

Heavy-Duty Diesel Engine Test Category For API CI-4 and CI-4 PLUS

Requirements	Test Method	Properties	Unit	Limits		
				1 Test	2 Tests	3 Test
1. LABORATORY TESTS FOR API CI-4 AND CI-4 PLUS						
1.1 Viscosity Grades		SAE J300		Manufacturer specifies viscosity target within SAE J300 specification		
1.2 High Temperature Corrosion Bench Test	ASTM D6594	Copper increase, max Lead increase, max Copper strip rating, max (D130)	ppm ppm	20 120 3	No MTAC ^{(1),(2)}	
1.3 Foam Test	ASTM D892 (Option A not allowed)	Foaming/Settling, max Sequence I Sequence II Sequence III	mL mL mL	10/0 20/0 10/0	No MTAC ^{(1),(2)}	
1.4 Shear Stability	ASTM D6278	After shear viscosity, SAE 10W-30, min After shear viscosity, SAE 15W-40, min	cSt cSt	9.3 12.5	No MTAC ^{(1),(2),(3)}	
1.5 Volatility	ASTM D5800 (Noack)	Evaporative loss at 250°C, max	%	15	No MTAC ^{(1),(2)}	
1.6 High Temperature/High Shear	As allowed in SAE J300	Viscosity, min	mPa-s	3.5	No MTAC ^{(1),(2)}	
1.7 Low Temperature Pumpability	ASTM D4684 (MRV TP-1)	Viscosity of 75h used oil sample from T-10 Test at -20°C, max	mPa-s	25000	No MTAC ^{(1),(2)}	
	Modified D4684 (if yield stress)	Viscosity at -20°C, max Yield stress, max	mPa-s Pa	25000 35		
1.8 Elastomer Compatibility	Nitrile Silicone Polyacrylate FKM	Volume Change	Hardness	Limits	Elongation	
		+5/-3	+7/-5	+10/-TMC1006	+10/-TMC1006	
		+TMC1006/-3	+5/-TMC1006	+10/-45	+20/-30	
		+5/-3	+8/-5	+18/-15	+10/-35	
		+5/-2	+7/-5	+10/-TMC1006	+10/-TMC1006	
2. ENGINE TESTS FOR API CI-4						
2.1 Mack T-8E	ASTM D5967 (Ext. T8-E)	Relative viscosity at 4.8% soot, max (RV=Visc. at 4.8% soot/Visc. of new oil sheared in D6278)		1.8	1.9	2.0
2.2 Mack T-10	T10 test with EGR	Merit Rating, min		1000	1000	1000
2.3 Cummins M11-EGR	ASTM D6975	Crosshead weight loss, max	mg	20.0	21.8	22.6
		Top ring weight loss, max	mg	175	186	191
		Filter delta pressure at 250h, max	kPa	275	320	341
		Sludge rating, min	merits	7.8	7.6	7.5
2.4 Caterpillar 1R	ASTM D6923	WDR, max	demerits	382	396	402
		TGC, max	demerits	52	57	59
		TLC, max	demerits	31	35	36
		Initial Oil Consumption, max	g/h	13.1	13.1	13.1
		Final Oil Consumption, max	g/h	IOC+1.8	IOC+1.8	10C+1.8
		Piston ring and liner scuffing		None	None	None
		Ring Sticking		None	None	None
2.5 Caterpillar 1K or Caterpillar 1N	ASTM D6750	WDK, max	demerits	332	347	353
		TGF, max	%	24	27	29
		TLHC, max	%	4	5	5
		Oil Consumption (0-252h), max	g/kW-h	0.5	0.5	0.5
		Piston ring and liner scuffing		None	None	None
ASTM D6750	WDN, max	demerits	286.2	311.7	323.0	
	TGF, max	%	20	23	25	
	TLHC, max	%	3	4	5	
	Oil Consumption (0-252h), max	g/kW-h	0.5	0.5	0.5	
	Piston ring and liner scuffing		None	None	None	
Ring Sticking		None	None	None		
2.6 Roller Follower Wear Test	ASTM D5966	Average Pin Wear, max	µm (mils)	7.6 (0.30)	8.4 (0.33)	9.1 (0.36)
2.7 Engine Oil Aeration Test	ASTM D6984	Aeration, max	Vol %	8.0	MTAC applies ⁽²⁾	
2.8 Sequence IIIF	ASTM D6984	Viscosity increase at 80h, max	%	275	MTAC applies ⁽²⁾	
3. ENGINE TESTS FOR API CI-4 PLUS (same as API CI-4 Engine Tests above in addition to following)						
3.1 Mack T-11	T-11 Soot/Viscosity Control	Minimum TGA Soot Content at 12.0 cSt increase at 100° C	%	6.00	5.89	5.85

⁽¹⁾ Not an ACC Test.

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

⁽³⁾ Limit of 30 pass for API CI-4, 90 pass for API CI-4 PLUS.