

# Bitumens with end of life crumb rubber



Special binders



In its continued interest in innovation and the improvement of the environment, Repsol has developed its own technology **for using end of life crumb rubber**, which improves the behaviour of the bitumens.

In addition to technical benefits, these bitumens provide important environmental benefits, aiding in the disposal of end of life tyres in landfill sites.

In attention to Spanish Circular Order 21/2007 and 21bis/2009, Repsol uses a wet industrial manufacturing process that ensures traceability in the production, quality and digestion times of the product.

The stability and homogeneity of the final product has been achieved thanks to a specific process and to the use of previously selected bitumens, giving the following range of products as a result: Rubber-Improved Bitumens, Rubber-Modified Bitumens, High-End Rubber-Modified Bitumen and High-Viscosity Rubber-Modified Bitumen.

## RUBBER-IMPROVED BITUMENS

### / APPLICATIONS

In its continued interest in innovation and the improvement of the environment, Repsol has developed its own technology for using end of life crumb rubber, which improves the behaviour of the bitumens. In addition to technical benefits, these bitumens provide important environmental benefits, aiding in the disposal of end of life tyres in landfill sites.

### / PRODUCT CHARACTERISTICS

The following table lists the characteristics of the rubber-improved bitumens that correspond to those adopted by the Ministry of Development (OC 21/2007 and OC 21bis/2009):

CHARACTERISTICS		UNE EN	UNIT	BC 35/50	BC 50/70
<b>Tests on original bitumen</b>					
Penetration at 25°C		1426	0,1 mm	35-50	50-70
Softening point		1427	°C	≥ 58	≥ 53
Cohesion. Strength-ductility		13589 13703	J/cm <sup>2</sup>	≥ 0,5 a 5°C	≥ 0,5 a 5°C
Fraass breaking point		12593	°C	≤ - 5	≤ - 8
Elastic recovery at 25°C		13398	%	≥ 10	≥ 10
Stability in storage	Difference in softening point	13399 1427	°C	≤ 10	≤ 10
	Difference in penetration point	13399 1426	0,1 mm	≤ 8	≤ 10
Flash point		ISO 2592	°C	≥ 235	≥ 235
<b>Durability-Resistance to agei EN 12607-1</b>					
Change of mass		12607-1	%	≤ 1,0	≤ 1,0
Retained penetration		1426	%	≥ 65	≥ 60
Increase in softening point		1427	°C	≤ 8	≤ 10
Decrease in softening point		1427	°C	≥ -4	≥ -5

## / RECOMMENDATIONS FOR USE

The following tables show the recommended temperatures for mixing, laying and compacting for both types of rubber-improved bitumens.

<b>BC 35/50</b>	MEZCLADO	165 - 175°C
	EXTENDIDO Y COMPACTACIÓN	155 - 165°C

<b>BC 50/70</b>	MIXING	160 - 170°C
	SPREADING AND COMPACTING	150 - 160°C

*Indicative data, not contractual and not subject to specifications. Temperatures depend on the specific viscosity curves of each product.*

A specific study of compaction is recommended for mixes madewith bitumens and containing rubber from used tires.

## / PRODUCT BEHAVIOUR IN THE MIX

Rubber-improved bitumens, despite having slightly lower modules compared to binders with the same penetration, provide some advantages to hot mix asphalts over conventional bitumens, although not exceeding the performance of rubber-modified bitumens:

- Greater resistance to fatigue.
- Greater resistance to ageing..
- Increase in service temperature range.

## RUBBER-MODIFIED BITUMENS

### / APPLICATIONS

Rubber-modified-bitumens can be used for the same applications as polymer-modified bitumens, such as:

- Wearing courses.
- Thin discontinuous BBTM A and BBTM B type layers.
- PA draining mixes.
- AC S mixes in an intermediate layer with improved fatigue and/or plastic deformation properties.

### / PRODUCT CHARACTERISTICS

The technical specifications of rubber-modified bitumens correspond to those set out in article 212 of PG -3, as indicated in OC 21/2007, approved by the Ministry of Development.

### / RECOMMENDATIONS FOR USE

As with polymer-modified bitumens due to their configuration and rheological behaviour, the temperatures for using rubber-modified bitumens cannot be deduced from the viscosity temperature. For this reason Repsol offers its Technical Support and Development Department that can offer advice regarding the best possible conditions of use, handling and storage of this type of special binder.

### / PRODUCT BEHAVIOUR IN THE MIX

The behaviour in the rubber-modified bitumen mix has the following advantages over conventional bitumen:

- Greater cohesion.
- Greater resistance to fatigue.
- Greater resistance to ageing.
- Greater adhesiveness to aggregates.
- Better performance at low temperatures.
- Lower thermal susceptibility.
- Greater resistance to plastic deformations.

## HIGH-VISCOSITY RUBBER-MODIFIED BITUMEN PMB 45/80-70 AV C

### / APPLICATIONS

AV applications consist mainly of the following PMB 45/80-70 AV C:

- Mixes for high-end wearing courses resistant to the propagation of surface cracks. This binder allows the manufacturing of mixes with open/discontinuous granulometrics with 6-7.5 % of bitumen and strong fatigue resistance.
- Anti-crack mixes in interlayer system.

### / PRODUCT CHARACTERISTICS

The following table shows the characteristics of PMB 45/80-70 AV C Bitumen

CHARACTERISTICS	UNE EN	UNIT	PMB 45/80-70 AV C	
<b>Tests on original bitumen</b>				
Penetration 25°C	1426	0,1 mm	45-80	
Softening point	1427	°C	≥ 70	
Cohesion. Strength-ductility	13589 13703	J/cm <sup>2</sup>	≥ 3 @ 5°C	
Fraass breaking point	12593	°C	≤ -15	
Elastic recovery at 25°C	13398	%	≥ 80	
Stability in storage	Difference in softening point	13399 1427	°C	≤ 5
	Difference in penetration point	13399 1426	0,1 mm	≤ 13
Flash point in open cup	ISO 2592	°C	≥ 235	
<b>Durability-Resistance to ageing</b>				
Change of mass	12607-1	%	≤ 1,0	
Retained penetration	1426	%	≥ 60	
Increase in softening point	1427	°C	≤ 10	
Decrease in softening point	1427	°C	≤ 5	

### / RECOMMENDATIONS FOR USE

Temperature ranges	MIXING	170 - 180°C
	SPREADING AND COMPACTING	165 - 175°C

*Indicative data, not contractual and not subject to specifications. Temperatures depend on the specific viscosity curves of each product.*

### / PRODUCT BEHAVIOUR IN THE M

The most interesting field of application for these binders are the hot mixes with high resistance to reflection cracking. Bitumen gives the mix reinforced elastomeric recovery characteristics, as well as a very good resistance to plastic deformation at high temperatures and excellent flexible behaviour at low temperatures.

The higher viscosity present in the modified PMB 45/80-70 AV bitumen and the high void content of the mixture enable a higher application of the binder without exudations, which gives the desired behaviour and properties to the mixture.

# HIGH-END RUBBER MODIFIED BITUMEN PMB 45/80-70 F C

## / APPLICATIONS

PMB 45/80-70 F C applications consist mainly of the followin:

- Discontinuous mixtures for thin wearing courses subject to heavy traffic and significant stress.
- Mixes for high-end wearing courses. This new binder allows the manufacture of mixes with open/discontinuous granulometrics with 5.5-6.5 % of bitumen and strong fatigue resistance.
- Draining mixes with a high percentage of holes in the mix. One example of this type of mix is the Twin Layer system.

## / PRODUCT CHARACTERISTICS

The following table shows the characteristics of the PMB 45/80-70 F C bitumen:

CHARACTERISTICS	UNE EN	UNIT	PMB 45/80-70 F C	
<b>Tests on original bitumen</b>				
Penetration at 25°C	1426	0,1 mm	45-80	
Softening point	1427	°C	≥ 70	
Cohesion. Strength-ductility	13589 13703	J/cm2	≥ 3 a 5°C	
Fræass breaking point	12593	°C	≤ -15	
Elastic recovery at 25°C	13398	%	≥ 80	
Stability in storage	Difference in softening point	13399 1427	°C	≤ 5
	Difference in penetration point	13399 1426	0,1 mm	≤ 13
Flash point in open cup	ISO 2592	°C	≥ 235	
<b>Durability-Resistance to ageing EN 12607-1</b>				
Change of mass	12607-1	%	≤ 1,0	
Retained penetration	1426	%	≥ 60	
Increase in softening point	1427	°C	≤ 10	
Decrease in softening point	1427	°C	≤ 5	

## / RECOMMENDATIONS FOR USE

Temperature ranges	MIXING	170 - 180°C
	SPREADING AND COMPACTING	165 - 175°C

*Indicative data, not contractual and not subject to specifications. Temperatures depend on the specific viscosity curves of each product.*

## / PRODUCT BEHAVIOUR IN THE MIX

The PMB 45/80-70 F binder gives the asphalt mix the following advantages:

- Characteristics reinforced in elasticity.
- Very good resistance to fatigue and ageing, which increases the durability of the surface.
- Greater resistance to plastic deformations.
- Excellent flexibility at low temperatures.

