



Technical Data Sheet Use of RARX®:

An ELASTOMERIC ASPHALT EXTENDER, that modifies the plain bitumen by increasing its PG grading, resilience, and recovery properties.

RARX® can be added to any type of Hot Mix Asphalt [HMA] - Dense, Open Graded, Gap graded, SMA, etc., for replacing part of the bitumen at different proportions. In the mixing plant **RARX®** is added directly to the pug mill or dryer drum, right after the aggregates, using existing feeders [i.e. Fiber feeders for SMA mixes, etc.).

Product

Identification of the substance or preparation:

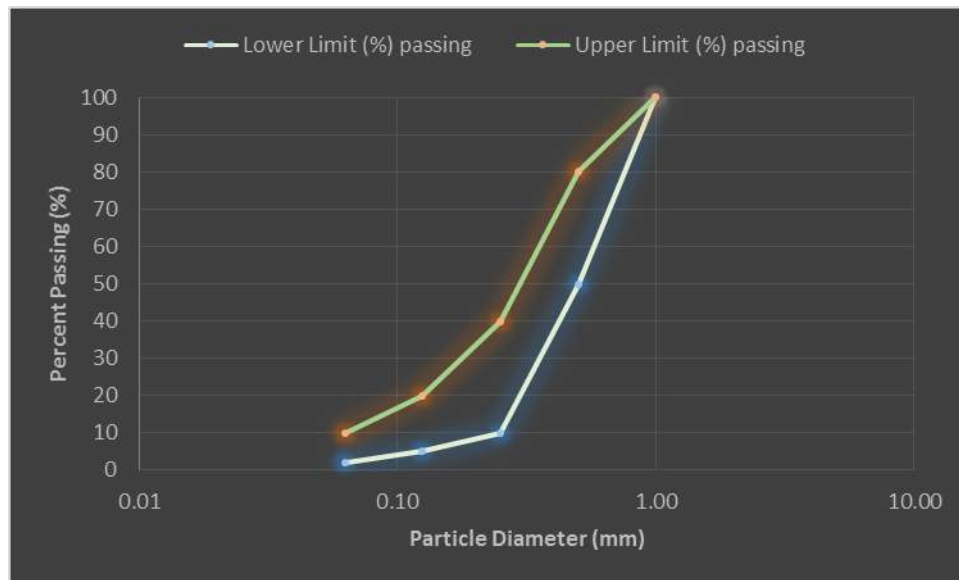
Product Name: **RARX®**
Material Applications: Elastomeric Asphalt Extender

General Description:

RARX® is composed of fine rubber granules, conventional bitumen, and by mineral fillers reacted at properly optimized percentages and at appropriate temperatures and time.

| | |
|----------------------|---|
| Physical State: | Solid, Black powder |
| Odor and Appearance: | Mild Rubber, Black with Brownish color granules |
| Bulk density: | 0.6 [± 0.03] gr/cm ³ |
| Specific Gravity | 1.031 gr/cm ³ [± 0.03] |
| Flash Point [°C]: | >300 (°C) |
| Solubility: | Insoluble in water |
| Chemical stability: | Incompatible with strong oxidizing |

| Seive Opening (mm) | Lower Limit (%) passing | Upper Limit (%) passing |
|--------------------|-------------------------|-------------------------|
| 1.000 | 100 | 100 |
| 0.500 | 50 | 80 |
| 0.250 | 10 | 40 |
| 0.125 | 5 | 20 |
| 0.063 | 2 | 10 |



Typical RARX® gradations should be within the limits showed above.

Shelf Life:

One year from production date. It is recommended that there be a vibrating metal net on its bottom to disaggregate any agglutinations that may occur.

Storage:

Keep big bags closed in ventilated warehouses when not in use. Avoid direct sun lights. Keep in dry place.

Transportation:

No need a special transportation.

Guidelines for use:

In the production of bituminous mixtures with **RARX®** a normal filler silo with a proper feeder may be used to add the **RARX®** in the mixer used in asphalt plants. However it should be considered that **RARX®** has a 0.6 density does requiring a high-volume throughput system. In order to ensure a homogeneous mixture, **RARX®** is added to the mixer together with the aggregates and before bitumen. To ensure a homogeneous mixture, **RARX®** should be mixed for about 10 seconds with the aggregate, before the addition of bitumen, and about 20 to 30 seconds afterwards.

It is recommended the aggregates to be overheated by 5 to 15° C, compared to the normal temperature used in similar type of mixing (but without exceeding 195° C) in order to compensate for the fact that **RARX®** is added at regular ambient temperature. It is recommended that the heating of the bitumen, is 5° C above the normal temperature used for this kind of mixtures (but without exceeding 195° C or the temperature recommended by bitumen producer).

Before compaction, the mix with **RARX®**, bitumen and aggregate **must stay** for about 30 minutes to 1 hour before compaction in the field. Usually this residence time observed by the time it usually takes between mixing in the plant and compaction in the field. During this time **RARX®** coatings are activating the bitumen and aggregate surfaces.

It is recommended a mixing temperature between 175° C and 180° C. It is recommended compaction temperature between 160° C and 170° C with steel rollers cylinder, wet with water with about 2% hydrated lime. The compaction must be done with at least three roller compactors, and one of them should always be close to the paver at maximum distance of 10 meters.

The addition of **RARX®** should be done by replacing part of the amount of bitumen to be used in the percentage that is defined in the formulation study, being this value variable between 12% and 40%, depending on the type of bituminous mixture to be manufactured. **RARX®** can be applied to the most diverse types of hot bituminous mixtures such as, open, dense, for thin layers, conventional, Stone Mastic Asphalt, gap graded and thingap, etc.

The exact percentage of **RARX®**, the mixing temperature, as well as the minimum mixing time, shall be determined by the mixture formulation study prepared by an Independent Testing Laboratory, experienced in the formulation of such bituminous mixtures, and approved by the Supervision. Once the exact percentage of **RARX®** to be used is set, deviations of more than $\pm 0.5\%$ from that value cannot be accepted.

RARX® General Concept

RARX® has been formulated so that, when added to an unmodified bitumen in suitable quantities, it can meet the requirements of a Rubber Asphalt - according to ASTM D 6114 - Standard Specification for Asphalt-Rubber Binder, (i.e. having an initial viscosity, at 5 minutes at 175 ° C, between 1500 and 5000 cPoises (according to EN 13302), a softening temperature value by Ring and Ball method, greater than 65 °C (by EN 1427) and a Resilience value higher than 30% (by ASTM D 5329)). It should also maintain the viscosity of the binder for 2 hours between the initial viscosity plus or minus 30%. Preferably, this viscosity should show stabilization signals during the last hour.

