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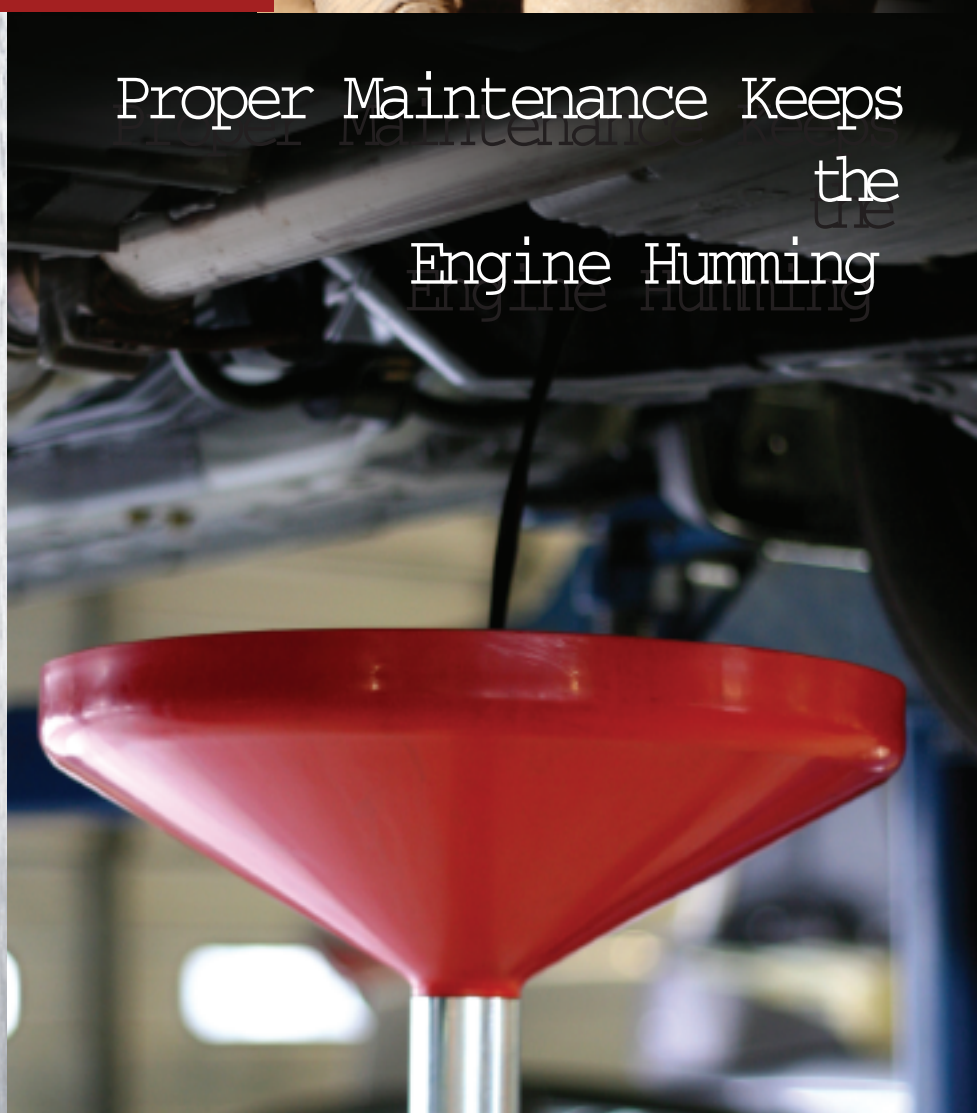
Motor Oil

Technical Training Series

Proper Maintenance Keeps the Engine Humming



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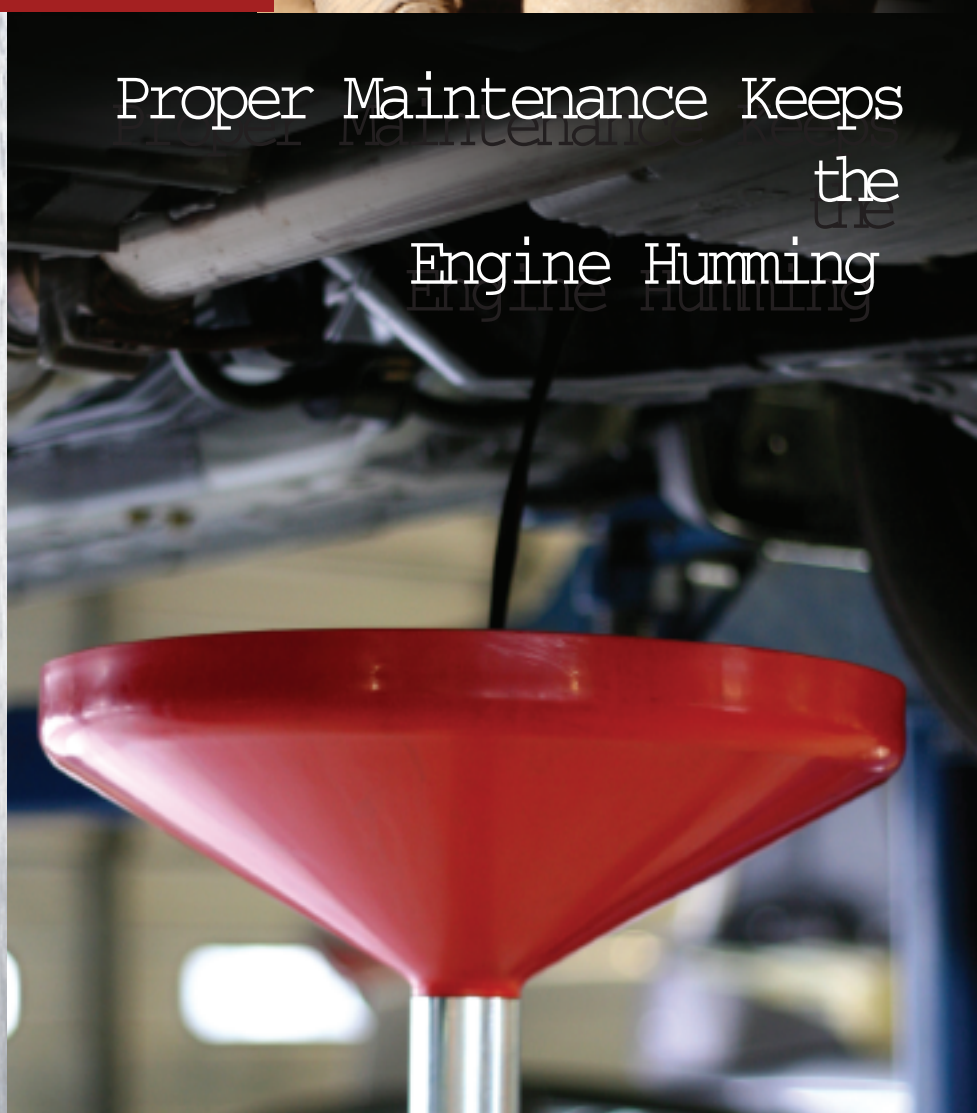

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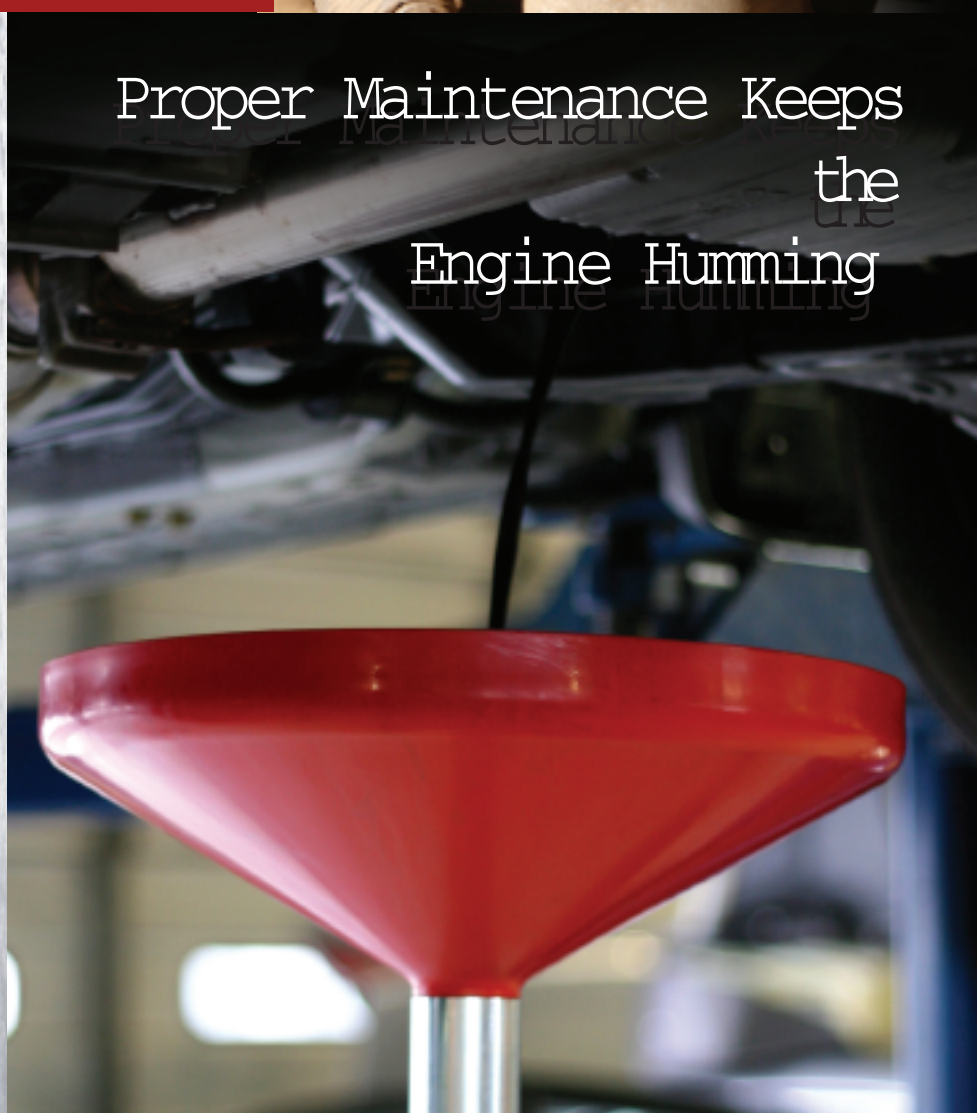

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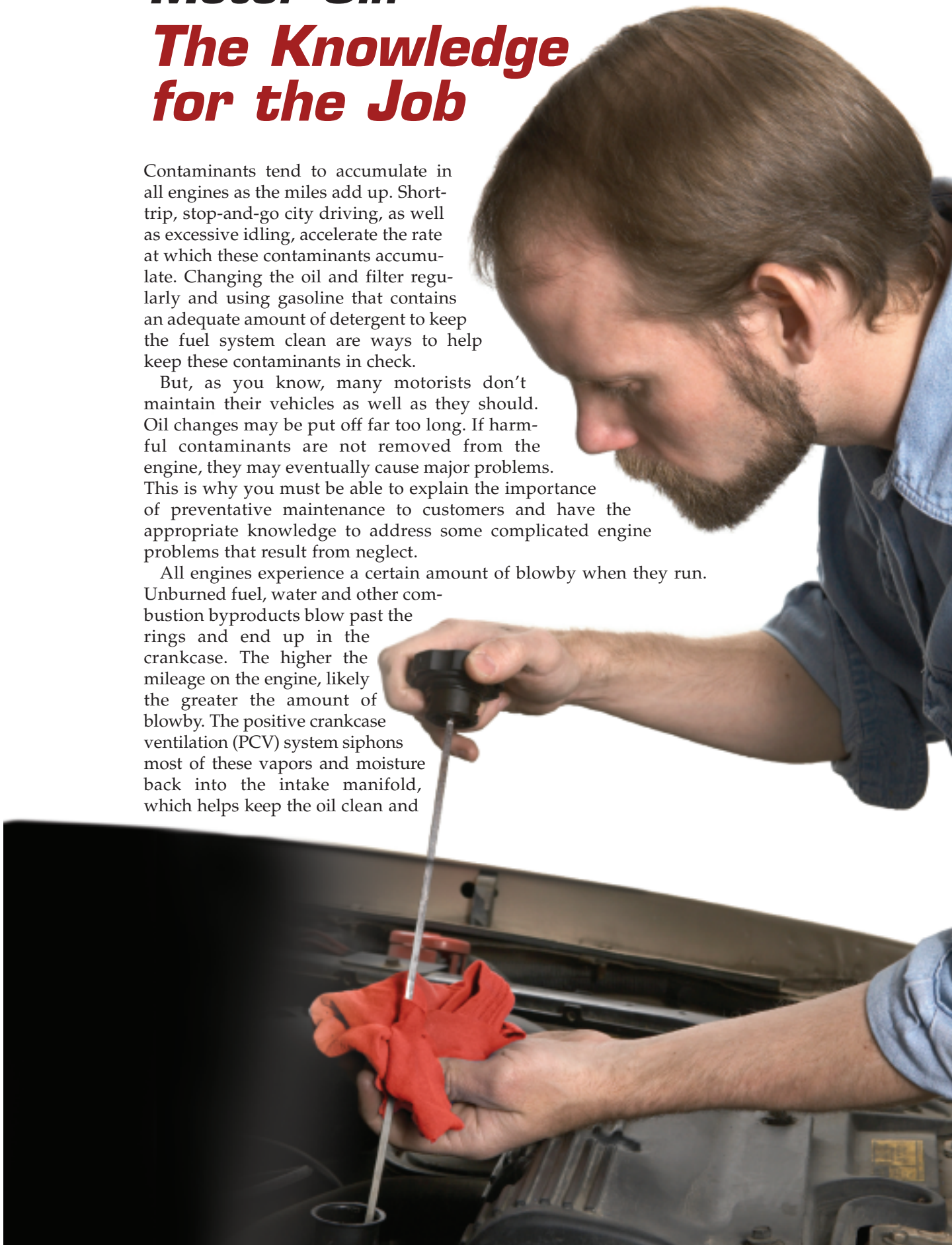
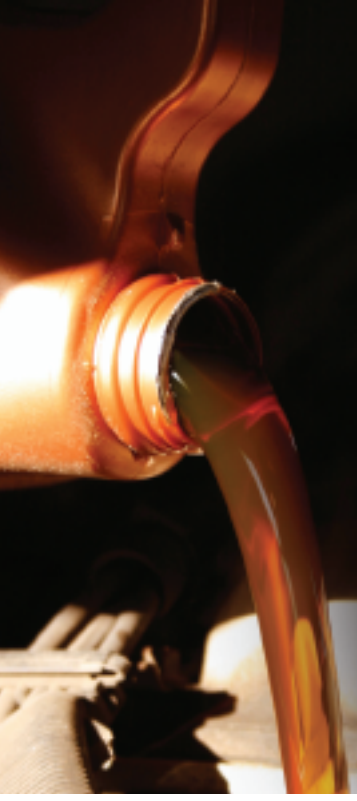
Motor Oil:
The Knowledge for the Job



Contaminants tend to accumulate in all engines as the miles add up. Short-trip, stop-and-go city driving, as well as excessive idling, accelerate the rate at which these contaminants accumulate. Changing the oil and filter regularly and using gasoline that contains an adequate amount of detergent to keep the fuel system clean are ways to help keep these contaminants in check.

But, as you know, many motorists don't maintain their vehicles as well as they should. Oil changes may be put off far too long. If harmful contaminants are not removed from the engine, they may eventually cause major problems. This is why you must be able to explain the importance of preventative maintenance to customers and have the appropriate knowledge to address some complicated engine problems that result from neglect.

All engines experience a certain amount of blowby when they run. Unburned fuel, water and other combustion byproducts blow past the rings and end up in the crankcase. The higher the mileage on the engine, likely the greater the amount of blowby. The positive crankcase ventilation (PCV) system siphons most of these vapors and moisture back into the intake manifold, which helps keep the oil clean and



CONSUMER HABITS AND BRAND LOYALTY

Today's motorists are waiting longer than the standard 3,000-mile recommended oil change. With this change in driver habits, the number of oil changes repair shops perform every month has dropped. In 2006, most shops did about 25 oil changes a month, compared to an average of 30 oil changes a month in 2005.

Regardless of the length of time between oil changes, brand loyalty remains important. Seventy-two percent of technicians surveyed say their key deciding factor when buying motor oil is finding a brand they trust.

While oil change intervals are extending, oil changes are still a common job for shops, and most (80 percent) keep a good stock of motor oil on hand. When shops do need to source motor oil 47 percent go to their jobbers, 26 percent go direct to WDs and 18 percent go to retailers. Fast delivery (37 percent), availability (32 percent) and good sales reps (29 percent) were the primary reasons shops chose one source over another.

reduces the formation of acids and sludge. But if the PCV system isn't working, is plugged up or the oil isn't changed often enough, the oil soon becomes saturated with contaminants, and sludge may start to form inside the engine. If this sludge is not removed, it can be very damaging and may eventually cause the engine to fail.

Motor oil contains detergent additives that neutralize some of the blowby contaminants and help keep the inside of the engine clean. Oxidation inhibitors in the oil also help it withstand high temperatures that would cause it to break down. But the protective additives don't last forever. That's why the aftermarket has long recommended changing the oil and filter per the manufacturer's recommendations, which is typically every 3,000 miles or three months. It's possible to go longer between oil changes under ideal conditions, but few vehicles today operate under ideal conditions.

HOW OFTEN SHOULD CUSTOMERS CHANGE THEIR OIL AND FILTERS?

In recent years, certain automakers have extended oil change intervals. Some automakers, for example, have told owners of their vehicles that oil changes are needed only every 7,500 miles or six months, whichever comes first under "normal" driving conditions, and 5,000 miles or four months under "severe" driving conditions. But with this recommended extended mileage, in some cases, there is risk of severe oil sludging problems as a result.

Some vehicle manufacturers have gone away from published oil change recommendations and use an oil reminder light to signal the driver when the oil needs to be changed. In many cases, the oil change interval is determined not by the measured condition of the oil in the engine, but by guesstimating its condition based on a mathematical equation. By monitoring engine temperature, rpm, running time, ambient temperatures and other variables, the powertrain computer in the vehicle predicts when the oil should be changed — but without actually measuring the various attributes of the oil, it is still a best guess.

Most professionals recommend replacing the filter every time the oil is changed. Filters should be changed often enough to prevent premature engine wear and damage. That means replacing the filter before it loses its ability to keep the oil clean and before it plugs up. As a filter becomes saturated with dirt, soot and sludge, it begins to build up resistance to the flow of oil. This creates a backup of pressure ahead of the filter and a drop in oil pressure downstream of the filter. Unless the filter is soon changed, it eventually reaches the point where the pressure differential across the filter exceeds the limit of the relief valve (typically 10 to 12 psi). When this happens, the relief valve is forced open so unfiltered oil can bypass the filter to prevent oil starvation. Any dirt or wear particles in the oil will then go straight to the bearings.

MOTOR OIL RECOMMENDATIONS

Motor oil is largely made up of various base stocks. The base stocks are blended with other ingredients to create motor oils with unique

properties for specific engine applications. Additives improve the lubricating qualities of the oil, reduce friction and extend the life of the base oil.

Many motor oils meet certain requirements set forth by the vehicle manufacturers and the American Petroleum Institute (API). The API "service rating" of an oil certifies that it meets specific OEM quality and performance standards. The service rating is shown in the API "Service Symbol Donut" on the product label. There may also be an "API Certified for Gasoline Engines" seal on the label.

The current service category rating for gasoline engines is "SM," introduced in November 2004 for 2005 and newer engines. SM-rated oils along with the previous "SL" (2001) and "SJ" (1997) ratings are backwards compatible and can be safely used in older engines.

For diesel engines, API has a separate rating system. The current category is "CJ-4" (introduced for 2007 diesels to meet exhaust emission requirements). The previous "CI-4," (2002), "CH-4" (1998), "CG-4" (1995) and "CF-4" (1990), can all be used in older four-stroke diesel engines. "CF-2" (1994) is the API classification for two-stroke diesels. API also gives oils an "Energy Conserving" rating if the oil meets certain criteria for improving fuel economy.

Motor oils that meet the current API SM rating may also meet the International Lubricant Standardization and Approval Committee (ILSAC) "GF-4" specifications for North American and Asian vehicles. Meeting this specification is indicated on the label by the API Certification Mark, commonly referred to as the Starburst Symbol.

WHAT KIND OF MOTOR OIL SHOULD CUSTOMERS USE?

Not only are there manufacturer recommendations to follow when it comes to selecting motor oil, but there's also many different types of motor oil in the marketplace. Needless to say, sometimes choosing the right one for a particular application can be tricky.

An important factor to look at when choosing a motor oil is the "viscosity" (thickness). Viscosity refers to how easily oil pours at a specified temperature. Thinner oils have a water-like consistency and pour more easily at low temperatures and thicker oils have a more honey-like consistency. Thin is good for easier cold-weather starting, reducing friction and improving fuel economy, while thick is better for maintaining film strength and oil pressure at high temperatures and loads.

The viscosity rating of a motor oil is determined in a laboratory using various test procedures. The viscosity of the oil is measured and given a number, which refers to the thickness of the oil (which some people call the "weight" of the oil, but has nothing to do with the oil's actual weight in kilograms or ounces). The lower the viscosity rating, the thinner the oil and the higher the viscosity rating, the thicker the oil.

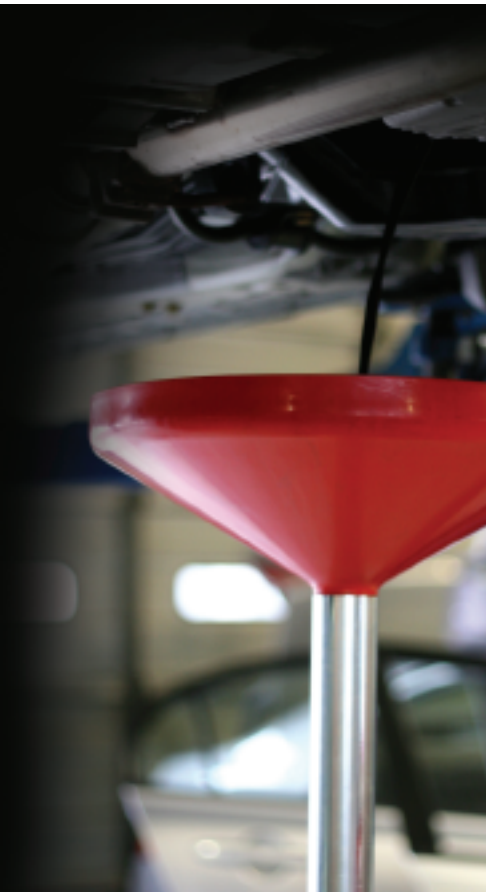
RECYCLING USED OIL

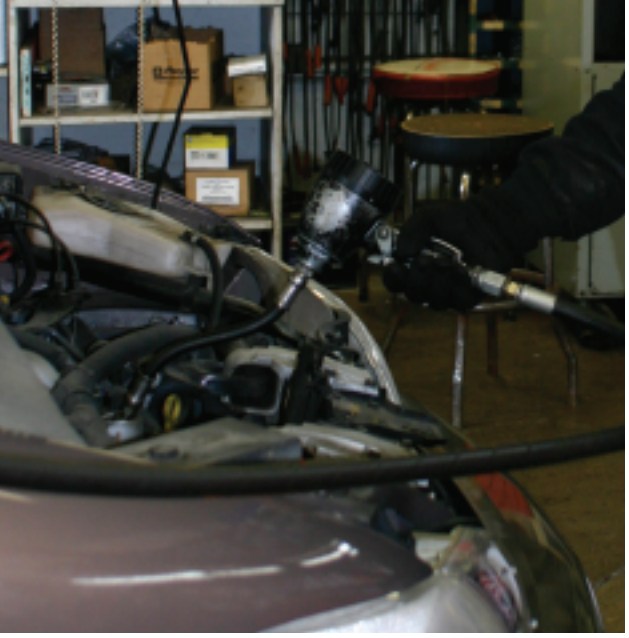
What do you do with old oil after a busy month of oil changes? Well, you should find the best way to properly dispose of it and your shop may have several options:

- **Power plants can use reprocessed oil to generate electricity for homes, schools and businesses.**
- **It can be burned in certain home furnaces for heat.**
- **It can also be used in industrial burners, or re-refined into high-quality motor oil.**
- **Just two gallons of used oil can generate enough electricity to run the average household for almost 24 hours.**
- **The petroleum industry provides convenient used oil collection sites across the country at many of its service stations.**

Motor oil is a valuable resource and recycling, re-fining it, etc. helps keep our surface waters and ground water safe from possible contamination from improper motor oil disposal.

(American Petroleum Institute)





SAE viscosity grade ratings for commonly used motor oils typically range from zero up to 50. A "W" after the number stands for "Winter" grade oil, and represents the oil's viscosity at subzero temperatures. Low viscosity motor oils that pour easily at low temperatures typically have a "5W" rating. There are also 10W, 15W and 20W grade motor oils.

Higher viscosity motor oils that are thicker and better suited for high temperature operation typically have an SAE 30, 40 or even 50 grade rating.

These numbers, by the way, are for "single" or "straight" weight oils. Such oils are no longer used in late-model automotive engines but may be required for use in some vintage and antique engines. Straight SAE 30 oil is often specified for small air-cooled engines in lawnmowers, garden tractors, portable generators and gas-powered chain saws.

When dealing with replacement oils, follow the viscosity recommendations in the vehicle owner's manual. Most vehicles today are factory-filled with 5W-30 because it is good for cold starting and fuel economy, and allows the oil to reach critical upper valvetrain components in overhead cam engines more quickly than heavier viscosity oils.

Most vehicle manufacturers also allow 10W-30 for certain times of the year. Yet many people prefer 10W-40 or even 20W-50 because they believe the higher numbers provide better protection — which, in limited applications, they do at higher temperatures. The heavier viscosity oils may also be good for older high-mileage engines depending on the application. But 20W-50 is typically too thick for cold weather (below 32° F).

Synthetic motor oils are popular as an upgrade for vehicle owners who want the best protection. Synthetic oils typically outperform ordinary motor oils at both high and low temperatures (from over 400° F down to -40° F). Though synthetic oils may outperform conventional oils in several ways, their use is *not* an automatic license to extend the oil drain intervals. Motor oils perform several functions and if any of the functions are depleted, the oil should be changed. For example, if excessive idling causes the oil to be contaminated by fuel, then the contaminated oil — synthetic, synthetic blend or mineral-based — needs to be changed.

Though more expensive than mineral-based motor oils, synthetics are a good choice for high output, turbocharged or supercharged engines, vehicles that are used for towing (especially during hot weather), or vehicles that are operated in extremely cold or hot climates.

Synthetics are available in the same popular SAE grades as ordinary motor oils such as 5W-30 and 10W-30. There are also synthetic blends that combine synthetic oil with mineral oil to provide some of the advantages that synthetics offer at a lower cost.

High-mileage oils are designed to aid worn, leaking or smoking engines. As the average vehicle age increases, it's easy to see why oil manufacturers are aggressively addressing this market.

So what makes these oils different? Oil manufacturers say high-mileage motor oil is blended to the higher end of each SAE viscosity grade. And, most of these motor oils have increased detergents along with seal-conditioning agents to minimize oil leaks.

High-mileage oils will cover many of your customer's older engine needs.

It also should be noted that while high-mileage vehicle oils try to address some of the problems associated with older engines, they are not a "cure all." Oil manufacturer technology experts told us that no oil can be expected to make a severely worn-out engine run like new. Serious mechanical engine problems and seals that are broken, for example, must be repaired by a technician — not an oil.

PUTTING IT ALL TOGETHER

The topic of motor oil is more complex than some people may think, especially when maintenance like oil and filter changes are ignored. And then, of course, there's the challenge of choosing the right oil for the right application from the wide variety that's offered in the marketplace. But, armed with the information in this training series, you should feel confident in your abilities to handle complex issues dealing with oil and filter changes.

q&a

I've often heard of people referencing water in the oil. What are they talking about and can it damage my engine?

An important reason as to why it is imperative that drivers change their oil on a regular basis is the introduction of contaminants to the engine which are created during the normal process of running a vehicle, no matter what type of car you drive or what motor oil you use.

When a mixture of gasoline and air are burned, even in the most efficient combustion engine, one result is water in the exhaust. Even the latest engines straight off the showroom floor with the most advanced technology will suffer from water contamination anytime the engine is running and gasoline is burning. Basic chemistry proves that for every gallon of gasoline burned, an engine will generate about a gallon of water even under ideal combustion. The heat of the engine can evaporate some of the water, but the remaining water may still end up in the engine's oil.

In addition to the obvious concern of generating rust on engine parts, water can introduce a whole host of other problems. If left in the oil pan, water can mix with the detergent additive in the motor oil, giving the oil a milky appearance. Over time, this can even lead to the creation of soft sludge. Another problem generated by the accumulation of water in the oil is sulfur from both the oil and the fuel can react with water to form sulfuric acid. Similarly, water in the oil can react with nitrogen from the air to form nitric acid. Both acids can attack the metals inside the engine, especially copper overlays on journal bearings causing irreversible damage.

Motor oil additive consumption is a problem with many engines. How exactly does this happen?

Maintaining oil drain intervals as established by OEMs is always recommended because of the natural consumption of additive packages in the motor oil over the life of the drain interval. While premium quality motor oils should maintain their effectiveness over the life of the drain without a significant drop in engine protection, it is always recommended to follow the manufacturer's service schedule. Some key elements of additive packages that suffer from depletion, their function and how they are lost are found below:

Zinc (ZDDP) is an anti-wear and antioxidant that is consumed as it lays down an anti-wear film. It is also consumed as it stops the oxidation process.

Dispersant grabs dirt and sludge before it can build up during engine operation. As the oil gets dirtier it needs to be changed or deposits may form.

Detergent is consumed as it helps keep high-temperature surfaces such as pistons clean.

Antioxidants stop oil oxidation and help keep the oil from becoming too thick. Properly functioning oil helps prevent loss of fuel economy, sludge and varnish deposits, and helps maintain proper low-temp pumpability.

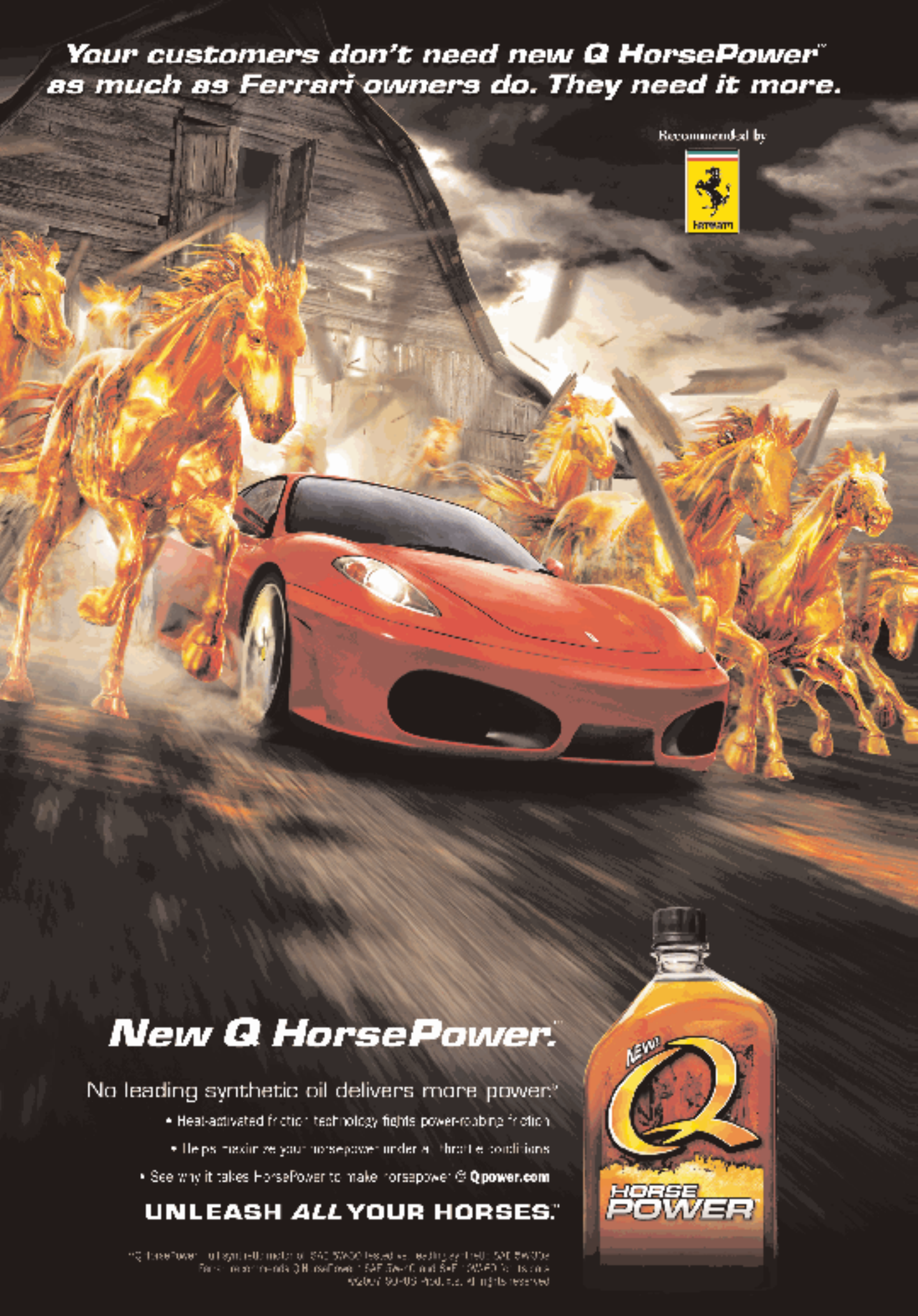
Oil plays a major role in heat transfer in the engine. As oil ages and becomes thicker, it may lose its ability to cool the engine.

Each engine consumes different parts of the oil at varying rates, therefore it is not possible to establish a universal oil drain interval. It is always recommended that OEM drain intervals be followed.

I've often heard the term 'viscosity breakdown.' What is it?

Most multi-grade oils contain an additive that helps the oil resist thinning as it is heated — called a Viscosity Index Improver (VII). This allows the oil to be more consistent in viscosity as the temperature rises. On a molecular level, the VII additives are typically long chains that could be pictured in your mind as spaghetti noodles. When the VII are cold, they curl up and have minimal effect on the oil's overall viscosity. But as the VII is heated, the spaghetti unravels in a way that keeps the overall viscosity more consistent.

Viscosity breakdown can occur as the VII additive in the motor oil makes its normal journey throughout the engine. The gears in the oil pump, the valve train and other mechanical hardware can literally "cut the spaghetti" into smaller pieces which limit how effectively the oil can maintain its viscosity. A poor VII could end up changing an SAE 5W-30 into an SAE 5W-20 or even an SAE 10W-20 in extreme cases.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