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## Technical Presentation: Selecting Engine Oil for Your Mercedes-Benz

### A Brief History of Petroleum

- Oil pits were known in Greece over 4,000 years ago: asphalt was used to construct walls and the towers of Babylon.
- The Chinese drilled for oil using bamboo poles around 347 AD: they used it to burn brine to produce salt and they used natural gas for lighting and heating.
- The streets of Baghdad were paved with tar in the 9<sup>th</sup> century.
- Petroleum was known in America when Sir Walter Raleigh's account of the Trinidad Pitch Lake was written in 1595.
- Peter Kalm wrote about oil springs in Pennsylvania in 1719.



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### A Brief History of Petroleum

- Kerosene was refined from crude oil by the Dubinin brothers in Russia by 1823.
- The first “modern” oil well is considered to be the Drake Well in Titusville, Pennsylvania in 1859. He drilled, not dug, for oil and had a company with financial backing that led to him getting credit for creating the oil well.
- The invention and development of the internal combustion engine led to the demand for petroleum. (Credit to Benz, Daimler, Maybach, and Diesel).
- Demand led to oil booms in Pennsylvania, Texas, Oklahoma, California, and other states.
- Worldwide demand and searching for resources take us to today.



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### A Brief History Refining

- In the early 1850s Benjamin Silliman Jr., a chemist at Yale University was hired to analyze the properties of oil as an illuminant.
  - He determined that oil could be distilled into several fractions, the highest of which made an excellent illuminant.
- From this the Pennsylvania Rock Oil Company was formed.
- Interestingly, most early “drilling” was done to find water and when oil was found the well was abandoned because the oil was a nuisance.
- In 1911 Standard Oil was forced to dissolve its monopoly and the independents had no basis for working together. After WW I, the American Petroleum Institute was founded on March 20, 1919 to create standards.



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### A Brief History Refining

- As engine technology improved the need for engine oils changed dramatically.
- Up until 1975 (when catalytic converters were installed to control emissions) there were relatively minor improvements over the years.
- Starting in 1976 oils began to change to reduce damage to catalytic converters from ZDDP (zinc dialky-dithio-phosphate).
  - However, ZDDP was critical as an anti-wear ingredient for rubbing parts in engines – such as camshafts, tappets, and bearings.
  - Newer engines were being built to higher tolerances to reduce blow-by and with rolling components to reduce friction.
  - Engine-management systems and fuel injection reduced the risks of gasoline corrupting engine oil (something quite common with carburetors).
  - Pre-1976 engines needed 1200-1500 ppm of ZDDP
  - 1976-1998 engines saw ZDDP reduced gradually to ~800 ppm
  - 1998 and newer engine oils have about 600 ppm



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### A Brief History Refining

- Refineries initially were not attuned to the needs of older engines and the loss of ZDDP was a serious risk for engines with rubbing parts such as tappets, cam followers, crankshaft bearings and connecting rod bearings.
- First generation synthetic base oils caused problems with engine seals and leaking oil was a big problem.
- HOWEVER, with experience and lots of feedback, oil refineries realized that they needed to provide oil for vehicles of all ages. Contemporary oils from major manufacturers meet all the requirements for classic as well as modern Mercedes-Benz engines, even with low levels of ZDDP (zinc dialky-dithio-phosphate) or ZDTP (zinc di-thio-phosphate).



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### Characteristics of Engine Oils

- Classification/API Certification Mark:
  - S = Spark Ignition for gasoline engines
  - C = Compression Ignition for diesel engines
  - CS = for diesel engines that may also be used in older gasoline engines
- Formulation:
  - Letters and Numbers that indicate milestone points of ingredients in oil:  
SN, SM, SL, SJ are current for gasoline engines.  
CJ-4, CI-4, CH-4 are current for diesel engines.
- Base Stock:
  - Mineral base (original base stock, requires more frequent changes).
  - Synthetic base (high-tech base stock, requires less frequent changes).
  - Semi-synthetic base (a blended base stock that is **not** recommended).



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### Classification/API Certification Mark and Formulation of Engine Oils

- The API Certification Mark is also known as the Starburst symbol.
  - S is for gasoline engines
    - SN introduced in October 2010 for 2011 and newer engines
    - SM for 2005 to 2010 engines
    - SL for 2002 to 2004 engines
    - SJ for 2001 and older engines
  - C is for diesel engines
    - CJ-4 introduced to meet 2010 and newer engines with low sulfur fuels (not over 15 ppm)
    - CI-4 introduced in 2002 for 2002 to 2009 engines
    - CH-4 introduced in 1998 for 1998 to 2001 engines
  - PLUS indicates oils that are designed to conserve energy and reduce particulates and soot especially for newer diesel engines.





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### Viscosity of Engine Oils

- Viscosity indicates how well oil flows at different temperatures.
  - Oil flow at room temperature is shown below





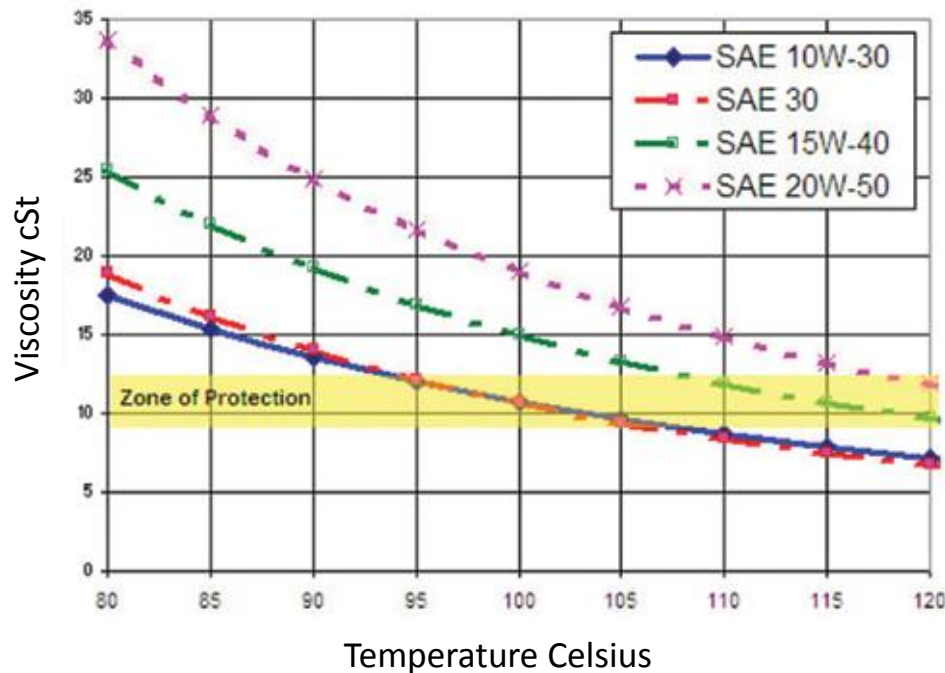


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### Viscosity of Engine Oils

- Oil Viscosity and Zone of Protection



The viscosity cSt is the actual standard of thickness of oil. Viscosity of 10 + is considered the desired operating thickness for all internal combustion engines. Oils are formulated to reach and operate at that thickness (10 viscosity). The ratings numbers on labels are API performance classifications, not thickness.

The oil temperatures at the crankshaft are usually held between 185°F (85°C) and 240°F (116°C) for normal operation. As crankshaft bearing temperature increases past 225°F (107°C), the 30 weight oils begin to fail. Note how the 20W-50 does not reach the zone of protection until the oil temperature reaches 245°F (118°C) at the crankshaft bearings. Few engines run that hot. With 20W-50 oil, the engine is **never** properly protected.



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### Viscosity of Engine Oils

- Selecting the best viscosity for the climate/temperatures your engine faces:
  - API makes the following recommendations, although they also suggest following your vehicle manufacturer's recommendations.

If the lowest outdoor temperature is:  
0° C (32° F)

Typical SAE Viscosity Grades are:  
OW-20, OW-30, 5W-20, 5W-30, 10W-30,  
10W-40

-18° C (0° F)

OW-20, OW-30, 5W-20, 5W-30, 10W-30,  
10W-40

Below -18° C (0° F)

OW-20, OW-30, 5W-20, 5W-30

- 20W-50 is not recommended although some mechanics will use it in high-mileage vehicles, in warm climates. Remember that most engines never reach an operating temperature where 20W-50 will protect it.



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## Technical Presentation: Selecting Engine Oil for Your Mercedes-Benz

### Selecting Oil for the Age of My Gasoline-engine Mercedes-Benz

- Pre-WW II Vehicles use CH-4 or CI-4 Mineral Base and allow warm-up time of ~30 seconds before driving gently until the engine reaches full operating temperature.
- 1947 – 1975 gasoline-engine vehicles, use CI-4/SL, Mineral base if less than 3,000 annual miles; use CI-4/SL Synthetic base if over 3,000 annual miles. Warm-up for ~15 seconds and drive lightly until at operating temperature.
- 1976-1997 gasoline-engine vehicles, use Synthetic base if over 3,000 annual miles; or stay with Mineral base to save costs if under 3,000 annual miles. Warm-up 15 seconds and drive lightly until at operating temperature.
- 1998-2013 gasoline-engine vehicles, use Synthetic base ONLY! Warm-up 5 seconds.

<u>Year of Production</u>	<u>Gasoline-engine</u>	<u>Diesel-engine</u>
<b>1947 - 1975</b>	CI-4/SL, Mineral base, 10W-30, 10W-40 CI-4/SL, Synthetic base, 10W-30, 10W-40 (no synthetics for 300SLs)	CI-4, Mineral base, 10W-30, 10W-40
<b>1976 – 1997</b>	CJ-4/SM, Synthetic base, 10W-30 or CJ-4/SM, Mineral base, 10W-30	CI-4, Mineral base, 10W-30 or CI-4 Synthetic base, 10W-30
<b>1998 – 2013</b>	SN or SM, Synthetic base, 0W-40	CJ-4, Synthetic base, 0W-40



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## Technical Presentation: Selecting Engine Oil for Your Mercedes-Benz

### Selecting Oil for the Age of My Diesel-engine Mercedes-Benz

- Pre-WW II Vehicles use CH-4 or CI-4 Mineral Base or Single-grade and allow warm-up time of ~30 seconds before driving gently until the engine reaches full operating temperature (~20 minutes).
- 1947 – 1975 diesel-engine vehicles, use CI-4, Mineral base if less than 3,000 annual miles. Warm-up for ~15 seconds, drive lightly until at operating temp.
- 1976-1997 diesel-engine vehicles, use CI-4, Synthetic base if over 3,000 annual miles; or stay with Mineral base only. Warm-up ~15 seconds, drive lightly until at operating temperature.
- 1998-2013 diesel-engine vehicles, use CJ-4, Synthetic base only! Warm-up 5 sec.

<u>Year of Production</u>	<u>Gasoline-engine</u>	<u>Diesel-engine</u>
1947 - 1975	CI-4/SL, Mineral base, 10W-30, 10W-40 CI-4/SL, Synthetic base, 10W-30 (no synthetics for 300SLs)	CI-4, Mineral base, 10W/30, 10W-40
1976 – 1997	CJ-4/SM, Synthetic base, 10W-30 or CJ-4/SM, Mineral base, 10W-30	CI-4, Mineral base, 10W-30 or CI-4 Synthetic base, 10W-30
1998 – 2013	SN or SM, Synthetic base, 0W-40	CJ-4, Synthetic base, 0W-40



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### General Information and Recommendations

- On 1947-1975 engines:
  - Change mineral base oils at least every 3,000 miles or annually.
  - Change synthetic base oils at least every 6,000 miles or annually.
- On 1976-1997 engines:
  - Change oil as recommended in owner's manual or with FSS.
  - The guideline for 1947-1975 engines is advisable with no FSS.
- On 1998 and newer engines:
  - Change oil per FSS or 10,000 miles, or annually as recommended in owner's manual.
- Do NOT put an after-market ZDDP additive into your crankcase on any engines.
  - Use ONLY the correct oil for your engine as produced by the oil company. ZDDP additives can create ash and sludge when added to an existing oil formulation. You don't need that problem.



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### A Look at What is Available at Auto Parts Stores

- Read the labels carefully and look for API Donut Symbol or other text on the container that indicates the API Classification.
- Refer to the handout **Oil Specifications and Brands** for oil characteristics and what you can consider for your specific age and model of Mercedes-Benz.
- For Pre-1976 gasoline engine vehicles do NOT use any oil with the API Starburst symbol unless you know they have anti-wear additives.
- For Pre-1998 diesel engine vehicles do NOT use any of the CJ-Plus or CI-Plus oils as these all have an “energy conserving” statement meaning a formula that reduces ZDDP and is not designed for earlier engines.
- For any car engines, the use of heavy-duty, truck engine oil is not advised.



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### MBUSA “StarTekInfo” Recommendations

Use the table below to determine the MB approval number. The model and engine type can be found in the “Technical Data” chapter of your Operator’s Manual in the table under “Engine oil.” The engine number is also stamped on the back of the crankcase.

Engine Type	MB Approval Number	Approved Oil Viscosity Range
113	229.5	0W-30, 0W-40, 5W-30, 5W-40
152	229.5	0W-40, 5W-40
155 SLR	229.3	5W-50
156	229.5 or 229.51	0W-40, 5W-40
157	229.5	0W-40, 5W-40
159	229.5 or 229.51	0W-40, 5W-40
271	229.3, 229.5 or 229.51	0W-40, 5W-30, 5W-40, 5W-50
272	229.3 or 229.5	0W-40, 5W-30, 5W-40
273	229.3 or 229.5	0W-40, 5W-30, 5W-40
275	229.5	0W-40, 5W-40
276	229.3, 229.5	0W-40, 5W-30, 5W-40
278	229.5	0W-40, 5W-30, 5W-40
285	229.5	0W-40, 5W-40
642	228.51, 229.31 or 229.51	0W-40, 5W-30, 5W-40, 10W-40



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### **Questions and Discussion**