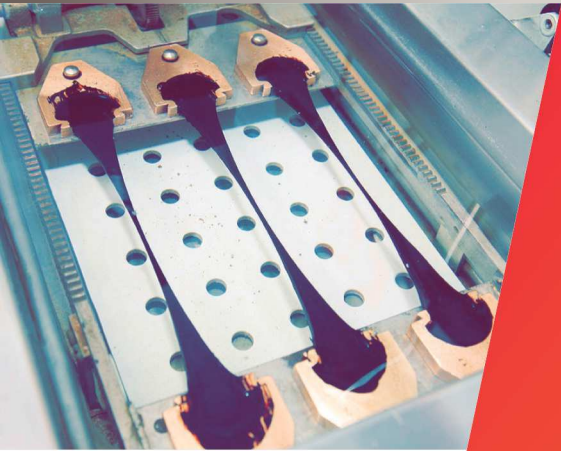


# Polymer-Modified Bitumens



Asphalt bitumens



Repsol has developed a complete range of **polymer-modified bitumens** which includes all the types set out in article 212 of PG-3 [General Technical Specifications for Road and Bridge Works required by the Spanish Ministry of Public Works], as well as other specific products. The greater part of our modified bitumens are produced through a Repsol-developed reticulation system which provides a microscopically homogeneous structure and guarantees its stability in storage..

Repsol also has great experience in the development of polymers for all kinds of applications. Both Repsol Química, in the field of polyolefins, and Dynasol, in the field of elastomers, are leaders in their sector..

Modified bitumens facilitate the manufacture of bituminous mixtures with greater mechanical and functional performance that allows us to adapt roads to the increase in traffic and the greater demands that arise as a result. This results in greater durability and a saving on maintenance costs.

## / APPLICATIONS

The following table shows the main applications of the different types of polymer-modified bitumens set out in the PG-3.

<b>PMB 10/40-70</b>	High modulus mixes Fatigue-resistant mixes
<b>PMB 25/55-65</b>	Base layers Reinforcement surface layers Draining and conventional mixes Fatigue-resistant mixes
<b>PMB 45/80-60</b>	AC type continuous mixes Mixes resistant to plastic deformation Discontinuous BBTM A and BBTM B type wearing courses PA type draining wearing courses
<b>PMB 45/80-65</b>	AC type continuous mixes Mixes resistant to plastic deformation High-end discontinuous BBTM A and BBTM B type wearing courses High-end PA type draining wearing courses Draining mixes with a high percentage of holes
<b>PMB 45/80-75 <sup>(1)</sup></b>	Anti-crack mixes for wearing courses Anti-crack mixes for intermediate or thin layers High-end discontinuous mixes for thin wearing courses High-end draining mixes
<b>PMB 75/130-60</b>	High-end superficial treatments Anti-reflective cracking membranes

[1] See specific product file [PMB 45/80-75 F and PMB 45/80-75 AV].

In addition to these standard binders, polymer-modified bitumens such as high-viscosity bitumens for anti-cracking mixtures, modified bitumens for high-end wearing courses, modified bitumens with end of life crumb rubber, modified low temperature bitumens and activated bitumens



## / PRODUCT CHARACTERISTICS

The following table shows the characteristics of polymer-modified bitumens:

UNE EN 14023 DENOMINATION			PMB 10/40-70	PMB 25/55-65	PMB 45/80-60	PMB 45/80-65	PMB 45/80-75 <sup>(1)</sup>	PMB 75/130-60
Previous denomination			BM-1	BM-2	BM-3b	BM-3c		BM-4
Characteristics	UNE-EN	UNIDAD	Ensayos sobre el betún original					
Penetration at 25°C	1426	0,1 mm	10-40	25-55	45-80	45-80	45-80	75-130
Softening point	1427	°C	≥ 70	≥ 65	≥ 60	≥ 65	≥ 75	≥ 60
Cohesion. Strength-ductility	13589 13703	J/cm <sup>2</sup>	≥ 2 a 15°C	≥ 2 a 10°C	≥ 2 a 5°C	≥ 3 a 5°C	≥ 3 a 5°C	≥ 1 a 5°C
Fraass breaking point	12593	°C	≤ -5	≤ -7	≤ -12	≤ -15	≤ -15	≤ -15
Elastic recovery at 25°C	13398	%	TBR	≥ 50	≥ 50	≥ 70	≥ 80	≥ 60
Stability in storage	Difference in softening point	13399 1427	°C	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5
	Difference in penetration point	13399 1426	0,1 mm	≤ 9	≤ 9	≤ 9	≤ 9	≤ 13
Flash point	ISO 2592	°C	≥ 235	≥ 235	≥ 235	≥ 235	≥ 235	≥ 220
Characteristics	UNE-EN	UNIDAD	Durabilidad-Resistencia al envejecimiento EN 12607-1					
Change of mass	12607-1	%	≤ 0,8	≤ 0,8	≤ 1,0	≤ 1,0	≤ 1,0	≤ 1,0
Retained penetration	1426	%	≥ 60	≥ 60	≥ 60	≥ 60	≥ 60	≥ 60
Increase in softening point	1427	°C	≤ 8	≤ 8	≤ 10	≤ 10	≤ 10	≤ 10
Decrease in softening point	1427	°C	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5

Specifications included in article 212 of PG-3.

[1] See specific product files for modified bitumens PMB 45/80-75 AV y PMB 45/80-75 F.

• TBR [To Be Reported]: value will be reported.

The use of polymers provides significant improvements in the properties of the bitumens. In particular:

- Increase in the ring-and-ball temperature.
- Lower thermal susceptibility.
- Increase of penetration rate.
- Increase in range of plasticity.
- Increase in viscosity.
- Greater elastomericity.
- Better performance at low temperatures.
- Greater resistance to ageing.
- Improvement in storage stability.

## / RECOMMENDATIONS FOR USE

Due to its configuration and rheological behaviour, polymer-modified bitumens cannot be applied the same recommendations for use as conventional bitumens. Therefore, the temperatures of use cannot be deduced from the viscosity-temperature data.

Repsol offers its Technical Support and Development Department that can offer advice regarding the best possible conditions of use.

## / PRODUCT BEHAVIOUR IN THE MIX

Polymer-modified-bitumens provide great advantages in the behaviour of bituminous mixtures:

- Greater cohesion, allowing for more critical granulometric structures.
- Greater fatigue resistance, decreasing the risk of crackingn.
- Greater resistance to ageing in the most adverse conditions [greater durability in service].
- Greater adhesiveness to aggregates.
- Increase in service temperature range.
- Greater resistance to plastic deformations [ruts].