

Performance-Graded Asphalt Binder (PG)

PG 46 • PG 52 • PG 58 • PG 64 • PG 70 • PG 76 • PG 82

In accordance with AASHTO M 320 / ASTM D6373 — Standard Specification for Performance-Graded Asphalt Binder

1. Description

The performance-grading (PG) system defines the asphalt binder by the pavement temperature range over which it must perform adequately, rather than by an empirical consistency property. The designation PG XX-YY indicates the maximum design pavement temperature (XX, in °C) and the minimum design temperature (YY, in °C). A PG 64-22 is formulated to perform between -22 °C and 64 °C pavement temperature.

The tests underpinning the classification — dynamic shear rheometer (DSR), bending beam rheometer (BBR) and direct tension (DT) — are performed on the original binder, on the rolling thin-film oven (RTFO) residue (short-term ageing) and on the pressure ageing vessel (PAV) residue (long-term ageing), so that the specification covers binder behaviour throughout the life of the pavement.

2. Applications

- High-performance hot mix asphalt and structural pavement layers.
- Corridors with high heavy-traffic indices and climates of wide thermal swing.
- Airport pavements subject to FAA specifications (AC 150/5370-10, Item P-401).
- Projects requiring performance specification rather than empirical grading.

3. Specifications

Standard grades tabulated in AASHTO M 320, Table 1

High-temperature grade	Available low-temperature grades
PG 46	-34 • -40 • -46
PG 52	-10 • -16 • -22 • -28 • -34 • -40 • -46
PG 58	-16 • -22 • -28 • -34 • -40
PG 64	-10 • -16 • -22 • -28 • -34 • -40
PG 70	-10 • -16 • -22 • -28 • -34 • -40
PG 76	-10 • -16 • -22 • -28 • -34
PG 82	-10 • -16 • -22 • -28 • -34

The grade matrix is not complete: PG 46 is not specified above -34 and PG 76 and PG 82 are not specified below -34. Only PG 52 covers the full -10 to -46 range.

Specification requirements

Property	Method	Requirement	Test temperature
Original (unaged) binder			
Flash point, Cleveland open cup (°C), min.	T 48	230 °C	—
Rotational viscosity at 135 °C (Pa·s), max.	T 316	3.0 Pa·s	135 °C
DSR — $G^*/\sin \delta$ on original binder (kPa), min.	T 315	1.00 kPa	Grade high temperature (10 rad/s)
Rolling thin-film oven (RTFO) residue — AASHTO T 240			
Mass change after RTFO (%), max. (absolute value)	T 240	1.00 %	163 °C
DSR — $G^*/\sin \delta$ on RTFO residue (kPa), min.	T 315	2.20 kPa	Grade high temperature (10 rad/s)
RTFO + pressure ageing vessel (PAV) residue — AASHTO R 28			
DSR — $G^*\cdot\sin \delta$ on RTFO + PAV residue (kPa), max.	T 315	5,000 kPa	Grade intermediate temperature
BBR — creep stiffness S at 60 s (MPa), max.	T 313	300 MPa	Grade low temperature + 10 °C
BBR — m-value at 60 s, min.	T 313	0.300	Grade low temperature + 10 °C
Direct tension — failure strain (%), min.	T 314	1.0 %	Grade low temperature + 10 °C (1.0 mm/min)

Technical warning — BBR and direct-tension test temperature: the low-temperature tests are NOT performed at the nominal grade temperature, but at that temperature plus 10 °C. A PG 64-22 is tested in the BBR at -12 °C, not at -22 °C. This is the most frequent transcription error in the industry's data sheets.

Test temperatures for the most requested grades

Grade	DSR original and RTFO (°C)	DSR on PAV — intermediate (°C)	BBR and direct tension (°C)	PAV temp. (°C)
PG 52-34	52	13	-24	90
PG 58-22	58	22	-12	100
PG 58-28	58	19	-18	100
PG 64-22	64	25	-12	100
PG 64-28	64	22	-18	100
PG 70-22	70	28	-12	100
PG 70-28	70	25	-18	100
PG 76-22	76	31	-12	100
PG 82-22	82	34	-12	100

The intermediate temperature is calculated as $(T_{high} + T_{low})/2 + 4$ °C. The PAV ageing temperature is 90 °C for PG 46 and PG 52, and 100 °C for PG 58 and above; in desert climates 110 °C may be specified for PG 70 and above. If creep stiffness is below 300 MPa the direct tension test is not required; if it is between 300 and 600 MPa, the direct-tension failure strain may replace the stiffness requirement, but the m-value must be met in both cases. The rotational viscosity limit is a pumpability criterion and may be waived if the supplier warrants that the binder can be pumped and mixed at conventional temperatures.

4. Storage and transport

Bulk storage shall be in clean tanks to avoid product contamination. The tank must have a heating system distributed along its length and an agitation and/or recirculation system that guarantees thermal homogeneity of the product. Transport from the production plant is carried out hot and in bulk, in tank trucks with adequate heating systems and thermometers located in visible places.

At 130 °C the product behaves as a stable liquid and its road transport presents no risk in transit. It is stable at plant or site working temperature (130 to 170 °C); however, above 230 °C the vapours emitted may ignite in the presence of a flame. Handling the product above 195 °C is not recommended, both because of the risk of toxic vapour emission and because of the loss of its physico-chemical properties.

5. Packaging and logistics

In bulk in heated tank trucks from 9 to 35 t · steel drums of 180–200 kg · Bitubags (thermally lined big bags) of 1,000–1,300 kg · 25 kg block packaging with anti-adhesive film for dry-container export. HS code: 2713.20 (petroleum bitumen).

6. Quality control

Every batch shipped is accompanied by a laboratory-issued quality certificate reporting the tests required by the applicable standard, with traceable batch identification. Additional testing or independent third-party inspection (SGS, Bureau Veritas, Intertek, Cotecna) at origin or destination can be arranged at the customer's request.

Consult the product Safety Data Sheet (SDS) before handling.

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