Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

Indian Standard

LUBRICANTS FOR AIR-COOLED SPARK-IGNITION ENGINES — SPECIFICATION

PART 1 TWO-STROKE SPARK-IGNITION ENGINES

(First Revision)
FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lubricants and Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was first issued in 1996. It covers the requirements for lubricants primarily intended for use in automotive, two-stroke spark-ignition air-cooled gasoline engines for mopeds, scooters, motor-cycles, chain saws, lawn mowers and portable small generators, etc. The Committee responsible for the preparation of the standard decided to revise it with respect to the performance parameters, keeping in view the current and future engine/vehicle population in the market place. The revised version is being issued in two parts, namely, Part 1 covering the requirements of lubricants for two-stroke spark-ignition engines, and Part 2 covering the requirements of lubricants for four-stroke spark-ignition engines.

This standard (Part 1) covers the requirements of lubricants for two-stroke spark-ignition engines. Proper lubrication of two-stroke engines is of primary importance for their satisfactory operation. Generally the following parameters constitute the basis for acceptability of lubricant for two-stroke engines:

- Lubricity,
- Deposits,
- Ring sticking,
- Spark plug fouling,
- Exhaust port blocking,
- Power loss,
- Preignition,
- Miscibility, and
- Exhaust smoke.

Because of many variations in design and the broad range of power applications, varying degrees of stresses are placed on the lubricants. The choice of a suitable lubricant is an especially difficult task in the absence of any guide.

In preparation of this standard considerable assistance has been derived from the requirements given in documents provided by various technical societies such as ASTM/API/SAE/CEC and JASO.

In the present version the performance levels for two-stroke engine oils have been covered as under:

<table>
<thead>
<tr>
<th>Category</th>
<th>Equivalent International Performance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-SL3</td>
<td>JASO FC Plus API TC</td>
</tr>
<tr>
<td>T-SL4</td>
<td>JASO FC Plus Additional Detergency Requirement^2</td>
</tr>
<tr>
<td>T-SL5</td>
<td>ISO 13738 : 2000 (EGD Category)</td>
</tr>
</tbody>
</table>

The above performance levels are also in accordance with the requirements in the Gazette Notification No. 311, 20th August, 1998, issued by the Ministry of Environment and Forests (MoEF) which stipulates, with effect from 1 April, 1999, two-stroke engine oil marketed in the country shall conform to the performance level of JASO FC Plus API TC with Smoke Index = 85, Min.

^1 T-SL3 category shall be discontinued after December 31, 2001, if the Yamaha 350M2 engine test, which is a part of API TC specification, does not evolve into an engine test having well defined precision and having ASTM and industry acceptance.

^2 3 hour Honda Detergency Test (CEC L-079-T-97) with pass limits of DJX = 100 Min and VIX = 90 Min.

(Continued on third cover)
Indian Standard

LUBRICANTS FOR AIR-COOLED SPARK-IGNITION ENGINES — SPECIFICATION

PART 1 TWO-STROKE SPARK-IGNITION ENGINES

(First Revision)

1 SCOPE

1.1 This standard (Part 1) covers lubricants primarily intended for use in automotive, two-stroke, spark-ignition, air-cooled, gasoline engines such as mopeds, scooters, motor cycles, portable generators, etc.

1.2 This standard prescribes the requirements and the engine tests for the three classes (see 3.1) of lubricants as applicable to air-cooled spark ignited two-stroke 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 two-stroke gasoline engines.

2 REFERENCES

The following 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:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Part 1) :2000</td>
<td>sampling (first revision)</td>
</tr>
<tr>
<td>1448</td>
<td>Methods of test for petroleum and its products:</td>
</tr>
<tr>
<td></td>
<td>[P : 1] :1971 Neutralization number of potentiometric titration (first revision)</td>
</tr>
<tr>
<td></td>
<td>[P : 10] :1970 Cloud point and pour point (first revision)</td>
</tr>
<tr>
<td></td>
<td>[P : 15] :1976 Detection of copper corrosion from petroleum products by the copper strip tarnish test (second revision)</td>
</tr>
<tr>
<td></td>
<td>[P : 16] :1990 Density of crude petroleum and liquid petroleum products by hydrometer method (third revision)</td>
</tr>
<tr>
<td></td>
<td>[P : 21] :1992 Flash point (closed) by Pensky Martens Apparatus (second revision)</td>
</tr>
</tbody>
</table>


[P : 40] :1987 Water by distillation (third revision)

[P : 54] :1979 Determination of phosphorous in lubricating oil; Quinoline phosphomolybdate method (first revision)

[P : 56] :1980 Viscosity index by calculation (second revision)

[P : 69] :1969 Flash and fire point by Cleveland (Open) cup

[P : 77] :1971 Metallic constituents of lubricating oils, chemical method


3 CLASSIFICATION

3.1 Types

Lubricants qualifying against this standard shall be classified as two-stroke lubricants (2T) under one of the following types:

a) T-SL3
   - Low smoke 2T-Lubricants intended for use in moderate output engines.
   Equivalent International Performance Level: JASO FC Plus API TC

b) T-SL4
   - Low smoke 2T-Lubricants intended for use in moderate output engines
   Equivalent International Performance Level: JASO FC Plus Additional Detergency Requirement

T-SL3 category shall be discontinued after December 31, 2001, if the Yamaha 350M2 engine test, which is a part of API TC specification, does not evolve into an engine test having well defined precision and having ASTM and industry acceptance.

3.2 Types

T-SL5
- Low smoke 2T-Lubricants intended for use in high output engines requiring additional protection against deposit formation
Equivalent International Performance Level: ISO 13738:2000 (EGD category)

3.3 Types

T-SL6
- Low smoke 2T-Lubricants intended for use in high output engines requiring additional protection against deposit formation
Equivalent International Performance Level: ISO 13738:2000 (EGD category)

1) T-SL3 category shall be discontinued after December 31, 2001, if the Yamaha 350M2 engine test, which is a part of API TC specification, does not evolve into an engine test having well defined precision and having ASTM and industry acceptance.

2) 3 hour Honda Detergency Test (CEC L-079-X-97) with pass limits of DIX = 100 Min and VIX = 90 Min.
4 REQUIREMENTS

4.1 General
The lubricant shall be formulated using virgin or re-refined oil or synthetic base stock blended with suitable additive material.

4.1.1 Blended base oil shall meet the requirements laid down in Table 1.

Table 1 Tests for Blended Base Oil Without Diluent and Without Additives (PIB or Any Other) (Clause 4.1.1)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Method of Test, Ref to Part of IS 1448</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Density at 15°C, g/ml</td>
<td>To be reported</td>
<td>[P:16]</td>
</tr>
<tr>
<td>i)</td>
<td>Viscosity index, Min</td>
<td>95</td>
<td>[P:56]</td>
</tr>
<tr>
<td>ii)</td>
<td>Flash point, °C, Min</td>
<td>To be reported</td>
<td>[P:21]/[P:69]</td>
</tr>
<tr>
<td>iii)</td>
<td>Carbon residue (Conradson), percent by mass, Max</td>
<td>0.4</td>
<td>[P:122]</td>
</tr>
<tr>
<td>iv)</td>
<td>Total acid number, Max mg KOH/gm</td>
<td>0.05</td>
<td>[P:1]</td>
</tr>
<tr>
<td>v)</td>
<td>Strong acid number mg KOH/gm</td>
<td>Nil</td>
<td>[P:1]</td>
</tr>
<tr>
<td>vii)</td>
<td>Sulphur, percent by mass</td>
<td>± 20 percent of the reported value</td>
<td>[P:33]</td>
</tr>
<tr>
<td>viii)</td>
<td>Copper strip corrosion at 100°C for 3 h, Max</td>
<td>1</td>
<td>[P:15]</td>
</tr>
<tr>
<td>ix)</td>
<td>Ash content, percent, Max</td>
<td>0.01</td>
<td>[P:4]</td>
</tr>
<tr>
<td>x)</td>
<td>Water content, percent by volume, Max</td>
<td>0.03</td>
<td>[P:40]</td>
</tr>
</tbody>
</table>

4.2 Physico-Chemical Requirements

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

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

4.3 Engine Test Requirements

4.3.1 Approved Engine Tests — The approved engine tests for performance evaluation of types T-SL3, T-SL4 and T-SL5 are summarized below (see also Table 3 and Annex A):

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Test Procedure</th>
<th>JASO/ASTM Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Lubricity test procedure for evaluating two-stroke gasoline engine lubricants</td>
<td>JASO M340</td>
</tr>
<tr>
<td>2.</td>
<td>Detergency test procedure for evaluating two-stroke gasoline engine lubricants</td>
<td>JASO M341</td>
</tr>
<tr>
<td>3.</td>
<td>Smoke test procedure for evaluating two-stroke gasoline engine lubricants</td>
<td>JASO M342</td>
</tr>
<tr>
<td>4.</td>
<td>Exhaust system blocking test procedure for evaluating two-stroke gasoline engine lubricants</td>
<td>JASO M343</td>
</tr>
<tr>
<td>5.</td>
<td>Detergency test procedure for evaluating two-stroke gasoline engine lubricants</td>
<td>CEC L-079-T-97</td>
</tr>
<tr>
<td>6.</td>
<td>Determination of the tendency of lubricants to minimize ring sticking and piston deposits in two-stroke gasoline engines other than outboards</td>
<td>ASTM D-4857</td>
</tr>
<tr>
<td>7.</td>
<td>Determination of the tendency of lubricants to promote pre-ignition in two-stroke gasoline engine lubricants</td>
<td>ASTM D-4858</td>
</tr>
<tr>
<td>8.</td>
<td>Determination of lubricity of two-stroke gasoline engine lubricants</td>
<td>ASTM D-4863</td>
</tr>
</tbody>
</table>

Table 2 Physico-Chemical Requirements for Two-Stroke Engine Lubricating Oils (Clauses 4.2.2 and 9.2)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Method of Test, Ref to Part of IS 1448</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Kinematic viscosity at 100°C, cSt, Min</td>
<td>6.5</td>
<td>[P:25]</td>
</tr>
<tr>
<td>i)</td>
<td>Flash point, °C, Min</td>
<td>70</td>
<td>[P:21]/[P:69]</td>
</tr>
<tr>
<td>ii)</td>
<td>Sulphated ash, percent by mass, Max</td>
<td>0.25</td>
<td>[P:4]</td>
</tr>
</tbody>
</table>

4.3.2 Pass/Fail Criteria in Engine Tests

The candidate lubricant is rated as "pass" if it meets the criteria specified in Table 3 for that particular test.

5 STABILITY AND COMPATIBILITY OF FINISHED LUBRICATING OILS

5.1 The finished blended lubricating oils shall have
### Table 3 Pass/Fail Criteria for Two-Stroke Engine Lubricants

*Clauses 4.3.1 and 4.3.2*

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Characteristic</th>
<th>Criteria for Pass</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>T-SL3</td>
<td>T-SL4</td>
</tr>
<tr>
<td>1)</td>
<td>i) Lubricity test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Lubricity index (LIX), Min</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>b) Initial torque index (TIX), Min</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>ii) Detergency test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Detergency index (DIX), Min</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>iii) Smoke test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Smoke index (SIX), Min</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>iv) Exhaust blocking test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Blockage index (BIX), Min</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>v) Detergency test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Detergency index (DIX), Min</td>
<td>—</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>b) Piston varnish index (VIX), Min</td>
<td>—</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>vi) Ring sticking and piston deposit test (see Note 1 below):</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Second ring sticking, MR</td>
<td>≥ (ASTM VI-D - 0.5)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>b) Piston skirt varnish, MR</td>
<td>≥ (ASTM VI-D - 0.5)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>c) Spark plug fouling/bridging</td>
<td>&lt; (ASTM VI-D + 2)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>d) Pre-ignition</td>
<td>&lt; (ASTM VI-D + 1)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>e) Exhaust port blocking, percent</td>
<td>&lt; (ASTM VI-D + 10%)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>vii) Pre-ignition test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. of major pre-ignitions, Max</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>viii) Lubricity test:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average torque drop</td>
<td>STM VI-D</td>
<td>—</td>
</tr>
</tbody>
</table>

**NOTE** — Limits indicated are based on complete test. Early pass criteria mentioned in ASTM D-4857 shall also be acceptable.

1) MR = Merit Rating.
2) Benchmark reference oil.
3) No. of occurrences.
d) Product-identification data as per Table 4; and

e) Engine-performance data as applicable and as given below:

1) 2-stroke, air cooled gasoline engine oils (Table 3), and

2) any supplementary or alternate data, or evidence in support of the performance claims.

It is possible that the performance test data would have been generated on engine tests carried out in different laboratories conducted at different periods of time, using base stocks from different sources. However, the applicant will have to satisfy the qualification authority about validity of the provisions exercised by him in terms of base oil interchange, viscosity read-across, minor additive component substitution, etc (as provided in the relevant API/ACEA/OEM specifications) and that the data presented is valid for the applicant's formulation in vogue. The Panel, based on an overall review of the performance data, shall decide whether the lubricating oil formulated by the applicant meets the requirements of this standard. The Panel shall accordingly, communicate its decision to the Bureau of Indian Standards.

7 PRODUCT IDENTIFICATION

To ensure acceptance of only qualified products and for the purposes of product identification, tests may be carried out by the purchaser or his agency on the characteristics of the oil mentioned in Table 4 and the test results shall be compared with the corresponding figures given in the product identification report. Permissible tolerances of the results are indicated against each of the characteristics in Table 4.

8 PACKING AND MARKING

8.1 Packing

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

8.2 Marking

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

a) Indication of the source of manufacture;

b) Name, type and grade of the material;

c) Net mass of the material;

d) Recognized trade-mark, if any, and
e) Identification in code or otherwise to enable the lot of consignment or manufacture to be traced back from records.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Method of Test, Ref to Part of IS 1448</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>i)</td>
<td>Flash point, °C, Min</td>
<td>as specified</td>
<td>[P:21]/[P:69]</td>
</tr>
<tr>
<td>ii)</td>
<td>Pour point, °C, Max</td>
<td>as specified</td>
<td>[P:10]</td>
</tr>
<tr>
<td>iii)</td>
<td>Kinematic viscosity at 40°C, cSt</td>
<td>± 10 percent of the reported value</td>
<td>[P:25]</td>
</tr>
<tr>
<td>iv)</td>
<td>Kinematic viscosity at 100°C, cSt, Min</td>
<td>as specified</td>
<td>[P:25]</td>
</tr>
<tr>
<td>v)</td>
<td>Viscosity index, Min</td>
<td>as specified</td>
<td>[P:56]</td>
</tr>
<tr>
<td>vi)</td>
<td>Sulphated ash, percent by mass, Max</td>
<td>as specified</td>
<td>[P:4]</td>
</tr>
<tr>
<td>vii)</td>
<td>Calcium</td>
<td>−10 to +20 percent of the reported value</td>
<td>[P:77]</td>
</tr>
<tr>
<td>viii)</td>
<td>Barium</td>
<td>do</td>
<td>[P:77]</td>
</tr>
<tr>
<td>ix)</td>
<td>Magnesium</td>
<td>do</td>
<td>[P:77]</td>
</tr>
<tr>
<td>x)</td>
<td>Phosphorus</td>
<td>do</td>
<td>[P:54]</td>
</tr>
<tr>
<td>xi)</td>
<td>Sulphur</td>
<td>do</td>
<td>[P:33]</td>
</tr>
<tr>
<td>xii)</td>
<td>Nitrogen</td>
<td>do</td>
<td>[P:9]</td>
</tr>
<tr>
<td>xiii)</td>
<td>Zinc</td>
<td>do</td>
<td>[P:77]</td>
</tr>
</tbody>
</table>

1) Under preparation. Till such time, ASTM D-4629 may be followed.

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

8.2.2 BIS Certification Marking

Each container may also be marked with the Standard Mark.

8.2.2.1 The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 SAMPLING

9.1 Representative samples of the material shall be drawn as prescribed in IS 1447.

9.2 Number of Tests

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

9.3 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 satisfy the relevant requirements stipulated in the specification.

4
ANNEX A

(Clause 4.3.1)

SUMMARY OF ENGINE TEST METHODS

A-1 LUBRICITY TEST PROCEDURE (JASO M340-92)

This test procedure evaluates the lubricity characteristics of oils.

The lubricity test is run in Honda 49CC single cylinder air cooled engine supplied with a 50:1 by volume fuel to oil mixture. The engine is brought to equilibrium at 4 000 rpm wide open throttle, and the cooling air flow is adjusted to give a spark plug gasket temperature of 100 ± 2°C. Cooling air to the cylinder is then cut-off and the output torque is recorded. When the plug gasket temperature is in the range of 200 to 300°C, the cooling air flow is restored. The smaller the reduction in torque output at constant speed during this interval, the better the ability of the oil to lubricate the piston. This is normally a non-destructive test. The tests are run alternately on reference lubricants Jatre-1 and candidate oils. The result of the test is expressed in terms of two different indices, namely, Lubricity Index (LIX) and initial Torque Index (TIX). The performance of the candidate oil is expressed by these two indices which are arrived at by comparing the performance of the candidate oil with that of the reference oil Jatre-1.

A-2 DETERGENCY TEST PROCEDURE (JASO M341-92)

This test method evaluates the high temperature detergency of oils.

The detergency test is run using a Honda 49CC single cylinder, air cooled engine supplied with a 100 : 1 by volume fuel to oil mixture. The engine is run at 6 000 ± 20 rpm at wide open throttle for 60 min. After testing, the engine is dismantled and various parts are rated for deposits. The main areas evaluated are ring sticking, piston deposits and cylinder head deposits. The rating is carried out as per test procedure JPI-5S-34-91. The test is run on both the reference oil Jatre-1 and candidate oil on the same day. The result of the test is expressed in terms of an index, namely, Detergency Index (DIX) and initial Torque Index (TIX). The performance of the candidate oil is expressed by these two indices which are arrived at by comparing the performance of the candidate oil with that of the reference oil Jatre-1.

A-3 SMOKE TEST PROCEDURE (JASO M342-92)

This test method evaluates the exhaust smoke formation characteristics of oils.

The smoke test is run using a Suzuki generator SX 800R 69 CC single cylinder air cooled engine supplied with 10:1 by volume fuel to oil mixture. The engine is run at 50 Hz and OW for 20 minutes and then at 50 Hz and 670±10W. The above cycle is repeated three times. During each, peak value of the smoke density is recorded with a smoke meter. The smoke test is run on both the reference oil Jatre-1 and candidate oil on the same day. The results of the test are expressed in terms of an index, namely, Smoke Index (SIX). The performance of the candidate oil is expressed by this index which is arrived at by comparing the performance of the candidate oil with that of the reference oil Jatre-1.

A-4 EXHAUST SYSTEM BLOCKING TEST PROCEDURE (JASO M343-92)

This test method evaluates the exhaust system blocking characteristics of oils.

The exhaust system blocking test is run using Suzuki generator SX 800R 69CC single cylinder air cooled engine supplied with 5:1 by volume fuel to oil mixture. The test is carried out by running simultaneously the two test engines on fuel containing the reference oil Jatre-1 and candidate oil. The engines are run at 3 600 rpm, 750W. The test is terminated when the inlet pressure of 2kPa is reached. The result of the test is expressed in terms of an index, namely, Blockage Index (BIX). The performance of candidate oil is expressed by this index which is arrived at by comparing the performance of the candidate oil with that of the reference oil Jatre-1.

A-5 DETERGENCY TEST PROCEDURE (CEC L-079-T-97)

This test method evaluates the high temperature detergency of oils.

The detergency test is run using a Honda 49CC, single cylinder, and air cooled engine supplied with a 100:2 by volume fuel to oil mixture. The engine is run at 6 000 ± 20 rpm at wide open throttle for three hours. After testing, the engine is dismantled and various
parts are rated for deposits. The main areas evaluated are ring sticking, piston deposits and cylinder head deposits. The rating is carried out as per test procedure JP1-5S-34-91. The test is run on both the reference oil Jatre-1 and candidate oil on the same day. The result of the test is expressed in terms of two indices, namely, Detergency Index (DIX) and Piston Varnish Index (VIX). The performance of the candidate oil is expressed by these two indices which are arrived at by comparing the performance of the candidate oil with that of the reference oil Jatre-1.

A-6 RING STICKING AND PISTON DEPOSITS TEST PROCEDURE (ASTM D-4857)

This test method evaluates the high temperature detergency of oils.

The test is run in a 347 cm³ Yamaha RD-350B twin-cylinder air cooled motorcycle engine. It is intended primarily to evaluate ring sticking and piston skirt deposits. Spark plug fouling, combustion chamber deposits, and exhaust port blockage are also evaluated. The engine is set up with one cylinder supplied with 50:1 by volume fuel and oil mixture made using the candidate oil and the other with 50:1 by volume fuel and oil mixture using the benchmark reference oil ASTM VI-D. The test is normally run twice, exchanging the oils between cylinders for the second run. Each run is performed on a 25 min part throttle 5 min idle cycle, with a 60 min minimum shutdown after each 150 min of running time. Total running time per single test is 20 h. The performance of the candidate oil is evaluated by comparison with the benchmark reference oil.

A-7 PRE-IGNITION TEST PROCEDURE (ASTM D-4858)

This test method evaluates the tendency of oils to promote pre-ignition.

The test is run in a 49 cm³ Yamaha CE-50 single-cylinder air cooled engine operated under the conditions of 4000 rpm and wide open throttle using fuel to oil ratio of 20:1 by volume for a period of 50 h. The number of occurrences of pre-ignition, as indicated by a rapid increase in combustion chamber temperature is recorded. The performance of the candidate oil is evaluated by comparison with the benchmark reference oil ASTM VI-D.

A-8 LUBRICITY TEST PROCEDURE (ASTM D-4863)

This test method evaluates the lubricity characteristics of oils.

The test is run in a 49 cm³ Yamaha CE-50 single-cylinder air cooled engine operated under the conditions of 4000 rpm and wide open throttle using fuel to oil ratio of 150:1 by volume. After conditions have been stabilized, the cooling air flow is cut off. The output torque is recorded when the spark plug gasket temperature reaches 200°C and again when it reaches 350°C, at which point the cooling air flow is restored. The performance of the candidate oil is evaluated by comparing the reduction in torque output observed with the candidate oil and benchmark reference oil ASTM VI-D.
ANNEX B
(Clauses 5.1 and 5.2)

HOMOGENEITY AND MISCIBILITY TEST

B-1 GENERAL
This test determines whether an oil is and will remain homogeneous and whether it is miscible and is stable when blended with certain standard reference oils after being submitted to a prescribed cycle of temperature changes.

B-2 REFERENCE STANDARD TEST METHOD
This test method generally conforms to U.S. Federal Test Standard No. 791B-Method 3470 dated January 15, 1969 excepting in one feature that the reference oils are those approved by the qualifying authority.

B-3 SAMPLE
B-3.1 Test Sample
Approximately 300 ml.

B-3.2 Standard Reference Oils
As approved by the qualifying authority (Ref. oil TSR-1).

B-4 APPARATUS
B-4.1 Test Jar — A test jar of clear glass, cylindrical form, flat bottom, approximately 30 to 35 mm in inside diameter and 115 and 125 mm in height.

B-4.2 Thermometer — Minus 50 to 50°C range, conforming to ASTM E1-67 or its equivalent.

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

B-4.4 Jacket — Glass or metal, water-tight, of cylindrical form, bottom, about 115 mm in depth, with inside diameter 9.5 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.

B-4.7 Bath — A cooling bath of a type for obtaining the required temperatures.

B-5 PROCEDURE
B-5.1 Shake oil sample well and pour into six sample jars to the 37.5 mm mark and one sample to the 75 mm. Add reference oil to each of the sample jars to the 75 mm mark. Mix the oil thoroughly and heat to 46°C in a water bath. After the oil reaches room temperature, observe and record the colour and evidence of separation. Determine and record the colour and evidence of separation. Determine and record the pour point of each oil.

B-5.2 Maintain the temperature of the cooling bath at -1 to 2°C. Support the jacket, containing the test jar, firmly in a vertical position in the cooling bath so that more than 25 mm of the jacket projects out of the cooling medium.

B-5.3 Beginning at a temperature 12°C before the expected pour point, at each test thermometer reading that is a multiple of 3°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 3s. If the oil has not ceased to flow when its temperature has reached 10°C, place the test jar in the jacket in a second bath maintained at a temperature of -18 to -15°C. If the oil has not ceased to flow when its temperature has reached -7°C, place the test jar in the jacket in a third bath maintained at a temperature of -34.5°C. For determination of very low pour points additional baths should be maintained with successively lower temperature differentials of about 17°C. In each case transfer the jar when the temperature of the oil reaches a point of 28°C, above the temperature of the new bath. At no time place the cold test jar 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 5s as noted by a stop watch or other accurate timing device, and observe carefully. It 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°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 for exactly 5s. 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°C and immediately remove the sample jars. Cork the samples and store them at their respective pour points for 18 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 having once reached pour point;

c) After a cycle of heating to 230°C cooling to pour point storing it for 24 h at this temperature and warming to just above pour point; and

d) Warmed to room temperature.

Evidence of separation is to be reported as:

a) Condition
   1) Definition, and
   2) None or doubtful.

b) Location
   1) Near Top,
   2) Filament, and
   3) Uniformly distributed.

c) Particle size
   1) Small, as in cloud or haze, and
   2) Specks or larger particles.

d) Colour
   1) White or very light,
   2) Yellow, and
   3) Black.
ANNEX C
(Foreword)
COMMITTEE COMPOSITION
Lubricants and Related Products Sectional Committee, PCD 4

Organization

Indian Oil Corporation Ltd (R&D Centre), Faridabad
Ashok Leyland Ltd, Chennai
Association of Manufacturers of Petroleum Specialities, Mumbai
Bajaj Auto Ltd, Pune
Balmer Lawrie & Co Ltd, Kolkata
Bharat Heavy Electricals Ltd, Bhopal
Bharat Petroleum Corporation Ltd, Mumbai
Castrol India Ltd, Mumbai
Central Institute of Road Transport (Training & Research), Pune
Centre for High Technology, New Delhi
Gulf Oil Ltd, Mumbai
Hindustan Petroleum Corporation Ltd, Mumbai
Indian Additives Ltd, Chennai
Indian Institute of Petroleum, Dehradun
Indian Oil Blending Ltd, Mumbai
Indian Oil Corporation Ltd (Refineries & Pipelines Division), New Delhi
Indian Oil Corporation Ltd (Marketing Division), Mumbai
IPSS 1:9 Oils and Lubricants Subcommittee of Interplant Standardization in Steel Industry
Lubrizol India Ltd, Mumbai
Madras Refineries Ltd, Chennai
Manuti Udhyog Ltd, Gurgaon
Ministry of Defence (DGAQA), New Delhi
Ministry of Defence (DMS & RDE), Kanpur
Ministry of Defence (DGQA), New Delhi
Ministry of Petroleum and Natural Gas, New Delhi

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SHRI A. K. SINGH (Alternate)
ADVISER (REFINERIES)
DIRECTOR (SUPPLY) (Alternate)

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**Internal Combustion Engine Oils Subcommittee, PCD 4:5**

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The performance levels prescribed in this specification are also in accordance with the test methods outlined in the following documents:

JASO M345 Two Cycle Gasoline Engine Oil Performance Classification Implementation Manual, issued by JASO, Japan; and


In order to provide for certification of lubricants for two-stroke spark-ignition engines by independent third party certifying agency, the procedure for qualification approval has been given in 6. Bureau of Indian Standards may be contacted for further details of qualification approval and product conformity certification procedure. These procedures are in accordance with the ISO/IEC Guidelines 53. It is expected that having updated the standard in accordance with the International practice in vogue and the prevailing situation in the country, lubricant manufactures for two-stroke gasoline engines will opt for certification of their products conforming to this specification under BIS Certification Marks Scheme which would help combat the menace of spurious or non-conforming products. BIS Certification Marks Scheme is operated under a well defined Scheme of Testing and Inspection (STI) designed and supervised by the Bureau but operated by manufacturers.

The composition of the Committee responsible for formulation of this standard is given in Annex C.

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 2:1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
Bureau of Indian Standards

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. PCD 4 (1903).

Amendments Issued Since Publication

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Printed at Prabhat Offset Press, New Delhi-2