

**Ball & Roller Bearing Grease; Petroleum Oil-Base**

EMPIS Material D6A2 identifies petroleum oil-based grease suitable for ball and roller bearing applications, as follows:

<u>EMPIS designation</u>	<u>Description</u>
D6A2A5	Sodium-calcium soap
D6A2B2	Water resistant (anhydrous calcium soap)
D6A2C2	Channeling, nonbleeding (sodium-complex soap)
D6A2C5	General purpose (lithium soap)
D6A2C6	High speed, channeling, (sodium-complex soap)
D6A2C7	Odorless and tasteless (lithium soap)
D6A2C9	High speed, high temperature (sodium soap)
D6A2C10	High speed, high temperature, railway (lithium soap)
D6A2C11	General purpose, lower penetration (lithium soap)
D6A2C13	High temperature, (9.5 % polyurea thickener)
D6A2C14	High temperature (14.5 % polyurea thickener)
D6A2C16	Extreme pressure, multipurpose (lithium complex soap), NLGI Grade 1
D6A2C17	High temperature, multipurpose (lithium complex soap)
D6A2C18	Extreme pressure, multipurpose (lithium soap)
D6A2C19	Extreme pressure, hard service (lithium complex soap)
D6A2C20	Low temperature, multipurpose (lithium complex soap)
D6A2C21	High speed, high temperature (lithium soap)
D6A2C22	High temperature, low noise (12 % polyurea thickener)
D6A2C23	High temperature, low noise (polyurea thickener)
D6A2C24	Extreme pressure, multipurpose (lithium complex soap), NLGI Grade 2
D6A2C25	Wide temperature range (lithium soap)
D6A2D	Special sealing grease (sodium-calcium soap)

REFERENCED DOCUMENTS:

ASTM D 88	Saybolt Viscosity
ASTM D 128	Analysis of Lubricating Grease
ASTM D 217	Cone Penetration of Lubricating Grease
ASTM D 445	Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)
ASTM D 566	Dropping Point of Lubricating Grease
ASTM D 942	Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
ASTM D 1263	Leakage tendencies of Automotive Wheel Bearing Greases
ASTM D 1404	Deleterious Particles in Lubricating Grease
ASTM D 1478	Low-Temperature Torque of Ball Bearing Grease
ASTM D 1742	Oil Separation from Lubricating Grease During Storage
ASTM D 1743	Corrosion Preventive Properties of Lubricating Greases
ASTM D 2265	Dropping Point of Lubricating Grease Over Wide Temperature Range
ASTM D 2509	Load-Carrying Capacity of Lubricating Grease (Timken Method)
ASTM D 3336	Life of Lubricating Greases in Ball Bearings at Elevated Temperatures
ASTM D 3527	Life Performance of Automotive Wheel Bearing Grease
ASTM D 4057	Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D 4177	Practice for Automatic Sampling of Petroleum and Petroleum Products
EMPIS E4B3	High Temperature Performance; Ball & Roller Bearing Grease
EMPIS E4C17	Dirt Particles in Grease (see also ASTM D 1404)

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PROPERTIES:

EMPIS designation	Penetration unworked, mm/10	Penetration worked, mm/10, 60 x	Dropping point °F (°C), min	Grease base		
				Mineral oil viscosity SUS at 100 °F	Thickener or soap	% Content
D6A2A5	290 – 320	300 – 320	325 (163)	400 – 600	Na-Ca	13 – 15
D6A2B2	–	265 – 295	280 (138)	1370 (4)	Anhydrous Ca	7 nom
D6A2C2	85 – 225	195 – 225	480 (249)	450 – 700	Na complex	–
D6A2C5	–	265 – 295	340 (171)	–	Li	–
D6A2C6	275 – 310	285 – 310	450 (232)	220 – 500	Na complex	–
D6A2C7	–	265 – 295	340 (171)	80 nom (2)	Li	–
D6A2C9	260 nom	240 – 280	350 (177)	525 – 575	Na	–
D6A2C10	235 – 255	220 – 240	380 (193)	475 – 525	Li	10 – 13
D6A2C11	–	225 – 245	360 (182)	470 – 520	Li	12 – 15
D6A2C13	230 nom (1)	265 – 285	425 (218)	540 – 595	Polyurea	8 – 10
D6A2C14	(1)	265 – 295	440 (227)	575 – 625	Polyurea	12 – 15
D6A2C16	–	325 nom	500 nom	750 nom	Li complex	–
D6A2C17	235 nom	235 nom	426 (219)	600 nom	Li complex	–
D6A2C18	260 – 300	265 – 295	350 (177)	900 nom	Li	13 nom
D6A2C19	–	265 – 295	450 (232)	1170 nom	Li complex	8 – 12
D6A2C20	–	265 – 295	426 (219)	50 nom (4)	Li complex	–
D6A2C21	–	265 – 295	380 (193)	129 (4)	Li	18 nom
D6A2C22	–	265 – 295	500 (260)	129 nom (4)	Polyurea	12 nom
D6A2C23	–	265 – 295	550 (288)	115 nom (4)	Polyurea	–
D6A2C24	–	265 – 295	500 (260)	725 – 775	Li complex	–
D6A2C25	–	250 nom	392 (200)	77 nom (11)	Li	15 – 25
D6A2D	150 – 210	180 – 210	330 (166)	220 – 400	Na-Ca/Na (5)	22 – 27

EMPIS designation	Free alkali as NaOH (% max)	Free acid as oleic (% max)	Dirt particles per g, max	Color	Soluble in water	Corrosion 24 hrs at 210 °F (99 °C)
D6A2A5	0.35	Nil	2	Amber	Yes	–
D6A2B2	–	–	–	Green	No	Shall pass
D6A2C2	0.60	Nil	2	Brown	Yes	Shall pass
D6A2C5	0.35	Nil	2	Amber	No	Shall pass
D6A2C6	0.60	Nil	2	Brown	Yes	Shall pass
D6A2C7	0.35	Nil	2	Brown	No	Shall pass
D6A2C9	–	Nil	(6)	Amber	Yes	Shall pass
D6A2C10	0.5	Nil	(6)	Amber	–	–
D6A2C11	0.06	–	–	Amber	No	Shall pass
D6A2C13	–	–	(7)	Bluegreen	No	Shall pass
D6A2C14	–	–	(7)	Red	No	Shall pass
D6A2C16	–	–	–	Brown	No	Shall pass
D6A2C17	–	–	–	Green	No	Shall pass
D6A2C18	–	–	–	Amber	No	Shall pass
D6A2C19	–	–	–	Dark red	No	Shall pass
D6A2C20	–	–	–	Dark green	No	Shall pass
D6A2C21	–	–	–	Bluegreen	No	Shall pass
D6A2C22	–	–	–	Purple	No	Shall pass
D6A2C23	–	–	–	Blue	No	Shall Pass
D6A2C24	–	–	–	Green	No	Shall Pass
D6A2C25	–	–	–	Light yellow to white	No	Shall Pass
D6A2D	0.35	Nil	2	Amber	Yes	–

(See page 3 for footnotes)

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PROPERTIES: (continued)

EMPIS designation	Oxidation resistance		Starting torque at RT, gm-cm, max	Running torque at RT, gm-cm, max	Temperature at which starting torque reaches 1000 gm-cm °F (°C), max
	Time to reach 20 psi drop, hrs, at 210 °F min	Pressure drop, psi, after 500 hrs at 210 °F, nom			
D6A2B2	—	5 (8)	—	—	—
D6A2C2	400	15	150	150	-15 (-26)
D6A2C5	750	—	150	150	-20 (-29)
D6A2C6	400	15	150	150	-10 (-23)
D6A2C7	750	—	150	150	-20 (-29)
D6A2C9	1000	5	—	—	—
D6A2C10	1000	—	—	—	—
D6A2C11	—	5 (8)	—	—	—
D6A2C13	750	—	—	—	—
D6A2C14	1000	—	—	—	—
D6A2C17	—	6	—	—	—
D6A2C18	—	10 (8)	—	—	—
D6A2C19	—	10 (8)	—	—	—
D6A2C24	—	10 (8)	—	—	—

EMPIS designation	Operation at 100 °C (306 Brg, 3600 rpm) hrs, min	Operation at 100 °C (207 Brg, 11000 rpm) hrs, min	Bleeding 500 hrs at 100 °C, % max	Evaporation 500 hrs at 100 °C, % max	Lubrication life 10,000 rpm, hrs, 250 °F/300 °F (10)	Timken OK, lbs, min
D6A2B2	—	—	—	—	—	50 nom
D6A2C2	2000	500	1	6	1500/400	—
D6A2C5	10000	—	10	6	—	—
D6A2C6	2000	500	6	6	1500/400	—
D6A2C7	10000	—	10	6	—	—
D6A2C9	10000	—	3	3	5000+/1000	—
D6A2C10	—	—	3	4	—	—
D6A2C13	—	—	3	4	—	—
D6A2C14	—	—	9	5	—	—
D6A2C19	—	—	—	—	—	40
D6A2C20	—	—	—	—	/1000	—
D6A2C24	—	—	—	—	—	40

Wheel bearing leakage (D6A4B2 only) -

Pass

Wheel bearing life (D6A2C21 only), B50, hrs -

240

High temperature lubrication life, ASTM D 3336, 350 °F (171 °C), hrs (10) -

D6A2C22
485D6A2C23
750

(1) On aging thickener can build in structure.

(2) SUS at 210 °F.

(3) Viscosity index (VI) of oil is 90 minimum.

(4) Centistokes at 40 °C.

(5) One or a combination of any soap bases specified may be used.

(6) Dirt particles per cc, max:

25 µm or greater - 7500

75 µm or greater - 1600

125 µm or greater - Nil

(7) Dirt particles per cc, max:

10 µm or greater - 560

25 µm or greater - 140

50 µm or greater - 35

75 µm or greater - Nil

(8) 100 hrs at 210 °F

(9) Data not available.

(10) Engineering information, not a requirement.

(11) Centistokes under 40 °C.

ADDITIONAL REQUIREMENTS:

Quality – Material shall be a smooth, homogeneous mixture of mineral oil and a thickening agent, such as a soap, made from non-rancid animal or vegetable fats or oils, and containing no lumps, filler material, such as rosin, rosin oils, talc, wax, powdered mica, sulfur, asbestos, clay, tarry, or asphaltic matter, and shall be free from rancid or objectionable odors. The lubricant shall contain no more than 0.05 % of material insoluble in petroleum ether and hydrochloric acid as measured by the soap determination in ASTM D 128. EMPIS Materials D6A2C13, C14, C22 and C23 shall contain a polyurea thickening agent.



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ADDITIONAL REQUIREMENTS: (continued)

- Soap bases – All calcium soap base greases shall be completely saponified with hydrated lime. The lime used in the manufacture of the grease shall contain not more than 7 % magnesium oxide or 2 % gritty non-soap-forming substances. Sodium or lithium soap base greases shall be completely saponified with sodium or lithium hydroxide, respectively.
- Oxidation resistance – All materials, except D6A2D, are required to contain antioxidant additives to increase their storage stability and resistance to oxidation under use conditions.
- Rust inhibitor – EMPIS Materials D6A2B2, C5, C7, C11, C13, C14, C16, C17, C18, C19, C20, C21, C22, C23, C24 and C25 shall contain suitable rust inhibitors.
- EP additives – EMPIS Materials D6A2B2, C16, C18, C19, and C24 shall contain a suitable EP additive.
- Aging – Greases shall not increase in hardness more than 15 points over the original unworked penetration value when standing in containers for periods up to one year. When used in apparatus in storage or operating with bearing temperatures not exceeding 175 °F (79 °C), the grease shall not get more than 30 points stiffer in consistency in six months time than the worked consistency at the time it was applied. Greases not meeting this requirement will be subject to removal as an approved material, but polyurea-type greases are exempted at this time.
- Odor and taste – EMPIS Material D6A2C7 shall be odorless and tasteless and shall not impart odor or taste to butter or distilled water after enclosure in a glass container with these substances for 48 hours at room temperature.
- Oil separation – When tested in accordance with ASTM D 1742, EMPIS Material D6A2C22 and C25 - 0.5 weight %, nom. EMPIS Material D6A2C23 - 0.3 weight %, nom.

REFEREE METHODS:

Sampling.....	ASTM D 4057 or D 4177
Penetration.....	ASTM D 217
Dropping point.....	ASTM D 566 or D 2265 (15)
Viscosity, SUS.....	ASTM D 88
Viscosity.....	ASTM D 445
Soap determination.....	ASTM D 128
Free alkali or acid.....	ASTM D 128
Consistency.....	ASTM D 217
Dirt particles.....	EMPIS E4C17
Corrosion.....	ASTM D 1743 (14)
Oxidation resistance.....	ASTM D 942
Start and running torque.....	ASTM D 1478 (12)
High temperature performance.....	EMPIS E4B3 (13)
Bleeding and evaporation.....	As agreed between purchaser and supplier
Lubrication life.....	ASTM D 3336
Timken.....	ASTM D 2509
Wheel bearing leakage.....	ASTM D 1263
Wheel bearing life.....	ASTM D 3527
Oil separation.....	ASTM D 1742
High temperature lubrication life.....	ASTM D 3336

(12) Modify for temperatures specified.

(13) Except shall be geometric mean of five tests.

(14) 5 % synthetic sea salt, for D6A2C19, C21 and C22; 3 % salt water, 24 hrs at 126 °F (52 °C) for D6A2C20; distilled water for D6A2C23.

(15) ASTM D 2265 for D6A2C17 and C20.

CERTIFICATE OF TEST:

When requested, the supplier shall submit promptly to the purchaser at the point of delivery a certificate of test showing the results of tests for properties required by this specification. This certificate shall be addressed to the section, unit, or person specified on the purchase order, and shall contain the EMPIS designation, the purchase order number, and the quantity shipped so that the certificate may be identified with the shipment.

PACKING AND MARKING:

Material shall be packaged in a manner suitable to meet DOT and carriers' regulations and to protect the product against deterioration, contamination or loss during normal shipping and storage.

Each shipping container shall be legibly marked with the purchase order number, the manufacturer's name or trade name, the batch and code number, the weight, the quantity contained, the EMPIS designation and appropriate safety and hazard information.

DOCUMENT REVISION STATUS:

<u>Rev</u>	<u>Description</u>	<u>Revision Date</u>
S32	Previous revision	2005 Apr 30
S33	Added designation C25	2012 Aug 31