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البتروول ومشتقاته - الخصائص القياسية للرابط الأسفلتي المصنّف حسب درجة الأداء
*Petroleum and petroleum products – Standard specification for performance-
graded asphalt binder*

*"This Jordanian National Standard is based on ASTM D 6373-23, Standard
specification for penetration-graded asphalt binder for use in pavement construction.
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مؤسسة المواصفات والمقاييس
المملكة الأردنية الهاشمية

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Foreword

Jordan Standards and Metrology Organization is the national standardization body in Jordan. The work of preparing Jordanian Standards is normally carried out by technical committees composed of the interested parties, which are involved in the scope of the standard. All the interested parties have the right to comment on the draft Jordanian Standard during the inquiry stage, taking into consideration the importance of harmonizing Jordanian Standards with the international, regional or national standards (as much as possible) for the purpose of eliminating technical barriers to trade and facilitating the international trade.

Jordanian Standards are drafted in accordance with the rules given in the Jordanian Directive 1-2:2005, part 2: Rules for the structure and drafting of Jordanian Standards related to standardization department*.

The permanent technical committee for Petroleum and petroleum products 6 has studied the prepared project of the Jordanian Standard 2426:2026 related to "**Petroleum and petroleum products – Standard specification for performance-graded asphalt binder**", and has recommended to approve the amended project as a Jordanian Standard 2426:2026, according to article (12) of Standards and Metrology Law No. (22) For the year 2000 and its amendments.

This Jordanian Standard 2426:2026 is a modified adoption of the ASTM D6373-23 "**Petroleum and petroleum products – Standard specification for performance-graded asphalt binder**", using reprint method, single vertical bars (|) in the margins are used to indicate the applicable technical modifications which have been changed and shown in annex NA, and single vertical dotted bars (·) in the margins are used to indicate the applicable editorial modifications which have been changed and listed below.

For the purposes of this Jordanian Standard, the following editorial changes have been made applying the Jordanian Directive 1-2:2005, part 2: rules for the structure and drafting of Jordanian Standards:

- Substitution of "this specification", by "this Jordanian Standard".
- Deletion of clause 1-2 and clause 1-3 because they relate to ASTM requirements.
- Deletion of footnote 1, 2, 3, 5, and renumbering footnote 1 by 4, because they relate to ASTM requirements.
- Deletion clause 10.

* under amendment

Petroleum and petroleum products – Standard specification for performance-graded asphalt binder

1- Scope

This Jordanian Standard covers asphalt binders graded by performance. Grading designations are related to the LTPPBind Online calculated maximum pavement design temperature and the minimum pavement design temperature. This Jordanian Standard contains Tables 1 and 2. Table 2 incorporates Practice ASTM D6816 for determining the critical low cracking temperature using a combination of Test Method ASTM D6648 and Test Method ASTM D6723 test procedures. If no table is specified, the default is Table 1.

Note 1: For more information on LTPPBind Online, see <https://infopave.fhwa.dot.gov/Foils/LTPPBBindOnline> accessed May 23, 2023.

Note 2: For asphalt cements graded by penetration at 25 °C, see Specification JS 612. For asphalt cements graded by viscosity at 60 °C, see Specification ASTM D3381/D3381M.

Note 3: AASHTO R 29 provides non-mandatory information for determining the performance grade of an asphalt binder.

2- Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Indexes for published standard can be found in JSMO's library.

- ASTM D8, Terminology relating to materials for roads and pavements.
- ASTM D92, Test method for flash and fire points by cleveland open cup tester.
- ASTM D95, Test method for water in petroleum products and bituminous materials by distillation.
- ASTM D140/D140M, Practice for sampling asphalt materials.
- ASTM D2042, Test method for solubility of asphalt materials in trichloroethylene or toluene.
- ASTM D2872, Test method for effect of heat and air on a moving film of asphalt (Rolling Thin-Film Oven Test).
- ASTM D3381/D3381M, Specification for viscosity-graded asphalt binder for use in pavement construction.
- ASTM D4402/D4402M, Test method for viscosity determination of asphalt at elevated temperatures using a rotational viscometer.
- ASTM D6521, Practice for accelerated aging of asphalt binder using a pressurized aging vessel (PAV).
- ASTM D6648, Test method for determining the flexural creep stiffness of asphalt binder using the bending beam rheometer (BBR).
- ASTM D6723, Test method for determining the fracture properties of asphalt binder in direct tension (D1) (Withdrawn 2021)¹⁾
- ASTM D6816, Practice for determining low-temperature performance grade (PG) of asphalt binders (Withdrawn 2021)¹⁾
- ASTM D7175, Test method for determining the rheological properties of asphalt binder using a dynamic shear rheometer.
- ASTM D7553, Test method for solubility of asphalt materials in N-Propyl bromide.
- AASHTO R 29, Grading or verifying the performance grade of an asphalt binder.

¹⁾ The last approved version of this historical standard is referenced on www.astm.org.

- AASHTO M 320, Standard specification for performance-graded asphalt binder.
- JS 612, Petroleum and petroleum products — Standard specification for penetration-graded asphalt binder for use in pavement construction.

3- Terminology

Definitions for many terms common to asphalt binder are found in Terminology ASTM D8.

4- Ordering information

When ordering under this specification, include in the purchase order the performance grade (PG) of asphalt binder required and the table used (for example, PG 52-16, Table 1 or PG 64-34, Table 2). If no table is specified, the default is Table 1.

Note: Agencies may elect to specify PG grades not listed in the tables, either outside the table limits or between listed grades, based on specific design or performance criteria. For these PG grades it is still appropriate to test the original and RTFO DSR at the specified PG high temperature, and BBR at the specified PG low temperature +10 °C and PAV DSR at $(PG\ high + PG\ low)/2 + 4$ °C, for example, for PG 64-22, $(64 + (-22))/2 + 4 = 25$.

5- Materials and manufacture

5-1 Asphalt binder shall be prepared by the refining of crude petroleum, with or without the addition of modifiers.

5-2 Modifiers may be any materials of suitable manufacture that are used in virgin or recycled condition, and that are capable of being dissolved, dispersed, or reacted in asphalt binder with the objective of improving its performance.

Note: This Jordanian Standard is not intended to address the grading of asphalt binders containing particulate or fibrous materials larger than 250 µm in size.

5-3 The asphalt binder shall be homogeneous, free from water and deleterious materials, and shall not foam when heated to 175 °C.

5-4 The asphalt binder shall be at least 99.0 % soluble, as determined by Test Method ASTM D2042 or ASTM D7553. Any insoluble component shall be substantially free of fibers.

5-5 The grades of asphalt binder shall conform to the requirements given in Table 1 or Table 2.

Note: Conformance with all of the parameters of this specification is not a guarantee that the asphalt concrete mix made from these products will perform in the field. The end user of asphalt binders should assess the suitability of the binder to meet the performance requirements of the projects on which they will be used.

Table 1 – Performance graded asphalt binder specification

Performance Grade	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82
	-34 -40 -46	-10 -16 -22 -28 -34 -40 -46	-16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34	-10 -16 -22 -28 -34
LTPP Bind algorithm max Pavement Design Temperature, °C	< 46	< 52	< 58	< 64	< 70	< 76	< 82
Minimum Pavement Design Temperature, °C ^{a)}	> -34 > -40 > -46	> -10 > -16 > -22 > -28 > -34 > -40 > -46	> -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34	> -10 > -16 > -22 > -28 > -34
Original Binder							
Flash Point Temp., ASTM D92; min °C	230						
Viscosity, ASTM D4402/D4402M ^{b)} max. 3 Pa·s, Test Temp., °C	135						
Dynamic Shear, ASTM D7175 ^{c)} G*/sinδ, min. 1,00 kPa, 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s, °C	46	52	58	64	70	76	82
Rolling Thin Film Oven (Test Method ASTM D2872)							
Mass Change, max. percent	1,00						
Dynamic Shear, ASTM D7175: G*/sinδ, min. 2,20 kPa 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s, °C	46	52	58	64	70	76	82
Pressure Aging Vessel Residue (Practice ASTM D6521)							
PAV Conditioning Temperature, °C ^{d)}	90	90	100	100	100	100	100

Table 1 – Performance graded asphalt binder specification (cont.)

Performance Grade	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82
	-34 -40 -46	-10 -16 -22 -28 -34 -40 -46	-16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34	-10 -16 -22 -28 -34
Dynamic Shear, ASTM D7175: G* sin δ , ^a max 6000 kPa δ , ^b min 42° 8 mm Plate, 2 mm Gap Test Temp. at 10 rad/s, °C	10 7 4	25 22 19 16 13 10 7	25 22 19 16 13	31 28 25 22 19 16	34 31 28 25 22 19	37 34 31 28 25	40 37 34 31 28
Creep Stiffness, ASTM D6648 ^c , S, max 300 MPa, m-value; min. 0.300 Test Temp. at 60 s, °C	-24 -30 -36	0 -6 -12 -18 -24 -30 -36	-6 -12 -18 -24 -30	0 -6 -12 -18 - 24 -30	0 -6 -12 -18 -24 -30	0 -6 -12 -18 -24	0 -6 -12 -18 -24
Direct Tension, ASTM D6723 ^d Failure Strain, min. 1.0%, Test Temp. at 1.0 mm/min, °C	-24 -30 -36	0 -6 -12 -18 -24 -30 -36	-6 -12 -18 -24 -30	0 -6 -12 -18	0 -6 -12 -18 -24 -30	0 -6 -12 -18 -24	0 -6 -12 -18 -24

^a) Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPPBind Online software program, or are provided by the specifying agency.

^b) The referee method shall be Test Method ASTM D4402/D4402M using a No. 21 spindle at 20 RPM; however, alternate methods may be used for routine testing and quality assurance. If the binder is too stiff to test with the No. 21 spindle, the No. 27 spindle shall be used. The spindle size and shear rate shall be reported. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

^c) The mass change shall be less than 1.00 % for either a positive (mass gain) or a negative (mass loss) change.

^d) For climates with a LTPPBind high pavement temperature of 76 or above, the PAV conditioning temperature shall be 110 °C.

^e) If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

^f) If the intermediate temperature stiffness, G* sin δ , is below 5000 kPa, the phase angle minimum limit is not required. If the intermediate temperature stiffness, G* sin δ , is between 5000 and 6000 kPa, the intermediate phase angle minimum limit is required.

Table 2 – Performance graded asphalt binder specification

Performance Grade	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82
LTPPBind algorithm max Pavement Design Temperature, °C	< 46	< 52	< 58	< 64	< 70	< 76	< 82
Minimum Pavement Design Temperature, °C ^{a)}	> -34 > -40 > -46	> -10 > -16 > -22 > -28 > -34 > -40 > -46	> -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40	> -10 > -16 > -22 > -28 > -34 > -40
Original Binder							
Flash Point Temp., ASTM D92; min °C	230						
Viscosity, ASTM D4402/D4402M ^{b)} max. 3 Pa·s, Test Temp., °C	135						
Dynamic Shear, ASTM D7175 ^{c)} G*/sinδ, min. 1.00 kPa, 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s, °C	46	52	58	64	70	76	82
Rolling Thin Film Oven (Test Method ASTM D2872)							
Mass Change, max. percent	1,00						
Dynamic Shear, ASTM D7175; G*/sinδ, min. 2,20 kPa 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s, °C	46	52	58	64	70	76	82
Pressure Aging Vessel Residue (Practice ASTM D6521)							
PAV Conditioning Temperature, °C ^{d)}	90	90	100	100	100	100	100

Table 2 – Performance graded asphalt binder specification (cont.)

Performance Grade	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82
		-34 -40 -46	-10 -16 -22 -28 -34 -40 -46	-16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34 -40	-10 -16 -22 -28 -34
Dynamic Shear, ASTM D7175: $G^* \sin \delta$, ^h max 6000 kPa δ , ⁱ min 42° 8 mm Plate, 2 mm Gap Test Temp. at 10 rad/s, °C	10 7 4	25 22 19 16 13 10 7	25 22 19 16 13	31 28 25 22 19 16	34 31 28 25 22 19	37 34 31 28 25	40 37 34 31 28
Critical Low Cracking Temperature, ASTM D6816, ^e PASS Test Temp °C	-24 -30 -36	0 -6 -12 -18 -24 -30 -36	-6 -12 -18 -24 -30	0 -6 -12 -18 -24 -30	0 -6 -12 -18 -24 -30	0 -6 -12 -18 -24	0 -6 -12 -18 -24

^a Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPPBind Online software program, or are provided by the specifying agency.

^b The referee method shall be Test Method ASTM D4402/D4402M using a No. 21 spindle at 20 RPM; however, alternate methods may be used for routine testing and quality assurance. If the binder is too stiff to test with the No. 21 spindle, the No. 27 spindle shall be used. The spindle size and shear rate shall be reported. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

^c The mass change shall be less than 1.00 % for either a positive (mass gain) or a negative (mass loss) change.

^d For climates with a LTPPBind high pavement temperature of 76 or above, the PAV conditioning temperature shall be 110 °C.

^e For verification of grade, at a minimum perform Test Method ASTM D6648 at the test temperature and at the test temperature minus 6 °C, and Test Method D6723 at the test temperature. Testing at additional temperatures for Test Method D6648 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from Test Method ASTM D6723 to the calculated induced thermal stress as per Practice ASTM D6816. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

^f If the intermediate temperature stiffness, $G^* \sin \delta$, is below 5000 kPa, the phase angle minimum limit is not required. If the intermediate temperature stiffness, $G^* \sin \delta$, is between 5000 and 6000 kPa, the intermediate phase angle minimum limit is required.

6- Sampling

The material shall be sampled in accordance with Practice ASTM D140/D140M.

7-Test methods

The properties outlined in 5-3, 5-4, and 5-5 shall be determined in accordance with Test Methods ASTM D92, ASTM D95, ASTM D2042, ASTM D2872, and ASTM D4402/D4402M, Practice ASTM D6521, Test Methods ASTM D6648 and ASTM D6723, Practice ASTM D6816, and Test Method ASTM D7553 or ASTM D7175.

8- Inspection and certification

Inspection and certification of the material shall be agreed upon between the purchaser and the seller. Specific requirements shall be made part of the purchase contract. The seller shall provide material handling and storage procedures for each asphalt binder grade certified.

Note: A number of relevant research studies have suggested that limits for the loss stiffness for the binder, $G^* \cdot \sin \delta$, in the ASTM and AASHTO PG Binder Specification is, by itself, not a sufficient indicator of fatigue performance of an asphalt cement, or the asphalt concrete in asphalt pavement structures, or both.

9- Rejection and rehearing

If the results of any test do not conform to the requirements of this Jordanian Standard, retesting to determine conformity is performed as indicated in the purchase order or as otherwise agreed upon between the purchaser and the seller.

10- Labeling

The following information shall be written clearly, visible and difficult to remove in Arabic and/or English on label for each container or in attached document.

- a) The name of the product.
- b) The name and address of the manufacturer and importer. The trademark may be mentioned (if any).
- c) Penetration-grade.
- d) Warning statements and/or warning symbols for the transfer, handling and/or use.
- e) Storage conditions.
- f) Weight, volume, or nominal capacity using international standard units (SI).
- g) Country of origin.

Annex NA
(Normative)
National technical modifications

Table NA - 1 illustrates the technical national deviations from ASTM D6373:23 adopted as a Jordanian Standard, where single vertical bars (|) in the margins are used to indicate these technical national modifications have been changed.

Table NA - 1 - List of national technical modifications

Clause	Modification	Explanation
Wherever mentioned	Substitution of "ASTM D946/ D 946M", by "JS 612"	To confirm with published Jordanian standards, because JS 612 is modified adaption of ASTM D946/ D 946M
10	Add clause for Labelling	Applying the Jordanian Technical Regulation 119:2022 "Labeling - Labeling of industrial products".