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भारतीय मानक मसौदा

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(IS 2297 का चौथा पुनरीक्षण)

Draft Indian Standard

GEAR LUBRICANTS, COMPOUNDED — SPECIFICATION

(Fourth Revision of IS 2297)

(ICS No. 75.100: 21.200)

Lubricants and their related products
Sectional Committee, PCD 25

Last date for receipt of comment is
6 February 2025

FOREWORD

(Formal clauses will be added later)

This standard was originally published in 1963. It was revised in 1975 in the light of the then prevailing SAE viscosity classification, test methods, and the trade practices followed in the country. In the last revision, lubricants covered by this standard were equivalent to the service designation API-GL-2 as described in the API Publication 1560 ‘Lubricant service designations for automotive manual transmissions and axle, February 1976’.

This standard was originally intended for use in enclosed and semi-enclosed gears operating under such conditions of load, temperature and sliding viscosity for which straight mineral oils are not suitable. This was particularly suited for automotive type worm-gear axles. Recent changes in the design of Automotive axles have limited the use of such oils for automotive applications. However, its use in industrial applications is quite large. Taking this into consideration, the sectional committee responsible for the preparation of this standard felt that it should be revised to fall in line with ISO viscosity classification and also adopted in IS 9466 : 2020 ‘Viscosity classification of industrial liquid lubricants’ and include additional tests which experience has shown to be relevant for the operating conditions of the equipment. The third revision covered eleven grades of lubricants. These grades are approximately equivalent to well-known SAE/AGMA grades of lubricants classification as per details given below.

<i>Sl No.</i>	<i>Viscosity Grades</i>	<i>Equivalent Grade</i>
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		SAE	AGMA
(1)	(2)	(3)	(4)
i)	VG 32	75W	—
ii)	VG 46		1
iii)	VG 68	80W	2
iv)	VG 100		3
v)	VG 150		4
vi)	VG 220	90	5
vii)	VG 320		6
viii)	VG 460	140	7
ix)	VG 680	140	8
x)	VG 1000		8A
xi)	VG 1500		9

The fourth revision has been brought out to keep pace with the latest technological developments and international practices. In this revision, the following changes have been made:

- a) The composition requirement of the material has been modified; and
- b) New requirements added – Four ball wear scar diameter, four ball weld load, and biodegradability (optional).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

1.1 This standard prescribes the requirements, methods of sampling and test for the gear lubricants intended for use in worm gear drives.

1.2 The lubricant shall conform to one of the eleven viscosity grades as distinguished by the prescribed viscosity limits given in Table 1.

1.3 These lubricants are primarily intended for use in enclosed and semi-enclosed worm gears operating under such conditions of load, temperature and sliding speed for which straight mineral oils are not adequate and EP (extreme pressure) type oils are not called for. These are, however, NOT SUITABLE for lubrication of hypoid gears. The lubricants covered by this standard are equivalent to the service designation API-GL-2.

2 NORMATIVE REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
IS 1447 (Part 1) : 2021	Methods of Sampling of Petroleum and its Products Part 1 Manual Sampling (<i>second revision</i>)
IS 1448	Methods of test for petroleum and its products
(Part 2) : 2007 / ISO 6619 :1988	Petroleum products and lubricants — Neutralization number - potentiometric titration method (<i>second revision</i>)
(Part 4/Sec 1) : 2021	Determination of ash (<i>fourth revision</i>)
(Part 8) : 2012 / ISO 4262 : 1993	Determination of carbon residue — Ramsbottom method (<i>second revision</i>)
(Part 10/Sec2): 2021/ISO 3016: 2019	Petroleum and related products from natural or synthetic sources Section 2 Determination of pour point (<i>third revision</i>)
(Part 15) : 2004 / ISO 2160 : 1998	Petroleum products — Corrosiveness to copper strip test (<i>third revision</i>)
(Part 22) : 2019	Determination of asphaltenes (heptane insoluble) in crude petroleum and petroleum products (<i>third revision</i>)
(Part 25/Sec 1) : 2018 / ISO 3104	Transparent and opaque liquids section 1 Determination of kinematic viscosity and calculation of dynamic viscosity (<i>second revision</i>)
(Part 55/Sec 1): 2004	Determination of saponification value of petroleum products (<i>first revision</i>)
(Part 56): 2013 / ISO 2909 : 2002	Calculation of viscosity index from kinematic viscosity (<i>third revision</i>)
(Part 67) : 2020	Determination of foaming characteristics of lubricating oils (<i>second revision</i>)
(Part 69): 2019 / ISO 2592:2017	Determination of flash and fire points — Cleveland open cup method (<i>second revision</i>)
(Part 96) : 2019	Petroleum products and lubricants — Petroleum oils and other fluids — Determination of rust-preventing characteristics in the presence of water (<i>first revision</i>)
(Part 170): 2021 / ISO 20623 : 2017	Determination of the extreme pressure and anti-wear properties of lubricants — Four-ball method European conditions (<i>first revision</i>)

3 GRADES

Gear lubricants shall be of eleven grades primarily on the basis of kinematic viscosity, namely, VG 32, VG 46, VG 68, VG 100, VG 150, VG 220, VG 320, VG 460, VG 680, VG 1000 and VG 1500 as indicated in Table 1.

4 REQUIREMENTS

4.1 General Requirements

4.1.1 The material shall be formulated using mineral lubricating oil base stock [virgin or re-refined (*see* Note) or combination thereof] compounded with vegetable oil like rapeseed oil; triglyceride, ester or any other suitable bio-based fatty ingredient along with, if required, additives such as pour point depressants, rust inhibitor and defoamant necessary to meet the requirements of this standard.

NOTE - The incorporation of re-refined oils in the formulation should be declared by the supplier to the user along with the properties of base oil. The initial total acid number (TAN) value of the base oil shall not be more than 0.05 for guaranteeing proper re-refining. The re-refined base oil shall conform to appropriate parts of IS 18722.

4.1.2 The nature and percentage of the fatty ingredients used for compounding shall be declared by the supplier and approved by the purchaser.

4.1.3 The material shall be clear, homogeneous, free from water, suspended matter, dust, sediment or any allied extraneous impurities.

4.2 Specific Requirements

The material shall comply with the requirements prescribed in Table 1 when tested according to the relevant methods of test as given in col 14 of Table 1.

5 PACKING AND MARKING

5.1 Packing

Material shall be packed in suitable containers of appropriate size and strength as agreed to between the purchaser and the supplier.

5.2 Marking

5.2.1 The containers shall be securely closed and marked with the following:

- a) Indication of the source of manufacture;
- b) Name and grade of the material;
- c) Net mass/volume of material;
- d) Recognized trade-mark, if any; and
- e) Identification in code or batch number to enable the lot of consignment or manufacture to be traced back from records.

5.2.2 All markings including batch number shall be made on the flat end when the material is packed in barrels.

5.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the rules and regulations framed thereunder, and the products may be marked with the Standard Mark.

6 SAMPLING AND CRITERIA FOR CONFORMITY

6.1 Representative samples of material shall be drawn as prescribed in IS 1447 (Part 1).

6.2 Tests for determining all the characteristics given in Table 1 of the standard shall be conducted on the composite sample.

6.3 The lot shall be declared as conforming to the requirements of this standard, if all the test results on the composite sample satisfy the requirements of this standard.

Requirements for Gear Lubricants, Compounded

(Clauses 1.2, 3, 4.2 and 6.2)

Sl No	Characteristics	Grade Requirements											Methods of Test
		VG 32	VG 46	VG 68	VG 100	VG 150	VG 220	VG 320	VG 460	VG 680	VG 1000	VG 1500	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	Kinematic viscosity, at 40 °C, mm ² /s	28.8 to 35.2	41.4 to 50.6	61.2 to 74.8	90 to 110	135 to 165	198 to 242	288 to 352	414 to 506	612 to 748	900 to 1 000	1 350 to 1 650	IS 1448 (Part 25/Sec 1)
ii)	Viscosity index, <i>Min</i>	90	90	90	90	90	90	90	90	80	80	80	IS 1448 (Part 56)
iii)	Flash point (Cleveland open cup), °C, <i>Min</i>	160	180	180	200	200	200	230	230	230	250	250	IS 1448 (Part 69)
iv)	Acidity												IS 1448 (Part 2)
	Organic, mg KOH/g, <i>Max</i>	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
	Inorganic, mg KOH/g, <i>Max</i>	Nil											

v)	Saponification value, mg KOH/g of oil	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	IS 1448 (Part 55)
vi)	Pour point, °C, <i>Max</i>	← -3 →								← 0 →			IS 1448 (Part 10/Sec 2)
vii)	Ash, percent by mass, <i>Max</i>	← 0.01 →											IS 1448 (Part 4/Sec 1)
viii)	Hard asphalt (Asphaltene-content), percent by mass, <i>Max</i>	0.01	0.01	0.01	0.01	0.01	0.2	0.2	0.2	0	0.2	0.2	IS 1448 (Part 22)
ix)	Carbon residue Ramsbottom, percent by mass, <i>Max</i>	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.5	3.5	IS 1448 (Part 8)
x)	Copper strip corrosion test at 100 °C for 3 h, <i>Max</i>	← 1 →											IS 1448 (Part 15)
xi)	Rust protection	← No rust after 24 h with distilled water →											IS 1448 (Part 96)

xii)	Foam tendency/stability, ml/ml, <i>Max</i>				IS 1448 (Part 67)
	Sequence I	←	300/Nil	→	
	Sequence II	←	50/Nil	→	
	Sequence III	←	300/Nil	→	
xiii)	Stability test at 0 °C	← Shall show no stratification and shall flow readily on tilting →		-	Annex A
xiv)	Four Ball Wear Scar Dia	←	To Report	→	IS 1448 (Part 170)
xv)	Four Ball Weld Load	←	To Report	→	
xvi)	Biodegradability ^a	←	To Report	→	OECD 301B / ASTM D5864

^a Optional requirement, if required by seller.

ANNEX A

[Table 1, Sl No. (xiii)]

TEST METHOD FOR STABILITY

A-1 PROCEDURE

Heat the oil to 80 °C and allow to cool down to room temperature. Fill a test-tube 18 mm in diameter with the oil to a height of about 30 mm. Then seal or cork tightly and coat with a suitable wax to avoid moisture getting in. Expose the tube containing the oil to a temperature of 0 °C for 48 h. Immediately after the exposure, visually examine the oil for the requirements specified in Table 1.