You thought you knew what you needed to know about oils when armed with a knowledge of SAE grades and API classifications. Suddenly, your dealer tells you that your Audi requires oils meeting the VW502.00 or VW505.01 specs. He adds that he can sell it to you for 4 times what you thought was the going rate for oil. You wonder whether this is an evil marketing ploy, but then you remember hearing stories about black sludge in turbo European engine, and you wish you knew more about the subject… Keep reading.

SAE grade not specific enough.

The most obvious characteristic of an engine oil sold to US consumers is its SAE viscosity grade. SAE viscosity is obtained through 4 measures covering the combination of two variables: temperature and shearing.

		Temperature	
		Low	High
Shearing	Low	MRV (low temp. pumpability)	Kinematic viscosity at 100°C (Kv100)
	High	CCS (low Temp. cranking)	HTHS (fuel economy)

The MRV and CCS have only *maximum* viscosity requirements, HTHS has a *minimum* viscosity requirement. The range of the only measure which must be between a minimum *and* a maximum is quite large: two oils labeled 5W30 can have viscosities at 100°C of respectively 9.3cSt, and 12.4cSt : an allowance of 33% !! This is to illustrate that the category encompassing 5W30 oils, for example, is very wide. More troublesome is the fact that the minimum HTHS (High Temperature High Shearing) viscosity of 2.9cP that the SAE requires for xW30 and xW40 oils has been judged insufficient by most German car manufacturers to prevent wear on the cams and bearings. For most vehicles, Audi requires a HTHS of 3.5cP, as do BMW and Mercedes. This means that Audi engineers had to find a way to explain to consumers that many oils labeled SAE 5W30, 10W30, 5W40 or 10W40, including some also labeled “synthetic”, are inadequate to use in your Audi. Do I have your attention? I have worse news. First, passing the grueling but popular ILSAC fuel economy test requires a low cranking viscosity, meaning that the correlated HTHS viscosity will often be well below 3.5cP. This ILSAC standard has been demanded by the largest automotive brands, such as GM, Ford and Honda and you are much more likely to find low-HTHS oil than high-HTHS oil at your local auto parts store. Also, HTHS is far from being the only “technical disagreement” between SAE and Audi...

API, ILSAC, and “Synthetic oil”.

API (American Petroleum Institute) has long been issuing the best-known oil quality standards in North America. Over the past twenty years, API SF, SG, SH, SJ and SL have

succeeded each other as the "highest oil standard", each new standard being "backward compatible": it could also be used in older cars. Thin oil is better for fuel economy: you use less energy walking in water than you do walking in mud, right? Eager to compensate with thinner oils the growing appetite of the market for gas-guzzling SUVs, American and Asian car manufacturers have promoted new and stricter "Fuel Economy" standards, first through API, and since the late 90's, through a new organization named ILSAC. An ILSAC GF-3 oil is equivalent to an API SL with good Fuel Economy properties (thinner oil). The new ILSAC GF-4 is so extreme on fuel economy that it has been criticized by a quick-lube organization as dangerously incompatible with older domestic engines. This is what your new Audi and an old Buick have in common: do not use ILSAC GF-4 oils in them! These newest standards are also strongly influenced by the needs of the largest distribution outlets. Mass-merchandisers such as Wal-Mart are the largest customers for engine oils of many of the oil companies sitting at the board of ILSAC, so technical choices are encumbered by the current oil distribution system which is geared towards moving large volumes of cheap oil. This system does not really allow to consider whether one $100 oil change every 15,000 miles could be equivalent to, or better than five $20 oil changes every 3,000 miles. As a result, it is still technically possible to pass GF-4 with a conventional mineral oil. So in short, ILSAC standards, which are slowly replacing API standards, are mostly dedicated to increasing by a few points that "city/highway MPG" on the window sticker of new SUVs while keeping the volumes of oil flowing.

Synthetics are better engine oils than conventional oils. That is a fact. We will see below that European car manufacturers have defined technical standards that only synthetics can meet. In the US, oil marketers have promoted better oils as "synthetics" through TV campaigns and mass-merchandisers, but without an authoritative technical benchmark. SAE gave up their definition of "synthetic" when new technology made it irrelevant. Until 1999, by accepted industry standards, these "synthetics" were made of Group IV base stocks (polyalphaolefins) or Group V (Esters). But in 1999, a well-known marketer of synthetics won from the Better Business Bureau the right to call its oils made of Group III "synthetics" as well. The bar had been lowered: the pressure from mass-merchandisers was intense, and Group III oils are less expensive than Group IV, while having viscosity retention and volatity superior to that of conventional mineral oils (Group I and Group II) justifying the "synthetic" claim. On the other hand, Group III have some serious drawbacks, like not being consistent for example, and too often on the "fail" side, for piston deposit-forming properties (*SAE Technical Paper Series 2002-01-2678*). So synthetics are usually better, yes, but they do not follow a clear technical definition, and not all oils currently named "synthetic" are fit for your Audi. The 1999 ruling also opened the door for the definition of "synthetic" to further evolve towards cheaper technologies.

ACEA and Audi oil standards:

To say that Europe has been more serious than the US about the fuel efficiency of their vehicles is an understatement. In 2008, average CO2 emissions of passenger cars sold in Europe will be 140g/km, which translates to an average of 40 miles per gallon. The US equivalent, the Corporate Average Fuel Economy (CAFE) has been stuck at 27.5 mpg for

cars, and 20.7 mpg for trucks. To meet these ambitious goals, for now twenty years, European manufacturers have been moving aggressively towards technologies bringing more efficient combustion, more stress on a lighter engine, and have sought the cooperation of the fuel and oil industry to provide chemicals supporting their new engine technologies. ACEA (www.acea.be), the European Car Manufacturer Association, defined tough new oil standards, and European lubricants became de facto a "spare part" of new vehicles. All recent European engines have been designed with the assumption that these ACEA-level lubricants would be available for the service of the car. Some engines can take a "low-HTHS", and they can therefore use the oil to get better gas mileage. Some other engines, like Audi engines, need "high HTHS".

ACEA distinguishes between gasoline engine oils for fuel economy, classified A1 and A5, and oils meeting the needs of engines with higher stress and higher temperature with a higher HTHS viscosity, classified A2 and A3. These four standards co-exist, allowing adapted oil recommendations for different car generations and technologies. Synthetic components are necessary to meet the most recent ACEA standards, like A3 or A5, and oils meeting those specs end up being "synthetic". The "synthetic" qualifier is here a technical necessity, not a marketing tool.

Still, ACEA standards are a *minimum* standard for 13 European Car Manufacturers. Most manufacturers build their cars based on those minimums, but manufacturers such as Mercedes, Porsche, Saab, BMW, VW, and Audi take the ACEA level add extra conditions and manage their own oil standards above ACEA's. The current VW/AUDI standards are as follows:

Specifications	500.00	501.01	502.00	503.00	503.01	505.00	505.01	506.00	506.01
Status	Obsolete	Obsolete	Current	Current	Interim	Current	Interim	Current	Curent
SAE Grades	Several	Several	Several	0W/5W-X	0W/5W-X	Several	5W-40	0W/5W-X	0W/5W-X
HTHS	3.5 min	3.5 min	3.5 min	2.9 - 3.4	3.51 min	3.5 min	3.5 min	2.9 - 3.4	2.9 - 3.4
ODI (kKms/Years)	15/1	15/1	15/1	30/2	30/3	15/1	15/1	50/2	50/2
Gasoline	All	All	All	All	Audi S3				
Diesel	Nat Asp	Nat Asp				T/C	T/C+TDI+UI	TDI	TDI + UI
Model Year	=< 2000	=< 2000	=< 2000	>= 2000	>= 2000	=< 2000	=< 2000	>= 2000	>= 2000
LongLife Service	No	No	No	Yes	Yes	No	No	Yes	Yes
ACEA Level	A3	A2/A3	A2/A3	A3-98	A3-98	B2/B3	A3/B3/B4	B4	B4
M111SL									
VW 1302									
VW T4									
Audi FE (PV1451)									
RNT									
C&T									
VWICTD									
VWTDI2									
VW Type Testing									
VW Seals	Old	Old	Old	New	Old	Old	Old	New	New

As you can see, 502.00 and 505.01 are not the only oil standards defined by VW/Audi, but they are the only ones currently recommended by Audi of America. ODI means "Oil Drain Interval". There are 4 generations of VW oil standards: the initial **500.00/501.01** is now obsolete. The **502.00 (gas) / 505.00 (diesel)** generation is recommended in Europe for model years before 2000, for Oil Drain Intervals (ODI) of 15,000 kilometers (9,300 miles) or at least once a year. Models after 2000 came with an option to use the **503.00/506.00** generation of oil, with better fuel economy (thinner viscosity), but mostly a 30,000 kilometer or once-every-two-years oil drain interval!! This switch did not come smoothly, and two "interim" standards, 503.01 and 505.01, were created to address the needs of specific "higher stress" engines which did not take well the thinner viscosity of 503.00/506.00, until the release of 506.01 which solves these problems. A fourth generation of oils, **504.00/507.00** is currently appearing in Europe: these oils are low SAP (Sulfur-Ashes-Particles) oils, designed to avoid contamination of three-way-catalysts, Nox traps and other particle filters necessary to pass the latest European emission tests.

Why are 502.00 and 505.01 the only oil standards recommended by Audi of America at this point? Because of the high cost of the newer oils, first, and the fact that in the US, where an "oil change every 3,000 miles" is still the rule in advertising, promoting an oil that can do 9,300 miles is advanced enough! Still, this was not simple for Audi of America.

Audi of America waits… then acts.

Wholesale technical problems on German cars due to inadequate US lubricants had been growing in North America in the late 90's. BMW, Mercedes and VW-Audi were all facing some tough decisions. In the mid-90's, BMW worked with a US oil supplier to provide its dealers with a BMW synthetic branded product at a price that would not shock their customers. On the current version of this oil, a full synthetic 5W30, none of the European BMW oil standards (LL-98, LL-01 or LL-04) appear on the label, but we can trust that BMW of America has selected a good technology to its US customers and packaged it with a BMW label. It also creates an extra "genuine" item for BMW dealers. Mercedes issued in March 2001 a recommendation to use "synthetic oil" for some of its 1998 and 1999 engines equipped with FSS (Flexible Service System). A class action lawsuit ensued, claiming that the use of conventional oil could cause engine damage. Mercedes settled the lawsuit for millions. Mercedes USA has since been using its 4-year service plan to promote their own technical standards: MB229.3 and MB229.5.
By 2003, VW and Audi of America had then seen what to do, or rather what **not** to do to tackle their own issues regarding oil recommendation. Audi could use the "Audi Advantage plan" to recommend a new oil standard without being sued, but that was also an expensive decision: someone at Audi had to sign on a three-to-four fold increase of the oil budget of "Audi Advantage". VW had for its part to navigate the legal difficulties of avoiding a class action on the 1.8Turbo engines while also making sure that they recommended an oil that was available enough to avoid accusations of "bundling" (recommending a product that is only available from them) under the Moss-Magnusson act. So Audi and Volkswagen acted together. In the summer of 2003, the new "high-stress" engines of the Diesel Pump-Düse VW TDI and the Bi-Turbo Audi RS6 came with

a strict recommendation to use only the 505.01 standard. We saw earlier that 505.01 is an "interim" standard chosen for its cost, but also because it proved its worth after the first PD TDI engines appeared in Europe in 1999. On the other hand, its limited market and "interim" status make it unlikely that more companies will join the current marketers of 505.01. Castrol 505.01 is only available through Volkswagen of America, but VW and Audi dealers can buy their 505.01 anywhere they want.

Then, in the summer of 2004, VW and Audi released an extended 8-year warranty for 1.8T engines on vehicles going back to 1998 models, on the condition that oil passing the 502.00 standard be used for all future services. This extended warranty reached 420,000 VW and thousands of Audis, and made it then worthwhile for most US oil marketers to release a "European style" formulation meeting VW502.00. The distribution of these "European formulations" is still patchy, though. Most large oil distributors never trained their staff on the "European oil" specificities, and they prefer to stock faster movers, like lubricants formulated to meet the fuel economy and cost demands of ILSAC. You can then help them do their job by forwarding them this article, or you can allow specialists to help you.

ELF is the synthetic oil brand of Total, the 4th largest oil company in the world, mostly present in Europe, Africa, Middle East, South America. Total-ELF has been on the forefront of all the European engine technologies by housing the oil programs of several car manufacturers, most recently to develop lubricants compatible with extended service and with all the new post-emission treatments, gasoline and diesel. Now, ELF is developing in North America a network of distributors who understand these new lubricants issues, get training on them, and are able to make the proper recommendation for all European cars, old and new, now and in the future. You can find a list of ELF distributors on www.elfmoto.com .