DUS 249-3

DRAFT UGANDA STANDARD

Second Edition
2018-mm-dd

Engine Oils — Performance Classification — Part 3: API Specification for light and heavy duty Compression- ignition (diesel) engines

Reference number
DUS 249-3: 2018

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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 1: 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*

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Introduction

Due to the technological advances that have occurred since the publishment of US 249:2000/ EAS 159, it has become necessary to keep abreast with such changes, hence the revision of this standard.

It has become necessary to sub-divide this standard into five parts.

DUS 249-1:2017 Engine Oil — Performance Classifications — Part 1: General,

DUS 249-2:2017 Engine Oils — API Performance Classifications — Part 2: API Specification for Spark Ignition (petrol) Engine Oils

DUS 249-3: 2017 Engine Oil — API Performance Classification — Part 3: API Specification for light and heavy duty compression Ignition (diesel) engine oil

DUS 249-4: 2017 Engine Oil — Performance Classification — Part 4: Specification for internal combustion engine oils used in four stroke -cycle motorcycle gasoline engines and associated drive trains

DUS 249-5: 2017 Engine Oils — Performance Classification — Part 5: Specification for Internal Combustion engine oils used in two stroke- cycle motorcycle gasoline engines and associated drive trains

Note: Current engine oil categories that may be deemed obsolete by API during the course of the application of this standard shall be considered obsolete as well

Engine Oil — Performance Classification — Part 3: Specification for light and heavy duty compression Ignition (diesel) engine oil

1 Scope

This Draft Uganda standard specifies requirements and test methods for light and heavy duty naturally aspirated, turbo-charged or super-charged compression-ignition engines, meeting or exceeding API Service Category CH-4.

It does not cover engine oil for spark ignition engines, aviation equipment, outboard motors, lawn mowers, railroad, locomotives, industrial and marine application.

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.

DUS 2040, Standard test method for flash and fire points by Cleveland open cup tester

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

US 1730:2017, Standard test method for pour point of petroleum products.

US ISO 3104:1994, Standard test method for kinematic viscosity of transparent and opaque liquids (the calculation of dynamic viscosity).

DUS 2067 Standard Test Method for Sulfated Ash from Lubricating Oils and Additives

DUS 2067 Standard Test Method for Measuring Apparent Viscosity at High-Temperature and High-Shear Rate by Multicell Capillary Viscometer

DUS 2068 Standard Test Method for Evaluation of Corrosiveness of Diesel Engine Oil at 135°C

DUS 2041, Standard test method for foaming characteristics of lubricating oils.

DUS 2042, Standard practice for calculating viscosity index from kinematic viscosity at 40 and 100 °C.

DUS 2073, Standard Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography1, 2

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 2068 Standard Specification for Fuel System Icing Inhibitors

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 coupled plasma atomic emission spectrometry.

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

DUS 2072 Standard Test Method for Determining Automotive Engine Oil Compatibility with Typical Seal Elastomers

DUS 2046, Standard test method for evaporation loss of lubricating oils by the Noack method.

DUS 2075. Standard Test Method for Shear Stability of Polymer Containing Fluids Using a European Diesel Injector Apparatus

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

DUS 2069, Standard Test Method for Shear Stability of Polymer Containing Fluids Using a European Diesel Injector Apparatus at 30 and 90 Cycle

DUS 2070, Standard Test Method for Evaluation of Diesel Engine Oils in the T-11 Exhaust Gas Recirculation Diesel Engine

DUS 249-4, Engine Oil- Performance Classification- Part 4: Specification for internal combustion engine oils used in four –stroke- cycle motorcycle gasoline engines and associated drive trains

DUS 249-1:2018, Engine Oil- Performance Classification- Part 1- General

3 Terms and definitions

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

3.1
additives
material added to the lubricant for the purpose of imparting new properties or enhancing existing properties

3.2
heavy duty engine
an engine that is designed to allow operations continuously at or close to its peak output. Such engine is installed in large trucks and buses, as well as farm, Industrial, and construction equipment.

3.3
light duty engine
an engine that is designed to be normally operated substantially less than its peak output. This type of engine is typically installed in Automobiles and small trucks, vans and buses.

3.4
miscibility
the ability of reference oil and test oil to form a uniform mixture after blending and not separate into two phases after submission to a series of temperature changes

3.5
tamper proof seal
seal designed such that malicious disassembly and reassembly using commonly available tools will be detected upon visual inspection

4 Abbreviated terms

For the purposes of this standard, the following abbreviations in addition to those indicated in DUS 249-1, shall apply:

4.1
EELQMS
European Engine Lubricants Quality Management System.

4.2
EOLCS
Engine Oil Licensing and Certification System.

5 Classification

Engine lubricating oils shall be classified according to viscosity grade and performance.

5.1 Classification according to viscosity

The viscosity of the lubricating oil shall be classified as either single grade or multi-grade basing on the SAE viscosity grades, as per designations indicated in SAE J300

5.2 Classification according to performance

Engine lubricating oil shall be classified according to performance based on API classification.

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 All products licensed under API shall be listed in API EOLCS licensee directory (www.api.org) and shall bear appropriate labelling as described in 7.2 in addition to the API Engine oil quality marks

6.1.3.1 The Uganda National Bureau of Standard shall be notified of any changes in the formulation of engine oil and an API warranty certificate shall be produced as evidence before a new spec can be taken for reference purposes

6.1.4 Physico-Chemical Requirements

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

6.2.2 The oil shall comply with the physico-chemical requirements Table 1 and other bench-test requirements as specified in this standard

Table 1 — Requirements for Physico-Chemical (other than viscosity)

Sl No.	Characteristics	Requirement for Grade												
(1)	(2)	SAE 0W (3)	SAE 5W (4)	SAE 10W (5)	SAE 15W (6)	SAE 20W (7)	SAE 25W (8)	SAE 20 (9)	SAE 30 (10)	SAE 40 (11)	SAE 50 (12)	SAE 60 (13)	Multi-Grade (14)	Method of Test
i)	Appearance	When examined in transmitted light in a colourless test tube of 25mm internal diameter, oil shall be clear, bright and free from turbidity and sediments.												
ii)	Viscosity index, (Min)	100	100	100	95	95	95	95	95	90	90	90	_	DUS 2042
iii)	Pour point, ^{0}C, (Max)	-33	-33	-27	-24	-21	-15	-9	-6	-6	-6	6	_	US 1730:2017
iv)	Flash point COC ^{0}C, (Min)	160	160	190	190	200	200	200	215	215	220	220	200 or 185	DUS 2040
v)	Evaporative loss, %, Max	20	20	20	25	25	15	15	10	10	10	10	22 or 20	DUS 2046
For defence requirements pour point for SAE 40 shall be -18^{0}C, Max and for SAE 50 shall be -9^{0}C, Max Flash point for multigrade is valid only for 0W-20, 5W-20, 5W-30, 10W-30 and for other multigrades it is not required														

6.2 Viscosity Grades

6.2.1 The oils shall conform to one of the SAE mono-viscosity grades as in Table 2 or SAE multi-grades, 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 2.

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

Table 2 — 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)[c] 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		
8	-	-	4	<6.1	1.7
12	-	-	5.0	<7.1	2.0
16			6.1	<8.2	2.3
20			6.9	< 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 2074

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

[d] test method to be used is DUS 2043

6.3 Performance Categories

Candidate engine oils shall be formulated such that their engine performance requirements meet one of the performance categories for engine oil sequence given in Table 3.

Table 3 — Engine oil performance categories

Classification	Performance Categories
API	CJ-4, Cl-4, CI-4 PLUS, CJ-4, CK-4, FA-4

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

6.3.1 Engine oil labelled or used as light and heavy duty compression ignition engine oils under the API classification must have a performance not lower than that defined by API CJ-4.

6.3.2 API categorie FA-4 shall only be used for heavy duty compression ignition engines and is not Backward Compatible with other API categories listed in table 3.

6.4 Test requirements

All engine oil licensed under the API sequence in addition to meeting the requirements stipulated in clause 6 above, shall comply with laboratory tests requirements as specified in Annex A.

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 a tamper- proof seal.

7.2 Labelling

Each container and each carton (if present) shall be legibly and indelibly marked with the following information in English language.

a) product name and application

b) name and address of the manufacturer and registered trade mark if any and/or distributor's name;

c) the categories of oils according API service classification

d) API engine oil quality marks

e) SAE viscosity grade

f) net content.

g) origin of the product/Made in.

h) Date of production and the batch number

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)

Laboratory/ bench test requirements

A.1 Requirements for API service category API CK-4 and FA-4 categories

Table A.1 — Laboratory test requirements for API CK-4 and FA-4 category

Test method	Measured Parameter	Units	Primary Performance Criteria	
			CK-4 SAE J300 viscosity xW-30, xW-40	FA-4 SAE J300 viscosity xW-30
DUS 2071 (High temperature/high shear) or DUS 2068 or DUS 2067	Viscosity at 150°C,			
	xW-30 grades, (min)	mPa-s	3.5	2.9
	xW-30 grades, (max)	mPa-s	N/A	3.2
	xW-40 grades	mPa-s	Meet SAE J30	N/A
DUS 2068 (135°C HTCBT)	Copper, increase, (max)	mg/kg	20	20
	Lead, increase, (max)	mg/kg	120	120
	Copper strip rating, (max)	_	3	3
DUS 2069	Kinematic viscosity after 90 pass shearing, mm2/s at 100°C, (min)			
	xW-30 0W-40	mm^2/s	9.3	9.3
	Other xW-40	mm^2/s	12.5	N/A
	xW-30 0W-40	mm^2/s	12.8	9.3
	HTHS viscosity at 150°C, (min) xW-30 grades3	mm^2/s	3.4	2.8
DUS 2046 (NOACK)	Evaporative loss at 250°C, (max)	%	13	13
DUS 2041	Foaming/settling, (max)			
	Sequence I	ml	10/0	10/0
	Sequence II	ml	20/0	20/0
	Sequence II Sequence III	ml	10/0	10/0
DUS 2074 (Sooted oil MRV TP-1) (DUS 2070engine test requirement)	Viscosity, 180 h used oil sample from T-11/T-11a test, tested at -20°C, (max)	mPa-s	25000	25000
	Yield stress of 180 h used oil sample above, (max)	Pa	<35	<35
DUS 2067	Mass fraction sulfated ash, (max)	%	1.0	1.0
DUS 2045	Mass fraction phosphorus, (max)	%	0.12	0.12
DUS 2045	Mass fraction sulfur, (max)	%	0.4	0.4

A.2 Requirements for API service category CJ-4

Table A.2 — Laboratory test requirements for API CJ-4 service category

Requirements	Test method	Properties	Unit	Limits		
				1 Test	2 Test	3 Test
1.1 Viscosity Grades	_	SAE J300	_	Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion, 135ºC	DUS 2068	Copper, used oil increase, (max)	Ppm	20	No MTAC	
		Lead, used oil increase, (max)	ppm	120		
		Copper Strip Rating, (max)	_	3		
1.3 Foaming	DUS 2041	Foaming/Settling, (max)			No MTAC	
		Sequence I	%	10/0		
		Sequence II	%	20/0		
		Sequence III	%	10/0		
1.4 Shear Stability	DUS 2069	KV @ 100ºC after 90-passes for SAE XW-40, (min)	cSt	_	No MTAC	
		KV @ 100ºC after 90-passes for SAE XW-30, (min)	cSt			
1.5 Noack Volatility	DUS 2046	Evap Loss @ 250ºC, Viscosity Grades other than SAE 10W-30, (max)	%	13	No MTAC	
		Evap Loss @ 250ºC, SAE 10W-30, (max)	%	15		
1.6 High Temperature/ High Shear	DUS 2071	Viscosity @ 150ºC, (min)	cP	3.5	No MTAC (1), (2)	
1.7 Sooted Oil MRV	DUS 2074	180 hour sample from Mack T-11 or T-11A			No MTAC	
		Viscosity @ -20ºC, (max)	cP	25,000		
		Yield stress	Pa	<35		
1.8 Chemical Limits (Non-Critical)	DUS 2064	Sulfated Ash, (max)	%	1.0	No MTAC (1), (2)	
	DUS 2045	Phosphorus, (max)	%	0.12		
		Sulfur, (max)	%	0.4		

1.9 Seal Compatibility	DUS 2072	Limits			
		Volume Change	Hardness	Tensile strength	Elongation
	Nitrile	+5 / -3	7 / -5	7 / -5	+10 / -TMC1006
	Silicone	+TMC1006 / -3	+5 / TMC1006	+5 / -TMC1006	+20 / -30
	Polyacrylate	+5 / -3	+8 / -5	+8 / -5	+10 / -35
	FKM	+5 / -2	+7 / -5	+7 / -5	+10 / -TMC1006
	Vamac G	+TMC1006 / -3	+5 / -TMC1006	+5 / -TMC1006	+10 / -TMC1006

(1) Not an ACC Test.

(2) MTAC is a statistical method for treating multiple engine oil test results if applicable. Consult your sales representative for further information

A.3 Requirements for API service category CL-4 and CL-4 Plus

Table A.3 — Laboratory test requirements for API CL-4 and CI-4 PLUS service category

Requirements	Test method	Properties	Units	Limits		
				1 Test	2 Test	3 Test
1.1 Viscosity Grades		SAE J300		Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion Bench Test	DUS 2068	Copper increase, (max)	ppm	20	No MTAC (1), (2)	
		Lead increase, (max)	ppm	120		
		Copper strip rating, (max) (D130)	_	3		
		Tin increase, (max)	ppm	report		
1.3 Foam Test	DUS 2041 (Option A not allowed)	Foaming/Settling, (max)			No MTAC (1), (2)	
		Sequence I	mL	10/0		
		Sequence II	mL	20/0		
		Sequence III	mL	10/0		
1.4 Shear Stability	DUS 2075	After shear viscosity, SAE 10W-30, (min)	cSt	9.3	No MTAC (1), (2), (3)	
		After shear viscosity, SAE 15W-40, (min)	cSt	12.5		
1.5 Volatility	DUS 2046 (Noack)	Evaporative loss at 250oC, (max)	%	15	No MTAC (1), (2)	
1.6High Temperature /High Shear	As allowed in SAE J300	Viscosity, (min)	mPa-s	3.5	No MTAC (1), (2)	
1.7 Low Temperature Pumpability	DUS 2074 (MRV TP-1)	Viscosity of 75h used oil sample from T-10 Test at -20oC, (max)	mPa-s	25000	No MTAC (1), (2)	
	Modified DUS 2074 (if yield stress)	Viscosity at -20oC, (max)	mPa-s	25000	-	
		Yield stress, (max)	Pa	35		

1.8 Elastomer Compatibility	DUS 2072	Limits			
		Volume Change	Hardness	Tensile strength	Elongation
	Nitrile	+5 / -3	+7 / -5	+10 / -TMC1006	+10 / -TMC1006
	Silicone	+TMC1006 / -3	+5 / -TMC1006	+10 / -45	+20 / -30
	Polyacrylate	+5 / -3	+8 / -5	+18 / -15	+10 / -35
	FKM	+5 / -2	+7 / -5	+10 / -TMC1006	+10 / -TMC1006

(1) Not an ACC Test..

(2) MTAC is a statistical method for treating multiple engine oil test results if applicable Consult your sales representative for further information.

A.4 Requirements for API service category CH-4

Table A.4 — Laboratory test requirements for API CH-4 service category

Requirements	Test method	Property	Units	Limits		
				1 Test	2 Test	3 Test
Viscosity Grades		SAE J300		Manufacturer specifies viscosity target within SAE J300 specification		
High Temperature Corrosion Bench Test	DUS 2068	Copper increase, (max)	ppm	20	No MTAC (1), (2)	
		Lead increase, (max)	ppm	120		
		Tin increase, (max)	ppm	report		
		Copper corrosion rating, (max) (D130)	-	3		
Foam Test	DUS 2041 (Option A not allowed)	Foaming/Settling, (max)			No MTAC	
		Sequence I, (max)	mL	10/0		
		Sequence II, (max)	mL	20/0		
		Sequence III, (max)	mL	10/0		
Shear Stability	DUS 2075	After shear viscosity SAE 10W-30, (min)	cSt	9.3	No MTAC (1), (2)	
		After shear viscosity SAE 15W-40, (min)	cSt	12.5		
Volatility	DUS 2046	Noack (SAE 10W-30)	% loss	20	No MTAC (1), (2)	
		Noack (SAE 15W-40)	% loss	18		
	DUS 2073or	GCD (SAE 10W-30)	% loss	17		
		GCD (SAE 15W-40)	% loss	15		

(1) Not an ACC Test..

(2) MTAC is a statistical method for treating multiple engine oil test results if applicable Consult your sales representative for further information

Annex B
(normative)

CH- 4 Multiple Test Programs

B.1 CH- 4 Multiple Test Programs

B.1 For the CH- 4 test parameters on which outlier criteria apply (as shown in table A.4), if three or more tests are run, one complete test can be discarded if the outlier criteria defined in practice ASTM E178 are met at a significance level of 5%. Since the criteria are based upon the number of tests in the program, each program is unique.

B.2 Section 6 (Recommended Criteria for Known Standard Deviation) of practice ASTM E178 is used to determine outliers. The standard deviation applied for each parameter is shown in table B.1.

Table B.1 Outlier Test Determination Values

Test parameter	Estimate of standard deviation
1P- WDP	57.6
1P- TGC	7.74
1P- TLC	13.15
1P- AOC	0.3238 Natural log transform
1P- FOC	0.5177 natural log transform
1K- WDK	35.6
1K- TGF	15.7
1K- TLHC	1.1 (Ln TLHC +1)
1K- AOC	0.145
T-9 ALW	2.35
T-9 TRWL	29.29
T-9 EOT ΔPb	1.203
T-10-CLW	4.2
T-10- TRWL	18
T-10-EOT ΔPb	0.2339
RFWT- APW	0.04
M11- XHEAD WEAR	2.2
M11- OFDP	0.3270
M1- SLUDGE	0.27
T-8E- $VISCOSITY_{REL}$ at 4.8% SOOT	0.15
T-8E VISCOSITY INCREASE AT 3.8% SOOT	0.93
ISM- Crosshead wear	0.6
ISM-OFDP	0.4227
ISM SLUDGE	0.2

B.2 Multiple test acceptance criteria

Multiple Test Acceptance Criteria (MTAC), is any data-based approach for evaluation of the quality and performance of a formulation where more than one test may be run. Generally for a candidate tested once, test data for each criterion shall be a pass. For a candidate tested twice, the mean (average) value of each result shall be a pass. For a candidate tested three or more times, one test might be declared an outlier and thus discarded and the mean (average) value of retained test data for each result shall be a pass. Data are rounded in accordance with the procedures specified in Practice E29.

For the Sequence IIIF, Sequence IIIG, and EOAT tests as used the only requirement for declaring an outlier is that three or more tests have been run.

Annex C
(informative)

Current and Obsolete engine oil Categories for compression ignition engine applications

C.1 API Categories

Table C.1 —Table showing current and Obsolete API Categories of Engine oil

Category	Status	Service	Backward Compatibility
CK-4	Current	API Service Category CK-4 describes oils for use in high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway and Tier 4 non-road exhaust emission standards as well as for previous model year diesel engines. These oils are formulated for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, the use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust after treatment system durability and/or oil drain interval. These oils are especially effective at sustaining emission control system durability where particulate filters and other advanced after treatment systems are used. API CK-4 oils are designed to provide enhanced protection against oil oxidation, viscosity loss due to shear, and oil aeration as well as protection against catalyst poisoning, particulate filter blocking, engine wear, piston deposits, degradation of low- and high-temperature properties, and soot-related viscosity increase. API CK-4 oils exceed the performance criteria of API CJ-4, CI-4 with CI-4 PLUS, CI-4, and CH-4 and can effectively lubricate engines calling for those API Service Categories. When using CK-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval recommendations.	CJ-4, CI-4, CI-4 PLUS, CI-4, and CH-4
FA-4	Current	API Service Category FA-4 describes certain XW-30 oils specifically formulated for use in select high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway greenhouse gas (GHG) emission standards. These oils are formulated for use in on-highway applications with diesel fuel sulfur content up to 15 ppm (0.0015% by weight). Refer to individual engine manufacturer recommendations regarding compatibility with API FA-4 oils. These oils are blended to a high temperature high shear (HTHS) viscosity range of 2.9cP–3.2cP to assist in reducing GHG emissions. These oils are especially effective at sustaining emission control system durability where particulate filters and other advanced	**Not Backward Compatible**

		aftertreatment systems are used. API FA-4 oils are designed to provide enhanced protection against oil oxidation, viscosity loss due to shear, and oil aeration as well as protection against catalyst poisoning, particulate filter blocking, engine wear, piston deposits, degradation of low- and high-temperature properties, and soot-related viscosity increase. API FA-4 oils are not interchangeable or backward compatible with API CK-4, CJ-4, CI-4 with CI-4 PLUS, CI-4, and CH-4 oils. Refer to engine manufacturer recommendations to determine if API FA-4 oils are suitable for use. API FA-4 oils are not recommended for use with fuels having greater than 15 ppm sulfur. For fuels with sulfur content greater than 15 ppm, refer to engine manufacturer recommendations**.**	
CJ-4	Current	For high-speed four-stroke cycle diesel engines designed to meet 2010 model year on-highway as well as for previous model year diesel engines. These oils are formulated for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, the use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust after treatment system durability and/or drain interval. CJ-4 oils are especially effective at sustaining emission control system durability where particulate filters and other advanced after treatment systems are used. Optimum protection is provided for control of catalyst poisoning, particulate filter blocking, engine wear, piston deposits, low- and high-temperature stability, soot handling properties, oxidative thickening, foaming, and viscosity loss due to shear. API CJ-4 oils exceed the performance criteria of API CI-4 with CI-4 PLUS, CI-4, CH-4, CG-4 and CF-4 and can effectively lubricate engines calling for those API Service Categories. When using CJ-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval.	CI-4 and CI-4 Plus
CI-4 Plus	Current	Meets all requirements of CI-4 but includes increased resistance to oil thickening from soot and increased shear stability.	CD, CE, CF-4, CG-4 and CH-4
CI-4	Current	Introduced in 2002. For high-speed, four-stroke engines designed to meet 2004 exhaust emission standards implemented in 2002. CI-4 oils are formulated to sustain engine durability where exhaust gas recirculation (EGR) is used and are intended for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, CG-4, and CH-4 oils. Some CI-4 oils may also qualify for the CI-4 PLUS designation.	CD, CE, CF-4, CG-4 and CH-4
CH-4	Current	Introduced in 1998. For high-speed, four-stroke engines designed to meet 1998 exhaust emission standards. CH-4 oils are specifically compounded for use with diesel fuels ranging in sulfur content up to	CD, CE, CF-4 and CG-4

		0.5% weight. Can be used in place of CD, CE, CF-4, and CG-4 oils.	
CG-4	Obsolete	Introduced in 1995. For severe duty, high-speed, four-stroke engines using fuel with less than 0.5% weight sulfur. CG-4 oils are required for engines meeting 1994 emission standards. Can be used in place of CD, CE, and CF-4 oils.	CD, CE and CF-4
	Obsolete		
CF-2	Obsolete	Introduced in 1994. For severe duty, two-stroke-cycle engines. Can be used in place of CD-II oils.	CD-II Does not necessarily meet the requirements of CF or CF-4 oils.
CF	Obsolete	Introduced in 1994. For off-road, indirect-injected and other diesel engines including those using fuel with over 0.5% weight sulfur. Can be used in place of CD oils.	CD
CF-4	Obsolete	Introduced in 1990. For high-speed, four-stroke, naturally aspirated and turbocharged engines. Can be used in place of CD and CE oils.	CD and CE
CE	Obsolete	Introduced in 1985. For high-speed, four-stroke, naturally aspirated and turbocharged engines. Can be used in place of CC and CD oils.	—
CD-II	Obsolete	Introduced in 1985. For two-stroke cycle engines.	—
CD	Obsolete	Introduced in 1955. For certain naturally aspirated and turbocharged engines.	—
CC	Obsolete	CAUTION: Not suitable for use in diesel-powered engines built after 1990.	—
CB	Obsolete	CAUTION: Not suitable for use in diesel-powered engines built after 1961.	—
CA	Obsolete	CAUTION: Not suitable for use in diesel-powered engines built after 1959.	—

Bibliography

[1] SAE J300, Engine oil viscosity classification.

[2] ACEA European Oil Sequences 2012. Service fill oils for Gasoline engines, light duty diesel engines, engines with after treatment devices and heavy duty engine oils

[3] API 1509, Engine oil licensing and certification system.

[4] ASTM D4485 Standard Specification for Performance of Active API Service Category Engine Oils

[5] SANS 1517:2005 High Performance engine lubricating oil for diesel engines (for API Service Category CH- 4)

[6] DUS249:2000/EAS159, Specification for engine oil,

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