TABLE 7 – Diesel Engine Oil Category CL-4

Required Test Method	Engine Test Method	Rated or Measured Parameter	Primary Performance Criteria		
			One-test	Two-test	Three-test
T-13 (D8048)	D8048	IR Peak at EOT, Abs., cm^{-1}, max	80	87	90
		Kinematic Viscosity Increase at 40 °C, %, max	50	58	62
		Avg. Oil Consumption, 48 h to 192 h, g/h	Report	Report	Report
ISB Soot Viscosity (D8617 ISB V156)	D8671	TGA % Soot at 6.0 mm^2/s increase, at 100 °C, min	3.5	3.3	3.3
		TGA % Soot at 12.0 mm^2/s increase, at 100 °C, min	5.6	5.5	5.4
		TGA % Soot at 15.0 mm^2/s increase, at 100 °C, min	5.7	5.6	5.5
C13 (D7549)	D7549	Merit rating [A], min	1000	1000	1000
Caterpillar Oil Aeration Test COAT (D8047)	D8047	Average Aeration, [A] 40 h to 50 h, %, max	11.8	11.8	11.8
ISB (D7484)	D7484	Slider tappet mass loss, mg, average, max	100	108	112
		Cam lobe wear, µm, average, max	55	59	61
		Crosshead mass loss, mg, average	Report	Report	Report
ISM (D7468)	D7468	Top Ring Mass Loss, mg, max	100	100	100
		Merit Rating, [A] min	1000	1000	1000
DD13 Scuffing (D8074)	D8074	Time to Scuff, hours, min	31	31	31

CL-4 Category Bench Tests

Test Method	Measured Parameter		Primary Performance Criteria		
	SAE J300 Viscosity Grade		SAE xW-30	SAE xW-40	
D4683 or D4741 or D5481	High temperature/high shear viscosity at 150 °C, mPa·s	min	3.5	Meet SAE J300	
		max	N/A		
HTCBT, 135 °C (D6594)	Copper, mg/kg increase, max		20	20	
	Lead, mg/kg increase, max		120	120	
	Copper strip rating, [B] max		3	3	
Noack (D5800)	Evaporative loss at 250 °C, %, max		13	13	
Foam (D892)	Foaming/settling, [C] Sequence I, mL, max		10/0	10/0	
	Foaming/settling, [C] Sequence II, mL, max		20/0	20/0	
	Foaming/settling, [C] Sequence III, mL, max		10/0	10/0	
D7109 and HTHS Viscosity after 90 pass shearing (see above methods)	Kinematic viscosity after 90 pass shearing, mm^2/s at 100 °C, min		xW-30	0W-40	Other xW-40
			9.3	12.5	12.8
	HTHS viscosity at 150 °C, mPa·s, min		3.4	N/A	N/A
Sooted Oil MRV TP-1 (D6896) **from a** (D8617) **OR** (D8617) **Annex A9 Engine test**	Viscosity, 108 h used oil sample from ISB Viscosity test [D], tested at −20 °C, mPa·s, max		25 000	25 000	
	Yield stress of the 108 h used oil sample above, Pa, max		<35	<35	

Chemical Limits (non-critical)

Test Method	Measured Parameter	Primary Performance Criteria
D874	Mass fraction sulfated ash, %, max	0.9
D4951 or D5185	Mass fraction phosphorus, %, max	0.08
	Mass fraction sulfur, %, max	0.3

D7216 (Elastomer Compatibility)

Note: These are the unadjusted specification limits for elastomer compatibility. Candidate oils shall, however, conform to the adjusted specification limits, the calculation of which is described in Annex A5.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, −3)	(+7, −5)	(+10, −SL107-30)	(+10, −SL107-17)
Silicone (VMQ)	(+SL107, −3)	(+5, −SL107)	(+10, −45)	(+20, −30)
Polyacrylate (ACM)	(+5, −3)	(+8, −5)	(+18, −15)	(+10, −35)
Fluoroelastomer (FKM)	(+5, −2)	(+7, −5)	(+10, −SL107+2)	(+10, −SL107)
Vamac G	(+SL107+2, −3)	(+5, −SL107-2)	(+10, −SL107+2)	(+10, −SL107+10)
Hydrogenated Nitrile (HNBR)	(+10, −10)	(+12, −12)	Rate & Report	Rate & Report

Note: TMC SL107 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC SL107.

A See Annex A8 for additional information
B The rating system in Test Method D130 is used to rate the copper coupon in Test Method D6594
C Ten minutes for Sequence I, II, and III
D From either a valid 108 h or 156 h ISB Viscosity D8617 test

TABLE 8 – Diesel Engine Oil Category FB-4

Required Test Method	Engine Test Method	Rated or Measured Parameter	Primary Performance Criteria		
			One-test	Two-test	Three-test
T-13 (D8048)	D8048	IR Peak at EOT, Abs., cm^{-1}, max	80	87	90
		Kinematic Viscosity Increase at 40 °C, %, max	50	58	62
		Avg. Oil Consumption, 48 h to 192 h, g/h	Report	Report	Report
ISB Soot Viscosity (D8617 at 108h [A] **OR** D8617 Annex A9 ISBV108)	D8617 at 108h [A] **OR** D8617 Annex A9 ISBV108	TGA % Soot at 12.0 mm^2/s increase, at 100 °C, min	4.8	4.7	4.6
C13 (D7549)	D7549	Merit rating [B], min	1000	1000	1000
Caterpillar Oil Aeration Test COAT (D8047)	D8047	Average Aeration, [B] 40 h to 50 h, %, max	11.8	11.8	11.8
ISB (D7484)	D7484	Slider tappet mass loss, mg, average, max	100	108	112
		Cam lobe wear, µm, average, max	55	59	61
		Crosshead mass loss, mg, average	Report	Report	Report
ISM (D7468)	D7468	Top Ring Mass Loss, mg, max	100	100	100
		Merit Rating, [B] min	1000	1000	1000
DD13 Scuffing (D8074)	D8074	Time to Scuff, hours, min	31	31	31

FB-4 Category Bench Tests

Test Method	Measured Parameter		Primary Performance Criteria	
	SAE J300 Viscosity Grade		SAE xW-20	SAE xW-30
D4683 or D4741 or D5481	High temperature/high shear viscosity at 150 °C, mPa·s	min	Meet SAE J300	2.9
		max		3.2
HTCBT, 135 °C (D6594)	Copper, mg/kg increase, max		20	20
	Lead, mg/kg increase, max		120	120
	Copper strip rating, [C] max		3	3
Noack (D5800)	Evaporative loss at 250 °C, %, max		13	13
Foam (D892)	Foaming/settling, [D] Sequence I, mL, max		10/0	10/0
	Foaming/settling, [D] Sequence II, mL, max		20/0	20/0
	Foaming/settling, [D] Sequence III, mL, max		10/0	10/0
D7109 and HTHS Viscosity after 90 pass shearing (see above methods)	Kinematic viscosity after 90 pass shearing, mm^2/s at 100 °C, min		6.9	9.3
	HTHS viscosity at 150 °C, mPa·s, min		2.5	2.8
Sooted Oil MRV TP-1 (D6896) **from a** (D8617) **OR** (D8617) **Annex A9 Engine test**	Viscosity, 108 h used oil sample from ISB Viscosity test [E], tested at −20 °C, mPa·s, max		25 000	25 000
	Yield stress of the 108 h used oil sample above, Pa, max		<35	<35

Chemical Limits (non-critical)

Test Method	Measured Parameter	Primary Performance Criteria
D874	Mass fraction sulfated ash, %, max	0.9
D4951 or D5185	Mass fraction phosphorus, %, max	0.08
	Mass fraction sulfur, %, max	0.3

D7216 (Elastomer Compatibility)

Note: These are the unadjusted specification limits for elastomer compatibility. Candidate oils shall, however, conform to the adjusted specification limits, the calculation of which is described in Annex A5.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, −3)	(+7, −5)	(+10, −SL107-30)	(+10, −SL107-17)
Silicone (VMQ)	(+SL107, −3)	(+5, −SL107)	(+10, −45)	(+20, −30)
Polyacrylate (ACM)	(+5, −3)	(+8, −5)	(+18, −15)	(+10, −35)
Fluoroelastomer (FKM)	(+5, −2)	(+7, −5)	(+10, −SL107+2)	(+10, −SL107)
Vamac G	(+SL107+2, −3)	(+5, −SL107-2)	(+10, −SL107+2)	(+10, −SL107+10)
Hydrogenated Nitrile (HNBR)	(+10, −10)	(+12, −12)	Rate & Report	Rate & Report

Note: TMC SL107 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC SL107.

A A 108 h result from a 156 h test can support an FB-4 claim IF that stand is also calibrated per D8617 Annex A9.
B See Annex A8 for additional information.
C The rating system in Test Method D130 is used to rate the copper coupon in Test Method D6594.
D Ten minutes for Sequence I, II, and III.
E From either a valid 108 h or 156 h ISB Viscosity D8617 test.