



API CJ-4 FREQUENTLY ASKED QUESTIONS

1. Why was the new API CJ-4 oil performance category developed?

New emission standards for heavy-duty engines will be phased-in between 2007 and 2010. Engines meeting these new standards will be equipped with advanced emission control technologies, including diesel particulate filters (DPF) and in most cases exhaust gas recirculation (EGR). The new API CJ-4 performance category was developed to

- define oils addressing the unique needs of these new engines
- protect older engines

while enhancing the life of the emission control system and minimizing vehicle maintenance requirements.

2. Do engine manufacturers recommend use of API CJ-4 oils to protect 2007 emission-controlled engines?

Yes, 2007 and newer engines that utilize advanced emission control technologies have been designed to deliver optimum performance using the combination of API CJ-4 oils and ultra low sulfur diesel (ULSD) fuel. These oils have been subject to the most severe qualification testing requirements of any API engine lubricant category. API CJ-4 oils are formulated to meet the expectations of the engine manufacturer and the customer in terms of both engine performance and maintenance intervals. *Use of the wrong oils can affect performance of the emission system and DPF filter life.*

3. Will individual OEMs have their own lubricant specifications? Will oils meeting these requirements be available prior to official first license date of API CJ-4 oils?

Yes, as in the past many OEMs will have their own lubricant specifications and products meeting them should be available prior to the first official API license date. Typically, these OEM specifications require API CJ-4 as the minimum acceptable performance level. In many instances the requirements significantly exceed the API minimum. New OEM specifications include:

Mack EO-O Premium Plus 07 First list is expected to be in September 2006

Caterpillar ECF-3 Oils are self-certified and can be made available now

Cummins CES 20081 Oils need to be registered

Detroit Diesel Power Guard 93K218 Oils need to be registered

Volvo Standard 417-0001 Same as Mack

4. How does the performance of API CJ-4 oils differ from previous categories such as API CI-4 or API CI-4 PLUS?

Compared with previous API performance categories, API CJ-4 oils are formulated to provide improved: wear protection, deposit and oil consumption control, soot-related viscosity control, prevention of viscosity loss from shearing, used oil low-temperature pumpability, and protection from thermal and oxidative breakdown. In addition to this improved engine protection, these new oils have sophisticated additive systems that are specially designed to improve the protection of advanced emission control systems such as DPFs. Use of API CJ-4 oils is intended to help maintain the life of the emission control system as required for regulatory compliance.

5. Does the use of API CJ-4 oils have an impact on oil drain intervals?

Most engine manufacturers do not make a single oil drain recommendation. Instead, they develop application-specific oil drain recommendations that vary widely depending on engine type, duty cycle, fuel type and other factors. *Similar to today's oils, fleets using API CJ-4 oils can extend oil drain intervals by using appropriate oil monitoring practices for the duty cycle seen by the particular fleet.* As always, users should seek guidance from their engine or vehicle manufacturer regarding specific service recommendations.

6. Do I need to adjust my used oil analysis program for API CJ-4 oils?

API CJ-4 oils will provide enhanced engine protection compared with current API CI-4 and CI-4 PLUS products. The use of oil analysis to assess oil condition and as a monitor for the suitability of drain intervals is a best practice. Infineum would expect to see comparable or slightly lower levels of engine wear metals for engines operating on API CJ-4 oils.

7. Do API CJ-4 oils protect older engines as well as API CI-4 or API CI-4 PLUS oils?

Yes, API CJ-4 oils are required to pass several new engine tests that define a significantly higher level of engine protection compared with the tests used for API CI-4 or API CI-4 PLUS oils. API CJ-4 test requirements define a more robust level of performance versus previous API categories. Specifically, these oils are formulated for improved: wear protection, deposit and oil consumption control, soot-related viscosity control, prevention of viscosity loss from shearing, used oil low-temperature pumpability, and protection from thermal and oxidative breakdown.

8. Do API CJ-4 oils protect older engines if they are operated on 500 ppm maximum sulfur fuel?

Yes, API CJ-4 oils are designed to have performance benefits over API CI-4 and API CI-4 PLUS oils when using either 15 ppm or 500 ppm maximum sulfur fuel. Qualification testing is conducted using both fuels. To ensure they meet emissions requirements, 2007 on-highway engines with advanced emission systems must use ultra low sulfur diesel (ULSD) fuel containing 15 ppm sulfur or less. In cases where older engines/vehicles are operated

with 500 ppm sulfur fuel, API CJ-4 oils are designed to protect the engine better than oils meeting the requirements of API CI-4 and API CI-4 PLUS. *It is expected that most off-road fuel in North America will either be ULSD or well below the 500 ppm maximum level defined for API CJ-4 oils.*

9. Can API CJ-4 oils be used in off-highway applications?

API CJ-4 oils can and should be used in off-highway applications. However, the use of API CJ-4 oils with higher sulfur fuels, such as those currently allowed for off-highway use that may contain up to 5000 ppm sulfur, may result in modified oil drain intervals and other maintenance recommendations. As non-road fuel sulfur levels are reduced, first to 500 ppm in June 2007 and then to 15 ppm in June 2010, manufacturer recommendations may be revised. *If an engine will see fuel sulfur in excess of 500 ppm for an extended time, the engine manufacturer should be contacted for specific service recommendations.*

10. What are the chemical limits for API CJ-4 and how do they compare to the previous API categories?

The chemical limits for API CJ-4 require finished lubricants to be formulated to a maximum of 1.0 mass% SASH, 0.4 mass% Sulfur and 0.12 mass% Phosphorus. These limits allow the use of advanced emission control devices such as diesel particulate filters (DPFs) and diesel oxidation catalysts (DOCs) on which these components may have a negative impact. The following table illustrates the differences between API CJ-4 maximum and API CI-4 typical lubricants:

Parameter	API CJ-4 Maximum Limits	API CI-4 Typical Range
SASH	1.0%	1.2 – 1.5%
Sulfur	0.4%	No limit
Phosphorus	0.12%	0.12 -- 0.14%
Volatility	13%	12 - 15%

11. What are the implications of formulating CJ-4 oils with the new chemical restrictions?

The Sulfur limit of 0.4 mass% maximum severely limits the use of higher sulfur Group I base stocks. The 1.0 mass% maximum Sulfated Ash limit caps the allowable detergent level, which will limit the fresh oil TBN of some API CJ-4 formulations and will prevent the use of very high TBN oils. However, Infineum's D3472 API CJ-4 core technology will continue to offer the same 10 TBN by D2896 (8 TBN by D4739) as our D3421 and D3422 API CI-4/CI-4 PLUS technology.

12. Are API CI-4 PLUS and API CJ-4 oils compatible?

All engine oils are required to pass a series of bench tests to ensure they can be mixed together without causing chemical reactions or additive drop out. However, the use of an API CI-4 or CI-4 PLUS oil to top off an API CJ-4 product can result in a blend that no longer meets either the chemical or the performance requirements of API CJ-4. We do not recommend the routine mixing of lower quality products with API CJ-4 oils. *Conversely, API CJ-4 oils can be used to top off lower quality oils without loss of performance.*

13. What are the differences and advantages in switching to the new API CJ-4 oils?

The 2007 model year on-highway diesel engines and advanced emission control systems are designed to give optimum system performance using API CJ-4 oils. Most heavy duty diesel engine manufacturers strongly recommend or require their use in these engines. In pre-2007 engines, API CJ-4 oils will provide enhanced engine protection compared with previous API heavy duty categories. Specifically, API oils are formulated for improved: wear protection, deposit and oil consumption control, soot related viscosity control, prevention of viscosity loss from shearing, used oil low temperature pumpability and protection from thermal and oxidative breakdown.

14. Will fleets with both 2007 and older vehicles need to stock API CI-4, CI-4 PLUS and CJ-4 oils?

Backward compatibility is a design requirement for API CJ-4 oils, which offer enhanced engine protection compared with API CI-4 and CI-4 PLUS engine oils. Therefore, there is no engine application need for a fleet operator to stock more than one product as long as the fleet is operating on ULSD fuel. If the fleet is using higher sulfur fuel, API CJ-4 oils will still provide advanced engine protection. However, the fleet should consult with the engine manufacturer as to appropriate drain intervals, which may depend on the TBN of the API CJ-4 product.

15. When will API-licensed CJ-4 oils be available?

Oil marketers may license diesel engine oils meeting API CJ-4 requirements on October 15, 2006. After that date, these oils can be identified by looking for API Service CJ-4 at the top of the API Donut or by asking the user's bulk oil supplier. If users need API CJ-4 oils before October 15, 2006, they should contact their oil supplier. Many marketers will have API CJ-4 oils available prior to first official use. A complete list of API-licensed CJ-4 oils will be available at www.api.org/eolcs after October 15.

16. How much more is the new oil going to cost?

Finished oil pricing is driven by market conditions and the performance level of the finished lubricant. However, industry has spent more than \$100 million to develop these new API CJ-4 category products. In addition, the imposition of chemical limits has an impact on both the type and the cost of additives used as well as the cost of base stocks, which will make API CJ-4 oils more costly to produce. Actual market costs will depend on specific competitive situations as well as the claims and services supplied.

17. How does Infineum foresee the US market making the transition to API CJ-4?

Unlike previous categories, transition to API CJ-4 oils will be slower than in the past especially with reasonably small sales of 2007 class engines. Once sales increase, customers will look for the simplicity of a single oil that can be used in the majority of their applications. Infineum's new API CJ-4 heavy duty diesel technology will give marketers flexibility to formulate lubricants meeting API CI-4 PLUS/SL, API CJ-4/SL and/or API CJ-4/SM with the highest level of performance and product claims based on a single detergent inhibitor (DI) package.

18. How long will it be before API CI-4 and CI-4 PLUS oils are phased out?

Infineum believes that API CI-4 PLUS and CJ-4 oils will dominate the market over the next couple of years with API CJ-4 being the principal oil supplied by 2007. API CI-4 oils will decline; while they remain a low cost alternative, their range of application will be limited.

19. What can customers expect by adopting the Infineum API CJ-4 technology?

Lubricants formulated with Infineum products will offer enhanced engine protection across the board. Infineum D3472 offers all of the advanced engine protection required to meet API CJ-4 performance while continuing to provide the same 10 TBN signature of our existing D3420 series API CI-4 PLUS products. This allows the maximum potential to extend oil drain intervals even with higher sulfur fuels. This capability should come as no surprise to the marketplace: Infineum has been formulating oils in the range of 8-10 TBN, 0.8-1.2 mass% SASH and 0.12 mass% Phosphorus for more than 25 years. These products have provided 2,500,000,000,000 (yes, 2-1/2 trillion!) miles of engine protection. Welcome to the *Infineum Zone* 10 TBN and 1.0% sulfated ash!

20. Which base oils will be covered by Infineum for general sales product development?

Infineum has completed its deployment work for all major Group II base stocks available in North America. In addition Group I options are available for CITGO and Sun Tulsa base stocks. Finished lubes must also meet the 13% NOACK requirement as well as the sulfur maximum. Contact your Infineum sales representative for further details.

21. Will Infineum cover SAE 10W-30/API CJ-4 as part of its general market offering?

As with our historical practice API CJ-4 performance claims can be made with Infineum D3472 technology. Consult your account representative for formulations and marketing constraints versus SAE 15W-40/API CJ-4 oils.

22. What are the main engine tests for API CJ-4?

API CJ-4 Engine Tests and Performance Criteria										
Performance	Cummins ISM	Cummins ISB	GM 6.5L	Cat C-13	Cat 1N	Mack T-12	Mack T-11	Mack T-11 (A)	Gasoline III G/III F	Navistar 7.3L
Valve Train Wear	X	X	X							
Cylinder Liner Wear						X				
Ring Wear	X					X				
Bearing Corrosion						X				
Oil Oxidation						X			X	
Oil Consumption				X	X	X				
Iron Piston Deposits				X						
Aluminum Piston Deposits					X					
Soot Viscosity Increase							X			
Engine Sludge	X									
Filter Plugging	X									
Oil Aeration										X
Low Temp Pumpability								X		