

MAINTENANCE AND REPAIR RECOMMENDATIONS FOR FLAT ROOFS WATERPROOFED WITH MODIFIED BITUMEN SHEETS





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1. WHY DOES MAINTENANCE HAVE TO BE CARRIED OUT ON FLAT ROOFS?

A flat roof is constantly submitted to different physical and chemical factors as a result of the use for which it is intended, the type of roof, the climate where the building is located etc... A roof intended for use by pedestrians is not the same as a roof intended for use by vehicles, a green roof or a non-walkable roof.



Multipurpose roof with trafficable areas and gardened areas.

The roof's durability will depend on how these physical and chemical factors will act to a greater or lesser extent on it.

It must be borne in mind that isolated, minor, insignificant problems may bring about a premature deterioration of the roof. Slight deteriorations caused to the roof may, if not detected in time, entail a rapid deterioration in the medium-term.

It must be borne in mind that the roof protects the whole building. It protects owners, tenants, the structure, equipment, computers, machinery, the electrical system etc... It also allows the carrying out of the activity for which the building has been designed.

It is therefore important to draw up a good roof maintenance plan to avoid deterioration.

Due consideration must be given to any standard which exists or may arise locally or nationally and which makes express reference to roof maintenance.

In the UK Annex B of the BS 6229:2003 Flat roofs with continuously supported coverings — Code of practice is mandatory.

2. MAINTENANCE PLAN AND MAINTENANCE MANUAL

In order to be able to manage the maintenance work on the roof, prevent problems and avoid deterioration thereof, a maintenance plan must be drawn up.

A maintenance plan is merely a preventive programme of actions which sets out to increase roof durability, affording greater protection to the building, to the elements contained therein and allowing the appropriate use for which it has been designed.

To manage the maintenance work required, a maintenance manual must be drawn up by a competent technician.

The maintenance Manual is a document which must contain a detailed description of the building's roof, a periodic site inspection programme and corrective actions.

The maintenance manual should contain no less than the following information:

- Roof installation date.
- Detailed description of all those elements going to make up each of the building's roofs as well as the subsequent changes carried out afterwards.
- The construction details and a definition of the construction systems used.
- The maintenance works carried out.
- Information about possible changes in the use of the roof.
- Equipment situated on the roof and their installation date.
- Other elements situated on the roof such as signs, aerials, stairs/ladders, solar panels etc...
- Site inspections, frequency and type of inspection.
- Inspection type (visual, with appliances etc...).

- Elements to be inspected including a checklist.
- Corrective actions to be carried out in line with the defect observed.
- Reports on the different inspections.

In the case of green roofs a specific maintenance plan will be required setting out at least the following aspects:

- Adaptation of the planting to the construction system.
- Irrigation of surfaces with vegetation, bearing in mind the watering needs of the plant species and rainwater.
- Supply of fertilisers, cleaning and rehabilitation of the sterile areas and separation devices with other elements.
- Removal of undesired plants, cultivation and clearance of uncultivated surfaces.
- Removal of undesired bushes, removal of plants at façades, removal of withered plants.
- All those operations required for the smooth operation of the roof, waterproofing and construction elements.

The importance of periodic visual inspections needs to be stressed, inspections that will enable us to observe the condition of the roof, informing us about any defects which appear on it and which must be repaired immediately to prevent the water from penetrating our building or from making the problem bigger in the future.



Green roofs must have a specific maintenance Plan.

3. When to carry out site inspections

Periodic site inspections must be carried out on flat roofs to check the condition of the roofs and determine the maintenance work to be carried out.

At least two periodic visits must be carried out per year. These periodic visits will preferably be carried out at the start of spring and autumn.

The purpose of the spring inspection will be to detect any possible damage caused to the roof after the winter (damage resulting from snowfalls, frost, rainfall etc...) and to be able to plan and carry out repairs during the mildest time of the year weatherwise.

The autumn inspection will verify that the roof is free of weeds, dirt or any other element which may block the drains and cause subsequent damage to the roof. Furthermore, during this inspection any possible final works will be verified which need to be carried out in anticipation of the arrival of the winter.

The aforementioned premises will be adapted to the climate zone where our building is located in line with the season, geographic area, altitude, rainfall etc...

It may prove necessary to increase inspection work in the following cases:

- Buildings situated in areas with high levels of contamination and dust or in contact with industrial processes which may discharge fumes and oils into the exterior such as industrial kitchens.
- Non-sloping roofs or when the fall is low and occasional water accumulates in the vicinity of the drains.



Roof on which waterlogging occurs.

- Buildings situated in the vicinity of areas with trees or vegetation of a certain size to verify that there have been no blockages to drains or outlets. Considerations needs to be given to the seeds transported by the wind to make sure that they are not germinating and generating problems in the roof.



Condition of the roof in a building near areas with a lot of vegetation on which no periodic site inspections have been carried out.

- Channels or gutters where there is not enough of a slope to drain the water which accumulates in the areas near the drains.



Channel with water accumulations in the vicinity of the gutters.

It is also necessary to carry out a supplementary site inspection when any of the following situations occur:

- When construction works have been carried out on the roof of the building or to adjoining buildings.
- When the roof usage has changed.
- When construction works have been carried out on elements annexed to the roof (handrail, façades, turrets, gutters or flat or sloping roofs that discharge onto the roof, drainpipes etc...).



Works in areas adjoining the roof may bring about damage thereunto, particularly in the case of autoprotected roofs.

- When new equipment or elements have been installed on the roof (air-conditioning, solar panels, aerials, etc...) or in the event that maintenance works have already been carried out to those already installed.



The installation of equipment on the roof may bring about serious damage to our waterproofing system.

- When the roof has been used to access another roof, or material has piled up there to carry out works, support scaffolding or any other action on it even if it is of an extraordinary nature.
- In the event that there have been unusual weather conditions, such as hail, winds and/or very heavy rain or heavy snowfalls.
- After a fire, act of vandalism or any other known damage to the roof or to buildings near the roof.

Due consideration must be given to any standard which exists or may arise locally or nationally and which makes express reference to roof maintenance.

In the UK Annex B of the BS 6229:2003 Flat roofs with continuously supported coverings — Code of practice is mandatory.

4. Elements to be checked during site inspections

Before carrying out site inspections the following information should be obtained

- Verification that the roof is being used for that for which it was originally designed and its use has not changed.
- Verification that the works have been carried out on the roof. It is particularly important to find out if there have been any works carried out on it privately and whether other additional elements have been added privately such as drip edges, equipment, signs, etc...
- Verification of any possible works carried out on elements near the roofs (such as façades, gutters, eaves etc...) which may have caused damage to the roof. In site inspections the interior of the building, construction elements of its exterior, construction elements of the roof and drainage elements will be checked.

The site inspection must commence inside the building, looking at all the interior ceilings and walls to check for water ingress and damp stains.

Damp stains may result from condensation if the roof has incorrect thermal insulation, though it may also derive from defects in the waterproofing system.

Any possible cracks or fissures must also be reviewed as they may be the sign of future problems on the roof.

Any façades, drainpipes and gutters, eaves and exterior drainage elements must also be included in site inspections, checking whether they have suffered any movements or breaks as well as the possible existence of dampness.

The inspection of the roof must be carried out in detail, following the check list and noting down those aspects that are important for carrying out corrective actions. The following elements must be inspected:

- Main waterproofing: Condition of the waterproofing membrane.



Autoprotected waterproofing.

- Waterproofing protection. Condition of the waterproofing, whether the latter is paving,, gravel or any other element.
- Waterproofing finishes against upstands and façades. Condition of the waterproofing membrane finish with the vertical masonry elements (breastplates, panels, façades etc...) as well as against gutters, edges, perimeters, small-scale machinery etc...



Waterproofing finish against an upstand with the correct height. The finishing profile is properly installed and sealed above.

- Vertical masonry elements: Condition of the vertical elements where the waterproofing is finished from that which constitutes the support to the protection elements and waterproof coating such as upstands, metallic profiles, metallic flashing, including copings and railings.

- Waterproofing finishes against any other emerging elements: Condition of the waterproofing membrane finish for chimneys, skylights, vents, ventilation elements, ducts, installation channels and any other element which may cross the waterproofing.



Waterproofing finish with duct channels without suitable special parts.

- Auxiliary construction elements of the horizontal edges of the roof (eaves): Condition of the metallic horizontal elements or other rigid and semi-rigid components arranged at the eaves to operate as a roof railing or as protection from wind uplift.



Metallic coping at a low upstand of a roof.

- Drainage elements: Condition of the drainage elements such as drains, gutters, manholes, drip edges and drainpipes.



During site inspections check for any debris which may be found on the roof and see to its removal.

- Other elements: Any other element to be found on the roof.



Metallic stairs support by means of reinforcement elements to avoid damage to the waterproofing membrane.

5. Minimum maintenance actions to be carried out periodically on roofs

The maintenance actions to be considered must be no less than the following:

- Cleaning and disposal of waste such as nails or screws, bottles, tins, balls, boards, the remains of bricks and factory materials etc...
- Cleaning and disposal of leaves, paper, dirt, dust and silt and any other material that can be deposited on the roof and which, if deposited in the drainage elements of the roof (drains, gutters, manholes, drip edges etc...) may clog them up. Any materials which prevent the correct drainage of water and which may bring about flooding should be removed.
- Elimination of any mould, moss, weeds and any other kind of vegetation which it has been able to generate on the roof. Should it prove necessary to use algacides, they must be compatible both with the paving and with the insulation and waterproofing.



The site inspections are intended to avoid the appearance of plants which may cause obstructions in our drainage elements.

- Verification that the gravel and any other protection of the membrane (tiles, asphalt etc...) is in perfect condition. In the event that the mineral has disappeared from some occasional areas of the roof, the mineral will be redistributed. If there is any paving missing (tiles, etc...), it should be replaced. The paving cracks need to be sealed using appropriate materials.



Verification of the uniform thickness of the gravel layer.

- Inspection of the condition of the waterproofing on non-trafficked roofs (overlaps, adherence to the support etc...). In line with the defects observed, the corresponding corrective measures will be adopted.



Appearance of the transversal and longitudinal overlaps of the upper sheet of an autoprotected roof.

- Verification of the mechanical fixings of the heat insulation and/or the waterproofing in the event of autoprotected roofs. It will be checked that the fixings do not perforate the waterproofing and should this problem arise, they should will be replaced with other suitable ones consisting of a double-threaded screw and distribution washer.
- Checking of the condition of the heat insulation, particularly in the case of autoprotected roofs. It will be checked that it does not have any holes and that it isn't damp. Where it proves necessary to replace it, a material endowed with the

same characteristics and the same thickness should be used.

- Checking of the existence of maintenance walkways on non-trafficked roofs. If there are no walkways, when the roof is not trafficked with gravel, they should be created by placing loose DANOLOSA on the waterproofing or on the heat insulation. In the event if autoprotected roofs, the maintenance corridors will be created by placing loose DANOLOSA on the waterproofing or welding to it an autoprotected sheet ESTERDAN PLUS 50/GP TECHNICAL CORRIDORS.



Detail of a maintenance corridor welding to the autoprotected waterproofing ESTERDAN PLUS 50/GP TECHNICAL CORRIDORS.

- Checking the height of waterproofing on the upstands is necessary. This inspection must also be carried out on door and window thresholds, sliding windows and any other glazed vertical element.



Insufficient height at the waterproofing finish against a vertical element as well as lack of adherence thereunto. Immediate corrective measures must be adopted.

- Verification that the upstand details against the joints with vertical faces (emerging elements, breastplates, chimneys, skylights, vents, vent ducts, installation ducts etc...) are in good condition without cracks nor detached from the vertical face. If they are in poor condition, they should be repaired.
- Verification that the ground clearance where the waterproofing elements are embedded on the vertical walls, protect the sheets at the joints with vertical faces (emerging elements, breastplates, chimneys, skylights, vents, vent ducts, installation ducts etc...) are in good condition without cracks nor detached from the vertical face. If they are in poor condition, they should be repaired.
- Verification that the metallic profiles of the waterproofing finishes on the vertical walls (emerging elements, upstands, chimneys, skylights, vents, vent ducts, installation ducts etc...) are in good condition, well secured to the faces and well-sealed. If they are in poor condition, they should be repaired.
- Verification of the waterproofing such as upstands, façades, chimneys, vents, skylights, ventilation conduits etc...



Waterproofing joint against a vent which is not very high. Immediate corrective measures must be adopted.

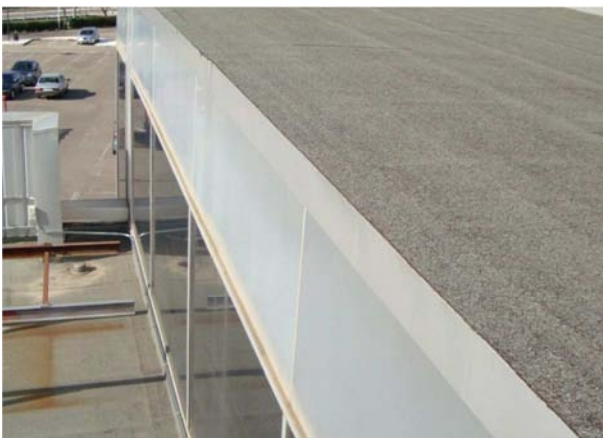
- Verification that the seals at (emerging elements, breastplates, chimneys, skylights, vents, vent ducts, installation ducts, expansion joints etc...) are in good condition. If they are in poor condition, they should be repaired.

- Verification that the metallic handrails of the roof do not perforate the waterproofing and that if they do, this has been resolved by means of special procedures.
- Checking the condition of the copings and the roof railings and the sealing between parts. If they are in poor condition, they should be repaired.



Repair using liquid systems for a coping with problems. It could also have been resolved by applying primer and subsequently welding an autoprotected sheet ESTERDAN PLUS 40/GP ELAST, ESTERDAN 40/GP POL or IMPERDAN FP 40 GP.

- Checking the condition of the waterproofing finishes at the horizontal edges of the roof (eaves). If they are in poor condition, they should be repaired.



Waterproofing finish against eaves by means of a metallic profile.

- Checking the condition of the vertical faces of the roof, particularly in the case of brickwork or stonework. If they are in poor condition (cracks, flaking, potholes, dampness), they should be repaired.

- Checking the condition and cleanliness of the water drainage elements (drainpipes, gutters, drains, drip edges, manholes etc...) Where necessary, the appropriate corrective measures should be adopted.



Condition of a drain on which the corresponding maintenance work has not been carried out. It must be cleaned immediately.

- Checking the watertightness of the joint between the waterproofing and the water drainage elements (drainpipes, gutters, drains, drip edges, manholes etc...) Where necessary, the appropriate corrective measures should be adopted.
- Checking for leaf guards in the drainage elements (drains, drip edges etc...) of the gravel -finished roofs and the autoprotected roofs. If there aren't any, they should be installed.



Leaf Guards on a roof.

- Checking the existence of gratings on the manholes of paved roof drains. If there aren't any, they should be installed.
- Checking that the pipes and installations that cross the waterproofing have been

installed using suitable prefabricated elements. Where necessary, the appropriate corrective measures should be adopted.



Passage of vent ducts through conduits.

- Checking that the support elements of the ducts found on the roof are in good condition, being supported on distribution elements, not perforating the waterproofing nor restricting water drainage. Where necessary, the appropriate corrective measures should be adopted.



Duct support element retaining water drainage.

- Checking that the equipment to be found on the roof rests on small supports or, if supported on the roof, on distribution elements, not perforating the waterproofing nor restricting water drainage. This will be carried out with regard to advertising posters, aerials, light standards, metallic stairs etc. Where necessary, the appropriate corrective measures should be adopted.



Supporting of elements on the waterproofing without any protection element. Immediate corrective actions must be adopted.

- Removal from the roof of any equipment that has ceased to be used as it may cause potential damage. The same applies with regard to aerials, posters, metallic stairs etc...
- Verification of operation and of the condition of the expansion joints, both the structural ones of the building and the working ones on the roof. Where necessary, the appropriate corrective measures should be adopted.
- Checking the condition of the lifelines and any other element to be found on the roof as an antifall protection measure. Where necessary, the appropriate corrective measures should be adopted.
- Checking the condition of any metallic element situated on the roof (handrails, stairs, small-scale machinery etc...), checking for their possible oxidation. Where necessary, the appropriate corrective measures should be adopted.

6. Inspection of the condition of waterproofing on autoprotected non-trafficable roofs

Non-trafficable roofs are those on which the access is limited solely to the maintenance of the roof or of the elements situated on it (aerials, air-conditioning equipment etc...).

This type of roof can be resolved using a protection layer above the waterproofing, usually gravel, or using waterproofing membranes.

Autoprotected waterproofings are those carried out using sheets with an upper finish in slate or mineral finish.

In the event that the roof waterproofing can be resolved using autoprotected sheets, we should periodically check the condition of the waterproofing system.

The main aspects to be checked on the bituminous sheets are the following:

Existence of blisters or air pockets between the waterproofing sheets (in double layer systems).

Possible origin: Expansion on sunny days with air or water trapped between the sheets.

Operations to be carried out: It is not always necessary to carry out an action. It will depend on the size of the blister and its location. In the case of air pockets, their repair is recommended. The operation consists of removing the blister and placing a patch on the area concerned.

1. The bituminous layer is cut with a cutter from the centre of the blister and as far as the exterior (at X) on various parts and without damaging the lower sheets. These unbonded waterproofing pieces will be welded again to the lower sheet with the blowlamp. In the event that instead of a blister it is an air pocket (larger dimensions), the waterproofing layer is cut around the blister and removed.
2. The waterproofing area is prepared at the place where the patch is to be welded. A

patch 15cm greater than the blister is to be used.

3. A waterproofing patch is welded with a blowlamp to the pre-treated area and to the top layer. In the event that the waterproofing is made of elastomer bitumen, the patch to be welded should be carried out using the ESTERDAN PLUS 50/GP ELAST sheet. In the event that the sheet is made of plastomer bitumen of the POL range, the patch to be welded should be the ESTERDAN 50/GP POL sheet. In the event that the waterproofing is made of plastomer bitumen, the IMPERDAN range, the patch to be welded should be the IMPERDAN 50 or ESTERDAN 50/GP POL sheet.

Existence of blisters or air pockets between the waterproofing system (single layer or double layer system) and the support.

Possible origin: Expansion on sunny days with air or water trapped between the waterproofing membrane and the support (mortar or concrete) or heat insulation.

Operations to be carried out: It is not always necessary to carry out an action. It will depend on the size of the blister and its location. In the case of air pockets, their repair is recommended. Notwithstanding, an air pocket or a blister may always serve as a sign of other situations which are harmful to the roof it should always be borne in mind.



Ball bearings between the waterproofing system and the support

The solution, where necessary, will always consist of removing the blister and placing a patch on the area concerned.

In the event that there is air or water trapped in the support (mortar or concrete).

1. The waterproofing membrane is cut and removed using a cutter in the blister area.
2. The area is prepared at the place where the patch is to be welded, soaking the slate grain of the sheet in the mastic with the hot joint tool in a rectangle whose dimensions are at least 25 cm greater than the outer edge of the blister.
3. A plastified sheet patch is welded with a blowlamp to the support and to the sheet area where the grain has been embedded (around 10 cm). The patch will be 10 cm greater than the edge of the blister. In the event that the waterproofing is made of elastomer bitumen, the patch to be welded is carried out using the GLASDAN 30 P ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the GLASDAN 30 P POL sheet. In the event that the waterproofing is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the GLASDAN 30 P PLAST sheet.
Note: In some markets this GLASDAN 30 P PLAST sheet may be replaced by the IMPERDAN FV 30 P sheet.
4. A patch is welded with a blowlamp to the pre-installed plastified lower sheet and to the sheet area where the grain has been embedded. The patch will have the dimensions of the area where the grain has been eliminated (around 25 cm greater than the edge of the blister). In the event that the waterproofing is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 40/GP ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 40/GP POL sheet. In the event that the waterproofing is made of plastomer

bitumen of the IMPERDAN range, the patch to be welded is carried out using the IMPERDAN FP 40 GP POL or ESTERDAN 40/GP POL sheets.

5. Furthermore, the humidity of the deck must be verified before carrying out the repair and it may prove necessary to include ventilation stacks.

In the event that there is water trapped in the insulation.

1. The condition of the insulation must be checked as damp insulation loses its properties.
2. Depending on the condition of the insulation, its replacement with one endowed with the same characteristics may prove necessary.
3. In line with surface concerned and the waterproofing system (bonded system or fixed mechanically) a repair system will be adopted which will be more similar to a rehabilitation system than to an occasional repair system.
4. In the event of occasional emergency repairs, the aforementioned criteria may be followed and it may prove necessary to replace the insulation in the area concerned with another endowed with the same characteristics in the event that the insulation is wet.
5. Furthermore, the humidity of the deck must be verified before carrying out the repair and it may prove necessary to include ventilation stacks.

Lack of adherence of the waterproofing system to the deck.

Possible origin: Lack of heat to the waterproofing during its installation.

Operations to be carried out: It is not always necessary to carry out an action. It will depend on the size of the unbonded area. In the event of large unbonded areas, their repair is always recommended. Notwithstanding, as in the previous case above, an unbonded area may always serve as a sign of other situations which are harmful to the roof so it should always be borne in mind.

The solution, where necessary, will be similar to that mentioned above (blisters or air pockets between the waterproofing system and the support).

Loss of mineral.

Possible origin: Loss of mineral. Loss of mineral is a habitual process on roofs. European standard EN 12.039 allows a certain mineral loss percentage. This loss in mineral may be caused by scarce maintenance of the roof, excessive traffic and the accumulation of water, sediments, deposits and dirt above the waterproofing.

Operations to be carried out: In the majority of cases the loss in mineral is a merely aesthetic aspect, under no circumstances affects the watertightness of the roof. It is only necessary to carry out periodic cleaning of the lost mineral as well as of any other type of deposit and sediment that has accumulated on the roof.



Loss of slate grain.

In the event that the deterioration can be put down to the transit of people it is necessary to restrict and limit the thoroughfare of people above it, making available technical maintenance or transit walkways

These maintenance or walkway corridors can be carried out by means of filtering slab DANOLOSA or ESTERDAN PLUS 50/GP ELAST TECHNICAL CORRIDORS in a colour different from that of the roof.

DANOLOSA is placed dry on the waterproofing without the need to place a geotextile filter.

ESTERDAN PLUS 50/GP ELAST TECHNICAL CORRIDORS is adhered with a blowlamp to the existing waterproofing.

Should it prove necessary to add mineral to the area in which there is a major loss, the area suffering mineral loss can be heated up with a blowlamp and then sprinkle slate sold in bulk. A cold adhesive can also be used with the subsequent sprinkling of the slate mineral.

Water flooding.

Possible origin: Insufficient falls; drains, gutters and channels incorrectly designed and/or built; building settlements; structural movements; crushing of the insulation.

Operations to be carried out: The action of water does not cause any damage to the waterproofing membrane. However, flooding may bring about undesired situations such as the sedimentation of sludge and other debris, the germination of plants, mosses and lichens and the clogging of drains. These phenomena may bring about the early aging of the waterproofing system. It is thus necessary to carry out periodic maintenance works.

1. Eliminate the reason behind the water flooding.
2. If the cause cannot be eliminated, the water can be eliminated periodically using a rubber rake.
3. In some cases it may prove necessary to have new drains in areas where a lot of water accumulates.

In some cases, when, owing to the effect of the water and the lack of cleaning, foreign particles are accumulated (slime, dust, leaves etc...) at the low points of the roof, the crocodile skin effect may occur. These foreign bodies form a crust above the waterproofing which, when the water evaporates, contracts and may bring about cracks in the surface. This crocodile skin effect occurs on roofs with little maintenance or poor construction and/or design of the drainage elements.

The crocodile skin effect is an aesthetic phenomenon which does not affect the watertightness of the waterproofing.

To prevent sediments from accumulating on the roof it usually suffices to carry out twice-yearly maintenance works and keep the water drainage elements clean. This maintenance works will be increased on non-sloping roofs or on those on which water flooding is evident.



Crocodile skin effect.

As a preventive measure, the water accumulation area must be treated by means of a monocomponent polyurethane fibre coating, REVESTIDAN FINISH.

1. The area of the waterproofing to be treated is brushed, removing any sediments and deposits accumulated on the surface.
2. It is applied with a flat brush (around 10 cm wide) and a coat of REVESTIDAN FINISH with an approximate yield of 1.2 kg/m².
3. If it is wished for the waterproofing membrane to have the same finish as the sheet, after applying REVESTIDAN FINISH slate mineral sold in bulk can be sprinkled on the still fresh coating. To eliminate any excess mineral, the area treated with a brush is swept.

This same procedure can be carried out in those areas where the phenomenon has occurred.

Wrinkles.

Possible origin: Wrinkles may have different causes from the implementation to the condition and type of support of the waterproofing membrane.

Operations to be carried out: Depending on the type of wrinkle, its size and the phenomenon originating it, different actions must be adopted. If it is a double layer system, it must be checked whether the wrinkle is seen on the first sheet, or on both sheets.

Prior to carrying out any action, it is necessary to obtain a precise diagnosis of the reason behind the wrinkles.

Parallel wrinkles in the longitudinal direction of the roll.

Possible origin: In the case of minor parallel wrinkles in the longitudinal direction of the roll, the latter are usually caused by excess heat caused to the roofs during its installation when the latter has a polyester felt reinforcement.

Operations to be carried out: They are merely aesthetic phenomena which do not affect the watertightness of the waterproofing.

Wrinkles perpendicular to the longitudinal direction of the roll.

Possible origin: They are usually caused by a defect in the waterproofing system installation of the resistant support movement or of the waterproofing support movement (mortar, concrete, wood or heat insulation).

Operations to be carried out: The wrinkles usually bring about aesthetic phenomena which do not affect the watertightness of the waterproofing membrane and it is thus not always necessary to repair it.

In the case of wrinkles of a certain size, their elimination is recommended.

Prior to the action the cause of the wrinkle must be diagnosed. If it is a consequence of the deck

movement, opportune corrective measures must be adopted (increasing the heat insulation fixings in the area near the wrinkles if this is the cause etc...).

Once the causes generating the wrinkles have been corrected, it should be repaired.



Wrinkles perpendicular to the longitudinal direction of the roll.

In the event that the wrinkle only affects the upper sheet, the treatment consists of eliminating the wrinkle and placing a patch.

1. The area is prepared at the place where the patch is to be welded, soaking the slate grain of the sheet in the mastic with the hot joint tool in a rectangle whose dimensions are at least 15 cm greater than the outer edge of the wrinkle.
2. The wrinkle is cut with a cutter lengthwise and both ends are welded to the support.
3. A patch is welded with a blowlamp (15 cm greater than the edge of the wrinkle). In the event that the waterproofing is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 50/GP ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 50/GP POL sheet. In the event that the waterproofing is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the

IMPERDAN 50 or ESTERDAN 50/GP POL sheet.

Fish mouth.

Possible origin: This is a specific case of transversal wrinkles in which the waterproofing is raised on the transversal overlap. They are usually caused by a defect in the waterproofing installation, in the resistant support movement or in the waterproofing support movement (mortar, concrete, wood or heat insulation).

Operations to be carried out: In this case it must be repaired.

Prior to the action the cause of the wrinkle must be diagnosed. If it is a consequence of the deck movement, opportune corrective measures must be adopted (increasing the heat insulation affixations in the area near the wrinkles if this is the cause etc...).

The repair procedure is that indicated above.



Fish mouth.

Cracks in the waterproofing system.

Possible origin: This is a phenomenon which occurs when there are working joints on the waterproofing support, usually mortar or concrete (though sometimes the waterproofing support is a heat insulation or wood), joints between different materials and expansion joints. It usually occurs most frequently on fibre-glass reinforced sheets than in the case of using sheets with a polyester felt reinforcement.

Operations to be carried out: This type of phenomenon requires repair as it may entail the immediate entry of water into the building.

Prior to the repair the cause of the crack must be diagnosed.

In the event that the crack is occurring at an expansion joint of the waterproofing support, this must treat it as if it was an expansion joint.

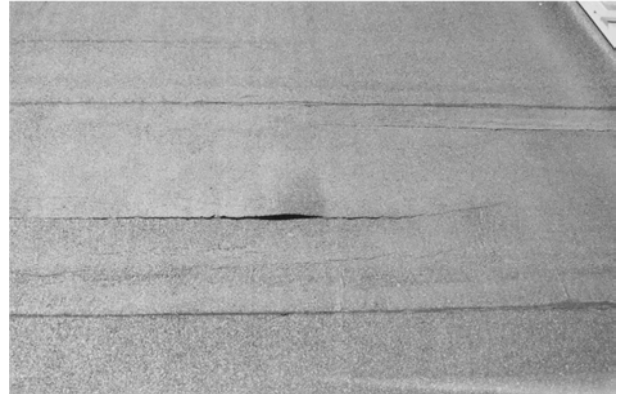
In the event that the crack is occurring at a working joint of the waterproofing support, or in the case of a joint amongst different materials, this will have to be treated as if it was an expansion joint or providing an upper reinforcement band with an autoprotected sheet depending on the movement of the crack opening.

In the event of minor movements in the crack, the treatment may be carried out with an upper reinforcement band.

1. The area of the waterproofing is prepared where the reinforcement band is to be welded. This can be carried out by soaking the slate grain of the sheet in the mastic with the hot joint tool with a width at least 25 cm greater than the outer edge of the crack. Instead of soaking the slate grain, a MAXDAN bituminous emulsion may be applied to the area to be prepared. The mineral is not soaked or the autoprotected sheet not primed for the 5 cm adjoining each side of the crack.
2. The waterproofing layer is welded with a blowlamp in the pre-treated area. A waterproofing layer is welded with a blowlamp to the sheet area where the mineral has been soaked or primed (25 cm greater than the edge of the wrinkle), leaving the 5 cm adjoining the crack unwelded. In the event that the waterproofing is made of elastomer bitumen, the reinforcement band to be welded is carried out using the ESTERDAN PLUS 50/GP ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the reinforcement band to be welded is carried out using the ESTERDAN 50/GP POL sheet.

In the event that the waterproofing is made of plastomer bitumen of the IMPERDAN range, the reinforcement band to be welded is carried out using the IMPERDAN 50 GP or ESTERDAN 50/GP POL sheets.

In the event that the crack is the consequence of a retraction joint of the support, the treatment consists of welding an upper reinforcement band in the same way as mentioned earlier .



Crack in waterproofing with sheets bonded with fibreglass reinforcement.

In the event that the cracks appear in double layer waterproofing carried out using sheets with fibre glass reinforcement welded to the support, the cause may be due to the fact that a working joint of the support is transmitting stresses to the waterproofing system. Should this be the case, the repair solution may be very complicated and rewaterproofing may be required.

Punctures or ripping in the waterproofing system.

Possible origin: This may have occurred during repair works to elements and equipment installed on the roof as well as owing to inappropriate traffic on the roof.

Operations to be carried out: This type of problem requires repair as it entails an entry of water into our building. The repair consists of putting a patch on the damaged area. In line with the importance of the damage as well as the fact that the waterproofing is single layer or double layer, the patch may be placed with a single sheet or with two sheets (a first plastified sheet and a second autoprotected sheet).

In the case of a single layer membrane, or should it be decided to resolve the repair with a single sheet, the procedure is as follows:

1. The area of the sheet is prepared where the patch is to be welded. This can be carried out by soaking the slate mineral of the sheet in the mastic with the hot joint tool with a width at least 15 cm greater than the outer edge of the damaged area. In the event that there is major damage, it may prove necessary to eliminate the former waterproofing.
2. A patch is welded with a blowlamp to the sheet area where the mineral has been soaked to the mineral (15 cm greater than the edge of the crack). In the event that the waterproofing is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 50/GP ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 50/GP POL sheet. In the event that the waterproofing is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the IMPERDAN 50 or ESTERDAN 50/GP POL sheet.

In the case of a double layer autoprotected membrane, or should it be decided to resolve the repair with two sheets, the procedure is as follows:

1. The area of the waterproofing is prepared where the patch is to be welded. This can be carried out by soaking the slate mineral of the sheet in the mastic with the hot joint tool with a width at least 25 cm greater than the outer edge of the damaged area. In the event that there is major damage, it may prove necessary to eliminate the former waterproofing.
6. A plastified sheet patch is welded with a blowlamp to the pre-treated area. A patch is welded with a blowlamp to the sheet area where the grain has been embedded (around 10 cm). The patch will be endowed with dimensions 10 cm greater

than the edge of the damaged area. In the event that the waterproofing is made of elastomer bitumen, the patch to be welded is carried out using the GLASDAN 30 P ELAST sheet. In the event that the waterproofing is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the GLASDAN 30 P POL sheet. In the event that the waterproofing is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the GLASDAN 30 P PLAST sheet.

Note: In some markets this GLASDAN 30 P PLAST sheet may be replaced by the IMPERDAN FV 30 P sheet.

2. A patch is welded with a blowlamp to the pre-installed lower sheet and to the sheet area where the grain has been embedded. The patch will have the dimensions of the area where the grain has been eliminated (around 25 cm greater than the edge of the damaged area). In the event that the sheet is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 40/GP ELAST sheet. In the event that the sheet is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 40/GP POL sheet. In the event that the sheet is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the IMPERDAN FP 40 GP POL sheet.

To prevent the deterioration caused by the transit of people to the waterproofing (system used on visitable roofs not intended for heavy footfall), it is necessary to restrict the thoroughfare of people on it, making available technical maintenance or transit walkways to limit the transitable areas.

These maintenance or transit corridors can be carried out by means of filtering slab DANOLOSA or ESTERDAN PLUS 50/GP ELAST TECHNICAL CORRIDORS in a colour different from that of the roof.

DANOLOSA is placed dry on the waterproofing without the need to place a geotextile filter.

ESTERDAN PLUS 50/GP ELAST TECHNICAL CORRIDORS is adhered with a blowlamp to the existing autoprotected sheet.

Affixations protruding from the insulation and perforating the waterproofing.

Possible origin: Use to affix the insulation or the waterproofing with unsuitable fixings.



Inappropriate affixation that has brought about the puncturing of the waterproofing system.

As a consequence of the crushing of the insulation, when stepping on areas near the affixations (heat insulation affixations or affixations of the waterproofing system), the screw head juts out from the heat insulation, perforating the waterproofing.

Operations to be carried out: This type of problem requires immediate repair as it entails an evident entry of water into our building. The repair consists of replacing the affixation with a new double threaded one and subsequently protecting the area concerned with a patch. In line with the importance of the damage as well as the fact that the waterproofing is single layer or double layer, the repair may be carried out with a single sheet or with two sheets (a first plastified sheet and a second autoprotected sheet).

In the case of a single layer membrane, or should it be decided to resolve the repair with a single sheet, the procedure is as follows:

1. The waterproofing membrane is cut with a cutter from the centre of the affixation and as far as the exterior thereof (at X), eliminating this part.

2. The old affixation is removed and it is replaced by one with appropriate characteristics.
3. The area of the sheet is prepared where the patch is to be welded. This can be carried out by soaking the slate grain of the sheet in the mastic with the hot joint tool with a width at least 15 cm greater than the outer edge of the damaged area.
4. A patch is welded with a blowlamp in the pre-treated area. An autoprotected sheet patch is welded with a blowlamp to the sheet area where the grain has been embedded (15 cm greater than the edge of the crack). In the event that the sheet is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 50/GP ELAST sheet. In the event that the sheet is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 50/GP POL sheet. In the event that the sheet is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the IMPERDAN 50 or ESTERDAN 50/GP POL sheet.

In the case of a double layer system, or should it be decided to resolve the repair with two sheets, the procedure is as follows:

1. The waterproofing membrane is cut with a cutter from the centre of the affixation and as far as the exterior thereof (at X), eliminating this part.
2. The old affixation is removed and it is replaced by one with appropriate characteristics.
3. The area of the autoprotected sheet is prepared where the patch is to be welded. This can be carried out by soaking the slate grain of the sheet in the mastic with the hot joint tool with a width at least 25 cm greater than the outer edge of the damaged area.
7. A plastified sheet patch is welded with a blowlamp to the pre-treated area. A sheet patch is welded with a blowlamp to the sheet area where the grain has been embedded or primed (around 10 cm). The patch will be endowed with dimensions 10

cm greater than the edge of the damaged area. In the event that the autoprotected sheet is made of elastomer bitumen, the patch to be welded is carried out using the GLASDAN 30 P ELAST sheet. In the event that the autoprotected sheet is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the GLASDAN 30 P POL sheet. In the event that the sheet is made of plastomer bitumen of the IMPERDAN range, the patch to be welded is carried out using the GLASDAN 30 P PLAST sheet.

Note: On some markets this GLASDAN 30 P PLAST sheet may be replaced by the IMPERDAN FV 30 P sheet.

4. A patch is welded with a blowlamp to the pre-installed lower sheet and to the sheet area where the grain has been embedded. The patch will have the dimensions of the area where the grain has been eliminated (around 25 cm greater than the edge of the damaged area). In the event that the sheet is made of elastomer bitumen, the patch to be welded is carried out using the ESTERDAN PLUS 40/GP ELAST sheet. In the event that the sheet is made of plastomer bitumen of the POL range, the patch to be welded is carried out using the ESTERDAN 40/GP POL sheet. In the event that the sheet is made of plastomer bitumen of the

IMPERDAN range, the patch to be welded is carried out using the IMPERDAN FP 40 GP POL or ESTERDAN 40/GP POL sheets.

Retraction at the overlaps of the sheet

Possible origin: Excess heat when welding the transversal and/or longitudinal overlaps.

Operations to be carried out: This type of problem is usually merely aesthetic, not affecting waterproofing.

In the case of minor retractions, heat can be provided to the retraction area and the slate grain sprinkled.



Longitudinal and transversal overlap retraction.

Note:

This document is a recommendations' manual based on the knowledge and experience of Danosa published to provide information about the actions and repairs to be carried out on the roofs to achieve appropriate maintenance that extends their durability.

As well as following the suggestions of this manual, in any case, the maintenance guide must be complied with which must be drafted by a competent technician in line with the needs of each building and the standards applicable in the different countries where Danosa products are used.



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