BB00.40-P-0900A	Search aid for Specifications for Operating Fluids	28.2.97

MODEL all

Modification notes

27.3.03	Sheet 352.0 added	Sheet 352.0	BB00.40-P-0352-00A
27.3.03	Sheet 352.1 added	Sheet 352.1	BB00.40-P-0352-01A
10.10.03	Sheet 225.11 added	Sheet 225.11	BB00.40-P-0225-11A
10.10.03	Sheet 229.31 added	Sheet 229.31	BB00.40-P-0229-31A

New sheet number	Sheet contents	Previous sheet number	
i	Preface	Sheet 020	BB00.40-P-0001A
Sheet 021.0	Conditions for Approval of Operating Fluids	Sheet 021	BB00.40-P-0021-00A
Sheet 022.0	Obligations Regarding Approval of Operating Fluids	Sheet 022	BB00.40-P-0022-00A
Sheet 023.0	Hazardous substances	Sheet 023	BB00.40-P-0023-00A
Sheet 110.1	General information on fuels	Sheet 110	BB00.40-P-0110-01A
Sheet 112.0	Fuel hazard classes	Sheet 112	BB00.40-P-0112-00A
Sheet 119.0	Additives and secondary additives for fuels	Sheet 119	BB00.40-P-0119-00A
Sheet 121.0	Gasoline engine fuels in the Federal Republic of Germany		BB00.40-P-0121-00A
Sheet 121.1	Fuel qualities for MB cars, cross-country vehicles, vans and Unimogs fitted with gasoline engines		BB00.40-P-0121-01A
Sheet 122.2	Minimum requirements for unleaded gasoline fuel		BB00.40-P-0122-02A
Sheet 124.0	Antiknock rating of commercially-available gasoline fuel in Europe	Sheet 124	BB00.40-P-0124-00A
Sheet 124.1	Antiknock rating of commercially-available gasoline fuel in Africa	Sheet 124	BB00.40-P-0124-01A
Sheet 124.2	Antiknock rating of commercially-available gasoline fuel in America	Sheet 124	BB00.40-P-0124-02A
Sheet 124.3	Antiknock rating of commercially-available gasoline fuel in Asia	Sheet 124	BB00.40-P-0124-03A
Sheet 124.4	Antiknock rating of commercially-available gasoline fuel in Australia	Sheet 124	BB00.40-P-0124-04A
Sheet 125.0	Fuels for gasoline engines	Sheet 125	BB00.40-P-0125-00A
Sheet 126.0	Sulfur in gasoline		BB00.40-P-0126-00A
Sheet 131.0	Fuels for diesel engines		BB00.40-P-0131-00A
Sheet 132.1	Minimum requirements for fuels for diesel engines (DIN EN 590)		BB00.40-P-0132-01A
Sheet 132.3	Minimum requirements for fuels for diesel engines (ASTM)		BB00.40-P-0132-03A
Sheet 133.0	Calibration fluid for diesel injection equipment		BB00.40-P-0133-00A
Sheet 134.0	Aviation turbine fuel as diesel fuel		BB00.40-P-0134-00A
Sheet 135.0	Fatty acid methyl ester (FAME) as diesel fuel		BB00.40-P-0135-00A
Sheet 136.0	Sulfur in diesel fuel		BB00.40-P-0136-00A
Sheet 137.0	Winter operation with diesel fuels		BB00.40-P-0137-00A
Sheet 137.1	Flow improvers for diesel fuels		BB00.40-P-0137-01A
Sheet 138.0	Microorganisms in diesel fuel	Sheet 138	BB00.40-P-0138-00A
Sheet 138.1	Microbiocides for these fuels		BB00.40-P-0138-01A
Sheet 141.0	Diesel fuel for industrial engines	Sheet 141	BB00.40-P-0141-00A
Sheet 210.0	General information on lubricants	Sheet 210	BB00.40-P-0210-00A
Sheet 211.0	SAE viscosity grades of engine/gear oils		BB00.40-P-0211-00A
Sheet 215.0	Use of lubricating oils		BB00.40-P-0215-00A
Sheet 218.0	Regulation lubricants for construction machinery and construction-site vehicles		BB00.40-P-0218-00A

Sheet 219.0	Special additives for lubricants (vehicles and engines)		BB00.40-P-0219-00A
Sheet 221.0	Requirements in respect of engine oils		BB00.40-P-0221-00A
Sheet 222.0	Use of single-grade / multigrade engine oils and high-lubricity oils		BB00.40-P-0222-00A
Sheet 223.1	Prescribed break-in engine oils - overview		BB00.40-P-0223-01A
Sheet 223.2	Specified engine oils (service) - survey		BB00.40-P-0223-02A
Sheet 224.1	Viscosity classes of engine oils (car engines)		BB00.40-P-0224-01A
Sheet 224.2	Viscosity classes of engine oils (CV engines)		BB00.40-P-0224-02A
Sheet 225.0	Single grade break-in oils (Sheet 225.0)		BB00.40-P-0225-00A
Sheet 225.1	Multigrade break-in oils (Sheet 225.1)		BB00.40-P-0225-01A
Sheet 225.5	Multigrade break-in oils (Sheet 225.5)		BB00.40-P-0225-05A
Sheet 225.6	Multigrade break-in oils (sheet 225.6)		BB00.40-P-0225-06A
Sheet 225.7	Multigrade break-in oils (Sheet 225.7)		BB00.40-P-0225-07A
Sheet 225.8	Multigrade break-in oils (Sheet 225.8)		BB00.40-P-0225-08A
Sheet 225.10	Multigrade break-in oils (Specification 225.10)		BB00.40-P-0225-10A
Sheet 225.11	Multigrade break-in engine oil Low SPAsh		BB00.40-P-0225-11A
Sheet 226.9	Multigrade engine oils (Sheet 226.9)		BB00.40-P-0226-09A
Sheet 227.0	Single-grade engine oils (sheet 227.0)		BB00.40-P-0227-00A
Sheet 227.1	Multigrade engine oils (Sheet 227.1)		BB00.40-P-0227-01A
Sheet 228.0	Single-grade engine oils (Sheet 228.0)		BB00.40-P-0228-00A
Sheet 228.1	Multigrade engine oils (Sheet 228.1)		BB00.40-P-0228-01A
Sheet 228.2	Single-grade engine oils (Sheet 228.2)		BB00.40-P-0228-02A
Sheet 228.3	Multigrade engine oils (Sheet 228.3)		BB00.40-P-0228-03A
Sheet 228.5	Multigrade engine oils (Sheet 228.5)		BB00.40-P-0228-05A
Sheet 229.1	Multigrade engine oils (Specification 229.1)		BB00.40-P-0229-01A
Sheet 229.3	Multigrade engine oils (Sheet 229.3)		BB00.40-P-0229-03A
Sheet 229.5	Multigrade engine oils (Sheet 229.5)		BB00.40-P-0229-05A
Sheet 229.31	Multigrade service engine oil Low SPAsh		BB00.40-P-0229-31A
Sheet 231.0	General gear oils	Sheet 231	BB00.40-P-0231-00A
Sheet 231.1	Specified gear oils (cars, cross-country vehicles) - survey	Sheet 234	BB00.40-P-0231-01A
Sheet 231.2	Specified gear oils (commercial vehicles) - overview	Sheet 234	BB00.40-P-0231-02A
Sheet 231.3	Prescribed gear oils (UNIMOG, MB-tractors) - overview	Sheet 234	BB00.40-P-0231-03A
Sheet 235.0	Hypoid gear oils (SAE 90, 85 W-90)		BB00.40-P-0235-00A
Sheet 235.1	Gear oils (SAE 80, 80W, 80 W/85 W)		BB00.40-P-0235-01A
Sheet 235.4	Synthetic gear oils (SAE 75 W/85 W)		BB00.40-P-0235-04A
Sheet 235.5	Gear oils (SAE 80, 80 W/85 W)		BB00.40-P-0235-05A
Sheet 235.6	Hypoid gear oils (SAE 90, 85 W-90, Sheet 235.6)		BB00.40-P-0235-06A
Sheet 235.7	Universal hypoid gear oils (SAE 85 W-90)		BB00.40-P-0235-07A
Sheet 235.8	Hypoid gear oils (SAE 75 W-90)		BB00.40-P-0235-08A
Sheet 235.9	Differential oils (Specification 235.9)		BB00.40-P-0235-09A
Sheet 235.10	Gear oils (Sheet 235.10)		BB00.40-P-0235-10A
Sheet 235.11	Gear oil (Sheet 235.11)		BB00.40-P-0235-11A
Sheet 235.12	Gear oil (Sheet 235.12)		BB00.40-P-0235-12A
Sheet 236.1	Automatic transmission fluids (ATF, Sheet 236.1)		BB00.40-P-0236-01A
Page 236.2	Automatic transmission fluids (ATF, type A, suffix A)		BB00.40-P-0236-02A
Sheet 236.3	Steering gear oils (ATF)		BB00.40-P-0236-03A
Sheet 236.5	Automatic transmission fluids/engine oils (Allison C4)		BB00.40-P-0236-05A
Sheet 236.6	Automatic transmission fluids (ATF, Sheet 236.6)		BB00.40-P-0236-06A
Sheet 236.7	Automatic transmission fluids (ATF, Specification 236.7)		BB00.40-P-0236-07A

Sheet 236.8	Automatic transmission fluids (ATF, Specification 236.8)		BB00.40-P-0236-08A
Sheet 236.9	Automatic transmission fluids (ATF, Sheet 236.9)		BB00.40-P-0236-09A
Sheet 236.10	Automatic transmission fluids (ATF, Specification 236.10)		BB00.40-P-0236-10A
Sheet 236.11	Automatic transmission fluids (ATF, Sheet 236.11)		BB00.40-P-0236-11A
Sheet 236.81	Automatic transmission fluids (ATF, Sheet 236.81)		BB00.40-P-0236-81A
Sheet 261.0	General lubricating grease	Sheet 261	BB00.40-P-0261-00A
Sheet 264.0	Liquid grease (NLGI grades 00/000)	Sheet 264	BB00.40-P-0264-00A
Sheet 265.1	High temperature antifriction bearing grease (NLGI grade 2)		BB00.40-P-0265-01A
Sheet 266.0	Grease (NLGI grade 1)	Sheet 266	BB00.40-P-0266-00A
Sheet 266.2	Long-life grease (NLGI grade 2)		BB00.40-P-0266-02A
Sheet 267.0	Multipurpose grease (NLGI Class 2)	Sheet 267	BB00.40-P-0267-00A
Sheet 267.1	Wheel bearing grease (NLGI grade 2)		BB00.40-P-0267-01A
Sheet 268.0	Leaf spring grease	Sheet 268	BB00.40-P-0268-00A
Sheet 269.2	Complex grease (NLGI grade 2)		BB00.40-P-0269-02A
Sheet 310.1	Coolant specifications	Sheet 310	BB00.40-P-0310-01A
Sheet 311.0	Coolant refining agents	Sheet 311	BB00.40-P-0311-00A
Sheet 312.0	Coolant additives (water-soluble) without antifreeze protection requirement	Sheet 312	BB00.40-P-0312-00A
Sheet 325.0	Anticorrosion/antifreeze agents (Sheet 325.0)		BB00.40-P-0325-00A
Sheet 325.2	Anticorrosion/antifreeze agents (Sheet 325.2)		BB00.40-P-0325-02A
Sheet 325.3	Anticorrosion/antifreeze agents (Sheet 325.3)		BB00.40-P-0325-03A
Sheet 326.0	Premixed coolant (Sheet 326.0)		BB00.40-P-0326-00A
Sheet 326.2	Premixed coolants (Sheet 326.2)		BB00.40-P-0326-02A
Sheet 326.3	Premixed coolant (Sheet 326.3)		BB00.40-P-0326-03A
Sheet 330.1	General brake fluid	Sheet 330	BB00.40-P-0330-01A
Sheet 331.0	Brake fluids (DOT 4 plus)		BB00.40-P-0331-00A
Sheet 331.1	Brake fluids (DOT 4 type 200)		BB00.40-P-0331-01A
Sheet 332.0	Brake pad paste	Sheet 332	BB00.40-P-0332-00A
Sheet 341.0	Tipper and hydraulic fluids	Sheet 341	BB00.40-P-0341-00A
Sheet 342.0	Hydraulic fluids (Sheet 342.0)	Sheet 342	BB00.40-P-0342-00A
Sheet 343.0	Hydraulic oils (Specification 343.0)	Sheet 343	BB00.40-P-0343-00A
Sheet 344.0	Central hydraulic fluids	Sheet 344	BB00.40-P-0344-00A
Sheet 345.0	Hydraulic fluids (Specification 345.0)	Sheet 345	BB00.40-P-0345-00A
Sheet 350.0	Lubricants for electrical equipment	Sheet 350	BB00.40-P-0350-00A
Sheet 351.0	Regeneration agents (activation agent) for exhaust-gas filter systems	Sheet 351	BB00.40-P-0351-00A
Sheet 352.0	NO_x reducing agent AUS 32 ("ADBlue") for SCR systems		BB00.40-P-0352-00A
Sheet 352.1	Approved NO_x reducing agent AUS 32 ("ADBlue")		BB00.40-P-0352-01A
Sheet 361.0	Refrigerants	Sheet 361	BB00.40-P-0361-00A
Sheet 362.0	Compressor oils	Sheet 362	BB00.40-P-0362-00A
Sheet 371.0	Windshield washer fluid concentrate	Sheet 371	BB00.40-P-0371-00A
Sheet 381.0	Preservation instructions	Sheet 381	BB00.40-P-0381-00A
Sheet 385.1	Wax preservation agents for underbody		BB00.40-P-0385-01A
Sheet 385.2	Wax preservation agents for cavities		BB00.40-P-0385-02A
Sheet 385.3	Wax preservation agents cavities (bus)		BB00.40-P-0385-03A
Sheet 385.4	Wax preservation agents for engine compartment		BB00.40-P-0385-04A
Sheet 385.5	Wax preservation agents for vehicle exterior		BB00.40-P-0385-05A

Operating fluids (such as engine oils, gear oils, automatic transmission fluids (ATF), hydraulic oils, greases, coolant/antifreeze agents, brake fluids etc.) are just as i […]

exactly the brand name printed on the approval certificate.

The use of approved operating fluids forms an integral part of the warranty terms and conditions.

The fees charged are the same for all types of operating fluids and for all applicants.

Approval of operating fluids is contingent upon fulfillment of the following conditions:

1. The operating fluid complies with the technical requirements specified by DaimlerChrysler AG. Technical specifications are available from the Operating Fluids Department (Abteilung Betriebsstoffe see address below).

2. The brand name consists of no more than 40 characters.

2.2 The brand name is written in Latin letters and contains no special characters. Such characters will be corrupted or suppressed during electronic data transfer.

2.3 The brand name of engine oils is verified by the submission of front and back labels for, for example, one liter or quart containers. Submission must be made within six months of receipt of the approval certificate. Failure to submit the label will result in withdrawal of the engine oil approval

3. For oils, all SAE grades and all formulations of a given brand name fulfill the specifications required for approval and inclusion in the sheet of the "Mercedes-Benz Specifications for Operating Fluids" for which an application is submitted.

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4. The brand name clearly identifies the operating fluid. Brand names of single-grade and multigrade oils must differ.

5. The applicant
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ledges by signature acceptance of the "Obligations Regarding Approval of Operating Fluids" (see enclosure).

6. The approval fee has been paid by the applicant for specified services related to the verification of product data and the inclusion of the product data in the "Mercedes-Benz Specifications for Operating Fluids." Other services are provided free of charge. See the table belo
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2000 EUR

6.1. For
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approvals (originals or rebrands)

6.2 For a change to a brand name coinciding
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ith a change in the formulation

6.3 For reapproval of an operating fluid deleted form the list due to non-compliance
w
ith the "Obligations Regarding Approval of Operating Fluids"

Free of charge

6.10 For product evaluations not resulting in an approval.

6.11 For rebrands: On request the rebrand
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ill be upgraded to a higher sheet provided the original
w
as previously approved for this sheet.

6.12 For rebrands: Changes to the formulation of the original.

6.13 For the verification of an operating fluid provided in the form of a yearly verification. This verification must be submitted by October 1st of each year. See the "Obligations Regarding Approval of Operating Fluids."

6.14 For the documentation of minor technical alterations
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here such alterations improve product quality and thus serve the interests of DaimlerChrysler AG and its customers.

1000 EUR

6.4 For a change to the brand name of an original product
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ith no change to its formulation

6.5 For a change to a formulation
w
ith no change to the brand name of a previously approved operating fluid

6.6 For a change to the brand name of an original product
w
ith no change to the brand name of an approved rebrand

6.7 For every additional formulation of a previously approved operating fluid

6.8
Ne
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approvals and releases of revisions for trade products. Trading products are products that are intended for
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holesale only and not for sale to the ultimate consumer. Brand names of trading products are not listed in the "Mercedes-Benz Specification for Operating Fluids" and are indicated as not approved to ultimate consumers.

6.9 For each listing of a product on an additional sheet in the "Mercedes-Benz Specification for Operating Fluids" in cases
w
here the operating fluid is approved for several sheets by the Department of Operating Fluids.

6.15 For minor changes to a brand name required to comply
w
ith legal regulations and standards.

6.16 For the documentation of changes to the company's name or the location of its registered office.

Correspondence Address:
DaimlerChrysler AG
Dept. Operating Fluids
HPC C405

D-70546 Stuttgart
Germany

Enclosure
Obligations Regarding Approval of Operating Fluids

Thursday, October 2, 2003

DaimlerChrysler AG, at the request of

- hereinafter referred to as "the Company" -

has tested the product called

Provided the Company fulfils the obligations given below, DaimlerChrysler AG will include the above operating fluid in the "Mercedes-Benz Specifications for Operating Fluids" and approve it for use in Mercedes-Benz vehicles and assemblies:

1. The Company shall not distribute any product under the above designation anywhere in the world other than the product tested and approved by DaimlerChrysler AG.

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2. The Company is responsible to DaimlerChrysler AG for ensuring compliance with the "Obligations Regarding Approval for Operating Fluids" throughout the world. When using an identical brand name, the approval is also valid in countries other than those listed in the "Mercedes-Benz Specifications for Operating Fluids," regardless of where the product is manufactured or distributed.

3. The Company may distribute different formulations under one and the same designation if DaimlerChrysler AG has tested and approved each formulation individually. Each formulation distributed under the same product name must display the same performance quality. Each formulation distributed under the same product name must display the same performance quality.

4. The Company shall at all times be able to inform DaimlerChrysler AG as to which formulation is or was being distributed in any given country at any given time.

5. The Company shall on all containers, price lists, etc. completely and clearly label the approved operating fluid in Latin letters with the **exact** same brand name given above.

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6. In connection with engine oils, the Company agrees to send for inspection a picture of the front and back labels for items such as one liter containers to the Operating Fluids Department (Abteilung Betriebsstoffe) within six months of receipt of the approval certificate.

7. If the approved operating fluid is altered in **any way**, the approval will become null and void. The Company shall provide advance written notification to DaimlerChrysler AG of any intended alteration in the formulation of the approved operating fluid to allow for examination and testing of the altered operating fluid. Unless DaimlerChrysler AG has been informed **at least 12 weeks before alteration**, the product will be removed from the "Mercedes-Benz Specifications for Operating Fluids."

8. As regards the use of the operating fluid in Mercedes-Benz vehicles or major assemblies, the Company shall only give recommendations (for oil change intervals and viscosity classes, etc.) which are in compliance with DaimlerChrysler AG specifications.

9. DaimlerChrysler AG may revoke approval at any time.

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10. The Company shall inform DaimlerChrysler AG annually in the **yearly verification** due to **October 1st** whether the operating fluid is still being distributed unchanged. Oils shall be listed with the brand name, sheet number, SAE grade, oil code and additive package. Rebrands/reblends shall be listed with the brand name, brand name of the original product, and upstream supplier. **Failure to submit the yearly verification shall result in the deletion of the product**.

11. The Company shall not utilize the approvals for advertising purposes. This restriction does not apply to references to the approval placed on containers, price lists, etc. The following reference is allowed: "Approved in accordance with sheet XXX.X of the Mercedes-Benz Specifications for Operating Fluids" or an unambiguous abbreviated version hereof, such as "Mercedes-Benz XXX.X".

12. The Company agrees to oblige its dealers and agents to **only** use the designations and descriptions prescribed by the Company for the approved product in all dealings with third parties. Dealers and agents shall abstain from making any changes to the brand name.

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13. The approval does not imply any obligation on the part of DaimlerChrysler AG or its service organization to procure the operating fluid.

. . . . . .
Place/date

. . . . . .
Stamp and signature
of applicant

Hazardous substances

Operating fluids for vehicles are in many cases hazardous substances for which certain rules require to be observed in respect of handling, storage, transportation, marking and the disposal.

These rules result from the legal provisions and technical codes of practice for hazardous substances which apply in the particular country. In view of the fact that major differences may exist from one country to the other, it is not possible to provide a comprehensive worldwide valid statement regarding the legislation and regulations to be observed.

The user of the products stated herein therefore has an obligation to inform himself of any nationally applicable legislation and regulations. DaimlerChrysler AG does not assume any liability whatsoever in respect of improper or illegal use of the operating fluids which are approved by them.

In the sections which follow we provide you with a number of basic information in respect of handling various operating fluids:

Safe handling of gasoline

- Gasoline is poisonous and highly flammable. May also produce cancer.
- W
  hen used, explosive/easily flammable vapor-air mixtures may be formed. Keep away from sources of ignition - do not smoke.
- If swallowed, consult a doctor without delay.
- Do not inhale vapors; avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Keep under lock and key. Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.

Safe handling of coolant

- Coolant is harmful to health. If swallowed, consult a doctor without delay.
- Avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.
- Dispose of empty cans in accordance with regulations.

Safe handling of lubricants (fresh and used oil)

- If swallowed, consult a doctor without delay.
- Do not inhale vapors; avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.
- Dispose of empty cans in accordance with regulations.

Safe handling of diesel fuel

- Diesel fuel is harmful to health and, if swallowed, can cause damage to the lungs. Irreversible damage possible. Consult a doctor without delay. Do not attempt to make the person vomit.
- Do not inhale vapors; avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.
- Dispose of empty cans in accordance with regulations.

Safe handling of brake fluid

- If swallowed, consult a doctor without delay.
- Avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.
- Dispose of empty cans in accordance with regulations.

Safe handling of central hydraulic fluid Sheet 345.0

- Central hydraulic fluid is harmful to health. May possibly cause damage to reproductive ability. May possibly cause damage to a child in the womb.
- If swallowed, consult a doctor without delay.
- Avoid contact with eyes and skin. In the event of eye contact, rinse out thoroughly with plenty of water. In the event of skin contact, wash off with water and soap.
- Take off soiled clothing immediately.
- Must be kept away from children.
- Do not allow to get into the sewage system, surface waters, groundwater or the soil.
- Dispose of empty cans in accordance with regulations.

BB00.40-P-0130ZZ	Fuels for road vehicle diesel engines	28.2.97

MODEL all
Sheet 130

Modification notes

6.5.02	Sheet 135.0 revised	Fatty acid methyl ester (FAME) as diesel fuel	BB00.40-P-0135-00A

Sheet 131.0	Fuels for diesel engines		BB00.40-P-0131-00A
Sheet 132.1	Minimum requirements for fuels for diesel engines (DIN EN 590)	Excerpt from DIN EN 590, February 2000	BB00.40-P-0132-01A
Sheet 132.3	Minimum requirements for fuels for diesel engines (ASTM)	American Society for Testing and Materials - ASTM D 975 (89a)	BB00.40-P-0132-03A
Sheet 133.0	Calibration fluid for diesel injection equipment		BB00.40-P-0133-00A
Sheet 134.0	Aviation turbine fuel as diesel fuel		BB00.40-P-0134-00A
Sheet 135.0	Fatty acid methyl ester (FAME) as diesel fuel		BB00.40-P-0135-00A
Sheet 136.0	Sulfur in diesel fuel		BB00.40-P-0136-00A
Sheet 137.0	Winter operation with diesel fuels		BB00.40-P-0137-00A
Sheet 137.1	Flow improvers for diesel fuels		BB00.40-P-0137-01A
Sheet 138.0	Microorganisms in diesel fuel		BB00.40-P-0138-00A
Sheet 138.1	Microbiocides for these fuels		BB00.40-P-0138-01A

Particularly essential preconditions for running a diesel engine are the availability and quality of the diesel fuel. Fuels and engines must be compatible with each other in technical terms in order to ensure trouble-free operation. At any given time and place the fuel should be available at low cost and easy to access.
Mercedes-Benz diesel engines are designed for diesel fuel, which complies with respective national and international requirements (EN 590 in Europe).

Conventional diesel fuels

Conventional diesel fuels, such as have been used for many years now worldwide for high-speed diesel engines, are hydrocarbons that occur in the range between 180 °C and 360 °C during the fractionating crude oil distillation process in the refineries.
Th
ese hydrocarbons can have
ext
remely different molecular structures, which
naturally
ex
hibit different characteristics.

Chemical structure of diesel fuel

Th
e quadrivalent carbon C and the monovalent hydrogen H have numerous bonding capabilities.
Th
ere are linear and various branched chains as well as assorted ring-type systems, which can be saturated or unsaturated, and the number of multiple bonds is also different.

Alcanes are chain-shaped saturated hydrocarbons with the total formula CnH2n+2, whi

Alcenes are chain-shaped (straight-chained or branched) unsaturated hydrocarbons with a double bond; they have the total formula CnH2n.
Th
ese products which are also known as olefins, are similar to the iso-paraffins, but they have a less favorable smoke characteristic.

Cycloalcanes are ring shaped, saturated hydrocarbons with the total formula CnH2n.
Th
ese products known as cycloparaffins, or better still naphthenes,
ex
hibit a moderate ignition quality, but have a more favorable low-temperature characteristic, and they have a smoke characteristic similar to that of the olefines. Density and volumetric calorific value are average.

Aromatics, ring-shaped hydrocarbons with double bonds, have a lower ignition quality, poor smoke characteristic and a moderate low-temperature behavior. Density and volumetric calorific values are high.

Requirements, characteristics, parameters (DIN EN 590)

The diesel fuel characteristics that are necessary for running a diesel engine can either be specified

In our view diesel fuel additives are absolutely essential for improving quality.
Thi
s lies within the remit of the supplier as it bears the overall responsibility for its product (see here also the section on Additives).

Ignition quality

Th
e ignition quality represents one of the essential features of diesel fuel.
Wit
h regard to its significance for the anti-knock rating of the benzines however only a limited comparison can be drawn. Looked at technically the ignition quality represents the opposite of the anti-knock property.

The ignition quality is expressed as the cetane number and in fact measured in accorde
methyl naphthaline), the cetane number being calculated from the volumetric percentag

The ignition delay, in other words the time span between the injection point and spontar

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Boiling characteristics

The diesel fuel's boiling characteristics lies between approx. 180 °C and 360 °C, whereby there are

Th
e DIN standard recognizes three limit values only, namely:

up to 250 °C max. 65 Vol. % vaporized

up to 350 °C min. 85 Vol. % vaporized

95 Vol. % point at max. 360 °C

Suitable commercial diesel fuels are however
sub
je
ct to much more stringent specifications.

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e sulfur content in diesel fuel is essentially dependent upon the origin of the crude oil, the refinery's desulfurization capabilities and is governed by standards and/or regulations.
It represents one of the most significant application-engineering parameters for diesel fuel and for this reason it is dealt with in its own Sheet 136.0 "Sulfur in diesel fuels". In general the sulfur content should be as low as is possible.
The reduction in sulfur content discussed here which over the past few years has not or

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Low-temperature behavior

The hydrocarbon compounds generally looked on favorably for operation in diesel engines have a certain d

Depending upon the method of fuel production and the vehicle configuration it was possible in practice to transfer these parameters more or less successfully. Today the

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Apart from a certain drop in performance this has no negative effect on the engine, as l
on the low-temperature behavior, but also exerts a negative influence on viscosity, the f

Now that there are several suppliers who offer diesel fuel with a guaranteed low-temperature resistance, it is advisable to use such fuels only. See Sheets 137.0 and 137.1

Density

Density is not specified in every country's standard. DIN EN 590 specifies that the density of the diesel fuel is between 820 and 845 kg/m3 at 15 °C. In the European mark and suppliers place value on having as wide a range of permissible densities as possible. It is not possible to achieve the necessary performance with the given injection-pump settings and an ultralight fuel nor to comply with the specified emission-control levels with a very heavy fuel.

Viscosity

Viscosity, in other words the internal friction, the fuel's tenacity, is responsible for the flow processes and the wear resistance in the injection system and influences the pulverization capability in the combustion chamber. In accordance with the DIN standard it can be between 2.0 and 4.5 mm2/s, measured at 40 °C; as a general rule this large tolerance band is not fully exploited.

Additives

With regard to the service life and cleanliness of the engines and fuel systems, the retention of favorable exhaust-emission values as well as the attainment of an overall positive operating behavior, the use of diesel fuel with high additivity levels represent a necessary measure which in the long term is also inexpensive.

In terms of the supply of such fuels, the individual customer must rely on the filling stati

We would expressly like to point out that according to our assessment the slight percen

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The fuel additive gains greater significance when the problems associated with lubricity in sulfur-free fuels is entered into the equation (see section on "Lubricity"). Looked at in this way optimizing the additive process is no longer an option, but a necessity.

The additive process should be undertaken by the supplier as part of its quality assurance responsibility with regard to the fuels, the addition of secondary additives by the customer is not recommended.

Storage and transportation

The following instructions are of particular relevance to those of our customers who own their own filling station.

Diesel fuel is a valuable energy carrier. If it is to be used in the vehicle - in accordance with the customer's wishes - without any problems then certain basic technical rules must be observed.

Never operate the tanks alternately, in other words do not fill them alternately with diesel and gasoline, but if demand exists for both fuel types (minimum) then two dedicated tanks should be used. If this instruction is not followed then alternating contamination effects are inevitable.

In particular, customers who do not purchase diesel fuel often, should completely use up their stocks of summer-grade and transitional fuel before receiving a delivery of winter-grade quality.

The ground tank must not contain any water or other dirt (e.g. from contamination with microorganisms, see Sheet 138.0).
This applies particularly prior to filling the tank with winter diesel fuel. If this should however occur, have the tank cleansed thoroughly. Check the bottom tanks at regular intervals!

If the fuel supply is changed from fuels without additives to fuels with additives then special care must be taken to ensure that the storage tanks are clean.
The detergents present in the fuels containing additives, which serve to keep the vehicle fuel system clean, can also carry dirt particles from the storage tanks into the vehicle's fuel system and thus contribute to a faster blocking of the filter.

Nonobservance of this rule can lead to premature blockage of the fuel system filter and performance problems during the winter months.

Ignition point/hazard class

Th
e diesel fuel's ignition point, as measured by ISO 2719, must be higher than 55 °C. For combustion within the engine, this is in fact meaningless, but important so that the diesel fuel falls into hazard class A III (fluids which are not soluble in water with a flash point between 55 °C and 100 °C) (see also Sheet 112.0).

Even very small
admi
xtu
res of gasoline will significantly lower the ignition point of diesel fuel. Although the ignition point of diesel fuel is higher than that of gasoline, the self-ignition temperature for diesel fuel is lower than that for gasoline.

Purity

Diesel fuel must be free of any organic acids and solid matter and be clear when at ambient temperature.

Th
e water content must not be higher than 200 mg/kg in order to prevent corrosion from occurring. In order to ensure that the diesel fuel does not contain any organometallic, wear-enhancing compounds, the permissible ash content has been set at
ma
x.
0.01 percent by weight.

Diesel fuel components which tend to promote carbonization can cause considerable engine-related problems, e.g. nozzle coking and
ex
cessive combustion-chamber deposits. For this reason the coke residue is limited to 10 % petroleum stock (as measured by Conradson).

Lubricity

Th
e reduction in sulfur content for environmental reasons which has taken place during the past few years has brought with it the problem of the diesel fuel's lubricity, because hydrogenation of the middle distillate which was required to gain the reduction, also caused the removal of the natural lubrication enhancers.

Th
ere is evidence that diesel fuels that comply with the European limit of
ma
x.
0.05 percent by weight, today
ma
x.
0.035 % by weight of sulfur can cause wear in the
inj
ection equipment.
Thi
s means that the addition of lubricant enhancing additives by the fuel producers is absolutely essential if our customers are to be protected against long-term damage.

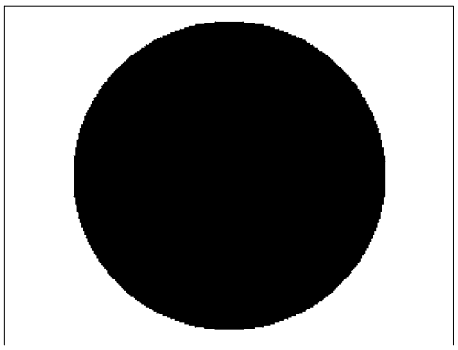
Cm at EN 590 2/99 regulates this through specifications in the "HFRR test" ("High Frequency Reciprocating Rig Test"), in which a ball is put into forced oscillation under load on

Although the method is largely accepted in the industry, point of criticisms regarding precision and meaningfulness (i.e. correlation with practice) of the test still
exi
st. DaimlerChrysler has proposed normalization of a pump test at ACEA and CEC, and work has started on it.

Miscellaneous

Almost all previously mentioned characteristics or parameters are dependent on each other.
Thi
s applies in particular to density, boiling characteristic, viscosity, ignition point, low-temperature behavior and ignition quality. If one of these characteristics is altered, the others inevitably change too.

Characteristics				Requests	Test method
Density	at 15 °C	g/ml		0.820-0.845	EN ISO 3675
Boiling characteristics	at 250 °C	vol %	max.	65	EN ISO 3405
	at 350 °C	vol %	min.	85	
	95 % - point	°C	max.	360	
Kinematic Viscosity	at 40 °C	mm2/s (cSt)		2-4.5	ISO 3104
Flash Point		°C	min.	56	ISO 22719
Filterability	Summer	°C	max.	0	EN 116
	Winter	°C	max.	-20	
	transition period	°C	max.	-10	
Sulfur content		percent by weight	max.	0.035	EN 24260
Coke residue as under Conradson (10 % petroleum stock)		percent by weight	max.	0.3	EN ISO 10370
Ignition Quality		Cetane number	min.	51	EN ISO 5165
		Cetane index	min.	46	EN ISO 264
Ash (oxide ash)		percent by weight	max.	0.01	EN ISO 6245
Lubricity at 60 °C		Cm	max.	460	ISO 12156-1
Polycycl. arom.hydrocarbon		percent by weight	max.	11	IP 391/95
Oxidation stability		g/m3	max.	25	EN ISO 12205
Total contamination		mg/kg	max.	24	EN 12662
Water content		mg/kg	max.	200	prEN ISO 12937
Corrosive effect on copper		Corr. deg.		1	EN ISO 2160



P00.40-0206-01

BB00.40-P-0132-03A	Minimum requirements for fuels for diesel engines (ASTM)	American Society for Testing and Materials - ASTM D 975-94 i Comment: The fuels which are rich in sulfur are to be dyed blue.	Sheet 132.3

Characteristics			**Requests**		**Test method ASTM**
			No. 1 -D	**No. 2 -D**	
Boiling characteristics 90 Vol.-%	°C	min.	-	282	D 86
	°C	max.	288	338	
Kinematic Viscosity at 40 °C	mm2/s (cSt)	min.	1.3	1.9	D 445
	mm2/s (cSt)	max.	2.4	4.1	
Flash Point (Pensky-Martens)	°C	min.	38	52	D 93
Carbon residue from a 10 % residue (Ramsbottom)	percent by weight	max.	0.15	0.35	D 524
Ash	percent by weight	max.	0.01	0.01	D 482
Corrosive effect on copper	Class. no.	max.	3	3	D 130
Sulfur content (low sulfur grade) Sulfur content (high sulfur grade)	percent by weight	max.	0.05	0.05	D 2622
			0.50	0.50	D 129
Water and Sediment	vol %	max.	0.05	0.05	D 2709
Alternative: Cetane index Aromatic content					
		min.	40	40	D 967
	vol %	max.	35	35	D 1319
Ignition Quality	Cetane number	min.	40	40	D 613

Warranty claims in respect of attainable performance, dynamic characteristics, start capability, emission characteristics, extent of maintenance and attainable life are linked to the use of standardized diesel fuels of good quality.

In the event that Mercedes-Benz engines are operated with other fuels, this will likely result in disadvantages for the operator.

The disadvantages which may occur with aviation turbine fuels of quality grades Jet A/A1 and JP 8, JP 5, F 34, F 35, F 44, F 63 (for properties and specifications see table of aviation turbine fuels), are familiar to us from test bench trials and practical experience based on series 300 and 400 engines (CVs) and on the prechamber engines with inline pump for cars; it is not yet possible to fully evaluate more recent engines (series 500 and 900, car engines with distributor pump, with Common Rail Direct Injection) in all aspects.

The following statements therefore essentially apply to engines of older technology (series 300 and 400 (CVs) and to prechamber engines with inline pump for cars). Similar statements apply to the new fuel F 63, which is formulated F 35 by the addition of wear protection and ignition promotion additives; we cannot at present provide a conclusive opinion of the extent to which these additives provide the desired effect.

A major drawback of such fuels for diesel engines is in their non-defined ignition performance (cetane number), which may also assume cetane numbers of less than 40. This, in turn, can result in poor starting characteristics, combined with the development of white exhaust, as well as to a deterioration in emission levels. In this connection, we urgently recommend using additional start aids (flame starting systems or special heating flanges) to improve the cold starting property.

The low boiling range can involve a reduction in the life of the fuel injection system as a consequence of cavitation at nozzles and injection lines; in addition, the reduced lubricity (excessive HFRR value) may result in increased wear in injection equipment.

In view of the lower density, a lower engine performance (approx. 5 %) is likely if the fuel injection pump setting is maintained.

The fuel filter used must be a filter element which is approved for use with aviation turbine fuel; this is normally the case for car engines and for CV engines of series 500 and 900.

Filter elements with part no. 000 092 38 05 should be used for CV engines of series 300; the filter housings can continue to be used. Suitable filter elements for series 400 engines are available on request from the suppliers who cooperate with MB (Hengst, Knecht).

Aviation turbine fuels of grade Jet B, JP 4, F 40 have not been tested by MB and are not recommended by virtue of the as yet lower boiling characteristic and lower density.

i Aviation turbine fuels are used both in the military as well as in the civilian sector. The table listed below contains the qualities which are used most frequently, together with the corresponding designations and principal requirements.

i Table: The specifications in the same line, describe approximately identical fuels. They typically differ in respect of three main characteristics: density, boiling range and freezing point. We recommend consulting the comprehensive original standards (ASTM D 1655 or MIL-T-5624 and MIL-T-83133) for more detailed information.

Aviation turbine fuels

Civilian	**Density** kg/m3	**Freezing point** °C	**Military**	**Density** kg/m3	**Freezing point** °C	**Boiling point** requirements, see original standards °C approx.
Jet A	775-840	max. -40	JP 5, F 44	788-845	max. -47	175-300
Jet A1 without anti-icing inhibitors	775-840	max. -47	JP 8, F 34, F 63 (= F 35 with additives) F 35 (= F 34 without anti-icing inhibitors)	775-840	max. -47	130-300
Jet B	751-802	max. -50	JP 4, F 40	751-802	max. -58	50-240

Preliminary remarks

MB diesel engines are basically designed for diesel fuels which meet the respective national or European requirements. Other types of fuel are not generally planned for.

Because the most varied of abbreviations are used to describe bio-diesel fuels we have listed below a brief "glossary":

FAME	Fatty acid methyl ester	generic term, to be used in future as part of the European standard
PME	veg. oil fatty acid methyl ester	previously used generic term within German-speaking area
RME	rape oil fatty acid methyl ester	specific "bio diesel fuel made from rape seed oil

We are fundamentally against the use of non-transesterified oils (of vegetable or animal origin) as diesel fuel as a consequence of our negative experience in this area (carbonization, deposits in the combustion chambers etc.).
For the remainder of the text we will refer to "bio-diesel fuel " in keeping with the European standard activities as "FAME", although our experience has shown that we basically tend more towards RME.
FAME may have a future as a niche fuel and be used where ecological advantages are required in particular (e.g. in water protection areas).
A distinction is to be made between operating with 100% FAME and mixtures of FAME with conventional diesel fuel. Items 1 to 3 listed below relate to 100% FAME, mixtures are dealt with in item 4.

In the interest of using biomaterials and supporting domestic agriculture the past few years have entertained discussions on the possible application of "Bio-diesel fuels". In chemical terms these so-called "bio diesels" are mainly vegetable oils, which can be transformed as the result of a chemical reaction into appropriately mixed fatty acid methyl esters (FAME).
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1. Approval status

A general approval for passenger cars is not possible due to material incompatibility. As of 8/99 for individual models, E 200/220 D or CDI, C 200/220 D or CDI - irrespective of the respective engine designation - FAME-able vehicle equipment is available as special equipment. The vehicles mentioned mainly contain other, consistent elastomers in the fuel and fuel injection system.

Further details, in particular on the replacement parts valid for this, can be obtained from the Service Information 00.40-P-0005A dated 30.03.2000.

The approval of MB commercial vehicles and MB industrial engines for FAME operation are governed by service information releases (STIN, e.g. No. 00.00S0028), which are available to the MB field organizations; they describe the approval status with regard to type of vehicle, year of construction, any possible conversion measures required etc. for SK, MK, trucks, omnibuses, vans and Unimogs.

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2. Technical situation

2.1 Engine values

In comparison with diesel fuel operation the following applies to the engine values when operating with FAME:

- The volumetric fuel consumption is slightly higher because of the lower calorific value.
- The rated output is slightly lower due to the lower calorific value and higher viscosity.
- The emissions are at a similar low level on direct injection engines (trucks, buses). The black smoke level is considerably lower. Slightly higher NOx values are monitored.

In the event of unfavorable conditions, in particular where the engine idles for a long time, an unusual odor may result. The use of an oxidation catalytic converter will result in a significant reduction in HC, CO and particulate emissions as well as any odors.

2.2 Fuel

Items 1 to 3 of this sheet apply to pure FAME, not to mixtures of FAME with diesel fuel. In vehicles approved for FAME operation it is however permissible to use FAME or diesel fuel alternately, without the need for any additional measures. For mixtures of FAME with diesel fuel, see Item 4.

The fuel, also in the case of mixtures, must meet the requirements of the standard draft EN 14214.
It is particularly important to pay attention to complying with EN 14214 as operating with fuel of lower quality can result in malfunctions and damage.

2.3 Engine oil

With regard to its disposal the following applies in general:
Not every producer of rerefined engine oils is in a position to process engine oils, which exhibit a specific FAME content. The customer should ask at his/her used oil dealership.

2.3.1 Cars

The same oil change intervals apply here as for diesel fuel.
Replace the fuel filter at 1000 to 5000 km as well as every 30.000 km.
When diesel fuel is used for longer periods (> 10000 km) the fuel filter must be changed shortly after converting to FAME (at 1000 - 2000 km).
Vehicles, which are converted to FAME and which are shut down for more than 2 weeks are to be converted to diesel fuel beforehand and driven for at least 30 minutes.
When temperatures drop to below - 10 °C it is advisable to change to commercial winter diesel fuel.

2.3.2 CVs

Engine oil quality in accordance with MB Specifications for Operating Fluids, Sheet 228.0/1 to Sheet 228.5 is suitable (preferred in accordance with Sheet 228.3 or 228.5). The reduced oil change intervals when operating with FAME are specified for all commercial vehicle engines in the Service Information SI 00.40-N-0008A dated 27.05.2002
It has not yet been finalized as to whether all engine oils approved for diesel fuel operation are also suitable for FAME operation.

2.4 FAME resistance of components

Passenger cars:
The material in elastomer hoses and seals in the fuel supply system has to be converted to fluorocaoutchouc; the availability of such parts is permissible for specific models only (see "Approval status"). More details are given in the service information releases as listed under 1).

Commercial vehicles:
In some vehicle models not all components, particularly those made from elastomer material, are resistant to FAME when subject to continuous operation. Suitability for FAME operation has to be checked for each individual vehicle model for reasons of road and operating safety and may, where applicable, in some cases be given through specific modifications. More details are given in the service information releases as listed under 1).

2.5 Miscellaneous

The question regarding winter capability/cold starting has not been solved. Depending upon the vehicle and the engine it may be necessary to install a fuel preheater system to cope with minus temperatures.

FAME is an excellent solvent. Therefore it is advisable to prevent coming into contact with the paint surface when refueling.

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3. Legal situation

3.1 Fuel standard

Valid for FAME as a diesel fuel is the standard EN 14214 Issue 09/2003.

3.2 General operating permit

When in FAME mode the rated output as specified by the manufacturer may drop by more than 5%. This does not invalidate the general operating permit.

When an oxidation catalytic converter is used in a commercial vehicle, the question as to the validity of the general operating permit remains unresolved.

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4. Mixtures of FAME with mineral oil diesel fuel

4.1 Background relating to tax law

It is to be assumed that with effect from 01.01.2003 when mixing FAME with diesel fuel, the biogenic fuel components are freed from mineral oil tax. The consequence of this may be that the mixture of FAME with diesel fuel in accordance with EN 590 will be available at fuel pumps in Germany provided the valid DIN EN 590 does not expressly forbid this mixture.

4.2 Normative information

From a political aspect (EU commission) the use of bio fuels in the EU is to be favored. Therefore in the next revision of EN 590, mixing of up to **5 vol. % FAME** in accordance with EN 14214 was expressly allowed. Identification of the gasoline pumps is not planned.

4.3 Technical implications

The regulations described in 4.1 and 4.2 presuppose that all vehicles on the European market withstand continuous operation with up to 5 vol. % FAME without disadvantages for the customer or environment. This cannot be assured completely.
According to a statement of the ACEA (Association of the European automotive industry) a concentration of 5 vol % of FAME can be tolerated, although there are certain risks with older vehicles. The mixture, however, must fully conform to EN 590 and the FAME share to EN 14214. Higher concentrations of FAME must be noted and should be avoided on vehicles which have not been adapted.

1. Origins of sulfur

Mercedes-Benz diesel engines are designed for diesel fuel, which complies with respective national and international requirements (DIN EN 590 in Europe).
These requirement standards usually contain a limit for the maximum permissible sulfur content, they do not say anything about any minimum sulfur content required. Neither is this necessary because sulfur does not have any function in the diesel fuel; its presence is down to crude oil, which naturally exhibits a different specific sulfur content. The level of sulfur content in the diesel fuel depends on the origin of the crude oil, desulfurization facilities at the refineries and is limited by standards and/or laws.

2. Sulfur content regulation

2.1 In the EU

In the Federal Republic of Germany, changes to the mineral oil tax regulations for low-sulfur fuel (max. 50 ppm) that came into effect on November 1, 2001, made low-sulfur fuel the fuel of choice; for the same reason, only sulfur-free gasoline fuels with max. 10 ppm sulfur has been available on the German market since January 1, 2003.
In other EU states comparable regulations have likewise led to a lowering of the sulfur content in the fuel.

2.2 In other countries

In many countries even today values around 0.3% by weight are usual, in some countries as always there are sulfur values around 1.0% by weight and above. In the USA max. 0.05% by weight applies across the country.

For this reason there are no technical objections to operating an engine on diesel fuel with a low s u
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3. Effect of sulfur

3.1 "Conventional" emission-control technology

By this we refer to either no exhaust-gas after treatment at all or an emission control by means of an oxidation catalytic converter.
The service life of the engine is impaired with a sulfur content > 0.3% by weight in the diesel fuel. Sulfur dioxide is given off during the combustion process which together
Clear advantages in emission levels are achieved with fuels that have not only had significant reductions in their sulfur content, but also where other relevant diesel fuel properties such as aromatic compounds/poly aromatic content and density are reduced and ignition quality of the fuel improved.
Wit
h a sulfur content < 0.005 (50 ppm) or even < 0.001% by weight (10 ppm) diesel fuels generally have favorable properties due to their manufacture also in the criteria mentioned.

3.2 "Advanced" emission-control technology

These are understood to include, for example, NOx storage catalytic converters based on earth alkali/rare metal or the "CPF-System" for particulate reduction.
For trouble-free operation these systems require sulfur-free diesel fuel (< 10 ppm). In both cases the sulfur trioxide formed from the fuel sulfur interferes with the catalytic conversion of pollutants, in addition the NOx storage catalytic converter being irreversibly blocked by the formation of earth alkali sulfates.

Conclusion: Where possible Mercedes-Benz vehicles should be operated with sulfur-free diesel fuel.

4. Supporting measures

In general it should be noted that low-sulfur or sulfur-free diesel fuels meet the requirements of **EN 590**.

In the case of diesel fuels with very low sulfur content, particular importance is to be attached to the question of **lubricity** (see section on "Lubricity" Sheet 131.0); without an appropriate treatment with additives with lubrication-improving additives,
wear in the
inj
ection system, particularly the pump is to be reckoned with.

1 General

At low outside temperatures, the viscosity of the diesel fuel can be negatively influenced due to precipitation of paraffin crystals. This can lead to delivery problems resulting from the filter and/or fuel lines clogging up. To prevent such problems, winter diesel fuels with improved cold viscosity characteristics are available on the market during the winter months. In most cases, these are suitable for the outdoor temperatures usually occurring.

Remedies when fuel is not sufficiently resistant to low temperature

When winter diesel fuels are not available within sufficient time or an ex ceptionally cold period is ex pected, it is advisable to add **kerosene or aircraft turbine fuel** in a percentage depending on the ex pected outdoor temperature. This can apply in central Europe depending on national standards for outdoor air temperatures below -9 °C to -15 °C when winter diesel fuel is used and below 0 °C when summer diesel fuel is used. On vehicles with fuel heater these values are approx. 8 °C better. As a guideline value adding 5 vol % of kerosene or aircraft turbine fuel improves the resistance to low temperatures by approx. 1 °C. This should be regarded as an emergency measure; continuous operation is not recommended, neither is any addition of more than 50 percent by volume. **The use of gasoline is not allowed because it impairs the fuel's oiliness and reduces safety (lowers inflammation point).**

Adding after the paraffin has already precipitated out has no effect. In this case the only remedy is to heat up the entire fuel system and then add the kerosene or aircraft turbine fuel.

Diesel fuel with improved cold viscosity properties

In some countries certain oil companies offer diesel fuel with improved cold viscosity properties. Other improved properties are also claimed frequently in this conte xt.

We recommend using only winter diesel fuels which are guaranteed by the fuel suppliers for operation down to -20°C and below.

For safety reasons, mi xin g should be accomplished only in the vehicle fuel tank. When filling up the tank, add the specifically lighter additive fuel before the diesel fuel. Then the engine should be run until the entire fuel system is filled with the mi xe d fuel. Failure to do this can result in malfunctions due to unmi xe d fuel in the entire system.

Approved viscosity improvement additives can be used instead of kerosene or aircraft turbine fuel. Adding kerosene or aircraft turbine fuel reduces the flashpoint of the diesel fuel. This increases the risk for handling and storing such fuel mi xtu res; therefore always observe the applicable safety regulations (see Sheet 112.0).

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2 Flow improvers for diesel fuels

General information

Although viscosity improvement additives cannot prevent paraffin from precipitating out, they do have a great deal of influence on the shape and growth of the crystal. As the fuel cools off a large number of modified paraffin crystal forms, which can pass through the fuel filter. The fuel can still flow and be filtered, because formation of unsuitable crystals is prevented. 0.01 up to

Adding 0.01 to 0.2% of such additives by weight can convert summer diesel to winter diesel and improve the low temperature properties of winter diesel fuel. It should be

Application

Measuring and mixing viscosity improvement additives is not unproblematic, therefore observe the man

When adding viscosity improvement additives, the diesel fuel should have a temperature of at least 8 °C above the cloud point in order to achieve high effectiveness. However, since the cloud point is not usually known, the fuel temperature for winter diesel fuel should be at least +/- 0 °C and for summer diesel fuel at least +8 °C. Adding after the paraffin has already precipitated out has no effect. In this case, the only remedy is to heat up the entire fuel system. After viscosity improvement additives have been added to the diesel fuel in the vehicle tank, the engine should then run until mi xe d fuel is present in the entire fuel system. Failure to observe this can result in the unmi xe d fuel in the lines and fuel filter causing malfunctions.

Viscosity improvement additives have a positive effect on the low temperature characteristics of a number of diesel fuels. However, it is not possible to give any guarantee with this, because with some diesel fuels they have no effect or, when a number of unfavorable factors occur simultaneously, the low temperature characteristic can even be influenced negatively, particularly when diesel fuels with the optimum additives are already present (e.g. "-22 °C guarantee"). In such cases, we do not recommend subsequent addition of viscosity improvement additives.

Auto TAP 10	Agip Schmiertechnik GmbH, Würzburg, Germany
Minus	Octel Deutschland GmbH, Herne
Unil Mix CFI	Unil Deutschland GmbH, Stuttgart, Germany

Symptoms

The following symptoms indicate that a vehicle or base tank is infected by micro-organisms:

- Frequent fuel filter change necessary due to loss of performance, gel-like substance in filter

- Increased occurrence of internal tank corrosion.

Particularly after long periods of being laid up, this can be attributed to the occurrence of microorganisms.

Remedial action

- Tank cleaning (mechanical, supported by suitable neutral cleaners, involved tank cleaning company in the case of base tanks)

- Prevention: addition of microbiocide additives in accordance with Sheet 138.1 in the concentration specified by the manufacturer. The period of this treatment must depend on the individual circumstances. In serious cases, we recommend a discussion with the biocide developer.

In the case of base tanks, clean tanks at shorter intervals (the micro-organisms cannot grow without water!).

Bakzid	Bode Chemie GmbH & Co., Hamburg/Germany
GrotaMar 71	Schülke & Mayr GmbH, Norderstedt

Diesel fuels should be used for industrial engines that comply with the quality requirements as under Sheets 131.0, 132.1 and 132.3.

In special instances direct-injection engines may be permitted to use diesel fuel with a different grade, if such a fuel fulfills the following minimum requirements:

Minimum requirements diesel fuel for direct-injecting engines

Characteristics				**Requests**	**Test method**		
					DIN	**ASTM**	**IP**
Density	at 15 °C	g/ml	max.	0.92	51757	D 1298	160
Viscosity	at 20 °C	mm2/s	max.	17	51550	D 445	71
	at 100 °F	mm2/s	max.	9			
Final boiling point		°C	max.	390			
Calorific value (lower)		MJ/kg	min.	40.8	51900	D 240	12
Flash Point		°C	min.	65	51755		170
Carbon residue		percent by weight	max.	1.5	51551	D 189	13
Ash content		percent by weight	max.	0.02	51575	D 482	4
Sulfur content		percent by weight	max.	1.8	51768	D 1551	63
Water content		percent by weight	max.	0.25	51777	D 1744	
Sediment		percent by weight	max.	0.05		D 473	53
Ignition Quality		Cetane number	min.	40	51773	D 613	41

The increase in sulfur content which these grades normally exhibit, requires shorter oil change intervals.

If the diesel fuel's sulfur content is greater than 0.5 % by weight, then the engine oil change is subject to extreme service conditions. For this reason the oil change intervals, insofar as no extreme service conditions are prevalent, must be halved. If the diesel fuel's sulfur content is more than 1.0 % by weight, the oil change must always be made subsequent to maintenance category I (refer also to Sheet 215.0, Section 3.6).

Particularly where diesel fuel with a high sulfur content is used it is very important to ensure that only tested and approved engine oils as under Sheets 228.0/.1/.2/.3 /.5
are used. The higher the grade of oil the easier it is to compensate for the negative effect exhibited because of the sulfur content.

If the fuel has a high viscosity it may be necessary to conduct a fuel preheating operation.

If the density of the diesel fuel is greater than 0.86 g/ml at 15 °C, the injection quantity is to be reduced as follows:

Quantity Reduction for Various Fuel Densities

Density at 15 °C **g/ml**	**Required fuel-quantity reduction** **%**
0.86	1.5
0.87	3.0
0.88	4.5
0.89	6.0
0.90	7.5
0.91	9.0
0.92	10.5

To this end the injection pump should be removed and readjusted on the injection-pump test bench taking the fuel-quantity reduction into account. This work must be conducted by skilled personnel only.

The primary fuel filter and fuel filter should be checked and cleaned on a more regular basis. In some cases it may be necessary for such diesel-fuel grades to undergo a centrifuging operation beforehand.

It should be pointed out that the use of unfavorable diesel fuel grades will exert a considerable influence on the engine performance as well as its service life. If such unfavorable diesel-fuel grades are used it is impossible to achieve the same results as when using excellent diesel-fuel grades. These special cases, i.e. the use of the above fuel qualities are to be clarified in advance with the Abteilung Betriebsstoffe, EP/MGB [operating fluids department].

General information
The tasks performed by lubricants are just as important as those performed by parts and components. Lubricants, too, should be adapted to all the stresses occurring in a

Viscosity
The viscosity (flow resistance) is the ability of a lubricating oil to establish internal resistance (friction) against distortion (relative motion between two fluid layers). The viscosity rating indicates the flowability of the lubricating oils (e.g. in the low and high temperature range).

Dynamic viscosity
The SI unit (SI = Système International d'Unités) for dynamic viscosity is the Pascal second (Pa s).
Measuring unit: 1 Pa s = 1 Ns/m2.
Viscosity conversion: 1 mPa s = 1 cP (centipoise).

Kinematic viscosity
The quotient of dynamic viscosity and density is the kinematic viscosity
=/.
The SI unit is m2/s.
Viscosity conversion: 1 mm2/s = 1 cSt (centistoke).

Viscosity temperature response (VT response)
The VT response of a mineral oil indicates the change in viscosity under the influence of temperature. The viscosity of mineral oil changes with the temperature and the pressure, that of structurally viscous oils also under the influence of the shear rate.

Viscosity index (VI)
The viscosity
index identifies the viscosity temperature characteristics of mineral oil. It is a calculated
°C and 100 °C.

SAE viscosity grades
The Society of Automotive Engineers (SAE) has established a classification for the two most important lubricating oils of motor vehicles, engine and gear oils, with regard

SAE grades for engine oils
SAE J 300 lists the SAE viscosity grades for engine oils. Oils marked with the letter
"W"
have defined cold-flow properties, i.e. two low-temperature viscosities, Cranking Viscosity and Pumping Viscosity (both dynamic viscosities in mPas), are specified for each
"W"
grade oil (see Sheet 211.0). In the high-temperature range, oil viscosities are specified at a temperature of 100 °C (kinematic viscosity in mm2/s), and the dynamic viscosity and high-shear viscosity 106 s-1 (dynamic viscosity in mPas) at 150 °C.

SAE grades for gear oils
The SAE viscosity grades for gear oils are standardized in SAE J 306.

Additives
The high demands made on lubricating oils today can only be met by blended lubricating oils, that is, by oils with special chemical additives which are dissolved in the oil.

The type and quantity of the additives must be accurately adapted to the functions of the respective components. The effects of additive components in the oils and their performance characteristics are tested during ex haustive and ex pensive tests.

It is therefore our policy to approve and list in our Mercedes-Benz Specifications for Operating Fluids only those lubricants which have been tested by DaimlerChrysler AG.

The principal requirements in respect of lubricating oils, and their additives, are described in Sheet 221.0 for engine oils, 231.0 for gear oils and 261.0 for lubricating greases.

If lubricants must be changed or replenished, and the brand used up to now is not available, another approved brand of the same type may be used without fear of subsequent damage. No special relubricating (cleaning) instructions need to be observed.

However, repeated changes of oil brands without a definite reason should be avoided, since the resulting mi xtu res may be less efficient than intended.

Engine oils - SAE J 300, June J3002001 (Dec. 1999).

SAE-viscosity classes	**Low temperature (°C) Cranking viscosity** (ASTM D 5293) **(mPa s)** **max.**	**Low temperature (°C) Pumping viscosity** (ASTM D 4684) **(mPa s)** **With no yield stress** **max.**	**Low shear rate Kinematic viscosity** (ASTM D 445) **(mm2/s) at 100 °C**		**High shear rate viscosity** (ASTM D 4683, CEC L-36-A-90 (ASTM D 4741)D5481) **(mPa s) at 150 °C and 10 6 s-1** **min.**
			min.	**max.**	
0 W	6200 at -35	60 000 at -40	3.8	-	-
5 W	6600 at -30	60 000 at -35	3.8	-	-
10 W	7000 at -25	60 000 at -30	4.1	-	-
15 W	7000 at -20	60 000 at -25	5.6	-	-
20 W	9500 at -15	60 000 at -20	5.6	-	-
25 W	13000 at -10	60 000 at -15	9.3	-	-
20	-	-	5.6	< 9.3	2.6
30	-	-	9.3	< 12.5	2.9
40	-	-	12.5	< 16.3	2.9 (0W-40, 5W-40, 10W-40)
40	-	-	12.5	< 16.3	3.7 (15W-40, 20W-40, 25W-40, 40)
50	-	-	16.3	< 21.9	3.7
60	-	-	21.9	< 26.1	3.7

Gear oils - except SAE J 306, 1998

Automotive Gear Lubricant Viscosity Classification			
SAE Viscosity Grade	**Max. Temperature for Viscosity of 150,000 cP (°C)** Using ASTM D2983 Additional low-temperature viscosity requirements may be appropriate for fluids intended for use in light-duty synchronized manual transmission	**Kinematic viscosity at 100 °C (cSt)** Using ASTM D445	
		min. Limit must also be met after testing in CEC L-45-T-93, Method C (20 hours)	**max.**
70W	5 55 The precision of ASTM D2983 has not been established for determinations made at temperatures below 5 40 °C. This fact should be taken into consideration in any producer-consumer relationship.	4.1	5
75W	5 40	4.1	5
80W	5 26	7.0	5
85W	5 12	11.0	5
80	5	7.0	< 11.0
85	5	11.0	< 13.5
90	5	13.5	< 24.0
140	5	24.0	< 41.0

250	5	41.0	5

The following points are important for the correct use of lubricating oils:

1. Kind and quality of oil
2. Capacities
3. Oil change intervals
4. SAE grade (viscosity)

1. Kind and quality of oil

Details on the specified type and quality of oil are included in Sheets 221.0, 223.1/.2 and 231.0 to 231.3.

The type and quality of oil are clearly stipulated by brand names. The designations on the lubricant containers must therefore accurately match the brand names approved by us.

2. Capacities

A distinction is to be made between the following terms depending on the purpose and timing of the oil fill:

2.1 initial fill quantity
2.2 filling capacity
2.3 topping-up quantity

2.1 **The initial fill quantity** is that oil quantity which is required to fill the empty and dry major assembly. It is always larger than the filling capacity which is normally specified.

2.2 **Filling capacity** is understood to mean the oil quantity which is required for the oil change. Because the oil change is included in the regular maintenance operations, only the filling capacities are always specified in the Specifications for Operating Fluids.

2.3 **Replenishment quantity** is the quantity which is required to supplement the oil consumed between the oil change intervals.

3. Oil change intervals

The quality of the lubricating oil is reduced in operation. The more difficult the operating conditions, the quicker the good properties of the oil are used up. It is therefore important that the oil remains in the major assembly as long as it still performs its lubrication task and carries out its other functions satisfactorily. For economic reasons, however, it is not too soon to be replaced for new oil.
The question "**which oil change interval is right**" cannot therefore be answered easily even with a precise knowledge of the operating conditions.

Reason: The quality changes of the oil due to operation can be accelerated or slowed down due to various factors with different effect.

Except for the quality and degree of alloying of the oil, the following factors are decisive for the oil change:

1	Design of engine	gasoline/diesel
		prechamber/direct injection
		naturally aspirated/supercharged
2	Specific capacity of engine oil circuit	
3	Oil load/temperatures	
4	Oil consumption and topping-up quantities	
5	Oil filter efficiency/maintenance	
6	Air cleaner efficiency/maintenance	
7	Operating conditions on	Urban traffic
		construction site
		long distance
8	Aggravating fuel characteristics	Sulfur content
		Components
		additives
9	Thinning by fuel	Boiling characteristics
		Final boiling point
10	Water/antifreeze compound	
11	Oil quality	
12	Oil viscosity/season	

As each of these factors alone and together with one or more can cause different effects, it is understandable why the question concerning the correct oil change interval cannot generally be answered.

Above all it is the operating conditions which necessitate different oil change intervals. In addition to this fuel quality plays a part. We therefore distinguish between oil change intervals for

- 3.1 Running-in period
- 3.2 Aggravated operating conditions
- 3.3 Normal operating conditions
- 3.4 Vehicle subject to low level of stress
- 3.7 Diesel fuel with increased sulfur content
- 3.9 Flexible Service System for commercial vehicles (Telligent)
- 3.10 Trucks fitted with longlife oil filter (code M 18)
- 3.12 Active Service System - ASSYST

In general at each oil change the filter element should also be replaced.

3.1 During the **break-in period** parts sliding on each other must run in and metal abrasion is therefore greater than after the break-in period. On some major assemblies therefore the oil is to be changed sooner than in subsequent operation (see Service documents).

On trucks, buses and vans there are different subdivisions of operating conditions on which the oil change intervals depend. Depending on the vehicle type, class or generation for example a distinction is made between maintenance categories I, II, or I, II, III or between aggravated operation, short-distance haulage and long-distance haulage.

With aggravated conditions the operating hours counter or engine maintenance counter delivers an exact measure for the engine oil change cycle given in distance d

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3.2 Many motor vehicles, especially commercial vehicles, are driven under **aggravated operating conditions**.
These mainly include:

Extremely short-distance traffic, very poor road conditions, all-wheel drive operation, high incidence of dust, construction site operation; operation of municipal vehicles, firefighting vehicles, taxis and doctor's vehicles, agricultural and forestry vehicles and more of the same.

With commercial vehicles a mileage of less than 10 000 km a year counts as aggravated operating conditions.

For cars a distinction is made between normal and aggravated operating conditions: under aggravated conditions the oil change intervals are to be reduced in accordance with the maintenance booklet.

The following applies as aggravated operating conditions on passenger cars:

, More than 50% short-distance traffic (less than 8 km per journey) in conjunction with a coolant temperature below 80 °C. This applies in particular for low outside temperatures.

, More than 50% of journeys in the lower gears in combination with high engine load (hill-climbing, towing a trailer, etc.).

3.3 Alternating town, country roads and expressway journeys are understood to be **normal operating conditions**. In this mode relatively long oil change intervals can be stipulated. The oil change interval for normal operating conditions is mostly specified in accordance with distances covered in kilometers (km).
The normal distances traveled for commercial vehicles are between 10,000 and 100,000 km in **maintenance category II** and over 100,000 km in **maintenance category III**.

3.4 On vehicles which only travel **short distances** in the course of a year, the oil change interval is not determined by distance traveled, operating hours, engine maintenance counter or fuel throughput, but rather by time. Depending on the vehicle model and type of use, the usual time periods for an oil change are twice a year, once a year or once every two years. The specifications in the respective maintenance booklet are decisive.

3.5 Maintenance categories for industrial engines

With industrial engines the three maintenance categories are determined on the one hand by operating time per year, on the other hand by the assignment to "aggravated operation", "normal operation" and "continuous operation".

3.6 Diesel fuel with high sulfur content

If the sulfur content of the diesel fuel is more than 0.3% by weight, then the oil change intervals must be halved, provided aggravated operating conditions do not exist in any case. If the sulfur content of the diesel fuel is above 0.8% by weight, then the oil change on all commercial vehicle and industrial engines must be carried out in accordance with maintenance category I as for aggravated operation, i.e. oil change intervals divided by three.

3.7 Used oil analysis for stipulating oil change intervals

Oil change intervals do not take place in accordance with a rigid system. They take place in accordance with distance traveled, operating hours or fuel flow rates as well as depending on operating conditions, fuel and oil quality. In addition we offer our Flexible Service System (Telligent). Here, engine and vehicle data, e.g. number of cold starts, oil temperatures and engine rpms, are also used to calculate the optimal use period for the engine oil.

To determine the specific intervals, field, test stand and laboratory studies as well as years of experience are required.

If our specifications are followed correctly, an oil change is not necessary prior to the stated period. For technical warranty reasons, it is not possible to extend the oil change intervals.

It is absolutely essential to adhere to the max. oil change intervals - even if used oil analyses are carried out.

3.7.1 Used oil analyses for early damage recognition by determining abrasion elements

Attempts for early damage recognition are based on determining abrasion elements, such as e.g. iron, copper, chromium, etc.

The Service Companies will encounter difficulties when evaluating such an analysis. Limits to be used are not only dependent on the analysis method used (often differs from laboratory to laboratory), but also on the type of engine used (knowledge of components necessary), on the oil change interval driven, on the type of oil, on the fuel and not least also on the operating conditions.

Such evaluation problems often lead to uncertainty or to improper responses.

It is also very important to take a proper sample. It has to be taken from the oil circuit when the engine is running. A sample taken from the oil sump often results in incorrect analyses as a result of the residues which are present in the sump.

Unfortunately for cost and capacity reasons it is not possible for us to take counter-samples. We also cannot issue any certificate of non-objection for investigation results not determined by us.

3.7.2 Used oil analyses as an aid to workshop practice

Used oil analyses may be sensible if they are needed to identify undesired components in the oil, such as fuel, water, glycol or sand/silicon.

It is possible to react at short notice and possible damage can also be avoided or rectified.

3.7.3 General recommendation

There is no good reason for regular used oil analyses (cost/benefit relationship). Due to oil analyses it is possible to shorten the oil change interval but not to extend it under any circumstances.

Observing our maintenance and care instructions as well as our Specifications for Operating Fluids can prevent damage from occurring and guarantees the long service life expected.

3.8 Controlled vehicles

For vehicles with three way catalytic converter, or with three way catalytic converter and oxygen sensor, the same oil recommendations apply (approved products, oil change intervals, etc.) as to vehicles without three way catalytic converter.

3.9 Commercial vehicles which are equipped with the **Flexible Service System (Telligent)** are not maintained in accordance with fixed maintenance intervals. The system determines the correct time for the service depending on the stress and for each major assembly separately. In particular it is **not** necessary to classify the vehicle in a particular "maintenance category" depending on the operating conditions.

Maintenance operations due are automatically announced on a display in the instrument panel; the vehicle owner decides which operations are to be completed combined with other operations. Alternatively the system can also provide a summary itself.

For the control unit of the Flexible Service System to operate correctly, the default setting of the oil quality (in accordance with sheet no. of this Specifications for Operating Fluids), the oil viscosity and fuel sulfur content in percentage by weight is required. For more detailed information on this, refer to operator's manual, service booklet and workshop literature.

3.10 Engine oil change interval in combination with MB longlife oil filters (code M18)

Via code M18, for the MK and SK including industrial engines, a long-life oil filter has been available for a long time for particular model designations/code combinations. This is an additional engine oil filter which is attached to the frame. The oil is additionally filtered in the bypass flow.

After the positive conclusion of detailed long-term trials, it is possible to redefine the interval for engine oil and filter change for vehicles fitted with a longlife oil filter: double interval in comparison to vehicles not fitted with this special equipment.

Account is also taken, as before, of the operating conditions (long-haul working, short-haul working, aggravated operation), the oil quality and the sulfur content of the fuel.

The filter element of the long-life oil filter is not longer changed at the inspection. However, the engine oil in the filter bowl must be replaced at the inspection.

i After changing the engine oil, run the engine at idle speed for about 10 minutes.

The stipulation also applies retroactively to vehicles which were equipped with code M18 at an earlier point in time. It goes without saying that it only applies to long-life oil filters approved and tested by us. The maintenance booklets and maintenance sheets have been revised accordingly. Vehicles with the Flexible Service System (FSS/code Y88) can of course be equipped with the long-life oil filter. As a result, they likewise achieve double the engine oil change intervals which are certainly determined depending on load here.

3.11 Installation of external bypass oil filters

Various companies have advertised intensely in recent times with the retrofitting of bypass flow oil filters and have stated that this makes it possible to dispense with changing the oil.

We should like to take this occasion to inform you on the possibilities and limitations of bypass flow oil filtering.

3.11.1 Approved MB longlife oil filter (code M 18) for MK / SK trucks

Primarily the interval extension is attributable to the significant increase in oil quantity with this special equipment. Above all the additional filter serves to increase the filter capacity.

3.11.2 The chemical/physical changes to the engine oil as well as their consequences

A modern engine oil consists of a highly-complex mixture of base stock and additives. Additives are oil-soluble agents for protection against scuffing and wear, for neutralization of acid combustion products and for the prevention of sludge and deposits to name but a few examples.

The additives reduce in continuous operation. The base stock also suffers under the engine's influences. This limits the service life of the engine oil. The performance limits are reflected in the specified oil change intervals.

General statements according to which oil change intervals can be extended beyond certain overall travel distances or even dispensed with when using external bypass oil filters, are not justifiable from a technical standpoint.

As the bypass oil filter can only filter dirt and abrasion out of the oil, the exhausted oil is not refreshed. The replenishment quantities due to oil consumption and filter change are not sufficient for refreshing the oil.

The most important negative effects when installing external bypass oil filters, linked with exceeding of the oil change intervals specified by us:

Effect	**Consequence**
Additives not refreshed	Engine oil exhausted
Reduction in dirt conveying capacity, increase in oil oxidation	Sludging, deposits, wear
Increase in content of iron and solid foreign bodies	Increased wear, increase in oil viscosity
Increase in oil viscosity and friction resistance	Increased fuel consumption, poorer cold starting performance
Reduction in neutralization capacity, formation of acids	Corrosion, wear, deposits

There are not any oil filers through which the oil quality in operation is improved.

3.11.3 External bypass oil filter and environmental protection

Manufacturers outside of MB frequently advertise their bypass oil filters with environmental protection. For this one should know:

, Used engine oil is not waste but a high-quality raw material. The used oil disposal in workshops and gas stations is organized and safeguarded so that the used engine oil can be added to recycling.

, The bypass filter manufacturers on the free market specify changing the filter elements frequently (as a rule every 10 000 km). Used oil filters are special waste and must be burnt under particular safety precautions and with comparatively high costs in a manner which has neutral effect on the environment.

, As a consequence of exhausted engine oil and engine wear, there is a deterioration in exhaust gas emissions, an increase in fuel consumption, a worse CO_2 balance and a reduced service life of the engine.

3.11.4 Costs when using a remote bypass oil filter

, No cost advantage due to installation costs and due to frequent filter change (procurement and disposal of the filter)

, Increased fuel costs due to increased viscosity and friction

, Shorter service life of the engine due to higher wear

, No warranty in the event of engine damage due to an external bypass oil filter

Alone the costs for the filter change, the installation and fuel consumption are higher than the savings which are possible with the engine oil.

3.11.5 Additional technical risks and warranty provisions

Bypass oil filters are not usually attached to the engine but to the chassis or body. Particular attention is to be paid to the connection between the engine and filter in the design layout, testing and assembly to avoid leaks (chafing, slipping, breakage, etc.). Defects can result in expensive engine damage due to oil loss, but also be a danger to traffic and pollute the environment due to the oil which runs out.

We must point out that damage which has a causal relationship with the installation of parts not approved by us as well as the resultant consequential damage and irregularities do not fall within our area of responsibility. Our company also does not take over any warranty for parts which do not originate from MB and which are retrofitted to our vehicles.

3.11.6 Advantages of Mercedes-Benz long-life oil filter

, Doubling of oil change intervals
, Filter change only in combination with oil change
, Service and warranty as a package
, Can be ordered from the plant, no idle times for retrofit
, Easy to retrofit and tried and tested
, Special equipment and retrofitting are competitive

3.12 ASSYST Active Service System

With a production breakpoint of February 1997 the previous maintenance system for passenger cars with rigid intervals was superseded by an **A**ctive **S**ervice **Syst**em named "ASSYST".

Beginning with the W 210 4-Matic in 02/97 and phased in on the remaining model series as of 06/97 (except G 463, 09/97) the introduction followed.

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i see also:

- Introduction into Service manual passenger cars model series 210 Innovations February/March 1997
- Video "Model series 210 Innovations model year 1997"
- WIS (microfilm) complete system description, GF00.20-P-0999AZ

With "ASSYST" service intervals up to 40,000 km or 2 years (min. 15,000 km or 1 year) are made possible for the first time at Mercedes-Benz. The system takes into account individually the driving style of the customer by evaluating engine speed, engine temperature, engine load and time. The timing of the service required is calculated and the due date is displayed to the customer in the instrument cluster.

3.13 Diesel particulate filter for passenger car diesel engines

The following information is also available in SI14.40-P-0001A dated September 15, 2003.

As of October 2003, 4-cylinder diesel engines will be available for the first time in a combination of the engine version EURO-4 standard as an option with a diesel particulate filter, CODE474. The Mercedes-Benz diesel particulate filter, also known in the press as a soot filter, enabl

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(diesel fuel injection, intake air throttling, exhaust gas recirculation and boost pr

Specified engine oil to be used is described in Sheet 229.31 "Low SPAsh":
For EURO-4 engines with a diesel particulate filter, a specific engine oil has been developed which when operated generates less combustion residue and thus safeguards the filter's high mileage life. In the event of an engine oil change vehicles with the filter (CODE 474) must use the engine oil as specified in Sheet 229.31. Following an oil change the vehicle - after having been filled with oil as specified in Sheet 229.31 - will have a startup distance of 15,000 km. Oil refilling by the customer with oils as under Sheets 229.3 and 229.5 is possible.
Part number for the 1 liter container "Low SPAsh" engine oil":
A000 989 89 01 10

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4. SAE grade (viscosity)

The SAE grades refer to the viscosity of the lubricating oils. The SAE class indicates the viscosity at low and high temperatures Viscosity is of importance at low temperatures for cold-starting and at high temperatures for adequate lubricating properties at full load or at high speeds. It is therefore important to pay attention to the SAE grades specified on Sheets 224.1/224.2 and 231.1/.2/.3.

The brochure "Standard Lubricants for Construction Machinery and Construction Vehicles" is published by the Hauptverband der Deutschen Bauindustrie e. V., Wiesbaden (printers: Bauverlag GmbH, Wiesbaden and Berlin) and is available in book stores (ISBN-3-7625-31-02-1).

The decisive factor for the use of operating fluids in Mercedes-Benz vehicles **is the approval**
wit
h the name of the product being mentioned **in the valid issue of the MB Specifications for Operating Fluids.**

i The comparison table presented
belo
w
is intended only for information.

	Sheet of MB Specifications for Operating Fluids		**Standard lubricant abbreviated designation**
Engine oils	Sheet 227.0 (single-grade engine oils for commercial vehicle diesel engines if oils of 228.0/.1/.2/.3 are not available)	SAE 10W	EO 10
		SAE 20W-20	EO 20
		SAE 30	EO 30
		SAE 40	EO 40
	Sheet 227.1 (Multigrade engine oils for commercial vehicle diesel engines if oils of 228.0/.1/.2/.3 are not available - not for spark ignition engines)	SAE 5W-40	EO 0540 A and B
		SAE 10W-40	EO 1040 A and B
		SAE 15W-40	EO 1540 A and B
	Sheet 228.3/.5 (Multigrade engine oils for commercial vehicles)	SAE 5W-40	EO 0540 C
		SAE 10W-40	EO 1040 C
		SAE 15W-40	EO 1540 C
	Sheet 229.1 (Multigrade engine oils for spark ignition engines)	SAE 5W-40	EO 0540 D
		SAE 5W-50	EO 0550 D
		SAE 10W-40	EO 1040 D
Gear oils	Sheet 235.0 (rear a x le gear oils)		GO 90
	Sheet 235.1 (CV manual transmission oils)		GO 80
	Sheet 236.1/.5/.6/.7/.8/.9		ATF
Greases	Sheet 267.0 (multipurpose greases)		MPG-A
	Sheet 266.2 (MoS2 greases)		MPG-D
	Sheet 264.0 (viscous greases)		MPG-G
Anticorrosion/antifreeze protection	Sheet 325.0 (all engines)		SP-C
	Sheet 325.2 (not for car engines)		SP-C

For the operation of motor vehicles and engines, only blended oils are approved. These lubricants are made from selected base oils (on a mineral, partially or fully synthetic basis) by adding oil-soluble chemical additions (additives) and therefore have, in addition to a high lubricating effect, all the characteristics which a good lubricant is expected to have, such as protection against wear, protection against corrosion, pressure absorption capacity, dispersion capacity and washing effect, resistance to aging, foam prevention, cold-flow capacity and many others.

During the production of lubricants, the formulation, concentration and combination of the additives must be adapted to each other and to the base oil in such a manner th

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However, motorists are always offered additives which are said to improve the effectiveness of the tested, conventional lubricants approved by us. For better differentiation, we refer to such additives as **specific additives.** These specific additives may be oil-soluble or non-soluble in oil.

After the composition of the lubricants approved by us has been established on a basis of extensive research and tests, it is by no means up to the consumer to change the character of such lubricants later on. This, however, would be done by the addition of specific additives.

Practical experience has shown that the consumer is rarely able to recognize and evaluate a specific additive from personal experience, both with regard to its effect and whether the additive will partially or completely cancel given qualities of the lubricant.

Straight (non-blended) oils can be improved by specific additives. But since we exclusively approve and recommend blended lubricants, there is **not the slightest reason for adding specific additives.**

It is therefore an obvious conclusion that we do not approve the use of specific additives for our vehicles and engines, since they will not provide any improvement during operation and will only cause unnecessary additional cost.

Specific additives not soluble in oil, so-called solid lubricants, are mainly products on a molybdenum disulfide or graphite base. The use of such specific additives in er

The check as to whether a specific additive that is not soluble in oil meets these demands is not easily done. Controlled road tests are necessary, but we do not run such tests. As we see no necessity for adding specific additives that are not soluble in oil, and the possibility of confusion can never be excluded, we recommend not to use specific additives insoluble in oil even in engines without turbocharger and without catalytic converter.

But we definitely do **not approve** of the use of specific additives which are not soluble in oil in certain components, particularly in automatic transmissions, synchromesh transmissions and limited-slip differentials. These components establish positive connections which will remain effective only if the frictional value is not changed by the addition of some friction reducer or other (molybdenum disulfide or graphite).

The oils approved by us for the rear axle and the steering system meet all pertinent demands, so that any addition of specific additives for these components is not required.

Specific additives on a polytetrafluoroethylene (PTFE) basis which, according to the manufacturer, are expected to form layers on sliding contact surfaces, are also re je cted by us, since the possibility of damage cannot be excluded.

The application of specific additives is always at the risk of the operator of the vehicle, since their use may impair the warranty issued both by the manufacturer of the vehicle and the supplier of the lubricant.

The use of specific additives should never result in an extension of the specified oil change intervals or altering of other specifications.

Constant developments in combustion engines demand that engine oil too keeps pace with the technical status at any given time of the engines both in terms of its prope

The basic requirements placed on engine oils are listed verbally in the following list and in th e for

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Area I: Friction and wear

1. Friction reduction
2. Fuel consumption reduction
3. Protection against wear
4. Oil film tensile strength
5. No surface damage (pitting)
6. Preservation of honing pattern
7. Matching additive reaction temperature
8. Neutralization capacity
9. Adhesive force

Range II: temperature and viscosity

10. Thermal stability
11. Oxidation resistance
12. Nitration resistance
13. High-temperature viscosity (shear rate, pressure)
14. Low-temperature viscosity (overflow, pumpability, continuous flow, no air inclusion)
15. Low temperature-dependent viscosity change
16. Viscosity stability (mechanical, thermal, oxidative)

Range III: purity

17. Dispersing power
18. Detergent effect
19. No ring riding/no ring sticking
20. Prevention of hot sludge
21. Prevention of cold sludge
22. Prevention of paint
23. Resistance to water
24. Resistance to anticorrosion/antifreeze agents

Range IV: no residues

25. No deposits on intake valves
26. No residue build up in combustion chamber
27. No glow ignition
28. No deposits in area of turbochargers

Range V: oil/engine components

29. Corrosion protection
30. Compatibility with metals and paints
31. Compatibility with elastomers (seals)
32. Compatibility with filter materials
33. No plugging of filters
34. Thermal conductivity/cooling effect
35. Sealing capability

Range VI: Base stock/additives

36. Solubility of additives
37. Homogeneity
38. No filtering out of additives
39. No heat development
40. Foaming prevention
41. Air output capacity
42. Low volatility/vaporization trend

Range VII: application

43. Fuel consideration
44. Miscibility/compatibility
45. Running-in characteristics
46. Large change intervals
47. Applicability in different types of engine (manual transmissions, hydraulic systems)
48. Constant quality
49. Inexpensive ease of manufacture
50. Availability
51. Storage life

Area VIII: Environment

52. No negative effects on health and environment
53. No negative effects on the exhaust gas aftertreatment systems
54. Does not contribute to particulates
55. Does not emit odors
56. No disadvantages when disposing off and recycling

Explanations on the individual items in the areas
Area I - Friction and wear

1. Friction reduction
As with every lubricating oil, engine oil is obviously intended to prevent friction as far as is possible. A low engine friction horsepower contributes to improving efficiency; the output generated by the engine should primarily be available to propel the vehicle.

2. Fuel consumption reduction
Because the saving of energy has become the main focus of interest, engine oils must thus also play their part in helping to further reduce fuel consumption levels. A fuel consumption saving is possible, in particular during the warm up period, i.e. in the time between the cold start and reaching operating temperature.
Th
rough the choice of suitable additives it is now possible to exert a positive influence on friction-related conditions.

In the development and application of such oils, which are to be welcomed in principle, attention must however be paid to the fact that no disadvantages of any kind whatsoever arise, in particular in relation to the engine's service life.
Wit
h regard to the individual car driver, the fleet owner and the national economy these oils must of course realize both financial and energy-related advantages. On no account should the fuel-consumption level rise.

3. Protection against wear
In order to ensure that an engine achieves as high a mileage as possible without sufferi

4. Oil film tensile strength
Even under the greatest of loads and at the highest of temperatures the oil film, e.g. between the piston ring and cylinder contact surface, must not break down, because direct metallic contact can lead to "seizure" and thus to a total loss.

5. No surface damage (pitting)
Th
e engine oils must protect all components from any surface damage and should not cause any such damage themselves.
Thi
s applies in particular to pittings on tappets, which can lead to damaging the cams.
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6. Preservation of honing pattern
A well preserved honing pattern on the cylinder contact surface is essential for ensuring a controlled oil consumption.
For this reason "bore polishing" or "deposits" must not occur.
Thi
s is absolutely essential if a long service life is to be achieved.

7. Matching additive reaction temperature
Th
e oil additives used for protection against wear do not achieve this solely on account of their presence, but rather through a chemical reaction on the surface of the components.

Th
erefore, one has to make sure that the reaction temperatures of the additives match those operating temperatures (and pressures), e. g. that are prevalent on the cams.

8. Neutralization capacity
Gasoline fuels and, in particular, diesel fuels contain sulfur. During combustion of this sulfur content the fuel may give off sulfurous acids or sulfuric acid together with combustion water.
Thi
s must on no account take place, and therefore such acids must always be immediately neutralized.

Engine oil must also be alkaline; this alkalinity is partially reduced during the neutralization process, however a certain residual alkalinity must be retained until the next oil change is due.

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9. Adhesive force
If the engine is switched off during full-load operation at a high temperature, a residual oil film must remain at the lubricating point, so that a subsequent start-off in a cold condition does not lead to damage as a result of "running dry".

Area II - Temperature and viscosity

10. Thermal stability
Engine oil must exhibit thermal stability at whatever temperature; it must not alter in an unfavorable way.

11. Oxidation stability
Because oxygen is always present as a result of the high temperatures in the engine compartment, the oil must be oxidation resistant; it must not lose its advantageous properties and not form any natural oil oxidation products or residue.
Thi
s would lead to a rise in the oil's acidity level and to the oil thickening.
Thi
ckening oil causes problems when cold-starting and increases the fuel-consumption level.

12. Nitration resistance
During combustion, nitrogen oxide is formed, which acts upon the oil together with the blow-by gases.
Thi
s in turn can lead to a nitration with subsequent sludge formation. Ever since the arrival of the "oil-sludge problems" one is aware of how important nitration resistance is.
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13. High-temperature viscosity

To preserve the minimum lubricating film that is absolutely essential at high loads, it is necessary to have sufficient viscosity during these high temperatures.

When specifying this minimum viscosity the factors of shear rate and pressure conditions that are prevalent at the lubricating points must also be taken into account alongside that of temperature

14. Low-temperature viscosity

Engine oil is called upon to play a vital contribution when starting and warming up the engine at low temperatures. In this context several, independent of each other, procedures must be heeded.

First of all, the oil's internal friction must not be too large, so that the crankshaft and the other engine components can break free and rotate or move. The oil must be pum

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15. Low temperature-dependent viscosity change

The viscosity specifications at high and low temperatures, which directly oppose the physical characteristics of the oil, result from the necessity to keep the temperature-dependent viscosity changes as few as possible. Engine oils should be able to be used regardless of the particular season of the year and the outside temperature.

16. Viscosity stability

Multigrade oils are capable of fulfilling the low temperature-dependent viscosity changes. If however, these are produced with viscosity index improvers, then care should be taken to ensure that these exhibit mechanical, thermal and oxidative shear resistance.

This means that the viscosity of fresh oil should be retained for as long as possible and should not be depleted before the scheduled oil change interval is reached.

Area III - Cleanliness

17. Dispersing power

The insoluble oil residue which is generated during the combustion process and the natural oil residue have to be dispersed and suspended; they must not coagulate and deposit themselves on the engine components, this applies to both particularly hot and cold positions.

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18. Detergent effect

Engine oil must be capable of "washing away" previously deposited sediments to a certain extent and thus achieve a cleansing effect.

19. No ring riding/no ring sticking

Combustion and oil residue, which cannot be borne by the oil, tends to deposit itself in the piston ring grooves, because this is where extremely high temperatures occur. Here however, the piston rings which play a significant role in the engine's operation, can be impaired in their tasks.

The piston rings must be free to move at all times.

Deposits on the base of the ring groove or on the back of the ring must not be so strong that the ring tends to "ride"; deposits on the ring or groove sides must not cause ring sticking to occur. Riding or sticking rings lead to a power loss, increased oil consumption, ring/cylinder scuffing and to engine failure as a result.

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20. Prevention of hot sludge

The formation of sludge should also be prevented at the highest occurring temperatures under all conditions. In particular this should be observed for diesel fuel engines. If the oil pump is forced to breathe in sludge the lubrication of the engine (oil supply/protection against wear) can no longer be guaranteed.

Beyond this, sludge is not only a blemish, it also hampers any maintenance work to be conducted on the engine, as well as draining oil and carrying out an oil-level check.

21. Prevention of cold sludge

Applies mainly to gasoline engines, but diesel engines that are frequently driven over short distances are also affected and therefore it is necessary that the formation of cold sludge is prevented. Its formation is greatly favored by the presence of condensed water and fuel residue as well as any failure to reach the regular operating temperature.

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22. Prevention of paint
Paint, which primarily occurs in gasoline engines after running at high temperatures is also to be prevented where possible.

Paint coats, that exceed specific limits, will impair the operation of engine components. Paint also hampers the heat transfer, heat dissipation is poorer and excessive temperatures are the result.

23. Resistance to water
Condensed water can form at any time and anywhere and succeed in entering the engine oil.
Thi
s must not be impaired in its quality and function in any way.

24. Resistance to antifreeze with corrosion inhibitor
Coolant (water and antifreeze with corrosion inhibitor) occurs only rarely in engine oil, however in the
ma
jo
rity of such cases this can ruin the engine oil and cause sludge to be formed in the engine.

A greater resistance of the engine oil to water and antifreeze with corrosion inhibitor is highly desirable.

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28. No deposits in area of turbochargers
Extremely high temperatures can occur close to turbochargers, particularly after switching off the engine. Here and in the entire charge-air cooling system there should be no formation of deposits.

Area V - Oils/engine components

29. Corrosion protection
All metallic engine components must be reliably protected against corrosion, this must also include long service life periods.
Thi
s requirement applies to all engine oils, in particular of course for running-in engine oils.

30. Compatibility with metals and paints
It goes without saying that engine oils must be compatible with all the various metals that are present in the engine construction and that they are in no way impaired.
Th
ere have however been no problems in this area for a long time.

Th
e engine oil must also be absolutely compatible with all paints used for the body paintwork, i. e., such paints must not be impaired in any way. Occasionally engine components are also painted on the inside, e. g. the crankcase.
Th
ese paints too must not be aggravated in any way by the engine oil.

Area IV - No residue

25. No deposits on intake valves
Deposits on intake valves cause engines, that in terms of emissions and fuel consumption are ideally set, to malfunction during operation, particularly during the warm-up phase. Although fuel does indeed exert an essential influence it is important to ensure that the engine oil formula does not enable the oil to contribute in any way to the formation of deposits

26. No residue formation in combustion chamber
A certain minimum amount of engine oil is also burnt in the combustion chamber, this must not however generate any residue or deposits.
In direct-
inj
ection diesel engines the distances between the underside of the valve disk and the top of the piston base is extremely small at specific crankshaft positions. On no account may contact take place as a consequence of any residue or deposits.

27. No glow ignition
Wh
en residue is formed in the combustion chamber of a gasoline engine, it can have an affect similar to a glow plug and cause advance ignition and piston scorching.
Thi
s must be prevented.
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31. Compatibility with elastomers (seals)
Similar requirements regarding compatibility with the elastomers (seals) are also essent

32. Compatibility with filter materials
Primary and bypass filters or their inserts are made of different materials, e. g. high-grade paper or stuffed cotton. Engine oil must be compatible with all these different materials and provide a trouble-free filtration.

33. No plugging of filters
Naturally, the engine oil itself, and in particular the additives in it, must not lead to the filter being plugged up (increase in differential pressure).

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34. Thermal conductivity/cooling effect
It is the task of engine oil to cool the engine components which are the most highly stressed from a temperature point of view, i.e. to dissipate the heat. Obviously the temperature level in the engine is highly dependent on the engine design and operating conditions. Only when the component and oil temperatures do not exceed a reasonable value, is it possible to guarantee a long service life for the engine.
To this end the engine oil must fulfill its role as a heat-transfer oil.

35. Sealing capability
Where possible a complete and faultless sealing between the combustion chamber and the engine compartment is a significant precondition for ensuring high degree of engine efficiency. Engine oil must support the piston rings in this task.

Area VI - Basic oils/additives

36. Solubility of additives
All additives used in the production of engine oil must be capable of being completely dissolved in the basic oil and remaining so.

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37. Homogeneity
The engine oil must be absolutely homogeneous, even if stored in large containers over a longer period of time and if it has been refilled frequently.

38. No filtering out of additives
Several of the previously mentioned points make it inevitable that the applied additive may not be filtered out.

39. No heat development
The additives do not work solely on account of their presence, but rather their chemical conversion. As little heat as possible should be generated by this process.

40. Foaming prevention
Oil is subjected to very turbulent motion in the crankcase; this gives rise to the possibility of air intake, particularly at very high engine speeds. However, this air intake must be as low as possible in order to prevent any substantial foaming. Oil foam can naturally not form the required lubricating film; as a result wear damage occurs. Similarly, the hydraulic valve-clearance compensation is also impaired, with the result that undesirable noise is heard when the gas content is too high.
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41. Air output capacity
However if foam has already formed, the entrained air must be released again immediately, i.e. the entrained air must not be retained.

42. Low volatility/vaporization trend
All combustion engines have a certain degree of oil consumption. As a result the necessity to top up with fresh oil also represents an advantage in terms of the qualitative

Area VII - Application

43. Fuel consideration
Fuel exerts a greater influence on the engine oil than was previously assumed.
This is not just a matter of the different levels of sulfur content in diesel and gasoline fuels. Unfavorable, poorly combustible diesel fuel qualities pollute the engine oil to a major extent with combustion residue.

Nonburned fuel residue reduces the viscosity of the oil. Fuel additives can impair the function of oil additives. Nonburned fuel additives make their way into the engine oil.

Other fuels, such as methanol or plant oil methyl ester can demand modified engine oils. Flexible engines that have been designed to cope with several types of fuel, should also be supplied with corresponding engine oils, that are suitable for all kinds of fuel and mixtures.
The suitability of engine oils must be checked completely for all alternative fuels.

44. Miscibility/compatibility
Engine oils, even if from various producers and different SAE areas, must be mixable and absolutely compatible.
This also applies to all products that are intended for the same purpose, regardless of whether they, e.g. are based on synthetic or mineral basic oils. Decisive is whether the mixture fulfills all the tasks placed on the engine oil in every mixture ratio. A reference to miscibility on its own is therefore not sufficient.

However its is also obvious that mixtures cannot always be as good as non-mixed oils with regard to all the criteria. Certain losses in terms of viscosity temperature behavior and performance cannot be ruled out.

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45. Running-in characteristics
Th
ose engine oils that are used for new or reconditioned engines must, alongside their other tasks, also accelerate the running-in characteristic or at least make it possible.

46. Large change intervals
Oil changes not only cost time and money, but also represent a
ma
jo
r organizational task where large fleets are concerned. During the necessary stand-down times the vehicle is not capable of fulfilling its transportation tasks. For this reason, there is now a call for engine oil to not only fully fulfill all of its tasks when new or after only a few thousand driven kilometers, but for it to also do so over as long a period of operation as possible. A "lifetime filling" however still remains an illusion.

47. Applicability in different types of engine (manual transmissions, hydraulic systems)
Th
e idea of developing an optimum oil for each different kind of engine, is only a positive notion at first glance, this applies even to running-in oils. It is much more appropriate, to cater for as many of the various types of engine on the market with as few engine oil versions as possible and to do so not only adequately, but also without any associated problems.

With the great diversity of motor vehicles, resulting from the different requirements plac

In addition to their use in engines there are certain cases where there is also need to use engine oils in manual transmission and hydraulic systems.

48. Constant quality
It is not enough if the demands posed can only be fulfilled by samples manufactured un
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49. Inexpensive manufacturability
Th
e optimum engine oil formulation must also undergo inspection as to whether it can indeed be manufactured inexpensively.
Th
ere must be an appropriate relationship between price and quality.

50. Availability
Excellent engine oils must of course be available wherever there is a demand for them.

51. Storage life
On the condition that storage has taken place properly, i.e. good container, no ingress of contaminants and water, practically unlimited shelf life is to be claimed.

Area VIII - Environment

52. No negative effects on health and environment
The environment is naturally a factor of major importance. With regard to manufacture, application a

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53. No negative effects on the exhaust gas aftertreatment systems

(particulate trap, three way catalytic converter and Lambda probe)
A gasoline engine with a lambda probe and a three-way catalytic converter is ideally eq

54. No contribution to particulates
Further developments in diesel engines are geared towards
ma
jo
r efforts being undertaken to ensure that the level of particulates is significantly reduced. Because a significant portion of these particulates originates from oil, oil-consumption levels have been successfully cut back in recent years. However, the basic oil components and additives still require to be analyzed and optimized in terms of bringing about further particulate reductions.

55. Does not emit odors
Engine oils must not emit any unpleasant odors even at high temperatures. In this context, consideration should be given to drivers and passengers as well as the people who work in factories, workshops and warehouses.
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56. No disadvantages when disposing off and recycling

Until such time as lifetime oil is available oil will always need to be changed. Naturally, it is sensible to drain off this oil, collect it and to convey it to a reputable recycling plant. Right back at the initial conception of the engine oil, consideration must be given to ensuring that no problems will arise later on when it needs to be disposed off or recycled.

Summary:

Put simply, there should be no wear, no deposits, and the engine should remain as "new" for as long as possible.

Engine-oil tests

For the evaluation of engine oil quality there are both absolute dimensional units and comparative assessments and judgments. The fastest and most economical method of a series of test methods.

Th
e following test equipment is used in the appraisal of engine oils:

- testing machines with simple components
- test sets for inspecting oil on individual engine components
- single-cylinder engines on test rig
- multiple-cylinder engines on test rig
- engines in operation.

Because of the fact that these test methods differ significantly in outlay, the tests are conducted as each situation demands.

Wit
h regard to the overall assessment of an engine oil various countries and many different institutions have compiled specifications comprising

Th
e best known internationally are the classifications of the American Petroleum Institute (API, information on the Internet under www.api.org), as well as the test sequences of the European automotive manufacturers ACEA (ACEA = Association des Constructeurs Europeéns de L#Automobile; information on the internet under www.acea.be).
Th
e ACEA test sequences were presented for the first time in December 1995. As of January 1st 1996, these ACEA test sequences replaced the CCMC test sequences valid until then.

In the Mercedes-Benz engine oil specifications listed on the following pages the ACEA test sequences are taken into account as basic requirements. However, to some extent our requirements for modern engine oils in the Mercedes-Benz engine oil specifications go significantly beyond the requirements in the ACEA test sequences.

Due to the needs of current and future production engines, such as extension of oil cha

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Running-in engine oils

Running-in engine oils are suitable for running in and continued operation of engines beyond the prescribed maximum mileage or service life.
Th
ey are likewise used for function test and preservation of engines.

They are charged with the task of exerting a favorable influence on the engine's running-in process.

Sheet 225.0 (single-grade oils SAE 30) and
Sheet 225.1 (multigrade oils SAE 15W-30)

These break-in engine oils are suitable for passenger car and commercial vehicle engi
(For application refer also to Sheet 223.1).

Sheet 225.5 (multigrade oils SAE 15W-40)

These running-in engine oils have been approved for diesel engines model 300, model

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Sheet 225.6 (multigrade oils SAE 10W-40 and SAE 5W-30)
Th
ese break-in oils are released for diesel engines BR 300, BR 400, BR 500, BR 600, BR 900 for oil distances up to a maximum of 100.000 km (vehicle-dependent, corresponding to the maintenance booklet) and oil running times up to a maximum of 2000 h. (for use, see also Sheet 223.1)

Sheet 225.7 (multigrade oils SAE 15W-40)
These break-in engine oils have been approved for diesel engines model 100, model 600 for oil distan

Sheet 225.8 (multigrade oils SAE 10W-40)
These break-in oils are approved for certain engines of model100, model 200, model 600 (see Sheet 22

Th
ese oils are not approved for commercial vehicle engines (models 300, 400, 500 and 900) - these receive the oils on Sheet 225.6. (For application refer also to Sheet 223.1).
Additional information on Low SPAsh oils is available in Sheet 229.31.

In all cases, the oil change specifications, as specified in the maintenance booklet for the respective vehicle, apply.

Th
e most important requirements which we stipulate for a Mercedes-Benz approval of break-in oils can be seen in the summary table below " Mercedes-Benz specifications for engine oils (factory fill) V2003.1".
Th
e specification Sheet 225.11 is new (break-in oils with low sulfur content (low sulfur), low phosphorus content (low phosphorus) and low content of ash-forming components (low ash).

Sheet 225.10 (multigrade oils SAE 5W-30)
Th
ese low-friction break-in oils (for definition of low-friction oils, see Sheet 222.0) are only approved for the engines M 112, M 113, M 271, OM 611, OM 612, OM 613, OM 646, OM 647, OM 648, OM 664, OM 665 and OM 668.
Th
ey are not approved for engines M 111, M 137, M 160, M 166, M 275, OM 628, nor commercial vehicle engines OM 611 and OM 612 - these still contain oils from Sheet 225.8. Smart diesel OM 660 and AMG engines will continue to receive oils according to DBL 6674.31.

Th
ese oils are likewise not approved for commercial vehicle engines (models 300, 400, 500 and 900) - these receive the oils on Sheet 225.6. (For application refer also to Sheet 223.1).

Sheet 225.11 (multigrade oils SAE 5W-30) with low sulfur content, low phosphor content and low content of ash-forming components - "Low SPAsh oils"
Th
ese "Low SPAsh" break-in oils (for definition of low-friction oils, see Sheet 222.0) are initially only approved for model 600 EU4 passenger car diesel engines or cars which are equipped with diesel particulate filters. (For application refer also to Sheet 223.1).

Th
ese break-in oils are initially only planned for EU4 passenger car diesel engines or for vehicles which are equipped with a diesel particulate filter.

Mercedes-Benz specifications for engine oils (factory fill) V2002.2
oil requirements for initial fill oils

Mono/multigrade **MB working title** **SAE**	Name	=	**MB Sheet No.**							
			226.9 Multi 15 W -40 W	**225.0/.1** Mono/ Multi **Albatross** 30/ 15 W -30	**225.5** Mono/ Multi **Sirius** 15 W -40	**225.6** Multi **Topas** 10 W -40/ 5 -30	**225.7** Multi **Agate** 15 W -40	**225.8** Multi **Sapphire** 10 -40	**225.10 a.)** Multi **Diamond** 5 -30	**225.11 a.)** Multi **Opal** 5 -30
Application in engines **(see also Sheet 223.1)**	BR		CNG 300, 400 500, 900	(100, 600)	300, 400	300, 400, 500, 900, (600)	(100, 600)	100, 600	(100, 200, 600) see sheet 223.1 !	(600) see sheet 223.1 !

MB Read Across (based on ATC, ATIEL)	RA		no	no	no	no	yes o.)	yes o.)	yes o.)	yes o.)
Prescribed Additive Package	yes/no		no	yes	yes	no	yes	no	no	no
Additive packed to be used			5	3.9% Oloa 4659	14% LZ 3997	5	14.2% LZ 8885	14.2% LZ 8885	5	5
Possible base stock acc. ATIEL	MODEL		5	I	I	I, III, IV, V	I	I, III, IV, V	I, III, IV, V	II, III, IV, V
ACEA - only MB tests m.)		?	(A2-96)			B2-98 E4-99	A2-96	A2-96 A3-02	A3-02	A3-02
see ACEA 2002 European Oil Sequence		?	(E2-96) i.)			(E5-02) m.)	B2-98	B2-98 B3-98	B3-98 B4-02	B3-98 B4-02
Laboratory Tests										
Sulfated Ash	% b.w.	>	1.00	1.80	2.00	2.00	1.50	1.50	1.50	**0.80**
T BN (ISO 3771, fresh oil)	mgKOH/g	?	5	5	5	5	5	5	5	6.0
Pour point	°C	>	*/-27	*/-27	*/-27	-27	-27	-27	-36	-36
Evaporative Loss (CEC L-40-A-93, Noack)	%	>	13.0	13.0	13.0	13.0	13.0	13.0	10.0	12.0
Viscosity @high temp./high shear rate CEC L-36-A-97	mPa*s	>	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Sulfur	% b.w.	>	5	5	5	5	5	5	0.5	**0.20**
Phosphorus	% b.w.	>	5	5	5	5	5	5	0.11	**0,08**
Chlorine	% b.w.	>	5	5	5	5	5	5	0.005	0.0050
DBL	DBL		6610	6774	6674.00	6674.2 ff.	6674.10	6674	6674	6674
Elastomer Compatibility b.)	DBL		Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Engine Tests (x = number of tests for Package Pass)						acc. 228.5		acc. 229.1	acc. 229.5	acc. 229.31
M 111 (CEC L-53-T-95) c.)			x i.)					x	x	x l.)
Engine sludge avg.	merit	?	RHD 140+ 2 l	5	5	5	5	RHD 140+ 2 l	8.00 (a. 439h)	RHD 140+ 3 l
Cam wear avg.	Cm	>	5.0	5	5	5	5	5.0	5.0 (a. 439h)	3
M 111 (CEC L-54-T-96)										X
Fuel economy improvement vs. RHD 191	%	>	5	5	5	5	5	5	1.7	1.00
OM 611 DE22LA (MB DL, 300 h) c.) q.)						x q.)		x q.)	x q.)	x q.)
Piston cleanliness (avg. 4 pistons)	merit	?	5	5	5	27.0	5	23.0	27.0	25.00
Ring sticking	yes/no	>	5	5	5	no (ASF > 2.5)	5	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)
Engine sludge avg.	merit	?	5	5	5	9.00	5	8.00	9.00	8.50
Viscosity increase at 100 °C p.) - target value	%	>	5	5	5	90	5	100.0	90	100.00
Oil consumption p.) q.) - target value	g/test	>	5	5	5	6000	5	6000.0	6000	6000.00
Bore polishing (13 mm) - max. value of 4 cyl.	%	>	5	5	5	3.0	5	4.0	3.0	3.50
T iming chain wear (elongation) p.) - target value	%	>	5	5	5	0.4	5	0.4	0.4	0.40
Cylinder wear (avg. 4 cylinder)	Cm	>	5	5	5	5.2	5	7.0	5.2	7.0
Cam wear, inlet/outlet valve (avg. max. wear 8 cams)	Cm	>	5	5	5	121.8/ 139.2	5	139.2/ 156.6	121.8/ 139.2	139.2/ 156.6
Bearing wear, main/con rod bearing e.)	Cm	>	5	5	5	2.1/2.1	5	2.1/2.1	2.1/2.1	2.1/2.1
Piston ring wear axial @ ring 1/ ring 2/ ring 3 e.)	Cm	>	5	5	5	8.7/2.8/ 2.4	5	10.4/4.2/ 2.4	8.7/2.8/ 2.4	10.4/4.2/ 2.4
Piston ring wear radial @ ring 1/ ring 2/ ring 3 e.	Cm	>	5	5	5	5.6/8.4/ 8.0	5	5.6/8.4/ 8.0	5.6/8.4/ 8.0	5.6/8.4/ 8.0

OM 602 A (CEC L-51-A-98) c.) k.)						x		x	x	x
Piston cleanliness (no ring sticking)	merit	?	5	5	5	26.0	5	20.0	26.0	24.0
Bore polishing (13 mm)	%	>	5	5	5	3.0	5	7.0	3.0	4.5
Cylinder wear avg. new/old	Cm	>	5	5	5	15.0/10.0	5	20.0/12.0	15.0/10.0	15.0/10.0
Cam wear avg. new/old	Cm	>	5	5	5	45.0/28.0	5	50.0/30.0	45.0/28.0	45.0/28.0
Oil consumption	kg/test	>	5	5	5	10.0	5	10.0	10.0	10.0
Viscosity increase at 40 °C	%	>	5	5	5	60.0	5	90.0	60.0	70.0
Engine sludge avg.	merit	?	5	5	5	9.00	5	8.80	9.00	8.90
VW TDI (CEC L-78-T-97) or (CEC L-78-T-99)									x	x
ACEA B4-02	Pass		5	5	5	5	5	5	yes	yes
VW PV 1449									x	x
V W 502.00 or PV 1449	Pass		5	5	5	5	5	5	yes	yes
DC tests for 225.10 or maintenance 2000 a.) Bench Tests at DC							x	x	x	x
M 111 E23	Pass		5	5	5	5	no	no	yes	no
(T est rig Snail program PSP)										
OM 611 DE 22LA (12 point DL)	Pass		5	5	5	5	no	no	no q.)	no
M 112 E32 (12 point DL)	Pass		5	5	5	5	no	no	yes	no
M 113 E43 (12 point DL)	Pass		5	5	5	5	no	no	yes	no
M 111 00E23 ML (40 point DL)	Pass		5	5	5	5	no	no	yes	no
Field Test (S: Snail, B: Barracuda)										
S: 1x A 140; 1x E 430	Pass		5	5	5	5	no	no	yes	no
B: 1x E 220 CDI 99; 1x A 170 CDI; 1x ML 320	Pass		5	5	5	5	no	no	yes	no
OM 364 LA (CEC L-42-T-99) c.) f.)						x				
Piston cleanliness	merit	?	5	5	5	50.0	5	5	5	5
Bore polishing	%	>	5	5	5	0.5	5	5	5	5
Cylinder wear avg.	Cm	>	5	5	5	2.5	5	5	5	5
Engine sludge avg.	merit	?	5	5	5	9.60	5	5	5	5
Oil consumption	kg/test	>	5	5	5	10.0	5	5	5	5
OM 364 A (CEC L-42-A-92) c.) f.)			x i.)							
Piston cleanliness	merit	?	31,0	5	5	5	5	5	5	5
Bore polishing e.)	%	>	8.0	5	5	5	5	5	5	5
Cylinder wear avg. e.)	Cm	>	7.0	5	5	5	5	5	5	5
Engine sludge avg.	merit	?	9.00	5	5	5	5	5	5	5
Oil consumption	kg/test	>	18.0	5	5	5	5	5	5	5
OM 441 LA Euro II (CEC L-52-T-97) c.) f.)						x d.)				
Engine sludge avg.	merit	?	5	5	5	9.00	5	5	5	5
Piston cleanliness	merit	?	5	5	5	40.0	5	5	5	5
General engine deposits	demerit	>	5	5	5	3.0	5	5	5	5
W ear rating avg.	demerit	>	5	5	5	2.5	5	5	5	5
Bore polishing	%	>	5	5	5	2.0	5	5	5	5
Cylinder wear avg.	mm	>	5	5	5	0.008	5	5	5	5
Ring sticking 2. piston rings	ASF	>	5	5	5	1.0	5	5	5	5
Specific oil consumption	g/h	>	5	5	5	100.0	5	5	5	5
Boost pressure loss at 400 hours	%	>	5	5	5	4.0 n.)	5	5	5	5
OM 501 LA Euro III actual production c.)										
All parameters	rating	?	5	5	5	ref. oil	5	5	5	5
OM 906 LA Euro III actual production c.)										
All parameters	rating	?	5	5	5	ref. oil	5	5	5	5

Quality assurance & certif. tests in DC factory & DC in-house tests in actual engines c.)										
All parameters	rating	?	5	5	ref. oil	ref. oil	ref. oil	ref. oil	ref. oil	ref. oil
Bearing Wear c.) d.)						x d.)				
for SAE X W -40 and X W -50, w. o. 0 W -40			5	5	5	no	5	5	5	5
for SAE X W -30 and 0 W -40			5	5	5	yes	5	5	5	5
Oil drain interval for OM 441 LA	h		5	5	5	400	5	5	5	5
Field Trail with Trucks d.)			x i.)			x d.)				
for SAE X W -40 and X W -50, w.o. 0 W -40			(yes) i.)	5	5	no	5	5	5	5
for SAE X W -30 and 0 W -40			(yes) i.)	5	5	requested	5	5	5	5
Field trail with Actros trucks - oil strategy 2000	Matrix		5	5	5	possible	5	5	5	5

Notes:

a.) For Sheet 225.10 and 225.11 please contact Mr. Schenk, EP/MGB, phone +49-711-17-53244 before you start. Further requirements are listed in the performance standard.

b.) Elastomer compatibility tests according VDA 675301 and DBL 6674 with materials NBR34, AK6, ACM E7503 and EAM D8948/200.1

c.) Rerating by MB, department EP/MGB for all related engine parts.

d.) Evaluation of bearing wear in a OM 441 LA engine with new crankshaft and premeasured bearings. Rerating by MB, department PBE/DHM
Conditions: Sheet 228.3/.5 no oil drain, Sheet 228.1 oil drain after 200 h.

e.)
T
he worst result can be replaced by the second worst to calculate the average.

f.) For sheet 227.0/.1 and 228.0/.1/.2/.3 approval to OM 364 LA test or OM 364 A test or OM 441 LA test is mandatory. For Sheet 228.0/.1 oil drain in OM 441 LA after 200 h.

g.) Shear stability (CEC L-14-A-93): stay in grade.

i.) Approval conditions for engine oils or natural gas (CNG) engines: positive field test with MB CNG buses or a pass result in a 500 h CNG engine test by MB do Brazil or a read across from MAN M 3271 approval.

---

k.) New/Old Limits.
T
he new limits are only valid for test runs after 11.6.97 with tappets from Euroval.

l.) RL 140 + 2 l with reference fuel batch 1.

m.)
W
hen ACEA E5-02 is claimed, our MB OM 441 LA test and all other tests within ACEA E5-02 are mandatory.

n.) For OM 441 LA tests started after 1.9.1999.

o.) MB Read Across for engine tests
is based on
A
T
C and
A
T
IEL Code of Practice. Regarding
A
T
IEL Base Oil Interchange (BOI) for sheet 225.8, 225.10 and 225.11 MB tests (M 111 Sludge,
M 111 Fuel Economy, OM 602 A or OM 611 DE 22 LA) have to be run in every case, other tests will not be accepted.

p.)
T
arget value - no
limit
!
If result does not meet the target value, additional support data is needed.

q.) For Sheet 225.11 both tests OM 611 DE 22 LA and OM 602 A have to be run. For all other sheets also both tests
OM 611 DE 22 LA and OM 602 A have to be run after 01/01/2003. After 01/01/2004 OM 602A will be not mandatory anymore.
T
he new 300 hrs. OM 611 DE 22 LA test replaces the 600 hrs. OM 611 DE 22 LA test in the test matrix for sheet 225.10.

Engine oils (Service)

These engine oils are for service purposes, in other words for the continued operation of engines at t

An overview of our requirements on service engine oils for a Mercedes-Benz approval is printed in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1" on the following pages.

Engine oils (service) for commercial vehicles with natural-gas engines and industrial engines (natural gas) in the commercial vehicles' sector

Sheet 226.9 (multigrade oils)

Engine oils as under Specification 226.9 have been approved for all stationary and non-stationary commercial vehicle natural-gas engines based on BR 300 and BR 400

Engine oils (service) for commercial-vehicle and passenger-car diesel fuel engines, and industrial engines (diesel) from the commercial-vehicle and passenger-car sectors (BR 300, BR 400, BR 500, BR 600, BR 900)

Th
ese engine oils can be used as a continued operation oil in certain Mercedes-Benz diesel engines.
Th
ese oils are not approved for gasoline-fuel engines
!

Sheet 227.0 (single-grade oils) and
Sheet 227.1 (multigrade oils)

Engine oils in accordance with Sheet 227.0/.1 are only approved for certain non-supercharged diesel engines (see Sheet 223.2).
Th
ey are only approved for use in supercharged diesel engines in exceptional cases, where for instance no engine oils as under sheets 228.0/.1/.2/.3/.5 are available. **New approvals for these operating fluid sheets** have not been granted since 01.01.2003
!
The two sheets are listed in Supplement 12 in the Mercedes-Benz Specifications for Operating Fluids. As of January 1st, 2004 these sheets will be deleted! As an alternative or substitute for these oils, the single-grade and multigrade oils listed in 228.0/.1/.2/.3/.5 can be used.
(for use, see Sheet 223.2).

Sheet 228.0 (single-grade oils) and
Sheet 228.1 (multigrade oils)
Engine oils in accordance with Sheet 228.0/.1 are approved for certain diesel engines.
Th
e requirements for an approval of these engine oils are listed on the following pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1".
Th
ese engine oils are required to fulfill at least ACEA E2. Beyond this are the more comprehensive specifications of DaimlerChrysler AG.
(for use, see Sheet 223.2).

Sheet 228.2 (single-grade oils) and
Sheet 228.3 (multigrade oils)
Engine oils in accordance with Sheet 228.2/.3 are approved for certain diesel engines (see Sheet 223.2).
Th
e requirements for an approval of these engine oils are listed on the previous pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1".
Th
ese engine oils are required to fulfill at least ACEA E3. Beyond this are the more comprehensive specifications of DaimlerChrysler AG.
(for use, see Sheet 223.2).

Engine oils (service) for
Passenger vehicle engines (BR 100, BR 200, BR 600),
Commercial vehicle engines from the passenger vehicle sector (BR 100, BR 200, BR 600) and
Industrial engines from the car sector (series 100, series 600)

Th
e engine oils on Sheets 229.1, 229.3, 229.31 and 229.5 can be used as continued running oils (service engine oils for the oil service) depending on quality and application in certain Mercedes-Benz passenger car engines.
Th
ese oils are **not** approved for commercial vehicle diesel engines BR 300, BR 400, BR 500, BR 900.

General information
In 1997 we introduced a new approval system for passenger car engine oils which has been considerably expanded compared to the earlier approval procedure and demands precise documentation of the oil quality.
Th
e approval control for passenger car engine oils which was valid up until then and based on the CCMC test sequences became invalid with the appearance of Sheet
229.1
!

Th
e current approval system for passenger car engine oils with Sheets 229.1, 229.3, 229.31 and 229.5 is in harmony with ACEA test sequences introduced for the first time on 01.01.96, however in respect of the requirements goes significantly beyond them.

Every engine oil approved by us are therefore required to also pass a gasoline and a passenger-car diesel test sequence.
We
regard it as important that all the engine tests relevant to our approval procedure are reappraised by us in the Abteilung Betriebstoffe (Operating Fluids department), EP/MGB, HPC C405, D-70546 Stuttgart and we get an insight into the relevant test bench report.

Sheet 228.5 (multigrade oils)
Engine oils in accordance with Sheet 228.5 are approved for certain diesel engines (see
(for use, see Sheet 223.2).

Thi
s approval system for passenger car engine oils has been made consistently more advanced and expanded since its introduction.

To
day our customers have an adequate choice of options with engine oils on Sheets 229.1, 229.3, 229.31 and 229.5 of the Mercedes-Benz Specifications for Operating Fluids so that they can decide for themselves on a particular quality level and an optimum engine oil for their operating conditions.

Th
e use of Sheets 229.1, 229.3, 229.31 and Sheet 229.5 in certain passenger car gasoline and passenger car diesel engines (BR 100, BR 200, BR 600) is described in more detail on Sheet 223.2.

Whi
ch engine or which vehicle can use which oil quality over which oil change interval is also listed in the Service Information for passenger cars: "Engine oil change" SI18.00-P-0011A dated 18.04.2002. In each case the maintenance procedures which are stipulated individually for each vehicle model apply.

Whi
ch requirements apply to an approval of these passenger car engine oils are listed on the following pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1".

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and B3 and B4. DaimlerChrysler AG has further requirements.

Sheet 229.1 (multigrade oils)

Th
ese engine oils are approved for certain passenger car engines (BR 100, BR 200, BR 600), commercial vehicle engines from the passenger car range (BR 100, BR 200, BR 600) and industrial engines from the passenger car range (BR 100, BR 200, BR 600). (for use, see Sheet 223.2).

Th
e requirements for an approval of these engine oils are listed on the following pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1".
Th
ese engine oils must at least fulfill ACEA A2 or A3 and B2 or B3. Beyond this are the more comprehensive specifications of DaimlerChrysler AG.

The requirements for an approval of these engine oils are listed on the following pages

Compared with Sheet 229.1 these engine oils exhibit the following features:
- higher quality (with regard to wear and cleanliness)
- fuel saving potential
- better cold-starting properties
- better environmental compatibility (reduced chlorine and sulfur content).

Sheet 229.3 (multigrade oils)

Th
ese low-friction engine oils are approved for certain passenger car engines (BR 100, BR 200, BR 600), commercial vehicle engines from the passenger car range (BR 100, BR 200, BR 600) and industrial engines from the passenger car range (BR 100, BR 200, BR 600) and we highly recommend them. (for use, see Sheet 223.2).

Sheet 229.31 (multigrade oils with low sulfur content, low phosphor content and low content of ash-forming components - "Low SPAsh oils")

Th
ese Low SPAsh low viscosity engine oils are approved for certain passenger car engines (model 100, model 200, model 600), commercial vehicle engines from the passenger car range (model 100, model 200, model 600) and industrial engines from the passenger car range (model 100, model 200, model 600).
(for use, see Sheet 223.2).
For EU4 passenger car diesel engines or passenger car diesel-powered vehicles, which are equipped with diesel particulate filters, these "Low SPAsh" engine oils from Sheet 229.31 must be used !

Th
e requirements for an approval of these engine oils are listed on the following pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1". Approvals are only possible for low-viscosity engine oils, which comply with the low limits with regard to sulfur, phosphor content and the content of ash-forming components.
Th
e engine oils to be approved for Sheet 229.5 must at least meet ACEA A3 andB3 and B4. Beyond this are the more comprehensive specifications of DaimlerChrysler AG.

Compared with oils from Sheets 229.1/ 229.3 / 229.5 these oils also excel on account of:
- low sulfur content, low phosphor content and a low content of ash-forming components.
  T
  his means improved compatibility with exhaust gas aftertreatment systems such as, e.g. diesel particulate filter

Compared with oils from Sheet 229.1 these oils also excel on account of:
- improved environmental compatibility (reduced chlorine, sulfur and phosphor content)
- higher quality (with regard to wear and cleanliness)
- fuel saving potential
- better cold-starting properties

Th
e additive and mineral oil companies were notified by us on 9.8.2002 about the introduction of these new oil categories. Below follows an excerpt from this correspondence with a list of additional background information.

"T
o meet the coming emissions standards EU 4 and EU 5, in the future, additional exhaust gas aftertreatment systems, such as diesel particulate filters and NOx storage three way catalytic converters, will be necessary in passenger cars.

Th
ese exhaust gas aftertreatment systems must fulfill their function reliably over a very long application period specified by the legislator and must not be impaired or even destroyed by components of the engine oil.

Th
e aim is therefore to use such engine oils which if possible have no influence or a slight negative influence on these exhaust gas aftertreatment systems and permit a long life of these systems.
Th
erefore on the one hand this engine oil must maintain the effectiveness of EU 4 / EU 5 emission cleaning systems over long runtimes and on the other hand exhibit the previous good performance.

It is necessary to significantly reduce the content of ash-forming components of the engine oil (measured quantity is the sulfated ash) and simultaneously to reduce the sulfur and phosphorous content to a lower level.
Th
ese requirements have a very significant influence on the selection of base stocks and additives and consequently on the oil formulations.

The performance of these engine oils, which means low wear and good cleanliness for

---

Th
e aim is thus the development of an engine oil with low sulfur content, low phosphorous content and low content of ash-forming components of the engine oil (low ash) or in brief a so-called "Low SPAsh" engine oil.

Th
e new service oil specification will be designated as Sheet 229.31, the new First-Fill oil specification will be designated as Sheet 225.11 of the Mercedes-Benz Specifications for Operating Fluids.

It is planned that the new service engine oils on Sheet 229.31 may be used in all new as well as old passenger car gasoline and passenger car diesel engines. Downwards compatibility should be maintained.

Wit
h this letter on the one hand we want to inform you about the technical requirements and on the other hand about the planned introduction date in the Mercedes-Benz Specifications for Operating Fluids.

As in the past the technical requirements are based on laboratory and engine tests.

Th
e detailed requirements for an approval of these engine oils are listed on the following pages in the
Ta
ble "Mercedes-Benz specifications for engine oils (service fill) ".

"T
he sulfur content is limited to a maximum of 0.20% by weight, the phosphorous content to a maximum of 0.08% by weight and the sulfated ash must be less than 0.80% by weight.

To
gether with the Sheets 229.31 and 225.11 a new engine test is introduced based on the passenger car diesel engine OM 611 DE 22 LA (MB in-house program, 300 hours runtime, sulfur-free diesel fuel !).

In the case of Sheets 229.31 and 225.11 this test is to be run in addition to the OM 602 A test which is already known.
Th
e OM 602 A test is as always necessary right from the start in order to safeguard the downwards compatibility and operation with high-sulfur diesel fuel.

Should you still have questions on the approval procedure, on the approval requirements or approval conditions, we will be pleased to discuss this in detail with you.
Contact: Mr. Schenk, Abteilung Betriebsstoffe [Operating Fluids Department] EP/MGB,
Tel
.:+49 (0) 711 17 53244,
e-mail: Michael.Schenk@DaimlerChrysler.com.

Sheet 229.5 (multigrade oils)
Th
ese low-viscosity engine oils are approved for specific passenger car engines (model 100, model 200, model 600), commercial vehicle engine from the passenger car sector (model 100, model 200, model 600) and industrial engines from the passenger car sector (model 100, model 200, model 600) except the gasoline engine M 166 from the A-Class and are specifically recommended by us. For use, see Sheet 223.2.

Compared with Sheet 229.1 and 229.3 the engine oils are characterized by:
- highest quality (with regard to wear and cleanliness) for approved passenger car engine oils
- even further improved fuel saving potential
- potential for even longer oil change intervals (in combination with new oil filter elements)
- further improved environmental compatibility

Although these oils will possibly be more expensive due to these advantageous properties.

Th
e most important requirements which we stipulate for an approval of engine oils for the oil service can be seen in the following overview table "Mercedes-Benz specifications for engine oils (service fill) V2002.2".

Requirements for approval of these engine oils are listed on the following pages in the table "Mercedes-Benz specifications for engine oils (service fill) V2003.1". The eng

Mercedes-Benz specifications for engine oils (service fill) V2002.2
Service oil requirements

			MB Sheet No.								
Mono/multigrade			**226.9** Multi	**227.0/.1 a.)** Mono/ Multi	**228.0/.1** Mono/ Multi	**228.2/.3** Mono/ Multi	**228.5** Multi	**229.1** Multi	**229.3** Multi	**229.31 a.)** Multi	**229.5 a.)** Multi

Viscosity Grades	SAE		acc. ACEA	acc. ACEA	acc. ACEA	acc. ACEA X W	acc. ACEA W W	acc. ACEA W	0 - , 5 - X	0 - , 5 -, 10 - X	0 -, 5 -, 10 - X
SAE XW-30 and 0W-40		?	no	no	yes d.) g.)	yes d.) g.)	yes d.) g.)	A3-02+ B3-98	A3-02+ B3-98	A3-02+ B3-98	A3-02+ B3-98
MB Read Across (based on ATC, ATIEL)	RA		no	no	no	no	no	yes o.)	yes o.)	yes o.)	yes o.)
Package Pass 15W-40/20W-40/20W-50 (SN)	possible		(yes)	yes	yes	yes	no	no	no	no	no
ACEA - only MB tests m.)		?	(A2-96)	B2-98	B2-98	B2-98 E3-96	B2-98 E4-99	A2-96 A3-02	A3-02	A3-02	A3-02
see ACEA 2002 European Oil Sequence		?	(E2-96) i.)	(E2-96)	E2-96	(E5-02) m.)	(E5-02) m.)	B2-98 B3-98	B3-98 B4-02	B3-98 B4-02	B3-98 B4-02
Laboratory Tests											
Sulfated Ash	% b.w.	>	1.00	1.80	2.00	2.00	2.00	1.50	1.50	**0.80**	1.50
T BN (ISO 3771, fresh oil)	mgKOH /g	?	5	5	5	5	5	5	5	6.0	5
Pour point	°C	>	*/-27	*/-27	*/-27	*/-27	-27	-27	-36	-36	-36
Evaporative Loss (CEC L-40-A-93, Noack)	%	>	13.0	13.0	13.0	13.0	13.0	13.0	13.0	12.0	10.0
Viscosity @high temp./high shear rate CEC L-36-A-97	mPa*s	?	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Sulfur	% b.w.	>	5	5	5	5	5	5	0.5	**0.20**	0.50
Phosphorus	% b.w.	>	5	5	5	5	5	5	5	**0,08**	0.11
Chlorine	% b.w.	>	5	5	5	5	5	5	0.0100	0.0050	0.0050
DBL	DBL		6610	6612	6610	6610	6610	6615	6615	6615	6615
Elastomer Compatibility b.)	DBL		Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Engine Tests (x = number of tests for Package Pass)											
M 111 (CEC L-53-T-95) c.)			x i.)					x	x l.)	x l.)	x
Engine sludge avg.	merit	?	+ 2 l	5	5	5	5	+ 2 l	+ 3 l	+ 3 l	8.00 (a. 439h)
Cam wear avg.	Cm	>	5.0	5	5	5	5	5.0	3.0	3.0	5.0 (a.439h)
M 111 (CEC L-54-T-96)									x	x	x
Fuel economy improvement vs. RHD 191	%	>	5	5	5	5	5	5	1.00	1.00	1.70

OM 611 DE22LA					x q.)	x q.)	x q.)	x q.)	x q.)	x q.)	x q.)
(MB DL, 300h) c.) q.)											
Piston cleanliness	merit	?	5	5	23.0	25.0	27.0	23.0	25.0	25.0	27.0
(avg. 4 pistons)											
Ring sticking	yes/no	>	5	5	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)	no (ASF > 2.5)
Engine sludge avg.	merit	?	5	5	8.00	8.50	9.00	8.00	8.50	8.50	9.00
Viscosity increase at 100 °C p.)	%	>	5	5	100	100	90	100	100	100	90
- target value											
Oil consumption p.) q.)	g/test	>	5	5	6000	6000	6000	6000	6000	6000	6000
- target value											
Bore polishing (13 mm)	%	>	5	5	4.0	3.5	3.0	4.0	3.5	3.5	3.0
- max. value of 4 cyl.											
T	%	>	5	5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
iming chain wear (elongation) p.)											
- target value											
Cylinder wear (avg. 4 cylinder)	Cm	>	5	5	7.0	7.0	5.2	7.0	7.0	7.0	5.2
Cam wear, inlet/outlet valve	Cm	>	5	5	139.2/	139.2/	121.8/	139.2/	139.2/	139.2/	121.8/
(avg. max. wear 8 cams)					156.6	156.6	139.2	156.6	156.6	156.6	139.2
Bearing wear,	Cm	>	5	5	2.1/2.1	2.1/2.1	2.1/2.1	2.1/2.1	2.1/2.1	2.1/2.1	2.1/2.1
main/con rod bearing e.)											
Piston ring wear axial	Cm	>	5	5	10.4/4.2/ 2.4	10.4/4.2 /2.4	8.7/2.8 /2.4	10.4/4.2 /2.4	10.4/4.2 /2.4	10.4/4.2 /2.4	8.7/2.8 /2.4
@ ring 1/ ring 2/ ring 3 e.)											
Piston ring wear radial	Cm	>	5	5	5.6/8.4/	5.6/8.4/	5.6/8.4/	5.6/8.4/	5.6/8.4/	5.6/8.4/	5.6/8.4/
@ ring 1/ ring 2/ ring 3 e.)					8.0	8.0	8.0	8.0	8.0	8.0	8.0
OM 602 A (CEC L-51-A-98) c.) k.)				(x) a.)	x	x	x	x	x	x	x
Piston cleanliness	merit	?	5	20.0	22.0	24.0	26.0	20.0	24.0	24.0	26.0
(no ring sticking)											
Bore polishing (23 mm)	%	>	5	7.0	6.0	4.5	3.0	7.0	4.5	4.5	3.0
Cylinder wear avg. new/old	Cm	>	5	20.0/ 12.0	18.0/ 11.0	15.0/ 10.0	15.0/ 10.0	20.0/ 12.0	15.0/ 10.0	15.0/ 10.0	15.0/ 10.0
Cam wear avg. new/old	Cm	>	5	50.0/ 30.0	50.0/ 29.0	45.0/ 28.0	45.0/ 28.0	50.0/ 30.0	45.0/ 28.0	45.0/ 28.0	45.0/ 28.0
Oil consumption	kg/test	>	5	10.0	10.0	10.0	10.0	10.0	10	10	10.0
Viscosity increase at 40 °C	%	>	5	90.0	80.0	70.0	60.0	90.0	70.0	70.0	60.0
Engine sludge avg.	merit	?	5	8.80	8.90	8.90	9.00	8.80	8.90	8.90	9.00
VW TDI (CEC L-78-T-97) or									x	x	x
(CEC L-78-T-99)											
ACEA B4-02	Pass		5	5	5	5	5	5	yes	yes	yes
VW PV 1449									x	x	x
V	Pass		5	5	5	5	5	5	yes	yes	yes
W											
502.00 or PV 1449											
DC tests package for 229.5 a.)											x
Bench Tests at DC											
M 111 E23	Pass		5	5	5	5	5	no	no	no	yes
(											
T											
est bench Snail program PSP)											
OM 611 DE 22LA	Pass		5	5	5	5	5	no	no	no	no q.)
(12 point DL, 600 hrs.) q.)											
M 112 E32 (12 point DL)	Pass		5	5	5	5	5	no	no	no	yes
Field Test (S: Snail,											
B: Barracuda)											
S: 1x C 320	Pass		5	5	5	5	5	no	no	no	yes
B: 1x E220 CDI 99;	Pass		5	5	5	5	5	no	no	no	yes
1x A 170 CDI;											
1x ML 320											

OM 364 LA (CEC L-42-T-99) c.) f.)				(2x) a.)	3 X	3 X	x				
Piston cleanliness	merit	?	5	35.0	40.0	45.0	50.0	5	5	5	5
Bore polishing	%	>	5	6.0	3.5	1.0	0.5	5	5	5	5
Cylinder wear avg.	Cm	>	5	4.0	3.5	3.0	2.5	5	5	5	5
Engine sludge avg.	merit	?	5	9.30	9.40	9.50	9.60	5	5	5	5
Oil consumption	kg/test	>	5	20.0	16.0	12.0	10.0	5	5	5	5
OM 441 LA Euro II (CEC L-52-T-97) c.) f.)					3x d.)	3x d.)	x d.)				
Engine sludge avg.	merit	?	5	5	9.00	9.00	9.00	5	5	5	5
Piston cleanliness	merit	?	5	5	20.0	25.0	40.0	5	5	5	5
General engine deposits	demerit	>	5	5	3.0	3.0	3.0	5	5	5	5
W ear rating avg.	demerit	>	5	5	2.5	2.5	2.5	5	5	5	5
Bore polishing	%	>	5	5	3.0	2.0	2.0	5	5	5	5
Cylinder wear avg.	mm	>	5	5	0.008	0.008	0.008	5	5	5	5
Ring sticking 2. piston rings	ASF	>	5	5	1.0	1.0	1.0	5	5	5	5
Specific oil consumption	g/h	>	5	5	100.0	100.0	100.0	5	5	5	5
Boost pressure loss at 400 hours	%	>	5	5	R&R n.)	9.0 n.)	4.0 n.)	5	5	5	5
Bearing Wear c.) d.)					x d.)	x d.)	x d.)				
for SAE X W -40 and X W -50, w. o. 0 W -40			5	5	no	no	no	5	5	5	5
for SAE X W -30 and 0 W -40			5	5	yes	yes	yes	5	5	5	5
Oil drain interval for OM 441 LA	h		5	5	5/200	5/400	400	5	5	5	5
Field Trail with Trucks d.)			x i.)		x d.)	x d.)	x d.)				
for SAE X W -40 and X W -50, w.o. 0 W -40			(yes) i.)	5	no	no	no	5	5	5	5
for SAE X W -30 and 0 W -40			(yes) i.)	5	no	no	requested	5	5	5	5
Field trail with Actros trucks - oil strategy 2000	Matrix		5	5	5	possible	possible	5	5	5	5

Notes:

a.) For Sheets 229.5 and 229.31 please contact Mr. Schenk, EP/MGB, phone +49-711-17-53244 before you start. Further requirements are listed in the performance standard.
No new approvals will be given for Sheet 227.0/.1 after 01/01/2003.

b.) Elastomer Compatibility tests according VDA 675301 and DBL 6674 with materials NBR 34, AK6, ACM E7503 and EAM D8948/200.1

c.) Rerating by MB, department EP/MGB for all related engine parts.

d.) Evaluation of bearing wear in a OM 441 LA engine with new crankshaft and premeasured bearings. Rerating by MB, department PBE/DHM
Conditions: Sheet 228.3/.5 no oil drain, Sheet 228.1 oil drain after 200h.

e.)
T
he worst result can be replaced by the second worst to calculate the average.

f.) For sheet 227.0/.1 and 228.0/.1/.2/.3 approval a OM 364 LA test or a OM 441 LA test is mandatory. Only for Sheet 228.0/.1 oil drain in OM 441 LA after 200h.

g.) Shear stability (CEC L-14-A-93): stay in grade.

i.) Approval conditions for engine oils for natural gas (CNG) engines: positive field test with MB CNG busses or a pass result in a 500h CNG engine test by MB do Brazil or a read across from MAN M 3271 approval.

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k.) New/Old Limits.
T
he new limits are only valid for test runs after 11.6.97 with tappets from Euroval.

l.) RL 140 + 2 l with reference fuel batch 1.

m.)
W
hen ACEA E5-02 is claimed, our MB OM 441 LA test and all other tests within ACEA E5-02 are mandatory.

n.) For OM 441 LA tests started after 1.9.1999.

o.) MB Read Across for engine tests is based on
A
T
C and
A
T
IEL Code of Practice. Regarding
A
T
IEL Base Stock Interchange (BOI) for Sheet 229.1/.3/.31 and 229.5 MB tests (M 111 sludge, M 111 Fuel Economy or OM 602 A or OM 611 DE 22 LA) have to be run in every case, other tests will not be accepted.

p.)
T
arget value - no
limit
!
If test result does not meet the target value, additional support data in MB engines tests is needed.

q.) For sheet 229.31 both tests OM 611 DE 22 LA and OM 602 A have to be run as long as OM 602 A test available.
For all other sheets also both tests OM 611 DE 22 LA and OM 602 A have to be run after 01/01/2004
OM 602 A will be not mandatory anymore.
T
he new 300 hrs. OM 611 DE 22 LA test replaces the 600 hrs. OM 611 DE 22 LA test in
the test matrix for sheet 229.5.

Comments on and supplements to the requirements for engine oils

In the overview tables shown previously on the requirements for engine oils (Factory and Service Fill), i.e. in the "Mercedes-Benz specifications for engine oils" only the most important requirements are listed in the interest of clarity. Further requirements and details can be obtained from the appropriate DBL delivery instructions.
Th
e Abteilung Betriebstoffe [operating fluids department] EP/MGB, HPC C405, D-70546 Stuttgart, will also be pleased to provide you with information on this.

Apart from quality the viscosity (SAE grades) must also be observed when selecting engine oils. Information on this can be found on Sheets 223.1 or 223.2 and on Sheets 224.1 or 224.2.
Not every grade of approved engine oil is available with its respective viscosity grade. Single-grade engine oils are only approved for certain types of engine in summer.
To
day, they should only be used in pronouncedly warmer climes (in the corresponding SAE class).

1. Single-grade or multigrade oils

Single-grade engine oils SAE 10W, SAE 30, etc. only cover one SAE viscosity class and must among other things be changed depending on the climate zone and time of year.

The single-grade oils SAE 30 and SAE 40, which are suitable for high thermal loads on engines, make reliable cold starts more difficult or impossible at low outside temperatures and lead to undesirably high viscosity-related friction losses in the warm-up phase.

In contrast, the single-grade oils SAE W and SAE 1010W W-20 which are very suitable for cold starts are not suitable for use at high outside temperatures. These low-viscosity oils cannot ensure the necessary protection against wear.

Multigrade oils are engine oils which differ in comparison with single-grade oils by a slight temperature-dependent viscosity change. Due to their higher viscosity
inde
x
(lower viscosity/temperature dependence) they can be used in a relatively wide temperature range.

A correctly manufactured, shear-stable multigrade oil, e.g. SAE grade 10W-40, meets the requirements of SAE grade 10W at low temperatures for cold flow behavior and SAE grade 40 at high operating temperatures so that the oil change is independent of the time of year (in temperate climate).

1.1 Conventional multigrade engine oils

During the manufacture of conventional multigrade oils with a mineral oil basis, suitable base stock viscosity
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improvers (macromolecular polymers with an oil-thickening effect) are added.

A higher viscosity
inde
x
or multigrade character of the oils is achieved with these polymers. However, the VI improvers result in a non-Newton flow behavior. In other words, the viscosity of these oils is not only dependent on the temperature and the pressure, but also on the shear rate.

Depending on the shear resistance of the oils under high mechanical sheer loads in the engine, the polymer chains break resulting in a permanent loss of viscosity in the oils (permanent viscosity drop).

In addition to the permanent sheer loss, a temporary viscosity reduction may also occur, depending on the
ext
ent of the shear rate in the lubricating gap (reversible change in viscosity).

For all multigrade oils, therefore, we require a sufficient shear resistance, so that even after relatively long operating periods an adequate minimum viscosity is ensured.

It is therefore absolutely necessary to adhere precisely to the restrictions of the operational field of the SAE grades, as specified in the operating instructions and owner's manuals or on Sheet 224.1/.2.

1.2 Multigrade oils as low-friction oils

In the general public and in the media, "low-friction oils" are gaining more and more significance due to the increasing fuel prices and the growing oil change intervals.

In the Mercedes-Benz Specifications for Operating Fluids, low-friction oils have been approved for some time. However, these are not labeled as such on the individual sheets. This is due to the fact that the term "low-friction oil" has neither been standardized nor protected. Low-friction oils can be formed by lowering the viscosity, by using additives that lower the friction coefficient (friction modifiers) and by the use of special base stocks (synthetic oils or hydrocracking oils).

Currently in the European oil specifications there is neither a set engine or laboratory test, nor limits (e.g. for fuel saving or Fuel Economy) or test conditions which regulate the use of the designation "low-friction oil" in a binding manner. The term "low-friction oil" on the oil container is entirely the responsibility and at the discretion of the individual mineral oil companies. It should be pointed out here that there are also different definitions of a low-friction oil within the mineral oil industry.

In our opinion only such multigrade oils belong to the low-friction oils which belong to
SAE grades 0W-20, 0W-30, 0W-40, 5W-30, 5W-40, 10W-30, or 10W-40 and show a measurable fuel saving potential (with proof e.g. in the M 111 Fuel Economy in accordance with
CEC L-54-T-96, compared with the 15W-40 reference oil RL 191). However, these oils must not increase wear, make the engine dirtier, significantly reduce viscosity due to shearing or increase oil consumption.

For Sheets 229.3, 229.31 and 229.5 only such low-friction oils are approved which achieve a fuel consumption advantage of at least 1.0% or 1.7% in the M 111 Fuel Economy Test (CEC L-54-T-96) compared with the 15W-40 reference oil RL 191.

By using particularly suitable base stocks (e.g. synthetic oils or hydrocracking oils) it is possible to manufacture shear-resistant low-friction oils having a high viscosity
inde
x.
These low-viscosity multigrade oils have lower viscosity-related friction and flow losses and good cold starting properties due to their improved cold flow behavior.

On the other hand, these low-friction oils must not have a viscosity that is too low in the high-temperature range because this in turn could increase the proportion of
mi
xe
d friction and wear. During the warm-up phase, e.g. with mainly city-center traffic and low oil temperatures, fuel savings are possible with low-friction oils. With increasing distances, the fuel savings effect is reduced.

With regard to the level of savings that can be achieved specifically with low-friction oils, there are publications with very
different
ex
amination and test results, which in part go far beyond the actual savings for driving in practice.

In addition, the additional costs of these products in turn can consume potential fuel savings to some
ext
ent (cost/benefit ratio). It is therefore left to the vehicle operator whether he would like to use an approved low-friction oil due to the driving mode (short distance use, long distance use).

2. Friction-reducing additives (friction modifiers)

In the low temperature range, where hydrodynamic lubrication in some engine compone

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3. Special additives for lubricants for reducing friction and wear

For the operation of motor vehicles and engines, only blended oils are approved. These lubricants are produced from selected base stocks (on a mineral, partially or fully synthesized basis) by adding chemical oil-soluble additives and therefore have, in addition to a high lubricating effect, all the properties demanded from a good lubricant, such as reducing friction and wear, corrosion protection, oiliness, dispersal properties and detergent effect, a resistance to aging, foaming prevention, cold flow properties, etc.
From our point of view, there is no reason to add special additives.

Details are given in Sheet 219.0 of the Specifications for Operating Fluids (special additives for lubricants).

BB00.40-P-0223-01A	Prescribed break-in engine oils - overview	For Mercedes Benz and smart	Sheet 223.1
		i For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Passenger cars engines
Commercial vehicle engines from the passenger vehicle sector
Industrial engines from the car sector (series 100, series 600)

	MB Specifications for Operating Fluids Sheet No. Can be used all the year round							
	225.0 Single grade	**225.1 Albatross Multi-grade**	**225.5 Sirius Multi-grade**	**225.6 Topas Multi-grade**	**225.7 Agate Multi-grade**	**225.8 Sapphire Multi-grade**	**225.10 Diamond Multi-grade**	**225.11 Opal Multi-grade**
Gasoline engines model series 100, model series 200 4.)	8 1.)	8 1.)	5	5	8 1.)	- 3.)	- 3.)	5
Diesel engines model series 600 4.) 5.) without particulate filter	8 1.)	8 1.)	5	- 1.)	8 1.)	- 3.)	- 3.)	5
Diesel engines model series 600 with particulate filter	5	5	5	5	5	5	5	-

Commercial vehicles engines
Industrial engines from the commercial vehicle sector (BR 300, BR 400, BR 500, BR 900)

	MB Specifications for Operating Fluids Sheet No. Can be used all the year round							
	225.0 Single grade	**225.1 Multi-grade**	**225.5 Multi-grade**	**225.6 Multi-grade**	**225.7 Multi-grade**	**225.8 Multi-grade**	**225.10 Multi-grade**	**225.11 Multi-grade**
Diesel engines, BR 300, BR 400	8 2.)	8 2.)	8 2.)	-	5	5	5	5
Diesel engines BR 900, BR 500	5	5	5	-	5	5	5	5

- \- Should be used.
- 8 May be used in an exceptional case only.
- 5 May not be used.
- 1.) Use in exceptional case only, if engine oil in accordance with Sheet 225.8, or 225.10 is not available
- 2.) Only use in exceptional circumstances, if an engine oil in accordance with Sheet 225.6 is not available
- 3.) Sheet 225.10: Use only for M 112, M 113, M 137, M 271, M 275, M 285, OM 611, OM 612, OM 613, OM 646, OM 647, OM 648, OM 664, OM 665, OM 668.
  Sheet 225.8: Use only for M 111, M 160, M 166, OM 628, as well as for commercial vehicle engines OM 611, OM 612!
- 4.) Exceptions: for AMG engines use only oils from DB specifications for the supply of materials 6674.31/.32/.33
- 5.) Exceptions: for smart diesel OM 660 use only oil from DB specifications for the supply of materials 6674.31.

When using engine oils the temperature operational fields for the viscosity grades must be observed (see Sheet 224.1 and Sheet 224.2)!
Single-grade oils are only listed in Sheet 225.0 - Use only in summer
Multigrade oils are listed on Sheets 225.1/.5/.6/.7/.8/.10/.11 - Can be used all year round

		i For specified viscosity grades refer to " Sheet 224.1 (passenger-car engines) Sheet 224.2 (commercial-vehicle engines) - **Should be used** 8 Can be used - may not be used i Single grade oils are found on Sheets: 227.0, 228.0, 228.2 - Use only in the summer Multigrade oils are found on Sheets: 226.9, 227.1, 228.1, 228.3, 228.5, 229.1, 229.3, 229.5 - Can be used all the year round	 BB00.40-P-0224-01A BB00.40-P-0224-02A

Passenger vehicle engines,
Commercial vehicle engines from the passenger car division,
Industrial engines from the car sector (series 100, series 600)

	MB Specifications for Operating Fluids Sheet No.								
	226.9 Multi-grade	**227.0/.1 Single/ multi-grade**	**228.0/.1 Single/ multi-grade**	**228.2/.3 Single/ multi-grade**	**228.5 Multi-grade**	**229.1 Multi-grade**	**229.3 Multi-grade**	**229.31 Multi-grade**	**229.5 Multi-grade**
Gasoline engines, M166	-	-	-	-	-	-	-	-	-
Gasoline engines M 271, M275	-	-	-	-	-	-	-	-	-
Gasoline engines M285 (Maybach)	-	-	-	-	-	-	-	-	-
Gasoline engines BR 100, BR 200 except M 166, M 271, M 275, M 285	-	-	-	-	-	-	-	-	-
Diesel engines OM 646, OM 647, OM 648 without particle filter	-	-	-	-/ -	-	-	-	-	-
Diesel engines BR 600 with particle filter	-	-	-	-	-	-	-	-	-
Diesel engines BR 600 except OM 646, OM 647, OM 648	-	-/ 8	-/ -	-/ -	-	-	-	-	-

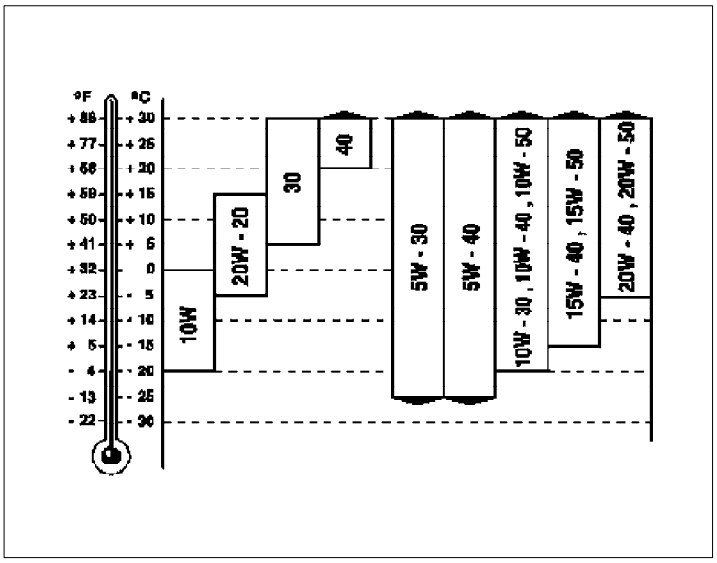
Commercial vehicle engines,
Industrial engines from the commercial vehicle sector (BR 300, BR 400, BR 500, BR 900)

	MB Specifications for Operating Fluids Sheet No.								
	226.9 Multi-grade	**227.0/.1 Single/ Multigrade** Use only in exceptional case, if engine oil according to Sheet 228.0/.1/.2/.3/ .5 is not available	**228.0/.1 Single/ Multigrade**	**228.2/.3 Single/ Multigrade**	**228.5 Multi-grade**	**229.1 Multi-grade**	**229.3 Multi-grade**	**229.31 Multi-grade**	**229.5 Multi-grade**

Diesel engines, BR 300, BR 400	-	8 / 8	8 / -	8 / -	-	-	-	-	-
Diesel engines BR 900, BR 500	-	-	8 / -	8 / -	-	-	-	-	-
Gas engines with and without turbocharger	-	-	-	-	-	-	-	-	-

BB00.40-P-0224-02A	Viscosity classes of engine oils (CV engines)	Commercial vehicle engines (BR 300, BR 400, BR 500, BR 900) Industrial Engines from the Commercial Vehicle Sector (BR 300, BR 400, BR 500, BR 900)	Sheet 224.2

A precise application of the SAE grades in accordance with ambient air temperatures would require more frequent engine-oil changes. The temperature limits for the SAE grades should therefore be regarded as guidelines, which can be exceeded or undercut for a short duration.



N00.40-2006-11

BB00.40-P-0225-05A	Multigrade break-in oils (Sheet 225.5)	For use in vehicles/engines refer to "	Sheet 225.5
		Sheet 223.1	BB00.40-P-0223-01A

Product name	**Company, town/country**
Addinol MD 1545 E	Addinol Lube Oil GmbH, Leuna, Germany
BP Olex MK 4435	BP p.l.c., London/England
DB engine oil	Exxon Mobil Corporation, Fairfax, Virginia, USA
Elf Rodage DB 1540	TotalFinaElf Lubrifiants, Paris, France
Fina Arusan FF Motor Oil	TotalFinaElf Lubrifiants, Paris, France
INA Super PPS	INA Maziva Rijeka, Rijeka, Croatia
PO DC-MB 15W/40	Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Rexol MBS	JSC Ryazan Refinery, Ryazan, Russia
Total MBS-STI	TotalFinaElf Lubrifiants, Paris, France
Total Moteur G 2311	TotalFinaElf Lubrifiants, Paris, France
Wintershall Antikorrol FFS	SRS Schmierstoff Vertrieb GmbH, Salzbergen, Germany

BB00.40-P-0225-06A	Multigrade break-in oils (sheet 225.6)	i For use in vehicles/engines refer to "	Sheet 225.6
		Sheet 223.1	BB00.40-P-0223-01A

Shell Rimula Ultra	Shell International, London/England

BB00.40-P-0227-00A	Single-grade engine oils (sheet 227.0)	i For use in vehicles/engines refer to "	Sheet 227.0
		Sheet 223.2	BB00.40-P-0223-02A
		For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	10W	20W-20	30	40	50	Customer+ town+country
Accor D3 2104 D			X			Accor Lubrifiants S.A., Cholet, France
Addinol Marine MS 4011				X		Addinol Lube Oil GmbH, Leuna, Germany
Adnoc Diesel Engine Oil S-3				X		Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc Diesel Engine Oil XD-3				X		Adnoc Distribution, Abu Dhabi, U.A.E.
Agip Diesel Sigma SX			X			ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Argon HD-Motorenöl DB	X	X	X	X		Voitländer GmbH & Co. KG, Kronach
Aristol HDC	X	X	X	X		Oelwerke Julius Schindler GmbH, Hamburg, Germany
Avin Sprint S-3			X			Motor Oil (Hellas), Maroussi, Greece
BP Vanellus C3 Mono	X	X	X	X		BP p.l.c., London, England
BP Vanellus DC 1310	X					Deutsche BP Aktiengesellschaft, Hamburg, Germany
BP Vanellus DC 1320		X				Deutsche BP Aktiengesellschaft, Hamburg, Germany
Calpam Fleet HD Oil	X	X	X	X		Calpam Mineralöl-Gesellschaft mbH, Aschaffenburg, Germany
Castrol Assuron T Plus	X	X	X	X		Castrol Ltd., Swindon, England
CS Mizar Serie-3	X		X	X		Repsol YPF Lubricantes y Especialidades, S.A., Madrid, Spain
Elf Disal HD 4			X	X		TotalFinaElf Lubrifiants, Paris, France
Elf Performance Super		X	X	X	X	TotalFinaElf Lubrifiants, Paris, France
Elf Performance XR			X	X	X	TotalFinaElf Lubrifiants, Paris, France
Emo Super Motor Oil			X			Motor Oil (Hellas), Maroussi, Greece
Gulf Super Duty Plus Monograde (GIL)			X	X	X	Gulf Oil International, London, England
Haco HD Motorenöl Extra C		X	X	X		Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Hegrol Turbo HDC			X			Hermann Groh, Reckendorf, Germany
Kroon-Oil Multifleet-Oil SCD			X			Kroon Oil B.V., Almelo, Netherlands
Mobil Delvac 1300			X	X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Monogrado DMOK 3040				X		Krafft S.A., Andoain (Guipuzcoa), Spain
MotorHP4D				X		Unil S.A., Saumur, France
Motorex Extra 30			X			Bucher AG, Langenthal, Switzerland
Motul Tekma Norma Monograde			X	X		Motul, Aubervilliers Cedex, France
Orly Diesel Oil 2001	X	X	X			Orly International, Vieux-Thann, France
Orly Diesel Oil Lloyd 1	X	X	X			Orly International, Vieux-Thann, France
Orly Diesel Oil Luna 1	X	X	X			Orly International, Vieux-Thann, France
Orly Draco 2001	X	X	X			Orly International, Vieux-Thann, France
Orly Stratus 2001	X	X	X			Orly International, Vieux-Thann, France
P.O. Süpersarj			X			Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
P.O. Süpersarj C			X			Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
P.O. Süpersarj E			X			Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Pennasol Motor-Oil Extra C		X	X	X		Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Pertamina Meditran-S			X	X	X	Pertamina, Jakarta, Indonesia
Pistoneeze Turbo M		X	X			Millers Oils Ltd., Brighouse West Yorkshire, England
Raloy Aceite Diesel				X		Raloy Lubricantes, Santiago Tianguistenco, Mexico

Raloy Diesel 1340			X			Raloy Lubricantes, Santiago Tianguistenco, Mexico
S. HD. Deisel (Mahroukat)				X	X	Gen. Co. of Homs Refinery, Homs, Syria
Super HD Diesel				X		Gen. Co. of Homs Refinery, Homs, Syria
Tamoil HP 300 (I)			X			Tamoil Petroli S.p.A., Milan, Italy
TERRA REC Motoroil Extra C		X	X	X		Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Tor HD Fleet Oil			X			De Oliebron B.V., Zwijndrecht, Netherlands
Total Rubia S			X	X		TotalFinaElf Lubrifiants, Paris, France
Uranol CD		X	X	X		Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Wecoline HDC		X	X	X		Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany

BB00.40-P-0227-01A	Multigrade engine oils (Sheet 227.1)	i For use in vehicles/engines refer to "	Sheet 227.1
		Sheet 223.2	BB00.40-P-0223-02A
		i For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	15W-40	10W-40	15W-50	20W-40	20W-50	Customer+ town+country
Accor Diesel				X		Accor Lubrifiants S.A., Cholet, France
Accor ZX Diesel	X					Accor Lubrifiants S.A., Cholet, France
Addinol Super Diesel MD 1545	X					Addinol Lube Oil GmbH, Leuna, Germany
Adnoc Super Tractor Universal Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Agip Superdiesel SX Multigrade	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Universal Motoroil	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Ambra Universal	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Autol Extra CPM HD S3	X					Agip Schmiertechnik GmbH, Würzburg, Germany
Aviatic-Super	X					Wilhelm Scholten GmbH, Münster, Germany
Avin Ultra-D			X			Motor Oil (Hellas), Maroussi, Greece
Castrol RX Super E	X					Castrol Ltd., Swindon, England
Chemoleums Diesel Master Engine Oil	X					Chemoleums Limited, Chrompet, Chennai, India
CS Dieselgrado	X			X		Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Elf Performance XR Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Emo Multi Diesel			X			Motor Oil (Hellas), Maroussi, Greece
Essolube XT 201	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Eurol WM Super	X					Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Euxin	X				X	S.C. Lubrifin S.A., Brasov, Rumania
Fenix Univerzal	X					NIS Fabrika maziva, Krusevac, Yugoslavia
Fina Kappa TDE Multi	X			X		TotalFinaElf Lubrifiants, Paris, France
Galax Super 3	X					NIS - Rafinerija Nafte Beograd, Belgrade, Yugoslavia
Gulf Super Diesel Plus (GIL)	X					Gulf Oil International, London, England
Gulf Super Duty Plus (GIL)	X					Gulf Oil International, London, England
Gulfleet Auto-Van (E)	X			X		SAEL, Madrid, Spain
Haco Multigrade Extra C	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Hafa Polymat		X				Hafa, Paris, France
Hylube LL	X					Hindustan Petroleum Corp. Ltd, Mumbai, India
Igol Trans Turbo 4	X					Igol France, Amiens - cedex 3, France
INA Super 5	X					INA Maziva Rijeka, Rijeka, Croatia
Kennoco Novi-D Motor Oil	X					Handel-Mij Noviol B.V., Nijmegen, Netherlands
Kompressol-Ultralub-C	X					Kompressol-Oel Verkaufs GmbH, Cologne, Germany
Kuwaitoil Extra Heavy Duty Diesel Oil	X					Kuwait National Petroleum Company, Kuwait, Kuwait
LEOL-Prestige	X					Lebedyn Oil Processing Plant Ltd., Lebedyn, Sumy reg., Ukraine
Lubrifin Super Motor Oil	X				X	S.C. Lubrifin S.A., Brasov, Rumania
Madit Turbo Plus	X					Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Megasuper	X					Rilub S.p.A., Ottaviano (NA), Italy
Milantar 2 B Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Engine D 250	X					Unil S.A., Saumur, France
Motul Tekma Norma	X					Motul, Aubervilliers Cedex, France
Multigrado S3 DMOK 2040				X		Krafft S.A., Andoain (Guipuzcoa), Spain
Novoil Extra 1	X					Novoufimsky Refinery, Ufa, Russia
OMV super diesel	X					OMV Aktiengesellschaft, Vienna, Austria
Orly Gemini 2002		X				Orly International, Vieux-Thann, France
Orly Gemini 3002	X					Orly International, Vieux-Thann, France

Orly Multigrade Lloyd 2	X					Orly International, Vieux-Thann, France
Orly Multigrade Luna 2				X		Orly International, Vieux-Thann, France
Orly Multitractor 3002	X					Orly International, Vieux-Thann, France
Orly Reda 3002	X					Orly International, Vieux-Thann, France
Orly Sirius 3002	X					Orly International, Vieux-Thann, France
P.O. Süper Dizel	X					Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Pennasol Longlife Dieselöl	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Pennasol Multigrade Extra C	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Petromin Diesel Gold	X			X		Saudi Arabian Lubricating Oil Co., Jeddah, Saudi Arabia
Prista Super	X			X	X	Prista Oil Ltd., Rousse, Bulgaria
Prista Super Diezel	X			X	X	Prista Oil Ltd., Rousse, Bulgaria
Q8 t 400	X					Kuwait Petroleum, Hoogvliet RT, Netherlands
Raloy Super	X					Raloy Lubricantes, Santiago Tianguistenco, Mexico
Selectol Universal Motorenöl	X					Karl Käppler GmbH u. Co KG, Stuttgart, Germany
Shell Harvella TX		X				Shell International Petroleum Co., London, England
TERRA REC Longlife Dieseloel	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
TERRA REC Multigrade Extra C	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Tor Multifleet Oil	X					De Oliebron B.V., Zwijndrecht, Netherlands
Total Rubia X	X					TotalFinaElf Lubrifiants, Paris, France
Unifarm	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Uranol Mehrbereichsöl CD	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Usoco-Excello HD XXX Multigrade	X			X		Usoco B.V., Ridderkerk, Netherlands
Wecoline HDC-IL	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Wecoline Multigrade HDC	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Wintershall Magnum Turbo	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen, Germany
Wintershall Rekord 15/40	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen, Germany
Yacco Transpro 15	X					Yacco SAF, Saint-Pierre-lès-Elbeuf, France

BB00.40-P-0228-00A	Single-grade engine oils (Sheet 228.0)	i For use in vehicles/engines refer to "	Sheet 228.0
		Sheet 223.2	BB00.40-P-0223-02A
		For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	10W	20W-20	30	40	50	Company, town/country
Addinol Turbo Diesel		X	X	X		Addinol Lube Oil GmbH, Leuna/Germany
Adnoc Engine Oil XD3+ Mono				X		Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc Extra Super Engine Oil Mono				X		Adnoc Distribution, Abu Dhabi, U.A.E.
Agip Diesel Sigma FS			X	X		ENI S.p.A.- Refining & Marketing Division, Rome/Italy
Antar Grapholia MS Monograde			X			TotalFinaElf Lubrifiants, Paris, France
Antar Traxolia Z Monograde			X	X		TotalFinaElf Lubrifiants, Paris, France
Aral BasicTurboral	X	X	X	X	X	Aral Aktiengesellschaft, Bochum/Germany
Caltex Delo 350			X	X		ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Caltex Delo 600			X	X		ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Calypsol Bison HD	X	X	X	X	X	Fuchs Europe Schmierstoffe GmbH, Mannheim/Germany
Castrol CRD-DB	X					Castrol Ltd., Swindon, England
Castrol RXC				X		Castrol Ltd., Swindon, England
CLAAS Engine 20W20	X	X	X	X	X	CLAAS Vertriebsgesellschaft mbH, Harsewinkel/Germany
Divinol Spezial 2000 HD	X	X				Zeller + Gmelin GmbH & Co., Eislingen/Germany
EKO Marsa			X	X		EKO, Athens, Greece
Elf Disola MT			X	X		TotalFinaElf Lubrifiants, Paris, France
Elf Performance 3 D			X	X	X	TotalFinaElf Lubrifiants, Paris, France
Elf Performance Super D Monograde			X	X		TotalFinaElf Lubrifiants, Paris, France
Emo Turbo Champion Plus Mono			X	X		Motor Oil (Hellas), Maroussi, Greece
Essolube X 301			X	X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube X4 40				X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube X4			X	X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Fina Kappa Super	X	X	X	X		TotalFinaElf Lubrifiants, Paris, France
Fuchs Titan Universal HD	X	X	X	X	X	Fuchs Petrolub AG, Mannheim/Germany
Galp Galaxia			X	X	X	Petrogal S.A., Lisbon, Portugal
Gulfleet Super Trailer (EP)			X			S.A.E.L., Madrid/Spain
Madit Extra			X			Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Mexlub MB-0P				X		Mexicana de Lubricantes, S.A. de C.V., Guadalajara / Mexico
MOL Turbo S	X	X	X	X	X	MOL -LUB Ltd., Almasfüzitö/Hungary
OMV truck		X	X	X		OMV Aktiengesellschaft, Vienna, Austria
Orly Draco 3001	X			X		Orly International, Vieux-Thann, France
P.O. Turbosarj			X			Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Panolin Extra Diesel			X			Panolin AG, Madetswil, Switzerland
Repsol Serie 3	X		X	X		Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Roils Turbo			X			JSC Ryazan Refinery, Ryazan, Russia
Shell Rimula X Monograde			X	X		Shell International Petroleum Co., London, England
Statoil DieselWay			X	X		Statoil Lubricants, Stockholm, Sweden
Stelvio 30			X			Conqord Oil S.r.l., Lacchiarella (Ml)/Italy
Südöl HD-Motorenöl S3	X	X	X			Südöl Mineralöl-Rafinerie GmbH, Eislingen/Germany
Südöl Motorenöl HD Super	X	X				Südöl Mineralöl-Rafinerie GmbH, Eislingen/Germany
Texaco Ursa Super LA		X	X	X	X	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Total Rubia K				X		TotalFinaElf Lubrifiants, Paris, France
Ursa Super LA			X	X		ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium

Veedol Diesel HDC	X	X	X	X		Veedol International, Swindon, England
Wintershall Rekord	X	X	X	X	X	SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany

BB00.40-P-0228-01A	Multigrade engine oils (Sheet 228.1)	i For use in vehicles/engines refer to "	Sheet 228.1
		Sheet 223.2	BB00.40-P-0223-02A
		i For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	15W-40	10W-30	10W-40	20W-40	20W-50	Company, town/country
76 Guardol QLT	X					ConocoPhillips, Costa Mesa, CA, USA
A-SR-Premium	X					Scientific-technical centre "Khimmotologia", Korolev, Russia
ad-Mehrbereichs-Oil	X					Carat GmbH & Co. KG, Eschborn/Germany
Addinol Super star MX 1547	X					Addinol Lube Oil GmbH, Leuna/Germany
Adnoc Engine Oil XD3+ Multi	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc HPSD Engine Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Agip Master Superturbo S.H.P.D.	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Superdiesel Multigrade	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Universal Extra	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Universal Multifleet	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agrola Multigrade HD	X					Landi Schweiz AG, Dotzingen, Switzerland
Agronil HD-Super C-S3	X					A.G. Röhrl GmbH & Co., Weiden/Germany
Alpha Juan 7000					X	Axcl Gulf FZE, Sharjah, U.A.E.
Alpine RST Super	X					Mitan Mineralöl GmbH, Ankum/Germany
Amalie Diesel Turbo	X					Amalie Petroquímica S.A., Madrid, Spain
Antar Grapholia MS Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Antar Traxolia Z Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Aral MultiTurboral	X				X	Aral Aktiengesellschaft, Bochum/Germany
Aral MultiTurboral U	X					Aral Aktiengesellschaft, Bochum/Germany
Areca Multi Funo Max	X					Durand Production S.A., Harnes, France
Argon-Hochleistungs-Mehrbereichsöl	X					Voitländer GmbH & Co. KG, Kronach/Germany
Argus Multi Fleet	X					Hemco, Belgrade, Yugoslavia
Aristokrat Motoröl Super KTX turbo HD	X					Hubert Math. Müller Handelsgesellschaft mbH, Eschweiler/Germany
Aseol Perla 15W-40	X					Shell Aseol AG, Bern, Switzerland
Astris Motor Oil MF	X					Astris S.A., Giornico, Switzerland
Autol Spezial CPM HD S3	X					Agip Schmiertechnik GmbH, Würzburg/Germany
Avia Multi CFE			X			Avia Mineralöl-AG, Munich/Germany
Avia Multi HDC Extra	X					Avia Mineralöl-AG, Munich/Germany
Avia Super 365	X					Avia Mineralöl-AG, Munich/Germany
Aviatic Super Multigrade	X					Wilhelm Scholten GmbH, Münster/Germany
Aviaticon Unique D	X					Finke Mineralölwerk GmbH, Bremen/Germany
Axle King	X					Beijing Tongyi Petroleum Chemical Co., Ltd, Beijing/P.R. China
BayWa Motorenöl Universal HD 1040 MC			X			BayWa AG, Munich/Germany
BayWa Super Multisyn SL			X			BayWa AG, Munich/Germany
BP Leichtlauf-Motorenoel 1040			X			Deutsche BP Aktiengesellschaft, Hamburg/Germany
BP Vanellus C4 Global	X					BP p.l.c., London, England
BP Vanellus C5 Global	X					BP p.l.c., London, England
BP Vanellus C6 Classic	X					BP p.l.c., London, England
Calpam Multifleet Longlife	X					Calpam Mineralöl-Gesellschaft mbH, Aschaffenburg/Germany
Caltex Delo 350 Multigrade	X			X	X	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Carl Mehrbereichs-Motorenöl Multi	X					Coparts Autoteile GmbH, Essen/Germany
Cartechnic Motorenöl	X					Wessels + Müller AG, Osnabrück/Germany
Castrol Assuron Max	X					Castrol Ltd., Swindon, England
Castrol Assuron T Max	X					Castrol Ltd., Swindon, England

Castrol Myndio Plus	X					Castrol Ltd., Swindon, England
Castrol RX Super Max	X					Castrol Ltd., Swindon, England
Cepsa Supermultigrado SHPD	X					Cepsa Lubricantes, S.A., Madrid, Spain
Chevron RPM Super Diesel Multigrade	X					ChevronTexaco, Cheltenham, England
CLAAS Engine	X					CLAAS Vertriebsgesellschaft mbH, Harsewinkel/Germany
CONCEP-Tech GDX	X					Swd Lubricants GmbH & Co. KG, Duisburg, Germany
Condat Vicam Turbo LD	X					Condat S.A., Chasse-sur-Rhône, France
Consol Titan Transit	X					Vial Oil Ltd., Moscow, Russia
Crown Super Ultra Diesel	X					Emirates Lube Oil Co. Ltd., Sharjah, U.A.E.
Diesel Ultra	X					Pemco Kuras, Kleipeda/Lithuania
Dislub Super	X					Diator de Mexico, S.A. de C.V., León, Guanajuato, Mexico
Dolomiti Super HD	X					Conqord Oil S.r.l., Lacchiarella (MI)/Italy
Duplex CDX 15/40	X					Morris & Co. Ltd., Shrewsbury, England
Duron	X					Petro-Canada Lubricants, Mississauga, Ontario, Canada
EKO Forza	X					EKO, Athens, Greece
Elf Disola W	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance 3D Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance Super D	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance Super Multigrade	X					TotalFinaElf Lubrifiants, Paris, France
Ellmotol HD Super C3	X					Eller-Montan-Comp. GmbH, Duisburg/Germany
Ellmotol HD Super GT	X					Eller-Montan-Comp. GmbH, Duisburg/Germany
Emo Turbo Champion Plus	X					Motor Oil (Hellas), Maroussi, Greece
Energomax Extra	X					Energoinvest-Proizvodnja Maziva ddo, Sarajevo, Bosnia-Herzegovina
ENOC Vulcan 550X 15W-40	X					ENOC International Sales L.L.C., Dubai/U.A.E.
ENOC Vulcan 660X 15W-40	X					ENOC International Sales L.L.C., Dubai/U.A.E.
Ergo Diesel Plus	X					ERG Petroli SpA, Rome, Italy
Ertoil Multirruta TD SHPD	X					Cepsa Lubricantes, S.A., Madrid, Spain
ESA Multilub 2004	X					ESA, Burgdorf, Switzerland
Essolube XT 3 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 301	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XTS 301			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Eurol Uni	X					Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Evva Multi GFP	X					Evva-Schmiermittel-Fabrik, Margarethen/Moos, Austria
Fenix Super	X					NIS Fabrika maziva, Krusevac, Yugoslavia
Fina Kappa Supra	X					TotalFinaElf Lubrifiants, Paris, France
Fina Kappa Turbo DI	X		X			TotalFinaElf Lubrifiants, Paris, France
Forol Unimax 15W40	X					Patting d.o.o., Varazdin, Croatia
Fuchs Titan Formel	X					Fuchs Petrolub AG, Mannheim/Germany
Fuchs Titan LD Extra			X			Fuchs Petrolub AG, Mannheim/Germany
Fuchs Titan Universal HD 1540	X					Fuchs Petrolub AG, Mannheim/Germany
Galax Unia	X					NIS - Rafinerija Nafte Beograd, Belgrade, Yugoslavia
Galp Formula D 2000	X					Petrogal S.A., Lisbon, Portugal
Galp Galaxia D	X			X		Petrogal S.A., Lisbon, Portugal
Gedol Yes Turbo	X					Gedol International S.r.l., Cerreto Guidi (FI), Italy
Genol Multigrade 1540 PL	X					GENOL Gesellschaft m.b.H. & Co, Vienna, Austria
Gerina Super Diesel	X					Nova Plama Trading, Pleven, Bulgaria
Gonher Super Fleet MB-1	X					Gonher de Mexico, S.A. de C.V., Santa Catarina, N.L., Mexico
Greatwall Flying Tiger	X					Greatwall Lube Oil Co. Sinopec, Beijing, P. R. China
Gulf Multi Duty (EP)	X					S.A.E.L., Madrid/Spain
Gulf Multitrailer	X					S.A.E.L., Madrid/Spain
Gulf Superfleet (GIL)	X					Gulf Oil International, London, England
Gulfleet Multi Trailer (EP)	X					SAEL, Madrid, Spain
Habarah Excel	X					Khaleej Lube Oil Company, Ahmadi, Kuwait

Hafa Multidex 500	X					Hafa, Paris, France
Hafa Multigrade TD	X					Hafa, Paris, France
HAI PAI Heavy Duty Diesel Engine Oil	X					Shanghai Oil Refinery, Pudong, Shanghai, P. R. China
Hercules Turbo Special	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Hessol Superior	X					Hessische Oelwerke, Bad Vilbel/Germany
Hunold Turbo Star	X					Hunold Schmierstoffe GmbH, Eching/Germany
ICPA Extra Universal	X					ICPA, Dordrecht, Netherlands
Igol Trans Turbo 4X	X					Igol France, Amiens - cedex 3, France
Inter TRX2	X					Ets A. Mauran & Fils S.A., Odars, France
Intercooler 400	X					Unil S.A., Saumur, France
Intercooler 450	X					Unil S.A., Saumur, France
Jet Basic Level Diesel	X					Conoco Mineralöl GmbH, Hamburg/Germany
Jet High Level Diesel			X			Conoco Mineralöl GmbH, Hamburg/Germany
LEOL-Premium	X					Lebedyn Oil Processing Plant Ltd., Lebedyn, Sumy reg., Ukraine
Liqui Moly Formula 3 Protech	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly Formula Super HD Motoröl	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly MB Service Fill Motor Oil	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly Nova Super HD Motoröl	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly Profi Touring	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly Touring High Tech Diesel Spezialoil	X					Liqui Moly GmbH, Ulm/Germany
Liqui Moly Touring High Tech Motoroil HD	X					Liqui Moly GmbH, Ulm/Germany
Lotos Diesel 3	X					Rafineria Gdanska S.A., Gdansk, Poland
Lubral Super Diesel MB-I	X					Lubricantes de America, S.A. de C.V., Santa Catarina, N.L., Mexico
Lubrifin Ultra Motor Oil	X				X	S.C. Lubrifin S.A., Brasov, Rumania
Lukoil Super	X					OAO Lukoil-Nizhegorodnefteorgsintez, Kstovo, Nizhni Novgorod Region, Russia
Lukoil Super N	X					OAO Lukoil-Nizhegorodnefteorgsintez, Kstovo, Nizhni Novgorod Region, Russia
Lukoil Super-V	X					OOO Lukoil-VNP, Volgograd, Russia
Lukoil - Super	X					OAO Lukoil-Nizhegorodnefteorgsintez, Kstovo, Nizhni Novgorod Region, Russia
Madit Turbo	X					Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Madit Turbo Plus	X					Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Marol Turbo HDC-DB	X					Martin GmbH & Co.KG, Nuremberg/Germany
Marol Turbo LL			X			Martin GmbH & Co.KG, Nuremberg/Germany
Maxidiesel	X					Verkol, S.A., Bera/Navarra, Spain
Maxima Super	X					Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
Meditran SC	X					Pertamina, Jakarta, Indonesia
Medoil Extra Diesel	X					Durand Production S.A., Harnes, France
megol Motorenoel HD-C3	X					Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
megol Motorenoel HD-C3 Super Turbo	X					Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
Mexlub CF-4 MB-1P	X					Mexicana de Lubricantes, S.A. de C.V., Guadalajara / Mexico
MHG Oil Unitop	X					MHG, Sulzbach-Rosenberg/Germany
Migrol HD Motor Oil S3	X		X			Migrol-Genossenschaft, Zurich, Switzerland
Migrol HD Motor Oil Superlife Special	X		X			Migrol-Genossenschaft, Zurich, Switzerland
Mobil Delvac Super 1300 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mogul Diesel DT	X					Koramo s.p., Kolin V/Czech Republic
MOL Turbo Diesel	X			X		MOL-LUB Ltd. Almasfüzitö /Hungary
Motorex Cobra 1040			X			Bucher AG, Langenthal, Switzerland
Motorex Cobra 1540	X					Bucher AG, Langenthal, Switzerland
Motorex Select SP-X			X			Bucher AG, Langenthal, Switzerland
Motorex Select SP-X Plus			X			Bucher AG, Langenthal, Switzerland
Motorex Topaz	X					Bucher AG, Langenthal, Switzerland

Motul Tekma Supra	X				X	Motul, Aubervilliers Cedex, France
National Super Ultra Diesel	X					Emirates Lube Oil Co. Ltd., Sharjah, U.A.E.
National Ultra Diesel	X					Emirates Lube Oil Co. Ltd., Sharjah, U.A.E.
New Process SHPD	X					New-Process AG, Tübach SG, Switzerland
Oest Gigant Universal HD Motoröl	X					Georg Oest Mineralölwerke, Freudenstadt/Germany
Olmaline Plus	X					OLMA, Ljubljana, Slovenia
Omega Süper	X					Opet Petrolcülük AS., Cigli/Izmir, Turkey
ÖMV con trol	X					OMV Aktiengesellschaft, Vienna, Austria
ÖMV truck CF	X					OMV Aktiengesellschaft, Vienna, Austria
ÖMV truck M plus	X					OMV Aktiengesellschaft, Vienna, Austria
Optimol Optilub Longlife	X					Castrol Industrie GmbH, Munich/Germany
Original Tetra	X					Shenyang Original Finechemicals Co., Shenyang, P. R. China
Orly Stratus 3002	X					Orly International, Vieux-Thann, France
Orly Stratus 3002 Z	X					Orly International, Vieux-Thann, France
Panolin Universal FEO	X					Panolin AG, Madetswil, Switzerland
Parnas EVO Super	X					Sakson S.A., Athens, Greece
Pazmular DB	X					Paz Lubricants & Chemicals Ltd., Haifa, Israel
Pennasol Multigrade Extra E	X				X	Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen/Germany
Pennzoil Long-Life 2000 Motor Oil	X					Pennzoil-Quaker State Mediteraneo, S.L., Madrid, Spain
Petrimex Unilube MF	X					S.A. Petrimex, Rancate, Switzerland
Petromin Turbodiesel C 15W40	X					Saudi Arabian Lubricating Oil Co., Jeddah, Saudi Arabia
PO Turbo Dizel S	X					Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Prista Leader 20W50					X	Prista Oil Ltd., Rousse, Bulgaria
Proton diesel	X					Petrol d.d., Ljubljana, Slovenia
Q8 t 500	X					Kuwait Petroleum, Hoogvliet RT, Netherlands
QS Serie III Multigrade	X					Commercial Importadora S.A., México, D.F., Mexico
Ravenol Formel Super Mineraloel Diesel	X					Ravensberger Schmierstoffvertrieb GmbH, Werther/Germany
Ravenol Turbo C	X					Ravensberger Schmierstoffvertrieb GmbH, Werther/Germany
Rektol Turbo Hochleistungsoel	X					Karl Pohlmann, Korbach/Germany
Repsol Elite TDI	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Repsol Multi G Diesel	X			X		Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Rexol HD Super	X					JSC Ryazan Refinery, Ryazan, Russia
Roils Turbo 15W40	X					JSC Ryazan Refinery, Ryazan, Russia
Scope Denim 2070	X					United Grease & Lubricants L.L.C., Ajman, U.A.E.
Shell Rimula X	X					Shell International Petroleum Co., London, England
Shell Universal Engine Oil	X					Shell International Petroleum Co., London, England
Sips-Multi-Plus-HD	X					Sips-Dieter Döcker GmbH, Viersen, Germany
SPC SDM 801	X					Singapore Petroleum Co. Ltd., Singapore
SPC SDM 803	X					Singapore Petroleum Co. Ltd., Singapore
Statoil PowerWay 10W-30		X				Statoil Lubricants, Stockholm, Sweden
Statoil PowerWay 15W-40	X					Statoil Lubricants, Stockholm, Sweden
Statoil RoadWay	X					Statoil Lubricants Technologies Sp. Z o.o., Krakow, Poland
Südöl Extra HDC	X					Südöl Mineralöl-Raffinerie GmbH, Eislingen/Germany
Südöl Recycling Super Motoröl turbo	X					Südöl Mineralöl-Raffinerie GmbH, Eislingen/Germany
Sunoco Forza	X					Sun Oil Co. (Belgium) N.V., Aartselaar, Belgium
Super Diesel Oil MB-1	X					Bardahl de México, México, D.F., Mexico
Super Speed 3S Diesel	x					Statoil Lubricants Technologies Sp. Z o.o., Krakow, Poland
Super Universal 15W-40	X					Raiffeisen Central-Genossenschaft Nordwest eG, Münster/Germany
Super diesel	X					Conqord Oil S.r.l., Cologno-Milan, Italy
swd Primus GDX	X					Swd Lubricants GmbH & Co. KG, Duisburg, Germany

Tamoil Extra Diesel Turbo (I)	X					Tamoil Petroli S.p.A., Milan, Italy
Tamoil Formula Turbo Diesel (I)	X					Tamoil Petroli S.p.A., Milan, Italy
Teboil Power	X					Suomen Petrooli Oy, Hamina, Finland
Tedex Diesel Truck Motor Oil	X					Tedex Vertriebs GmbH, Berlin/Germany
Tedex Multifleet FE Motor Oil	X					Tedex Vertriebs GmbH, Berlin/Germany
TERRA REC Multigrade Extra E	X				X	Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen/Germany
Texaco Ursa Super LA Multigrade	X				X	Chevron Texaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Top Lube Supreme Performance DEO	X					ABS Lubricants, Abu Dhabi, U.A.E.
Top X Turbo	X					Hubert Math. Müller Handelsgesellschaft mbH, Eschweiler/Germany
Tor Mixfleet Ultra	X					De Oliebron B.V., Zwijndrecht, Netherlands
Total Rubia 4400	X					TotalFinaElf Lubrifiants, Paris, France
Total Rubia XT	X					TotalFinaElf Lubrifiants, Paris, France
Triathlon Diesel	X					Adolf Würth GmbH & Co. KG, Künzelsau/Germany
Trysk Super Turbo	X					Paramo, Pardubice, Czech Republic
Ufalub HD Extra	X					AO Ufaneftekhim, Bashkir, Ufa, Russia
Ultsch Oel Multigrade	X				X	Georg Ultsch GmbH, Weismain/Germany
Unil Multi D	X					Unil Deutschland GmbH, Stuttgart/Germany
Urania Turbo	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Uranus Turbo	X					C.F.C.L.., Mérignac, France
Ursa Serie 5 ED	X					Productos Texaco S. A. de C. V., México, D.F., Mexico
Ursa Super DMO	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Ursa Super LA Multigrade	X				X	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Ursa Super Plus 15W40	X					Productos Texaco S. A. de C. V., México, D.F., Mexico
Valvoline All-Fleet Plus	X	X	X		X	The Valvoline Company, Dordrecht, Netherlands
Valvoline Diesel Turbo motor oil	X					The Valvoline Company, Dordrecht, Netherlands
Valvoline High Performance motor oil	X					The Valvoline Company, Dordrecht, Netherlands
Valvoline Turbo-V		X	X		X	The Valvoline Company, Dordrecht, Netherlands
Vanguard 15W40	X					Greenway Lubricants Limited, Wednesbury, West Mid, England
Vat Turbo Plus	X					VAT-Oil, Oisterwijk, Netherlands
Veco Super Turbo Diesel	X					Przedsiebiorstwo Modex-Oil, Kwidzyn, Poland
Veco Turbo Diesel	X					Przedsiebiorstwo Modex-Oil, Kwidzyn, Poland
Veritas Super Turbo 2000	X					Oelwerke Julius Schindler GmbH, Hamburg/Germany
Veritas Super Turbo HD	X					Oelwerke Julius Schindler GmbH, Hamburg/Germany
Versus	X				X	S.C. Lubrifin S.A., Brasov, Rumania
ViscoClass A+	X					Viscolube Italiana S.p.A., Pieve Fissiraga (LO), Italy
Wintershall Multi-Rekord	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall Primalub	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall TFE			X			SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wunsch Record Multi HD-E2	X					Wunsch Öle GmbH, Ratingen/Germany
Xorbol Mehrbereichsöl HDC	X					Hilbert GmbH, Emsdetten/Germany
Yacco Transpro 25	X					Yacco SAF, Saint-Pierre-lès-Elbeuf, France
Yacco Transpro 30 15W40	X					Yacco SAF, Saint-Pierre-lès-Elbeuf, France

BB00.40-P-0228-02A	Single-grade engine oils (Sheet 228.2)	i For use in vehicles/engines refer to "	Sheet 228.2
		Sheet 223.2	BB00.40-P-0223-02A
		For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	10W	20W-20	30	40	50	Company, town/country
Adnoc Extra Super Plus Engine Oil Mono				X		Adnoc Distribution, Abu Dhabi, U.A.E.
Caltex Delo Gold (ISOSYN)			X	X		Caltex International Technical Center Pty Ltd, /Australia
Caltex Delo SHP			X	X		Caltex (UK) Limited, London, England
Dislub Super 1				X		Diator de Mexico, S.A. de C.V., León, Guanajuato, Mexico
Elf Performance Trophy Monograde				X		TotalFinaElf Lubrifiants, Paris, France
Emo SHPD Plus Mono			X	X		Motor Oil (Hellas), Maroussi, Greece
Engen Dieselube 630			X			Engen Petroleum Ltd., Cape Town, South Africa
Exxmar CM Super 30			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Exxmar CM Super 40				X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Gonher Super Fleet MB-40				X		Gonher de Mexico, S.A. de C.V., Santa Catarina, N.L., Mexico
Kuwaitoil Super Diesel Oil SHPD Monograde			X	X	X	Kuwait National Petroleum Company, Kuwait, Kuwait
Long-Life EF Diesel Engine Oil			X			Pennzoil-Quaker State, Houston, Texas, USA
Lubral Super Diesel MB-40				X		Lubricantes de America, S.A. de C.V., Santa Catarina, N.L., Mexico
Mexlub MB-2P				X		Mexicana de Lubricantes, S.A. de C.V., Guadalajara / Mexico
Mobil Delvac 1400			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac 1630			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac 1640				X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac HP Monograde	X	X	X	X	X	Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Marine 40				X		Exxon Mobil Corporation, Fairfax, Virginia, USA
P.O. Turbosarj Ekstra E				X		Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Petromin Superfleet LDM 40				X		Saudi Arabian Lubricating Oil Co., Jeddah, Saudi Arabia
Q.S. Fleet H.D.				X		Commercial Importadora S.A., México, D.F., Mexico
Texaco Ursa Super TD Monograde			X	X		ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Ursa Super TD Monograde			X	X		ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium

BB00.40-P-0228-03A	Multigrade engine oils (Sheet 228.3)	i For use in vehicles/engines refer to "	Sheet 228.3
		Sheet 223.2	BB00.40-P-0223-02A
		i For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	15W-40	10W-30	10W-40	15W-30	20W-50	Company, town/country
76 Royal Triton QLT	X					ConocoPhillips, Costa Mesa, CA, USA
A.P.B. Super Turbo SHPD DDE	X					Ashland Oil Nederland, Dordrecht, Netherlands
Accor ZT3 Special Diesel	X					Accor Lubrifiants S.A., Cholet, France
AD Parts XTD	X					AD Parts, S.L., Girona, Spain
ad-Cargo Leichtlauf-Oil			X			Carat GmbH & Co. KG, Eschborn/Germany
ad-SHPD Truck Oil	X					Carat GmbH & Co. KG, Eschborn/Germany
Addinol Diesel Longlife MD 1547	X					Addinol Lube Oil GmbH, Leuna/Germany
Addinol Diesel Power MD 1547	X					Addinol Lube Oil GmbH, Leuna/Germany
Addinol Premium Star MX 1048			X			Addinol Lube Oil GmbH, Leuna/Germany
Addinol Super Longlife MD 1046			X			Addinol Lube Oil GmbH, Leuna/Germany
Adnoc Extra Super Engine Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc Extra Super Plus Engine Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc Global Engine Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Adnoc SHPD Engine Oil	X					Adnoc Distribution, Abu Dhabi, U.A.E.
Agip All Guard Motor Oil	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Blitum T	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Sigma Super TFE			X			ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Sigma TFE			X			ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Sigma Truck	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Sigma Turbo	X					ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agrola FEO Turbo Motoroil			X			Landi Schweiz AG, Dotzingen, Switzerland
Akron Ultra Clear CI-4	X					Mexicana de Lubricantes, S.A. de C.V., Guadalajara / Mexico
Alpine RST Super plus 15 W 40	X					Mitan Mineralöl GmbH, Ankum/Germany
Alusynt			X			Aluchem Srl, Cisliano, Italy
Amalie Superturbo Diesel SHPD	X					Amalie Petroquímica S.A., Madrid, Spain
Ambra Gold Super HSP	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Antar Dexelia FE 15W 40	X					TotalFinaElf Lubrifiants, Paris, France
Antar Grapholia TX	X					TotalFinaElf Lubrifiants, Paris, France
Aral ExtraTurboral			X			Aral Aktiengesellschaft, Bochum/Germany
Aral PlusTurboral	X					Aral Aktiengesellschaft, Bochum/Germany
Argon-Hochleistungs-Dieselmotorenöl SHPD	X					Voitländer GmbH & Co. KG, Kronach/Germany
Argon-Leichtlauföl 10W40 SHPD			X			Voitländer GmbH & Co. KG, Kronach/Germany
Argus Long Life	X					Hemco, Belgrade, Yugoslavia
Armorine Multigrade SHPDO Super S3	X					Armorine S.A., Lanester Cedex, France
Aseol Perla DO 10W40			X			Shell Aseol AG, Bern, Switzerland
Aseol Turbo SHPD 15W-40	X					Shell Aseol AG, Bern, Switzerland
Astris Motor Oil LDX	X					Astris S.A., Giornico, Switzerland
Astris Motor Oil Universal			X			Astris S.A., Giornico, Switzerland
Autol Valve SHP	X					Agip Schmiertechnik GmbH, Würzburg/Germany

Autol Valve Turbo FE			X			Agip Schmiertechnik GmbH, Würzburg/Germany
Autol Valve Turbo FE Plus			X			Agip Schmiertechnik GmbH, Würzburg/Germany
Avia Multi CFE Plus			X			Avia Mineralöl-AG, Munich/Germany
Avia Multi HDC Plus	X					Avia Mineralöl-AG, Munich/Germany
Avia Turbosynth CFE			X			Avia Mineralöl-AG, Munich/Germany
Aviatic Super SHPD	X					Wilhelm Scholten GmbH, Münster/Germany
Aviaticon Turbo	X					Finke Mineralölwerk GmbH, Bremen/Germany
Aviaticon Turbo D 10W-40			X			Finke Mineralölwerk GmbH, Bremen/Germany
BayWa Motorenöl HDC Superior 1540	X					BayWa AG, Munich/Germany
BayWa Motorenöl Rennklasse Turbo 2000			X			BayWa AG, Munich/Germany
BayWa Motorenöl Super Truck 1540	X					BayWa AG, Munich/Germany
BayWa Motorenöl Turbo 4000			X			BayWa AG, Munich/Germany
Behran Motor Oil SHPD	X				X	Behran Oil Company, Teheran, Iran
Bell Super Long - Protec	X					Bell chemicals, Banatsko Veliko Selo, Yugoslavia
BFT-Trucker-Oil	X					EFT, Bonn/Germany
Blasol 15W40	X					Blaser Swisslube AG, Hasle-Rüegsau, Switzerland
Blasol MHP 10W40			X			Blaser Swisslube AG, Hasle-Rüegsau, Switzerland
Blasol MHP 15W40	X					Blaser Swisslube AG, Hasle-Rüegsau, Switzerland
BP Spezial CRT			X			BP p.l.c., London, England
BP Terrac Motor Ultra			X			BP p.l.c., London, England
BP Vanellus C6 Global	X					BP p.l.c., London, England
BP Vanellus C6 Global Plus			X			BP p.l.c., London, England
BP Vanellus E6	X					BP p.l.c., London, England
BP Vanellus E6 Plus			X			BP p.l.c., London, England
BP Vanellus HT			X			BP p.l.c., London, England
Brad Penn Euro-Diesel LD	X					American Refining Group, Bradford PA, USA
buck	X					Fujian Laike Petrochemical Co., Ltd., Nan An City, Fujian Province, 362321, P. R. China
Burgan Diesel CH-4	X					Kuwait National Petroleum Company, Kuwait, Kuwait
Calpam Truck FE			X			Calpam Mineralöl-Gesellschaft mbH, Aschaffenburg/Germany
Calpam Turbofleet	X					Calpam Mineralöl-Gesellschaft mbH, Aschaffenburg/Germany
Caltex Delo 400 Multigrade	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Caltex Delo 600 Multigrade	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Caltex Delo Gold (ISOSYSN) Multigrade	X					Caltex International Technical Center Pty Ltd, /Australia
Caltex Delo SHP Multigrade	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Carl Motorenöl SHPD NKW	X					Coparts Autoteile GmbH, Essen/Germany
Carl Motorenöl Truck			X			Coparts Autoteile GmbH, Essen/Germany
Castrol CRT Extra			X			Castrol Ltd., Swindon, England
Castrol RX Super Plus	X					Castrol Ltd., Swindon, England
Castrol Syndio Plus	X					Castrol Ltd., Swindon, England
Castrol Tection	X					Castrol Ltd., Swindon, England
Castrol Tection 1040			X			Castrol Ltd., Swindon, England
Castrol Tection S	X					Castrol Ltd., Swindon, England
Castrol Tection T	X					Castrol Ltd., Swindon, England

Castrol Turbomax	X					Castrol Ltd., Swindon, England
Castrol Turbomax Light			X			Castrol Ltd., Swindon, England
Castrol Turbomax Light D			X			Castrol Ltd., Swindon, England
Cepsa Diesel Turbo SHPD	X					Cepsa Lubricantes, S.A., Madrid, Spain
Cepsa Euromax	X					Cepsa Lubricantes, S.A., Madrid, Spain
Cepsa Ultra SHPD	X					Cepsa Lubricantes, S.A., Madrid, Spain
Challoils Long Life Plus TD 15W40 S.H.P.D.O.	X					Redoil Italia S.p.A., San Vitaliano, Italy
Champion Turbofleet SHPD					X	Wolf Oil Corporation N.V., Hemiksem, Belgium
Chemoleums Turbo SHPD	X					Chemoleums Limited, Chrompet, Chennai, India
Chevron Delo 400 Euro HDMO	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Chevron Delo 400 Multigrade	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Citgo Citgard MB	X					Citgo International Latin America, Inc., Caracas, Venezuela
CLAAS Diesel Engine Plus	X					CLAAS Vertriebsgesellschaft mbH, Harsewinkel/Germany
CLAAS Engine Plus	X					CLAAS Vertriebsgesellschaft mbH, Harsewinkel/Germany
CLAAS Engine Synth Plus			X			CLAAS Vertriebsgesellschaft mbH, Harsewinkel/Germany
Classic Motorenöl Plus			X			Christian Lühmann GmbH & Co. KG, Hoya/Germany
Classic Motorenöl TD	X					Christian Lühmann GmbH & Co. KG, Hoya/Germany
Comma Super Diesel Oil 15W 40	X					Comma Oil & Chemicals Ltd, Gravesend, Kent/England
Condat Vicam Euro Turbo Exel	X					Condat S.A., Chasse-sur-Rhône, France
CPC Superfleet CH4 Motor Oil	X					Chinese Petroleum Corporation, Chia-Yi, Taiwan
CPC Superfleet E3 Synthetic Oil	X					Chinese Petroleum Corporation, Chia-Yi, Taiwan
CS Turbogrado	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
CS Turbogrado Extra	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Cyclon D Super	X					Cyclon Hellas S.A., Maroussi, Greece
Cyclon D1 SHPD	X					Cyclon Hellas S.A., Maroussi, Greece
Delkol Turbo Diesel	X					Delek, Natanya, Israel
Delkol Turbo engine	X					Delek, Natanya, Israel
Diesel Exclusive XFE	X					Millers Oils Ltd., Brighouse West Yorkshire, England
Diesel Special Benz M&A	X					M & A Oil Co. de Mexico, S.A. de C.V., México, D.F., Mexico
Diesel YPF Extra Vida	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Diesel YPF Extra Vida Plus	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Dislub Premium	X					Diator de Mexico, S.A. de C.V., León, Guanajuato, Mexico
Distance Oil Long Life	X					Zupljanka Zupa, Blace, Yugoslavia
Divinol Multimax Extra			X			Zeller + Gmelin GmbH & Co., Eislingen/Germany
Divinol Multimax Top	X					Zeller + Gmelin GmbH & Co., Eislingen/Germany
Dolomiti-T	X					Conqord Oil S.r.l., Cologno-Milan, Italy
Dragon Turbo Best	X					S-Oil Corporation, Seoul, Rep. of Korea
Econo-Veritas HDE			X			Oelwerke Julius Schindler GmbH, Hamburg/Germany
Econo-Veritas HDE Plus			X			Oelwerke Julius Schindler GmbH, Hamburg/Germany
EKO Petron	X					EKO, Athens, Greece

Eldon's SHP Diesel	X					Eldon's S.A., Athens, Greece
Elf Ecomax FE Plus			X			TotalFinaElf Lubrifiants, Paris, France
Elf Performance Trophy	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance Trophy DX	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance Trophy FE 15W-30				X		TotalFinaElf Lubrifiants, Paris, France
Elf Performance Victory 15W-40	X					TotalFinaElf Lubrifiants, Paris, France
Elf Performance Victory FE 10W30		X				TotalFinaElf Lubrifiants, Paris, France
Elf Polytrafic 10W-40			X			TotalFinaElf Lubrifiants, Paris, France
Ellmotol Econo HDC			X			Eller-Montan-Comp. GmbH, Duisburg/Germany
Ellmotol Turbo HD	X					Eller-Montan-Comp. GmbH, Duisburg/Germany
EMKA Ecomax DLE 10W-40			X			EMKA Schmiertechnik GmbH, Heilbronn/Germany
EMKA Supergrade LL-X 10W-40			X			EMKA Schmiertechnik GmbH, Heilbronn/Germany
EMKA Turbo Super SHPD	X					EMKA Schmiertechnik GmbH, Heilbronn/Germany
Emo Omega	X					Motor Oil (Hellas), Maroussi, Greece
Emo SHPD Plus	X					Motor Oil (Hellas), Maroussi, Greece
Energomax Super SHPD	X					Energoinvest-Proizvodnja Maziva ddo, Sarajevo, Bosnia-Herzegovina
Engen Dieselube 500 Super	X					Engen Petroleum Ltd., Cape Town, South Africa
Engen Dieselube 600 Super	X					Engen Petroleum Ltd., Cape Town, South Africa
Engen Dieselube 700 Super	X					Engen Petroleum Ltd., Cape Town, South Africa
ENOC Vulcan 770X 15W-40	X					ENOC International Sales L.L.C., Dubai/U.A.E.
Ergo Diesel TIR	X					ERG Petroli SpA, Rome, Italy
Ertoil SHPD	X					Cepsa Lubricantes, S.A., Madrid, Spain
Ertoil Super HPD LD	X					Cepsa Lubricantes, S.A., Madrid, Spain
ESA Multilub SK	X					ESA, Burgdorf, Switzerland
Essolube XT 4	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 4 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 401	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 5 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 5 b	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XT 501	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XTS 4 10W-40			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Eurol Bison			X			Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Eurol Biturbo			X			Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Eurol SHPD	X					Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Evva Galax FE			X			Evva-Schmiermittel-Fabrik, Margarethen/Moos, Austria
Evva Multi SHPDO	X					Evva-Schmiermittel-Fabrik, Margarethen/Moos, Austria
Exxmar CM Super 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Exxon XD-3 Extra	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Falcon Super XMD Oil	X					Falcon Oil Co. Ltd., Sharjah, U.A.E.
Fenix Superior	X					NIS Fabrika maziva, Krusevac, Yugoslavia

Fina Kappa Extra Plus	X					TotalFinaElf Lubrifiants, Paris, France
Fina Kappa Extra Plus FE 15W-30				X		TotalFinaElf Lubrifiants, Paris, France
Fina Kappa FE			X			TotalFinaElf Lubrifiants, Paris, France
Fina Kappa Optima 15W-40	X					TotalFinaElf Lubrifiants, Paris, France
Forol SHPD-Max	X					Patting d.o.o., Varazdin, Croatia
Fuchs Titan Formel Plus	X					Fuchs Petrolub AG, Mannheim/Germany
Fuchs Titan HPE	X					Fuchs Lubricants (UK) PLC, Belper, England
Fuchs Titan Truck	X					Fuchs Petrolub AG, Mannheim/Germany
Fuchs Titan Unic MC			X			Fuchs Petrolub AG, Mannheim/Germany
Fuchs Titan Unic Plus MC			X			Fuchs Petrolub AG, Mannheim/Germany
Galax Super Long	X					NIS - Rafinerija Nafte Beograd, Belgrade, Yugoslavia
Galp Galaxia LD	X					Petrogal S.A., Lisbon, Portugal
Gedol Long Drain DMO	X					Gedol International S.r.l., Cerreto Guidi (FI), Italy
Gedol Long Endurance	X					Gedol International S.r.l., Cerreto Guidi (FI), Italy
Genius 6000	X					Mexoil slr, Nocera Inferiore (SA), Italy
Golden Seven Stars	X					Petrochina Dalian Lubricating Oil Plant, Dalian City, Liaoning Province, P. R. China
Gonher Super Fleet MB-III	X					Gonher de Mexico, S.A. de C.V., Santa Catarina, N.L., Mexico
Greatwall Flying Leopard	X					Greatwall Lube Oil Co. Sinopec, Beijing, P. R. China
Green Star Multiturbo BD	X					F. lli. Galbarini S.r.l., Bresso, Italy
Guardian Commercial	X					Rock Oil Company, Warrington, Cheshire, England
Gulfleet LDS 15W-40	X					S.A.E.L., Madrid/Spain
Hafa Multidex 600	X					Hafa, Paris, France
Hafa Stradex 1200	X					Hafa, Paris, France
Hafa Stradex 1500	X					Hafa, Paris, France
Hafa Stradex 900	X					Hafa, Paris, France
Haipai 2460	X					Shanghai Oil Refinery, Pudong, Shanghai, P. R. China
Hankook Shell Rimula Super	X					Hankook Shell Oil Company Limited, Seodaemoon-gu Seoul/Rep. of Korea
Hankook Shell Rimula X CH-4	X					Hankook Shell Oil Company Limited, Seodaemoon-gu Seoul/Rep. of Korea
Hercules HTF Special	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Hessol Turbo-Diesel	X					Hessische Oelwerke, Bad Vilbel/Germany
HRD Maxima RLD ECO 10W30		X				Huiles Berliet S.A., Paris, France
HRD Maxteria 10W-40			X			Huiles Berliet S.A., Paris, France
Hunold HD 4 CX Plus	X					Hunold Schmierstoffe GmbH, Eching/Germany
Hydroclear Power-D Engine Oil	X					Conoco Inc., Ponca City, OK, USA
ICCS Mega Truck	X					Kuttenkeuler GmbH, Cologne/Germany
ICPA Eco Diesel			X			ICPA, Dordrecht, Netherlands
ICPA Superior Diesel	X					ICPA, Dordrecht, Netherlands
IDO Premium 15W40	X					Irving Oil Limited, Saint John, New Brunswick, Canada
Igol Trans Turbo 5X	X					Igol France, Amiens - cedex 3, France
Igol Trans Turbo 7X	X					Igol France, Amiens - cedex 3, France
ILS Extra Motor Oil	X					Industria Lubrificanti Speciali, Carsoli (AQ), Italy
INA Super Turbo	X					INA Maziva Rijeka, Rijeka, Croatia
Inter TRX3	X					Ets A. Mauran & Fils S.A., Odars, France
JB German Oil Turbo 3000D Truck Speed	X					JB German Oil, Neuhof/Germany
Kendall Motor Oil SHPD LD 15W40	X					Handel-Mij Noviol B.V., Nijmegen, Netherlands

Kluth Mehrbereichsmotorenöl Super HDC	X					Oswald Kluth, Bargfeld-Stegen/Germany
Kompressol-Ultralub C plus	X					Kompressol-Oel Verkaufs GmbH, Cologne/Germany
Kuwaitoil Super Diesel Oil SHPD	X					Kuwait National Petroleum Company, Kuwait, Kuwait
Liqui Moly LKW-Leichtlauf Motoroil			X			Liqui Moly GmbH, Ulm/Germany
Liqui Moly Profi Leichtlauf Motoröl			X			Liqui Moly GmbH, Ulm/Germany
Liqui Moly Touring High Tech SHPD	X					Liqui Moly GmbH, Ulm/Germany
Long-Life EF Diesel Engine Oil Multigrade	X					Pennzoil-Quaker State, Houston, Texas, USA
Lubral Super Diesel MB-III	X					Lubricantes de America, S.A. de C.V., Santa Catarina, N.L., Mexico
Lubro Supertrans Diesel	X					Lubritalia S.p.A., Palagiano (Taranto), Italy
Lukoil-Avangard	X					OAO LUKOIL, Moscow/Russia
Madit Tirman	X					Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Mannol Truck Special	X					SCT-Vertriebs GmbH, Wedel/Germany
Mapetrol Motorol SHPD	X					Mapetrol d.o.o., Maribor, Slovenia
Maschinenring-Premium 10W-40 (SHPD)			X			Wetterau Agrarservice GmbH, Wölfersheim/Germany
Maschinenring-Premium TD 15W-40 (SHPD)	X					Wetterau Agrarservice GmbH, Wölfersheim/Germany
master class ALPHA 1040.3			X			V.W. Günther Mineralölhandelsges.mbH, Bebra/Germany
master class Taurus 1540	X					V.W. Günther Mineralölhandelsges.mbH, Bebra/Germany
Maxima HC Prestige XLD	X					Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
Maxima Turbo	X					Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
Meditran SX	X					Pertamina, Jakarta, Indonesia
Medos 600	X					Unil S.A., Saumur, France
Medos 650	X					Unil S.A., Saumur, France
Megaturbo	X					Rilub S.p.A., Ottaviano (NA), Italy
megol Motorenoel Performance TOP TRANS	X					Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
megol Motorenoel SHPD	X					Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
megol Motorenoel Super Leichtlauf FAMO			X			Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
Mexlub CF-4 MB-3P	X					Mexicana de Lubricantes, S.A. de C.V., Guadalajara / Mexico
Migrol Motor Oil Multi SK	X					Migrol-Genossenschaft, Zurich, Switzerland
Migrol Superlife Special Plus			X			Migrol-Genossenschaft, Zurich, Switzerland
Mobil Delvac Super 1300	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac 1400 Super	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac CX			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac Excel	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac FL 10W40			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac HP	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac HP 15W40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac MX	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac MX 101 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac MX 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA

Mobil Delvac MX Extra 10W-40			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac XHP			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac XHP 15W-40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Universal FL			X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobilgard HSD 15W40	X					Exxon Mobil Corporation, Fairfax, Virginia, USA
Mogul Diesel DTT	X					Koramo s.p., Kolin V/Czech Republic
Mogul Optimal			X			Koramo s.p., Kolin V/Czech Republic
MOL Super Diesel	X					MOL LUB Ltd., Almasfüzitö/Hungary
MOL Transit TD	X					MOL LUB Ltd., Almasfüzitö/Hungary
MOL Transit TDS			X			MOL LUB Ltd., Almasfüzitö/Hungary
Molykote SHPD	X					Krafft S.A., Andoain (Guipuzcoa), Spain
Morris ring free Euro 3 Plus	X					Morris & Co. Ltd., Shrewsbury, England
Morris ring free XHD	X					Morris & Co. Ltd., Shrewsbury, England
Morris ring free XHD plus	X					Morris & Co. Ltd., Shrewsbury, England
Motorenöl 10W/40			X			Bundesamt für Betriebe des Heeres, Bern, Switzerland
Motorex MC Plus			X			Bucher AG, Langenthal, Switzerland
Motorex Motor Oil Farmer Uni			X			Bucher AG, Langenthal, Switzerland
Motorex Turbo SK	X					Bucher AG, Langenthal, Switzerland
Motorex Universal	X		X			Bucher AG, Langenthal, Switzerland
Motorol Super Long	X					Chemol, Belgrade, Yugoslavia
Motul Tekma Mega	X					Motul, Aubervilliers Cedex, France
Motul Tekma Mega X	X					Motul, Aubervilliers Cedex, France
Multigrado 15W40 SHPD	X					Krafft S.A., Andoain (Guipuzcoa), Spain
Multitruck	X					Wynn's Italia S.p.a., Santa Croce Sull' Arno (PI), Italy
Nervol TS4E	X					Nervol S.A., Montpouillan, France
Neste Turbo LXE 10W-40			X			Fortum Oil and Gas Oy, Fortum, Finland
Neste Turbo LXE 15W-40	X					Fortum Oil and Gas Oy, Fortum, Finland
New Process SHPD Super	X					New-Process AG, Tübach SG, Switzerland
New Process Super Dallas			X			New-Process AG, Tübach SG, Switzerland
New-Process Super Dallas THC			X			New-Process AG, Tübach SG, Switzerland
Niemoline Super Turbo SHPD CD plus	X					Jan Nieman, Exloermond, Netherlands
Nils Mistral	X					Nils Italia GmbH, Burgstall, Italy
Noaloil Diam LD turbo diesel	X					Noaloil, Noale (VE), Italy
Oel-Hauser TS Multi-Service HD Motor Oil			X			Emil Hauser & Co. AG, Wädenswil, Switzerland
Oest Dimo Super S 3	X					Georg Oest Mineralölwerke, Freudenstadt/Germany
Oest Gigant Turbo FE			X			Georg Oest Mineralölwerke, Freudenstadt/Germany
Oest Leichtlauföl FE			X			Georg Oest Mineralölwerke, Freudenstadt/Germany
Olmaline SHPD	X					OLMA, Ljubljana, Slovenia
Omega Turbo Power	X					Opet Petrolcülük AS., Cigli/Izmir, Turkey
OMV eco truck			X			OMV Aktiengesellschaft, Vienna, Austria
OMV eco truck extra			X			OMV Aktiengesellschaft, Vienna, Austria
OMV truck LD	X					OMV Aktiengesellschaft, Vienna, Austria
ORLEN OIL Diesel (3) SHPDO CG-4 15W40	X					Orlen Oil Sp. z o.o., Krakow, Poland
Orly Turbo 3002	X					Orly International, Vieux-Thann, France
Orol Gold HD Super Multigrad	X					Amstutz Produkte AG, Eschenbach LU, Switzerland
Orol Gold Maximot			X			Amstutz Produkte AG, Eschenbach LU, Switzerland

Orol Gold Truckmot SKSHPD	X					Amstutz Produkte AG, Eschenbach LU, Switzerland
Orol Gold Turbomot	X					Amstutz Produkte AG, Eschenbach LU, Switzerland
OTP Plus Universal-Leichtlauf-Motorenöl			X			Hubert Math. Müller Handelsgesellschaft mbH, Eschweiler/Germany
OTP Plus Universal-Motorenöl	X					Hubert Math. Müller Handelsgesellschaft mbH, Eschweiler/Germany
P.O. Turbo Dizel Ekstra E	X					Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Pakelo PKO Kentron	X					Pakelo Motor Oil S.r.l., San Bonifacio (Vr), Italy
Panolin Diesel Synth			X			Panolin AG, Madetswil, Switzerland
Panolin Universal	X					Panolin AG, Madetswil, Switzerland
Panolin Universal FE			X			Panolin AG, Madetswil, Switzerland
Panolin Universal SFE			X			Panolin AG, Madetswil, Switzerland
Parnas Hercules 4 SAE 15W-40	X					Sakson S.A., Athens/Greece
Pennasol Turbo Super	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen/Germany
Pennzoil Fleetmaster	X					Pennzoil-Quaker State Mediteraneo, S.L., Madrid, Spain
Pentotruck ECO Light			X			Deutsche Pentosin-Werke GmbH, Wedel/Germany
Pentotruck Extra	X					Deutsche Pentosin-Werke GmbH, Wedel/Germany
Performance Top Trans SHPD	X					Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis/Germany
Petrimex Ultratruck LD	X					S.A. Petrimex, Rancate, Switzerland
Petromin Fleetmaster LD	X					Saudi Arabian Lubricating Oil Co., Jeddah, Saudi Arabia
Petromin Superfleet LD 15W40	X					Saudi Arabian Lubricating Oil Co., Jeddah, Saudi Arabia
Petronas Motolub CS3 CH-4	X					Petroliam Nasional Berhad, Kuala Lumpur, Malaysia
Prista SHPD	X				X	Prista Oil Ltd., Rousse, Bulgaria
Profi-Car Diesel Power Truck Turbo	X					Profi-Tech chem. tech. Produkte GmbH, Gingen/Germany
Proton turbo diesel	X					Petrol d.d., Ljubljana, Slovenia
Q8 t 710	X					Kuwait Petroleum, Hoogvliet RT, Netherlands
Q8 t 720	X					Kuwait Petroleum, Hoogvliet RT, Netherlands
Q8 T 730	X					Kuwait Petroleum, Hoogvliet RT, Netherlands
Q8 t 800			X			Kuwait Petroleum, Hoogvliet RT, Netherlands
QS Superfleet	X					Commercial Importadora S.A., México, D.F., Mexico
Quaker State Super Diesel	X		X			Oel-Brack AG, Hunzenschwil, Switzerland
Quaker State Super Series III	X					Commercial Importadora S.A., México, D.F., Mexico
Raff Super HPDO	X					Raffineries Imperator, Baisieux, France
Raiffeisen Super Universal Plus	X					Raiffeisen Central-Genossenschaft Nordwest eG, Münster/Germany
Raloy Diesel Supreme Plus VDS-3	X					Raloy Lubricantes, Santiago Tianguistenco/Mexico
Ravenol Mineraloel Turbo - Plus SHPD	X					Ravensberger Schmierstoffvertrieb GmbH, Werther/Germany
Repsol Diesel SHPD	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Repsol Diesel Turbo THPD	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Repsol Super Turbo Diesel	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Roshfrans Voltro Diesel	X					Comercial Roshfrans, S.A. de C.V., Mèxico, D.F./Mexico

ROWE Formula GT 1040 HC			X			ROWE Mineralölwerk GmbH, Bubenheim/Germany
RTO Maxima RD ECO 15W-30				X		Huiles Berliet S.A., Paris, France
RTO Maxima RLD 15W-40	X					Huiles Berliet S.A., Paris, France
RTO MaxTERIA POLYTRAFIC 10W-40						Huiles Berliet S.A., Paris, France
Sarol SHPD Lorry	X					Sarol Lubricants Ltd, Schimatari, Greece
Sasol Sapphire 15W40	X					Sasol Oil (Pty) Ltd, Randburg, South Africa
Saturnia Super 15W40	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Sharlu Turbo Diesel Engine Oil	X					Sharjah National Lube Oil, Sharjah, U.A.E.
Shell Engine Oil DG			X			Shell International Petroleum Co., London, England
Shell Normina Plus	X					Shell International Petroleum Co., London, England
Shell Rimula MV	X					Shell International Petroleum Co., London, England
Shell Rimula Premium	X					Shell International Petroleum Co., London, England
Shell Rimula Super	X					Shell International Petroleum Co., London, England
Shell Rimula Super FE			X			Shell International Petroleum Co., London, England
Shell Rimula X CH-4	X				X	Shell International Petroleum Co., London, England
Shell Rotella T Multigrade	X					Shell Oil Products, US, Huosten TX/USA
Sigma Turbo RV 15W/40	X					LG-Caltex Oil Corp., Seoul, Rep. of Korea
Sips-Record Turbo T	X					Sips-Dieter Döcker GmbH, Viersen/Germany
Sips-TLM-1 Plus			X			Sips-Dieter Döcker GmbH, Viersen/Germany
Sips-TSL 3 Extra	X					Sips-Dieter Döcker GmbH, Viersen/Germany
SPC SDM 900	X					Singapore Petroleum Co. Ltd., Singapore
Statoil EuroWay	X					Statoil Lubricants Technologies Sp. Z o.o., Krakow, Poland
Statoil MaxWay	X	X	X			Statoil Lubricants, Stockholm, Sweden
Statoil MaxWay 10W-40			X			Statoil Lubricants, Stockholm, Sweden
Statoil MaxWay 15W-40	X					Statoil Lubricants, Stockholm, Sweden
Statoil TurboMaxWay	X					Statoil Lubricants Technologies Sp. Z o.o., Krakow, Poland
Strub Lato MB	X					Strub + Co AG, Reiden, Switzerland
Strub Super Multi Turbo			X			Strub + Co AG, Reiden, Switzerland
Südöl SHPD	X					Südöl Mineralöl-Raffinerie GmbH, Eislingen/Germany
Sunoco Super HPD	X					Sun Oil Co. (Belgium) N.V., Aartselaar, Belgium
Super Diesel Oil MB-3	X					Bardahl de México, México, D.F., Mexico
Superdiesel Turbo	X					Conqord Oil S.r.l., Cologno-Milan, Italy
SVG Esvaugol FE			X			Handelsges. für Kfz-Bedarf, Düsseldorf/Germany
SVG Uniplus Turbo SHPD	X					Handelsges. für Kfz-Bedarf, Düsseldorf/Germany
swd Expert LDF			X			Swd Lubricants GmbH & Co. KG, Duisburg, Germany
T-MF5-3			X			Fuchs Europe Schmierstoffe GmbH, Mannheim/Germany
Tamoil Super Diesel Turbo (I)	X					Tamoil Petroli S.p.A., Milan, Italy
Taurus SHPD E3	X					Greenway Lubricants Limited, Wednesbury, West Mid, England
Teboil Super HPD	X					Suomen Petrooli Oy, Hamina, Finland
Technik Ecomot Plus 10W-40			X			Raiffeisen Central-Genossenschaft Nordwest eG, Münster/Germany
Tedex Diesel Truck FE (SHPD) Motor Oil	X					Tedex Vertriebs GmbH, Berlin/Germany

TERRA REC Turbo Super	X					Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen/Germany
Texaco Ursa Energy		X				ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Texaco Ursa Premium TDX	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Texaco Ursa Super TD	X					ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Top Lube Extra Super DEO	X					ABS Lubricants, Abu Dhabi, U.A.E.
Tor Synfleet SHPD			X			De Oliebron B.V., Zwijndrecht, Netherlands
Tor Unifleet Ultra	X					De Oliebron B.V., Zwijndrecht, Netherlands
Total Rubia 4400 TSA	X					TotalFinaElf Lubrifiants, Paris, France
Total Rubia FE			X			TotalFinaElf Lubrifiants, Paris, France
Total Rubia Polytrafic 10W-40			X			TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR 6400	X					TotalFinaElf Lubrifiants, Paris, France
Total rubia TIR 6400 FE 15W-30				X		TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR 7400 15W-40	X					TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR 7400 FE 10W30		X				TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR Max	X					TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR XLD	X					TotalFinaElf Lubrifiants, Paris, France
Touring High Tech Super Tropic					X	Liqui Moly GmbH, Ulm/Germany
Triathlon Diesel Longlife	X					Adolf Würth GmbH & Co. KG, Künzelsau/Germany
Triathlon Dynamik			X			Adolf Würth GmbH & Co. KG, Künzelsau/Germany
Truckmaster E5	X					Millers Oils Ltd., Brighouse West Yorkshire, England
Truckmaster Global CX	X					Millers Oils Ltd., Brighouse West Yorkshire, England
Truckmaster Global XD	X					Millers Oils Ltd., Brighouse West Yorkshire, England
Truckmaster XHPD	X					Millers Oils Ltd., Brighouse West Yorkshire, England
Trysk Top Tir	X					Paramo, Pardubice, Czech Republic
Turbo Leichtlauf 10W-40			X			Raiffeisen Central-Genossenschaft Nordwest eG, Münster/Germany
Turbo Super Long	X					Oktanoil, Bela Crkva, Yugoslavia
Turbogrado	X					Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Turbopaz	X					Paz Lubricants & Chemicals Ltd., Haifa, Israel
Turdus 3 SHPD	X					Grupa Lotos SA., Gdansk/Poland
Unil Manto TD	X					Unil Deutschland GmbH, Stuttgart/Germany
Urania LD5	X					FL Italia s.p.a., Villastellone (Torino), Italy
Urania Turbo LD	X					FL Selenia s.p.a., Villastellone (Torino), Italy
Ursa Premium TDX	X	X				Productos Texaco S. A. de C. V., México, D.F., Mexico
Ursa Super TD	X				X	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Ursa Super TLF 10W-40			X			Texaco Deutschland GmbH, Düsseldorf/Germany
Ursa Turbo	X				X	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Valmax Ultra	X					Morris & Co. Ltd., Shrewsbury, England
Valvoline Premium Blue E	X					The Valvoline Company, Dordrecht, Netherlands
Vanguard Super Performance	X					Compagnia Italiana Lub., Milan, Italy
Veco Challenger SHPD	X					Przedsiebiorstwo Modex-Oil, Kwidzyn, Poland
Vector SHPD	X					S.C. Lubrifin S.A., Brasov, Rumania
Veedol Turbostar	X					Veedol International, Swindon, England

Veritas Super HDC-N	X					Oelwerke Julius Schindler GmbH, Hamburg/Germany
Verkol Turboplus	X					Verkol, S.A., Bera/Navarra, Spain
Verkoplus-SHPD	X					Verkol, S.A., Bera/Navarra, Spain
Wintershall Multi-Rekord Plus	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall Multi-Rekord top	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall TFF			X			SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall TFX			X			SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall Turbo Diesel	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wintershall Turbo-Rekord	X					SRS Schmierstoff Vertrieb GmbH, Salzbergen/Germany
Wisura Multi TS	X					Wisura Mineralölwerk, Bremen/Germany
Wisura Premium MC			X			Wisura Mineralölwerk, Bremen/Germany
Wolf Masterlube Ecomiles	X					Wolf Oil Corporation N.V., Hemiksem, Belgium
Wolf Masterlube Longdrain Turbo	X					Wolf Oil Corporation N.V., Hemiksem, Belgium
Wunsch TLM			X			Wunsch Öle GmbH, Ratingen/Germany
Wunsch Turbo Record	X					Wunsch Öle GmbH, Ratingen/Germany
Xorbol Leichtlauföl HDC			X			Hilbert GmbH, Emsdetten/Germany
Xorbol Super Mehrbereichsöl HDC	X					Hilbert GmbH, Emsdetten/Germany
Yacco Transpro 35	X					Yacco SAF, Saint-Pierre-lès-Elbeuf, France
Yacco Transpro 40	X					Yacco SAF, Saint-Pierre-lès-Elbeuf, France
YC-1000	X					Guangxi Yuchai Superior Lube oil Co., Ltd., Yuliin, Guangxi, P. R. China
York 645	X					Ginouves Georges S.A., La Farlède, France
York 745	X					Ginouves Georges S.A., La Farlède, France
York 846	X					Ginouves Georges S.A., La Farlède, France
Zeppelin Dieselmotorenöl DEO 1040			X			Zeppelin Baumaschinen GmbH, Garching near Munich/Germany
Zeppelin Dieselmotorenöl DEO 1540	X					Zeppelin Baumaschinen GmbH, Garching near Munich/Germany
ZIC 5000 Power			X			SK Corporation, Seoul, Rep. of Korea

BB00.40-P-0228-05A	Multigrade engine oils (Sheet 228.5)	i For use in vehicles/engines refer to "	Sheet 228.5
		Sheet 223.2	BB00.40-P-0223-02A
		i For specified viscosity grades refer to "	
		Sheet 224.1 (passenger-car engines)	BB00.40-P-0224-01A
		Sheet 224.2 (commercial-vehicle engines)	BB00.40-P-0224-02A

Product name	0W-30	10W-40	5W-30	5W-40	Company, town, country
AD SDX 10W40		X			AD Parts, S.L., Girona, Spain
ad-Super Cargo Leichtlauf-Oil		X			Carat GmbH & Co. KG, Eschborn, Germany
Addinol Super Truck MD 1048		X			Addinol Lube Oil GmbH, Leuna, Germany
Addinol Ultra Truck MD 0538			X		Addinol Lube Oil GmbH, Leuna, Germany
Agip Sigma Trucksint TFE			X		ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Sigma Ultra TFE		X			ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Antar Maxolia 10W-40		X			TotalFinaElf Lubrifiants, Paris, France
Aral GigaTurboral		X			Aral Aktiengesellschaft, Bochum, Germany
Aral MegaTurboral		X			Aral Aktiengesellschaft, Bochum, Germany
Aral SuperTurboral			X		Aral Aktiengesellschaft, Bochum, Germany
Ardea Semi Synthetic Special Diesel Oil		X			Peeters Brems S.A., Wijngem-Antwerpen, Belgium
Areca Funaria Syntex		X			Durand Production S.A., Harnes, France
Armorine Diamant		X			Armorine S.A., Lanester Cedex, France
Ashland A.P.B. Prefleet DDQ		X			Ashland Oil Nederland, Dordrecht, Netherlands
Astris TNX		X			Astris S.A., Giornico, Switzerland
Autol Valve Ultra FE		X			Agip Schmiertechnik GmbH, Würzburg, Germany
Averoil TIR-UHP		X			Olipes, S.L., Arganda del Rey, Spain
Avia Turbosynth HT-E		X			Avia Mineralöl-AG, Munich, Germany
Aviatic Super FEG		X			Wilhelm Scholten GmbH, Münster, Germany
Aviaticon FinkoTruck LD 10W-40		X			Finke Mineralölwerk GmbH, Bremen, Germany
Avilub engine oil WDB 10W-40		X			Hermann Bantleon GmbH, Ulm, Germany
BayWa Motorenöl Super Truck 1040 MC		X			BayWa AG, Munich, Germany
BayWa Super Truck 530 SL			X		BayWa AG, Munich, Germany
Blasol DHP 10W40		X			Blaser Swisslube AG, Hasle-Rüegsau, Switzerland
Blu Oil 5		X			Rondine Azienda Petrochimica S.p.A., Pero (Milano), Italy
BP Vanellus C8 Ultima			X		BP p.l.c., London, England
BP Vanellus E4 Plus		X			BP p.l.c., London, England
BP Vanellus E7 Plus		X			BP p.l.c., London, England
BP Vanellus E7 Supreme				X	BP p.l.c., London, England
BP Vanellus E7 Ultra			X		BP p.l.c., London, England
BP Vanellus E7 Ultra M			X		BP p.l.c., London, England
BP Vanellus E8 Ultra			X		BP p.l.c., London, England
BR-352-EX			X		Petrobras Distribuidora S.A., Rio de Janeiro, Brazil
Calpam Turbosynth		X			Calpam Mineralöl-Gesellschaft mbH, Aschaffenburg, Germany
Caltex Delo XLD		X			Chevron Texaco Technology Ghent/Gent, Zwijnaarde, Belgium
Carl Motorenöl Cargo		X			Coparts Autoteile GmbH, Essen, Germany
Castrol Dynamax		X			Castrol Ltd., Swindon, England
Castrol Elixion	X		X		Castrol Ltd., Swindon, England
Castrol Enduron		X			Castrol Ltd., Swindon, England
Castrol Enduron Plus				X	Castrol Ltd., Swindon, England
Cepsa Eurotrans SHPD		X			Cepsa Lubricantes, S.A., Madrid, Spain
Cepsa Eurotrans SHPD 5W30			X		Cepsa Lubricantes, S.A., Madrid, Spain
Champion Turbofleet UHPD		X			Wolf Oil Corporation N.V., Hemiksem, Belgium
CLAAS Ultratec - XXL		X			CLAAS Vertriebsgesellschaft mbH, Harsewinkel, Germany
Classic Motorenöl Super		X			Christian Lühmann GmbH & Co. KG, Hoya, Germany

Classic Motorenöl Ultra			X		Christian Lühmann GmbH & Co. KG, Hoya, Germany
Condat Vicam Eurosynth		X			Condat S.A., Chasse-sur-Rhône, France
Diesel Truck Performance			X		Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis, Germany
Divinol Multimax Synth		X			Zeller + Gmelin GmbH & Co., Eislingen, Germany
Divinol Multimax USHPD			X		Zeller + Gmelin GmbH & Co., Eislingen, Germany
ECLA		X			C.F.C.L.., Mérignac, France
Econo-Veritas Truck FE			X		Oelwerke Julius Schindler GmbH, Hamburg, Germany
Eldon's Elona Syn			X		Eldon's S.A., Athens, Greece
Elf Performance Experty 10W-40		X			TotalFinaElf Lubrifiants, Paris, France
Elf Performance Experty FE 5W30			X		TotalFinaElf Lubrifiants, Paris, France
EMKA Cargo MC 10W40		X			EMKA Schmiertechnik GmbH, Heilbronn, Germany
Engen Dieselube 3000 Super		X			Engen Petroleum Ltd., Cape Town, South Africa
ESA Multilub Freeway		X			ESA, Burgdorf, Switzerland
Essolube XTS 5		X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Essolube XTS 501		X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Eurol Concept LD		X			Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
Evva Truck Extra		X			Evva-Schmiermittel-Fabrik, Margarethen/Moos, Austria
Expert XH, SAE 10W40		X			Swd Lubricants GmbH & Co. KG, Duisburg, Germany
Fina Kappa First 5W30			X		TotalFinaElf Lubrifiants, Paris, France
Fina Kappa Ultra 10W-40		X			TotalFinaElf Lubrifiants, Paris, France
Freeway DBE4		X			Nervol S.A., Montpouillan, France
Fuchs Titan Cargo LDF		X			Fuchs Petrolub AG, Mannheim, Germany
Fuchs Titan Cargo MC		X			Fuchs Petrolub AG, Mannheim, Germany
Fuchs Titan Cargo SL			X		Fuchs Petrolub AG, Mannheim, Germany
Galax Extra HPD			X		NIS - Rafinerija Nafte Beograd, Belgrade, Yugoslavia
Galp Galaxia Extreme			X		Petrogal S.A., Lisbon, Portugal
Galp Galaxia LD S Ultra		X			Petrogal S.A., Lisbon, Portugal
Gulf Superfleet ELD 10W-40		X			Gulf Oil International, London, England
Gulfleet Highway 10W-40		X			S.A.E.L., Madrid, Spain
Gulfleet Supreme (EP)			X		S.A.E.L., Madrid, Spain
Hafa Eurodex		X			Hafa, Paris, France
Hankook Shell Rimula Ultra		X			Hankook Shell Oil Company Limited, Seodaemoon-gu Seoul, Rep. Korea
HRD Extensia 10W-40		X			Huiles Berliet S.A., Paris, France
HRD Extensia ECO 5W30			X		Huiles Berliet S.A., Paris, France
Hunold Multicargo		X			Hunold Schmierstoffe GmbH, Eching, Germany
Igol Trans Turbo 6X		X			Igol France, Amiens - cedex 3, France
Igol Trans Turbo 8X8X			X		Igol France, Amiens - cedex 3, France
INA Super 2000		X			INA Maziva Rijeka, Rijeka, Croatia
INA Super EKO		X			INA Maziva Rijeka, Rijeka, Croatia
Inter Turbo LD 5		X			Ets A. Mauran & Fils S.A., Odars, France
Jomo Delcion				X	Japan Energy Corporation, Tokyo, Japan
Kennoco Eurosynth HP		X			Handel-Mij Noviol B.V., Nijmegen, Netherlands
Kompressol-FX		X			Kompressol-Oel Verkaufs GmbH, Cologne, Germany
Liqui Moly LKW Langzeit Motoröl		X			Liqui Moly GmbH, Ulm, Germany
Lubroviscol Superior LD		X			Shell & DEA Oil GmbH, Hamburg, Germany
Lukoil Prima		X			OOO Lukoil-Permnefteorgsintez, Perm, Osentsy, Russia
Madit Mistral		X			Slovnaft Vúrup a.s., Bratislava, Slovak Republic
Mapetrol Motorol SHPD Ultra		X			Mapetrol d.o.o., Maribor, Slovenia
Master Truck		X			Kuttenkeuler GmbH, Cologne, Germany
Max Raloy Diesel			X		Raloy Lubricantes, Santiago Tianguistenco, Mexico
Maxima HC Magnum XHPD			X		Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
Maxima XHPD		X			Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
MB 228.5 Motorenöl 000 989 60 01 12		X			DaimlerChrysler AG, Stuttgart, Germany

MB 228.5 Motorenöl 000 989 60 01 13		X			DaimlerChrysler AG, Stuttgart, Germany
Mega Truck			X		Raiffeisen Central-Genossenschaft Nordwest eG, Münster, Germany
Megasynt		X			Rilub S.p.A., Ottaviano (NA), Italy
megol Motorenoel Super Leichtlauf DIMO		X			Meguin GmbH & Co. KG Mineraloelwerke, Saarlouis, Germany
MHT STL Extra		X			MHT Industrietechnische Produkte GmbH, Mayen, Germany
Mobil Delvac 1				X	Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac 1 SHC				X	Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac XHP Extra		X			Exxon Mobil Corporation, Fairfax, Virginia, USA
Mobil Delvac XHP Ultra			X		Exxon Mobil Corporation, Fairfax, Virginia, USA
Mogul Diesel Adut			X		Koramo a.s., Kolin V, Czech Republic
Mogul Diesel DTT Plus		X			Koramo a.s., Kolin V, Czech Republic
MOL Synt Diesel		X			MOL-LUB Ltd., Almasfüzitö, Hungary
Morris Ringfree Ultra		X			Morris & Co. Ltd., Shrewsbury, England
Motorex Eco Power			X		Bucher AG, Langenthal, Switzerland
Motorex MC Power 3		X			Bucher AG, Langenthal, Switzerland
Motorex MC Power Plus		X			Bucher AG, Langenthal, Switzerland
Motul Tekma Optima 5W-30			X		Motul, Aubervilliers Cedex, France
Motul Tekma Ultima		X			Motul, Aubervilliers Cedex, France
Multitruck FE		X			Wynn's Italia S.p.a., Santa Croce Sull' Arno (PI), Italy
New Process Motoroil Dallas Plus 3		X			New-Process AG, Tübach SG, Switzerland
Nils Stratos		X			Nils Italia GmbH, Burgstall, Italy
Noaloil Diam LD 100 10W40		X			Noaloil, Noale (VE), Italy
Oest Dimo HT Super		X			Georg Oest Mineralölwerke, Freudenstadt, Germany
OMV super truck			X		OMV Aktiengesellschaft, Vienna, Austria
OMV truck FE plus		X			OMV Aktiengesellschaft, Vienna, Austria
One Hundred SAE 10W40 MB 228.5		X			Oil Company Champion in the World s.r.l., Casoria (NA), Italy
ORLEN OIL Diesel (4) XHPDO CF 10W/40		X			Orlen Oil Sp. z o.o, Krakow, Poland
Orly Taurus 3002		X			Orly International, Vieux-Thann, France
Orol Gold Longmot SKSHPF		X			Amstutz Produkte AG, Eschenbach LU, Switzerland
OTP Plus Super-Leichtlauf-Motorenöl		X			Hubert Math. Müller Handelsgesellschaft mbH, Eschweiler, Germany
Pakelo Goldenstar			X		Pakelo Motor Oil S.r.l., San Bonifacio (Vr), Italy
Pakelo Kentron Over MB 5		X			Pakelo Motor Oil S.r.l., San Bonifacio (Vr), Italy
Panolin Diesel HTE		X			Panolin AG, Madetswil, Switzerland
Paramo Trysk Global		X			Paramo, Pardubice, Czech Republic
Pennasol Performance Truck		X			Mineralöl-Raffinerie Dollbergen GmbH, Uetze-Dollbergen, Germany
Petro-Oil Diesel XHPDO CF		X			Petro-Oil Sp. z o.o., Krakow, Poland
PO Maximus Diesel 10W/40		X			Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Power Truck 10W-40		X			Raiffeisen Central-Genossenschaft Nordwest eG, Münster, Germany
Proton Turbo Diesel Super		X			Petrol d.d., Ljubljana, Slovenia
Q8 SuperTruck FE			X		Kuwait Petroleum, Hoogvliet RT, Netherlands
Q8 T 850		X			Kuwait Petroleum, Hoogvliet RT, Netherlands
Quaker State Synquest Diesel		X	X		Oel-Brack AG, Hunzenschwil, Switzerland
Raff Maxi GRS		X			Raffineries Imperator, Baisieux, France
Ravenol Performance Truck		X			Ravensberger Schmierstoffvertrieb GmbH, Werther, Germany
Repsol Turbo UHPD		X			Repsol YPF Lubricantes y Especialidades, S.A., Mostoles-Madrid, Spain
Ring Free Ultra plus FE 5W30			X		Morris & Co. Ltd., Shrewsbury, England
Roadstar		X			Conqord Oil S.r.l., Lacchiarella (MI), Italy
Shell Normina Extra		X			Shell International Petroleum Co., London, England
Shell Rimula Ultra		X	X		Shell International Petroleum Co., London, England

Shell Rimula Ultra (E5)		X			Shell International Petroleum Co., London, England
Sips-TSL 4		X			Sips-Dieter Döcker GmbH, Viersen, Germany
Stamina LDS 100		X			Greenway Lubricants Limited, Wednesbury, West Mid, England
Statoil TruckWay		X	X		Statoil Lubricants, Stockholm, Sweden
Strub Partsynt HC Ultra UHPD		X			Strub + Co AG, Reiden, Switzerland
Sunoco Ultra HPD		X			Sun Oil Co. (Belgium) N.V., Aartselaar, Belgium
SVG Esvaugol SHPD-0		X			Handelsges. für Kfz-Bedarf, Düsseldorf, Germany
swd Expert PAO			X		Swd Lubricants GmbH & Co. KG, Duisburg, Germany
Syneco K-E5		X			Syneco S.p.A., S. Giuliano Mil., Italy
Syneco Multirange		X			Syneco S.p.A., S. Giuliano Mil., Italy
Tamoil Diesel Premium FE (CY)		X			Tamoil Lubricants International Ltd., Larnaca, Cyprus
Tamoil Diesel Top Performance FE (I)			X		Tamoil Petroli S.p.A., Milan, Italy
Teboil Super XLD		X			Suomen Petrooli Oy, Hamina, Finland
Tor Turbosynth		X	X		De Oliebron B.V., Zwijndrecht, Netherlands
Tor Turbosynth 10W40 NF		X			De Oliebron B.V., Zwijndrecht, Netherlands
Total Rubia TIR 8600 10W-40		X			TotalFinaElf Lubrifiants, Paris, France
Total Rubia TIR 9200 FE 5W30			X		TotalFinaElf Lubrifiants, Paris, France
Triathlon Super Cargo		X			Adolf Würth GmbH & Co. KG, Künzelsau, Germany
Truck MC Langzeit-Leichtlaufoel		X			Karl Pohlmann, Korbach, Germany
Truckmaster XPFE		X			Millers Oils Ltd., Brighouse West Yorkshire, England
Trucksynth			X		Millers Oils Ltd., Brighouse West Yorkshire, England
Turbo Ultra Long			X		Oktanoil, Bela Crkva, Yugoslavia
Turdus Semisyntetic XHPDO		X			Rafineria Gdanska S.A., Gdansk, Poland
Ultra SHPDO Synthetic		X			Krafft S.A., Andoain (Guipuzcoa), Spain
Unil LCM XS		X			Unil S.A., Saumur, France
Unil Opal LCM 800		X			Unil S.A., Saumur, France
Unil Opal LCM 850			X		Unil S.A., Saumur, France
Unil Unimot Truck LD		X			Unil Germany GmbH, Stuttgart, Germany
Urania 100K		X			FL Selenia s.p.a., Villastellone (Torino), Italy
Urania FE			X		FL Italia s.p.a., Villastellone (Torino), Italy
Ursa Premium FE			X		ChevronTexaco Technology Ghent, Ghent, Zwijnaarde, Belgium
Ursa Super TDX		X			ChevronTexaco Technology Ghent, Ghent, Zwijnaarde, Belgium
Ursa TDX		X			ChevronTexaco Technology Ghent, Ghent, Zwijnaarde, Belgium
Usoco UHPD		X			Usoco N.V., Wijnegem, Belgium
Valvoline ProFleet		X			The Valvoline Company, Dordrecht, Netherlands
Valvoline ProFleet Extra			X		The Valvoline Company, Dordrecht, Netherlands
Veedol Dynastar		X			Veedol International, Swindon, England
Veedol Dynastar FS				X	Veedol International, Swindon, England
Veritas Spezial HD Extra		X			Oelwerke Julius Schindler GmbH, Hamburg, Germany
Verkol TD-Max		X			Verkol, S.A., Bera, Navarra, Spain
Wintershall TFG		X			SRS Schmierstoff Vertrieb GmbH, Salzbergen, Germany
Wintershall TFL			X		SRS Schmierstoff Vertrieb GmbH, Salzbergen, Germany
Wisura Cargo MC		X			Wisura Mineralölwerk, Bremen, Germany
Wladoil UHP Diesel Oil		X			Solda' Vladimiro S.p.A., Creazzo (VI), Italy
Wolf Masterlube Longdrain Ultra		X			Wolf Oil Corporation N.V., Hemiksem, Belgium
Wunsch TSL-Diesel		X			Wunsch Öle GmbH, Ratingen, Germany
Xorbol Diesel Leichtlauföl SHPD		X			Hilbert GmbH, Emsdetten, Germany
York 845		X			Ginouves Georges S.A., La Farlède, France
York 847		X			Ginouves Georges S.A., La Farlède, France

1. Coolant

1.1 Coolant composition

1.1.1 Passenger car and commercial vehicle engines (normal case)

50 vol.-% Water
50 vol.-% Anticorrosion/antifreeze agents (see Sheet 325.0 or 325.2, 325.3) antifreeze protection down to approx. -37 °C

1.1.2 Commercial vehicle engines (without antifreeze specification)

Blend of water and coolant additive in accordance with Sheet 312.0, for prescribed mixture ratio refer to Sheet 312.0.

Scope: If constant ambient temperatures above freezing point.

1.1.3 Commercial vehicle engines (exceptional case, not for engines OM 500 and OM 900)

99 vol.-% Water
1 vol.-% Refining agent (see Sheet 311.0)

Scope: for constant ambient temperatures above freezing point, e.g. in tropical regions, in which it can be proven that no approved anticorrosion/antifreeze agents and coolant additives according to Sheet 312.0 are available.

⚠ Passenger-car engines, which are installed in a commercial vehicle, must always be filled up as for a passenger-car engine, refer to item 2.1/2.2.

i A quick-glance overview of the fields of application for the approved coolant additives and the prescribed change intervals is available in Section 5. Please note the mixing prohibition for Sheets 325.3 and 326.3!

1.2 Water

1.2.1 Fresh-water regulations/water treatment

Clean, and where possible, not too hard water should be used for processing the coolant. Drinking water frequently, although not always, complies with the given specifications.

Sea water, brackish water, brine and industrial waters are not suitable. The level of water containing dissolved substances can vary greatly depending upon its origin (ground, spring, surface water) and it is of major significance regarding the presence of corrosion.

Water that is too hard is disadvantageous because of the possibility of scaling or sludging occurring. Salt content, predominantly chloride, greatly promotes corrosion. If in doubt, analyze the water.

Information concerning the water quality of drinking water is available from the local water-plant authorities or the official water utilities on request.
If there is no available information regarding the quality of the drinking water then distilled or deionized water should be used.

If the water fails to comply with the approved analysis values, then it should be processed in a suitable manner, because even excellent anticorrosion/antifreeze agents are greatly impaired in their ability to protect against corrosion if the water quality is poor.

Should it not be possible to soften the water then the water should be brought up to an approved hardness by an admixture of soft or distilled (deionized) water.

If the chloride or total ionic content of the water is too high then the level can be reduced through the admixture of deionized, in other words, exchanged ions or distilled water.

Corresponding processing methods will need to be used (desalination and softening or the separating method) depending upon the contaminants present in the water. Hints on how to conduct water treatment are available from water plants or water utilities as well as several companies and engineering consultants who are experienced in this area.

Depending upon the composition of the coolant, the analysis values for the water should lie within the following limits:

1.2.2 Fresh-water quality for coolant composition as under item 1.1.1 (passenger-cars and commercial-vehicle engines)

Sum of earth alkalis (water hardness):	0 to 3.6 mmol/l (0 up to 20° d)*
pH-value at 20 °C:	6.5 to 8.5
Chlorine ion content:	max. 100 mg/l
Sum of chlorides + sulfates:	max. 200 mg/l

1.2.3 Fresh-water quality for coolant composition as under item 1.1.2/1.1.3 (commercial-vehicle engines)

Sum of earth alkalis (water hardness):	0 to 2.7 mmol/l (0 up to 15° d)*
pH-value at 20 °C:	6.5 to 8.0
Chlorine ion content:	max. 80 mg/l
Sum of chlorides + sulfates:	max. 160 mg/l

If in doubt, contact DaimlerChrysler AG, department EP/MEK (operating fluids), H 120, D-70546 Stuttgart.

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* Customary designations for water hardness in various countries:
1 mmol/l=5.6° d=10° f=7.02° e=100 mg/kg Ca CO_3.
1° d (German degree =1° dGH)=1.78° (French degree)=1.25° e (English degree)=17.9 mg/kg Ca CO_3 (USA hardness).

1.3 Premixed coolant

Several providers have water with premixed coolant in their product range. Provided they are approved (see below), they can also be used; the regulations relating to application, composition, change intervals, etc. of these coolant specifications also apply. It is imperative that the correct concentration (50/50) is used in their application and, of course, further dilution is not permitted!

Approval status:

Coolant for all vehicles and engines	(Basis 325.0) Sheet 326.0
Coolant for commercial vehicle and industrial engines	(Basis 325.2) Sheet 326.2
Coolant for commercial vehicle and industrial engines	(Basis 325.3) Sheet 326.3

The regulations for each respective Sheet 325.x are to be transferred correspondingly to Sheet 326.x.

At the time of compiling these regulations it is possible that not all the sheets 326.x are represented with approved products.

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2. Coolant additives (General information)

Normally, coolant consists of water and anticorrosion/antifreeze agents. The anticorrosion/antifreeze agents (ethylene glycol with corrosions inhibitors) in the cooling system have to fulfill, among other things, the following functions:

- to provide sufficient corrosion and cavitation protection for all cooling system components
- freezing point depression (antifreeze)
- increasing boiling point

For corrosion protection purposes the coolant approx. 50 vol.-% Anticorrosion/antifreeze agents are added if the expected ambient temperatures do not require an even higher concentration. This concentration (50 vol %) offers frost protection up to approx. -37 °C. A higher concentration is only necessary if the ambient temperatures are even lower.

Even with extremely low ambient temperatures, not more than 55 vol.-% anticorrosion/antifreeze agent should be used, because at this level the maximum antifreeze protection is reached and a greater concentration reduces the antifreeze protection again and decreases the heat dissipation (55 vol.-% corresponds to antifreeze protection down to approx. -45 °C).

Should these coolant regulations fail to be observed then corrosion and damage to the cooling system are inevitable.

The admixture of anticorrosion/antifreeze agent serves to increase the boiling point. By raising the pressure the boiling temperature can be increased yet further. Both physical relationships are put to use in modern cooling systems, the maximum coolant temperature is raised, without increasing the danger of boiling. In keeping with the higher temperature level the cooling performance is also greater. Only approved products (Sheet 325.0 and 326.0, or 325.2 and 326.2, 325.3 and 326.3, as well as 312.0 or 311.0) provide reliable protection of the cooling system. In special cases (commercial-vehicle engines, no antifreeze specification) coolant additives can be used that are primarily corrosion protection additives. In this case item 2.3 is valid.

As an exception, if neither anticorrosion/antifreeze agent conforming to Sheet 325.0 nor coolant additives without addition of antifreeze conforming to Sheet 312.0 are available, proceed according to point 2.4 (exception: OM 500 and OM 900). The systems described under items 2.2/2.3/2.4 are not compatible with each other. It is recommended to mix the entire coolant quantity outside the engine.

2.1 Anticorrosion/antifreeze agent for passenger-car engines

Alongside the correct constitution of the cooling water (item 1.2.2) care must be taken to ensure that only anticorrosion/antifreeze agents as approved for all engines in accordance with **Sheet 325.0** are used. These products serve to guarantee that, in particular, an effective protection against corrosion is provided for all light-alloy parts in the cooling system and they are also specified for all passenger-car engines.

In order to ensure that the protection against corrosion is effective, the anticorrosion/antifreeze agent must remain in the cooling system throughout the year - including w

As a result of the optimizations we have made to the system of engine/coolant/cooling system, in the majority of our newer passenger vehicles, a change of the coolant is not necessary until reaching 15 operating years or 250,000 km (whichever comes first). This may not apply to some models; in these cases the maintenance booklet will stipulate another regulation.

2.2 Anticorrosion/antifreeze agent for commercial-vehicle engines (normal case) (not: OM 601, OM 602, OM 603, M 102)

The coolant in commercial-vehicle engines is made up of both water and anticorrosion/antifreeze agent (refer to item 1.1.1) and as such offers ideal protection against corrosion and cavitation.

All the approved products on the Sheets 325.2, 325.3 or 325.0 which are part of the Specifications for Operating Fluids can be used to select an anticorrosion/antifreeze agent. However, it should be noted that passenger vehicle engines built into commercial vehicles must be filled like passenger vehicles (e.g. OM 601 in T1), i.e. a product conforming to Sheet 325/6.0 must be used.

Products that are not listed in Sheets 325.0 and 326.0, or 325.2 and 326.2, or 325.3 and 326.3 are not approved and are therefore not to be used under any circumstances.

Anticorrosion/antifreeze agents or coolants conforming to Sheet 325/6.3 may be used for longer than other products due to their composition. The change interval is set at 5 years (refer to Overview Section 5). However, it should always be remembered that anticorrosion/antifreeze agents or coolants conforming to Sheet 325.3 and 326.3 must not be mixed with those conforming to Sheet 325.0 and 326.0 or 325.2 and 326.2.

2.3 Coolant additives for commercial-vehicle engines without antifreeze specifications (refer to item 1.1.2) (not: OM 601, OM 602, OM 603, M 102)

In those application cases where no antifreeze is necessary, coolant for commercial-vehicle engines as under item 1.1.2 can be mixed to suit. It is impossible to cite gene

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2.4 Coolant regulations for commercial-vehicle engines (exceptional case, not engines OM 500 and OM 900)

In the event that neither an approved anticorrosion/antifreeze agent is available, nor a coolant additive in accordance with sheet 312.0 and if temperatures do not drop below freezing then it is possible in this exceptional case to use a coolant refining agent to 1 vol % if it is approved in sheet 311.0 (soluble corrosion protection oil). This will not raise the boiling point. The starting-off water itself underlies the more stringent regulations as under item 1.2.3.

The period of usage for this coolant, which may only be used in exceptional circumstances, is shorter than usual (refer to position 3).

⚠ Water that is too hard may impair the emulsion resistance, with the result that the emulsion breaks down (oil separation) and the engine's water jackets are contaminated.

2.4.1 Applying water refining mixture

When carrying out a new filling (initial filling or filling after a cleansing operation) an emulsion of 1.0-1.5 percent by volume should be used. When refilling, an emulsion of 0.5-1.0 vol % should be used. Concentrations that are too high (>1.5 vol %) do not improve the corrosion protection capability and may exert a negative influence on seals and hoses.

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3. Monitoring coolant operation

It is very important to monitor the coolant constantly if the engine is to run trouble free.

The concentration level should be checked every six months.

The inspection should be conducted with suitable apparatus. If, when monitoring the concentration of the coolant, it is determined that the concentration of anticorrosion/antifreeze agent has reached **40 vol.-%** or less or an antifreeze protection of **-28 °C** is no longer guaranteed, the concentration must be increased to the regulation filling of **50 vol.-% (-37 °C)**. When topping up (after coolant loss), an anticorrosion/antifreeze agent content in the coolant of at least 50 vol.-% (antifreeze protection down to -37 °C) must be ensured, or the concentration regulations according to point 2.3 / 2.4.1 must be observed. In closing an example is given in Overview Section 5.

The corrosion inhibitors diminish during operation and lose their protective capability. Coolant that is too old, and has lost its important inhibitors and anti-aging additives, becomes strongly corrosive. The coolant additives as under Sheets 311.0 and 312.0 will also age. This causes a deterioration in the level of protection capability, and with regard to coolant refining agents this will also cause the emulsion to break down.

For this reason it is important to replace the coolant, in order to ensure that its corrosion protection capability is retained. If necessary the cooling system should be thoroughly cleansed before refilling with the new coolant. A sufficient level of heat dissipation will only be given if the cooler surfaces are clean.

The maximum permissible period of usage for coolant is cited in Overview Section 5.

⚠ **Non observance of these regulations or the use of non-approved products will result in serious damage.**

⚠ **The use of approved operating fluids, which naturally include the anticorrosion/antifreeze agents, is a well-known constituent of the warranty conditions.**

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4. Disposal of coolants

The coolants are biologically-degradable material.

All statutory regulations or waste water regulations in each individual country with regard to the disposal of used coolant must be observed.

It is recommended to have the possibilities available for disposing of materials explained by the local responsible water authorities.

Currently in Germany methods are being compiled for the purification of used coolant. The separate collection of all used operating fluids is highly recommended.

However, as a consequence of the complex tasks asked of a modern coolant, it is on no account advisable to use an improperly "recycled" coolant, which has only undergone a mechanical pre-purification process.

5. Overview

Which coolant additive, what change interval for which engines?

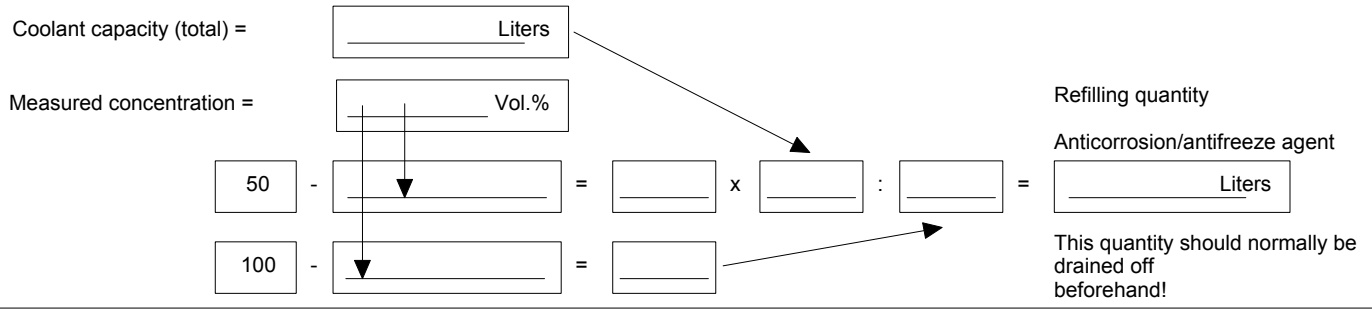
Passenger cars engines

Sheet No.	**Engine series**		**Change interval years/km**
	M100/M200	OM 600	
325.0/326.0	-	-	15/250.000 ℹ Whichever occurs first must be observed; Exception: in the vehicle's maintenance booklet shorter change intervals are stipulated

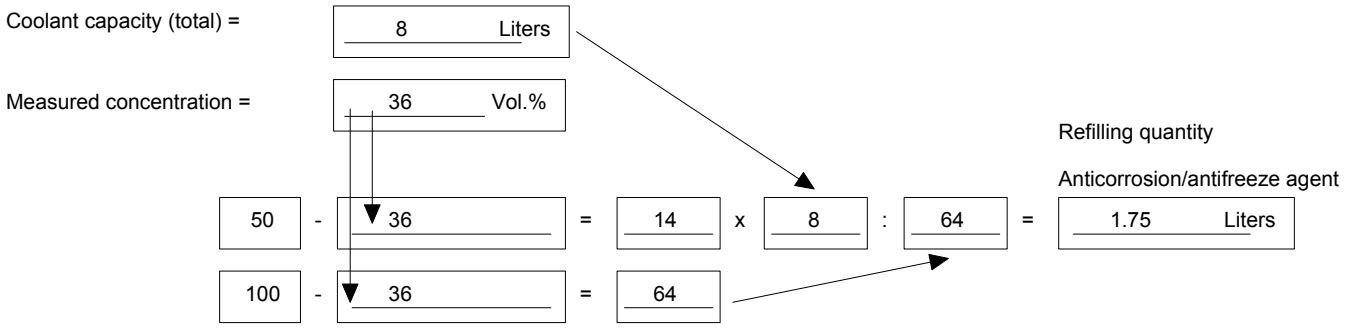
Commercial vehicles engines

Sheet No.	**Engine series**				**Change interval Years**
	OM 300	OM 400	OM 500	OM 900	
311.0	-	-			0.5
312.0	-	-	-	-	1
325.0/326.0	-	-	-	-	3
325.2/326.2	-	-	-	-	3
325.3/326.3	-	-	-	-	5

Calculation of the antifreeze quantity to be refilled with a concentration that is too low (specified: 50 vol.%)



Example of calculation:



Frost protection/concentration (approx.)

°C	-10	-14	-15	-18	-20	-23	-25	-27	-30	-33	-35	-40
vol %	20	25	26	30	32	35	37	40	42	45	47	50

BB00.40-P-0311-00A	Coolant refining agents	(Corrosion Protection Oil)	Sheet 311.0

Shell Oil 9156	Deutsche Shell GmbH, Hamburg, Germany

BB00.40-P-0312-00A	Coolant additives (water-soluble) without antifreeze protection requirement	Commercial vehicles and industrial engines: usable in all engines **except** OM 601, OM 602, OM 603 i Application concentration where otherwise not stated: 10 vol % 7 1 vol %	Sheet 312.0

Havoline Extended Life Corrosion Inhibitor	Arteco n.v., Ghent, Belgium
Korrosionsschutz VP 1749	Clariant GmbH, Frankfurt/Main
MB 312.0 Kühlmittelzusatz A 000 989 13 25 10	DaimlerChrysler AG, Stuttgart, Germany

BB00.40-P-0325-00A	Anticorrosion/antifreeze agents (Sheet 325.0)	Passenger vehicles and cross-country vehicles, passenger vehicle engines in commercial vehicles: stipulated in all engines Commercial vehicles and industrial engines: usable for all engines	Sheet 325.0

Product name	**Company, town/country**
Addinol Antifreeze Super	Addinol Lube Oil GmbH, Leuna/Germany
Agip Antifreeze Extra D	ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Antifreeze Plus	ENI S.p.A. - Refining & Marketing Division, Rome, Italy
Agip Langzeit-Frostschutz	Agip Schmiertechnik GmbH, Würzburg/Germany
Anticongelante Diator Premium	Diator de Mexico, S.A. de C.V., León, Guanajuato, Mexico
Antifreeze RL-Plus	Raloy Lubricantes, Santiago Tianguistenco, Mexico
Aral Antifreeze Extra	Aral Aktiengesellschaft, Bochum/Germany
Aseol Antifreeze	Shell Aseol AG, Bern, Switzerland
Avia Antifreeze APN	Avia Mineralöl-AG, Munich/Germany
Behran Zagros	Behran Oil Company, Teheran, Iran
BP Isocool	BP Centre, Cape Town, South Africa
Caltex CX Antifreeze Coolant	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Castrol Antifreeze NF	Castrol Ltd., Swindon, England
Dragon Power Coolant A	S-Oil Corporation, Seoul, Rep. of Korea
Engen Antifreeze and Summer Coolant	Engen Petroleum Ltd., Cape Town, South Africa
Engman's - Super Antifreeze Coolant	Unico Manufacturing Co., Durban, South Africa
ESA Frostschutz G05	ESA, Burgdorf, Switzerland
ESA Antifreeze G48	ESA, Burgdorf, Switzerland
Eurol Afrostin	Eurol Produktionsges.m.b.H, Ried im Innkreis, Austria
EuroPeak Coolant/Antifreeze	Old World Industries, Inc., Northbrook, IL, USA
Fricofin Kühlerfrostschutz	Fuchs Petrolub AG, Mannheim/Germany
Fridex G 48	Velvana, a.s., Velvary/Czech Republik
Genantin Super	Clariant GmbH, Frankfurt/Main/Germany
Glacelf MDX	TotalFinaElf Lubrifiants, Paris, France
GlycoShell	Deutsche Shell GmbH, Hamburg/Germany
GlycoShell N	Deutsche Shell GmbH, Hamburg/Germany
Glysantin Anti Korrosion	BASF AG, Ludwigshafen/Germany
Glysantin G 48	BASF AG, Ludwigshafen/Germany
Glysantin mit Protect Plus	BASF AG, Ludwigshafen/Germany
Hightec Antifreeze AN	ROWE Mineralölwerk GmbH, Bubenheim/Germany
INA Antifriz Al Super	Maziva Zagreb Ltd, Zagreb, Croatia
JET-Protect	Conoco Mineralöl GmbH, Hamburg/Germany
Krafft Refrigerant ACU 2300	Krafft S.A., Andoain (Guipuzcoa), Spain
MB 325.0 anticorrosion/ antifreeze agents 000 989 08 25	DaimlerChrysler AG, Stuttgart/Germany
MB 325.0 anticorrosion/antifreeze agents 000 989 21 25	DaimlerChrysler AG, Stuttgart/Germany
Motorex Antifreeze G05	Bucher AG, Langenthal, Switzerland
Motorex Antifreeze Protect G48	Bucher AG, Langenthal, Switzerland
OMV Kühlerfrostschutz	OMV Aktiengesellschaft, Vienna, Austria
Panolin Anti-Frost MT-325	Panolin AG, Madetswil, Switzerland
Permant 100	Oil Refinery Modrica, Modrica, Bosnia-Herzegovina
PO Özel Antifriz	Petrol Ofisi Anonim Sirketi, Istanbul, Turkey
Powercooling Concentrate Antifreeze	SMB, Passy, France
Recyclean 2000 CB	GVG Glykol-Vertriebs GmbH, Eppingen/Germany
Sasol Freezol	Sasol Oil (Pty) Ltd, Randburg, South Africa
Shell Tri Guard	Shell South Africa, Cape Town, South Africa

Total Antifreeze and Summer Coolant	TotalFinaElf Lubrifiants, Paris, France
Valvoline AntiFreeze Extra	The Valvoline Company, Dordrecht, Netherlands
Veedol AF	Veedol International, Swindon, England
Veedol Antifreeze MB	Veedol International, Swindon, England
Veedol Antifreeze NF	Veedol International, Swindon, England
Zerex G 05	The Valvoline Company, Lexington, Kentucky, USA
Zerex G 48	The Valvoline Company, Lexington, Kentucky, USA

BB00.40-P-0325-02A	Anticorrosion/antifreeze agents (Sheet 325.2)	Commercial vehicles and industrial engines: usable in all engines **except** model ranges OM 600 and M 100	Sheet 325.2

Product name	**Company, town/country**
Antigel DB 486	SMB, Passy, France
Aral Antifreeze T	Aral Aktiengesellschaft, Bochum/Germany
Avia Frostschutz	Avia Mineralöl-AG, Munich/Germany
BP anti-frost X 2270 A	Deutsche BP Aktiengesellschaft, Hamburg/Germany
C2270-1	Ineos n.v., Zwijndrecht, Belgium
Caltex Engine Coolant DB	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Glyco Star	Fragol Schmierstoff GmbH + Co. KG, Mülheim an der Ruhr/Germany
Glysantin	BASF AG, Ludwigshafen/Germany
Glysantin G 03	BASF AG, Ludwigshafen/Germany
Havoline AF 007/400F	Arteco n.v., Ghent, Belgium
Havoline AF 542	Arteco n.v., Ghent, Belgium
Mobil Frostschutz 600	Exxon Mobil Corporation, Fairfax, Virginia, USA
OZO Frostschutz S	TotalFinaElf Lubrifiants, Paris, France
TSK G 40	Theo Seulberger GmbH & Co. KG, Karlsruhe/Germany
Unil Froststop	Unil Deutschland GmbH, Stuttgart/Germany

BB00.40-P-0325-03A	Anticorrosion/antifreeze agents (Sheet 325.3)	Commercial vehicles and industrial engines: usable in all engines **except** model ranges OM 600 and M 100 **Mixing restrictions** with products as under Sheets 325.0, 326.0, 325.2 and 326.2	Sheet 325.3

Product name	**Company, town/country**
Aral Antifreeze Silikatfrei	Aral Lubricants GmbH & Co. KG, Bochum/Germany
BP ProCool	BP Oil International, London, England
Caltex Extended Life Coolant	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Glacelf Auto Supra	TotalFinaElf Lubrifiants, Paris, France
Glysantin Alu Protect	BASF AG, Ludwigshafen/Germany
Glysantin G 30	BASF AG, Ludwigshafen/Germany
Gulf Maximum	S.A.E.L., Madrid/Spain
Havoline Extended Life Antifreeze Coolant	ChevronTexaco Technology Ghent, Ghent/Zwijnaarde, Belgium
Havoline XLC+B (OF02), 33068	Arteco n.v., Ghent, Belgium
Motul Inugel Optimal Ultra	Motul, Aubervilliers Cedex, France
Orvema Protex LL Long Life	Orvema b.v., Maarssen, Netherlands
Petrol Antifriz Koncentrat	Petrol d.d., Ljubljana, Slovenia
Recyclean 2000 CA	GVG Glykol-Vertriebs GmbH, Eppingen/Germany
SB-G12	Sotragal Belgium S.A., Brussels, Belgium
Total Organicool	TotalFinaElf Lubrifiants, Paris, France
Total Organifreeze	TotalFinaElf Lubrifiants, Paris, France
Yacco LR Organique	Yacco SAF, Saint-Pierre-lès-Elbeuf, France
Zerex G 30	The Valvoline Company, Lexington, Kentucky, USA

BB00.40-P-0326-00A	Premixed coolant (Sheet 326.0)	Passenger-car and cross-country vehicles, passenger-car engines in commercial vehicles and as industrial engines: prescribed for all engines Commercial vehicles and industrial engines: usable for all engines	Sheet 326.0

Coolelf MDX -37	Elf Lubrifiants, Paris, France
Coolant G 05-23/50	BASF AG, Ludwigshafen

BB00.40-P-0326-03A	Premixed coolant (Sheet 326.3)	Commercial vehicles and industrial engines: usable in all engines **except** model ranges OM 600 and M 100 **Mixing restrictions** with products as under Sheets 325.0, 326.0, 325.2 and 326.2	Sheet 326.3

Coolantar Supra -37	Elf Lubrifiants, Paris, France
Coolelf Auto Supra -37	Elf Lubrifiants, Paris, France
Havoline XLC+B 50/50 (OF01), code 33073	Arteco n.v., Ghent, Belgium

BB00.40-P-0361-00A	Refrigerants	⚠ **Read Use and handling of halogenated refrigerants!** (Regulation in FR Germany) **Quality R 134 a:** Passenger vehicles, vans, UNIMOG, MB-trac, commercial vehicles i Note R 134 a label on the filling plate of the air conditioning system and thread type of Schrader valve!	Sheet 361.0

⚠ **Use and handling of halogenated refrigerants** (Regulation in FR Germany)

a) It is **prohibited**, when operating, repairing and taking air conditioning systems out of operation, to allow refrigerants R12 and R 22, contrary to the state of the art, to escape **into the atmosphere**.

b) The amounts used during operation and maintenance must be **recorded** and, on request, these documents must be presented to the competent authority.

c) Maintaining air conditioning systems and taking them out of operation as well as the taking back of R 12 and R 22 may only be carried out by persons who have the required expertise and technical equipment.

d) Take-back obligation for refrigerants R 12 and R 22
Distributors of R 12 and R 22 must take them back after use (as of Nov. 91). Records must be made and kept for 3 years regarding the take-back.

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i **R 134 a** may only be filled into the intended air conditioning systems. Passenger vehicle models as of year of construction 1984 (incl. MODEL 201) with A/C compressor 10 P and 10 PA, which have previously been operated with refrigerant R 12, can be converted to refrigerant R 134 a (read conversion instructions SI Group 83/81 dated 15. 2. 94).

Before topping up the refrigerant, always look on the major assembly to determine which air conditioning is fitted. R 134 a systems have green marks, a "R 134 A" plate is also provided on the compressor.

Mercedes-Benz refrigerant a, A 000 989 03 48 10 i **Observe R 134 a!**	DaimlerChrysler AG, Stuttgart, Germany

BB00.40-P-0362-00A	Compressor oils	Product approval dependent on A/C compressor and refrigerant Passenger vehicles: with the conversion of the air conditioning systems in passenger vehicle models as of year of construction 1984 (incl. Model 201) with AC compressor 10 P and 10 PA from refrigerant 12 to R 134 a, the refrigerant machine oil must also be changed. The converted R 134 a air conditioning systems may **only** be filled with the PAG oil of part no. 001 989 0803 !	Sheet 362.0

Passenger vehicles and commercial vehicles A/C compressor for R 12 /R 22 air conditioning systems

Calte x Capella W F 100	Caltex (UK) Limited, London, England
Capella W F 100	Texaco Technology Ghent, Ghent, Belgium
Shell Clavus Oel G 100	Deutsche Shell AG, Hamburg, Germany
Suniso 5 GS	Sun Company, Inc., Philadelphia, PA, USA

Passenger vehicles A/C compressor for R 134 a air conditioning systems

MB 362.0 Kompressorenöl A 001 989 08 03	DaimlerChrysler AG, Stuttgart, Germany

Bock compressors

MB 362.0 Kompressorenöl A 001 989 16 03	DaimlerChrysler AG, Stuttgart, Germany
Triton SE 55	DEA Mineraloel AG, Hamburg, Germany

Contents:

1 Vehicle preservation

1 Thoroughly clean the vehicle, the underbody, the engine and the engine compartment.

2 The engine compartment must be treated with preservative following engine cleaning.
i See Specifications for Operating Fluids Sheet 385.4.

3 Rectify paint damage and treat the paintwork with MB-polish and MB-gloss preserver.

4 Treat dull spots, discoloration, spots, etc. on the paintwork.
i Depending on the severity, treat with either MB-paint cleaner, MB-fine polishing paste or MB-polish and MB-gloss preserver. MB-chrome care products (if necessary, also MB-polish or MB-gloss preserver) are provided for chrome and anodized parts. Order number for microfilm Z12501..07/Z12502..07.

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5. Mask window, soft top.

6 Treat paintwork and chrome parts with exterior wax.
i The exterior preservation must be removed again after six months for standard paint and after 11 months for metallic paint, otherwise matting of the paintwork may occur. At average daytime temperatures of more than 30 °C the preservation must be removed earlier: with standard finish paint after 2...3 months and with metallic finish paints after 8...9 months. The times specified relate to vehicles parked in the open air and not under a roof.
For approved wax preservatives see Sheet 385.2/.3/.5/.

7 Spray underfloor with underbody seal.
i See Specifications for Operating Fluids Sheet 385.1.

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8 Before parking the vehicle, warm up the service brake so that any moisture at the brake disks and brake pads is evaporated.

9 Whenever possible, park vehicle in a sheltered area.

10 Secure vehicle using chocks. Release parking brake / spring brake reservoir to prevent the brake linings from rusting solid.

11 Drain condensation at the compressed air system.
i Vehicles without compressed air drier.

12 Apply prescribed lubricant to all lubrication points.
i See maintenance sheet.

13 Initiate intermediate lubrication on control unit.
i Commercial vehicles with central lubrication system. See WIS, FG 57.

14 Fill grease containers to the top and cover to protect against the sun.
i Commercial vehicles with central lubrication system.

15 Increase the tire pressure (approx. 2 bar above the standard pressure) to prevent the tires from becoming flat, or jack up the vehicle to relieve the load on the tires.

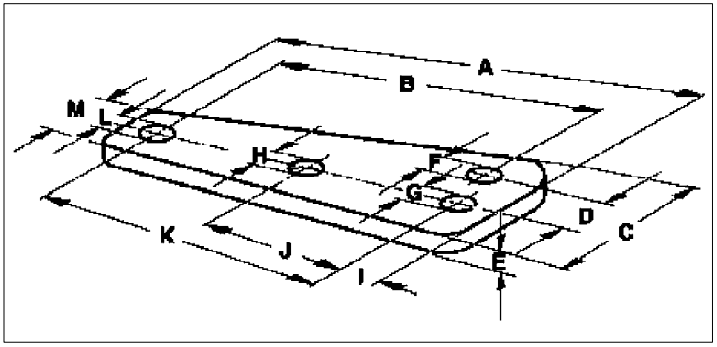
16 Cover the tires to protect from sunlight.

17 Disconnect the negative terminal of the battery to prevent discharging by closed-circuit accessories.

18 Fully charge the battery and recharge every 3 months or trickle charge with 0.06 A.

Bracket for clutch release mechanism

A 80 mm
B 57.2 mm
C 35 mm
D 12.7 mm
E 10 mm
F 9 mm
G 9 mm
H M 8
I 10mm
J 30 mm
K 60 ± 0.2 mm
L 9 mm
M 20 mm



P58.50-2021-10

i A pressure screw M 8 x 65 is required for this.

19 Disengage clutch so that the clutch lining does not stick.
i With mechanical clutch operation, a strip must be clamped between the seat frame and the clutch pedal. With hydraulic clutch operation, secure the release lever, and not the pedal, at the clutch housing/bearing bracket of the slave cylinder. If it is not possible to secure the release lever from outside, then the device shown in the following figure must be made for passenger vehicles. Remove slave cylinder and install the device.
i Not on vehicles with central release bearing.

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20 Check coolant for antifreeze protection, correct as required.

21 Check window and headlamp cleaning systems for antifreeze protection, correct as required.

22 Install rubber emergency bumper.
i Vehicles with hydropneumatic suspension.

23 Empty water containers, pumps and hoses to prevent freezing.
i Vehicles with kitchen and lavatory facilities.

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2 Engine preservation

Engines in temporary storage are those that are not operated for more than one month.

This relates to all installed and removed vehicle, industrial and OEM engines as well as new engines, ET and CBU engines.
i (ET = replacement or spare engines, CBU = completely built-up vehicles from factory)

Engines should be stored in dry, well-ventilated areas. If this is not possible, then these are **severe conditions,** and the specified **measures must be carried out after half the time,** i.e. after six months instead of twelve, for example.

Removed engines must always be protected from direct moisture (rain or splash water) by special measures.

When the engine is installed, it is expedient to perform the preservation operations at the storage location, because afterwards the engine may no longer be started.

2.1 Temporary storage up to 12 months

24 Clean engine.
i Removed and industrial engines.

25.1 Check engine oil level, correct as required.
i Only if break-in oil as defined by Specifications for Operating Fluids Sheet 223.1 is in engine.

25.2 Engine - oil and filter change.
i Only if service oil is in engine. Refill with break-in oil according to Specifications for Operating Fluids Sheet 223.1.

26 Check coolant level, correct as required.
i Fill with coolant according to Specifications for Operating Fluids Sheet 310. For removed engine, drain coolant completely.

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27 Remove catalytic converter and replace with a catalytic converter test pipe.
i Engine with catalytic converter.

28 Fuel system preservation.
i To diesel fuel add approx. 10 % break-in oil and to gasoline add approx. 5 % break-in oil. In accordance with Specifications for Operating Fluids Sheet 223.1. On German military vehicles, kerosene may be used instead of diesel fuel.

29 Warm up engine at a moderate rpms and allow to run for approx. five to ten minutes at operating temperature.

30 Shut off engine.

31 Fill oil-bath air filter to maximum fill level.
i Engines with oil-bath air filter only.

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32 Preserve combustion chambers and air compressors as described under **2.2** .
i For marine transport or preservation in tropical countries.

33 Remove rust spots from engine.

34 Grease all treated exterior surfaces and those surfaces that where preservation was not applied.
i Such as the flywheel, belt pulleys, keyway.

Preservation of the combustion chambers in gasoline engines.

38.1 Detach fuel line running between the fuel tank and the fuel pump.
i On carburetor engines.

38.2 Remove fuel pump relay.
i Engines with CFI-M, CFI-E and LH-SFI injection systems.

38.3 Disconnect main relay for the power supply to the control unit.
i Engines with electronic injection.

39 Start engine and run carburetor empty.
i On carburetor engines.

40.1 Detach a cable at the bolt connections of the ignition coil.
i Engines with coil ignition.

---

45 Pour 5...8 cm3 of break-in engine oil into each cylinder and operate starter for approximately 5 s.
i All engines except carburetor engines.

46 Clean and install air cleaner.

47 Attach fuel line.

48 Screw in spark plugs.

49 Connect cable to ignition coil / Plug electrical connector into ignition control unit/ignition coil.

50 Insert fuel pump relay / Insert main relay for control unit power supply.

Preservation of air compressors:

51 Spray or pour a maximum of 5 cm3/cylinder of break-in engine oil via the air intake side.

2.2 Temporary storage for 12 to 36 months

All measures listed in Sections **2.** and **2.1.** must be carried out.

Preservation of the combustion chambers in diesel engines.

35.1 Remove glow plugs.
i On prechamber engines.

35.2 Remove injectors.
i On direct-injection engines.

36 Pour the following quantity of break-in engine oil into each cylinder and operated the starter for approx. 5 s.
i Passenger car engines BR 600 = 5...8 cm3
Commercial vehicle engines BR 600 = 8...10 cm3
BR 300 = 8...10 cm3
BR 400 and all other diesel engines = 15...20 cm3

37 Install glow plugs / injectors.

40.2 Separate electrical connection on ignition control unit.
i Engines with transistorized ignition.

40.3 Separate electrical connection on ignition coils.
i Engines with electronic injection.

41 Remove air cleaner.
i On carburetor engines.

42 Fill carburetor with break-in engine oil.
i Except Stromberg carburetors.

43 Operate starter for approx. 5 s at full throttle.
i For Stromberg carburetors, inject corresponding quantity of break-in engine oil from oil can into the carburetor.

44 Unscrew spark plugs.
i All engines except carburetor engines.

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52 Crank air compressor for approx. 10 revolutions.
i Do not start engine.

2.3 Temporary storage for more than 36 months

All measures described in Sections **2.**, **2.1.** and **2.2.** must be repeated after 3 years or after 18 months.

2.4 For any temporary storage

53 Air-seal all engine openings.

54 Loosen the V-belt and the poly-V-belt.
i V-belt and poly-V-belt may, however, remain in position. The engine must no longer be started after this.

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3 Engine dewaxing

55 Remove all the sealing caps.

56 Remove preservative.

57 Tension V-belt/poly-V-belt according to specifications.

58 Install removed engines and restore connections.

59 Fill with approved operating fluids or top up to the maximum level.

60 Empty fuel tank or run tank empty.

61 Engines which have already undergone the inspection or running in on the test bench (300 km =6 h) must be topped up with approved service oils.
i Engines that have not been run in on the test bench or have not undergone inspection must be topped up with approved break-in oil.

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62 Warm up the engine to normal operating temperature while monitoring pressure and temperature readings.

63 Replace catalytic converter test pipe with a catalytic converter.

4 Vehicle dewaxing

64 Remove the securing means for the clutch release mechanism/make the clutch operational.

65 Correct tire inflation pressure.

66 Lower vehicle and secure with chocks.

67 Check the charge level of the battery, recharge the battery if necessary. Install or reconnect battery.

68 Check operation of electrical system.

69 Check coolant level. If it needs to be topped up, bleed auxiliary heater and check antifreeze mixture ratio.

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70 Remove rubber emergency bumper on vehicles with hydropneumatic suspension.

71 Check oil level in steering system, engine, transmission and drive axles.

72 For vehicles that were out of operation for more than 12 months, replace brake fluid.

73 Check hoses and lines for cracks.

74 Check air conditioning/automatic air conditioning for proper operation.

75 Check refrigerant level. To do this, allow the engine to run beforehand for approx. 4 min with the air conditioning switched on.

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76 If the paintwork is coated with exterior wax, remove the wax using a hot-water high-pressure cleaner (at least 85 °C, distance of 20...25 cm) with a biodegradable cleaning agent added. Washing shampoos based on alkyl sulfonate or alkyl aryl sulfonate, for example, are suitable for hot-water high-pressure washing (pH 6...8, dosage: 2...3 %). The tenside/water emulsion must not be disposed of via oil separators, but must be disposed of via an appropriate wastewater pretreatment (e.g. ultrafiltration).

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77 When dewaxing by hand, first spray the waxed surfaces with cleaning agent (dosage: 5...10 %). Wait 5...10 min, then thoroughly spray off the layer of dirt on the wax with a warm powerful jet of water (40...50 °C). The layer of dirt must be removed completely, otherwise the paint may be scratched during further treatment. Rub cleaning agent into the surfaces still coated with wax, painted surfaces must be rubbed with a sheepskin glove or a soft sponge. Using a warm, powerful jet of water (40...50 °C) spray off the dissolved wax.

78 Vehicles that were not preserved with wax must always be pre-cleaned with hot-water high-pressure cleaning equipment. This will remove large particles of dirt that may cause severe scratches.

79 If after thorough washing, a rough film, droplets, etc. remain on the paintwork or the trim parts, first try to remove these with MB paint cleaners according to specifications. Dissolve stubborn dirt by carefully washing off with pure benzine, silicone or tar removers (avoid contact with rubber parts, do not use aggressive solvents such as commercially available thinners). Then treat with MB-polish and MB-gloss preserver.

80 If it is not possible to remove coatings as described, treat the paintwork with polishing paste and buffer.

81 Test drive vehicle to check the function of the brake system and the steering system.