DUS 249-4

DRAFT UGANDA STANDARD

Second Edition
2018-mm-dd

Engine Oils — Performance Classification — Part 4: Specification for internal combustion engine oils used in four - stroke -cycle motorcycle gasoline engines and associated drive trains

Reference number
DUS 249-4: 2018y

Compliance with this standard does not, of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

The Executive Director
Uganda National Bureau of Standards
P.O. Box 6329
Kampala
Uganda
Tel: +256 414 333 250/1/2/3
Fax: +256 414 286 123
E-mail: info@unbs.go.ug
Web: www.unbs.go.ug

Contents

Page

Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to co-ordinate the elaboration of standards and is

(a) a member of International Organisation for Standardisation (ISO) and

(b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and

(c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of key stakeholders including government, academia, consumer groups, private sector and other interested parties.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

The committee responsible for this document is Technical Committee UNBS/TC 16, *[Petroleum Products and Facilities]*, Subcommittee SC 1, *[Petroleum and Petrochemicals Products]*.

This second edition cancels and replaces the first edition (US 249:2000), which has been technically revised.

US 249 consists of the following parts, under the general title Engine oil — Performance Classification:

- — *Part n: General*
- — *Part 2: API Specification for Spark Ignition (petrol) engines*
- — *Part 3: API Specification for light and heavy duty Compression ignition (diesel) engines*
- — *Part 4: Specification for internal combustion engine oils used in four stroke - cycle motorcycle gasoline engines and associated drive trains*
- — *Part 5: Specification for Internal Combustion engine oils used in two stroke - cycle motorcycle gasoline engines and associated drive trains*

Introduction

This Draft Uganda Standard aims to specify the minimum performance requirements for four-stroke engine oils used in land- based small engines and to classify their performance according to their frictional properties. Land- based small engines is a common industry description intended to separate engines normally used in motorcycles, motor scooters, all- terrain vehicles (ATVs) from the generally larger, two- stroke and four- stroke engines utilized in passenger cars, light- medium- and heavy- duty trucks and other industrial equipment.

Unique lubricant performance standards have not been in existence for four-stroke engine oils used in motorcycles, motor scooters, all-terrain vehicles (ATVs) and related equipment. As a consequence, manufacturers of this kind of equipment have experienced field-related problems where four-stroke engine oils not meeting the unique frictional requirements of some of these engines have been used. The intent of this Draft Uganda Standard is to enable engine manufacturers to better communicate the lubricant needs of their engines to consumers and, thus, assist the consumer in selecting the proper lubricant from the many available in the marketplace.

This Standard specifies the performance classification of four-stroke cycle gasoline engine oils based on Physico-Chemical Requirements, and three friction performance indices, which are derived from the frictional properties of the lubricant, according to the JASO T904 (test procedure1).

Engine Oils — Performance Classification — Part 4: Specification for Internal Combustion engine oils used in four-stroke cycle motorcycle gasoline engines and associated drive trains

1 Scope

This Draft Uganda Standard specifies performance requirements and test methods for four-stroke cycle spark ignition engines employing a common sump containing the lubricating oil for both the engine and associated drive train (transmission, clutch, starter) of motorcycles, motor scooters, all-terrain vehicles (ATVs) and related equipment.

2 Normative references

The following referenced documents referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

US 1732:2017, *Standard Practice for Manual Sampling of Petroleum and Petroleum Products*

US 1733:2017, *Standard Practice for Automatic Sampling of Petroleum and Petroleum Products*

DUS ISO 24254-2007 Lubricants, industrial oils and related products (class L) -- Family E (internal combustion engine oils) -- Specifications for oils for use in four-stroke cycle motorcycle gasoline engines and associated drivetrains (categories EMA and EMB)

DUS 2071, *Standard Test Method for Measuring Viscosity at High Shear Rate and High Temperature by Tapered Bearing Simulator*

DUS 2074, *Standard Test Method for Determination of Yield Stress and Apparent Viscosity of Engine Oils at Low Temperature*

DUS 2079, *Standard Test Method for Measuring Viscosity at High Temperature and High Shear rate by Tapered-Plug Viscosimeter*

DUS 2045, *Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectroscopy*

DUS 2056, *Standard Test Method for Apparent Viscosity of Engine Oils and Base Stocks Between –10 °C and –35 °C Using Cold-Cranking Simulator*

DUS 2046 *Standard test method for evaporation loss of lubricating oils by Noack Method*

DUS 2053, *Standard Test Method for Determination of Homogeneity and Miscibility in Automotive Engine Oils*

DUS ISO 3104:1994, *Petroleum products -- Transparent and opaque liquids -- Determination of kinematic viscosity and calculation of dynamic viscosity*

DUS ISO 3987:2010, *Petroleum products — Lubricating oils and additives — Determination of sulfated ash*

DUS ISO 6247, *Petroleum products — Determination of foaming characteristics of lubricating oils*

DUS ISO 20844:2015, *Petroleum and related products — Determination of the shear stability of polymer-containing oils using a diesel injector nozzle*

US 249-1:2018 *Engine Oil- Performance Classification- Part 1- General*

US ISO3 Terms and definitions

For the purposes of this document, the terms and definitions given in DUS 249-1 and the following apply.

3.1
candidate oil
four-stroke cycle engine oil whose performance is subject to DUS 249-4

3.2
reference oil
four-stroke cycle engine oil of known performance that is used for comparison to categorize the performance of a candidate oil

3.3
Friction index
relative performance index, which is determined by comparing the test results of the candidate oil with the results of the reference oils

3.4
Dynamic Friction Index
DFI
resultant index determined from the dynamic friction coefficients, ⌈d, obtained from the dynamic friction test

3.5
Static Friction Index
SFI
resultant index determined from the static friction coefficients, ⌈s, obtained from the static friction test

3.6
Stop Time Index
STI
resultant index determined from the stop time, ST, obtained from the dynamic friction test

4 Abbreviated terms

4.1
EELQMS
European Engine Lubricants Quality Management System.

4.2
EOLCS
Engine Oil Licensing and Certification System

5 Classification

Engine oils shall be classified according to their viscosity and performance as follows

5.1 Classification according to viscosity

Engine oils are classified to viscosity based on the SAE viscosity classification (SEA J300)

5.2 Classification according to performance

Engine oil are classified according to performance based on US ISO service classification

6 Requirements

6.1 General requirements

The engine oil shall consist of acceptable petroleum products, or of acceptable synthetically prepared products, or of a combination of these two types of products, compounded in all cases, with such functional additives, for example, detergents, dispersants, oxidation inhibitors and corrosion inhibitors as are necessary to enable it to comply with the other requirements of this standard.

6.1.1 Stability

When tested in accordance with DUS 2053, the engine oil shall remain clear and homogeneous, and shall show no evidence of separation of components and no evidence of colour change

6.1.2 Compatibility

When tested in accordance with DUS 2053, the engine oil shall be compatible with other oils of the same viscosity grade that comply with the requirements of this standard.

6.1.3 Licenses

6.1.3.1 API Categories

All products licensed under API shall be listed in API EOLCS licensee directory (www.api.org

6.1.3.2 ACEA Categories

All products licensed under ACEA shall be justified with a signed EELQMS oil marketers' Letter of Conformance

6.1.4 Physico-Chemical Requirements

6.1.4 1 The oil shall be free from suspended matter, grit, water or any other foreign matter and impurities.

6.1.4.2 The oil shall comply with the physico-chemical and other bench-test requirements as specified in this standard.

6.1.5 SAE viscosity Grades

The oils shall conform to one of the SAE mono-viscosity grades or SAE multi-grades in Table A.1, which are combinations of W-Grades and other mono-grades, as for example: SAE 10 W and SAE 30 for the SAE 10W-30 grade. Viscosity limits for each of the mono-grades are also given in Table A.1.

In case of multi-grades, the prescribed viscosity limits for both the constituent components of the multi-grade, shall be met

a) Table 1 — Engine oil viscosity classification

SAE Viscosity grade	Low – temperature (^{o}C) Cranking Viscosity , cp(1) (Max)[a]	Low temperature (^{o}C) Pumping Viscosity , cp with no yield stress (Max)[b]	Low-Shear-Rate Kinematic Viscosity (mm^2/s) at 100 ^{o}C[c]		High-shear-Rate Viscosity cP at 150 ^{o}C and 10^6 S[d]
			Min	Max	
0 W	6200 at -35	60 000 at -40	3.8		
5 W	6600 at -30	60 000 at -35	3.8		
10 W	7000 at -25	60 000 at -30	4.1		
15 W	7000 at -20	60 000 at -25	5.6		
20 W	9500 at -15	60 000 at -20	5.6		
25 W	13000 at -10	60 000 at -15	9.3		
20			5.6	< 9.3	2.6
30			9.3	< 12.5	2.9
40			12.5	< 16.3	2.9 (0W-40, 5W-40 and 10W-40 grades)
40			12.5	< 16.3	3.7(15W-40,20W-40, 25W-40,40 grades)
50			16.3	< 21.9	3.7
60			21.9	< 26.1	3.7

[a] test method to be used is DUS 2056

[b] test method to be used is DUS 2044

[C] test method to be used is US US ISO 3104:1994

[d] test method to be used is DUS 2043US ISO

6.2Requirements6.2.1 Performance quality level

Candidate four-stroke cycle engine oils shall be formulated such that their engine performance be of a quality level at least equivalent to one or more of the performance categories for engine oil sequences given in Table 2

Table 2 — Engine oil performance quality level categories

sequences	Quality Categories
API [a)]	SJ, SL, SM[c)], SN[d)]
ILSAC	GF-2, GF-3, GF-4, GF-5
ACEA[b)]	A1/B1, A3/B3, A3/B4 A5/B5 C2, C3, C4

[a)]API performance categories and standards are documented in DUS 249-2.

[b)] ACEA sequence tests and performance levels are documented in DUS 249-2 and or the ACEA European oil sequence for service fill gasoline engine oils.

[c)]Excluding SM/EC

[d)]Excluding SN/RC

6.2.2 Performance Categories

Candidate engine oils shall be formulated such that their engine oil specifications be of a quality level least equivalent to one of the performance categories for engine oil sequence given in Table 3.

Table 3 — Engine oil performance categories

Specifications	Performance Categories
ISO	EMA, EMA1, EMA2, EMB
JASO	MA, MB

NOTE: The consumer shall refer to the owner's or operator's manual for recommended category of engine oil to be used in a specific engine

ISO categories, EMA, EMA1, EMA2 and EMB, meet the requirements of this standard

JASO categories, MA and MB, which are equivalent to the ISO oil categories meet requirement of this standard

6.3 Performance grade requirements

The performance of four-stroke cycle engine oils shall be classified into one of two grades, as indicated in Table 3, based on the three performance indices derived from the friction indices according to the following equation:

The friction index, I_F, is calculated in accordance with Equation (1):

$$I_F = 1 + \frac{X_{Cand} - X_{JAFREB}}{X_{JAFREA} - X_{JAFREB}} \quad (1)$$

Where

X_{Cand} is the test result of the candidate oil;

X_{JAFREA} is the test result of the reference oil JAFRE-A;

X_{JAFREB} is the test result of the reference oil JAFRE-B.

NOTE The resultant friction indices are calculated such that 2.00 is obtained when the JAFRE-A oil is evaluated as the candidate and 1.00, when the JAFRE-B oil is evaluated as the candidate.

Table 3 — Performance classification

Rated parameter	Performance classification		Test method
	EMA	EMB	
Dynamic Friction Index (DFI)	≥ 1.45 and < 2.50	≥ 0.50 and < 1.45	DUS ISO 24254-2007
Static Friction Index (SFI)	≥ 1.15 and < 2.50	≥ 0.50 and < 1.15	
Stop Time Index (STI)	≥1.55 and < 2.50	≥ 0.50 and < 1.55	

Regarding the classification of a candidate oil, if any one or more of the three friction indices (DFI, SFI and STI) does not meet the classification of EMA, the candidate four-stroke cycle engine oil shall be classified as EMB.

Given the wide range in allowable EMA indices, further classification can be made into EMA subcategories, EMA2 and EMA1, as detailed in Table 4. Subcategories EMA1 and EMA2 may be used only if all the resultant friction indices for a candidate oil fall within that specific subcategory.

Table 4 — EMA Subcategory classification

Rated parameter	Performance classification		Test method
	EMA		
	EMA1	EMA2	
Dynamic Friction Index (DFI)	≥ 1.45 and < 1.80	≥ 1.80 and < 2.50	DUS ISO 24254-2007
Static Friction Index (SFI)	≥ 1.15 and < 1.70	≥ 1.70 and < 2.50	
Stop Time Index (STI)	≥1.55 and < 1.90	≥ 1.90 and < 2.50	

7 Packaging and Labelling

7.1 Packaging

The condition of the drums or smaller containers and the bulk tankers into which the engine oil is filled shall have no detrimental effect on the quality of the engine oil during normal transportation and storage. Only containers of the same size filled with oil of the same batch identification shall be packed together in a carton. Prior to use, the containers shall be firmly secured with tamper- proof seal.

7.2 Labelling

The following information shall appear in legible and indelible marking on each container and each carton (if used):

a) product name and application

b) US ISO category or JASO equivalent

c) the manufacturer's identification and/or distributor’s name;

d) API and ACEA Performance quality level

e) SAE viscosity grade;

f) Relevant quality and certification marks

g) batch identification;

h) net content (L)

i) Origin of the product/Made in.

j) Expiry date"

8 Sampling

The relevant sampling procedure given in US 1733:2017 or in US 1732:2017 shall be used to provide samples for testing

Annex A
(normative)

Physico-chemical requirements

A.1 Physical and chemical property requirements

In addition to prescribed performance requirements, candidate oil shall also satisfy the physical and chemical property requirements given in Table A.1.

Table A.1 — Physical and chemical property requirements for four-stroke cycle engine oils

Requirement	Unit	Limit	Test method
Sulphated ash, (max)	% (m/m)	1.2	DUS ISO 3987
Phosphorous content, (max)	% (m/m)	0.12	DUS 2045
Evaporation loss, (max)	% (m/m)	20	DUS 2046
Foaming Tendency Stability Sequence I, (max) Sequence II, (max) Sequence III, (max)	ml	 10/0 50/0 10/0	DUS ISO 6247
Shear stability 100°C kinematic viscosity after test XW-30, (min) XW-40, (min) XW-50 Other grades	mm^2/s	 9.0 12.0 15.0 Stay in grade	DUS ISO 20844
Viscosity at high shear rate and high temperature (150°C), (min)	mPa.s	2.9	DUS 2071 or DUS 2079

Note Test shall be conducted by Diesel injector method under standard test conditions

Annex B
(informative)

Background and examples of assignment of performance classification

B.1 Background

There are several common performance requirements for the lubrication of motorcycles and automotive engines. For many years, the performance requirements of automotive engine oils have been applied to those of motorcycles, scooters, ATVs and related equipment without modification. The minimum performance requirement for four-stroke engine oils currently recommended by motorcycle and motor scooter manufacturers is defined by the API SJ category.

However, with the recent trend towards improved fuel economy automotive engine oils (ILSAC GF-5), the propensity for misapplication of some of these oils has increased. Unique lubrication demands exist for the transmission gear, starter and clutch assemblies of motorcycles and motor scooters related to its viscosity and frictional characteristics. For low-viscosity engine oils (0W-20), transmission gear durability is known to decrease. In addition, with heavily friction modified engine oils, clutch slippage can result due to the low resultant frictional properties of the lubricant, especially at high temperatures where oils of higher frictional properties are desired.

The intention of specifying minimum performance requirements and establishing appropriate limits for viscosity, volatility and frictional properties, is to minimize the tendency for misapplication and resulting field problems. Four-stroke cycle engine oils, as defined by this Standard, should be classified according to their frictional properties as either EMA (EMA2 and EMA1) (high-friction coefficients) or EMB (low-friction coefficients). Note that there are applications, such as with some ATVs, where oils of lower friction are more desirable than those with higher friction properties, as defined by the JASO T904 test method. Also, for scooters and/or with motorcycles with dry clutches, where clutch slippage is no longer a concern, it can be desirable to use oils with lower friction characteristics for the derived benefits in fuel economy. Classification of interpreted as an indicator of overall perceived quality.

Furthermore, the phosphorus content of automotive engine oils, such as those meeting API SM has decreased to minimize catalyst po ISOning; acceptable ranges are between a minimum of 0.06 % (m/m) to a maximum of 0.08 % (m/m). Since current motorcycle design has the transmission lubricated by the engine oil, these low-phosphorous oils can lead to an increased propensity for gear pitting. To minimize these concerns, an acceptable range of phosphorous concentrations was incorporated into the specification. Based on gear durability tests and field experience, the phosphorous limits were set at a minimum of 0.08 % (m/m) and a maximum of 0.12 % (m/m) to ensure a cap to mitigate catalyst po ISOning concerns.

B.2 Examples of assignment of performance classification

Table B.1 provides examples of all possible combinations of friction indices and their relative classification assignments. For example, Sample 2 clearly shows all the friction indices, i.e. static friction index (SFI), dynamic friction index (DFI) and stop time index (STI), that fall in the EMA classification. Furthermore, it is clear that all the friction indices can be further classified as meeting subcategory EMA1. As such, either the EMA general classification or the EMA1 sub classification may be applied to this sample lubricant. Samples 4 through 9 provide examples where one or two of the individual indices do not meet either subcategory (EMA1 or EMA2) as represented by the shading, but clearly fall in the EMA category and are classified accordingly.

Conversely, Samples 10 through 15 provide examples where one or two of the friction indices fall into the EMB range, and, consequently, these samples can be classified only as EMB. Subcategories EMA1 and EMA2 may be used only if all the resultant friction indices for a candidate oil fall within that specific subcategory.

Table B.1- Examples of performance classification assignment

Sample	DFI	SFI	STI	EMA	EMA1	EMA2	EMB
1	≥ 0.50 and < 1.45	≥ 0.50 and < 1.15	≥ 0.50 and < 1.55	-	-	-	X
2	≥ 1.45 and < 1.80	≥ 1.15 and < 1.70	≥ 1.55 and < 1.90	X	X	-	-
3	≥1.80 and < 2.50	≥1.70 and < 2.50	≥1.90 and < 2.50	X	-	X	-
4	≥ 1.45 and < 1.80	≥ 1.70 and < 2.50	≥ 1.90 and < 2.50	X	-	-	-
5	≥ 1.80 and < 2.50	≥ 1.15 and < 1.70	≥ 1.90 and < 2.50	X	-	-	-
6	≥1.80 and < 2.50	≥1.70 and < 2.50	≥1.55 and < 1.90	X	-	-	-
7	≥ 1.45 and < 1.80	≥ 1.15 and < 1.70	≥ 1.90 and < 2.50	X	-	-	-
8	≥ 1.80 and < 2.50	≥ 1.15 and < 1.70	≥ 1.55 and < 1.90	X	-	-	-
9	≥1.45 and < 1.80	≥1.70 and < 2.50	≥1.55 and < 1.90	X	-	-	-
10	≥ 0.50 and < 1.45	≥ 1.15 and < 2.50	≥ 1.55 and < 2.50	-	-	-	X
11	≥ 1.45 and < 2.50	≥ 0.50 and < 1.15	≥ 1.55 and < 2.50	-	-	-	X
12	≥1.45 and < 2.50	≥1.15 and < 2.50	≥0.50 and < 1.55	-	-	-	X
13	≥ 0.50 and < 1.45	≥ 0.50 and < 1.15	≥ 1.55 and < 2.50	-	-	-	X
14	≥ 1.45 and < 2.50	≥ 0.50 and < 1.15	≥ 1.50 and < 1.55	-	-	-	X
15	≥0.50 and < 1.45	≥1.15 and < 2.50	≥0.50 and < 1.55	-	-	-	X

Bibliography

[1] ASTM D4485, Standard Specification for performance of Engine Oils

[2] JASO T 903, Motorcycles—four-Stroke Cycle Gasoline Engine Oils

[3] JASO T904, Motorcycles — Four Stroke Cycle Gasoline Engine Oils — Friction Properties Test for the Clutch Systems

[4] ISO24254:2007 Lubricants, industrial oils and related products (class L)- Family E (Internal combustion engine oils)- specifications for use in four-stroke cycle motorcycle gasoline engines and associated drevetrains (categories EMA and EMB)

Certification marking

Products that conform to Uganda standards may be marked with Uganda National Bureau of Standards (UNBS) Certification Mark shown in the figure below.

The use of the UNBS Certification Mark is governed by the Standards Act, and the Regulations made thereunder. This mark can be used only by those licensed under the certification mark scheme operated by the Uganda National Bureau of Standards and in conjunction with the relevant Uganda Standard. The presence of this mark on a product or in relation to a product is an assurance that the goods comply with the requirements of that standard under a system of supervision, control and testing in accordance with the certification mark scheme of the Uganda National Bureau of Standards. UNBS marked products are continually checked by UNBS for conformity to that standard.

Further particulars of the terms and conditions of licensing may be obtained from the Director, Uganda National Bureau of Standards.

ICS nn.nnn.nn

Price based on nn pages