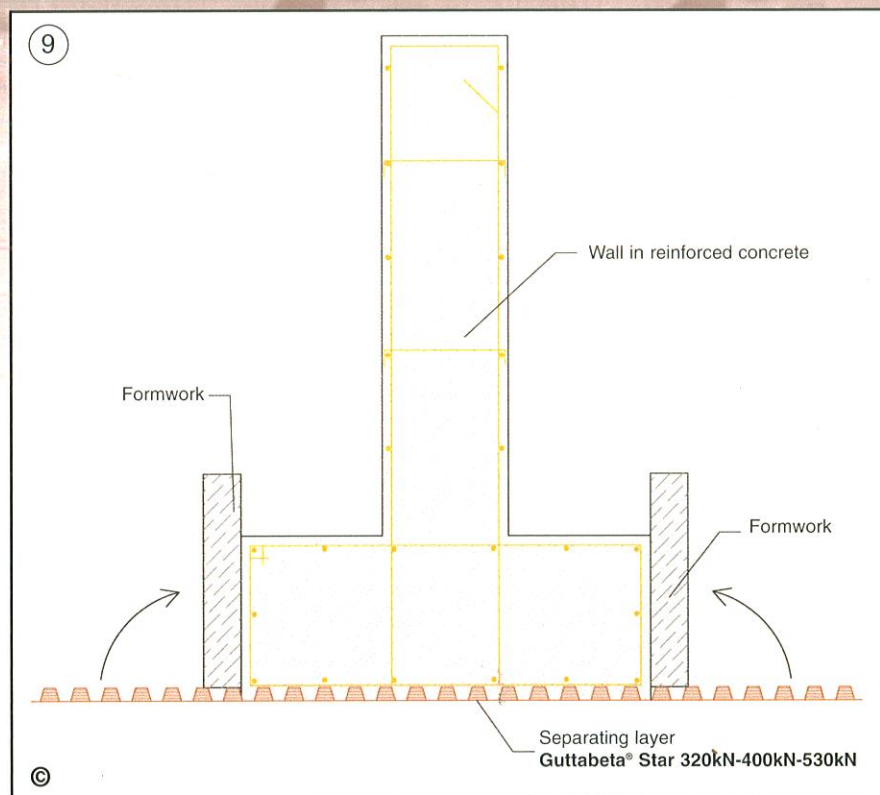
Protection of foundations without the layer of lean concrete.

Recommended products: Guttabeta® Star 320kN, Star 400kN, Star 530kN

The foundations rest on a layer of lean concrete or directly on the ground. Rarely is attention paid to the need for providing for a barrier against the capillary rise of water present in the soil and for protecting the structure meant to preserve the concrete and steel from aggressive substances found in the soil and/or dissolved in the water. Moreover, little attention is paid to the concrete cover, which must be guaranteed in order to adequately protect the reinforcing rods. By using **Guttabeta® Star**, laid with the male studs facing the concrete, it is possible to guarantee at the same time the waterproof barrier against the capillary rise and the minimum 8-mm cover of the rods (in many cases resting directly on the lean concrete). In case the ground is sufficiently leveled after the excavation, the layer of lean concrete can be avoided (see fig. 9). Moreover, if the soil is clayey, it is possible to prepare the foundation trench and lay the membrane on the sides as well and use it as a disposable formwork, thereby adding this function to the main one of waterproof barrier (see fig. 10). This results in considerable savings in terms of materials, labor costs and time required to lay the foundations. The **Guttabeta® Star** type is selected depending on the loads on the soil and on the characteristics of the foundation soil, considering that the product features a resistance such as to transfer the load directly on the ground. Thanks to its rotproofness, it guarantees a permanent barrier against capillary rise. Without such barrier, any subsequent attempt to eliminate the phenomenon is hardly effective and very burdensome, as it is carried out on a structure in direct contact with the soil.

Laying instructions

After the excavation and the leveling of the surface on which the foundations are laid, in case the lean concrete is not cast, the membrane sheets can be positioned, being careful to overlap them by at least 20 cm. When laying the membrane sheets, allow the membrane to also cover the sides of the structure, either immediately during the casting or after the sides are dismantled in case the job provides for the formwork of the same sides. Then position the reinforcing cages equipped with the relevant spacers so that they rest directly on the studs of the membrane, and proceed with the casting (see fig. 9-10). By guaranteeing the absence of



water and air on the contact surfaces between the structure and the soil, carbonation phenomena are inhibited and the cement is prevented from being attacked by salts and sulfates, which subsequently cause oxidation of the reinforcements and deterioration of the structure. The position in which such deterioration occurs does not allow for its detection until the

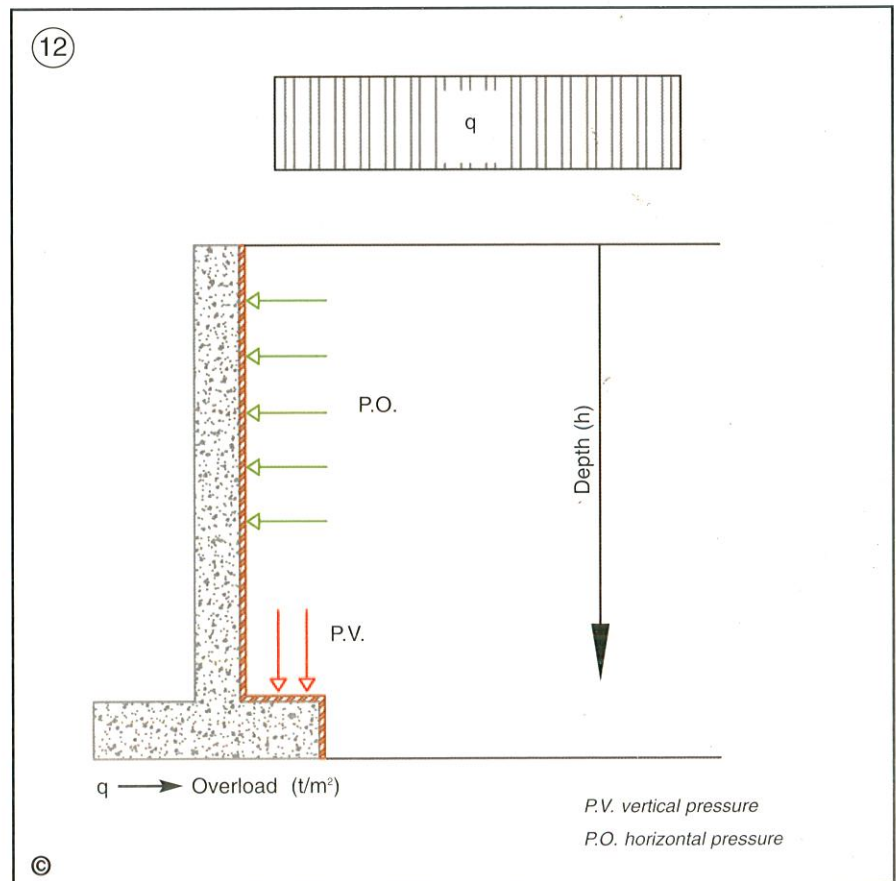
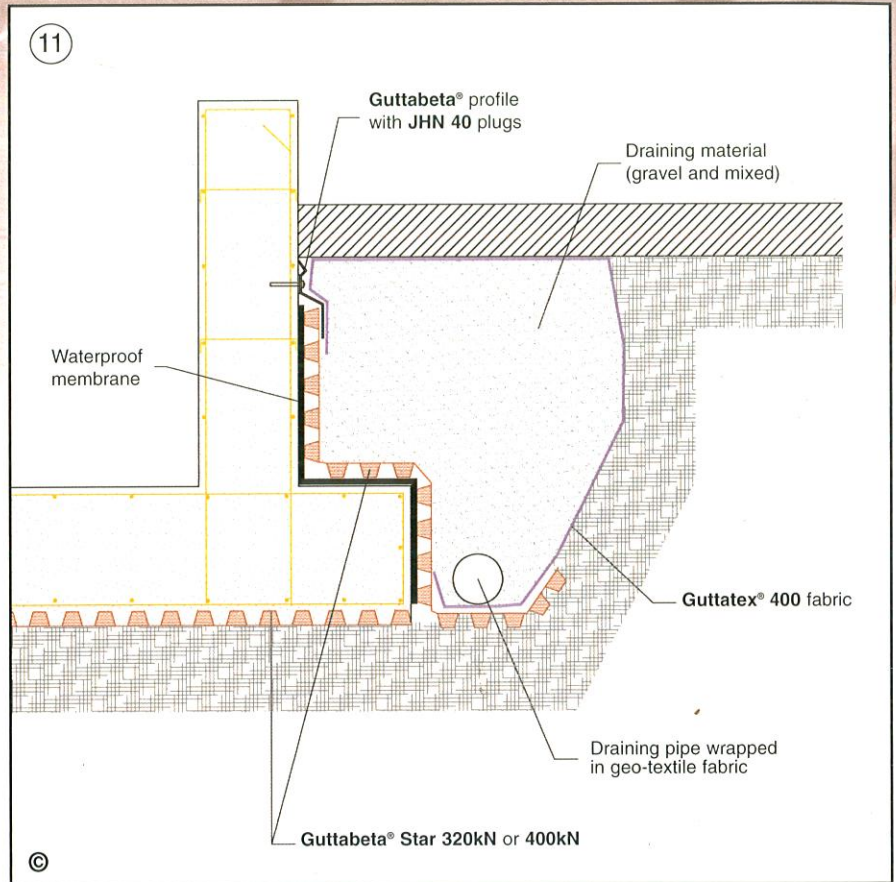
phenomenon is well under way. In this case, it would be very burdensome, if not even impossible, to restore the structure.

Protection and drainage of base slabs

Recommended product: Guttabeta® Star 320kN, Star 400kN

In base slabs and on foundations in general with large surfaces in contact with the soil, the effects of capillary rise and in any case of protecting the structure and the rooms located on the ground floor from humidity and radon gas are aggravated.

In case it is necessary to lay base slabs on a very humid soil or even below the water-bearing layer, it is crucial to guarantee the efficiency of the waterproofing barrier and its careful protection both during the jobs and in operation. This function must also be guaranteed the drainage in case of water flow generated by both a fluctuating water-bearing stratum and by meteoric events associated with artificial disposal systems. Such drainage has to ensure that the levels established in operation are maintained. All the more reason in these cases, given the constant presence of water and air on the soil-structure interface, to guarantee sufficient durability of the same structure by interposing a waterproof barrier with enough of a mechanical resistance to ensure both the transmission of loads from the structure to the soil and the non-tearing of the same barrier in case of objects with jagged surfaces in the soil and in cement castings. In areas where there is no waterproof sheath in contact with the soil, the guttabeta sheet guarantees an efficient barrier against radon gas, harmful to one's health, in many cases present in the soil.



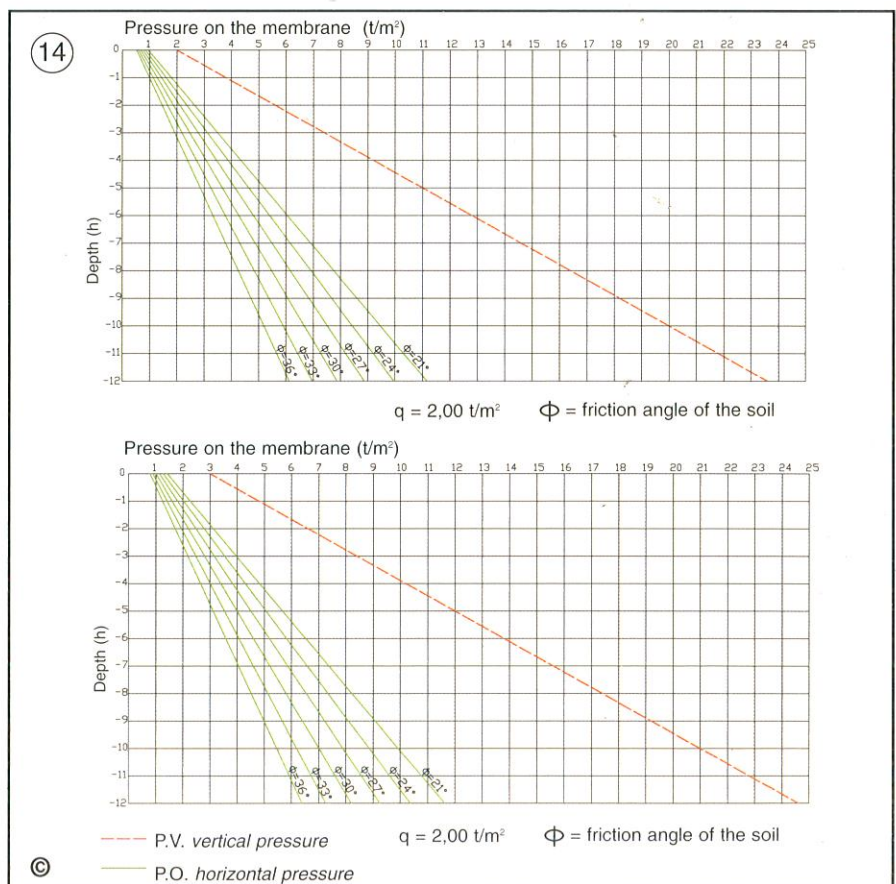
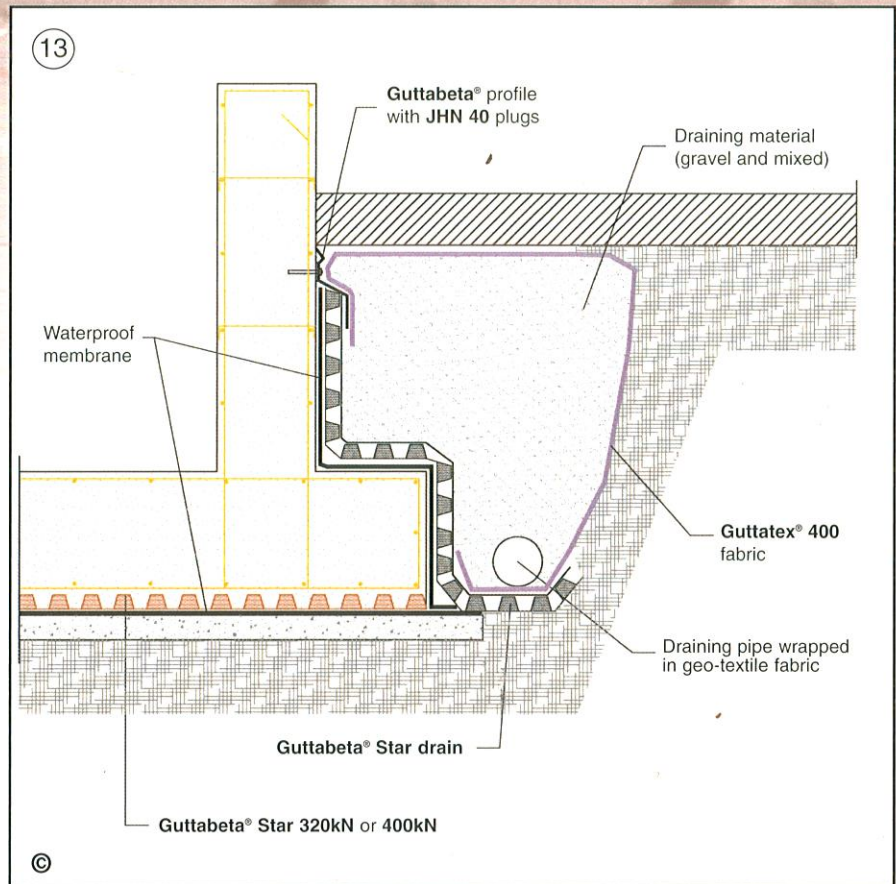
CONSTANT VALUES NOT INFERABLE FROM THE GRAPHS	
Specific weight of the soil	1,8
Parameter inclination with respect to the horizon	90
Internal friction angles of the soil	21° - 24° - 27° 30° - 33° - 36°

Laying instructions

After completing the foundation trench, proceed with leveling it or with casting lean concrete, on top of which the sheets of **Guttabeta® Star 320kN or 400kN** can be laid, being careful to overlap them by about 20 cm. Position the studs facing upward so as to guarantee a minimum concrete cover on the brackets of the reinforcing cages, which are equipped with suitable spacers, to be laid directly on the **Guttabeta® Star**. Fold the sheets over along the edges in order to ensure that the sides of the structures are covered immediately during the casting (if used as disposable formwork) or after formwork removal of the sides. Special attention must be paid in case of a water-bearing stratum higher than the foundation level. In this case, prior to the laying, a layer of cement must be cast on which to position a waterproof barrier consisting of bituminous sheaths.

In order to protect the waterproof layer both during the laying operations of the reinforcements and during the casting, position **Guttabeta® Star 320kN or 400kN** with the studs facing upward, cutting them off along their edges, inside the external edge of the structure so as to allow connection of the horizontal bituminous sheath with the sheath to be laid on the sides and on the elevating structure. After completing the latter, proceed with waterproofing it and with protecting the waterproof layer by laying **Guttabeta® Star 320kN or 400kN**, depending on the characteristics of the soil and/or the filling material (see fig. 11).

In case large amounts of water have to be disposed of in order to guarantee its flow in relation to the proper operation of natural or forced drainage systems, it is advisable to position a sheet of **Guttabeta® Star drain** close to the walls (see fig. 13). The methods for proper laying are described on page 13 in figures 3-4-5-6.



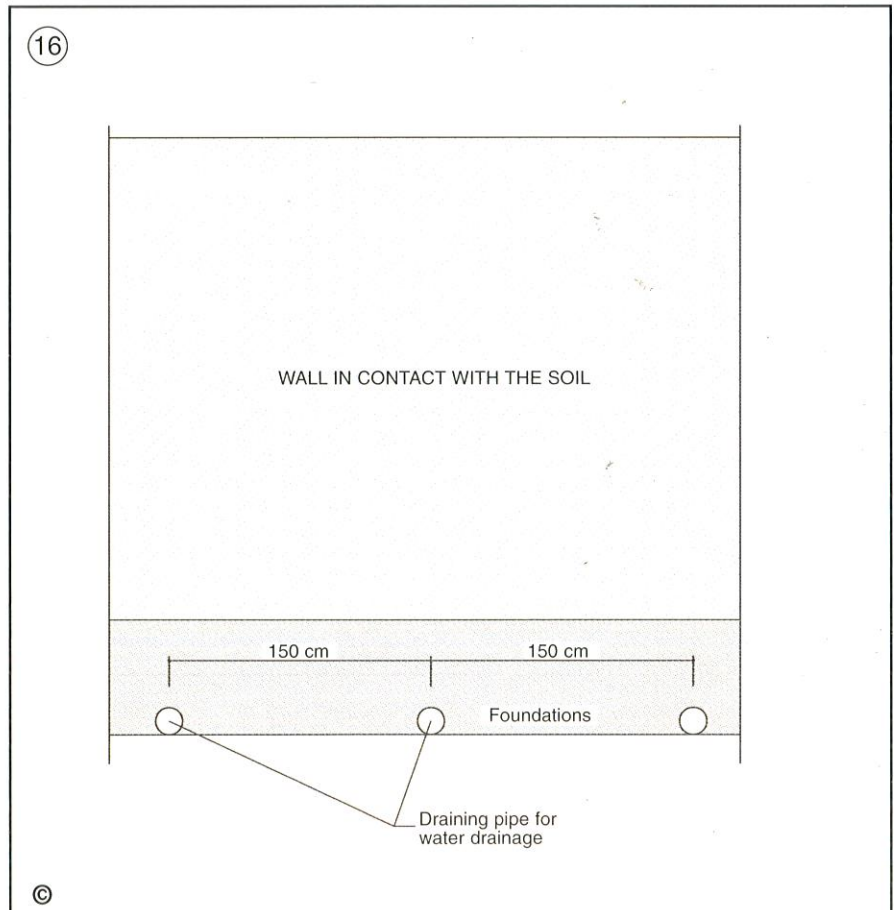
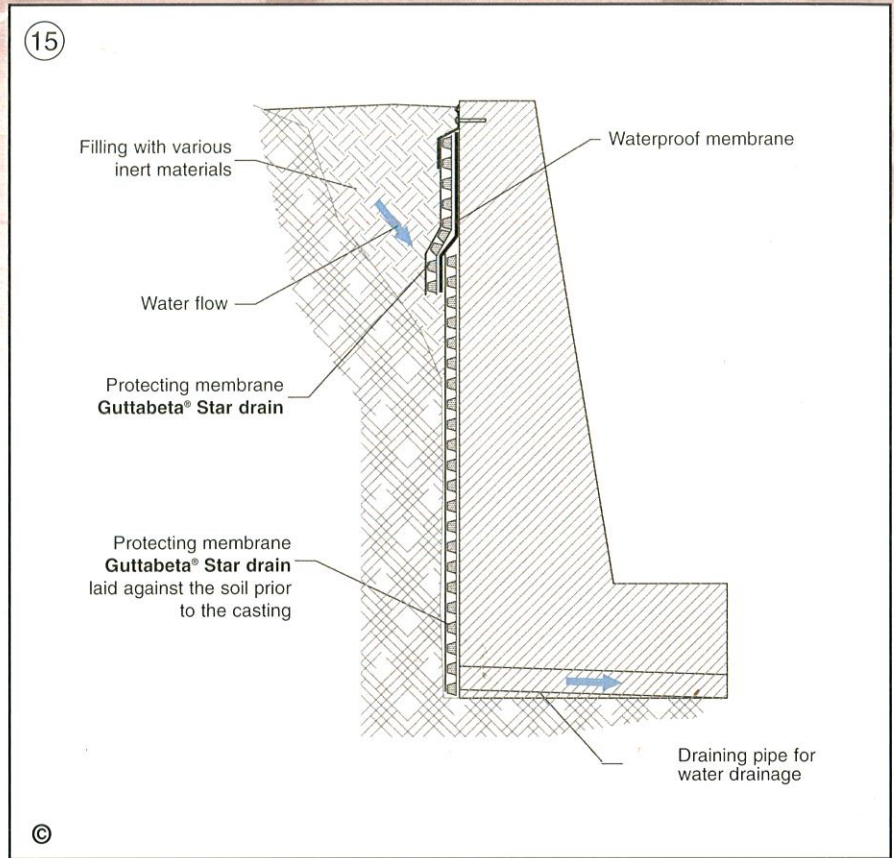
Protection and drainage of walls built with casting in contact with the soil and with a reduction of the hydrostatic thrust

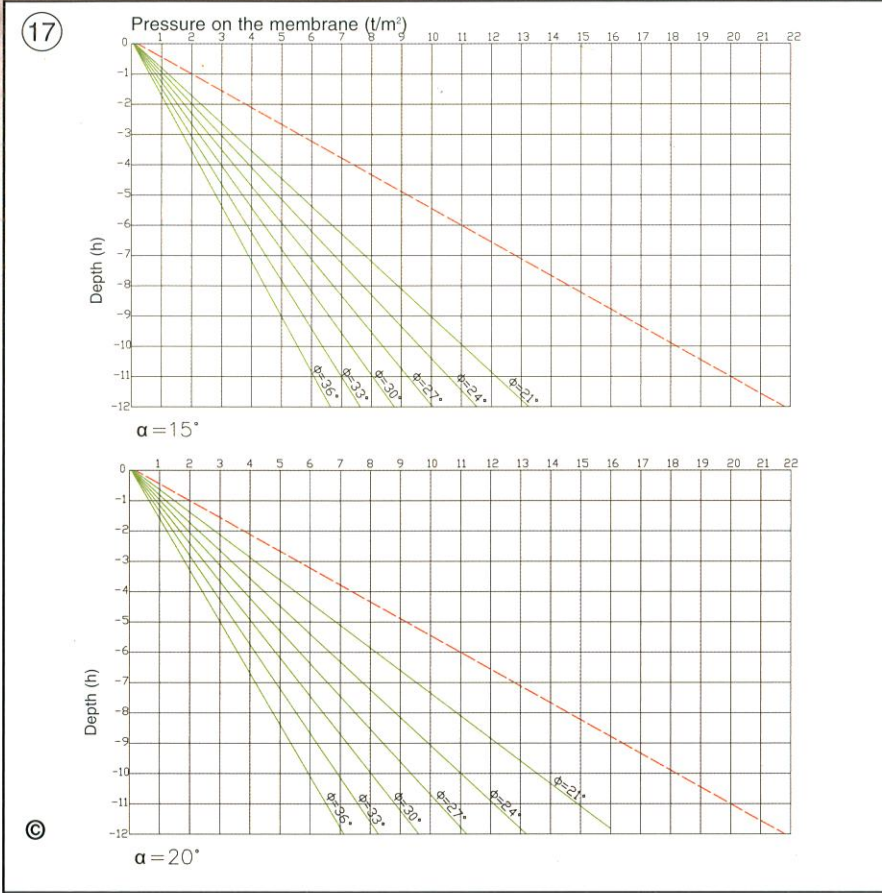
Recommended product: Guttabeta® Star drain

Guaranteeing proper drainage in elevating structures that require casting in contact with the soil is as hard as it is indispensable. In case this is not possible and the structure constitutes the wall of a building, in order to use the underground floors it is crucial to provide for the construction of a lining wall at a distance such as to ensure an air space equipped with discharges in order to eliminate the inevitable infiltrations of water. This results in a loss of surface area of the rooms and in the high cost of the lining wall. The presence of water under pressure close to the wall generates a stronger thrust on the same wall, and requires a wall size that results in higher costs.

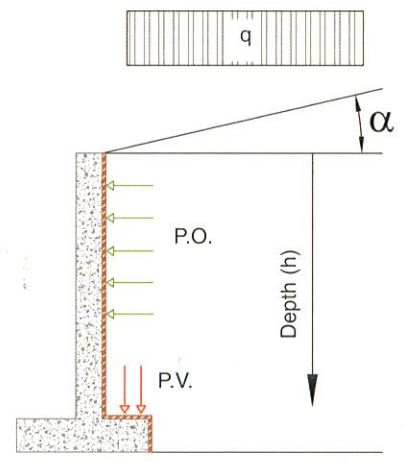
Laying instructions

This problem can be solved by positioning a sheet of **Guttabeta® Star drain** directly on the trench wall, with the fabric side laid against the ground and being careful to close the top opening with a sheet of fabric so as to avoid obstruction of the space between the fabric and the sheath that make up the **Guttabeta® Star drain** drain caused by fine soil particles conveyed by the incoming water on the top part (see fig. 15). Horizontal holes can be provided near the wall foundations to collect the water and direct it into the sewer system of the building or of the yards to be built downstream (see fig. 16). The upstream drainage guarantees the absence of hydrostatic thrust, while the presence of the waterproof element adhering to the wall ensures adequate protection in terms of wall durability. For the portion of the wall that extends beyond the part cast in contact with the soil, proceed as instructed on page 14, in relation to the requested





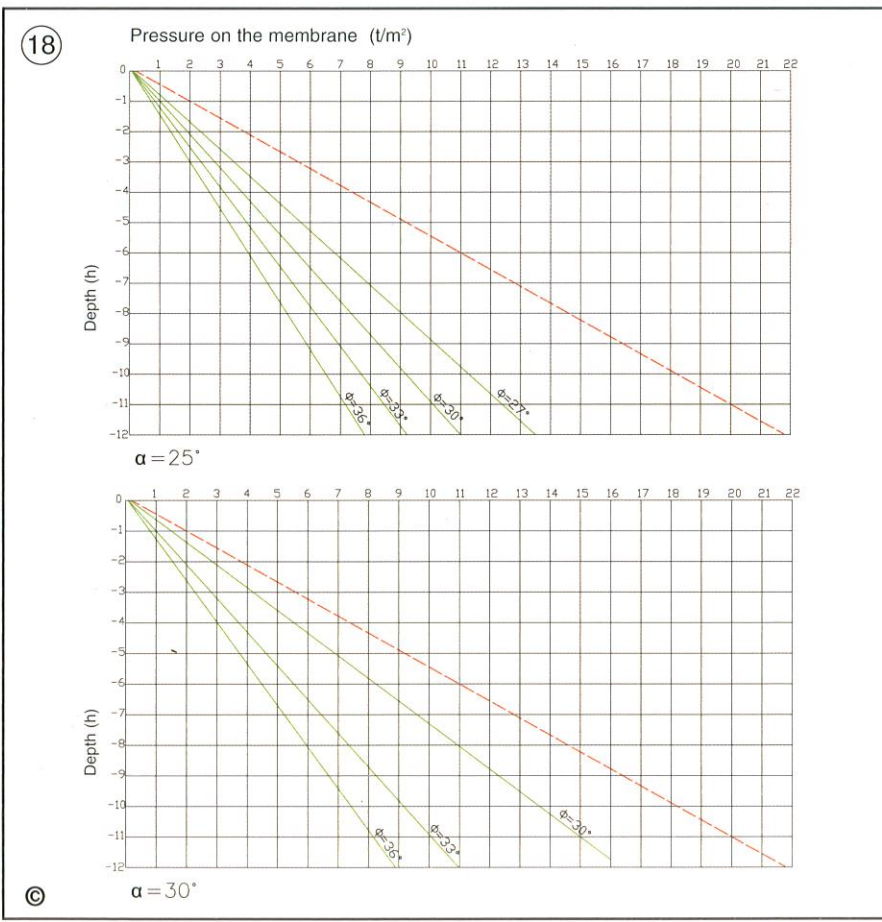
CONSTANT VALUES NOT INFERABLE FROM THE GRAPHS	
Specific weight of the soil	1,8
Parameter inclination with respect to the horizon	90
Internal friction angles of the soil	21° - 24° - 27° 30° - 33° - 36°



$q \rightarrow$ overload (t/m^2)

$\alpha \rightarrow$ angle of the soil

P.V. vertical pressure
P.O. horizontal pressure



Φ = friction angle of the soil

— P.V. vertical pressure

— P.O. horizontal pressure

Restoration and ventilation of damp interior walls.

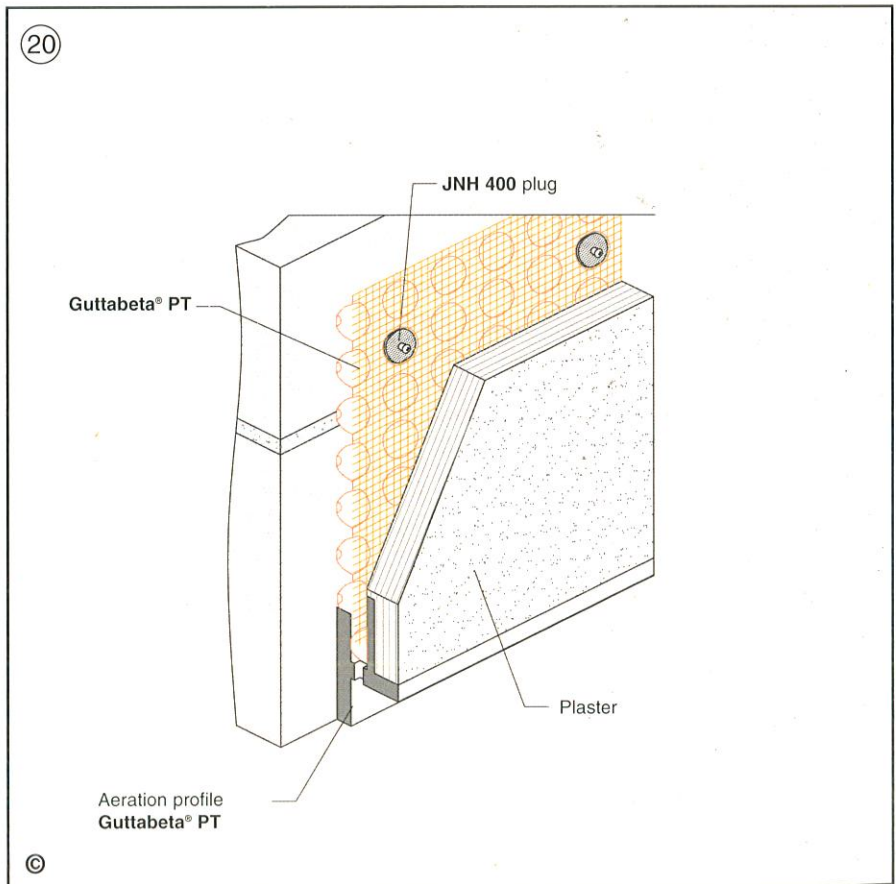
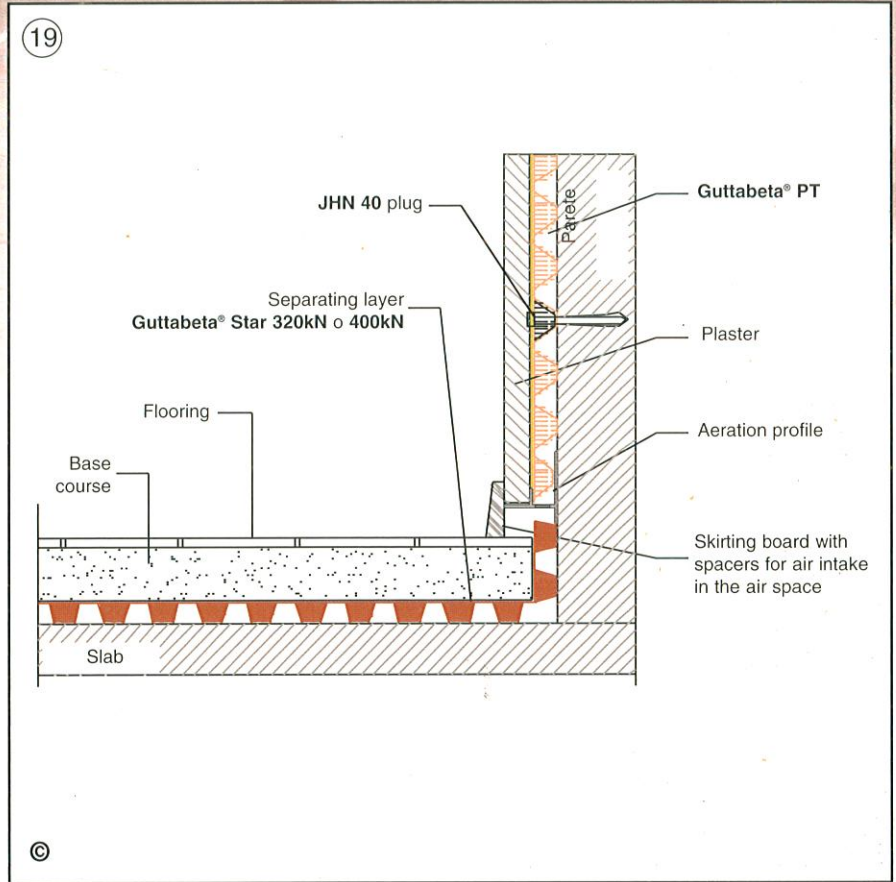
Recommended product: Guttabeta® PT (with plaster lining)

Humidity in vertical walls is a very common phenomenon, in particular if the walls are located on the ground floor of older buildings in areas with fine-grain soil, especially clayey, during construction works for which no techniques were adopted to insulate the foundations and the portions of wall in contact with the soil. The main cause is the capillary rise of water contained in the soil through the wall structure, which varies depending on the characteristics of the same structure. This phenomenon is usually limited to the ground floor. Another reason is the condensation of internal humidity on the surface of the perimeter wall, due to the low surface temperature of the same wall and to the presence of high-mass construction elements. In the case of walls built with a combination of stone and bricks, the condensate often forms on the stone elements.

In both cases unpleasant phenomena occur, such as flaking plaster, exudation, mold, damp areas or stains on the walls.

At times, these phenomena also occur in new buildings where unsuitable materials were used and the basic foundations insulation measures were not adopted, ventilated air gaps were not provided for, waterproofing of the walls in contact with the soil was not carried out and so on. The operation needed to fully eliminate the causes of these phenomena is very complex, and in most cases it is extremely difficult. However, it is possible to limit their occurrence inside the rooms to the point of almost eliminating the damages they cause on finishing materials such as plaster, floorings, linings and furniture, as well as to improve the health and sanitary conditions and the habitable quality of the same rooms.

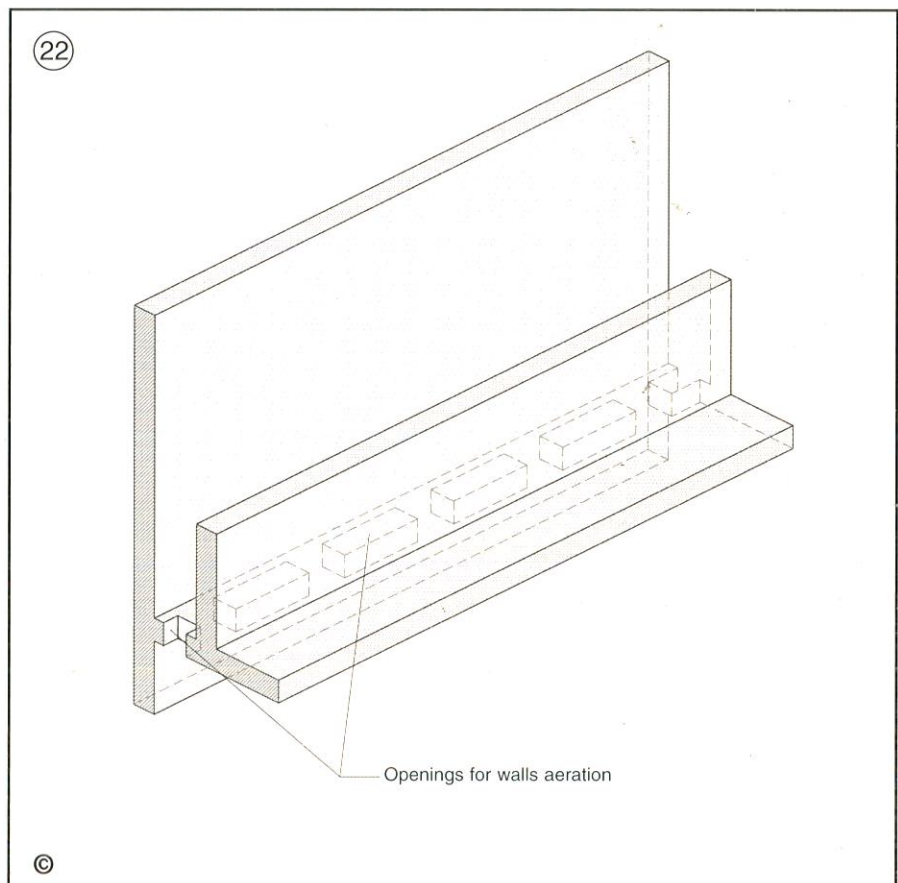
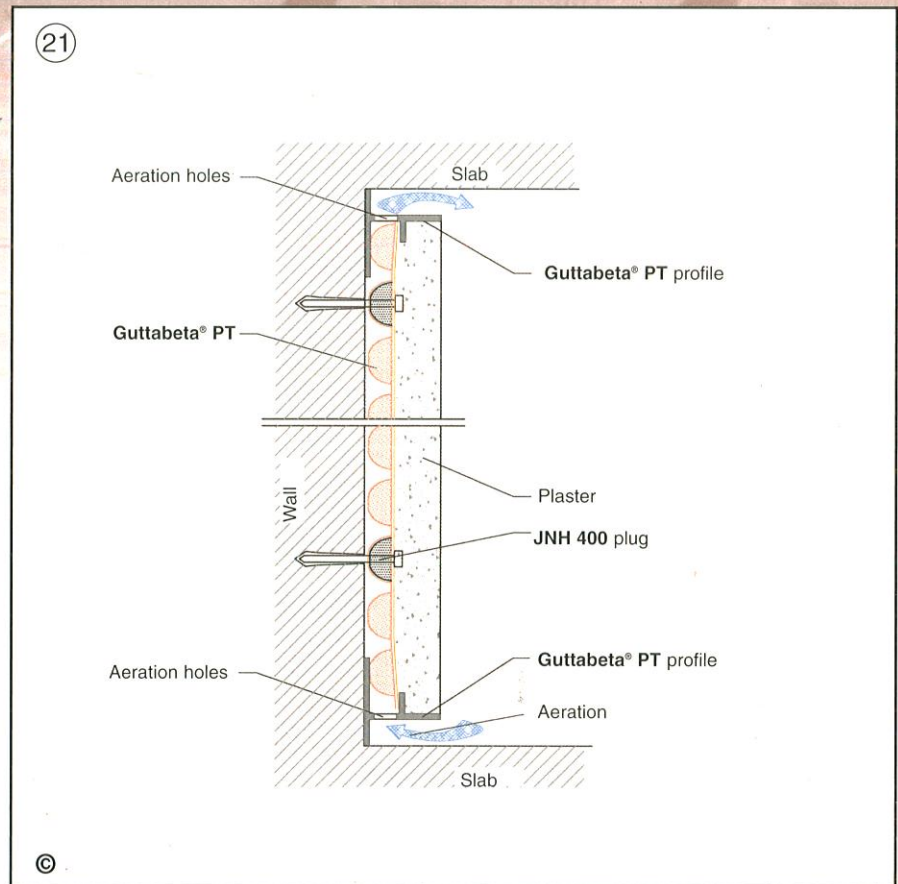
Guttabeta® PT can be used to solve these problems. It is a membrane in HDPE basically made of virgin polymer on which a plaster holding net is applied. This net is suitable for housing the finishing plaster. Thanks to the studs, which are fixed to the wall by means of suitable plugs, an air chamber is created between the damp wall and the finishing plaster, thus ensuring proper ventilation of the same wall. This results in dry plaster, stable colors and healthy rooms through time.



Laying instructions

The phases for laying **Guttabeta® PT** are the following: thoroughly clean the wall and, using a hard-bristle brush, remove as much as possible the damaged parts (flaking plaster, exudation and so on). If necessary, stucco any holes in the walls. Fix the PT profiles to the corner of the wall and the ceiling and to the corner of the wall and the floor. Unroll **Guttabeta® PT** from the top down (or vice versa).

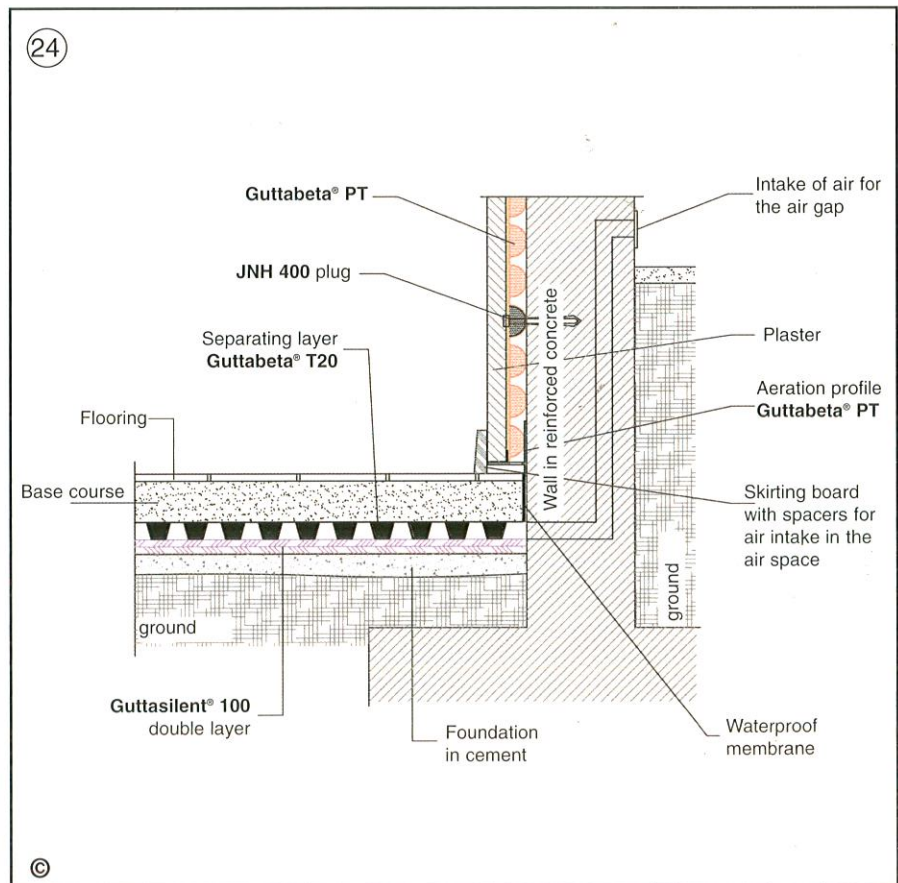
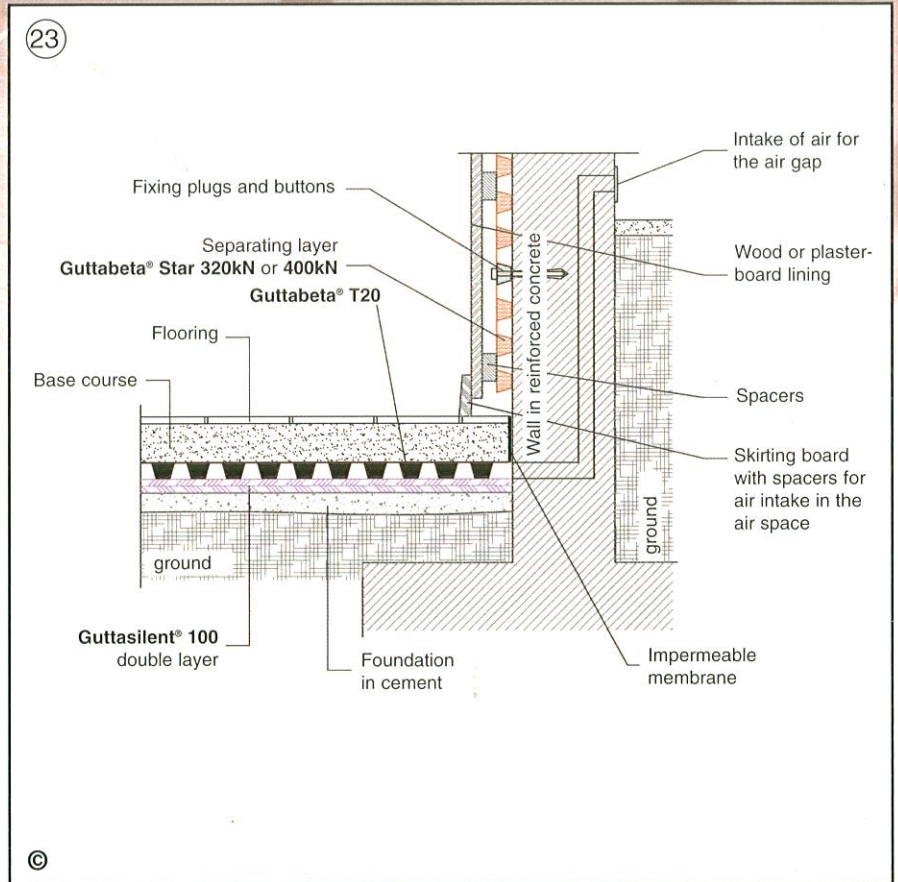
Fix the membrane from the starting point using JNH40 plugs and fixing buttons every 30 cm. Unroll the **Guttabeta® PT** membrane even further, continuing to rivet it with a 30x30 cm mesh, and being careful to lay it with your hands so as to avoid folds. Overlap the next roll by about 20 cm and make sure the studs match up. Using the same mortar as the plaster, fix all the plugs that were inserted into the wall and lay a strip of plaster holding adhesive net along the overlapping of the sheets. Prepare new mortar to apply with a trowel (not by spraying or casting). The flexibility of **Guttabeta® PT** does not create any problems when applying the plaster, and the wall stabilizes thanks to the hardening of the same plaster. In order to ensure proper ventilation between the damaged wall and **Guttabeta® PT**, use the special PT profiles only (see fig. 29 and 31) to be fixed to the ceiling and to the floor. They will maintain a good aeration thanks to their openings, and their projections will also help to smooth out the plaster. Sheets of plasterboard or matchboards can be applied to the **Guttabeta® PT** profile.



Air gaps for the protection of ground floor and underground rooms from capillary rise and radon gas

Recommended product: Guttabeta® T20, Guttabeta® PT, Guttabeta® Star 320 kN, 400kN

All rooms with floor located at the ground level, unless adequately protected, are subject to capillary rise, condensate formation and radon infiltrations from the underlying soil where this gas is present. The sanitary regulations in force in various regions require, in case of rooms intended as living quarters or production facilities, or in any case in the presence of people, the creation of a ventilated air gap that can act as a barrier against capillary rise and can eliminate any radon gas present in the soil. The construction of a ventilated air gap does not entail big problems in new buildings. Simply make a deeper excavation so as to allow in general the laying of plastic elements such as **Guttadrytek®**, of various heights, with the function of disposable formwork and cast the cement that constitutes the resting surface for the floor. In existing buildings, because of the foundations level, existing base courses, drainage networks, etc. it is not always possible to arrange for a traditional air gap. And when it is in fact possible, the job becomes very burdensome and inconvenient if the building is inhabited. When it is not possible or cost-effective to carry out a bigger excavation in case of new buildings, or in case of existing ones, an air gap can be built starting from the flooring support, consisting of a cement floor or the existing floor, in case of existing buildings, depending on the required minimum heights according to the regulations in force or desired by the Purchaser in relation to the intended use of the premises. It is important to associate a vertical air gap with the horizontal one on the perimeter walls as well. Especially in the case of existing buildings, in fact, these walls feature extended phenomena of capillary rise due to the absence of insulation of the structures from the soil. Only a constant flow of air inside the air gap allows the elimination of this humidity and higher temperature on the internal surface so as to limit the risk of condensate and consequently of mold. In case radon gas is present in the soil, it is important to keep the air gap aeration separate from that of the wall. Below is a description of the recommended methods for the realization of horizontal and vertical air gaps using our products.



Laying instructions

Floor with Guttabeta® T20

Thoroughly clean the air gap support (existing floor or foundation). Afterwards, it is advisable, for the purpose of limiting the dew effect on the floor, to unroll on the floor a double layer (with crisscrossing sheets) of **Guttasilent® N100**, closed-cell cross-linked polyethylene, being careful to weld the overlapping edges with hot air. Then unroll **Guttabeta® T20** on top of the **Guttasilent® N100**. The sheets must be overlapped by at least two studs, and sealed by filling the double row of female studs with bituminous elastic sheath (**Guttabelastic®**) and by overlapping the subsequent sheet. If necessary, position a reinforcing mesh on top of the **Guttabeta® T20**, with the relevant spacers for the casting. Cast the concrete topping, on top of which the floor will be laid. With regards to insulating walls from humidity, two products can be used: **Guttabeta® Star 320 kN** or **400 kN** (see drawing 19) or **Guttabeta® PT** (see drawing 20). In the first case, the function of the **Guttabeta® Star 320 kN** or **400 kN** will be to insulate the finishing, to be carried out in plasterboard or wood, against humidity through the supports. While in the second case, using **Guttabeta® PT**, the plaster finishing that will be applied directly on the membrane will receive the same waterproofing benefit by speeding up the job.

Wall with Guttabeta® Star 320 kN o 400 kN

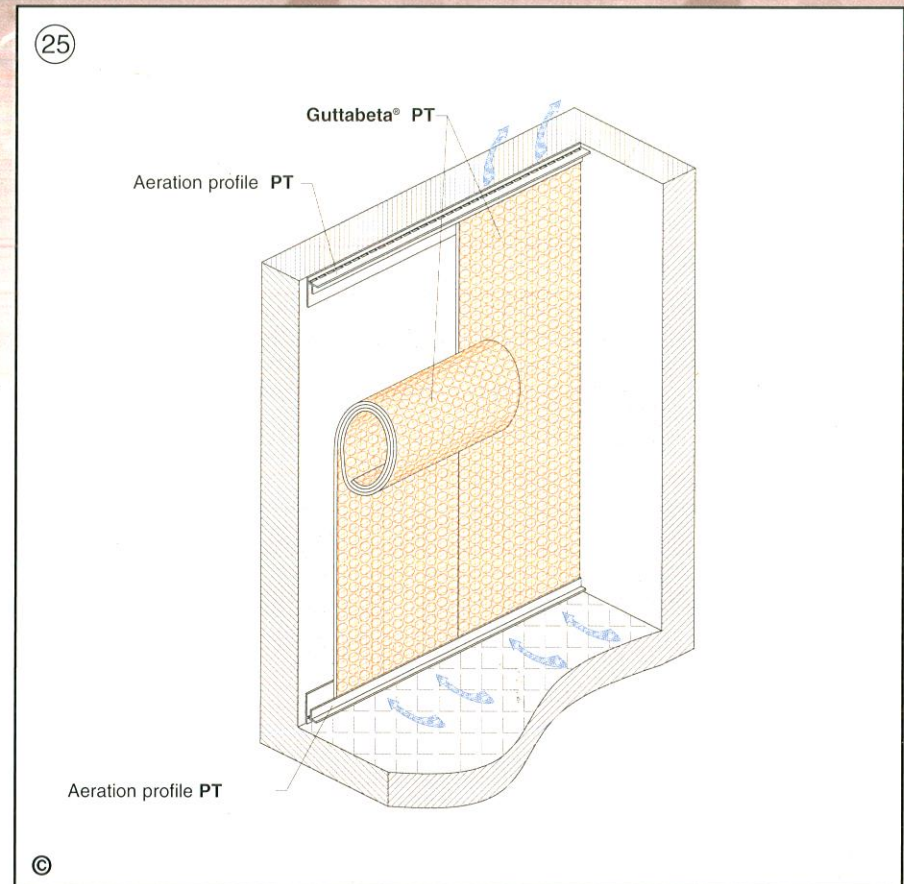
Clean the wall thoroughly and, using a hard-bristle brush, remove as much as possible the deteriorated parts (flaking plaster, exudation and so on). If necessary, stucco any holes in the walls.

Unroll the **Guttabeta® Star 320 kN** or **400 kN** membrane along the wall, being careful to leave a free space of 5 or 6 cm both at the bottom and near the ceiling in order to allow the passage of air (see drawing 19).

Anchor the **Guttabeta® Star 320 kN** or **400 kN** with steel nails and fixing plugs, creating a 1x1 m mesh, and position a bituminous adhesive strips between the overlapping of the two edges. Cover the wall with matchboarding installed on wooden traverse or with plasterboard slabs.

Wall with Guttabeta® PT

Clean the wall thoroughly and, using a hard-bristle brush, remove as much as possible the



deteriorated parts (flaking plaster, exudation and so on). If necessary, stucco any holes in the walls.

Fix the PT profiles to the corner between the wall and the ceiling and to the corner between the wall and the floor. Unroll the **Guttabeta® PT** starting from the top (or vice versa, see fig. 21).

Fix the membrane near the ceiling using JNH40 plugs and fixing buttons every 30 cm.

Unroll the **Guttabeta® PT** membrane even further, continuing to rivet it with a 30x30 cm mesh, and being careful to lay it with your hands so as to avoid folds. Overlap the next roll by about 20 cm and make sure the studs match up.

Using the same bastard mortar as the plaster, fix all the plugs that were inserted into the wall and lay a strip of plaster-holding adhesive net along the overlapping sheets. Let the bastard mortar applied on the plugs harden, then prepare new mortar to apply with a trowel (not by spraying or casting). The flexibility of **Guttabeta® PT** does not create any problems when applying the plaster, and the wall stabilizes thanks to the hardening action of the same plaster. In order to ensure proper ventilation between the damaged wall and **Guttabeta® PT**, use the special PT profiles only, fixed to the ceiling and to the floor.

They will maintain proper ventilation thanks to their openings, and their projections will also help to smooth out the plaster.

Sheets of plasterboard or matchboards can be applied to the **Guttabeta® PT** profile.

Vapor barrier in floors caused by humidity of construction materials

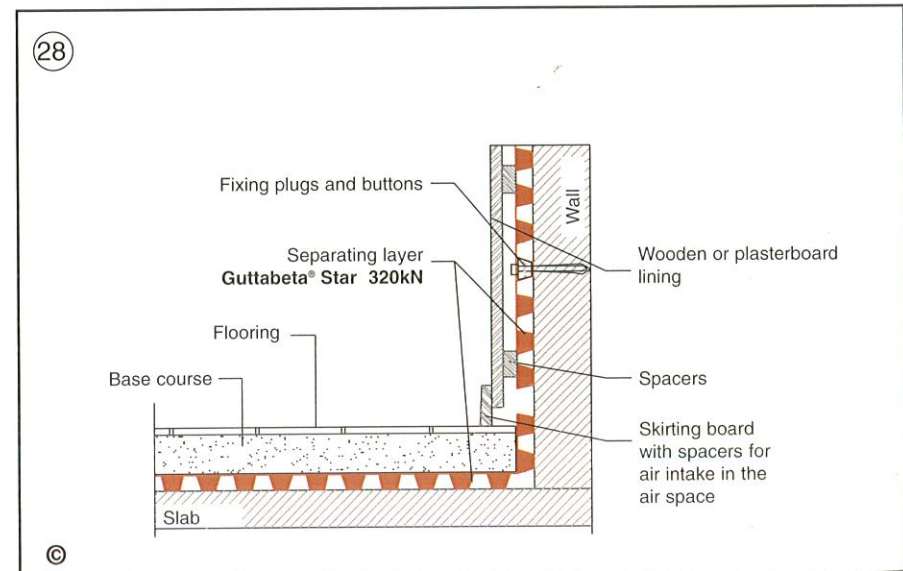
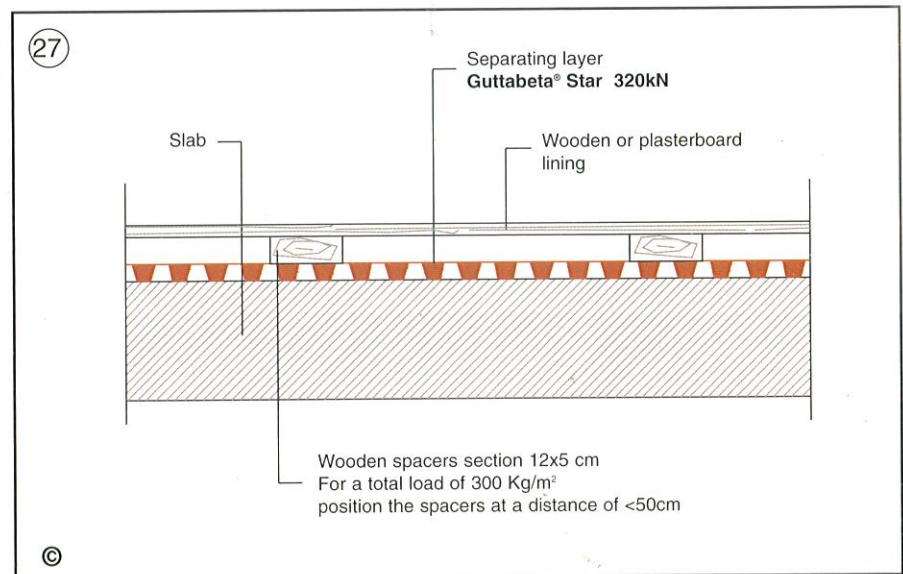
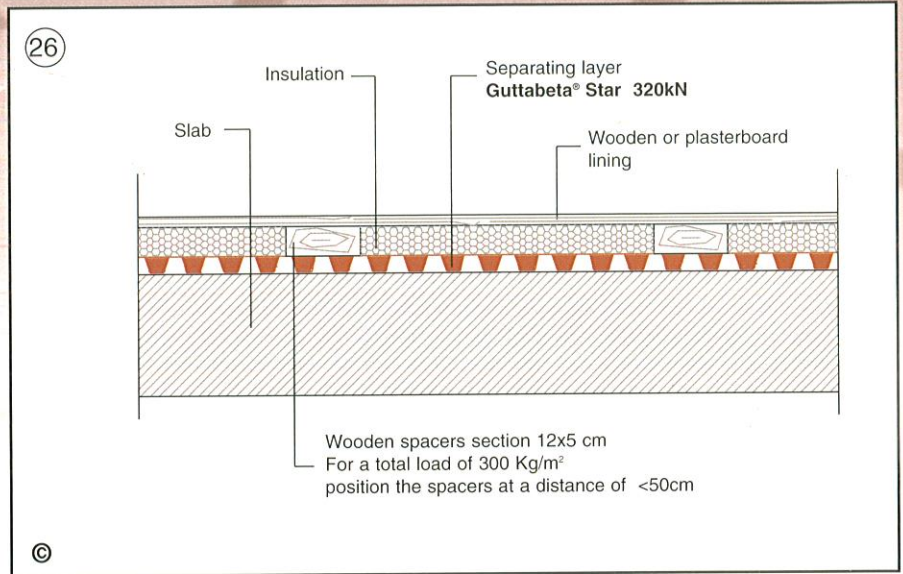
Recommended product: **Guttabeta® Star 320 kN, 400 kN**

The construction of any building requires the use of materials that contain large amounts of water during their installation. Only a portion of this water is released prior to completing the building with the laying of floors and linings. Especially in the initial building period, one has to deal with the excessive humidity of the rooms, caused by the release of residual humidity still present in the construction materials and its absorption by the finishing materials, which is even more damaging to the same materials (plasterboard walls, parquet, furniture, etc.). All this is compounded by the inconvenient and unsightly formation of humid areas on floors and linings in ceramic or natural stone caused by the formation of condensate. Even if limited to the first few months of building use, such phenomena can leave permanent damages to many finishings. Consequently, during its completion phase it is important to adopt all those measures, whose cost is irrelevant compared to the value of the property, which in addition to limiting the phenomena described above also guarantee a greater living comfort. In order to overcome all these inconveniences, it is necessary to provide for a waterproof multiwall separating layer between the flooring and the slab that allows the creation of an air cushion.

Laying instructions

Vapor barrier in floors made with wooden slats

Clean the foundation or the concrete slab thoroughly and remove all foreign and movable objects. Unroll the **Guttabeta® Star 320 kN** or **400 kN** membrane with the studs facing the foundation (see drawing 26), being careful to fold it up along the walls as high as the finished floor so that the air can circulate through the skirting board. The sheet must overlap by at least 10 cm, placing a bituminous adhesive strip between one edge and the other. The insulation layer selected, based on the desired acoustical feature, can be positioned on top of the membrane. If the slab being worked on is not on the ground floor, a thermal-acoustic insulation such as **Guttasilent® N50** (fig. 30) must be used; if, on the other hand, the job is being carried out at the ground floor level, a strictly thermal insulation, such as **Guttaclima®** can be used (fig. 26). In the case of in-between floors, unroll **Guttasilent® N50** (closed cells cross-linked polyethylene – see technical sheet in the acoustic insulation manual) on top of the **Guttabeta®** membrane, being careful to weld the overlapping edges with hot air and to let the roll go up



along the side walls to cover the underlying **Guttabeta® Star** membrane. For improved stability of the **Guttasilent®** on the **Guttabeta® Star**, the two layers can be welded together by heating up the **Guttasilent®** in spots, thus gluing it to the underlying **Guttabeta® Star**. Then position the wooden spacers with section of 12x5 cm at a distance <50 cm, so as to determine a maximum load resistance of the overlying wooden floor of 300 kg/m² (see drawing 26-27). After this phase is complete, lay the parquet. In case this is to be done on the ground floor, you can choose to use thermal-acoustic insulation with the same characteristics as the **Guttaclima®**, directly on the **Guttabeta® Star 320 kN** or **400 kN** membrane, proceeding with the laying of the wooden spacers as described above and positioning the insulation between one spacer and the next. After this is done, proceed with laying the parquet (see fig. 26).

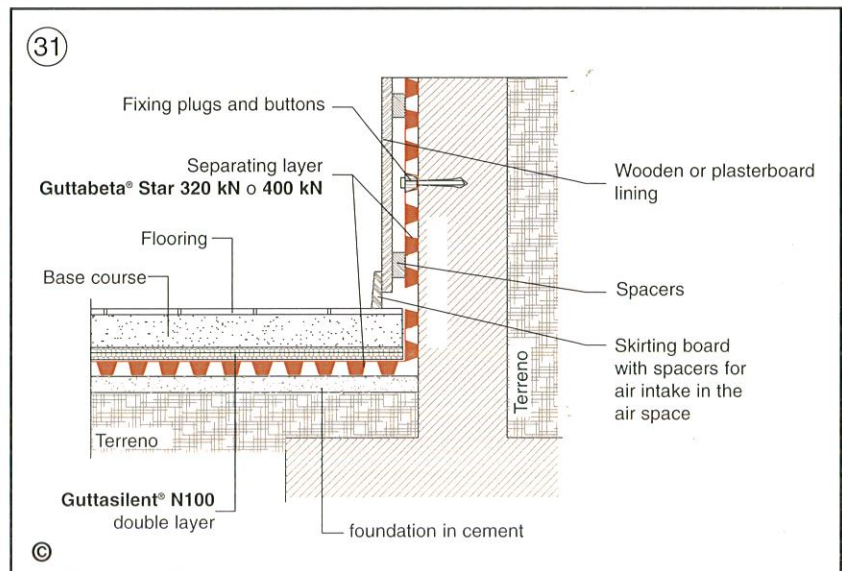
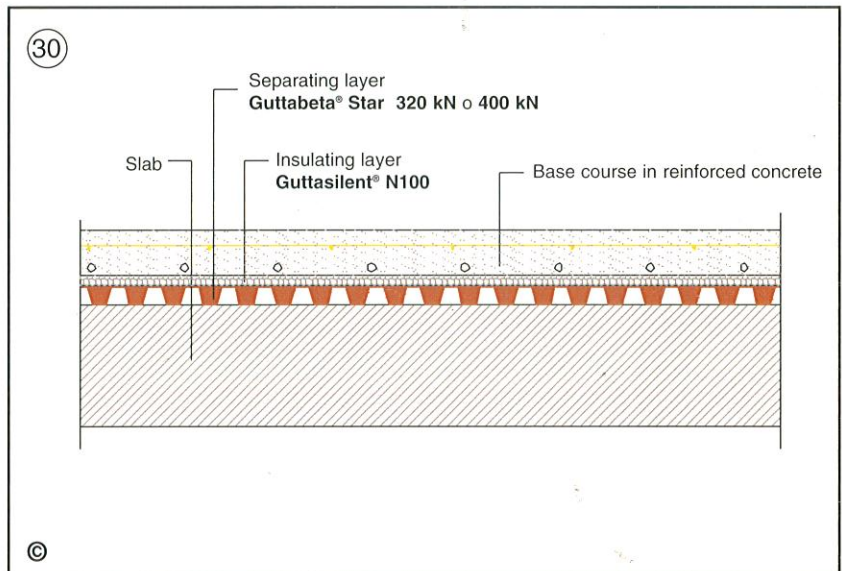
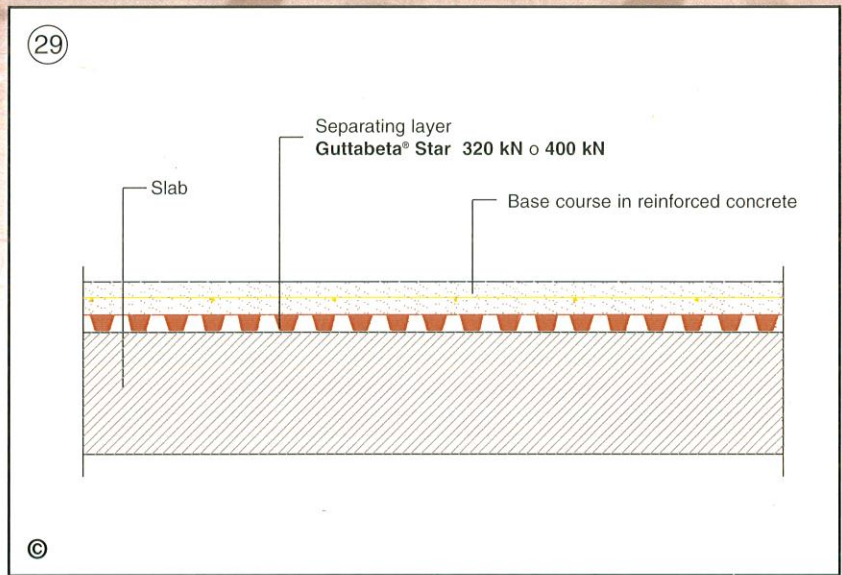
In some situations, it is not strictly necessary to interpose insulation between the structure and the floor. In these cases, then, proceed as described above, positioning the wooden spacers directly on top of the **Guttabeta® Star 320 kN** or **400 kN**, and then laying the parquet on top of the spacers (see fig. 27)

Vapor barrier in non-wooden floors

Lay the **Guttabeta®** membrane as described in the previous chapter for the wooden floor. After laying the membrane, depending on the desired degree of thermal-acoustic insulation, proceed as follows:

- Floor without thermal-acoustic insulation: position the electro-welded net with the appropriate spacers directly on the **Guttabeta® Star 320 kN** or **400 kN**; after that, cast the base course and lay the selected finishing (ceramic, granite, terracotta tiles, linoleum, etc. – See fig. 29)

- Floor with thermal-acoustic insulation: position a double layer of **Guttasilent® N100** (closed-cell cross-linked polyethylene) as described in the chapter "Vapor barrier in wooden floors" (page 26). After laying the **Guttasilent® N100**, position the electro-welded net with the suitable spacers, afterwards casting the base course and laying the selected finishing (ceramics, granite, terracotta tiles, linoleum, etc. (See fig. 30-31)



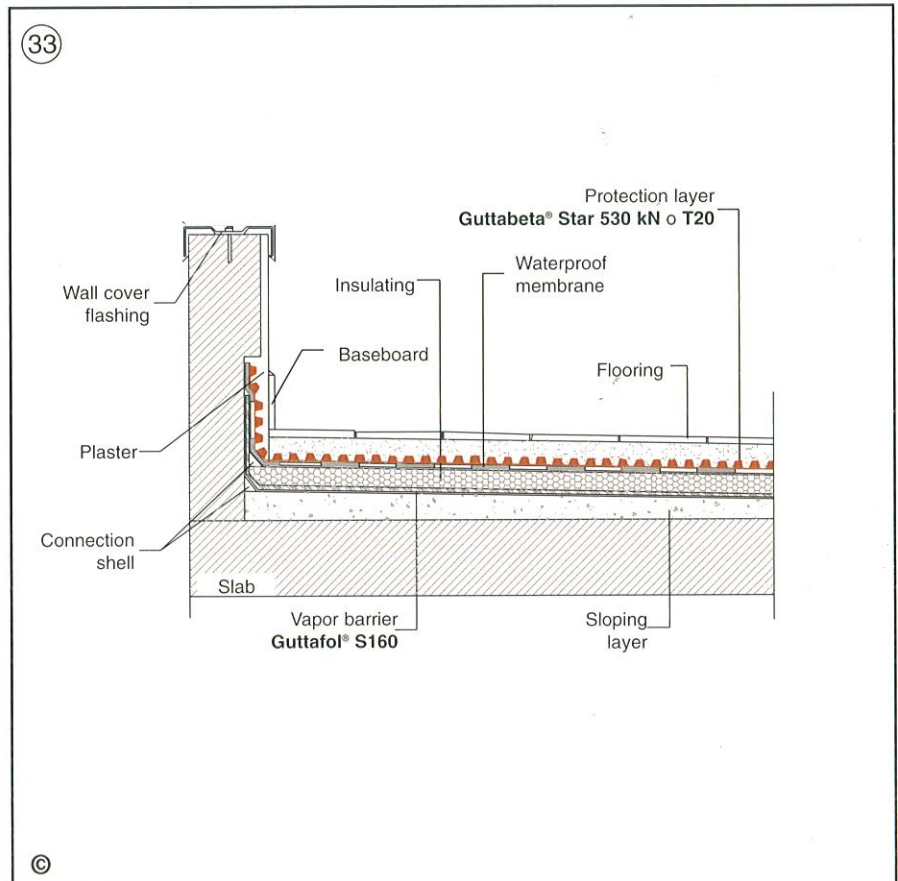
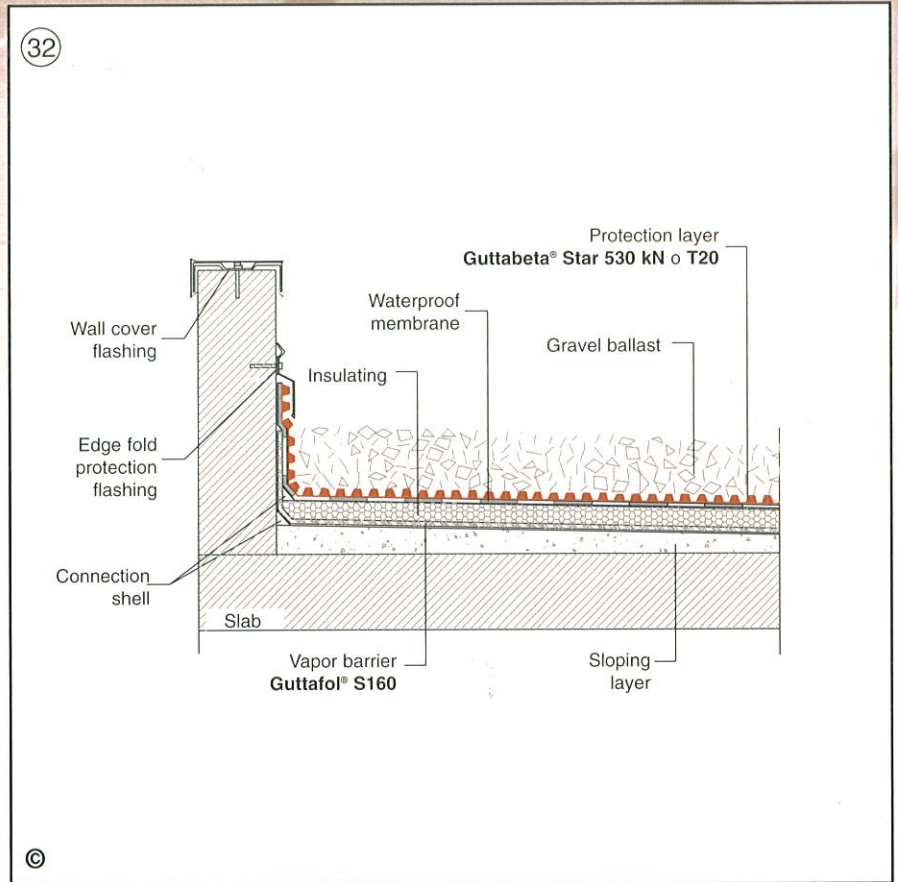
Protection of the waterproofing of flat roofings.

Recommended products: Guttabeta® Star 530 kN, Guttabeta T20

Waterproofing of flat roofs is usually done using bituminous sheaths arranged on two layers, and subsequently finished with the floor, the laying of gravel for drainage and cultivation soil for the formation of a roof garden or of flooring in cement blocks resting on plastic discs, etc. During these operations, the layer is sometimes subjected to stress that can lead to serious damage, resulting either immediately or subsequently, during the use of the building, in the loss of the waterproofing function. Repairing such damages can turn out to be very burdensome and complex, as it is difficult to identify the damaged areas that can also show up at a later time. The solution usually consists in the complete removal of the finishing laid on top of the waterproofing, in redoing the waterproofing and in replacing the covering. The costs related to such operation are by far higher than the cost of the original job.

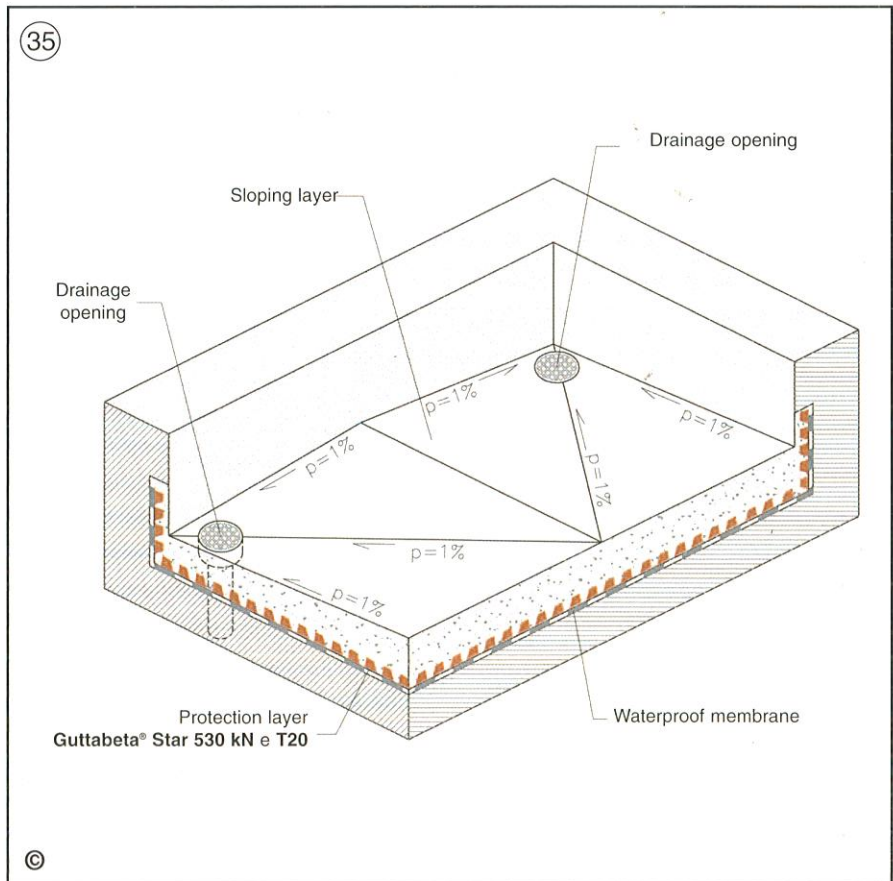
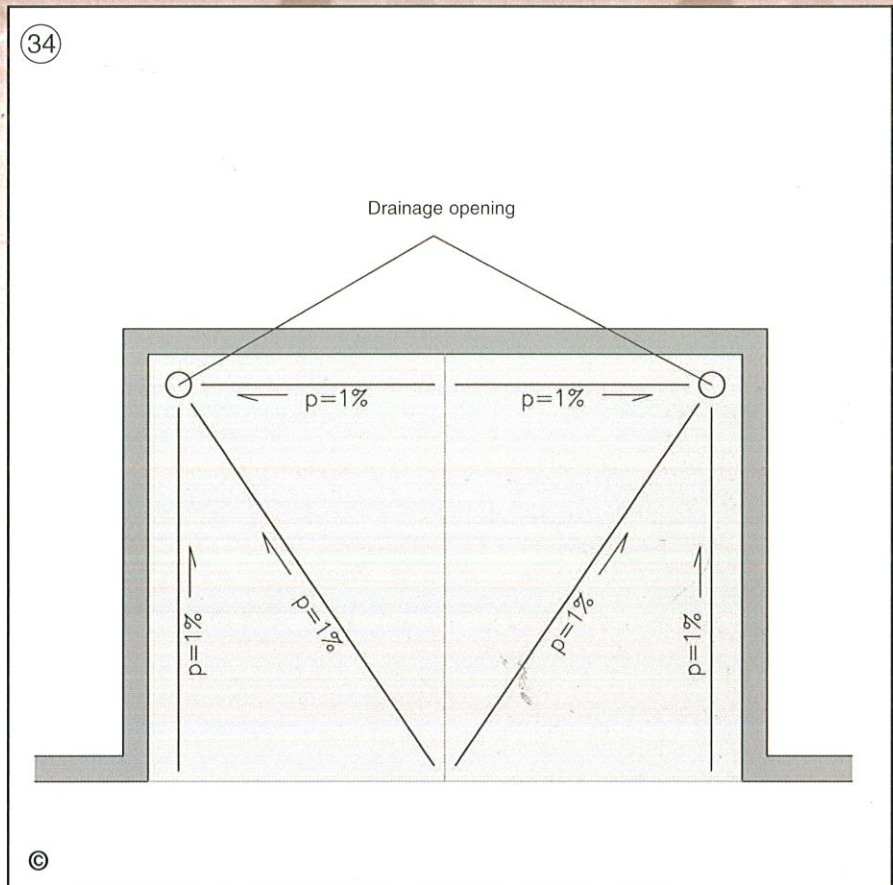
Consequently, it is crucial to ensure that the waterproofing layer is protected from collisions and damages during the jobs completion phase as well as from damages common during the operating phase, such as thermal dilatations, ultraviolet rays, restricted dilatations and small-footprint concentrated loads that may determine damages of the layer in the long run.

It is also important, generally speaking, but especially in case the lower floor is used as living quarters and therefore needs a non-conducting panel to be laid, to arrange for a vapor barrier capable of eliminating the humidity coming from below and prevent water absorption by the nonconducting panel.



Laying instructions

Start the job by cleaning the sloping base course thoroughly and eliminating sharp objects. Afterwards unroll the **Guttafol® S160** vapor-control sheet along the entire surface, starting at the point with the least slope and being careful to overlap the other sheets by at least 20 cm. Then seal the two edges with the PRE biadhensive strips provided with the **Guttafol®**. The top edge always has to cover the bottom one in the direction of the water flow. After this phase is complete, position the insulation, if any, along the entire surface. After that, proceed with laying the bituminous waterproofing layer, being careful to leave about 20 cm of sheath beyond the level of the finished floor. Unroll **Guttabeta® Star 530kN** by overlapping the layers as it was done for the laying of the vapor block, in relation to the direction of the water flow. Overlap the edges by about 20 cm and seal them with a bituminous biadhensive strip. Just like the bituminous sheath, unroll **Guttabeta® Star 530kN** so that it folds over along the edges of the flat roof for the same height. Now position the finishing layer, which may consist of a cement base course and relevant flooring (see fig. 33) or the laying of a simple gravel ballast (see fig. 32).

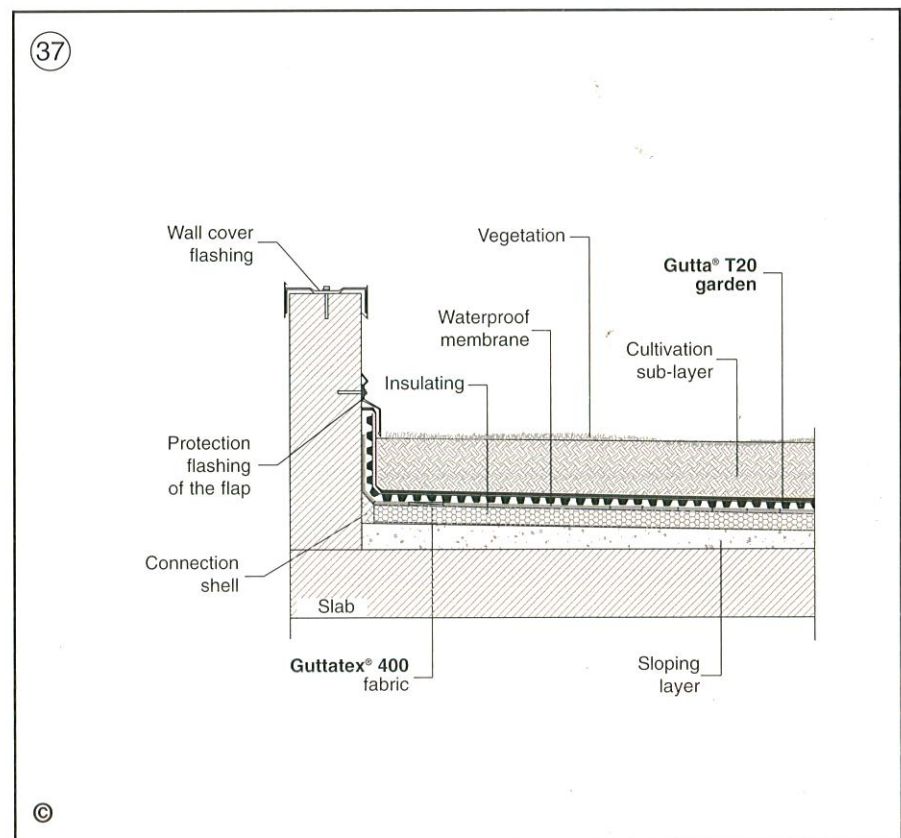
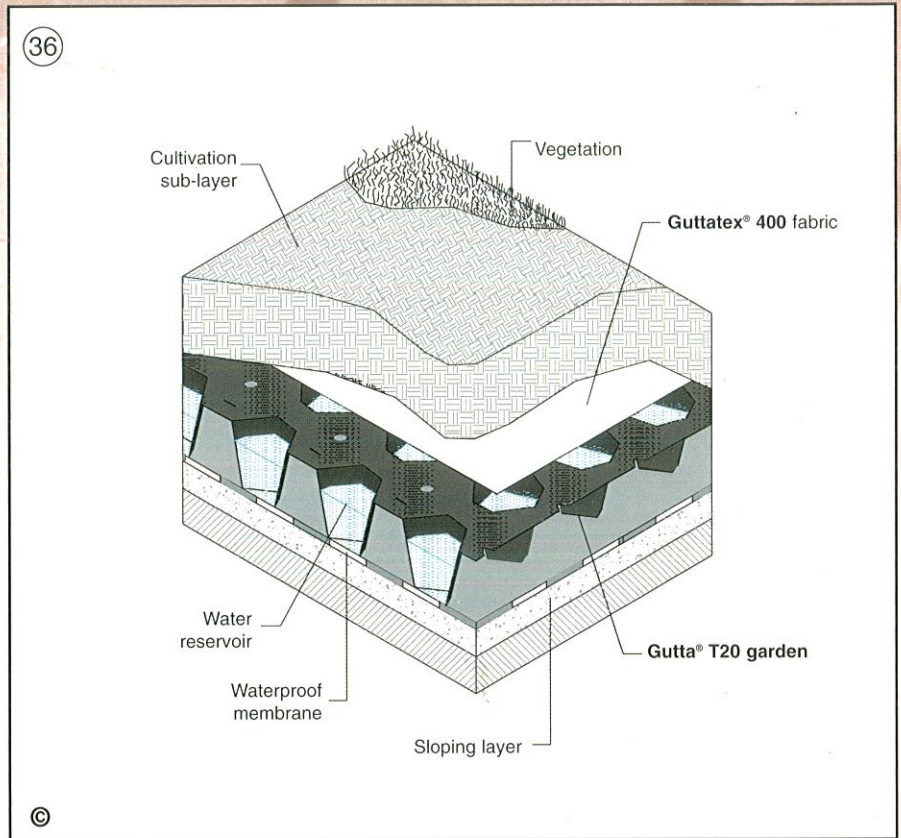


Roof gardens with (and without) water reservoir.

Recommended product: Guttabeta® T20 garden, Guttabeta® Star drain

Roof gardens With water reservoir

Roof gardens are becoming more and more popular, both to cover underground garages without having to give up a garden, but also to cover portions of residential terraces, etc. In addition to satisfying requirements of an aesthetic nature and the pleasant use of additional green spaces, this choice also guarantees the advantages resulting from high levels of thermo-acoustic insulation, the mitigation of sharp temperature changes and an efficient protection of the waterproofing system. For structural reasons, in many cases it is not possible to adopt a sufficiently large layer of cultivation soil, consequently this type of garden suffers from dry spells as the scarce amount of soil cannot accumulate water, while the excess water is eliminated by the underlying drainage. Consequently, these types of roof gardens need to be watered a little and very often. In order to avoid this and to guarantee optimal conditions for the survival of the garden, a technology must be adopted which is capable of carrying out various functions at the same time: protection of the sheath, drainage of the excess water released by the overlying soil and water reservoir, which is the same as laying a larger layer of soil. The use of **Gutta® T20 garden** creates an important water reservoir in the underlying cultivation layer, consisting of the 20-mm high studs arranged at a rate of 400 studs per square meter. Therefore it becomes a fundamental advantage, during the dryer season, to be able to count on a water reserve within the layer that makes up the roof garden so as to guarantee a better hydrometric ration of the soil. Moreover, the sheet also features a set of small holes which allow the excess water to flow into the underlying waterproofing layer after the water has already filled up the reservoir studs. These small holes are also important as they allow ventilation of the bottom root layer located above the air chamber formed by the studs with respect to the waterproofing layer. The sheets are light enough to be easily carried to the top floors of buildings, and they eliminate the high cost of using traditional draining layers in gravel.



Laying instructions

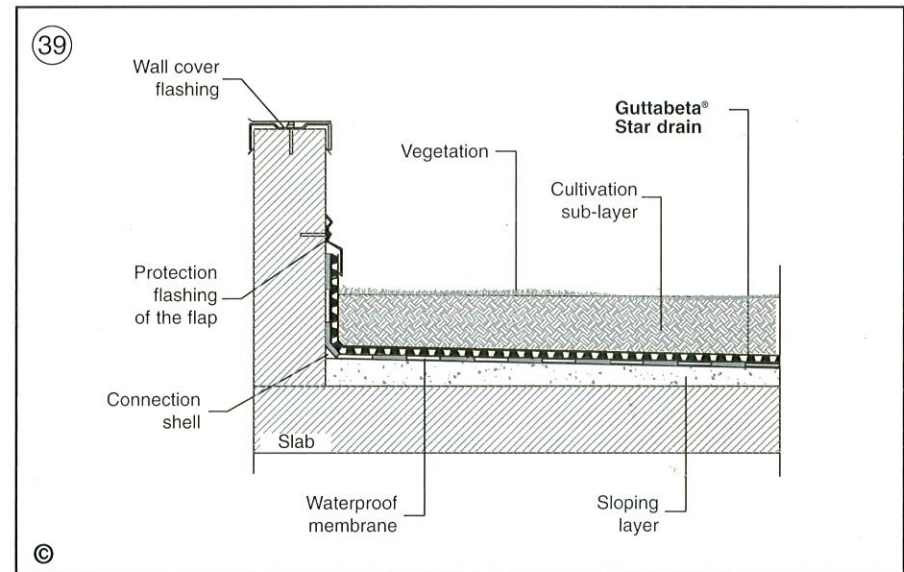
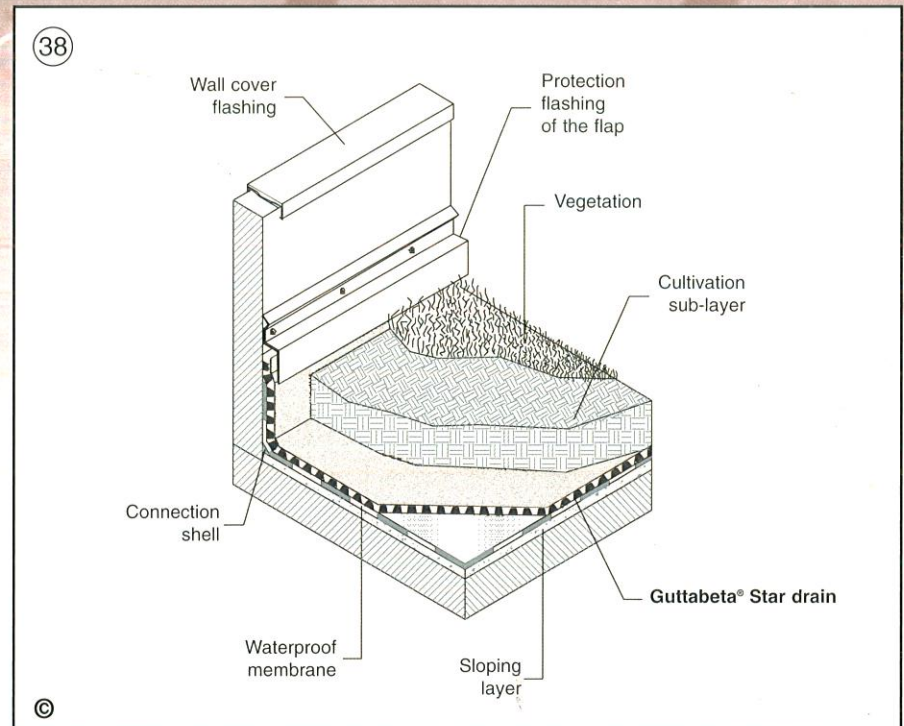
When building a roof garden, the first thing that must be done is to calculate the inclination needed to allow excess water to flow, which shall be equal to or greater than 1.5%. In addition, if the overall surface of the roof garden is rather larger, it is advisable to divided it into sectors, which shall have a maximum surface between 90 and 120 square meters (see fig. 34 on page 27). The number and the arrangement of the flowing surfaces determine the quantity of discharge channels, which always have to be at least two for each sector in order to avoid possible flows into a channel that can damage the discharge capacity of the water. The openings must be positioned in the lowest point of the flowing surface to which they belong and it must be possible to inspect them. Consequently, a sump with removable cover must be provided around the discharge. After completing the laying surface, the sloping base course must be waterproofed with a double layer of anti-root bituminous sheaths. In this phase, a layer of insulating material can be laid between the base course and the sheath (see fig. 37). The waterproofing has to rise up for about 20 cm along the sides, beyond the edge of the finished garden.

Afterwards, position the **Guttabeta® T20** sheaths on the entire surface, with the male studs facing downward and overlapping each sheet by about 15-20 cm, folding them up along the side walls to the level of the bituminous sheath applied previously. Cover the **Gutta®T20** garden with a layer of **Guttatex® 400** grams geotextile fabric, overlapping the various strips by at least 30 cm. The function of the high-weight fabric is indispensable as a separating and filtering layer between the HDPE membrane and the soil for the purpose of avoiding the clogging of the holes that govern the flow of excess water. After this phase is complete, fill with the cultivation soil and apply the relevant flashings along the side walls.

Roof gardens without water reservoir

In case a water reservoir is not necessary, all considerations listed in the previous paragraph still being valid, it is possible to create a bottom draining layer using gravel instead of **Guttabeta® Star drain**.

Guttabeta® Star drain consists of a membrane in extruded HDPE to which an extremely tough geotextile fabric in continuous filament polypropylene with a weight of 140



g/m² is applied. **Guttabeta® Star drain** features a high mechanical load resistance (530 kN/m²), excellent draining capacity, a large quantity of air, included between the studs and the filtering fabric, and limited weight. The construction phases of the sloping base course, of the related water flowing surfaces and waterproofing follow the same instructions as those provided in the previous chapter on page 28.

Laying instructions

After completing the waterproofing phase, position **Guttabeta® Star drain** by unrolling it on the waterproofed surfaces by overlapping the sheets by 10-15 cm. Overlapping occurs by

separating the filtering layer, for the entire length of the overlap, from the studs, matching up the male studs with the female studs by overlapping them. It is advisable to interpose a bituminous biadhensive strip between one edge and the other for improved adherence between the two sheets. **Guttabeta® Star drain** has to follow the bituminous sheath, even on the side walls, until it exceeds the edge of the finished garden for about 30 cm (see fig.38-39). Afterwards, position the cultivation soil on the geotextile fabric. Finish the job by positioning the flashings along the side walls.

Stabilization of road embankments.

Recommended product: guttabeta® Star 530kN

Roadways are subject to deterioration of both the wearing course and of the entire bearing structure due to the effect of road traffic. This deterioration occurs because of dilatations, poor soil conditions, water infiltration, concentrated loads, etc.

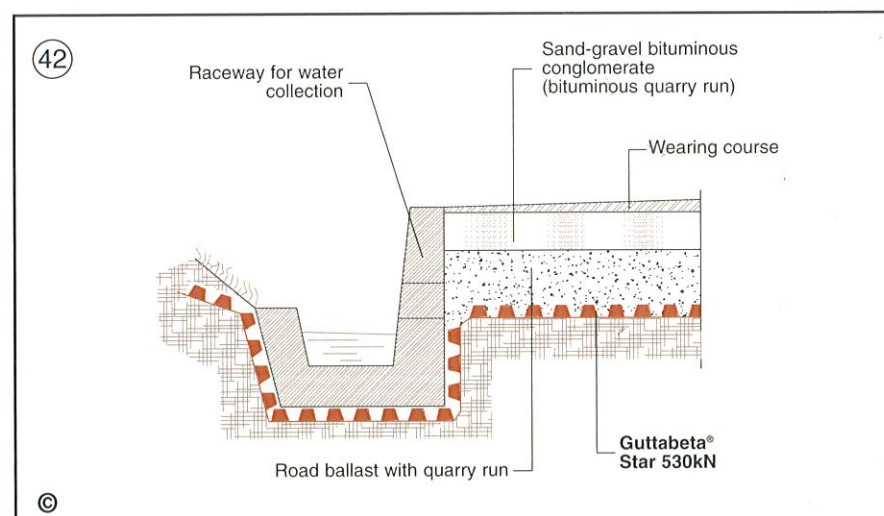
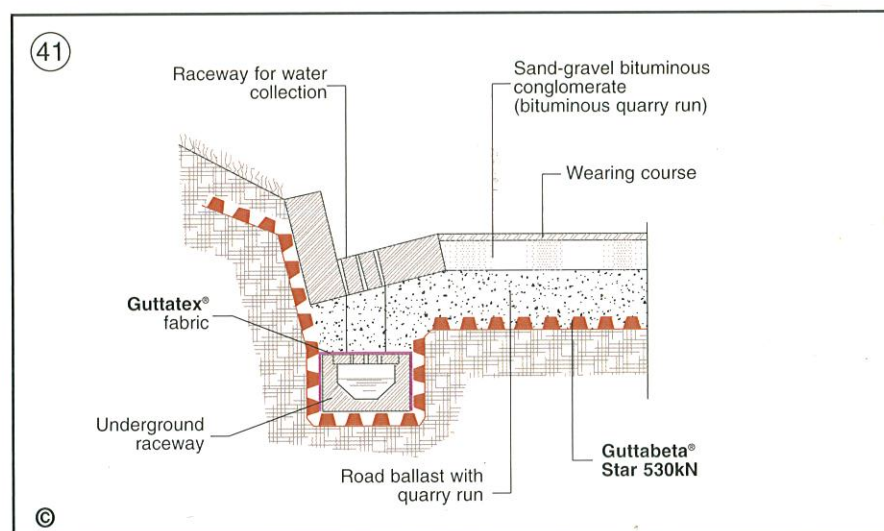
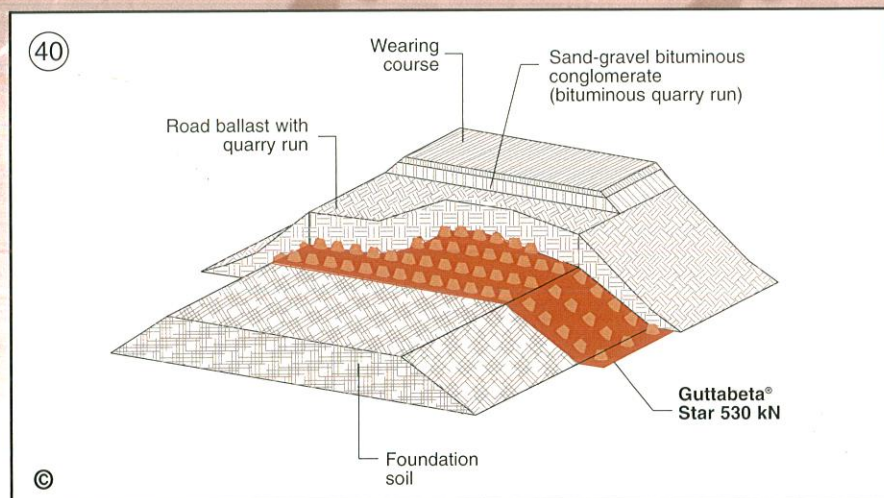
Pressure and sinking of the layers for the aforementioned reasons translate into subsidence of the road surface and in transversal tensions between the layers, which tends to destabilize the roadway. Consequently, it is important to properly manage the waters acting on the road surface in order to prevent their sudden deterioration. These waters can also derive from capillary phenomena within the soil, from the flow of rainwater or from the presence of underground water or infiltration. Their containment and distancing from the bearing structure of the roadway becomes a necessity since, due to the water action the smaller particles making up the grading tend to break up and wash away, leaving empty spaces with the relevant structural consequences. There is another basic reason, in addition to the ones mentioned above, for being very careful to drain the waters, and that is to prevent ice from forming in the underground layers. The consequences of a freezing substratum are the swelling of the layers and the plasticizing of the soil.

Guttabeta® Star 530 kN acts as a load distributor since it is positioned at the base of the unbound layers, contributing to a reduction of the deformations caused by an attempt to contrast the lateral dilatation of the underlying soil. Since the product consists of waterproof HDPE, it contributes to managing the waters as described above. The use of **Guttabeta® Star 530 kN** reduces the height of the various layers that make up the embankment, thus reducing their thickness by 20-25%.

This results in savings in terms of labor and materials, as well as in faster execution times.

Laying instructions

Laying of the road embankment starts by compacting the foundation surface. After that, position the **Guttabeta® Star 530 kN** with the studs facing upward along the roadway, then perpendicularly to its axis. Prior to cutting the membrane, take into account that it has to be long enough to contain any side channels for water discharge. If the underlying soil is especially damp or in the presence of a water table, it is advisable to interpose a 10-cm thick layer of sand between the foundation soil and



Guttabeta® Star 530 kN. The sheets must overlap by 15 cm, with a bituminous adhesive strip between one side and the other. Afterwards position the various layers of the road embankment: sand, quarry run, bituminous run and wearing course.

Stabilization of railway embankments.

Recommended product: guttabeta® Star 530kN

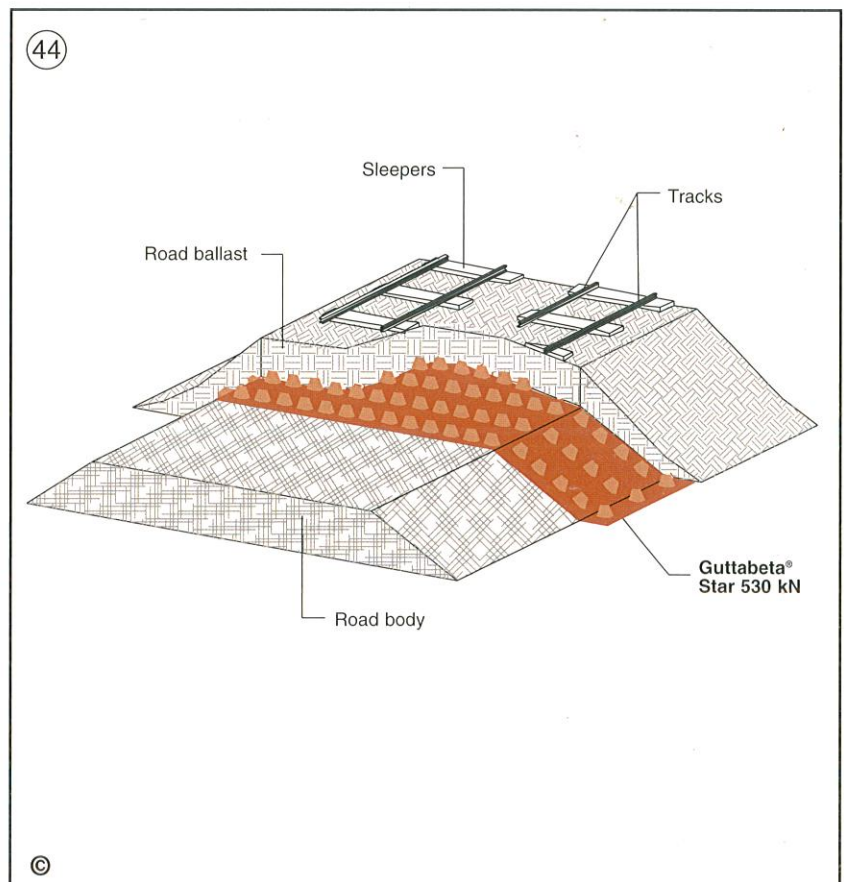
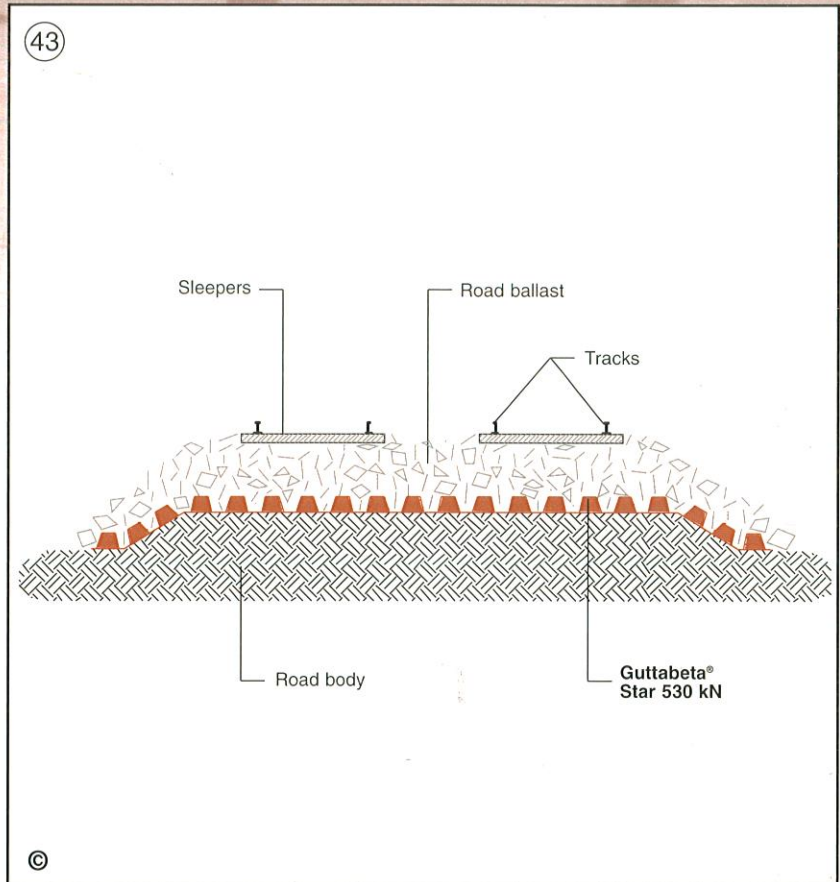
Stability of the ballast and the mixing of materials used to make the same ballast, with the relevant pollution caused by the flow between the two layers of bearing material are usually the most common problems in the case of railway embankments. It is common knowledge that the composition of embankments includes the body of the road, usually made up of filling earth, while the second layer consists of rubble with a grading diameter between 30 and 70 mm. The subsidence of the soil carrying capacity causes the deformation of the railway surface and of the relevant ballasts, with the resulting movement and deformation of the sleepers and of the tracks. In addition, the presence of a water table underneath the railway embankment, especially in clayey soils, forms areas in which water stagnates, causing problems during the passage of trains. In fact, the pressure exercised by the moving train creates a suction effect on the water present, as a result of which soil or parts of clay are carried inside the ballast. The entrance of fine particles of soil and/or clay in the ballast reduces its mechanical characteristics, which are crucial for the absorption of dynamic loads and for the prevention of negative transversal and longitudinal pressure.

Guttabeta® Star 530 kN offers excellent compression and traction characteristics. Its waterproofing nature means that it acts as a separating layer that prevents the suction of water between the road body of the ballast and the underlying soil.

Laying instructions

Laying of the railway embankment starts by compacting the foundation surface.

After that, position **Guttabeta® Star 530 kN** with the studs facing upward along the length of the railway and then perpendicular to its axis (see drawing 43-44). The sheets must be overlapping by 15 cm, with a bituminous biadhesive strip positioned between one side and the other. Then position the ballasts as usual, along with the sleepers and the tracks.



Channels protection and drainage in waterworks.

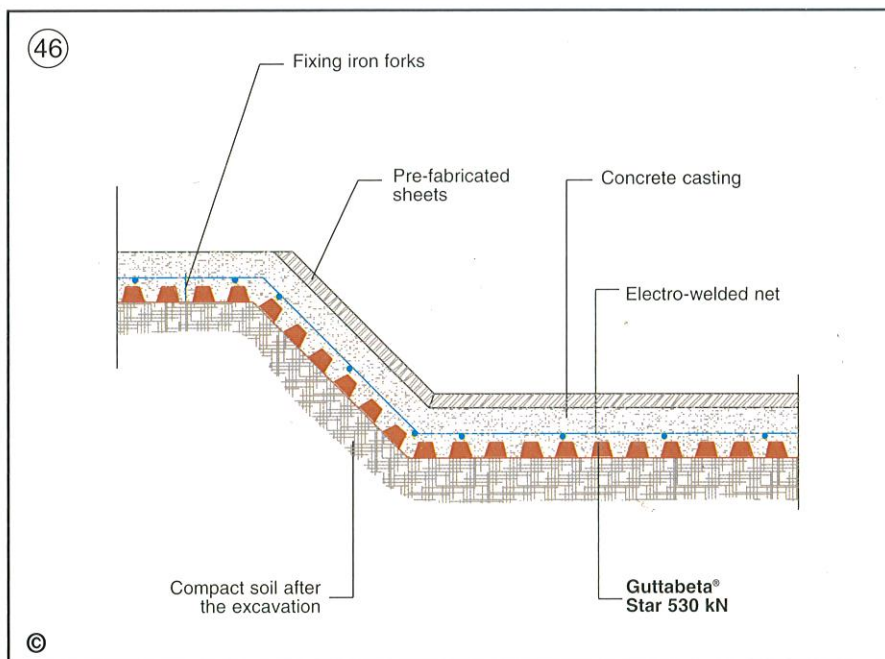
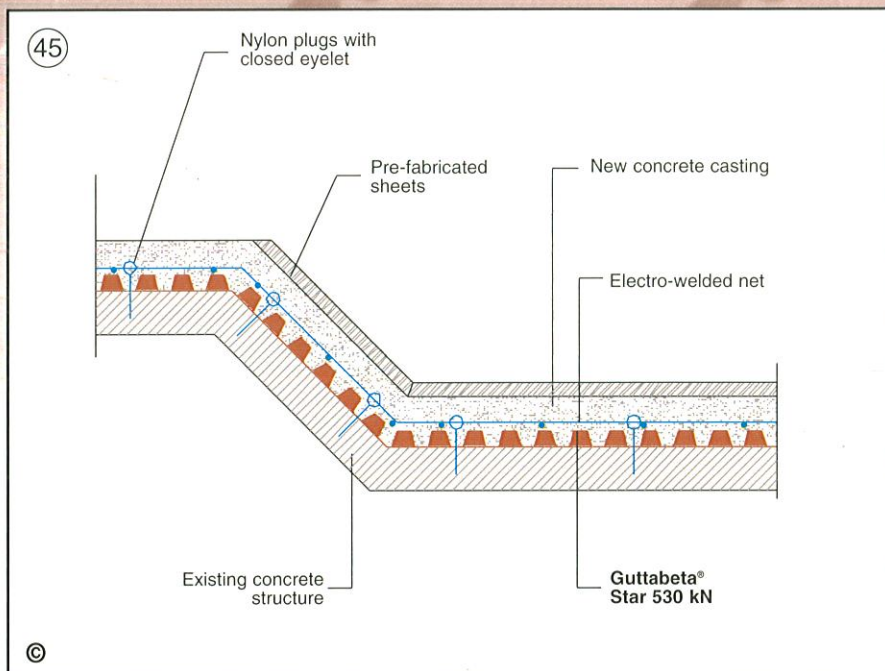
Recommended product: Guttabeta® Star 530 kN

During the construction of channels in waterworks, the waterproofing function is usually assigned to the thickness of the cement that forms the basin. But in order to ensure its full effectiveness, the grading curve must be absolutely continuous, the water/cement ratio must be limited and the use of additives must be carefully studied. In addition, a good recipe is not always enough to guarantee the impermeability of the channel as there are some variables to take into account: transporting the cement to the point of use, human intervention when laying the conglomerate, the methods, laying times and ageing of the work, deformation caused by shrinkage, viscosity, thermal dilatations, chemical agents contained in the water (which represent stress factors for the structure), erosion, etc.

All these deterioration causes can lead to the creation of cracks or small fissures that can considerably reduce the impermeability of the channel. Therefore, in addition to recommending the utmost attention during the design, transport, laying and maintenance of the cement, it is also advisable to use Guttabeta® Star 530 kN underneath the reinforced concrete layer, as it features a high compression resistance, intrinsic waterproofing of the raw material, which is the HDPE, offering continuity under the casting of reinforced cement. The use of Guttabeta® Star 530 kN is recommended for both the restructuring of existing channels and in the building new works.

Laying instructions

When restructuring damaged channels, it is necessary to first clean the bed thoroughly, removing all the deteriorated parts. Afterwards, lay the rolls of Guttabeta® Star 530 kN, with the studs facing upward, from one bank to the other, overlapping the sheets by 15 cm and positioning a bituminous adhesive strip in between. The sheets must be overlapped so that each edge upstream overlaps the one downstream, thus ensuring the maximum waterproofing possible. Fix the dimpled membrane to the underlying cement structure by means of nylon plugs with a closed



eyelet screw 9 mm in diameter, first drilling a hole and forming a mesh 100x100 cm in size. The base of the plugs will then be lined with an elastic bituminous sheath.

Lay the electro-welded net by fixing it to the eyelets of the plugs, then finish the job by casting the cement layer and positioning the prefabricated slabs afterwards (see fig. 45).

When building new channels, lay the Guttabeta® Star 530 kN, along the channel trench, being careful to cut the rolls with 70 cm length beyond the maximum width of the channel so as to be able to fix the

membrane to the bank by means of iron forks. Position some stones along the sides of the bed so that the Guttabeta® Star 530 kN adheres to the ground. Afterwards, lay the electro-welded net on the spacers. Cast the channel structure using suitable concrete and finish it by positioning the prefabricated slabs in reinforced cement (see fig. 46).

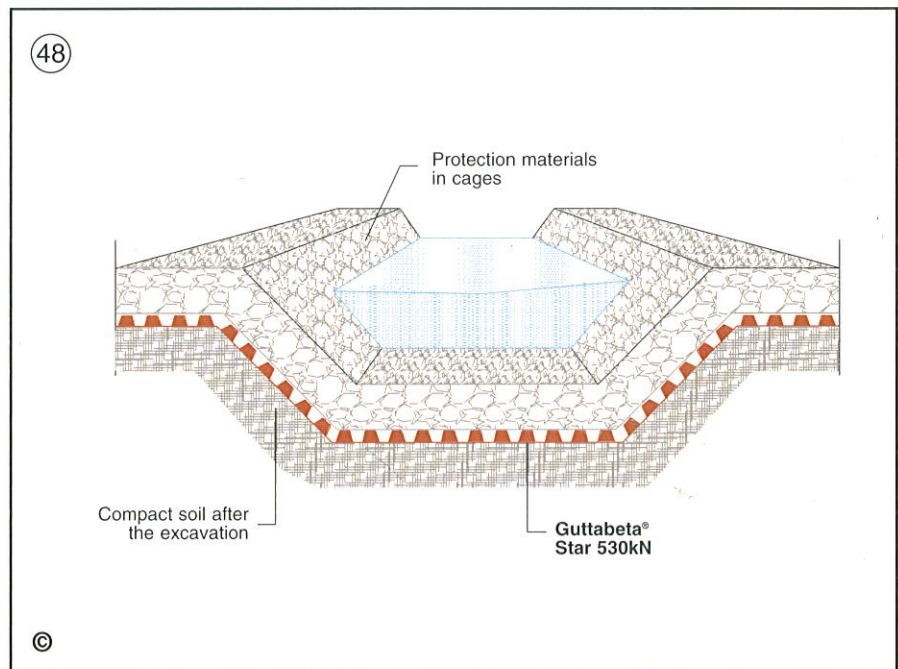
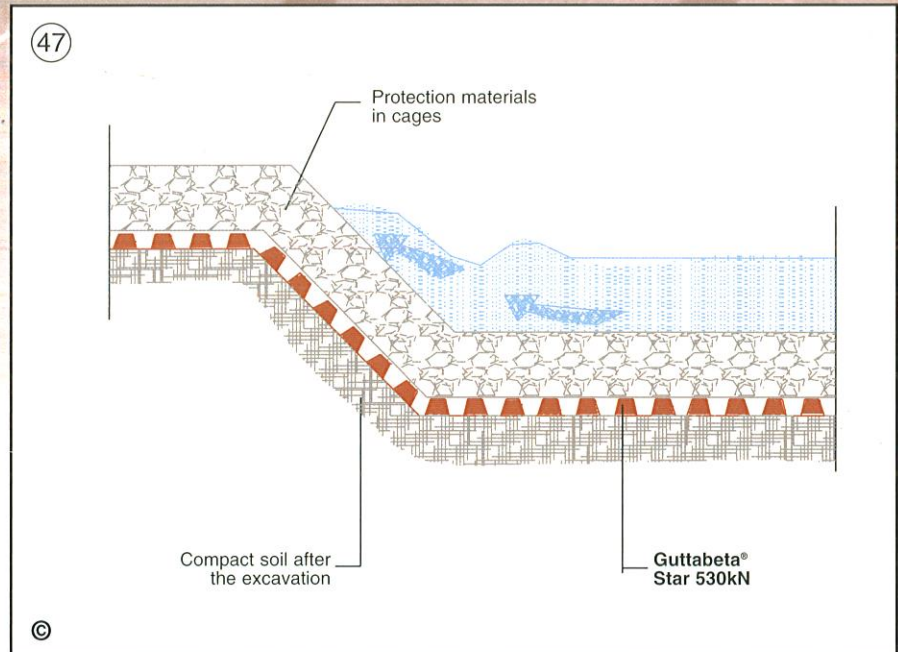
Reinforcement of banks/slopes.

Recommended product: Guttabeta® Star 530 kN

The banks of channels and water basins are usually protected against erosion phenomena generated by flowing water through the use of "cages", which are basically square or rectangular shaped containers consisting of an outer steel mesh containing rocks and/or inert material of different sizes. Prior to being positioned, the underlying soil is tamped and leveled using inert material. The water movement inside the cages follows the wave motion and the current. During the descent phase, the water removes the underlying inert material and the fine soil particles underneath it. In the long runs, this water motion generates considerable erosion phenomena underneath the cages which, albeit adapting to the level of the underlying soil, modify the original shape of the channel bank or of the basin in general. In order to prevent this erosion effect, the use of **Guttabeta® Star 530 kN** is recommended. The dimpled membrane positioned at the base of the cage prevents the water from flowing downward and consequently the erosion action of the same water on the underlying soil. The presence of studs and the high resistance featured by the membrane produces a contrasting force to the transversal deformation of the soil due to the effect of the overlying load, from which an increase in the carrying capacity of the same soil is derived. Laying the membrane improves the waterproofing qualities of the bank.

Laying instructions

In order to protect the bank against erosion through the use of **Guttabeta® Star 530 kN**, first of all unroll the membrane along the bank to be covered, taking into account any steps intended for the laying of the cages. In case of banks without such steps, it is advisable to fix **Guttabeta® Star 530 kN** at the top by means of iron forks dug into the ground. Then position the cages directly on the dimpled membrane and proceed with filling them.



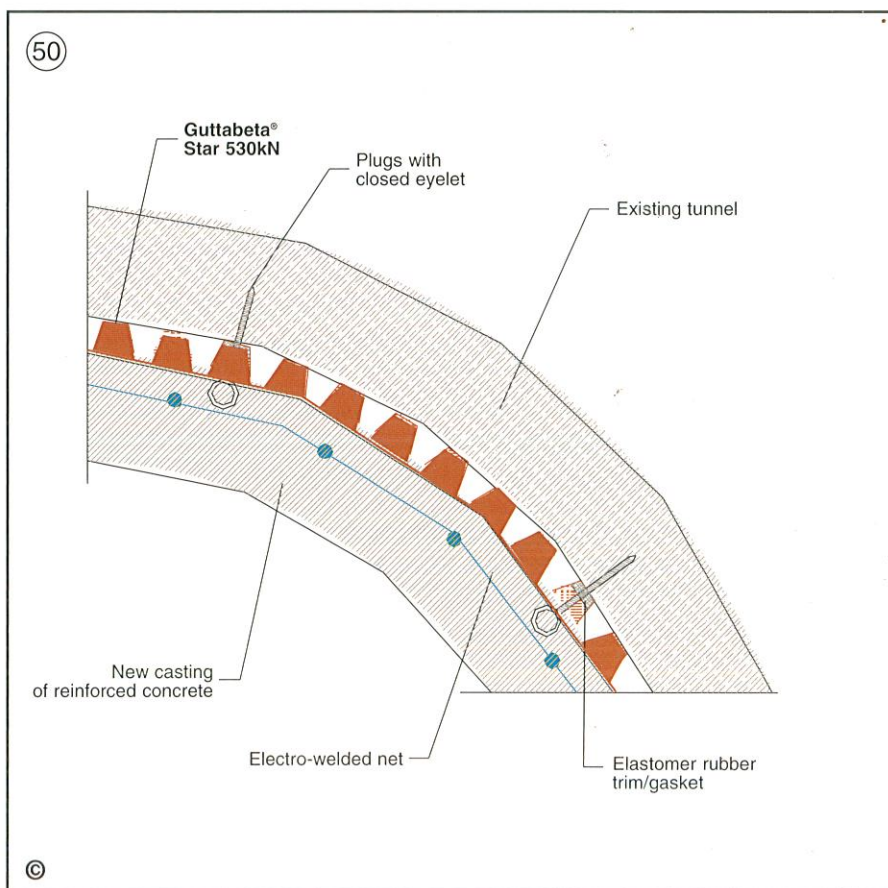
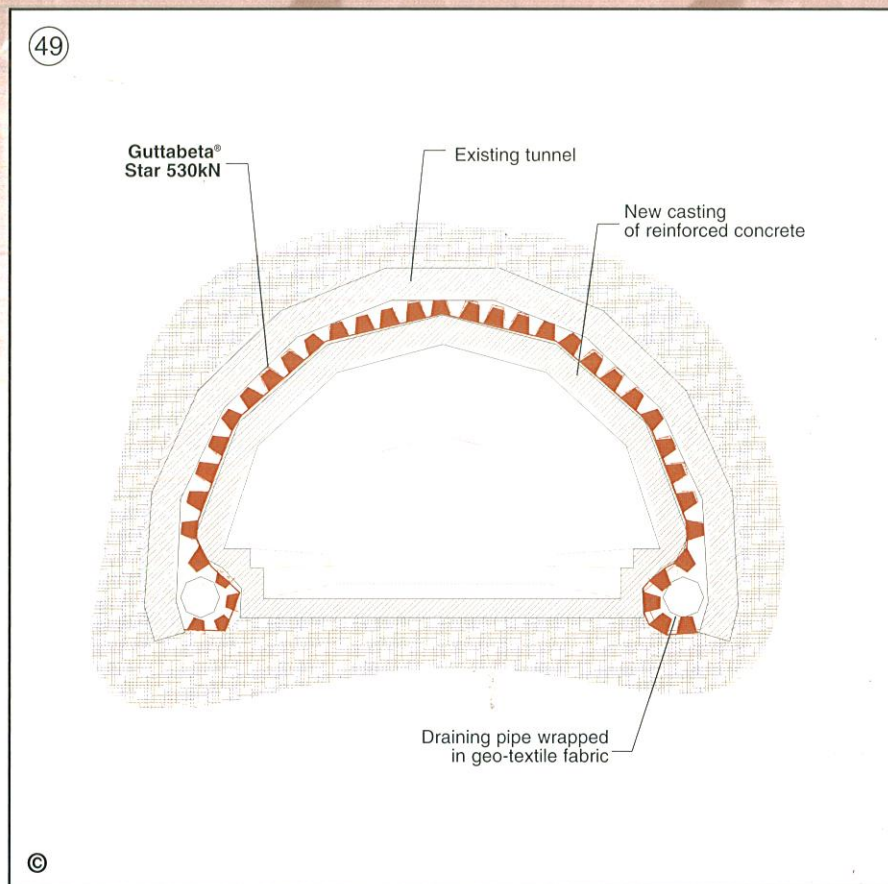
Drainage of tunnel vaults and tunnels

Recommended product: guttabeta® Star 530kN

The tunnels carried out by means of perforation and the immediate cast lining, if any, are intrinsically subject to water infiltrations that turn out to be harmful due to the erosive effect produced on the natural all. This can cause the material on the natural surface to become detached, to water dripping on the road surface and to the short durability of the works built inside the tunnel. The effects of water infiltration from above can also be very damaging during the construction of works that complete the tunnel, such as the casting of the vaults, the positioning of waterproofing materials and so on. Consequently, it is necessary to limit these phenomena as much as possible and to convey the waters filtering from the vaults into the appropriate draining systems, for the purpose of preventing water from dripping both on the completion works and on the operators while working, as well as to prevent the water from coming in contact with the finishing works when the tunnel is put into operation. Lining the tunnel vault immediately after the construction operations of the SEDE with **Guttabetta® Star 530 kN** protects the final cement coat from percolation, helping the structure to let the water flow along the sides. Draining of the tunnel starts by positioning the draining pipes along the sides of the tunnel, the purpose of such pipes being the collection of percolation water (see drawing 49).

Laying instructions

Measure the development of the vault and cut the membrane according to the calculations, taking into consideration that the Guttabetta® Star 530 kN will have to be folded over around the draining tube for at least 50 cm. Arrange the roll on a movable cart suitable for working near the vaults. Unroll the membrane and start to fix it 30 cm above the draining pipe, making a hole with a 9-mm diameter in the center of the stud. Afterwards, introduce the eyelet plug and repeat the operation creating a mesh 1x1 m. Continue to lay Guttabetta® Star 530 kN proceeding with the riveting as described above, until reaching the opposite side of the vault, in proximity to the second draining pipe, partially folding the dimpled membrane around the same pipe and positioning a bituminous adhesive strip between one sheet and the next. Position the electro-welded net by fixing it to the eyelets of the plugs, then spray the cement to form the vault (see drawings 49 and 50).



Drainage of open-air tunnel vaults

Recommended product: guttabeta® Star drain

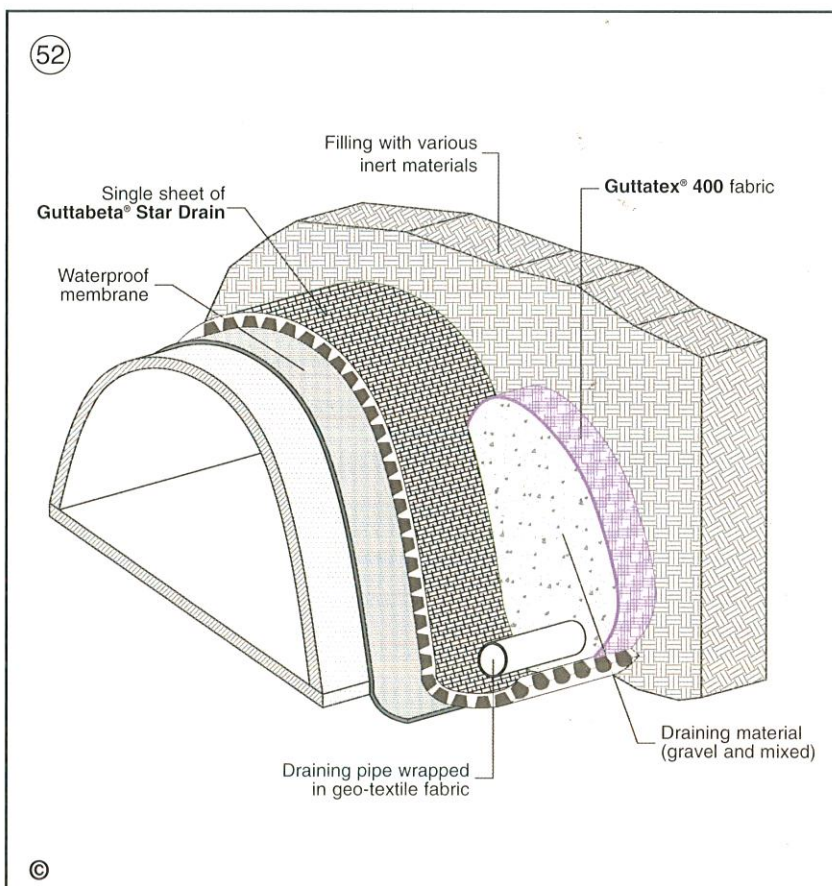
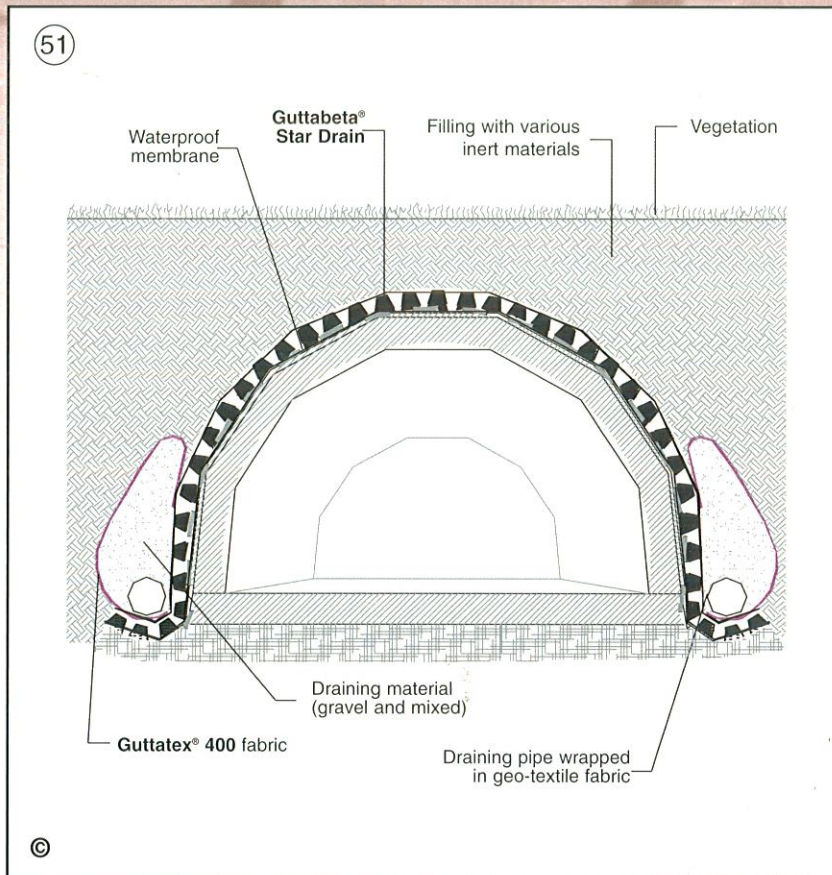
From a construction point of view, building tunnels with the subsequent filling is less difficult.

In spite of this, it is important to guarantee both the impermeability of the vault by protecting the waterproofing layer and the drainage of water at its extrados. In fact, after completing the construction of the vault with reinforced concrete, waterproofing is entrusted to bituminous or PVC sheaths, covering it afterwards with inert material. This is the most dangerous phase as the dynamic action of the filling material could cause lacerations or breaks in the waterproofing.

Despite the thick coat, sometimes it is possible, due to the reasons mentioned on page 32 regarding the quality of cements used and the ease with which cracks are created, to have percolations inside the passageways, including through the dilatation joints, which speed up the deterioration of the cement and make the passageway dangerous. In addition, drainage entrusted exclusively to the inert material on top of the vault is not always sufficient to guarantee the flow of water towards the collection channels positioned at the foot of the passageway. Using **Guttabeta® Star** offers the advantage of protecting the underlying waterproofing against mechanical phenomena which would otherwise have a negative impact on the waterproofed surface. In addition, the continuous filament polypropylene fabric filters the soil particles in the water, thus maintaining a constant drainage chamber between the fabric and the foot of the 7-mm studs of **Guttabeta® Star** drain and guaranteeing a high degree of drainage. Moreover, the dimpled membrane will protect the waterproofing from plant roots that grow on top of the tunnels, which could create openings in the dilatation joints.

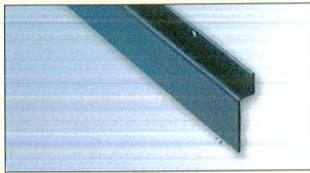
Laying instructions

Start by positioning the drainage pipe along the external side of the tunnels intended for the collection of drainage water from the structure. Arrange the rolls of **Guttabeta® Star** drain, keeping in mind that, in addition to the metric development, you will need to add 50 cm for each side so that the dimpled membrane can be partially wrapped around the draining pipe located at the sides. Position **Guttabeta® Star** drain at the summit of the tunnel, then unroll it along the sloping sides up to the draining piping, which will be partially wrapped by tearing off part of the dimpled membrane fabric. After this phase is complete, lay over the draining pipe, at a height of 50 cm, a layer of inert material, wrapping it with a layer of **Guttatex® 400** g/m² geo-textile fabric.



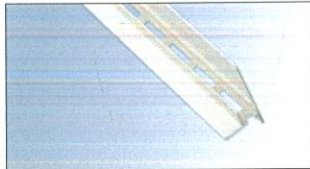
Accessories for dimpled membranes

GUTTABETA PROFILE



Profile in HDPE for Guttabeta dimpled membrane
2 m in size.

GUTTABETA PT PROFILE



Profile in HDPE for Guttabeta PT dimpled membrane
2 m in size.

BITUMINOUS ADHESIVE STRIP



Bituminous adhesive strip for overlapping,
size cm 4x1000

FIXING ACCESSORIES FOR GUTTABETA



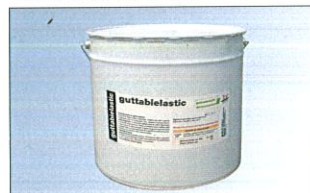
- 200 steel nails (mm 3,1 x 3,5)
- 200 fixing buttons
for Guttabeta dimpled membrane

FIXING ACCESSORIES FOR GUTTABETA PT



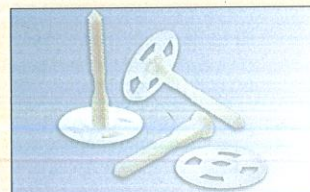
- 100 pressure plugs
- 100 fixing buttons
for Guttabeta PT dimpled membrane

GUTTABIELASTIC



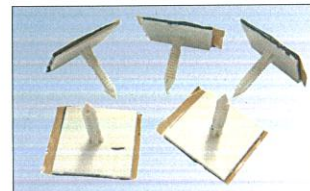
Ready-to-use, brown-colored semi-dense paste that becomes black when dry that features excellent adhesiveness and elasticity (more than 800%). It has a first-rate anchoring power even on vertical surfaces. It is recommended for waterproofing terraces, balconies, walls in contact with the soil, repairing old bituminous membranes, for sealing fireplaces, eaves gutters, etc.

FIXING ACCESSORIES FOR GUTTABETA DRAIN



100 nails for fixing the Guttabeta Drain
dimpled membrane
mm 80x6 head ø 53 mm

BITUMINOUS ADHESIVE PLUG



1000 plugs for fixing the Guttabeta dimpled membrane
mm 40x40 head
h 40 mm approx.

Certifications

Process certification

Process and product certifications



ISO 9001 Certificate



ISO 14001 Certificate



CE marking

Product certifications

P&P LMC s.r.l.

COMPORAMENTO ALLO SCHIACCIAMENTO

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Compression resistance Guttabeta® Star 320 KN Official laboratory

P&P LMC s.r.l.

COMPORAMENTO ALLO SCHIACCIAMENTO

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Compression resistance Guttabeta® Star 400 KN Official laboratory

P&P LMC s.r.l.

COMPORAMENTO ALLO SCHIACCIAMENTO

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Compression resistance Guttabeta® Star 530 KN Official laboratory

OMECO S.p.A.

REPORTO DI PROVA MECCANICHE E DI TENSILI ALL'ACQUA

COMPRESIONE

Prova di compressione statica a temperatura ambiente (23 ± 2°C) su provini cilindrici di lunghezza di circa 25 mm, della larghezza di 30 mm e della spessore di 4 mm ± 0,2 mm.

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Water tightness (UNI EN 1928)

OMECO S.p.A.

REPORTO DI PROVA MECCANICHE E DI TENSILI ALL'ACQUA

COMPRESIONE

Prova di compressione statica a temperatura ambiente (23 ± 2°C) su provini cilindrici di lunghezza di circa 25 mm, della larghezza di 30 mm e della spessore di 4 mm ± 0,2 mm.

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Tear resistance (UNI EN 12310/1)

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REPORTO DI PROVA MECCANICHE E DI TENSILI ALL'ACQUA

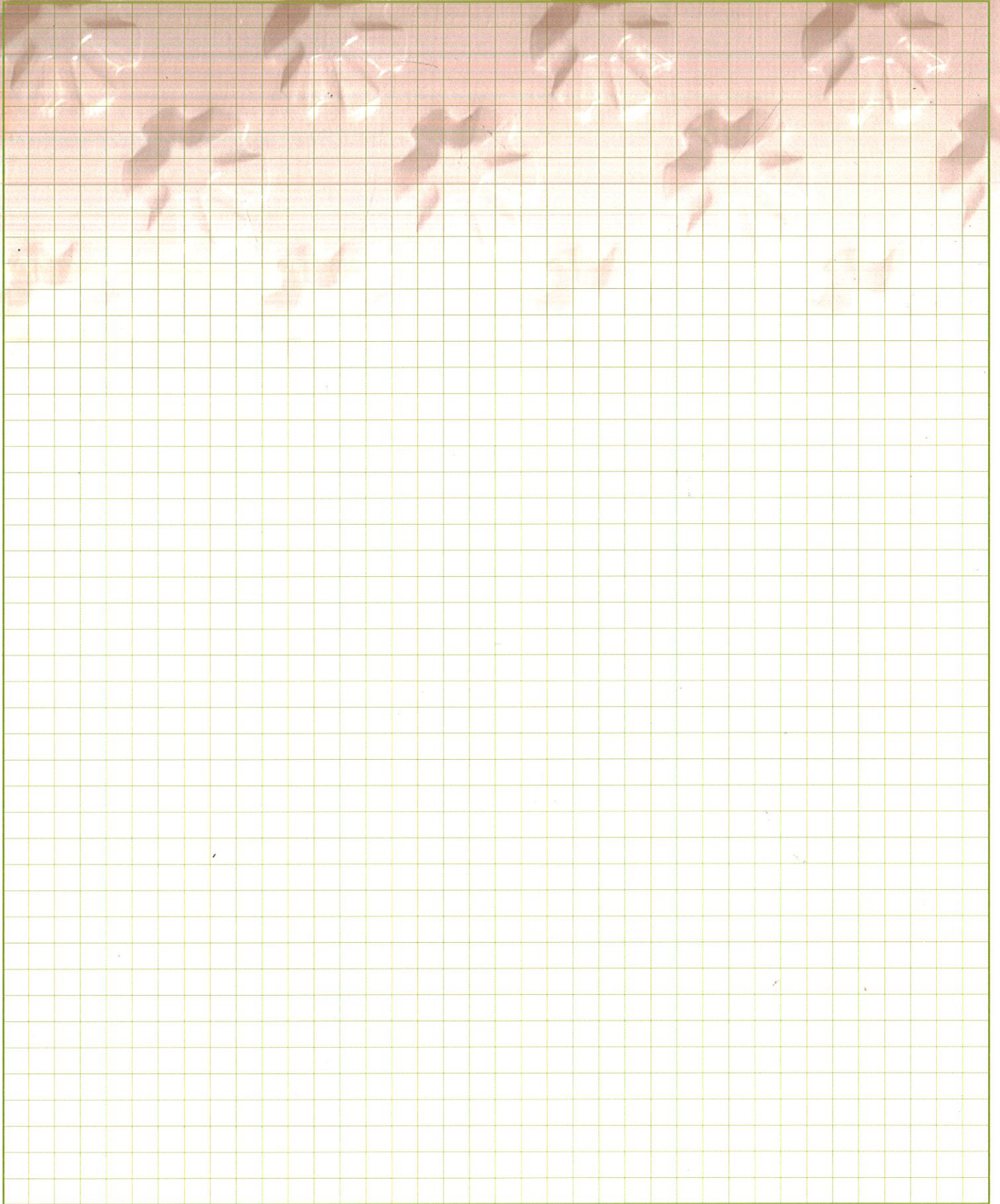
TENSILE

Prova di trazione statica a temperatura ambiente (23 ± 2°C) su provini a forma di doganella di lunghezza di circa 250 mm, della larghezza di 10 mm e della spessore di 4 mm ± 0,2 mm.

Prova	Dimensione media (mm)	Spessore (mm)	Altezza (mm)	Carica (N)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)	Carica (MPa)
1	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
2	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28
3	140	10	4,0	4,00	0,28	0,28	0,28	0,28	0,28

Tensile strength (UNI EN 12311/2)

notes



notes

A large grid of graph paper, consisting of approximately 25 columns and 45 rows of small squares, intended for taking notes. The grid is enclosed in a thin green border.

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