

JIS

JAPANESE INDUSTRIAL STANDARD

Lubricating grease

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JAPANESE INDUSTRIAL STANDARD

J I S

Lubricating grease

K 2220-1993

1. Scope This Japanese Industrial Standard specifies the lubricating grease (hereafter referred to as "grease") to be used mainly as the lubricants for various kinds of machine parts.

Remarks 1. The standards cited in this Standard are shown in Attached Table 1.

2. Corresponding International Standards to this Standard are shown as follows.

ISO 2137: 1985 Petroleum products - Lubricating grease and petrolatum - Determination of cone penetration

ISO 2176: 1972 Petroleum products - Lubricating grease - Determination of dropping point

3. The units and numerical values given in { } in this Standard are based on the traditional units and are standard values.

Further, those traditional units and numerical values shall be informative reference values on and after April 1st, 1995.

2. Definitions The principal terms used in this Standard shall be as defined below.

- (1) grease A solid or semisolid matter produced by dispersing a thickening agent in a lubricating oil. It may contain other ingredients to impart special properties.
- (2) gear compound A matter produced by dissolving or dispersing a viscous substance such as asphalt and others in mineral oil. It is used principally for the lubricants for open gears. It may contain other ingredients to impart special properties.
- (3) base oil Lubricating oil being a raw material for grease. The base oil is roughly classified into refined mineral oil, synthetic lubricating oil, and their mixed oil.
- (4) thickening agent Substance, dispersing in lubricating oil in colloidal state, to render it semisolid or solid. Thickening agents are classified principally into two types; metallic soap type and non-soap type. The former is represented by metallic soaps of lithium, calcium, sodium and others, and the latter by inorganic compounds such as bentonite, silica gel and others, and organic compounds such as urea derivatives, phthalocyanine and others. Properties of grease greatly depend upon the type of thickening agent used.

- (5) water resistance Resistance of the grease to moisture or water, it is to say the property of grease to withstand without being influenced when contacted with moisture or water in practical use.
- (6) mechanical stability Resistance of the grease to the change in hardness when subjected to a mechanical shearing force. It is also called shearing stability.
- (7) property of delivery under pressure The fluid properties of grease when it is fed under pressure through piping, nozzle and accessories of a lubricating system.
- (8) load carrying capacity Maximum load or pressure under which lubrication can continue without causing defects such as seizure or fusion on the bearing or the sliding surface when a lubricant is used under the specified conditions.
- (9) cone penetration Depth expressed in 10 times millimetre to which a specified cone penetrates into the sample grease vertically in the specified time. It indicates the consistency of a grease.
- (10) working To subject grease to the shearing action of the specified grease worker.
- (11) worked penetration Cone penetration of the sample grease, which have been maintained at 25°C in the specified worker, measured immediately after working 60 double strokes.
- (12) unworked penetration Cone penetration, at 25°C, of the sample grease which has been transferred, without disturbance as possible, from sample container to the specified worker or the vessel having the same dimensions.
- (13) prolonged worked penetration Cone penetration, obtained immediately after 60 double strokes, of the sample grease which has been worked in the specified worker to the specified number of strokes and then kept at 25°C.
- (14) undisturbed penetration Cone penetration of the sample at 25°C, as it is without being stirred, after stored for a specified period in the specified container.
- (15) block penetration Cone penetration of the sample grease, measured at 25°C, of which consistency is enough to keep shape, after it was cut into the specified dimensions.
- (16) quarter and half cone penetrations The value defined as the depth, expressed in 10 times millimetre, to which the specified cones, miniaturized to a quarter and a half size of the standard cone, penetrate into the sample grease in the specified time.
- (17) numbers of cone penetration The number classified according to the ranges of worked penetrations of greases, which are as enumerated in Table 1.

Table 1. Numbers of cone penetration

Number of cone penetration	Range of worked penetration
No. 000	445 to 475
No. 00	400 to 430
No. 0	355 to 385
No. 1	310 to 340
No. 2	265 to 295
No. 3	220 to 250
No. 4	175 to 205
No. 5	130 to 160
No. 6	85 to 115

- (18) dropping point Dropping point is defined as the temperature at which the first drop of the grease falls, when a sample is heated in the specified apparatus under the specified conditions and beginning to change its state from semisolid to liquid state.
- (19) worked stability After working grease sample one hundred thousand times in the specified grease worker, hold at 25°C, then immediately after working 60 double strokes, measure the cone penetration to be taken as worked stability.
- (20) water washout resistance The loss of a sample measured 1 h after a specified ball bearing packed with the sample is revolved at a specified number of revolutions ($600 \pm 30/\text{min}$), and the distilled water kept at a specified temperature is sprayed onto the housing of the ball bearing at a specified rate ($5 \pm 0.5 \text{ ml/s}$).
- (21) low temperature torque Low temperature torque is defined as the force enough to restrain the turning of the outer ring of the specified open type ball bearing, in which the grease sample is packed and of which inner ring is turned at the specified rate of revolution (one turn per minute) at the specified low temperature. It is expressed in two classified torques described below.
- (a) Starting torque The largest torque obtained at the start of revolution.
- (b) Revolving torque The averaged torque obtained after revolutions for the specified time.
- (22) apparent viscosity Apparent viscosity is defined as the ratio of shear stress to shear rate calculated from Poiseuille's formula. Since grease is non-Newtonian fluid, the ratio will vary with the shear rate.
- (23) shear rate Rate of a series of adjacent layers of grease to move each other.

3. Classification Grease shall be classified into 7 classes according to the use, and shall be further subdivided as shown in Table 2 according to grades (components and performance), and the number of cone penetration (worked penetration range or viscosity range).

Table 2. Classification

Classification			Applicable temperature range °C	Informative reference				Example of application
Class according to use	Grade	No. of cone penetration		Applicability to using condition			Contact with water	
				Load				
				Light	Heavy	Impact		
Grease for general purpose	Grade 1	No.1, No.2, No.3, No.4	-10 to 60	Applicable	Inapplicable	Inapplicable	Applicable	For general light load
	Grade 2	No.2, No.3	-10 to 100	Applicable	Inapplicable	Inapplicable	Inapplicable	For general medium load
Grease for rolling bearing	Grade 1	No.1, No.2, No.3	-20 to 100	Applicable	Inapplicable	Inapplicable	Applicable	For general purpose
	Grade 2	No.0, No.1, No.2	-40 to 80	Applicable	Inapplicable	Inapplicable	Applicable	For low temperature
	Grade 3	No.1, No.2, No.3	-30 to 130	Applicable	Inapplicable	Inapplicable	Applicable	For wide temperature range
Chassis grease for automobile	Grade 1	No.00, No.0, No.1, No.2	-10 to 60	Applicable	Applicable	Applicable	Applicable	For chassis of auto-mobile
Wheel bearing grease for automobile	Grade 1	No.2, No.3	-20 to 120	Applicable	Inapplicable	Inapplicable	Applicable	For wheel bearing of automobile

Table 2. (continued)

Classification			Applicable temperature range °C	Informative reference					Example of application
Class according to use	Grade	No. of cone penetration		Applicability to using condition				Contact with water	
				Load			Impact		
				Light	Heavy				
Grease for central lubricating system	Grade 1	No.00, No.0, No.1	-10 to 60	Applicable	Inapplicable	Inapplicable	Applicable	Applicable	For medium load of central lubricating system
	Grade 2	No.0, No.1, No.2	-10 to 100	Applicable	Inapplicable	Inapplicable	Applicable	Applicable	For medium load of central lubricating system
	Grade 3	No.0, No.1, No.2	-10 to 60	Applicable	Applicable	Applicable	Applicable	Applicable	For heavy load of central lubricating system
	Grade 4	No.0, No.1, No.2	-10 to 100	Applicable	Applicable	Applicable	Applicable	Applicable	For heavy load of central lubricating system
Grease for heavy load	Grade 1	No.0, No.1, No.2, No.3	-10 to 100	Applicable	Applicable	Applicable	Applicable	Applicable	For impact heavy load
Gear compound	Grade 1	No.1(1), No.2(1), No.3(1)	-10 to 100	Applicable	Applicable	Applicable	Applicable	Applicable	For open gear and wire rope

Note (1) The numbers given in this column are such those which are classified according to the range of viscosity.

- Remarks
1. Grade 1 grease for general purpose principally consists of base oil and calcium soap, and has sufficient water resistance.
 2. Grade 2 grease for general purpose principally consists of base oil and sodium soap, and has sufficient heat resistance.
 3. Grade 1 grease for rolling bearing principally consists of base oil and thickening agent, and has sufficient mechanical stability, water resistance, and rust preventive property.
 4. Grade 2 grease for rolling bearing principally consists of base oil and thickening agent, and has sufficient low temperature property, water resistance, mechanical stability, and rust preventive property.
 5. Grade 3 grease for rolling bearing principally consists of base oil and thickening agent, and has sufficient low temperature property, heat resistance, mechanical stability, water resistance, and rust preventive property.
 6. Grade 1 chassis grease for automobile principally consists of base oil and calcium soap, and has sufficient load carrying capacity and property of delivery under pressure.
 7. Grade 1 wheel bearing grease for automobile principally consists of base oil and thickening agent, and sufficient heat resistance, water resistance, mechanical stability, and anti-leakage property.
 8. Grade 1 grease for central lubricating system principally consists of base oil and calcium soap, and has sufficient property of delivery under pressure.
 9. Grade 2 grease for central lubricating system principally consists of base oil and thickening agent, and has sufficient property of delivery under pressure, heat resistance, and mechanical stability.
 10. Grade 3 grease for central lubricating system principally consists of base oil, calcium soap and extreme pressure additives, and has sufficient property of delivery under pressure and load carrying capacity.
 11. Grade 4 grease for central lubricating system principally consists of base oil, thickening agent and extreme pressure additives, and has sufficient property of delivery under pressure, load carrying capacity and mechanical stability.