Betriebsanleitung

Operating Instructions

Manuel d'Utilisation

Manual de Servicio

Istruzioni per l'Uso

ZF-ECOLIFE

for city buses, intercity buses, and coaches

4181 758 101

Subject to technical changes

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Before operating the vehicle for the first time, please note the following points:

- Read these operating instructions carefully and observe all safety instructions.
- To ensure operational safety and reliability of the transmission, always observe the maintenance instructions.

The ZF Customer Service specialists are available to assist you in carrying out transmission maintenance work or to help if any problems arise.
You will find the addresses in the “ZF Company Directory” (order number 0000 762 703) or on the Internet under www.zf.com (Service/Company Directory/Service Network).
You will find more product information on the Internet by logging on to www.zf.com (Products/Product World Bus).

NOTE
All details in these Operating Instructions refer to the basic version of the ZF-EcoLife transmission.
Due to the large number of installation options, no precise information can be provided for any specific vehicle.
If there should be any deviating operating instructions as regards this brochure and the Operating Instructions specific to an individual vehicle manufacturer, the vehicle-specific instructions will be binding.

Motoring pleasure with the ZF-Ecomat is brought to you by

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The following safety instructions are used with the present operating instructions:

NOTE
Reference is made to special procedures, methods, information, etc.

CAUTION
Used when deviating, unprofessional operation can damage the product.

⚠ **DANGER!**
This is used when lack of care could lead to personal injury or material damage.

⚠ **THREATS TO THE ENVIRONMENT!**
Lubricants and cleaning agents must not be allowed to enter the soil, ground water, or sewage system.

- **Ask your local environmental protection agency for safety data sheets on the relevant products and adhere to their requirements.**
- **Collect used oil in a suitably large container.**
- **Dispose of used oil, dirty filters, lubricants, and cleaning agents in accordance with environmental protection regulations.**
- **When working with lubricants and cleaning agents always observe the manufacturer's instructions.**

NOTE on cleaning the vehicle / transmission

CAUTION
Make sure not to point the steam cleaner or high-pressure cleaner directly at the breather, nor the EcoLife ECU, or the plug-in connections, when cleaning. Water ingress through the breather may damage the transmission!
- Breather, refer to chap. 1.3, item 10
- EcoLife ECU and plug, refer to chap. 1.3, items 1, 2, and 3

1 Description

1.1 Assemblies

EcoLife transmissions consist of a hydrodynamic torque conveter with a lockup clutch and a secondary 6-speed planetary transmission.

Torque converter

The hydrodynamic torque converter, which uses the Trilok principle, is a wear-free starting element equipped with a stator freewheel and an integrated lockup clutch. The converter operates only during the starting process and is automatically bypassed when the clutch closes. As a result, losses occurring in the converter are eliminated.

Torsional-Vibration Damper

All converter types are equipped with torsional-vibration dampers allowing not only better driving comfort but also reduction of fuel consumption as a result of lowered shifting speeds.

Retarder

Retarder equipment is standard for all transmission versions. The integrated hydrodynamic retarder is arranged in the basic transmission between converter and planetary transmission. Due to the location of the retarder on the transmission input (so-called primary retarder), the brake torque on the output is increased by the respective transmission ratio. As a result, a high retarder brake torque is available in the lower gears, and can be used almost until vehicle standstill. As long as permissible values are observed, this can be parameterized at will, which permits adaptation to individual applications or the wishes of customers.

Retarder control is normally managed through actuation of the brake pedal. The automatic electronic gearchange system converts the pedal signal - in steps or continuously - into a corresponding retarder torque.

Via CAN, the retarder can be combined with other brake systems. When this is done, the maximally permitted sum of brake torques must be taken into account. Optionally, or in combination with the brake pedal, the retarder can also be operated via a manual lever.

Planetary Transmission

The planetary transmission, next in line after the torque converter, is designed as a 6-speed unit. It represents a linked system of simple planetary gear sets (not a group-type design). The gears in the planetary transmission are selected automatically and without any interruption of traction.

The signals for individual gearshifts are supplied by the automatic electronic gearchange system. Depending on various operating variables of engine, vehicle, brake system, etc., the corresponding multidisk clutches or brakes are controlled via the electrohydraulic control unit.

Electrohydraulic Control Unit

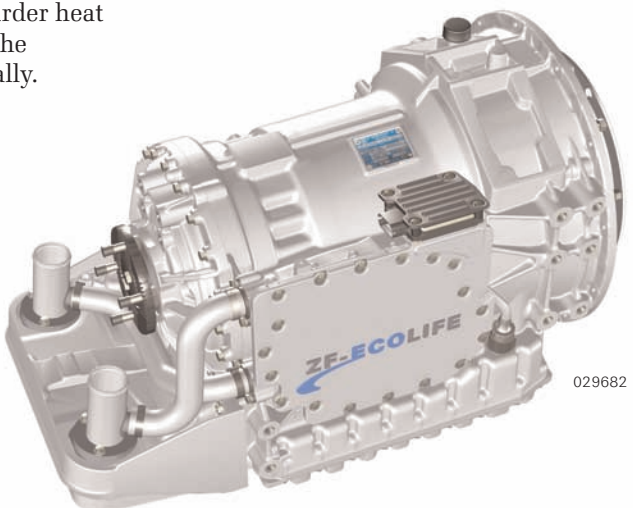
The transmissions are fitted with an electrohydraulic control unit. This unit receives shifting commands from the automatic electronic gearchange system. Proportional solenoid valves are used to modulate closing of the clutch and brake elements in accordance with the engine load.

1.2 Transmission Configuration and Add-On Parts

Based on the basic transmission with attached control unit ECU-EcoLife, the following variants exist:

- **Coaxial transmission version with heat exchangers directly attached.**

On the coaxial standard transmission, the retarder heat exchanger is mounted on the output end and the transmission heat exchanger is arranged laterally.



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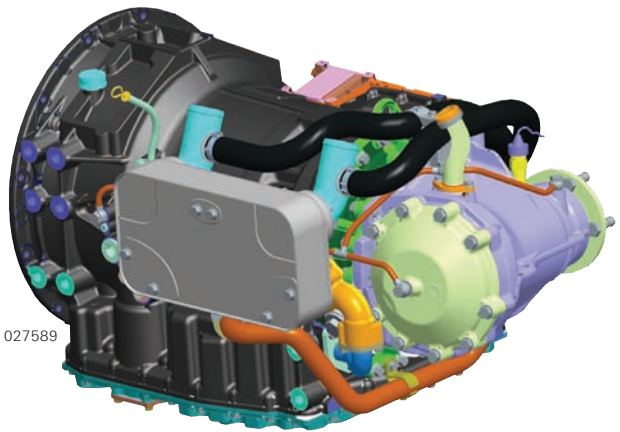
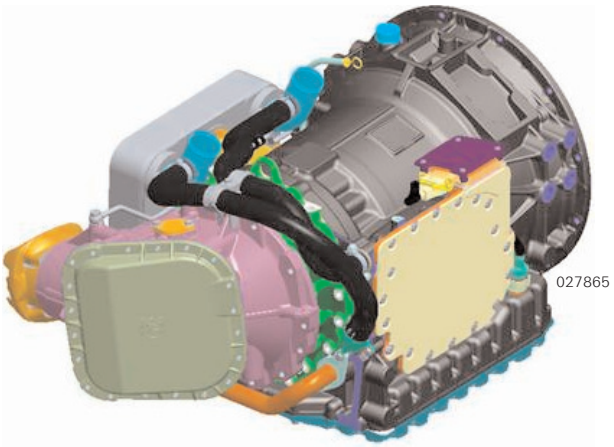
- **Transmission with flanged-on angle drive 80° (RHD, LHD) and directly attached heat exchangers.**

Depending on vehicle version and application, the ZF-EcoLife transmission can be equipped with flanged-on 80° angle drive (RHD, LHD). Special arrangements of the retarder heat exchanger are available.



Transmission with flanged-on angle drive 80° RHD



Transmission with flanged-on angle drive 80° LHD

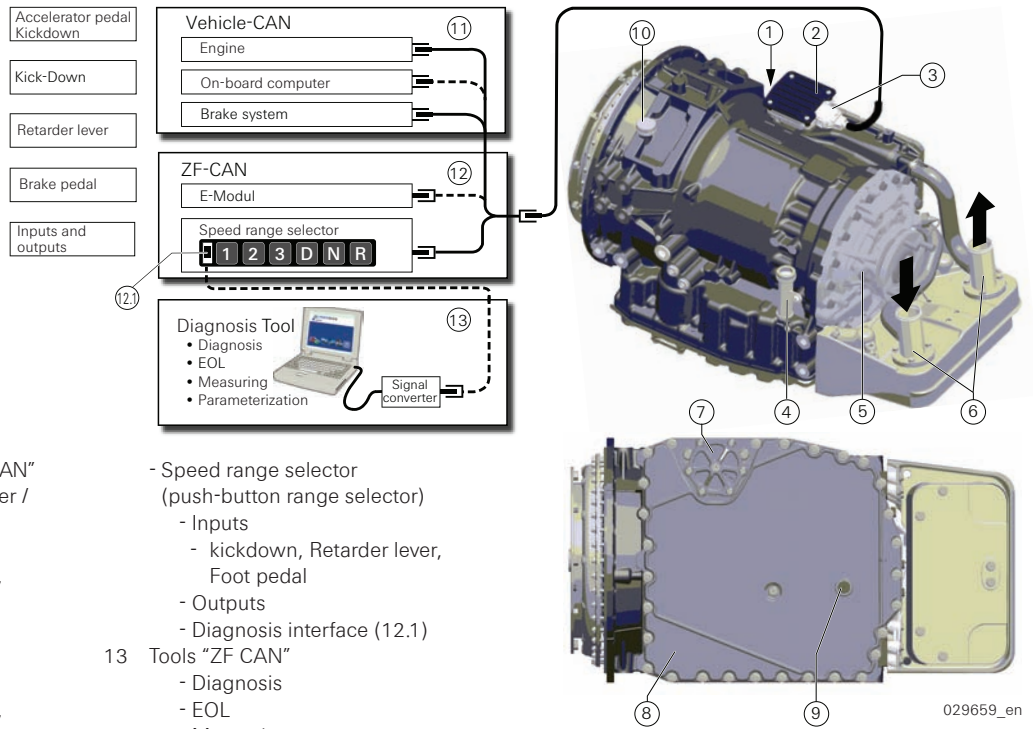
1.3 System Solution ZF-EcoLife

Key to drawing

1 ECU / transmission cable connection
2 Electronic control unit ECU-EcoLife
3 ECU EcoLife connector
4 Oil filler tube with oil dipstick
5 Tachometer impulse sensor (optionally 10 o'clock / 2 o'clock)
6 Cooling water connections
7 Pressure filter
8 Oil pan
9 Oil drain plug
10 Vent
11 Vehicle electric system "Vehicle CAN"
- Engine / On-board computer / brake system
- Accelerator pedal,
- kickdown, Retarder lever, Foot pedal

12 ZF peripheries "ZF CAN"
- E module 2 (optional)
- Inputs
- kickdown, Retarder lever, Foot pedal
- Outputs
- Speed range selector (push-button range selector)
- Inputs
- kickdown, Retarder lever, Foot pedal
- Outputs
- Diagnosis interface (12.1)

13 Tools "ZF CAN"
- Diagnosis
- EOL
- Measuring
- Parameterization



System Solution

The system diagram illustrates possible system solutions for the ZF-EcoLife with all requisite individual components.

The EcoLife transmission is connected to the vehicle electrics via the vehicle CAN; and via the ZF CAN with the range selector, the optional E-module, and the diagnosis tool.

The ECU controls and monitors the EcoLife transmission and features all standard diagnostic protocols. Vehicle and transmission input variables available via CAN are picked up and processed into signals for the control of the hydraulic control elements of the transmission.

The driver can intervene actively in the EcoLife control system using:

- Speed range selector (push-button range selector)
- Kickdown
- Accelerator pedal
- Brake pedal
- Switch for retarder actuation

- The range selector can be used to preselect speed ranges.
  Push-buttons will shine when depressed (permant illumination).

- The kickdown function can be used to move shift points towards higher engine speeds, so the transmission remains in each gear longer during acceleration and shifts out of each gear sooner during deceleration.

2 Operation

2.1 Push-button control with diagnostics connector

2.1.1 Variants

Variants: 3, 4, 5 or 6 push buttons for speed-range selection, horizontally or vertically arranged:

R = Reverse

N = Neutral

D = automatic forward driving range (Drive)

optional:

1, 2, 3 = limited forward driving ranges

For a description of the driving ranges see Section 2.2

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Push-button control with diagnostics connector, variant with 6 push buttons, horizontally arranged (details may be different from illustration).

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Cover for diagnostics connector open

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Diagnostic cable connected

2.1.2 Push-Button Illumination

Brightness levels 1 (low) and 2 (high) are available for push-button illumination.
Turning the vehicle key into driving position causes the system to perform an automatic illumination test. All push buttons will be illuminated for approx. 1.2 s at level 2 before the system changes to level 1 for easier location of the push buttons.

After depression of a push button it will be illuminated at level 2 as soon as it is accepted by the electronic control system.

Display of errors:

- **Illumination level 1 is retained despite depressed push button**

Possible causes:
- Information needed for illumination is not provided by the electronic control unit. In such a case, normal driving is still possible.
- Hardware defect on push-button selector

- **Depressed push button flashes**

Cause: Push button is not accepted by the electronic control unit (for potential cases see Sections 2.3 and 2.4)

- **All push buttons flash**

Possible causes:
- Serious internal fault of push-button selector
- Malfunction of CAN communication

2.1.3 Push-Button Selector Position

NOTE
If several push buttons are selected at the same time, the smallest gear locking button selected will be activated. Example: If push buttons 3 and D are accidentally depressed at the same time, push button 3 will be activated.

⚠ **DANGER !**
If the push button "N" is depressed during driving operation, the power flow between engine and output will be interrupted.
Engine and retarder braking action are then lost.
Risk of accident! – Apply the brake!
For safety reasons, when faults occur in the electronic control unit, or whenever there is a power failure, the transmission will automatically select "Neutral".

2.2 Driving Ranges

Driving ranges are selected through depression of the respective push buttons of the push-button range selector (cf. Section 2.1). Consult the vehicle operating instructions for precise information about the gears engaged in each of the speed ranges.

A defined range of gears is assigned to each driving range. Gearshifts are only executed at shift points defined by the electronic control unit.

Manual intervention in the automatic shifting process (shifting through driving ranges) is not expedient.

2.3 Starting the Engine

The engine may only be started under the following conditions:

- Vehicle standstill
- Activated service or parking brake
- Push-button selector in Neutral position ("N")

NOTE
Starting interlock: If the push-button selector is not in neutral position, engine start will as a rule be prevented. For details consult the vehicle operating instructions of the vehicle manufacturer.

It may be possible to start the engine when the push-button selector is not in neutral position. In such a case, the push button depressed will flash after the engine starts (cf. Section 2.1.2), and the transmission will remain in Neutral. To drive off, the push button “N” will then have to be depressed and subsequently (acc. to Sect. 2.4) the desired driving-range push button on the push-button range selector.

CAUTION
Only jump-start on the battery, never on the starter! Do not turn the vehicle key while driving!

2.4 Engaging a Gear

CAUTION
Never operate the push-button range selector and step on the accelerator at the same time!

Warm up the engine for about 5 minutes, with the push-button range selector in neutral position, after prolonged standstill at ambient temperatures below -20°C.

2.4.1 Standard

- Accelerator pedal in idling position
- n_{Mot} < 900 rpm
- Vehicle standstill
- Activated service or parking brake
- Select desired driving range by depressing-corresponding push button on push-button range selector.

In the following cases engagement of a starting gear is prevented by the electronic control unit in spite of a selected driving range (push button depressed). In such cases, the push button depressed will flash (cf. Section 2.1.2):

- Accelerator pedal operated
- n_{Mot} > 900 rpm
- Driving speed > approx. 3 km/h and driving range selected do not correspond to actual driving direction.
- Transmission oil sump temperature below -20°C.

2.4.2 Transmission with Additional Functions

2.4.2.1 Additional Function “Gear Release”

(Additional installation by vehicle manufacturer, recommended by ZF!)

Procedure as described under 2.4.1. In addition to the cases mentioned under 2.4.1, engagement of a starting gear is prevented by the electronic control unit in spite of a selected driving range (push button depressed) in the following case. In this case, the push button depressed will flash (cf. Section 2.1.2):

- Neither service nor parking brake activated

Operation of the service or parking brake will cause the starting gear to engage and the depressed push button will change from flashing to functional illumination.

2.4.2.2 Additional Function “Additional Push Button Reverse Gear”

For engagement of the reverse gear, depress the R push button of the push-button range selector and promptly also the R push button on the instrument panel.

Remaining procedure as described under 2.4.1.
In addition to the cases mentioned under 2.4.1, engagement of the reverse gear will be prevented by the electronic control unit in spite of the depressed R push button of the push-button range selector in the following case. In this case, the R push button depressed will flash (cf. Section 2.1.2):

- Additional R push button on instrument panel not depressed

2.5 Starting

After selecting the appropriate driving range, wait for approx. 1 to 2 seconds, then release the brake and accelerate.

Depending on vehicle configuration and loading state, the vehicle may start at low speed on a level track or on a slight uphill grade after release of the brake. If a lower driving speed is desired, this must be realized through operation of the brake pedal.

⚠ **DANGER!**

- **In the event of reduced grip of the front wheels, e.g. due to black ice, locking of the front wheels may occur. The vehicle can then no longer be steered.**
- **On major uphill grades, always accelerate with the parking brake activated**
  Do not release the parking brake before you can feel propulsion. RISK OF ACCIDENT caused by vehicle rolling backwards!
- **Fast rolling backwards in a forward gear, or rolling forward in the reverse gear, is not permitted and may result in stalling of the engine and loss of steering support.**
- **Always start with great care and gentle acceleration when starting near persons or obstacles in order to rule out any risks.**

2.6 Downhill Driving

Before driving down steep gradients, select driving range 1, 2, or 3 on the push-button speed range selector, as the situation may require. This limits upshifts.

⚠ **DANGER !**
In an extreme case, the hold mode will be cancelled to protect the engine.
In such a case, the transmission may shift up to the highest gear irrespective of driving range selected.
RISK OF ACCIDENT!
Watch revmeter!

2.7 Change in Direction of Travel

Before changing from Forward to Reverse or vice versa:

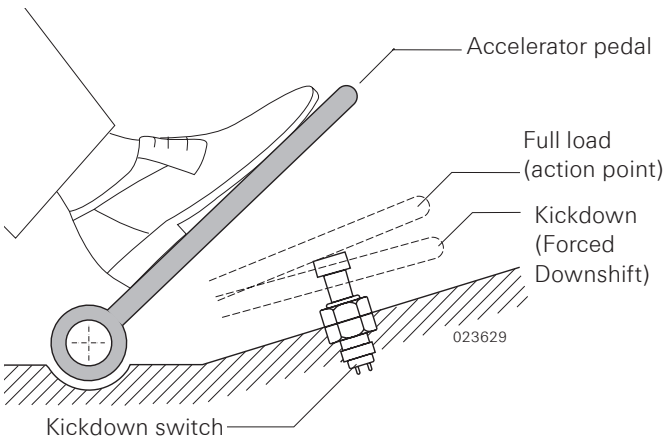
- Bring the vehicle to a complete standstill.
- Depress push button “N” on the push-button range selector
- Continue as described under Section 2.4.

2.8 Kickdown (Forced Downshift)

To utilize maximum engine power, higher shift points can be realized via the kickdown switch (see illustration) or the CAN system (for acceleration or on uphill grades).

- Depress the accelerator pedal beyond the full-load action point (kickdown position).

NOTE
Use of the kickdown function increases fuel consumption.



2.9 Retarder operation

The retarder is a gear-dependent hydrodynamic brake which operates without wear. The retarder should be used for every braking action. This extends the life of the service brake. The retarder can be operated via a hand lever and/or the brake pedal.

When control takes place exclusively via the brake pedal, there is usually a rocker switch “Retarder ON/OFF” on the instrument panel.

In the event of manual-lever control, the lever must be returned to neutral position after each braking action.

Consult the vehicle operating instructions for more details on retarder control.

Conditions for retarder operation

Retarder operation is accepted by the electronic control unit only under the following condtions:

- Accelerator pedal in idling position
- A forward gear is engaged
- The driving speed exceeds approx. 3 km/h
- The ABS system is not active

If any one of these conditions is not fulfilled with the retarder engaged, the retarder will be deactivated.

When the maximally permitted oil temperature acc. to Section 2.12 is approached, the retarder's performance will be reduced or the retarder will be disabled by the electronic control unit.

⚠ **DANGER !**
Risk of accident due to reduced braking power!

The retarder must be deactivated using the "Retarder ON/OFF" switch in the following cases:

- On icy roads.
  If an electronic braking system (EBS) and/or antilock system (ABS) is available, manual retarder shutdown is not required.
- When the permitted oil temperature acc. to Section 2.12 is exceeded.

Options for manually deactivating the retarder:

- Set the "Retarder ON/OFF" switch to the OFF position (if available)
- Set hand lever to zero position (if available)
- Depress pushbutton "N" on the pushbutton range selector and thus engage transmission neutral
  CAUTION: Only in emergencies on black ice if there is no other option for switching off the retarder available.

2.10 Stopping, Parking

Stopping

The vehicle can be stopped at any time through activation of the service brake, irrespective of the position of the push-button range selector. In such a case, the automatic electronic gearchange unit will engage the appropriate starting gear. Owing to the propulsion of the converter, the vehicle may come to a standstill on a slight grade even without actuation of the brake.

- Activate service or parking brake

In the event of a prolonged halt, the push-button selector should be set to the neutral position.

⚠ **DANGER!**
If the brake is not activated, the vehicle may start moving even without actuation of the accelerator pedal.

Transmission with function “Automatic Idle Shift” (AIS)

The automatic electronic gearchange unit will set the transmission to “Neutral” if the following conditions prevail simultaneously:

- Vehicle approaching standstill
- Service or parking brake activated
- Accelerator pedal in idling position

The range selected last on the push-button selector will be retained. As soon as one of the three conditions no longer prevails, the appropriate starting gear will be engaged.

Parking

- Activate the parking brake
- Then depress push button “N” on the push-button range selector

⚠ **DANGER !**
Before leaving the vehicle,
always activate the parking brake. When the engine is switched off, there is no direct connection between engine and axle. The vehicle can start to roll!

2.11 Towing

2.11.1 Towing Vehicle with Coaxial Transmission

2.11.1.1 Transmission is Functioning

- Push-button range selector in Neutral position.
- Max. towing time: 2 hours.
- Max. towing speed:
  Intercity and city buses: 25 km/h
  Coaches: 35 km/h

NOTE
At an ambient temperature below -15°C, the maximally permitted towing speed is 5 km/h.

2.11.1.2 Transmission Damage Suspected

CAUTION
If transmission damage is suspected, the propshaft flange between transmission and drive shaft must be disconnected.

Exception: In a dangerous situation, towing without separation of the drive train is permitted until the vehicle has left the danger area (e.g. intersection, tunnel, etc.).

2.11.2 Towing Vehicle with Angle Drive Transmission

When a vehicle with angle drive transmission is towed, the propshaft between transmission and powered axle must always be disconnected.

Exception: In a dangerous situation, towing without separation of the drive train is permitted until the vehicle has left the danger area (e.g. intersection, tunnel, etc.). In such a case the following conditions apply:

- Push-button range selector in Neutral position.
- Max. towing time 10 minutes.
- Max. towing speed: 15 km/h

NOTE
At an ambient temperature below -15°C, the maximally permitted towing speed is 5 km/h.

2.12 Temperature Monitoring

Transmission temperature monitoring is performed by the electronic control unit. Oil sump temperature and the oil temperature on the retarder output are sent to the vehicle computer via CAN. Depending on the vehicle application, alert signals will be issued when the permissible temperature limit values are exceeded.

Consult the vehicle operating instructions for more details.

When the permissible temperature limit values are approached during retarder operation, retarder performance will be reduced by the electronic control unit.

Action to be taken in the event of a temperature alert:

- Drive in partial-load range
- Using the “Retarder ON/OFF” switch: Deactivate the retarder.

If this does NOT cause the oil temperature to drop:

- Stop the vehicle.
- Put push-button range selector in Neutral position.
- Run engine at raised idle speed.

NOTE
If, after a few seconds, the temperature does not decrease to the permitted range, this may be due to:

- Oil level too low or too high.
- Contaminated vehicle heat exchanger.
- Defective cooling circuit.
- Transmission damage

Inform ZF Service Center!

2.13 Status Monitoring / Warning Lamps

The diagnostics system of the electronic control unit monitors the transmission status every time the vehicle system voltage is switched on and continuously while the vehicle is in motion.

Warning lamps
Faults are indicated by warning lamps lighting up (red or yellow) and/or by warning messages which appear on the driver's display panel (consult the vehicle operating Instructions).

If a selected driving range is not accepted by the ECU, the push button depressed on the push-button speed range selector will flash (see chap. 2.1.2).

2.14 Transmission Response to a Malfunction

To protect the transmission in the event of a malfunction, the following responses are provided:

Shift into Neutral:
In the event of serious malfunctions in the power supply to the transmission, e.g. short circuit.

Engagement of emergency operation mode (cf. Section 2.14.1):
If there is an interruption of CAN communication or a loss of speed information.

⚠ **DANGER !**
The following applies in the event of a malfunction of the transmission system:
- **Serious risk of transmission damage**
- **Limited system monitoring**
  RISK OF ACCIDENT!
- **Continuation of the trip is only allowed if the utmost care is practiced by driving as slowly and foresighted as possible.**

2.14.1 Emergency Operation

Depending on the fault prevailing, the following limitations may occur during emergency operation:

- Retarder function limited or not available.
- Automatic Idle Shift (AIS) function not available.
- No activation of the engine brake.
- Torque converter lockup clutch (WK) open.
- Limitation of engine torque for transmission protection (no engine control).
- Poorer shifting quality or no gearchanges.

2.15 Use in Sub-Zero Temperatures

Vehicle manufacturer specifications MUST be observed.

Outside temperature	**Down to −20°C**	**−20°C to −30°C**	**−30°C to −40°C**
Oil grade	in accordance with ZF-List of Lubricants TE-ML 20	in accordance with ZF-List of Lubricants TE-ML 20	in accordance with ZF-List of Lubricants TE-ML 20
Engine start	Permitted	Permitted	Transmission must be preheated before the engine is started.
When starting, note	–	Warm-up phase of at least 10 minutes, with increased idling speed of approx. 1500 rpm. **Transmission in Neutral**	This can be done e.g. with warm air which must not exceed 130°C on the transmission. **CAUTION: Do not heat up directly at the transmission and/or in the vicinity of the ECU and the wiring.**
Limitations	None	During the warm-up phase, the electronic automatic control unit will activate several functional restrictions (maintaining neutral position despite selected drive range via pushbutton range selector, limitation of speed and torque).	

2.15.1 Parking the vehicle at sub-zero temperatures

The vehicle may be parked or the transmission stored for long periods down to an outside temperature of –40°C.

3 Maintenance

Regular and correctly performed maintenance is essential to safeguard the operational safety of the transmission. It is therefore of particular importance that maintenance intervals are observed.

⚠ **THREATS TO THE ENVIRONMENT!**
Lubricants and cleaning agents must not be allowed to enter the soil, ground water, or sewage system.

- **Ask your local environmental protection agency for safety data sheets on the relevant products and adhere to their requirements.**
- **Collect used oil in a suitably large container.**
- **Dispose of used oil, dirty filters, lubricants, and cleaning agents in accordance with environmental protection regulations.**
- **When working with lubricants and cleaning agents always observe the manufacturer's instructions.**

3.1 Oil Grade

Only oil as specified by the ZF List of Lubricants TE-ML 20 may be used to fill up EcoLife transmissions. For the classification of your vehicle in terms of the maximum allowable oil sump temperature, please refer to the operating instructions of your vehicle. Subsequently, please use the oil grades as released in accordance with the ZF List of Lubricants TE-ML 20 and adhere to the change intervals stipulated for oil and pressure filter.

The latest List of Lubricants can be obtained from all ZF Sales & Service Centers or can be downloaded from the Internet at: www.zf.com (Service / Technical Information / ZF List of Lubricants).

3.2 Oil Quantities

- For oil changes (drain lasts approx. 10 min.) — approx. 24 liters
- For initial fills of dry transmissions — approx. 42 liters

NOTE
These values are reference values! The definitive oil quantity is the one determined by oil-level check at operating temperature (90°C).

3.3 Oil-Level Check

CAUTION
It is absolutely necessary to maintain the correct oil level:

- **Insufficient oil leads to transmission malfunctions and transmission damage.**
- **Too much oil causes overheating of the transmission.**

⚠ **DANGER !**
Insufficient oil leads to partial or complete failure of the retarder, i.e. braking action is impaired or not available.

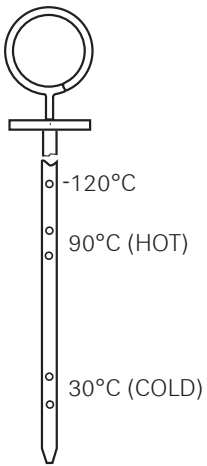
The following general rules apply:

- Oil-level check at operating temperature (90°C) is crucial.
- The oil level must be checked with the vehicle on level ground.
- The speed range selector (push-button selector) must be in Neutral.
- Let engine run at idle speed.
- Carry out oil-level checks at least quarterly.
- Conduct regular visual inspections of the transmission for signs of leakage.
- In exceptional cases, the oil level may need to be checked while the transmission oil is cold see Section 3.3.1.
  Then always check the oil again at operating temperature - see Section 3.3.2.

3.3.1 Check After Starting the Engine

Oil-level check with cold transmission oil (30°C):

- Vehicle stationary on level ground.
- The speed range selector (push-button selector) must be in Neutral.
- Let engine run for 15 - 20 seconds at 1200 - 1500 rpm.
- Let engine run at idle speed.
- Oil must be in the “30°C (COLD)” range.



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3.3.2 Check at Operating Temperature

Oil-level check with hot transmission oil (90 °C):

- Vehicle stationary on level ground.
- The speed range selector (push-button selector) must be in Neutral.
- Let engine run for 15 - 20 seconds at 1200 - 1500 rpm.
- Let engine run at idle speed.

CAUTION
The idle speed should be set to between 500 and 700 rpm. It must never drop below 400 rpm.

- Oil must be in the “90°C (HOT)” range.

NOTE
The oil level can rise and reach the “120°C mark” when the oil sump temperature is 120°C.
For your vehicle, a lower upper limit may apply for the transmission sump temperature, refer to 3.1.

3.3.3 Option for Heating-Up the Transmission Oil

The transmission oil can be heated up to its specified operating temperature for oil check purposes by running the vehicle with retarder cycles until the oil sump temperature reaches 90°C.

If normal driving operation is not possible, the transmission must be heated up as follows:

- Activate the parking brake.
- Select speed range 'D'.
- Activate the service brake.
- Run engine at partial load for **15 to 20 seconds** at 1200 to 1500 rpm.
- After each heating-up phase, and with the transmission in Neutral, run engine at 1500 to 2000 rpm for 15 to 30 seconds.
- Repeat several times in speed range selector position "D" and "N".

CAUTION
The maximum admissible oil temperature in the oil sump is determined by the classification of your vehicle in accordance with the ZF List of Lubricants TE-ML 20. For details, please consult the vehicle's operating instructions.

When the operating temperature is reached **carry out "Check at Operating Temperature"** (Section 3.3.2).

3.4 Oil-Change Intervals

- The specifications contained in the ZF List of Lubricants TE-ML 20 are binding.
- For the respective classification of your vehicle, please refer to the operating instructions of your vehicle.

CAUTION
The pressure filter must be renewed each time the oil is exchanged.

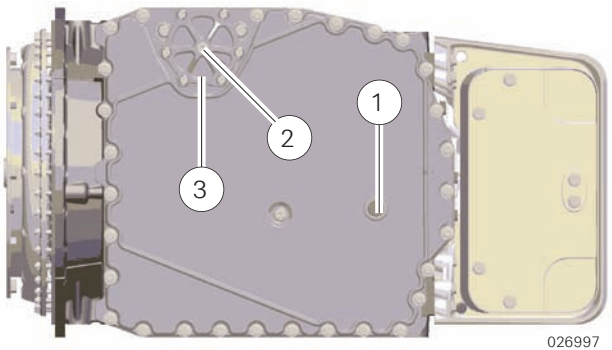
3.5 Oil Change

3.5.1 Oil drain

NOTE
Only drain oil at operating temperature and for at least 10 minutes:

- Engine standstill
- Unscrew oil drain plug **(1)** and drain oil.
- Unscrew screw plug **(2)** on filter cover **(3)** and drain oil from filter space.
- Unscrew filter cover **(3)**.
- Replace filter cartridge (pressure filter) and O-ring on filter cover and on th oil drain plug.

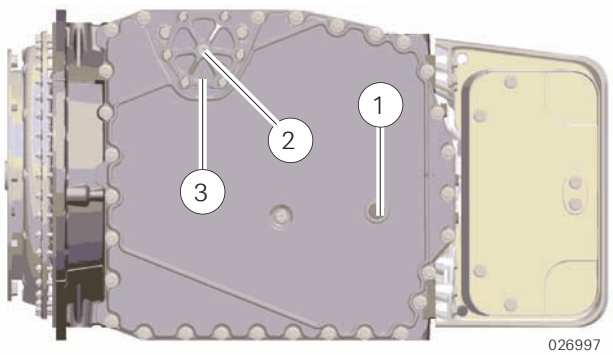
NOTE
Pressure filter must be replaced during oil change.



ZF 80° angle drive

The angle drive does not have its own oil drain plug. Drain oil through main transmission's oil drain plug as described in chap. 3.5.1.

3.5.2 Oil Fill



- Tighten filter cover **(3)**, tightening torque: **23 Nm**

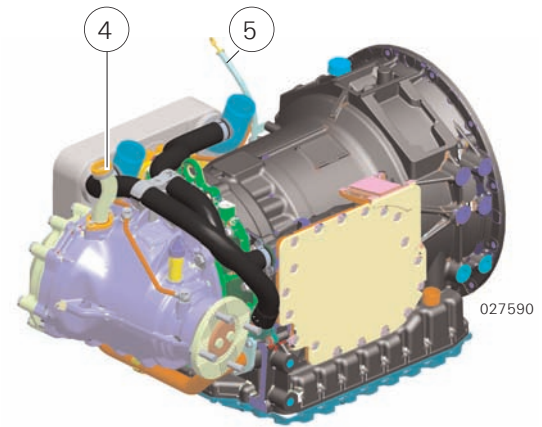
  NOTE
  Be aware of different screw lengths.

- Screw screw plug **(2)** into the filter cover **(3)**. Tightening torque: **25 Nm**
- Screw in oil drain plug **(1)**:Tightening torque: **35 Nm**

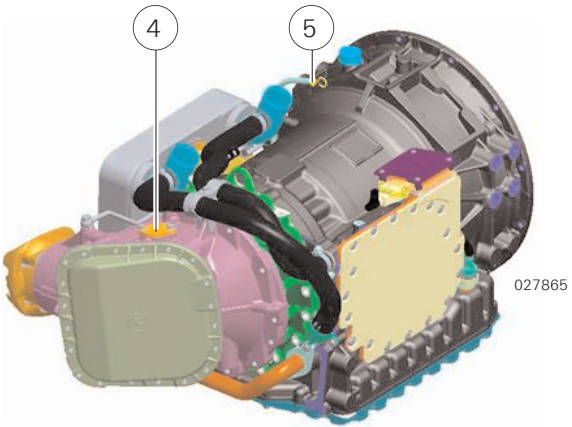
CAUTION
Always use genuine ZF oil drain plugs.
The converter drain valve is activated via the ZF oil drain plug.

- Fill in oil acc. to chap. 3.2 on oil filler pipe **(4)**.
- Check oil level on oil dipstick **(5)**, see chap. 3.3.
- For the oil grade, see chap. 3.1.

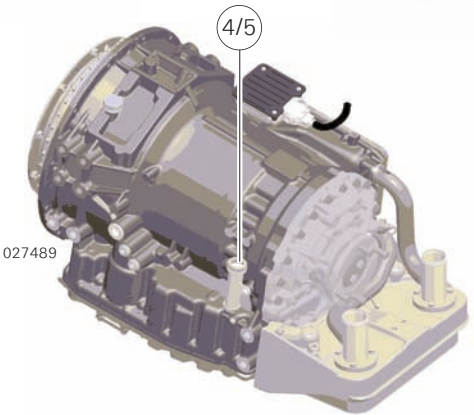
Transmission with angle drive 80° RHD



Transmission with angle drive 80° LHD



Coaxial transmission



Error	Possible cause	Remedial action
Engine will not start	Push-button range selector not in “Neutral”	Select “Neutral” on range selector
	Electronic control unit connector loose	Establish plug connection
	Starting interlock relay defective or missing CAN signal via CAN	Replace relay or check CAN signal
Transmission does not engage any gears	Accelerator pedal not in idle position or load signal too high	check accelerator pedal / injection pump or adjust it
	Engine idle speed > 900 rpm	Set engine idle speed
	Transmission oil sump temperature below -20°C	Warm up engine for approx. 5 minutes
	Only on transmissions with additional function “Gear release”: Neither service brake nor parking brake activated	Activate service or parking brake
	ECU in malfunction setting	Turn off the engine and start it again
Vehicle does not move	Oil level too low	Check / correct oil level
	Transmission defective	Call ZF Service
Oil temperature too high	Oil level too high	Check / correct oil level
	Retarder engaged	Deactivate retarder (via manual lever or rocker switch)
	Transmission damage	Call ZF Service
	Vehicle radiator dirty	Clean the radiator
No retarder effect	Oil level too low	Check / correct oil level
	Retarder proportional valve or solenoid valve not working, CAN signal not present	Check CAN signal and retarder connector signal

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