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भारतीय मानक मसौदा

स्पार्क-इग्निशन एयर-कूल्ड पेट्रोल इंजन के लिए लुब्रीकेंट - विशिष्ट
भाग 2 स्कूटर, मोपेड और मोटरसाइकिलों के लिए चार-स्ट्रोक स्पार्क-इग्निशन एयर-कूल्ड इंजन

(IS 14234 Part 2 *का पहला पुनरीक्षण*)

Draft Indian Standard

LUBRICANTS FOR SPARK-IGNITION AIR-COOLED GASOLINE ENGINES — SPECIFICATION
PART 2 FOUR-STROKE SPARK-IGNITION AIR-COOLED ENGINES FOR SCOOTERS, MOPEDS AND MOTORCYCLES

(*First Revision of* IS 14234 Part 2)

ICS 75.100

Lubricants and their Related Products Sectional Committee, PCD 25	Last date for receipt of comment is **1 September 2024**

FOREWORD

(*Formal clauses will be added later*)

This Indian Standard was originally published in 1996 for two stroke engines. Subsquently, the Committee responsible for the formulation of the standard decided to split the standards in two parts as follows:

Part 1 covering the requirements of lubricants for two-stroke spark-ignition air-cooled engines;
Part 2 covering the requirements of lubricants for four-stroke spark-ignition air-cooled engines.

This standard (Part 2) covers the requirements of lubricants intended for use in automotive four-stroke spark-ignition air-cooled gasoline engines for mopeds, scooters, motorcycles etc. Proper lubrication of four-stroke engines is of primary importance for their satisfactory operation as the variations in design and broad range of power application put varying degrees of stresses on the motorcycle lubricants. Generally, following parameters constitute the basis for acceptability of lubricant for four-stroke engines:

a) Density;
b) Kinematic viscosity;

c) Low temperature cranking viscosity;
d) Low temperature pumping viscosity;
e) High temperature high shear viscosity;
f) Foaming tendency;
g) Shear stability; and
h) Frictional characteristics.

In the development of this standard, considerable assistance has been derived from other widely used international standards for automotive sector such as ASTM, API, SAE, CEC, and JASO. Current motorcycle industry is driven by strict emission regulations and improved efficiency requirements. Accordingly, engine designes have evolved to meet these requirements and the operating conditions for lubricants have become more severe, demanding high perfroamnce lubricants.

In this first revision, the performance level for four-stroke engine oil for motorcycles and scooters have been categorized with respect to equivalent JASO performance standards JASO T903 : 2016 and JASO T903 : 2023. Based on JASO T903 : 2023, the major changes in this revision are as follows:

a) Performance levels SG and SH removed and new performance levels added – SN Plus and SP;
b) Limits for phosphorus content and noack volatility (evaporation loss) have been tightened; and
c) Friction plate material for friction performance test of clutch is upgraded.

The eight different categories of lubricants for four stroke spark-ignition air-cooled gasoline engines covered in this standard and their equivalent JASO performance level are given below:

Category	*Equivalent JASO Performance Level*
F-SL-21-A	JASO MA-T-903-2016
F-SL-21-B	JASO MA2-T-903-2016
F-SL-21-C	JASO MA1-T-903-2016
F-SL-21-D	JASO MB-T-903-2016
F-SL-26-A	JASO MA-T-903-2023
F-SL-26-B	JASO MA2-T-903-2023
F-SL-26-C	JASO MA1-T-903-2023
F-SL-26-D	JASO MB-T-903-2023

The timeline for applicability of categories equivalent to JASO T903 : 2016 and JASO T903 : 2023 are described below:

a) Products certified for JASO T903 : 2016 These products have been designated as F-SL-21-A/B/C/D and the expiration date for on-file data is April 30, 2028.
b) Products certified for JASO T903:2023 – These products have been designated as F-SL-26-A/B/C/D and it is valid with effect from October 2023.

For some requirements in Table 2, alternate test methods are provided below. However, in case of dispute, the referee methods prescribed in the respective tables shall be followed.

Characteristic	*Alternate Method of Tests*
Density at 15 ^{o}C, *g/ml*	ASTM D4052
Flash point, ^{o}C	ASTM D92, ASTM D93
Kinematic viscosity at 40 ^{o}C or 100 ^{o}C, mm^2/s	ASTM D445
Viscosity index	ASTM D2270
Sulphated ash, percent by mass	ASTM D874
Total base number, mg KOH/g	ASTM D2896
Total acid number, mg KOH/g	ASTM D664
Evaporative loss, percent by mass	ASTM D5800
Foaming stability, ml	ASTM D892
Calcium, Barium, Boron, Magnesium, Phosphorus, Zinc	ASTM D4951
Sulphur	ASTM D4294
Nitrogen	ASTM D5762, ASTM D4629 (up to 1000 ppm), ASTM D5291 (above 1000 ppm)

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 placed 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 covers lubricants intended for use in automotive, four-stroke, spark ignition, air-cooled, gasoline engines for mopeds, scooters, motorcycles etc.

1.2 This standard prescribes the requirements for the eight categories of lubricants (*see* **3.1** and **3.2**) as applicable to four-stroke spark ignition air cooled gasoline engines.

1.3 Lubricants conforming to the requirements of this standard may also be prescribed/ recommended by engine manufacturers for use in other types of four-stroke gasoline engines.

2 REFERENCES

The standards listed in Annex A 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 agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated in Annex A.

3 CLASSIFICATIONS

Lubricants conforming to this standard shall be classified as four-stroke lubricants (4T) and shall fall under one of the following categories:

3.1 Categories equivalent to JASO T903 : 2016 -

a) F-SL-21-A: High friction coefficients and intended for use in four-stroke spark ignited gasoline engines of motorcycles;
b) F-SL-21-B: Subset of F-SL-21-A;
c) F-SL-21-C: Subset of F-SL-21-A; and
d) F-SL-21-D: Low friction coefficients and intended for use in four-stroke spark ignited gasoline engines of scooters.

NOTE - Products certified for JASO T903 : 2016 are valid from October 2016. The last date to accept a new application for engine oils confirming to JASO T903 : 2016 was 30 September 2023 and the expiration date for on-file data for engine oils conforming to JASO T903 : 2016 is 30 April 2028.

3.2 Categories equivalent to JASO T903 : 2023 -

a) F-SL-26-A: High friction coefficients and intended for use in four-stroke spark ignited gasoline engines of motorcycles;
b) F-SL-26-B: Subset of F-SL-26-A;
c) F-SL-26-C: Subset of F-SL-26-A;
d) F-SL-26-D: Low friction coefficients and intended for use in four-stroke spark ignited gasoline engines of scooters.

NOTE - Products certified for JASO T903 : 2023 shall be valid from October 2023.

4 REQUIREMENTS

4.1 General

The lubricant shall be formulated using virgin or re-refined base oil [*see* PCD 25 (22088)] or synthetic base oil blended with suitable additive material.

4.2 Performance Level

The lubricant shall meet one of the performance levels of engine oil as given in Table 1.

Table 1 Engine Oil Performance Levels
(*Clause* 4.2)

Sl No.	Category	API Performance Level[1)]
(1)	(2)	(3)
i)	F-SL-21-A/B/C/D	SG, SH, SJ, SL, SM, SN
ii)	F-SL-26-A/B/C/D	SJ, SL, SM [2)], SN [3)], SN PLUS [3)], SP [3)]

[1)] For engine test requirement, *see* IS 13656
[2)] Excluding SM/EC
[3)] Excluding SN/RC, SN PLUS/RC, SP/RC

4.3 Physico-Chemical Requirements

4.3.1 The lubricant shall be free from suspended matter, grit, water or any other impurities.

4.3.2 The lubricant shall comply with the physico-chemical requirements prescribed in Table 2.

Table 2 Physico-Chemical Requirements for Finished Product
(*Clause* 4.3.2 and 8.2)

Sl No.	Characteristics	Requirement	Methods of Test
(1)	(2)	(3)	(4)
i.	Density at 15 ^{o}C, g/ml	To Report	IS 1448 (Part 16)
ii.	Flash point, ^{o}C	To Report	IS 1448 (Part 21)[a] / IS 1448 (Part 69)
iii.	Kinematic viscosity at 40 ^{o}C, mm^2/s	To Report	IS 1448 (Part 25/Sec 1)
iv.	Kinematic viscosity at 100 ^{o}C, mm^2/s	As specified for a particular SAE viscosity grade[b]	IS 1448 (Part 25/Sec 1)
v.	Viscosity index	To Report	IS 1448 (Part 56)
vi.	Low temperature cranking viscosity, cP, *Max*	As specified for a particular SAE viscosity grade[b]	ASTM D5293
vii.	Low temperature pumping viscosity, cP, *Max*	As specified for a particular SAE viscosity grade[b]	ASTM D4684
viii.	High temperature high shear viscosity, mPa, *Min*	2.9	ASTM D4683

ix.	Sulphated ash, percent by mass, *Max*	1.2	IS 1448 (Part 4/Sec 2)
x.	Total base number, mg KOH/g	To Report	IS 1448 (Part 86)
xi.	Total acid number, mg KOH/g	To Report	IS 1448 (Part 188)
xii.	Evaporative loss, percent by mass, *Max*		IS 1448 (Part 136)
	a) F-SL-21-A/B/C/D	20	
	b) F-SL-26-A/B/C/D	15	
xiii.	Foaming stability, ml, *Max*		IS 1448 (Part 67)
	a) Sequence I	10/0	
	b) Sequence II	50/0	
	c) Sequence III	10/0	
xiv.	Shear stability kinematic viscosity at 100 ^{o}C after test, mm^2/s, *Min*		ASTM D6278[c]
	a) XW-30	9.0	
	b) XW-40	12.0	
	c) XW-50	15.0	
xv.	Colour	To Report	Visual
xvi.	Calcium	To Report	IS 1448 (Part 103)[a] / IS 1448 (Part 172)
xvii.	Barium	To Report	
xviii.	Boron	To Report	
xix.	Magnesium	To Report	
xx.	Zinc	To Report	
xxi.	Other elements	To Report	
xxii.	Phosphorus		IS 1448 (Part 54)
	F-SL-21-A/B/C/D	0.08 to 0.12	
	F-SL-26-A/B/C/D	0.08 to 0.10	
xxiii.	Sulphur	To Report	IS 1448 (Part 33)
xxiv.	Nitrogen	To Report	IS 1448 (Part 155)

[a] Referee test method
[b] SAE J300 April 2021
[c] Test shall be conducted by diesel injector method under the standard test conditions (30 cycles)

4.4 Performance Classification

4.4.1 The four lubricant categories as per JASO T903 : 2016 shall meet the frictional performance criteria specified in Table 3.

Table 3 Frictional Performance Classification
(*Clause* 4.4.1 and 6.1)

Sl No.	**Test Method**	**Evaluation Item**	**Standard Index**			
			F-SL-21-A	**F-SL-21-B**	**F-SL-21-C**	**F-SL-21-D**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
i)		DFI (Dynamic friction index)	≥ 1.35 and < 2.50	≥ 1.50 and < 2.50	≥ 1.35 and < 1.50	≥ 0.40 and < 1.35

ii)	JASO T 903 **:** 2016	SFI (Static friction index)	≥ 1.45 and < 2.50	≥ 1.60 and < 2.50	≥ 1.45 and < 1.60	≥ 0.40 and < 1.45
iii)		STI (Stop time index)	≥ 1.40 and < 2.50	≥ 1.60 and < 2.50	≥ 1.40 and < 1.60	≥ 0.40 and < 1.40

4.4.2 The four lubricant categories as per JASO T903 : 2023 shall meet the frictional performance criteria specified in Table 4.

Table 4 Frictional Performance Classification
(*Clause* 4.4.2 and 6.1)

Sl No.	**Test Method**	**Evaluation Item**	**Standard Index**			
			F-SL-26-A	**F-SL-26-B**	**F-SL-26-C**	**F-SL-26-D**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
i)	JASO T 903 **:** 2023	DFI (Dynamic friction index)	≥ 1.30 and < 2.60	≥ 1.45 and < 2.60	≥ 1.30 and < 1.45	≥ 0.20 and < 1.30
ii)		SFI (Static friction index)	≥ 1.40 and < 2.55	≥ 1.60 and < 2.55	≥ 1.40 and < 1.60	≥ 0.25 and < 1.40
iii)		STI (Stop time index)	≥ 1.25 and < 2.65	≥ 1.50 and < 2.65	≥ 1.25 and < 1.50	≥ 0.00 and < 1.25

5 STABILITY OF FINISHED LUBRICATING OILS

The finished blended lubricating oils shall have the additive elements uniformly distributed throughout the oil and shall show no evidence of instability at temperature specified in the homogeneity test described in Annex B.

6 PRODUCT IDENTIFICATION

6.1 To ensure acceptance of only qualified products and for the purposes of product identification, tests may be carried out by the purchaser or their agency on the characteristics of the oil mentioned in Table 2 and the test results shall be compared with the corresponding figures given in the product identification report. Permissible tolerances against frictional performance characteristics, that is, dynamic friction index, static friction index, and stop time index are prescribed in Tables 3 and 4 for JASO T 903 : 2016 and JASO T 903 : 2023, respectively.

7 PACKING AND MARKING

7.1 Packing

The material shall be packed in metal containers or in any other suitable container as agreed to between the purchaser and the supplier.

7.2 Marking

7.2.1 The container shall be securely closed and marked with the following:

a) Name and address of manufacturer, along with trademark, if any;
b) Name and category of the material;
c) Net mass/volume of the material;
d) Month/year of manufacture or packaging;
e) Identification in code or otherwise to enable the lot of consignment or manufacture to be traced back from records; and
f) Any other statutory requirements.

7.2.2 All markings including batch number of lot of manufacture shall be made on one flat end when the material is packed in barrels.

7.2.3 *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.

8 SAMPLING

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

8.2 Number of Tests

Tests for all the characteristics given in Table 2 shall be conducted on composite sample.

8.3 Criteria for Conformity

The lot shall be declared as conforming to the requirements of the specification, if all the test results on the composite sample meet the relevant requirements prescribed in the specification.

ANNEX A
(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No. / International Standards	*Title*
IS 1447 (Part 1) : 2021	Methods of sampling of petroleum and its products Part 1 Manual sampling (*second revision*)
IS 1448	Methods of test for petroleum and its products
(Part 4 / Sec 2) : 2021	Ash from grease, sulphated ash and water soluble ash (*fourth revision*)
(Part 16) : 2014 / ISO 3675 : 1998	Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method (*fourth revision*)
(Part 21) : 2019 / ISO 2719 : 2016	Determination of flash point — Pensky-Martens closed cup method (*fourth revision*)
(P 25 / Sec 1) : 2018 / ISO 3104 : 1994	Transparent and opaque liquids Section 1 Determination of kinematic viscosity and calculation of dynamic viscosity (*second revision*)
(Part 33) : 2021	Sulphur by high pressure decomposition device method (*third revision*)
(Part 54) : 2017	Determination of Phosphorus content — Quinoline Phosphomolybdate method (*third revision*)
(Part 56) : 2013 / ISO 2909: 2002	Calculation of viscosity index from kinematic viscosity (*third revision*)
(Part 67) : 2020	Determination of foaming characteristics of lubricating oils (*second revision*)
(Part 69) : 2019 / ISO 2592 : 2017	Determination of flash and fire points — Cleveland open cup method (*second revision*)
(Part 86) : 2023	Determination of total base number by the potentiometrical perchloric acid titration method (*first revision*)
(Part 103) : 1981	Barium, calcium, phosphorus and zinc in lubricating oils by direct reading emission spectrographic method
(Part 136) : 1991	Determination of evaporation loss of lubricating oils (Noacks Method)
(Part 146) : 1998	Determination of yield stress and apparent viscosity of engine oils at low temperature
(Part 155) : 2020	Determination of trace Nitrogen in liquid petroleum hydrocarbons by oxidative combustion with chemiluminescence detector
(Part 172) : 2020	ICP-AES Method for determination of trace elements in petroleum products
(Part 188) : 2021 / ISO 6618 : 1997	Petroleum Products and Lubricants — Determination of Acid or Base Number - Colour-Indicator Titration Method
IS 13656 : 2019	Internal combustion engine crankcase oils for automotive application (diesel and gasoline) — Specification (*third revision*)

ASTM D 92	Standard test method for flash and fire points by cleveland open cup tester
ASTM D 93	Standard test methods for flash point by pensky-martens closed cup tester
ASTM D 445	Standard test method for kinematic viscosity of transparent and opaque liquids (and calculation of dynamic viscosity)
ASTM D 664	Standard test method for acid number of petroleum products by potentiometric titration
ASTM D 874	Standard test method for sulfated ash from lubricating oils and additives
ASTM D 892	Standard test method for foaming characteristics of lubricating oils
ASTM D 2270	Standard practice for calculating viscosity index from kinematic viscosity at 40 °C and 100 °C
ASTM D 2896	Standard test method for base number of petroleum products by potentiometric perchloric acid titration
ASTM D 4052	Standard test method for density, relative density, and API gravity of liquids by digital density meter
ASTM D 4294	Standard test method for sulfur in petroleum and petroleum products by energy dispersive x-ray fluorescence spectrometry
ASTM D 4629	Standard test method for trace nitrogen in liquid hydrocarbons by syringe/inlet oxidative combustion and chemiluminescence detection
ASTM D 4683	Standard test method for measuring viscosity of new and used engine oils at high shear rate and high temperature by tapered bearing simulator viscometer at 150 °C
ASTM D 4684	Standard test method for determination of yield stress and apparent viscosity of engine oils at low temperature
ASTM D 4951	Standard test method for determination of additive elements in lubricating oils by inductively coupled plasma atomic emission spectrometry
ASTM D 5291	Standard test methods for instrumental determination of Carbon, Hydrogen, and Nitrogen in petroleum products and lubricants
ASTM D 5293	Standard test method for apparent viscosity of engine oils and base stocks between –10 °C and –35 °C using cold-cranking simulator
ASTM D 5762	Standard test method for nitrogen in liquid hydrocarbons, petroleum and petroleum products by boat-inlet chemiluminescence
ASTM D 5800	Standard test method for evaporation loss of lubricating oils by the noack method
ASTM D 6278	Standard test method for shear stability of polymer containing fluids using a European diesel injector apparatus
JASO T 903 : 2016	Motorcycles — Four-stroke cycle gasoline engine oils

JASO T 904 : 2016	Motorcycles — Four-stroke cycle gasoline engine oils — Test procedure for friction property of clutch system
JASO T 903 : 2023	Motorcycles — Four-stroke cycle gasoline engine oils — Test procedure for friction property of clutch system

ANNEX B
(*Clause* 5)

HOMOGENEITY AND MISCIBILITY TEST

B-1 GENERAL

This test determines whether oil is and will remain homogenous and whether it is miscible and stable after being submitted to a prescribed cycle of temperature changes.

B-2 REFERENCE STANDARD TEST METHOD

This test method is equivalent to Annex B of IS 13656, except that the reference oils are those agreed between purchaser and supplier.

B-3 SAMPLE

B-3.1 Test Sample — Approximately 300 ml.

B-3.2 Standard Reference Oils

B-4 APPARATUS

B-4.1 Test Jar — A test jar of clear glass, cylindrical form, flat bottom, approximately 30 mm to 35 mm inside diameter and 115 mm and 125 mm height.

B-4.2 Thermometer — -50 ^{o}C to +50 ^{o}C range.

B-4.3 Cork — To fit the test jar, bored centrally to take the test thermometer.

B-4.4 Jacket — Of glass or metal, water-tight, of cylindrical form, flat bottom, about 115 mm in depth, with inside diameter 9.5 mm to 12.5 mm greater than the outside diameter of the jar.

B-4.5 Disk — Cork or felt, 6 mm in thickness of the same diameter as the inside of the jacket.

B-4.6 Gasket — A ring gasket, about 5 mm in thickness, to fit snugly around the outside of the test jar and loosely inside the jacket to prevent the test jar from touching the jacket. The purpose of the rings gasket is to prevent the test jar from touching the jacket.

B-4.7 Cooling Bath — Capable of obtaining the required temperatures.

B-5 PROCEDURE

B-5.1 Shake oil sample well and pour into a test jar in triplicate. Add reference oil to each of the test jars to 75 mm mark. Mix the oil thoroughly and heat to 46 °C in a water bath for 30 minutes.

Therafter, remove the test jar from the water bath and cool the mixture at ambient temprature. After the oil reaches room temperature, observe and record the colour and evidence of separation.

B-5.2 Maintain the temperature of the cooling bath at -1 ^{o}C to +2 ^{o}C. Support the jacket, containing the test jar, firmly in a vertical position in the cooling bath so that not more than 25 mm of the jacket projects out of the cooling medium.

B-5.3 Beginning at a temperature of 12 ^{o}C above the expected pour point, at each test thermometer reading that is a multiple of 3 ^{o}C, remove the test jar from the jacket carefully and tilt it just enough to ascertain whether there is a movement of the oil in the test jar. The complete operation of removal and replacement shall require not more than 3 s. If the oil has not ceased to flow when its temperature has reached 10 ^{o}C, place the test jar in the jacket in a second bath maintained at a temperature of -18 ^{o}C to -15 ^{o}C. If the oil has not ceased to flow when its temperature has reached -7 ^{o}C, place the test jar in the jacket in a third bath maintained at a temperature of -34.5 ^{o}C. For determination of very low pour points additional baths should be maintained with successively lower temperature differentials of about 17 ^{o}C. In each case transfer the jar when the temperature of the oil reaches a temperature of 28 ^{o}C above the temperature of the new bath. At no time, the test jar should be placed directly in the cooling medium. As soon as the oil in the test jar does not flow when jar is tilted, hold the test jar in a horizontal position for exactly 5 s as noted by a stop watch or other accurate timing device, and observe carefully. If the oil shows any movement under these conditions, place the test jar immediately in the jacket and repeat a test for flow at the next temperature 3 ^{o}C lower.

B-5.4 Continue the test in this manner until a point is reached at which the oil in the test jar shows no movement when the test jar is held in a horizontal position exactly for 5 s. Certain lubricating oils tend to move as a whole and should be closely observed. Record the reading of the test thermometer at this temperature, corrected for error, if necessary. Allow the samples to thaw and when the cloudiness has barely disappeared observe and record the colour and evidence of separation. When the samples reach room temperature, place them in an oil bath after removing the thermometer. Heat the bath at 230 ^{o}C and immediately remove the sample jars. Cork the samples and store them at their respective pour points for 18 h to 24 h. Remove the jars and allow the sample to thaw. When cloudiness has barely disappeared, observe and record the colour and evidence of separation. Repeat the last operation when the samples reach room temperature.

B-6 METHOD OF REPORTING RESULTS

B-6.1 Report evidence of separation in the following four successive stages:

a) Initial sample;
b) Warmed to just above cloud point after reaching pour point once;
c) After a cycle of heating to 230 ^{o}C, cooling and storing it for 18 h - 24 h at pour point, and warming to just above pour point; and
d) Warmed to room temperature.

B- 6.2 Evidence of separation is to be reported as:

a) Condition:

i. Definite, and
ii. None or doubtful.

b) Location:

i. Near top,
ii. Near bottom,
iii. Filament, and
iv. Uniformly distributed.

c) Particle size:

i. Small, as in cloud or haze, and
ii. Specks or larger particles.

d) Colour:

i. White or very light,
ii. Yellow, and
iii. Black.