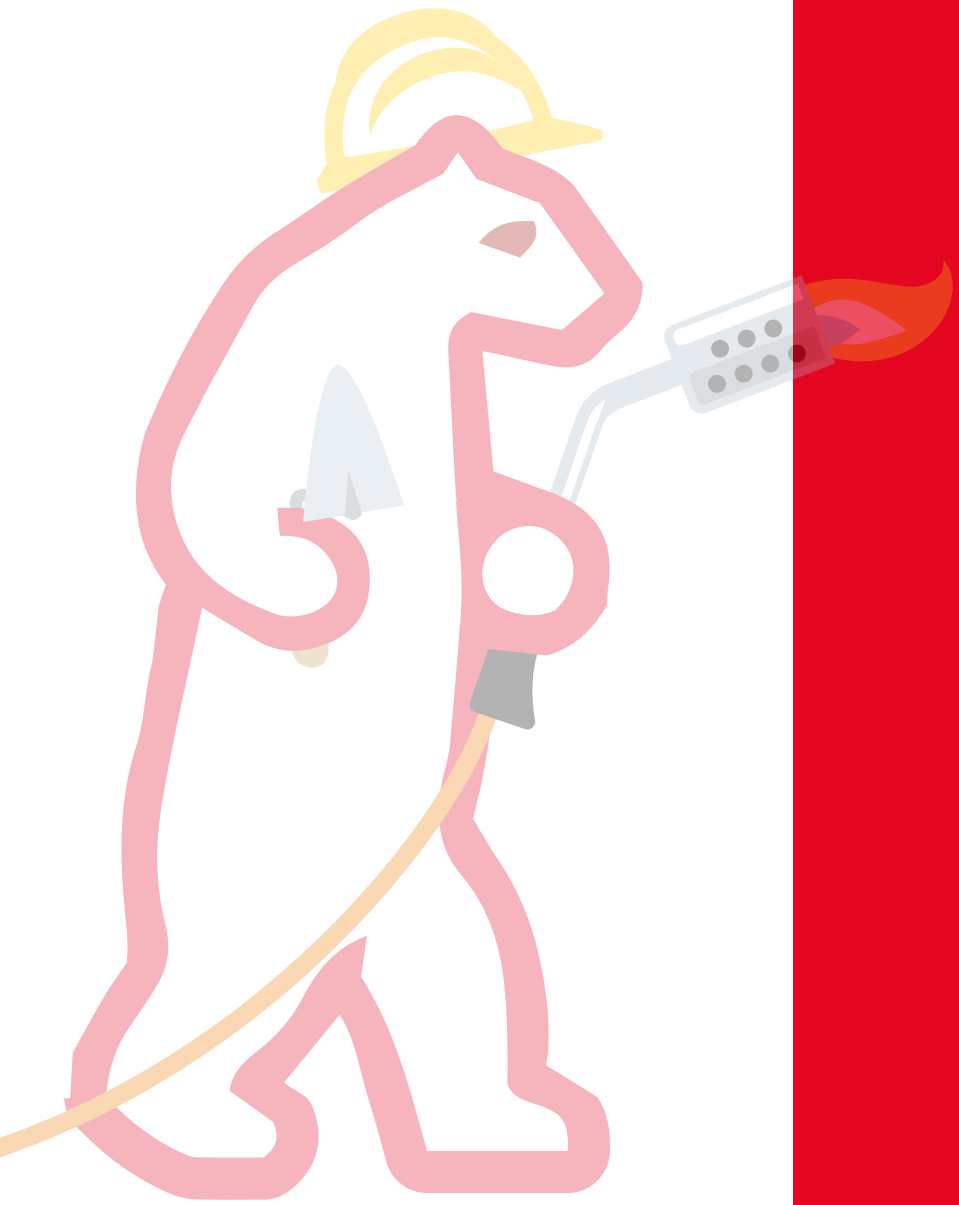
Nord Bitumi
SINCE 1967

INSTALLATION MANUAL

Distilled bitumen-polymer membrane application



Nord Bitumi
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The **installation manual** is an executive tool that takes full advantage of the skills acquired by a team of waterproofing professionals. Technicians, installers and designers have worked together to draft this complete and thorough document.

By following all the instructions provided hereto step by step, the installer can accurately install a polymer-bitumen membrane. This will guarantee the durability intrinsic to bituminous products when supported by technical aspects, qualified personnel and, obviously “text-book” installation.

Happy reading.

The Engineering Department

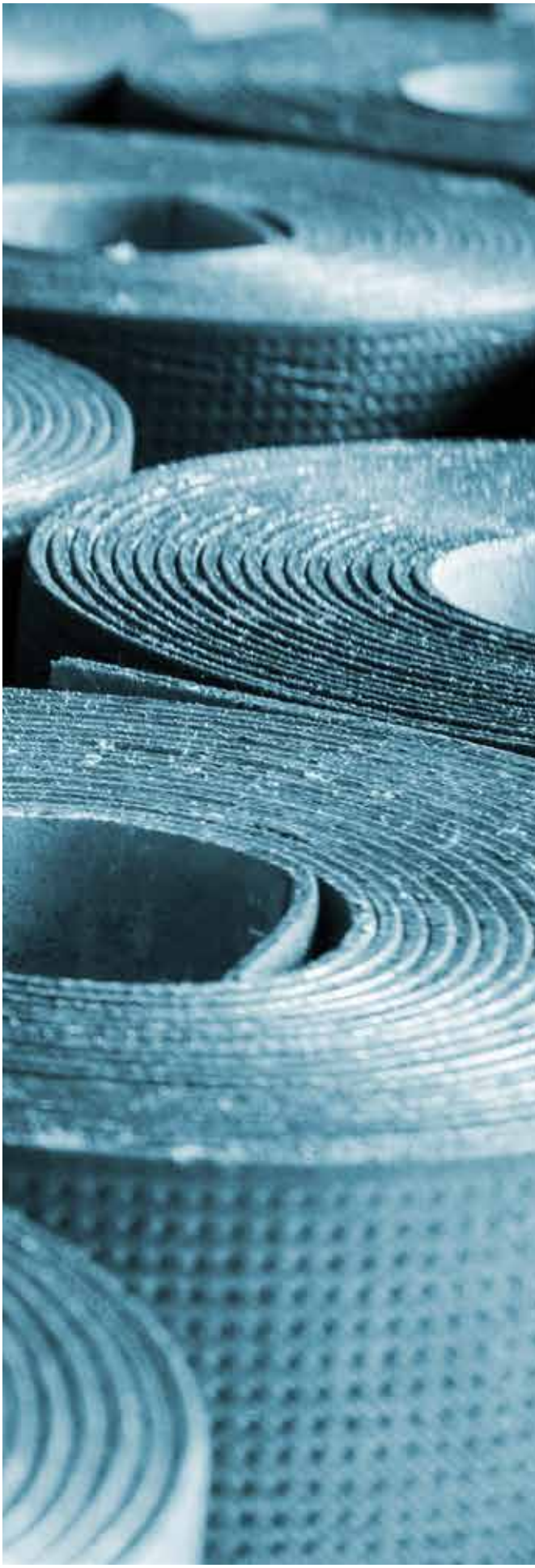
GENERAL **NOTES**

INSTALLATION **SEQUENCES**

FINISHES

DETAILS

APPENDIX OF DETAILS



THE ROOF

KEY CONCEPTS

The considerations necessary to formulate the best technological solution for a waterproof surface are:

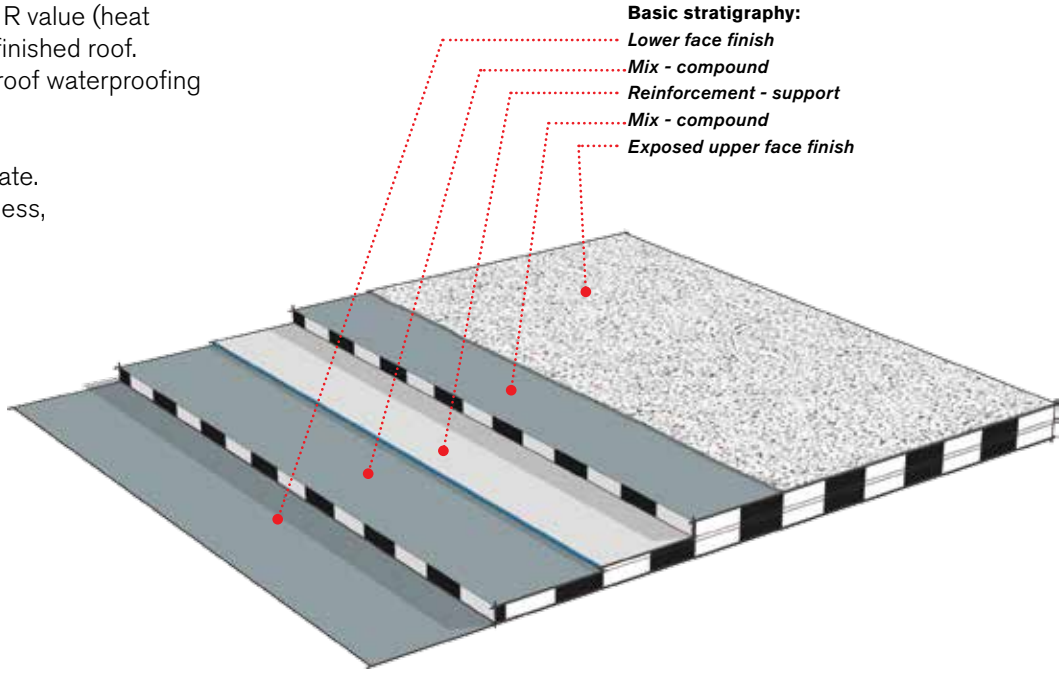
1. Distilled polymer-bitumen membrane technical-performance characteristics to be adopted (dimensional stability, tensile strength, tear resistance, heat stability, puncture resistance, etc.). Not all distilled polymer-bitumen membranes are suited to be used with the various installation methods: each compound and reinforcement behaves differently requiring careful system design.
2. Insulation panel technical-performance characteristics to be used (dimensional stability, compression resistance, heat stability, physical and chemical compatibility with the waterproof membranes, etc.).
3. Type of heat insulation installation, if included (warm roof, inverted roof, cold roof, double roof, etc.).
4. Conditions of the eventual heat insulation on the roof, with indication of the K value (heat transmission coefficient) or R value (heat resistance) required of the finished roof.
5. Protection required for the roof waterproofing element.
6. Roof slope.
7. Physical structure of substrate.
8. Wind exposure (area windiness, building height, etc.).
9. Use of roof.

THE DISTILLED POLYMER-BITUMEN MEMBRANE

The distilled polymer-bitumen membrane is a compound material created from the synergy of the two components:

- bituminous compound, based on modified bitumen with thermoplastic polymers (compound);
- support, fibre component of various nature (reinforcement).

The two constituent elements mutually integrate, exalting their individual qualities.
The bituminous compound guarantees waterproofness and durability while the reinforcement grants the product, according to the type, mechanical properties, a better load distribution and dimensional stability.
The main compound components are bitumen and the polymers that are added to improve the physical and mechanical properties, otherwise limited, in the bitumen.
Distilled polymer-bitumen membranes do not contain oxidised bitumen, halides, asbestos, etc.



ROOF CLASSIFICATION

These types of waterproofing systems are generally classified in roofs:

- Non-insulated roof
- Warm roof (the insulation is under the waterproofing)
- Inverted roof (the insulation is over the waterproofing)
- Double roof (warm roof + inverted roof).

Non-insulated roof

No insulation element is included in this type of solution. This solution is subject to large heat dispersions and is generally adopted in parking lots or unheated buildings. Non-insulated supports are more stressed by temperature changes than insulated systems.

Warm roof

In this type of solution, the insulation is located between the substrate and the waterproofing. This is the most frequent waterproofing system solution. Generally, a vapour shield or vapour barrier is applied on the substrate to protect the insulation from water vapour that migrates from the heated internal environment. This way the surface substrate and insulation are protected against temperature changes and the waterproofing surface is exposed to the elements, UV rays and temperature changes. Where necessary, the effects of this stress can be reduced with heavy or light protections.

Mobile heavy protections

- Gravel
- Supported floating floors
- Self-locking blocks on fine sand

Fixed heavy protections

- Cement mortar screed
- Cultivated land on drainage elements
- Tiled floor on mortar, etc.

Light protections

- Self-protected membranes with mineral slates
- Surface painting with acrylic, aluminium or polyurethane reflective paints, etc.

Inverted roof

In the “inverted roof” solution, the insulation is located over the waterproofing. The waterproof membrane applied to the substrate has a dual vapour shield and waterproofing layer function.

In this case, the substrate and waterproofing layer are protected against heat stress and UV rays thanks to the insulation and ballast layer.

The latter blocks the insulation, preventing it from being lifted by wind.

The most popular insulation used in inverted roofs is extruded polystyrene (XPS).

The insulation must have particular characteristics such as:

- the lack of water absorption;
- heat resistance;
- resistance to freezing & thaw cycles and aggressive acid rain.

When calculating heat dispersion, the thickness of the insulation should be increased by about 10%, given the water entirely surrounding the panels. We recommend installing a geo-textile between the waterproofing layer and insulation panel to promote water drainage and flow towards drains. Furthermore, to avoid lime and gravel accumulations between and under the panels, we recommend installing a divider geo-textile between the insulation and ballast.

A 4% slope is required in inverted roofs since any water stagnation would increase heat dispersion. In inverted roof systems, the ballast should be calculated according to the wind extraction effect.

Gravel ballast:

- material must be mined and not milled, cleaned and sized between 12 and 35 mm;
- the gravel ballast must always be laid after interposing a suitable dividing and/or filter layers;
- in independently applied systems, minimum gravel layer thickness and weight must be calculated according to the following table (Tab. 01).

Tab. 01

Minimum gravel layer thickness and weight calculation

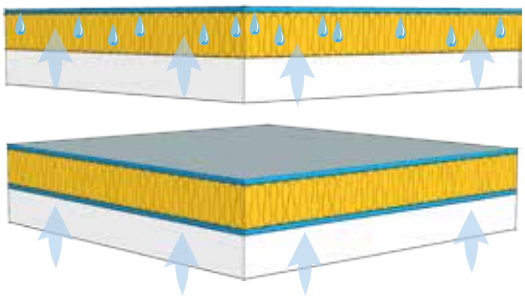
XPS extruded polystyrene foam panel thickness	Minimum gravel thickness required for the ballast	Minimum theoretic weight in gravel or pellets
Up to 30 mm	40 mm	65 Kg/m²
From 40 to 50 mm	50 mm	75 Kg/m²
From 60 to 70 mm	60 mm	90 Kg/m²
Up to 80 mm	70 mm	105 Kg/m²
Up to 90 mm	80 mm	120 Kg/m²
Up to 100 mm	85 mm	128 Kg/m²

Double roof

In the "double roof" solution, the insulation is located both over and under the waterproofing, thus offering effective protection able to reduce working temperature and thus ageing and consequent membrane hardening. The result is translated into a reduction in temperature changes effecting the structure, with less stress to the waterproofing membrane.
This type of roof can be considered one of the best possible on flat roofs, grouping all the advantages of a warm roof (heat-hygrometric control) and inverted roof (waterproofing element protection against UV rays and temperature changes); the DOUBLE roof is the PERFECT roof.
The most popular insulation used in duo roofs (inverted roof part) is extruded polystyrene (XPS).

THE VAPOUR BARRIER

The purpose of the vapour barrier is to block water vapour: its presence impedes condensation under the waterproofing layer.
At certain temperatures, air may contain high levels of vapour. The hotter the air, the more vapour it can contain. Water vapour produced in rooms migrates from the heated indoors towards the cold outdoors.



When vapour meets a cold area, reaching the dew point, it condenses into water. For this reason, some damages may occur such as stains, mould and, above all, a reduction in the insulation heat resistance. Indeed, wet insulation loses its characteristics, especially if sensitive to water.
The vapour barrier must thus be located under the insulation, on the warm side, to block water vapour before it reaches a cold zone and condenses.
The correct application of the vapour barrier is of key importance; many problems may occur if the overlaps are incorrect or if there are perforations, holes and tears.
For practical purposes and for normal working conditions, a vapour barrier is considered appropriate when the μ x thickness value (expressed in m) is ≥ 100 (equivalent to a vapour transmission resistance value equal to 100 m of air), where μ is the vapour barrier material's water vapour diffusion resistance coefficient.
The specifications and application standards must always be followed when applied.
The need to create the vapour barrier must be assessed for each single case by analysing the temperature and humidity.

THERMAL INSULATION

On the overall surface, the purpose of thermal insulation is to reduce heat transmission from the inside to the outside of the building.
The choice of insulation material should take its low heat conductivity into account.
Insulation materials are marked by the heat conductivity value λ = (W/mK); the lower this value is, the better the insulation's insulating capacity.
All materials are consequently insulating, but a product is considered insulating when its λ coefficient is under 0.07 W/mK.
To characterise the incidence of a layer (insulating or other) compared to heat flow, it is described as heat resistance, considering R (m² K/W).

$$R = \frac{d}{\lambda}$$

d = layer thickness
λ = heat conductivity coefficient (W/mK)

The higher the heat resistance, the better the insulation material's heat insulation.

INSULATION MATERIALS

When choosing the roof system insulation, a series of performances must be taken into account according to the result to be obtained: insulation quality, chosen roof system composition, costs, mechanical properties, etc. The thickness of the insulation needed to obtain the results is a function of:

- Set R heat resistance
- U heat transfer set by the wall.

For convenience, some values are provided as examples (Tab. 02)

Tab. 02 - U heat transfer

Material	Values λ (W/mK)	
MW rock wool	from 0,032	to 0,041
EPS polystyrene foam	from 0,033	to 0,040
CG cellular glass	from 0,040	to 0,048
XPS extruded polystyrene	from 0,027	to 0,034
PUR polyurethane	from 0,024	to 0,029
PF phenol foam	from 0,020	to 0,025
EPB perlite foam	from 0,052	to 0,055

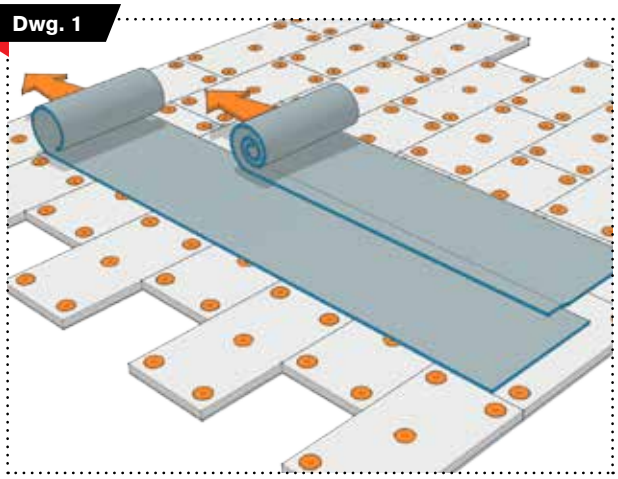
INSULATION APPLICATION

A series of factors must be taken into account when choosing the fasteners for the insulation application of the roof system:

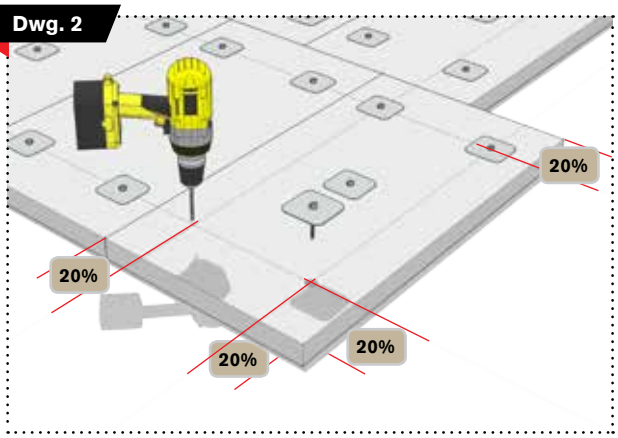
- insulation type (stability, compression characteristics, etc.);
- compatibility between the fasteners, insulation and waterproofing layer;
- stress exerted by wind;
- nature of the support.

Where mechanical fastening application is needed, panels must be staggered **(Dwg. 1)** and secured to the underlying vapour barrier, with fasteners appropriate for the substrate and of the necessary length according to thickness, placed at 20% intersection between insulation panel width and length **(Dwg. 2)**.
Overall panel fastening element resistance, at wind extraction load (Wh), should meet local requirements *"Criteria for continuous roof wind resistance design"*.
It is best to follow the manufacturer's instructions and any standard specifications when applying the insulation **(Dwg. 3)**.

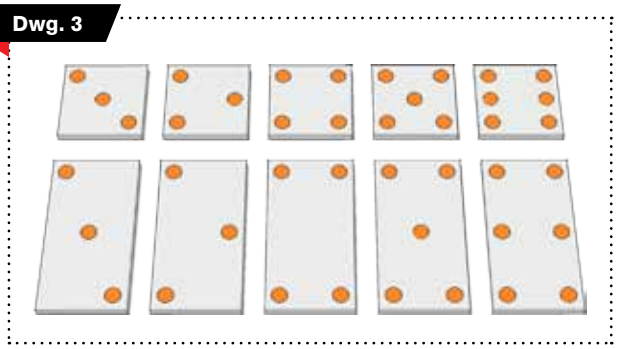
Dwg. 1



Dwg. 2



Dwg. 3



SLOPES

Slope means the slant of the support compared to the normal surface to the force of gravity.

Flat roof or sub horizontal
Slope < 5%

Do not let slopes drop under 1.5%. Should, for design, architectural or other reasons, slopes be under 1.5%, the following problems may arise:

- water stagnation on the surface;
- potential ice formation;
- formation of wet-dry areas, with the possible accumulation of organic and inorganic chemical substances, even aggressive;
- creation of environments that promote the growth of mould, bacteria and micro-organisms;
- deterioration of pavements made on cement mortar beds, due to frozen stagnant water.

Slanted roof
Slope > 5% and < 50%

This type of support is suited to convey water towards drains.

Highly slanted roof
Slope > 50% and ≤ vertical

This type of support is suited to convey water towards drains.

Curved roof

A curved base support is that support with a slope suited to convey water towards drains, in every area of the concerned surface, with simple or double curve, concave or convex.

DRAINING

The entire surface is divided into draining areas that correspond to a drain, and is divided by ridge lines.
The maximum surface of each drain area must be 100 -150 m^2.
As a safety measure in the event of clogged drains, we recommend overflow holes be installed midway between the highest point of the slope and the drains.
A simple empirical formula can be used to define the drain outlet diameter: the value of the drain diameter in cm, squared, can drain a m^2 surface of the same numeric value.
Therefore the drain diameter according to the drain area can be simplified as follows:

- a drain outlet with diameter 10 cm (10^2 =100) can easily drain a surface ≤ a 100 m^2;
- an outlet with diameter 12 cm (12^2 = 144) can drain a surface ≤ a 144 m^2;
- an outlet with diameter 15 cm (15^2= 225) can drain a surface ≤ a 225 m^2.

The choice of this calculation system, simplified and prudent, does not exempt the designer from verifying the tables and comparing results.

SURFACE WIND EXPOSURE

Wind is generally overlooked but may cause even serious problems.
In fact, the importance of wind is not assessed on normal values, but on exceptional ones.
A good roof includes a technical solution attentive to this problem (ballast, fully bonded systems, etc.).
Specifically, wind speed depends on the situation and geographic location, but also on the shape of the building that can condition wind effects.
Wind pressure exerted on a building are normally classified by local authorities (general criteria for building load and overload safety tests).
Furthermore, local norms or standards, may be in effect.

Wind speed mainly depends on the geographic location.
Wind is stronger on the coast, while buildings located near agglomerates (cities, etc.) are subject to lower wind speeds.
Thus four geographic classes have been identified to calculate wind stress of surfaces:

A. Coast
B. Urban Area
C. City
D. Rural Area

The key aspects to be considered are:
building height, shape and position compared to adjacent buildings.
The surface areas most exposed wind depression effects are the edges and corners, where a higher depressive effect is created mainly due to the vortex that is created when wind meets an obstacle (perimeter walls, protruding elements).
The higher the perimeter wall, the greater the negative depression effect.
Thus the wind effect on a surface can cause:

- membrane detachment from raised elements and formation of folds on the same, with consequent opening of the joints and loss of waterproofness;
- the membrane detached from the substrate is subject to shrinking;
- abnormal structure movements and vibrations;
- the roof could be ripped off by wind once the waterproofing system has unglued from the substrate.

Thus, to improve surface wind resistance in the areas more at risk, the following solutions must be considered in design:

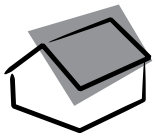
- fully bonded system,
- potential mechanical fastening,
- surface ballast,
- mechanical perimeter fastening or perimeter ballast.

Quick calculation of the wind depression effect.
The wind depression effect on roofs is normally calculated with formula

$$P = C \frac{V^2}{64} \text{ (Kg/m}^2\text{)}$$

where:
P = pressure expressed in Kg/m^2
V = wind speed in knots
C = variable coefficient, according to the surface shape and location, from –1 to +1.
With 54 knot wind and C=1, depression is p= 46 Kg/m^2

SURFACE USE



Non-walkable surfaces
This type of surface is only accessible for surface maintenance or to maintain any systems installed on it.

Walkable surfaces
Walkable surfaces, like attics, terraces, etc., are accessible to people. The upper layer will be made up of cement and/or pavement slabs (ceramic, tile, etc.) or floating prefabricated cement floor panels.

Road surfaces
These surfaces are accessible to vehicle transit and parking. The upper layer can be made up of reinforced concrete slabs and/or a bitumen compound wear layer or cement with mineral powder additives, tiles, floating road pavement.

Garden surfaces
Also called a green roof, these are ideal solutions for terraces, flower boxes & beds, etc. Normally for this type of roof solution, an anti-root waterproofing membrane is used together with a draining layer, soil or special water retaining/flow system.

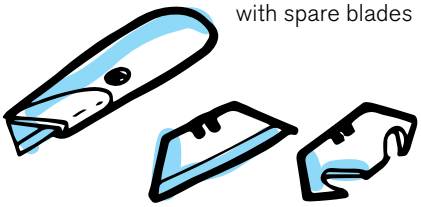
SUBSTRATES

Monolithic substrates
A monolithic substrate is a support with a continuous solution not due to structural needs (expansion joints, etc.). Monolithic substrates are:

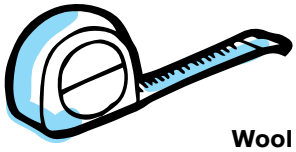
- reinforced concrete,
- cement brick,
- prefabricated reinforced concrete elements with EPS + structural screed,
- juxtaposed prefabricated reinforced concrete elements + structural screed,
- corrugated sheets + structural screed.

Segmented substrates
Segmented substrates lack continuity and are generally made up of prefabricated reinforced concrete elements (reinforced or pre-compressed reinforced), simply juxtaposed, perhaps equipped with their own slope, corrugated and/or composite sheets, wooden boards.

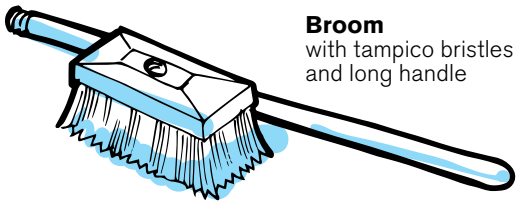
GEAR AND CLOTHING



Cutter
with spare blades

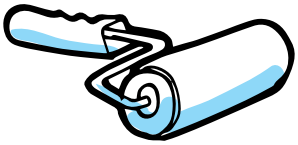


Roll-up tape measure

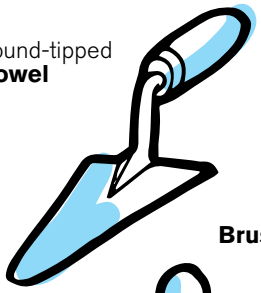


Broom
with tampico bristles and long handle

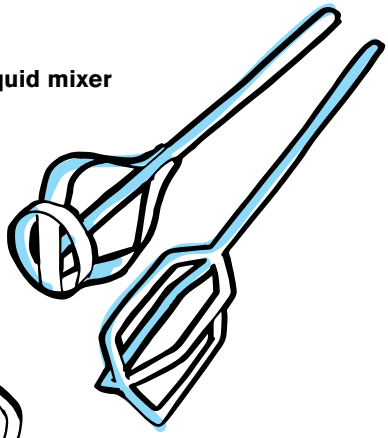
Wool roller



Roller
for selvedge



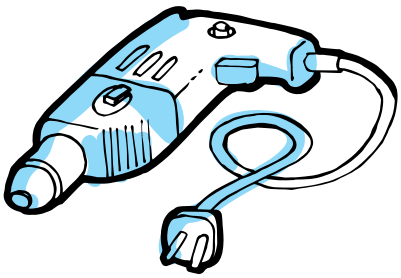
Round-tipped **trowel**



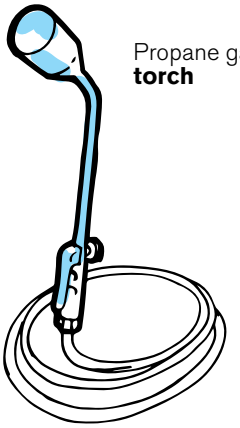
Liquid mixer

Brush

Drill

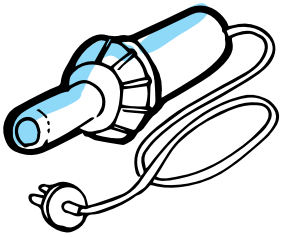


Overlap torch
to seal joints

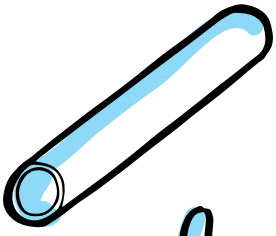


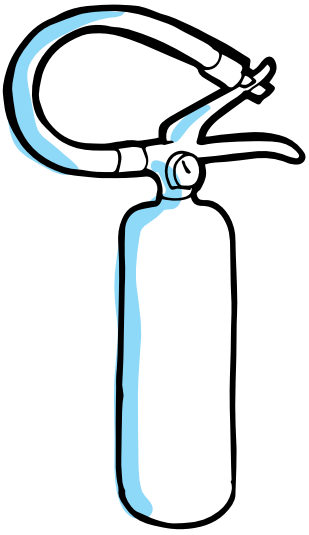
Propane gas **torch**

Hot air **welder**

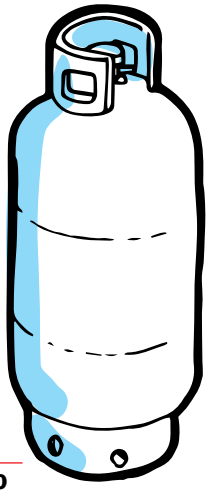


Anti-deformation tube size 96 cm

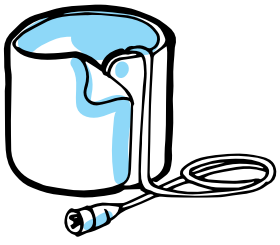




Propane gas **tank**



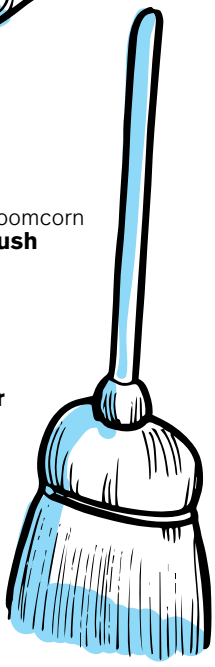
Heating band
for gas tanks



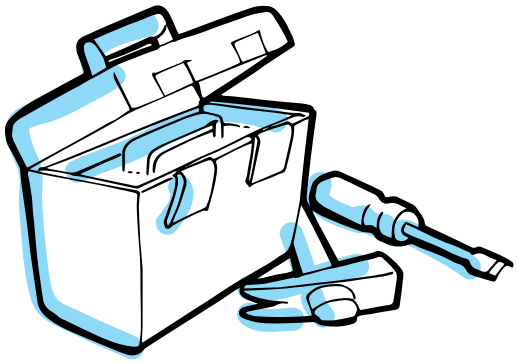
Fire extinguisher

Press roller
with long handle

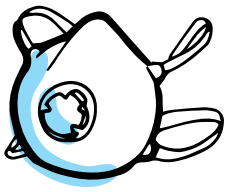
Broomcorn **brush**



Toolkit

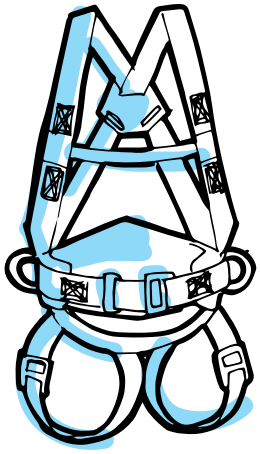


Protective mask



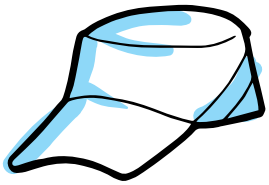
Work gloves

Safety
harness

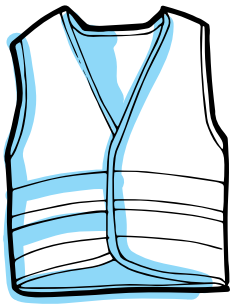


Collision
helmet

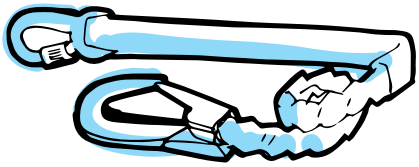
Sun
cap



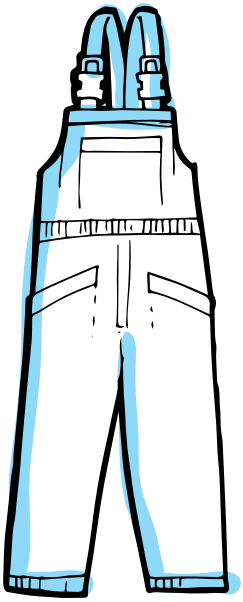
High visibility
vest



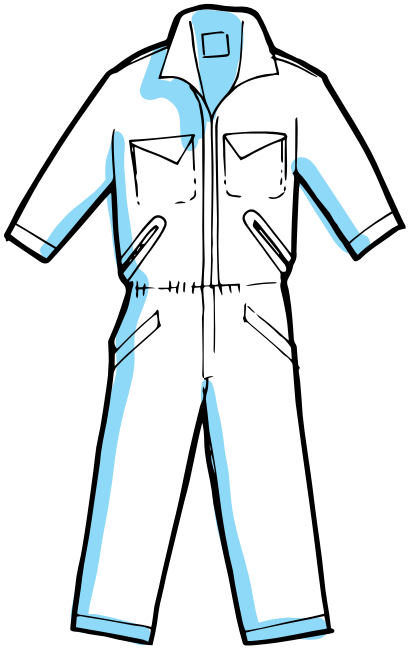
Safety
hook



Overalls
with bib



Work overalls
with pockets and reinforcements



Protected summer
sandal

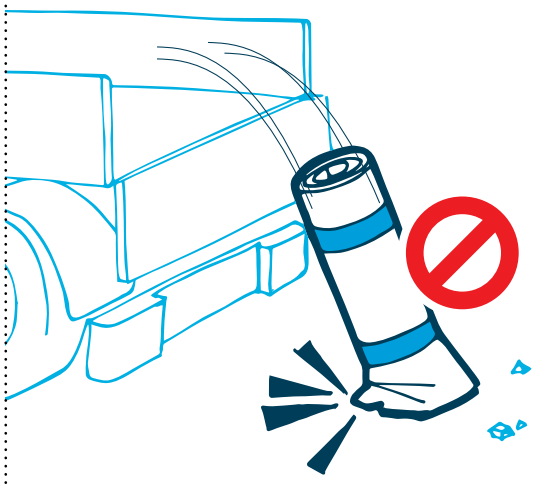
Protected work
boot

TRANSPORT AND STORAGE

TRANSPORT AND HANDLING

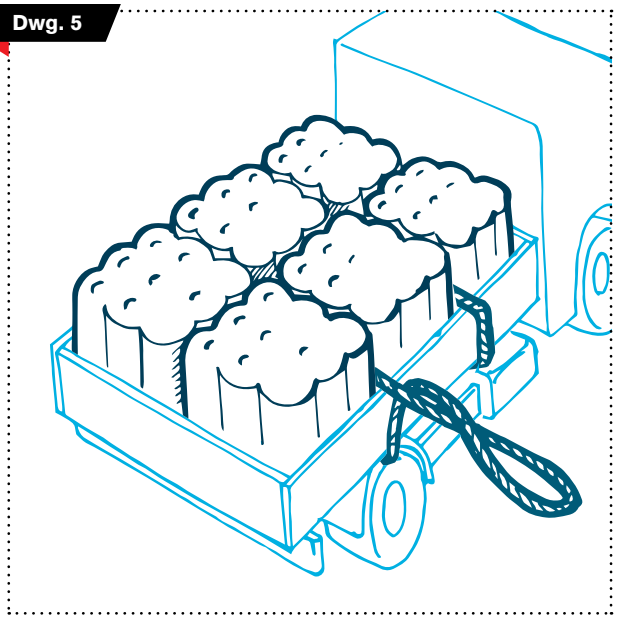
- Load and unload the pallets with care, avoiding contact with sharp corners or edges.
  Avoid violent impacts with the ground especially in low temperature conditions **(Dwg. 4)**.

Dwg. 4



- Abrupt transport vehicle braking or sudden movements could cause rolls to fall off pallets; to avoid this problem it is best to carefully and attentively load vehicles, facilitating the support of adjacent pallets.

Dwg. 5

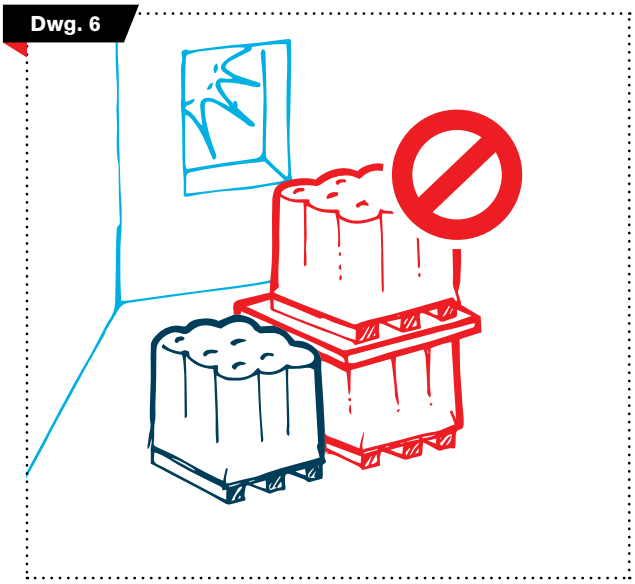


If this is not possible, place taut cords or metallic slats across the crate to secure the load **(Dwg. 5)**.

STORAGE AND CONSERVATION

- The original packaging is designed for optimal product storage.
  Once opened, store rolls vertically on the pallet or on smooth and flat surfaces. Always handle pallets with rolls vertically.
- The rolls are to be stored in an upright position, indoors in a dry and ventilated area, away from heat sources.
- Absolutely avoid the stacking of rolls and pallets for storage or transport to avoid possible deformations which may compromise a perfect installation **(Dwg. 6)**.

Dwg. 6

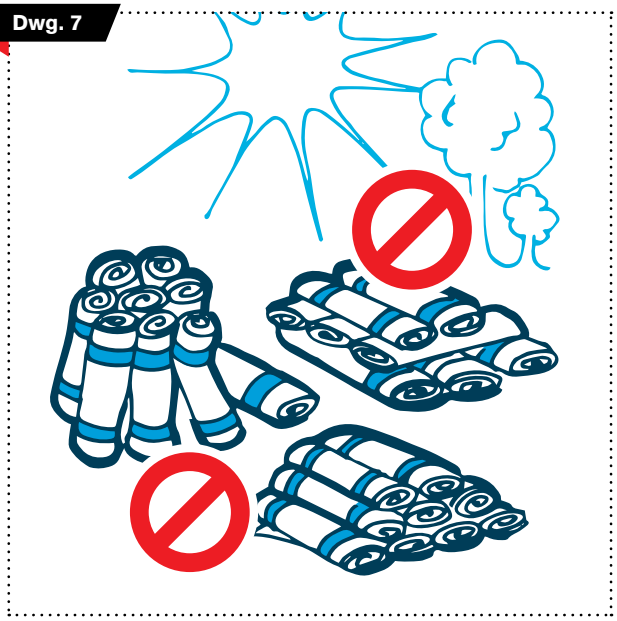


- It is recommended to store the product at temperatures above 0°C.
- In no case should rolls be stored horizontally unless equipped with an internal rigid cardboard or Styrofoam core and, even in this case, for short periods only **(Dwg. 7)**.
- Correct inventory turnover is recommended according to the stock time, first in first out logic.

WORK SITE STORAGE

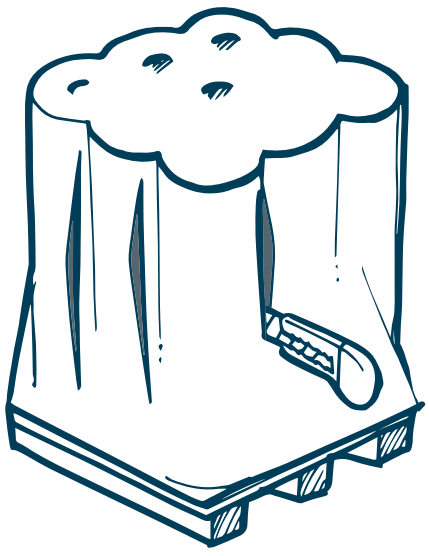
- Only place the rolls to be used during the work shift at the work site, given the importance correct storage and conservation have on these materials.

Dwg. 7



- For pallets on the roof in the summer, promote ventilation by cutting the heat shrink wrapping to reduce the greenhouse effect that would be generated inside the pallets **(Dwg. 8)**.

Dwg. 8

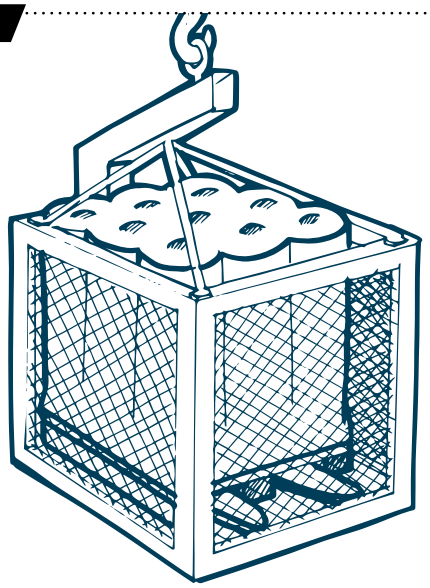


- In the winter, pallets on the roof need to be protected with insulation panels and suitably ballast so as not to expose rolls to excessively cold temperatures.

LIFTING AND HOISTING

- Supplied pallets are suited for normal warehouse handling and not hoisting.
- Rolls should be lifted on the roof with a crane, using suitable lifting accessories **(Dwg. 9)**.
- Lifting loose rolls with cords or other improper accessories that could ruin material and jeopardise operator safety is prohibited.

Dwg. 9



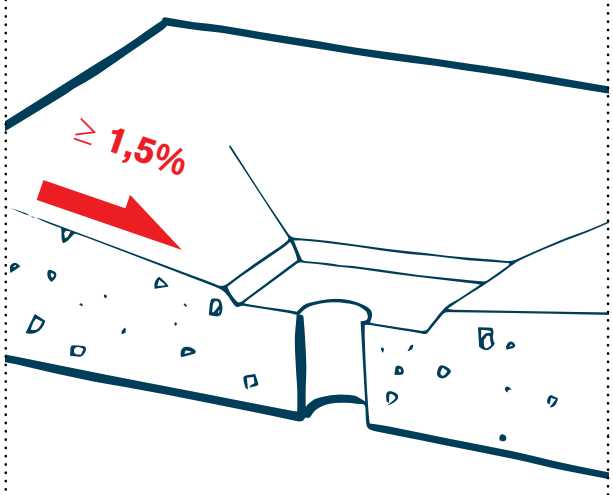
WORK SITE AND PRELIMINARY OPERATIONS

OVERVIEW

- Coordinate operations so as not to damage construction elements and underlying rooms.
- Avoid leaving portions of the roof without waterproofing overnight or when the work site is closed.
- The application surface must not have any depressions to avoid the risk of ponding water, the slope must be at least 1.5% on concrete decks and 3% for steel or wooden ones, this to guarantee a proper run off of rainwater. Drains should be dimensioned to efficiently drain off rain water **(Dwg. 10)**.
- For application on vertical surfaces over 2 m high or highly slanted supports, apply suitable mechanical fasteners at the head of the sheet, later sealed with the head joint.
- Install at environmental temperatures over + 5 °C.
- Suspend installation in the event of adverse weather conditions (high humidity, rain, fog, etc.) **(Dwg. 11)**.
- Avoid impacts and violent unrolling of the distilled polymer-bitumen membrane at low temperatures during application, that could severely damage it.

Dwg. 11

Dwg. 10



Dwg. 12

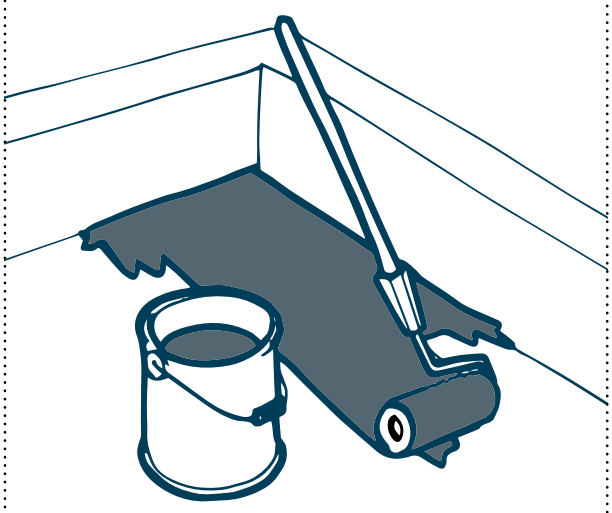
NEW BUILDINGS

- The installation surface must be clean **(Dwg. 12)**, dry, smooth and must not have depressions or irregularities over 1.5 mm under a 3 m straight edge **(Dwg. 13)**.
  Cement must have set for at least two weeks and the water content cannot be over 5%. Cement cohesion: pellet test: 1 MPa.
- Prepare the cement substrates, including uprights and other details, with bitumen primers to eliminate dust and promote membrane adhesion **(Dwg. 14)**. Let the primer layer dry before continuing with the other steps.
- In prefabricated constructions, apply a bridging strip of membrane suitably long on all construction joints. For structural joints, prefabricated buffer panels or sheet metal roofs, always include suitable expansion joints.

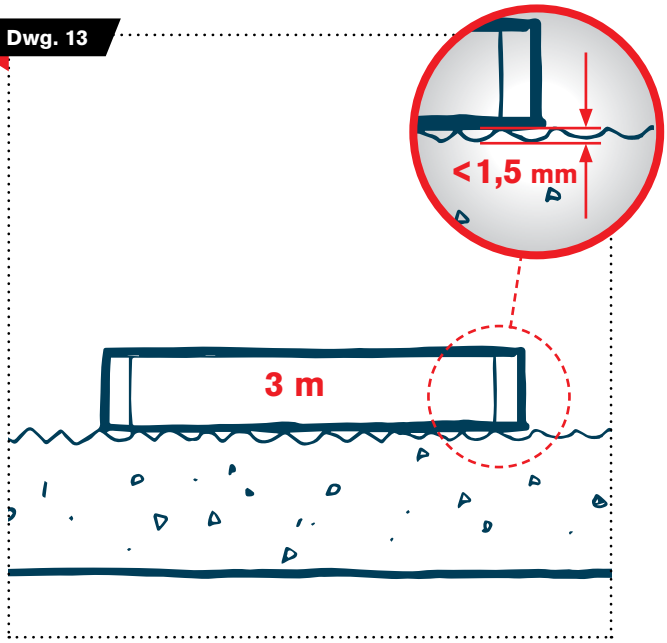
BITUMEN RE-ROOFING

- Accurately clean the existent roof and remove all dirt.
  In the event of roof defects like cracks, bubbles, folds, etc.:
  - eliminate bubbles and even out the surface using a safety or hot air torch and round-tipped trowel **(Dwg. 15)**,
  - cut folds over 10 mm tall and eliminate any protrusions, being careful to flame or hot air weld the edges of the cut fold.
- Check fasteners, the sturdiness and appropriateness of frame parts and repair if necessary.
- Remove skylights, check uprights to verify fasteners, their sturdiness and appropriateness and repair damaged parts if necessary.
- Insulation under old roofs must be in good conditions, dry, integral and suited for the technical solution chosen for the re-roofing.
- Remove and replace any insulation panels saturated with water.
- Install suitable insulation aerators to allow the humidity trapped in the old waterproofing system to dissipate.

Dwg. 14



Dwg. 13



Dwg. 15