BUMPER TO BUMPER

ENGINE LIFE

A guide created by

TBS Factoring Service

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CREATED BY TBS FACTORING SERVICE

With over 50 years of experience serving motor carriers, TBS makes trucking easier with cutting-edge technology and various services to help drivers get established, stay compliant, find loads, and get paid faster. TBS serves thousands of clients nationwide with simple and quick cash flow solutions.

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LET'S BE FRIENDS

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ENGINE LIFE

Properly maintaining a diesel truck engine has many benefits, including: reliable operation, maximized truck performance, less downtime, and longer life.

Conversely, improper care of a diesel engine and its emissions system can lead to an engine malfunction or breakdown, time-consuming downtime, and costly repairs and non-compliance with air pollution laws.

A best practice is to establish an effective preventive maintenance program that regularly takes vehicles to a shop for inspection and maintenance. Any defects and/or problems can then be identified and fixed which helps prevent a breakdown, violation, or accident.

DOWN THE DRAIN

Engine oil needs to be changed on a regular basis because it can lose its performance properties over time.

Engine oils oxidize and become loaded with soot, wear debris, and contaminants which can only be removed by draining the oil. Acids formed as a byproduct of combustion also degrade the oil.

Improvements in engine design and oil quality, along with onboard vehicle technology and oil analysis programs, enable truck operators/owners to extend oil drain intervals.

CHAPTER #1

ENGINE OIL FUNDAMENTALS

The primary purpose of engine oil is to minimize metal-to-metal contact that produces friction, heat and wear which, in turn, causes additional wear and damages moving engine parts.

The oil in an engine reduces friction, heat and wear by creating a slick lubricating film between metal parts that enables them to glide over one another efficiently and prevent expensive repairs. For engine longevity and performance, choosing the most appropriate engine oil for the engine and the operating conditions is paramount.

An oil's viscosity—a measure of its resistance to flow, along with the pressure and speed of movement—determines the thickness of the oil film between two moving surfaces. This, in turn, determines:

- The ability of the oil film to keep the surfaces apart.
- The rate heat is generated by friction.
- The rate the oil flows between the surfaces to convey the heat away.

Oil should have a viscosity at the operating temperature that is correct for maintaining a fluid film between the engine surfaces. Engine oils are commonly referred to as "thick" (having a high viscosity) or "thin" (having a low viscosity). Changes in an engine oil's viscosity can affect the oil's lubricating & protecting ability. If too thin or too thick, more friction and drag will be created, resulting in premature wear and failure.

THE ENGINE'S BLOOD VESSELS

Engine oil is analogous to the body's blood vessels. Blood vessels carry oxygen and nutrients to cells and transport carbon dioxide and waste products away from cells.

Oil circulates through the engine, performing critical functions necessary to maintain engine performance and maximize its useful service life.

Engine oil has four essential jobs:

- Control soot from combustion by-products which leads to oil thickening, premature filter clogging, and engine wear.
- Influence both low- and high-temperature protection and fuel economy with the appropriate viscosity.
- Prevent or minimize friction and wear that is caused by corrosion, metal contact, and contaminants.
- Control deposits and keep the engine as clean as possible, especially in critical areas such as upper piston surfaces and the valve deck.

CHAPTER #2

CK-4 & FA-4

Licensing of the American Petroleum Institute's CK-4 and FA-4 heavy duty diesel engine oils—formerly known as Proposed Category 11A and B—began on December 1, 2016. These oil specifications address the varying needs of engine technologies, enhancing protection against oil oxidation, safeguarding against engine wear, and protecting against degradation of low- and high-temperature properties. Additionally, the oil specs help diesel engine manufacturers meet more stringent emissions requirements.

The American Petroleum Institute (API)—the only national trade association representing all facets of the oil and natural gas industry—hadn't introduced two diesel engine oil standards at the same time since API CF and CF-2 in 1994. API has been publishing engine oil standards since the 1940s.

WHY HAVE STANDARDS?

Changes in diesel engine technology, the necessity for improved fuel economy, and more stringent greenhouse gas emissions standards brought about the need for heavy duty diesel engine oil standards.

Modern diesel engines are running at hotter temperatures and are incorporating newer metal technologies. Added performance demands also call for higher performing oil.

The last time the American Petroleum Institute (API) released a diesel engine specification was in 2006.

CK-4 & FA-4 (CONTINUED...)

API CK-4 oils replace API CJ-4 engine oils and are backward compatible with most applications where engine manufacturers recommended CJ-4, allowing use in the vast majority of older diesel engine vehicles.

The new CK-4 oils provide several improvements over CJ-4, including increased performance and protection gains, as well as the ability to extend the intervals required between oil changes.

API FA-4 oils will provide similar improvements over CJ-4 oils, but the FA-4 oils are specifically designed for newer on- and off-highway diesel engines. These oils have a lower viscosity, meaning less friction in the engine and a reduction in fuel consumption. Yet, they offer increased levels of wear protection.

FA-4 oils have limited or no backward compatibility with on- and off-highway diesels where engine manufacturers recommended CJ-4.

THE FOUR ASSASSINS

Four of the most lethal contaminants to diesel engine oil are:

• **Water** – Attacks engine-protecting additives in oil, deteriorates oil, interferes with the creation of lubricating film on parts, and boosts the corrosive potential of common acids found in oil. Water in oil can also emulsify, mopping up dead oil additives, soot, oxidation and sludge, and, when mobilized by flowing oil, can knock out filters and restrict oil flow to bearings, pistons, and the valve deck.

• **Soot** – All diesels create soot from fuel combustion, so some soot is to be expected. But high levels increase the depositing of soot and sludge on a wide variety of engine parts, which can cause poor ignition timing and restricted air filters.

• **Glycol** – Glycol from antifreeze/coolant can enter the engine oil as a result of defective seals, blown head gaskets, cracked cylinder heads, and corrosion. Glycol reacts with the oil's additives to reduce the oil's ability to protect engine parts.

• **Fuel Dilution/Mixing** – This is caused by excess, unburned fuel mixing with engine oil in an engine crankcase. This has a thinning effect, lowering oil viscosity, and increasing cylinder liner and bearing wear.

CHAPTER #3

USED OIL ANALYSIS

Akin to sending one's blood to the lab for testing, used oil analysis is a quick, non-destructive way to gauge an engine's "health" by providing important information about the condition of the engine's internal parts and oil contamination.

What's more, monitoring engine wear serves as an early warning system of potential engine problems. Through diagnostic oil analysis, hidden or emerging potential problems or failures can be identified. This allows appropriate preventive maintenance or repairs to be done while they are small, rather than waiting for costly catastrophic failures.

ALONG THE WAY...

On-site oil analysis services are an alternative to using an oil analysis laboratory or doing one's own instant analysis. Various truck stops, truck dealers, and oil companies offer on-site oil and antifreeze/coolant testing services. Among them:

- Rush Truck Centers
- Speedco
- TA and Petro Centers

Check your routes for locations that offer on-site oil analysis services.

USED OIL ANALYSIS (CONTINUED....)

With a consistent used oil analysis program, a truck operator/owner can help:

- Optimize oil drain intervals
- Lower repair bills
- Increase equipment reliability and life
- Minimize unscheduled downtime
- More precisely track operating efficiency and maintenance practices

This aggregate knowledge helps to lower total operating costs. To boot, a used oil analysis program can provide support in the event of a warranty dispute.

Knowing oil condition history provides additional information not only about the oil, but also to some extent, engine-wear-related problems. Such information might also add resale/trade-in value to the vehicle.

FIVE ESSENTIALS

Here are the five keys to a successful used oil analysis program:

1. Determine clearly defined goals and program requirements.

2. Take representative samples to make sure the lubricant and component can be determined by reliable, accurate testing.

3. Stay in regular contact with the oil analysis provider to promote accurate analysis interpretations.

4. Be sure sample information is complete.

5. Promptly review analysis reports to ensure abnormal or critical conditions are recognized and acted on in time to prevent damage and/or breakdowns, and to determine if some situations require monitoring.

CHAPTER #4

OIL SAMPLING PROCEDURE

Oil analysis involves sampling and examining engine oil for various properties and materials to monitor engine wear and contamination from such things as water, antifreeze/coolant, fuel, and dirt. This should be done on a regular basis to establish a baseline of normal wear and to help indicate abnormal wear or contamination.

Oil that has been inside an engine for any length of time will reflect the engine's internal condition. Oil is in contact with the mechanical components as metallic trace particles enter the oil. These particles are so small that they remain in suspension.

Products of the engine's combustion process will also become trapped in the circulating oil as well as any externally-caused contamination.

Thus, the oil becomes a working history of the engine. Identifying and measuring these impurities can identify the rate of wear and any excessive contamination.

A MATTER OF INTERPRETATION

Reading the results of a used oil analysis results can be a challenge, but it is important to fully understand the findings. Always consult with the oil analysis provider if you are unsure of anything or if you have specific questions about the report.

The number-one cause of machine wear is lubricant contamination. For that reason, oil analysis reports involving antifreeze/coolant, dirt, fuel and, in some cases, soot contamination should get full attention. If a sample indicates a critical issue, the laboratory will typically contact the customer.

Oil and lubricant analysis programs differ in many aspects, including tests available, interpretations and reports, turnaround time, price, and more. Invest adequate time and effort in selecting the program that best serves your requirements and needs.

OIL SAMPLING PROCEDURE (CONTINUED....)

A best practice when taking a used oil sample is to take a sample in the same manner each time. This helps to keep the results consistent.

All paperwork related to each sample must be as complete as possible because this information is critical to providing a complete and accurate analysis report.

Be sure to note if any oil was added between oil drains and what type was used.

Once a lab receives an oil sample, it typically takes 24 to 72 hours before the data is ready for reporting. Obviously, the longer it takes to get the sample to the lab the longer it takes to get the analysis back.

To save on shipping costs, truck operators/owners frequently accumulate several samples before sending them to the lab for analysis. In the long run, however, the value of the testing is lost due to this delay.

CONSIDER CAREFULLY

Selecting an oil analysis service is a strategic decision that requires a number of considerations. Among them:

- Is the provider well-established and well-equipped?
- Does the provider's company have a quality and reliable reputation?
- Does the provider have knowledgeable, well-trained, and experienced staff?
- Are analysis reports turned around rapidly?
- Does the provider offer an array of services, including training?
- How user-friendly is the program?
- Are report management features and tools available?

Talk with other truck operators/owners to get recommendations on oil analysis companies.

CHAPTER #5

ENGINE COOLING SYSTEM

The truck's engine cooling system serves several purposes, including keeping the engine running at its most efficient temperature, no matter the operating conditions. Failure to properly maintain the cooling system is a leading cause of catastrophic diesel engine problems, accounting for approximately 40 percent of engine failures. Damage is difficult to see until it is too late.

Neglect of antifreeze/coolant maintenance happens all too often, and most failures related to the antifreeze/coolant are preventable.

Good cooling system performance begins with the appropriate antifreeze/coolant type, and then continues with regular monitoring and maintenance. Routine antifreeze/coolant analysis and maintenance can help achieve maximum cooling system efficiency and identify potential problems before they become catastrophic failures. Antifreeze/coolant analysis can detect conditions such as corrosion, additive dropout, silica gel, contamination, chemical breakdown, and other conditions which lead to cooling system failure.

Properly maintained cooling systems and antifreeze/coolant allow the antifreeze/coolant to absorb the heat from the engine and release the heat through the radiator. If any of the components in the cooling system are not at optimum, the efficiency of the cooling system is diminished, eventually leading to engine damage or failure.

THE BIG SIX

Improper engine cooling system maintenance can result in numerous system problems and failures. The six most common problems seen in heavy duty engine cooling systems are:

- Acidity (pH)
- Foam
- Pitted cylinder liners
- Pitted water pump impellers
- Rust
- Scale (water hardness)

ENGINE ANTIFREEZE/COOLANT

A vital part of good engine cooling system preventive maintenance is using only the recommended type of antifreeze/coolant specified for the engine, and then continually maintaining the antifreeze/coolant to meet the engine manufacturer's specifications.

Because antifreeze/coolant is clear when manufactured, dye is used to color it for identification and marketing purposes. At one time, the color of antifreeze/coolant was an indicator of its formulation and corrosion inhibitor package, but that is no longer the case.

Many different colors and chemistries are available, so it is important to know which antifreeze/coolant to use because mixing chemistries can cause antifreeze/coolant contamination.

Be aware that both conventional and extended life products require very different procedures and change intervals.

ON THE SPOT

Instant lubricant analysis can serve as a stopgap between lab analysis cycles. Plus, it can offer an on-the-spot, lower-cost (as compared to conventional fluid analysis), quick method for determining a fluid's condition.

Instant analysis kits can determine the condition of motor oils, differential fluids, automatic and manual transmission fluids, brake fluids, power steering fluids and gear oils, as well as antifreeze/coolants.

For the most part, these kits are straightforward to use and require no tools or special knowledge.

Instant analysis kits use chromatographic methods to measure additive depletion and the level of sludge or debris in a lubricant.

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