# GENERAL LAYING INSTRUCTIONS

# PRELIMINARY WORKS
# TECHNICAL DETAILS

novaglass®

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# INTRODUCTION

Considerıng its low cost in relation to the overall cost of the building, waterproofing is often not given its correct priority by the designers or planners.
This means that the unenviable responsibility of choosing the appropriate waterproofing system, the right package of materials applied to produce the finished result, is often delegated to the applicator.
Under this consideration, NOVAGLASS would like to offer assistance in solving problems which occur from the design phase onwards, bearing in mind that in order to do this, in-depth knowledge of the following is required:

- structures and supports;
- types of material used;
- application techniques;
- the finishing.

This section gives practical advice and suggestions concerning the above, taking into account the characteristics of NOVAGLASS waterproofing membranes, and referring to trials and tested application techniques.

## THE MEMBRANES PRODUCED BY NOVAGLASS®

The complete range of Novaglass products is listed in Section 2, and consists of two types:

- plastomeric
- elastomeric

For both types, reinforcements with non woven polyester, fibreglass, and/or combinations of the two are used.
Products intended for certain applications incorporate PE film, aluminium laminates, or fibreglass materials.
The external surface finishes are sanded, or have slate chippings which are available in a variety of colours.
All the products must pass stringent testing and quality control before leaving the factory.

**NOTE:**
Every membrane consists of an impermeable mass with a central reinforcement. The mass has thermoplastic characteristics which, whilst allowing ease of bonding by flame, make the product susceptible to deformation during the processes leading up to application. For this reason, between warehouse and site, it is advisable to take the following precautions:

- maintain the storage temperature between +5 and +30°C;
- avoid exposure to the sun or humidity;
- position the rolls vertically;
- unload and carry the rolls by hand on arrival at the site taking care not to damage them.

## CHOOSING THE RIGHT MATERIALS AND DETERMINING THE WATERPROOFING PACKAGE

Every example of waterproofing application is based around a «system» or a sequence of layers, the simplest of which consists of the substrate (supporting element) and the impermeable sheet (waterproofing element).
The «system» always depends on the type of structure to be waterproofed and its specific requirements.
In every case a system design must always take into account all the parameters which more or less directly affect the final result.
In particular, the following must be considered:

- The type, material and function of the supporting element.
- The possible use of a thermal insulation element, taking note of its characteristics and behaviour.
- The climate and/or enviromental conditions.
- The degree of slope.
- The wind.
- The geographic location, altitude, limits of rainfall and temperature range.
- The accessibility and trafficability of the site.

During the design stage, other parameters affecting the performance of the system should not be neglected. These are:

- The aesthetic.
- The durability of the materials used.
- The ease of maintenance.
- The comfort under the acoustic and hygrothermic profiles.
- The reaction to fire.
- The performance during possible ground movements (vibrations, etc.).

When these parameters have been established, the ideal materials can be chosen and the complete waterproofing package put together.

## PEOPLE INVOLVED

The people involved in drawing up the project as a whole are:

- the owner;
- the designer or architect;
- the builder;
- the material manufacturer and supplier;
- the applicator.

All these people must contribute, each within his own field, to the correct system design and selection of the necessary materials, thus ensuring compliance with all specification requirements.

## LAYING THE MEMBRANE

The application of the membrane must only be carried out during suitable weather conditions and after the support has been prepared as described below.
Provision should be made for the expansion joints according to the nature and dimensions of the structure; in these areas the membrane must be made independent of the support using the techniques in according to each case.
In all cases, it is always necessary to unroll the membrane on the support surface onto which will be its final position and then re-roll it ready for bonding.
This allows any possible defects in either the waterproofing sheet or the substrate to be spotted in time.
A check must be made to ensure that the correct, torchable side of the membrane is the one in contact with the support.
The torch flame must, for a brief moment, melt the membrane surface and reheat the substrate.
This brings the bituminous mass to its correct fluidity without damaging the components, and at the same time prepares (heats) the support which is then in the ideal condition to «receive» the bonding of the impermeable mass.
A useful indication of the right amount of heat is given by the colour of the torch flame.
When it changes from blue-yellow to red with the emission of smoke, this means that combustion has started, and deterioration of the membrane will follow.
This is when the heating of the membrane must stop.

Torch-on application of the membrane.
Detail showing the correct position
of the roll and the colour of the flame.

## JOINTING

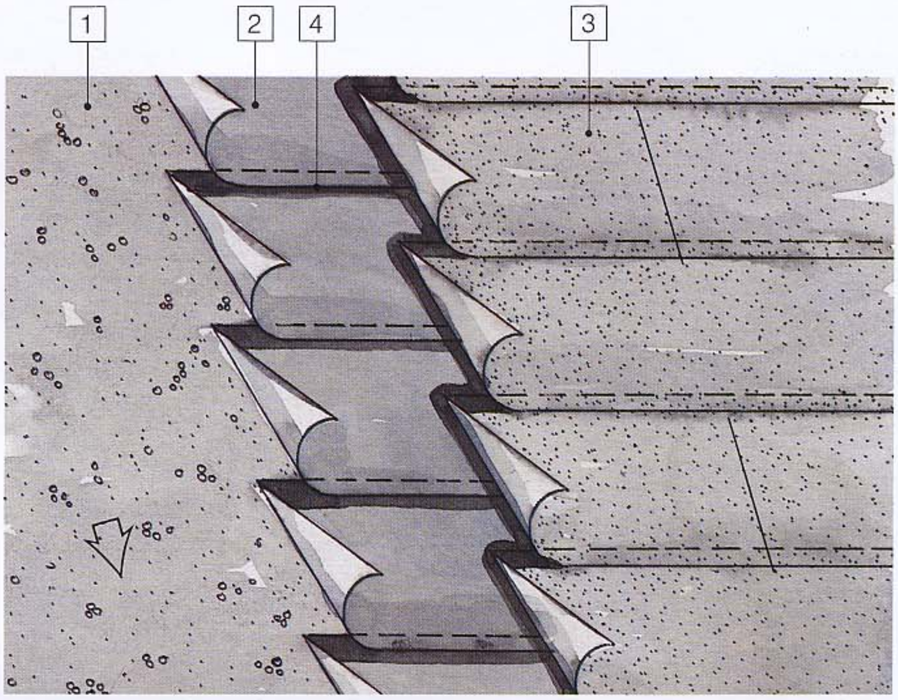
Jointing must be carried out by overlapping the edges (laid as «roofing tiles», in a way which allows the downflow of water) for at least 8 cm along the membrane length and 12 cm at the ends.
This operation must be carried out with care, using the torch as described. The operation is completed by gently pressing the edges so that some of the melted mass runs out. This can then be smoothed using a hot rounded trowel.

## LAYOUT OF THE SHEETS

If only a single layer is to be used, the above instructions apply. If two or more layers are required, the sheets must be arranged in staggered rows with the second sheets in the same directions.
With regard to the longitudinal layout, the sheets must run parallel to the supporting surface slope. The following diagrams show eyamples of sheet arrangements on a variety of supports with or without insulation.

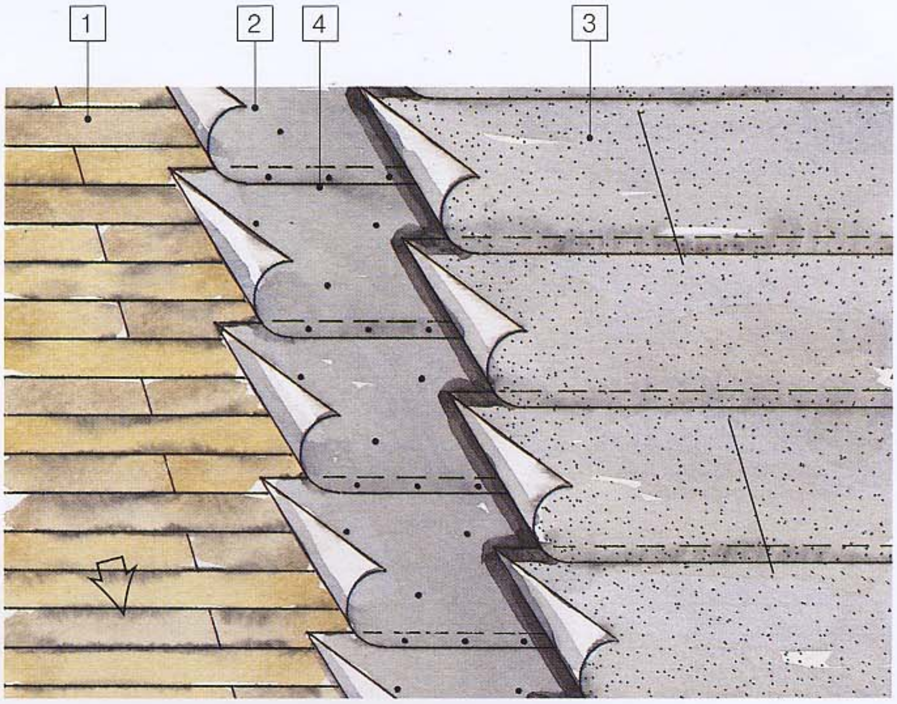
Jointing of the edge overlaps.

Sealing the overlaps using a rounded trowel.




MULTILAYERED WATERPROOFING ON CAST-CONCRETE SURFACE. SHEETS POSITIONED IN STAGGERED LAYOUT.

1 support
2 first layer
3 second layer
4 overlap



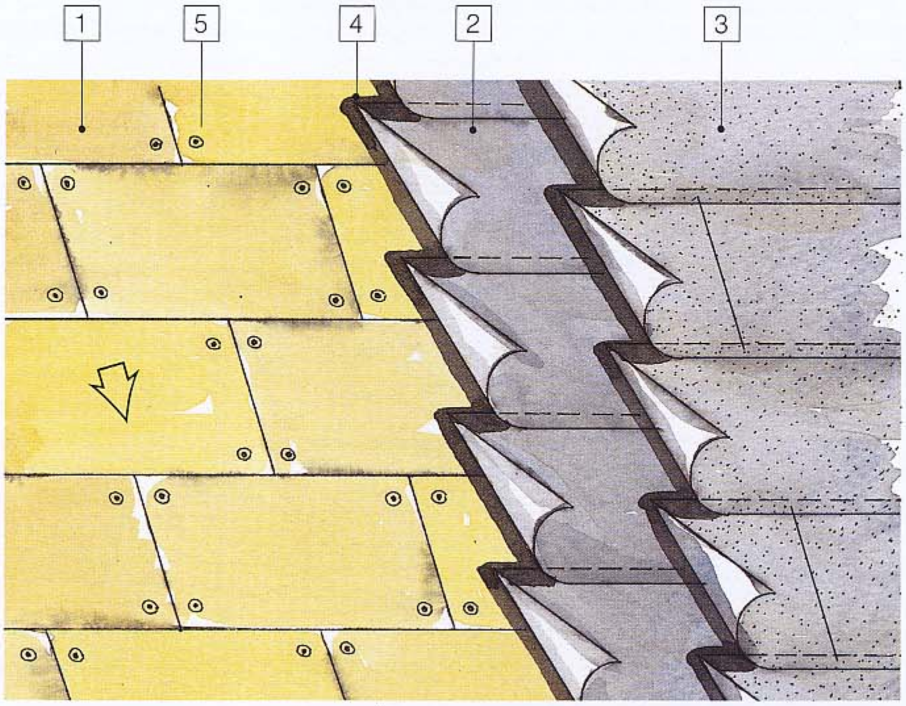

MULTILAYERED WATERPROOFING ON TIMBER SURFACE.

1 timber support
2 first layer
3 second layer
4 fastener

MULTILAYERED WATERPROOFING ON SURFACE WITH FIXED INSULATION LAYER.

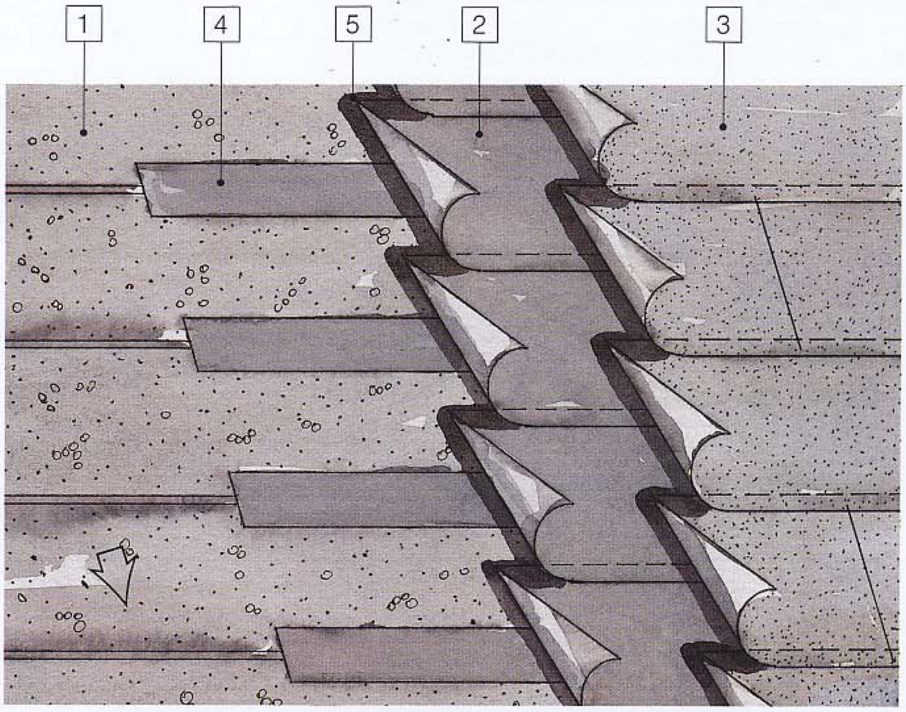
1 insulation panel
2 first layer
3 second layer
4 bonding by torch, or using hot oxidised bitumen
5 fasteners

Any waterproofing system on insulation board (anyhow fixed) shound always foresee the application of two layers.




MULTILAYERED WATERPROOFING ON PREFABRICATED, REINFORCED CONCRETE TILES.

1 prefabricated support
2 first layer
3 second layer
4 strip of membrane bonded along one edge only
5 torch-on bonding




## FASTENERS

Mechanical fasteners are necessary in situations where the use of partial bonding alone cannot guarantee the security of the membrane. These can be either nails or strips of rust-proof metal. The layout and distribution must be carried out uniformly across the overlap areas of the sheets. The number of nails depends on the type of support, the type of membrane, and environmental conditions. It can vary from a minimum of 2 to a maximum of 4/m² for traditional supports, increased for corrugated metal roofing. It should be reminded that nails and metal strips must always be covered with further layers or strips of membrane which can be fully bonded to the former.

## MEMBRANE LAYING TECHNIQUES

The technique used to position prefabricated membranes is an important factor on which depends the performance of the entire system. The choice of technique depends on the type of support, the degree of slope, the possible use of heavy protective layers, and on the general make-up of the roofing system. It must be reminded that there is a close interaction between the membrane and the substrate which, being made of other types of material, react differently to applied stresses. In particular, extension, shrinkage and elastic deformation; also flaws in the support can be partly or wholly passed on. For this reason, whenever allowed by the gradient and by the other conditions, it is advisable to apply the membrane partially bonded to the support by regular points. Depending on the situation, the membrane can be applied:

- non-bonded
- semi-bonded
- fully-bonded

In each of these cases, the type of application always refers to the first sheet; in multilayered waterproofing, the subsequent layers are always applied fully-bonded.

### NON-BONDING

Non-bonded laying, which always requires the use of heavy protective layers, can be used on surfaces with a maximum slope of 5% (approx. 3°). The work is carried out by simply laying the membrane over the surface and torch-bonding the sheet overlaps.
The sheets must, however, be attached to the support along its perimeter and to the vertical areas where it should be fully-bonded by torch.

### SEMI-BONDING

Semi-bonding can be used on slopes not exceeding 40% (22°) for concrete surfaces, and not greater than 20% (12°) for supports with thermal insulation covering. This type of application consists of bonding the membrane to the substrate only at certain points, or along staggered strips.
This technique is normally used to allow a continuous pocket between the substrate and the membrane, thus permitting the circulation or evacuation of the gases and air leaked through from the substrate. This way, the localized formation of blisters can be avoided. The number of anchoring points or strips used depends on the type of support and also the type of membrane. In all cases, the area bonded should never be less than 50% of the total membrane area.
To preserve the reliability of the head-joints,it is imperative the application of the membrane in complete adherence on the support at least 1 mt. from the same joints on both sides.
In the case of precast concrete, a torched-on covering strip 20-30 cm wide spanning the gap between supporting elements should be fixed (torched-on) to only one of the elements.
On supports of sheet insulation, two methods can be used:

- semi-bonding 50% of an initial layer of light fibreglass-reinforced membrane, followed by the full bonding of a second membrane to the first;
- semi-bonding 50% of a layer of bituminized fibreglass, followed by fully-bonding a membrane to this initial layer.

In any case,the whole system has to be applied in complete adherence on perimetrical and vertical areas.

### FULL-BONDING

Full-bonding must be carried out on in-situ concrete surfaces with slopes greater than 40% (approx. 22). It provides for the full bonding of the membrane to the support by following the instructions for semi-bonded laying.
To ensure strong adhesion of the top edges of the membrane to vertical or steeply inclined surfaces, it is advisable to use mechanical fasteners such as flashings. In these cases it is better not to use membranes with fibreglass reinforcement as this does not have sufficient extension in the event of the support breaking.
In the case of substrates covered with a layer of thermal insulation, the techniques described above for semi-bonding apply, with the difference that the first membrane or bituminized fibreglass must be completely bonded. For slopes greater than 20% (approx. 12°), mechanical fasteners must also be used.

## VAPOUR BARRIER

A vapour barrier is a layer of material impermeable to water vapour which prevents the migration of vapour (coming from both the structural materials and the rooms or spaces below) through the insulation where it could condense, spoiling the thermal characteristics and in many cases giving rise to deterioration.
The use of the vapour barrier is always advisable when thermal insulation on a roof is required. The choice of the type of material must be made according to the type of support and the hygrothermic conditions and the insulation chosen.
When the underlying relative humidity exceeds 80% at 20°C, the use of a product with zero permeability to vapour is suggested.
3 mm - thick NOVALL-I is the membrane which fulfils this requirement, as it is reinforced with a sheet of aluminium 0.07 mm thick coupled with 50 gr/m$^2$ fibreglass.
With lower relative humidity, a fibreglass-reinforced membrane such as 3 mm - thick NOVAGLASS® is sufficient. The choice of application method depends on the type of support and should be either non-bonded or semi-bonded.

## THERMAL INSULATION

Thermal insulation in this contest refers to products which have a thermal conductivity coefficient (  value)  0.1Kcal/mh °C.
As well as thermal characteristics, the insulation material must be resistant to ageing, pressure, and fire, and must show dimensional stability. The types available are either organic or inorganic. the inorganic varieties have a higher stability, but are less effective as insulation than the organic ones (see table).
The right thickness is calculated according to the type of insulation used and the thermal conditions needed to be maintained in the enclosed rooms or spaces.
The insulation material is normally used in the form of prefabricated panels, mainly to allow ease of application of the layers, using hot oxidised bitumen as an adhesive.
The insulation should be arranged in staggered rows; when the thickness exceeds 4 cm, it is advisable to carry out the insulation in double layers taking care to position the upper layer offset to the first. The two layers must then be bonded using hot bitumen.
When the conditions require a bonding strength greater than the one offered by the oxidized bitumen, mechanical fastening can be used.

## COMPARISON OF CHARACTERISTICS OF VARIOUS INSULATION MATERIALS

| PRODUCT TYPE | Density kg/mc | Coefficient of Thermal Conductivity | | Max Operating Temperature | Linear Contraction due to Decrease in Temper.: mm/m | | Linear Dilation due to Change of Ambient RH 5 to 95% mm/m | Resistance to Diffusion of $H_2O$ $\mu$ (13) | Vapour Barrier Required |
|---|---|---|---|---|---|---|---|---|---|
| | | at Temp. = 20°C | DIN Standards | | Thermal Jump 30°C | Thermal Jump 50°C | | | |
| **– EXPANDED POLYMERS** | | | | | | | | | |
| Exp. Polyurethane with R11 | 25 ÷ 100 | 0.016 ÷ 0.022 | 0.075 | 100 | 5.12 (8) | 9.42 (8) | 4.2 (8) | 40 ÷ 120 (9) | YES |
| Expanded Polystyrene | 15 ÷ 40 | 0.027 ÷ 0.033 | 0.035 | 75 | 1.67 (5) | 3.25 (5) | 0.04 (5) | 30 ÷ 70 | YES |
| Extruded Polystyrene | 28 ÷ 35 | 0.026 ÷ 0.029 | 0.035 | 75 | 2.46 (4) | 5.17 (4) | 0.04 (4) | 150 ÷ 250 | YES |
| Expanded Polyvinyl Resins | 25 ÷ 40 | 0.029 ÷ 0.032 | 0.035 | 55 | – | – | – | 100 ÷ 200 | YES |
| Exp. Phenol-Formaldehyde Resins | 30 ÷ 35 | 0.029 ÷ 0.030 | 0.035 | 150 | 0.98 (7) | 2.13 (7) | 9.6 (7) | 8 ÷ 20 | YES |
| **– EXPANDED MINERALS:** | | | | | | | | | |
| Cellular Glass | 144 | 0.048 | varies | 430 | – | 0.42 | – | ~ ∞ | NO |
| Loose Vermiculite | 60 ÷ 120 | 0.035 ÷ 0.040 | varies | 1,000 | – | – | – | ~ 1 | YES |
| Conglomerated Vermiculite | 250 ÷ 500 | 0.073 ÷ 0.100 | varies | 1,000 | – | – | – | ~ 1 | YES |
| Loose Perlite | 80 ÷ 180 | 0.034 ÷ 0.053 | varies | 1,000 | – | – | – | ~ 1 | YES |
| Conglomerated Perlite (10) | 160 ÷ 180 | 0.045 ÷ 0.065 | varies | 175 | 0.27 (3) | 0.53 (3) | 4.4 (3) | 4.5 | YES |
| Conglomerated Pomice | 600 ÷ 1300 | 0.090 ÷ 0.400 | varies | 450 | – | – | – | 2 ÷ 8 (11) | YES |
| Cellular Cement | 200 ÷ 1200 | 0.048 ÷ 0.300 | varies | 400 | – | – | – | 2 ÷ 10 (11) | YES |
| **– FIBROUS PRODUCTS** | | | | | | | | | |
| Rock Wool | 50 ÷ 120 | 0.029 ÷ 0.034 | 0.035 | 700 | 0.23 (2) | 0.56 (2) | 0.23 (2) | ~ 2 | YES |
| Glass Fibres | 10 ÷ 110 | 0.023 ÷ 0.029 | 0.035 | 500 (1) | 0.23 (2) | 0.56 (2) | 0.23 (2) | ~ 2 | YES |
| Asbestos Fibres | 150 ÷ 180 | 0.045 | 0.06 | 600 | – | – | – | ~ 1 | YES |
| **– OTHER PRODUCTS** | | | | | | | | | |
| Agglomerates of wood fibres | 230 ÷ 240 | 0.050 ÷ 0.055 | 0.04 ÷ 0.08 | 100 | – | – | 1.5 | 5 | YES |
| Magnesium Products (12) | 175 ÷ 200 | 0.046 ÷ 0.064 | varies | 350 | – | – | – | ~ 1 (11) | YES |
| Cork | 60 ÷ 270 | 0.033 ÷ 0.048 | 0.035 ÷ 0.04 | 100 | 2.52 (6) | 4.78 (6) | 6.7 (6) | 2 ÷ 40 | YES |

(1) - 250°C for resin products
(2) - density 100 kg/m³
(3) - density 180 kg/m³
(4) - density 30 kg/m³
(5) - density 25 kg/m³
(6) - density 80 kg/m³
(7) - density 30 kg/m³
(8) - density 32 kg/m³
(9) - without protective layer
(10) - conglomerate of expanded perlite, mineral fibres and asphalt binding
(11) - strongly hygroscopic materials unsuitable for low temperatures
(12) - with a base of Mg O
(13) - $\mu$ = factor of resistance to the diffusion of water vapour. It represents the relationship between the resistance to diffusion of vapour across the layer of material under test and the resistance of the diffusion of the same vapour across a layer of air of equal thickness. The air has a factor of resistance to diffusion $\mu = 1$.. This factor is therefore adimensional.