Polymer-bitumen membranes are manufactured using a reinforcement which is usually “non-woven” polyester fabric and/or fibreglass mat, impregnated and covered with a compound of distilled bitumen with added polymers.

The nature of the polymer mixed with the bitumen divides the membranes into two consistent groups:

- **APP bitumen membranes** (atactic polypropylene)
- **SBS bitumen membranes** (styrene butadiene copolymer)

Due to the physical characteristics of the polymer used, the APP type is also called plastomeric polymer-bitumen membrane, while the SBS type is called elastomeric polymer-bitumen membrane.

APP bitumen membranes are characterised by a high heat resistance and may be directly exposed to the sun’s rays, while SBS bitumen membranes, noticeably more elastic and flexible even at low temperatures, soften at a lower temperature.

Due to the fact that SBS is sensitive to U.V. rays, for use on surfaces which will remain visible, it is necessary to produce these membranes with a protective layer of slate flakes or mineral granules.

The areas of use of the two membrane groups overlap in many cases, except for a preference for SBS bitumen membranes where the climate is particularly cold or where a high level of elasticity is required, such as for metal deck coverings on light weight structures. The use of APP membranes has become indispensable in hot climates and for waterproofing road structures where tarmac is applied hot onto the membrane, or when covering waterworks where a smooth top face without a mineral finish is required.

Traditional production technology makes it possible to produce membranes with a single waterproofing mass. In other words, the compound which is used to impregnate the reinforcement is the same as that which covers both the top face and the underside of the sheet. Apart from the mechanical characteristics, the other characteristics of the membrane are determined solely by the type of polymer used in the mix.

Many attempts have been made to combine the qualities of APP with those of SBS by mixing them together with bitumen but the results to date have been disappointing as the SBS loses a consistent amount of its elasticity once it is mixed with a plastomer.

Index S.p.A. research is now being directed towards the concept of membranes in which both polymers are present but not mixed together.

Several membranes have been developed: it is possible to find different types of layers positioned in various ways depending on the specific use for which the membrane is designed. In order to produce these membranes it was necessary to devise and manufacture a new prototype line which allows differential build-up and it was also necessary to find new innovative bonding systems which guarantees a long-lasting and optimal adhesion between the layers of the membrane.

Index S.p.A. is now in a position to propose an innovative range of products called composite membranes, due to the fact that they are made up of several different layers which are synergetic and specialised because they have been designed to display specific characteristics.
PROTEADUO is a composite waterproofing membrane where the reinforcement is impregnated with SBS bitumen; the underside, in contact with the substrate, is made from SBS bitumen while the top face is made from APP bitumen. The elastoplastic composite compound of the underside contains distilled bitumen and thermoplastic rubber made from a block copolymer radial butadiene styrene. It has an ultimate elongation of 2000%, flexibility in cold weather that reaches −25°C and an extremely high resistance to thermo-oxidising ageing. The elastoplastic compound of the upper face’s protective layer contains distilled bitumen, atactic polypropylene, isotactic and polyolefinic elastomers which are resistant to U.V. rays; it has stabilizing additives against thermal shock and a softening point of over 150°C. The reinforcement is also the result of thorough research into the strengthening of waterproofing membranes. As is well known, “non-woven” polyester fabric, while being resistant and elastic, is more sensitive to temperature than mineral fibre reinforcement and can cause the membranes to deform. The traditional coupling with fibreglass solves the problem of stability but even during application the bending of the membrane causes tiny breakages in the fibreglass that can damage the bituminous mass which covers it.

PROTEADUO TRIARMATO (Triple reinforcement) has a special composite three-layer reinforcement, where the fibreglass is compressed between two layers of “non-woven” polyester single strand Spunbond fabric and so cannot damage the bituminous mass. Stability is guaranteed by the fibreglass mat which limits the movements of the membrane both at high and low temperatures. The compound is protected and reinforced with a “non-woven” polyester fabric. The composite material is more resistant to nail tearing than normal reinforcements, therefore PROTEADUO can be mechanically fixed. The fibres are completely impregnated and coated with an elastomeric compound using an exclusive procedure which guarantees absolute impermeability, high resistance to tearing and impact, and excellent elasticity even at low temperatures.

PROTEADUO POLYESTER is also reinforced with composite “non-woven” polyester fabric which is stabilized with fibreglass mat to guarantee stability in hot conditions, while at low temperatures it behaves like a pure polyester reinforced membrane.

The underside of PROTEADUO is coated with Flamina film which has a high retraction when torched during application. The elastomeric layer ensures excellent adhesion on the most widely used construction materials, on polymer-bitumen membranes and also on oxidized bitumen coatings and old bituminous layers. The upper face is coated with a new multifunction surface finish called Texflamina, which can be painted immediately after application and guarantees absolute impermeability of SOLARIS aluminium, INDECOLOR SV paints and INDECOLOR water-based paint. It is also compatible with ALLUMASOL, ELASTOLIQUID and ELASTOLIQUID PUR coatings. Thanks to the high heat resistance of the top polymeric layer, PROTEADUO can be covered with hot bituminous conglomera-

PROTEADUO withstands exposure to the sun’s rays without heavy protection, but a coat of light coloured paint is always recommended, especially when applying on insulation. This will help to reduce the effects of thermal shock and also help to insulate the roof.

To meet specific requirements, both types of membrane are produced with the upper face coated with slate flakes, both in a natural colour and stove coloured. These coated membranes are called MINERAL PROTEADUO.

The slate is hot bonded to the outer APP-bitumen layer with a strong and long-lasting bond. The membranes are produced with an 8-cm wide, slate free strip on the upper face to allow the bonding of the overlaps.

MINERAL PROTEADUO is used as a final visible layer where it is possible to appreciate its decorative effect.

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**PROTEADUO: COMPOSITE ELASTOPLASTOMERIC WATERPROOFING MEMBRANE**

- **Resistance to ageing**
  - PROTEADUO’s resistance to ageing is guaranteed by the upper APP bitumen layer.
- **Fatigue strength**
  - The underside in SBS-bitumen and the continuously extruded polyester fibre reinforcement guarantee PROTEADUO’s excellent fatigue strength.
- **Heat resistance**
  - The high softening point of the upper face guarantees PROTEADUO’s heat resistant properties. Hot road asphalt can be poured straight onto the membrane.
- **Compatibility**
  - The SBS-bitumen of the underside of PROTEADUO membranes is also compatible with oxidized bitumen coatings.
Both the SBS-bitumen and the APP-bitumen compounds pass the thermo-oxidizing ageing test in accordance with UEAtc Directives for waterproofing membranes of January 1984.

Even though the membranes are mainly made from SBS-bitumen, PROTEADUO resists ageing caused by U.V. rays (2000 hours Xenotest) provided for by the same Directives valid for APP membranes. It also resists the combined action of sunlight and rainwater UNI 8629 (800 hours Q.U.V. test). When subjected to 1500 cycles of thermal shock of the Thermal Hydra Shock test, PROTEADUO shows no signs of visible deterioration.

The joints are also strong and long lasting. Both new joints or those which have been subjected to ageing are up to the standards of UEAtc Directives.

**ADVANTAGES**

- Combines the advantages of APP bitumen with those of SBS bitumen.
- Lasts longer than both APP bitumen membranes and SBS bitumen membranes.
- Can be painted immediately.
- The only SBS bitumen membrane that is smooth (not slate) that can be directly asphalted.

**METHOD OF USE AND PRECAUTIONS**

The membrane is just one element, which joined with other such elements, form an unbroken layer which alone or with other unbroken layers, forms a waterproof surface. The membrane is part of an often complex stratigraphy, made up of different types of layers with different functions, which are often discontinuous and interact with each other. The high quality of the membrane alone is not enough to guarantee the successful implementation or the durability of waterproofing work in time, which are in fact the result of an inseparable combination of planning and the thorough knowledge of the stratigraphic behaviour which makes it possible to choose exactly the right materials for the job with a correct and attentive laying of the same, along with a meticulous attention to detail.

Therefore, we advise the reader to study the laying methods, the behaviour of the materials and the connections between layers in depth, by consulting the following Index S.p.A. printed handbooks: "Technical specifications", "Application manual", "Composition and analysis of roofing protection systems", "Waterproofing", where the various laying systems are described such as, bonding and hot air welding, mechanical fixing, cold bonding with adhesives and hot air welding. These handbooks also contain valuable information regarding the correct storage methods for the materials. The handbooks are also used for the various levels of training courses which Index organises at its Technical Training and Refresher Course Centre, where it is possible to carry out a more in-depth study of application techniques and planning.

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**TECHNICAL CHARACTERISTICS**

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<thead>
<tr>
<th>PROTEADUO TRIAMATO</th>
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<th>PROTEADUO POLYESTER</th>
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<tbody>
<tr>
<td>Reinforcement</td>
<td>3 layer composite reinforcement: fiberglass mat between 2 layers of “non-woven” Spunbond polyester fabric</td>
<td>Composite reinforcement in “non-woven” polyester fabric stabilized with fibreglass</td>
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<tr>
<td>Dimensional stability at 100°C (UEAtc)</td>
<td>Stable</td>
<td>Stable</td>
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<tr>
<td>Flexibility at low temperature (UEAtc)</td>
<td>-25°C</td>
<td>-25°C</td>
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<tr>
<td>Tensile strength (UEAtc)</td>
<td>750/650 N/5 cm</td>
<td>650/500 N/5 cm</td>
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<tr>
<td>Static puncture resistance on expanded polystyrene (UEAtc)</td>
<td>250 N</td>
<td>200 N</td>
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<tr>
<td>Dimensional stability in hot conditions (UEAtc)</td>
<td>-0.2%/+0.1%</td>
<td>-0.2%/+0.1%</td>
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<tr>
<td>Resistance to tearing max. load U/T (UEAtc)</td>
<td>250 N</td>
<td>200 N</td>
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<tr>
<td>Adhesion to concrete (Italian Motorways Company)</td>
<td>120 N</td>
<td></td>
<td></td>
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<tr>
<td>Resistance to U.V.</td>
<td>no visible deterioration</td>
<td>no visible deterioration</td>
<td></td>
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<tr>
<td>Resistance to thermal shock (Index)</td>
<td>no visible deterioration</td>
<td>no visible deterioration</td>
<td></td>
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<tr>
<td>Tensile strength of the joints (UEAtc)</td>
<td>breakage outside the joint</td>
<td>breakage outside the joint</td>
<td></td>
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<tr>
<td>Resistance to thermal ageing</td>
<td>breakage outside the joint</td>
<td>breakage outside the joint</td>
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<tr>
<td>Ultimate elongation L/T</td>
<td>0.4 MPa</td>
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<td>Fatigue strength on cracks at -20°C (UEAtc)</td>
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<td>Hot puncture resistance at 40°C</td>
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<td>Adhesion to concrete</td>
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<td>no visible deterioration</td>
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<td>Resistance to thermal shock</td>
<td>no visible deterioration</td>
<td>no visible deterioration</td>
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</tbody>
</table>

(*) On the mineralised membranes the test is carried out on the underside. (‡) Nominal value tolerance conform to UEAtc directive for polymer-bitumen membrane, January 1984.

**COMPOSITION OF THE MEMBRANE**

<table>
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<tr>
<td><strong>PRODUCT</strong></td>
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<tr>
<td>DIMENSIONS AND PACKAGING</td>
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