

PUBLIC TRANSPORT MAINTENANCE BOOK

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FOREWORD

“A stitch in time saves nine”. This old saying has not lost any of its meaning when related to buses. Modern electronics and new technology, which are now often used, certainly reduce maintenance, but do not make it unnecessary. Even the most advanced bus still needs maintenance.

Maintenance of buses can, however, be carried out quicker and more efficiently if the correct technical information and specifications are easily on hand. DAF BUS has therefore collected all the information necessary to carry out maintenance work in one book. You no longer have to search for the correct technical information because everything is neatly arranged.

The user will find it easy to carry out maintenance on DAF BUS vehicles when consulting this book.

Eindhoven, December 1997

The contents of this maintenance book has been updated until the time of printing. DAF BUS maintains the right to make alterations without prior notification.

GENERAL INFORMATION

General information

MAINTENANCE BOOK

This maintenance book contains all the relevant maintenance work and safety regulations and must be strictly observed.

Work which is not contained in this book such as overhaul, looking for faults etc, are contained in the DAF BUS Workshop Manual or in the Workshop Manual for the component concerned.

Whilst compiling this book, it has been assumed that the mechanic will have the necessary experience and the education or training which is required in order to carry out the maintenance work in a responsible and safe manner.

The technical information and the maintenance instructions stated in this maintenance book are compiled with the greatest care and are only relevant to the following vehicles:

SB 220 (LT160L, LT160G, LT195L, LT195G, GS160M, GS200M)
SBG 220 (LT160L, LT160G, LT195L, LT195G, GS200M, GS245M)
SB 225 (LT195L, GS160M, GS200M)
MB 230 (LT160/195L)
DB 250 (RS200L, HS 200 GBO)
SBR 3015 (WS242L/M)

(Refer to the relevant maintenance book for maintenance work on LPG engines.)

TECHNICAL INFORMATION

The technical information in this maintenance book, such as the explanation of maintenance work and the technical information needed in order to carry out the maintenance work in a responsible manner, has been updated until the time of printing.

DAF BUS maintains the right to make alterations without prior notification.

Note:

Important changes which effect the technical information which have not yet been (could not have been) included in this maintenance book shall be made available by an additional TI (Technical Information) publication.

SAFETY REGULATIONS

The safety regulations stated below must be strictly followed so as to prevent damaging the vehicle and to not endanger the health of the mechanic.

- Always follow the local legal safety and environmental regulations.
- The work described in this book must only be carried out by professionally trained personnel.
- Follow all warning and safety regulations stated in this maintenance book. Always read and follow the instructions and warnings on labels and stickers placed on components. They are placed there for your health and safety, so do not ignore them!
- Wear clean, tight fitting clothing and, if necessary, apply protective cream to parts of the body.
- Always wear clean, protective clothing, goggles and a face mask when working on the brake lining, brake pads or friction material. Always refer to the manufacturer's safety instructions when replacing the clutch plate and brake lining/pads.
- Avoid inhaling dust from the clutch plate or brake lining. Make sure there is good ventilation when working on these components.
- Do not run the engine unnecessarily in a closed or unventilated room i.e. make sure that the exhaust gases are well ventilated.
- Keep a safe distance from rotating and/or moving components.
- Do not **remove the filler cap from the cooling system if the engine is at operating temperature.**
- Caution is recommended when changing oil because hot oil can cause serious skin damage.
- Avoid unnecessary contact with drained off oil. Regular contact causes skin damage.
- Various oils and lubricants used are harmful to your health. This also applies to cooling liquid, washer fluid, coolants in air conditioning units, battery acid and diesel oil. Therefore avoid internal and external contact.
- To prevent fire, ensure that the engine and the surrounding area are free from flammable liquids.
- When working on the engine encapsulation, the engine compartment including the encapsulation and the engine must be thoroughly cleaned before every maintenance service because there is a risk of fire if the encapsulation, engine or engine compartment is contaminated.
- **Always disconnect the battery's earth connection when carrying out work on the vehicle's electrical system.**
- Always use chocks when carrying out work under the vehicle.

GENERAL INFORMATION

Safety regulations

- When charging up the batteries, make sure that there is good ventilation and avoid sparks or naked flames. Turn off the battery charger before removing the cables from the battery. Only use a quick charger if absolutely necessary. The positive and negative cables must be removed from the battery when using a quick charger.

WARNING SYMBOL

When this warning symbol is shown, information is given which is essential for the health and safety of the mechanic or which concerns a critical safety procedure. The remark given with this warning symbol must be strictly observed.



NOTE:

The text given here gives important information to prevent damaging the vehicle's components.

Environment

Carrying out the maintenance work regularly and on time, with the necessary professional skill, will help to cause less damage to the environment.

This may be achieved by noticing and repairing any leaks as early as possible and by keeping the engine in good condition (adjusting valves, renewing air filter elements etc.), so as to cause lower emission of damaging exhaust fumes.

It should also be noted that oils and liquids contain damaging components which are harmful to the environment.

Therefore, make sure that the drained off oil and liquid, and also the old oil and fuel filters, are collected in the appropriate, separate containers.

Quick summary:

Pay attention to the environmental implications when carrying out maintenance work.

Components

All genuine DAF BUS parts and components are carefully balanced to each other which helps to establish the DAF BUS quality.

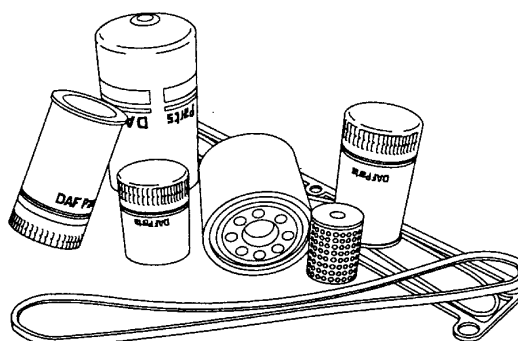
This quality is obviously best maintained if components are replaced with genuine DAF BUS parts and components.

For technical maintenance, we must think of components such as air drying elements, gaskets, V-belts and filters.

If, for example, filters are used which are not genuine DAF BUS products, then there may be insufficient protection from microscopic dust particles from the air, hardly noticeable metal filings in the oil and pollution in the fuel, resulting in:

- early replacement of cylinders, pistons, bearings, valves, injection pumps and other moving parts
- a reduction in engine performance
- increased fuel consumption.

Therefore, always use genuine DAF BUS parts and components.



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GENERAL INFORMATION

Tightening torques

TIGHTENING TORQUES

General information

The vehicles are equipped with threaded connections which are treated with lubricant (dipped threaded connections).

Galvanised nuts and bolts are treated with a wax dip during manufacture. The blackened and phosphate nuts and bolts are given an oil dip. The advantage of treating the nuts and bolts with a lubricant is that friction is reduced when tightening the bolts and the desired pre-load can be accurately reached. The result of this is that the tightening torque can be reduced whilst the pre-load remains the same.

Since the dispersion of the tightening torque is reduced, the threaded connections must be accurately tightened. Always use a torque spanner when tightening so that the tightening torque can be accurately achieved.

Note: regularly calibrate the torque spanner(s)

To obtain the correct pre-load when reusing nuts and bolts, it is important that the screw thread is thoroughly cleaned. After cleaning, apply a drop of lubricant to the first pitch of screw thread and a drop of lubricant to the nut's or bolt's contact surface. Only use engine oil as a lubricant when reusing nuts and bolts. Other lubricants, except for engine oil and the oil applied during manufacture, must not be used.

The friction coefficient of other lubricants is not the same as the lubricant which is applied during manufacture and varies too much.

The use of locking agents in combination with dipped nuts and bolts does not cause any problems. The locking agent should be applied to the screw thread before the lubricant.

From now on, the following applies for all threaded connections (for both old and new vehicles)

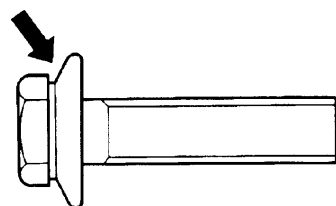
- Standard connections are given lubricant during assembly and are tightened/retightened according to the norm for dipped bolts.
- Special connections are given lubricant during assembly and are tightened/retightened according to the values stated in the workshop instructions.

The application of a lubricant also applies to new bolts from the warehouse. Dry threaded connections must not be used any more due to the variable friction coefficient.

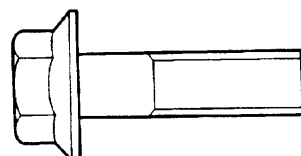
Standard tightening torque table NORM 00804-203

The tightening torques in the table below are the standard tightening torques and only apply to dipped threaded connections which must be fitted according to the instructions previously stated.

The quality of the nuts and bolts is stamped on the nut or bolt, with the exception of the spring flange bolt. The spring flange bolt can be recognised by a constriction between the hexagonal bolt head and the flange. A normal flange bolt does not have this constriction (see diagram).



Spring flange bolt



Flange bolt 00288B

Tightening torques for dipped threaded connections (Nm)

Bolt quality 8.8, nut quality 8 (tightening torque class B)

| | |
|-----|------------|
| M4 | 2,5 ± 0,2 |
| M5 | 5,1 ± 0,4 |
| M6 | 8,6 ± 0,7 |
| M8 | 21 ± 2 |
| M10 | 42 ± 3 |
| M12 | 75 ± 5 |
| M14 | 115 ± 10 |
| M16 | 180 ± 15 |
| M18 | 250 ± 20 |
| M20 | 350 ± 30 |
| M22 | 480 ± 40 |
| M24 | 600 ± 50 |
| M27 | 890 ± 70 |
| M30 | 1200 ± 100 |

Bolt quality 10.9, nut quality 10 (tightening torque class B)

| | |
|-----|-----------|
| M8 | 27 ± 2 |
| M10 | 54 ± 4 |
| M12 | 94 ± 8 |
| M14 | 148 ± 12 |
| M16 | 226 ± 18 |
| M18 | 320 ± 25 |
| M20 | 440 ± 35 |
| M22 | 615 ± 50 |
| M24 | 770 ± 60 |
| M27 | 1110 ± 90 |

Bolt quality 12.9, nut quality 12 (tightening torque class B)

| | |
|-----|------------|
| M8 | 32 ± 3 |
| M10 | 65 ± 5 |
| M12 | 115 ± 10 |
| M14 | 180 ± 15 |
| M16 | 275 ± 20 |
| M18 | 385 ± 30 |
| M20 | 550 ± 45 |
| M22 | 740 ± 60 |
| M24 | 925 ± 75 |
| M27 | 1370 ± 110 |

Spring flange bolt

Bolt quality 12.9, nut quality 12 (tightening torque class B)

| | |
|-----|----------|
| M12 | 180 ± 15 |
| M14 | 275 ± 20 |
| M16 | 425 ± 35 |
| M18 | 550 ± 45 |

GENERAL INFORMATION

Use of locking agents

USE OF LOCKING AGENTS

This maintenance book states when and which locking agent must be used.

The two locking agents below are mainly used.

- A locking agent for locking threaded connections with a medium force. These threaded connections can be loosened with normal tools. "Loctite 243" or a similar product may be used as a locking agent.
- A locking agent for locking threaded connections with a strong force. Mainly stud bolts or similar threaded connections are locked with this locking agent. It is difficult to loosen these connections. "Loctite 270" or a similar product may be used as a locking agent.

Both locking agents are applied in the same way:

- Clean both the inside and outside of the screw threads.
- Degrease the screw thread using a good degreasing agent which does not leave any residue behind which may reduce the efficiency.
- Depending on the size of the diameter, apply one or a few drops of locking agent to the screw thread. Never dip the bolt or stud bolt completely in the locking agent.
- **Apply a drop of oil under the bolt head. The locking agent also reduces the friction resistance so that no oil has to be applied to the screw thread.**
- Tighten the connection to the specified torque.

Note:

Certain cleaning products have a negative effect on the locking agent. In general, after cleaning fastenings and components with a cleaning product, they must be re-treated with a cleaning liquid which guarantees the efficiency of the locking agent.

GASKETS

- Paper and klingerit gaskets (rubber aramide fibre)

This maintenance book states when and which gasket must be used.

1. Remove old gaskets before fitting new ones.
2. Clean the joining faces and check them for damage.
3. Fit paper gaskets using a little bit of grease. These gaskets are used for sealing flat parts and are resistant to oil and medium temperatures.
4. Fit klingerit gaskets without using any grease. These gaskets usually have a layer of graphite. They are used for sealing flat parts and are resistant to oil, water and heat.
5. Always tighten the fixing bolts evenly.

- Liquid sealing compound

This maintenance book states when and which sealing compound must be used.

“Dirko D” and “Loctite 510” liquid sealing compounds, or other similar products, are mainly used.

These compounds replace the conventional gaskets and have been developed to seal flat connections. They are resistant to oil, water and temperatures of approximately 200° C.

Apply the sealing compounds in the following way.

1. Remove the gasket residue and clean the surfaces to be sealed.
2. Apply a little bit of the specified sealing compound to one of the sealing surfaces. Also apply the sealing compound to the stud bolt, bore hole, etc. so that these will be correctly sealed.
3. If sealing compound is present in one of the (oil) bore holes then this should be carefully removed.
4. Place the surfaces to be sealed together and tighten the fixing bolts evenly.

TECHNICAL INFORMATION

Lubricant specifications

LUBRICANT, COOLANT AND FUEL SPECIFICATIONS

IN ORDER TO COMPLY WITH THE WARRANTY TERMS AND TO GUARANTEE THE DURABILITY OF DAF BUS INTERNATIONAL'S PRODUCTS, IT IS ESSENTIAL THAT THE CORRECT LUBRICANTS, COOLANT AND FUEL ARE USED AND THAT THEY ARE CHANGED IN ACCORDANCE WITH THE INTERVALS SPECIFIED.

Ask your lubricant and fuel supplier(s) whether the products they supply comply with DAF BUS INTERNATIONAL' s specifications.



Avoid skin contact with:

- fuel
- lubricants
- coolants

In the case of skin contact, rinse immediately with soap and water.

TECHNICAL INFORMATION

Lubricant specifications

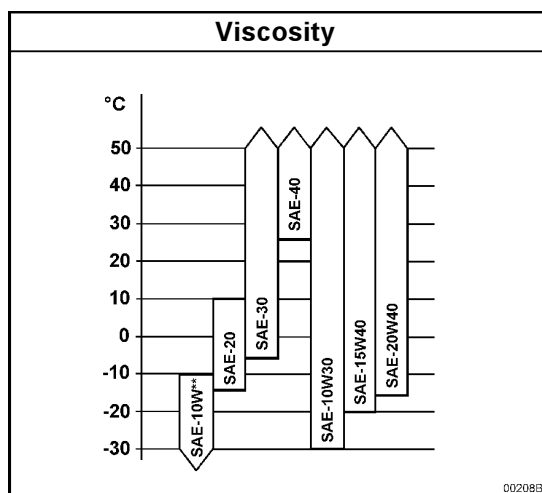
OIL SPECIFICATIONS

ENGINE OIL

| | Oil grade |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All engines with the exception of LPG engines | ACEA-E3/96 (or CCMC-D5) |
| LPG engines | <p>MAT 70310</p> <ul style="list-style-type: none"> - ACEA-E3/96 (or CCMC D5), but with a sulphate content of 0.6% - 1.0%. - Viscosity: 10W40 - Additives: oil must be suitable for LPG use in heavy diesel engines. <p>Suitable oils are: FINA gas engine oil E-0537 and TEXACO GEOTEX multi grade.</p> |

In the event of engine repair/overhaul involving the replacement of piston rings and/or liners, the engine should be filled with a “single grade (SAE 30)” ACEA-E1/96 (or CCMC-D4) oil. This oil must be replaced by the specified oil after 2,500 km.

The temperature limits should only be considered as reference values.



** If using SAE-10W oil, avoid long periods of high engine speeds and heavy engine loads when the temperature rises above the value shown.

Note

If ACEA-E1/96 or E2/96 (or CCMC-D4) engine oil is used instead of the ACEA-E3/96 (or CCMC-D5) grade specified, the maximum oil change interval must be 5,000 km, irrespective of the fuel's sulphur content.

TECHNICAL INFORMATION

Lubricant specifications

GEARBOX AND TRANSFER CASE OIL SPECIFICATIONS

| Type | Viscosity | | | Oil grade |
|-------------------------------------------------------------------------------|----------------------------------------------------|------------------|--------------------|-----------|
| | Multi grade oil | Single grade oil | | |
| ZF | SAE-80W90* | < 0° C | > 0° C | API-GL4 |
| | | SAE-80W | SAE-30 | CCMC-D4 |
| ZF manual gearbox with ZF retarder (secondary retarder; intarder) | | SAE-80W | SAE-30 SAE-40/* | CCMC-D4 |
| ALLISON (GM) | ATF type suffix A or DEXRON II D | | | |
| <i>Automatic gearbox</i> Voith D851, D854, Diwa 2/3 ZF HP 500, 590, 600 | ATF type Dexron II D or E, Dexron III, or Mercon M | | | |

* There may be an increase in gear changing forces if SAE-80W90 or SAE-40 oil is used.

RETARDER OIL SPECIFICATIONS

| Type | | Viscosity | Oil grade |
|-------|-----------------------------|------------------------------------------|--------------------------------|
| Voith | Single grade Multi grade | SAE-20W/20 or 10W or SAE 30 All types | CCMC-D4 API-CC/SF or better |

DRIVEN AXLES OIL SPECIFICATIONS

| Type | Viscosity | | Oil grade |
|-----------|-----------------|--------|-----------|
| | Multi grade oil | | |
| | < 0° C | > 0° C | |
| All types | SAE-85W 140 | | API-GL5 |

HYDRAULIC FLUID, GREASE AND OIL SPECIFICATIONS

HYDRAULIC FLUIDS

Hydraulic power steering system
Hydraulic fan drive
Alternator drive
Bevel box steering shaft
Intermediate gear (MB 230)
Hydraulically operated
brakes and clutches

ATF type A suffix A or
ATF type DEXRON II D, III
with valid approval number

Brake fluid DOT 4



It is important that the brake fluid is replaced at least every two years due to its tendency to absorb water.

GREASES AND OILS

Automatic grease lubrication:
Lubricating grease
Clutch bearings and constant pinion shaft
clutch plate
Oil lubricated front wheel hubs

Grease lubricated front and rear wheel hubs

Such as:

NLGI 0 EP grade
Lithium based grease NLGI 2 with EP additive
Lithium based grease NLGI 3

SAE-80W90 or SAE-80W according to API-
GL4 or GL5

Lithium based grease with EP additive,
NLGI 2 (or better)

Castrol LMX
BP ENERGREASE LC2
ELF GRX 500
MOBILGREASE HP2
Q8 RUBENS
SHELL RETINAX LX
TEXACO HYTEX EP2
FINA PLUTON L2
TOTAL MULTIS COMPLEX EP2
or similar

3rd axle blocking cylinder

Multi grade oil according to ACEA E3
(CCMC-D5)

DIESEL SPECIFICATIONS

Diesel must satisfy the EN 590 specifications. IF LEGALLY PERMITTED, a maximum of 20% kerosene may be added in extremely low temperatures. If this is NOT LEGALLY PERMITTED, then a maximum of 20% unleaded petrol can be added.

Only non-foaming fuel may be used when refuelling using a quick refuelling unit.

Warning:

The following oil change intervals must be observed if using diesel with a higher sulphur content than 0.5%:

| Sulphur content | Change interval |
|-----------------|-----------------|
| 0.5% - 1.0% | 10,000 km |
| 1.0% - 1.5% | 5,000 km |

FUEL AND LUBRICANT ADDITIVES – REGARDLESS OF WHAT TYPE THEY ARE – MUST NOT BE USED UNLESS SPECIFIED BY DAF BUS INTERNATIONAL.

TECHNICAL INFORMATION

Lubricant specifications

Fuel should have a lubricating effect according to the demands below ("lubricity standard"):
Test method: HFRR according to the CEC-F-06-A96 standard
Test value: ≤ 400 mm.

COOLANT SPECIFICATIONS



Coolant is a poisonous liquid. Protect skin and eyes. Coolant is harmful to the environment and should be processed as industrial waste after use.

The cooling system should preferably be filled with a ready-mixed coolant containing antifreeze and corrosion inhibiting additives.

When tap water is used, an ethylene glycol base with antifreeze must be added as well as corrosion inhibiting additives if there is a possibility of the temperature falling below $+5^{\circ}\text{C}$.

- For protection to -18°C , a solution containing at least 33% antifreeze is needed.
- For protection to -37°C , a solution containing at least 50% antifreeze is needed.

Both COOLANT and CORROSION INHIBITING ADDITIVES must satisfy the specifications:

Ethylene glycol: ASTM D-3306, BS 6580 and SAE-J-1034;

Propylene glycol: ASTM D-5216 and BS 6580.

Ethylene glycol and propylene glycol must never be mixed together because the additives do not tolerate each other. Even when using a single type of glycol, it is better not to mix products from different manufacturers.

The vehicles are equipped by the manufacturer with: GLYCOLSHELL.

The coolant with antifreeze may be left in the cooling system during the summer. The antifreeze concentration and the protection, for example, against corrosion must still be kept at the correct level. In climates where the temperature never falls below $+5^{\circ}\text{C}$, it is sufficient to use tap water mixed with a corrosion inhibiting agent according to ASTM D-3306.

Follow the coolant manufacturer's instructions.

COOLANT QUALITY REQUIREMENTS

| | |
|----------------------------|-----------------------------------------------------|
| pH | 5.5 - 9.0 |
| Total solid matter content | ≤ 340 ppm |
| Hardness | ≤ 170 ppm (calcium and/or magnesium carbonate) |
| Chloride | ≤ 40 ppm (sodium chloride) |
| Sulphate | ≤ 100 ppm (magnesium and/or sodium sulphate) |

The cooling system should be rinsed out and filled with new coolant every two years due to the use of additives.

The information above is based on normal operating conditions. Since the specified substances are marketed under various brand names, consult your lubricant supplier for the correct interpretation of these specifications.