

REPAIR INSTRUCTIONS

ZF-ECOLIFE

6 AP 1000 B / 6 AP 1200 B / 6 AP 1400 B / 6 AP 1700 B / 6 AP 2000 B
and the corresponding angle drive variants

Stages 1-2

BUSES



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Preface

This documentation was developed for specialized staff trained in the operation of ZF products by ZF Friedrichshafen AG (hereinafter referred to as "ZF").

The work described below may be performed by authorized, trained, and instructed staff only. It is the responsibility of the user's company or service company to ensure that their specialized staff is properly trained and that current documents are made available.

Object of documentation is a volume-produced ZF product. State of design acc. to date of issue.

The images illustrate the work sequence and do not always represent the original. Illustrations and figures are not drawn to scale; no conclusions about size and weight can be drawn.

The repair or assembly of the ZF product available to you may require different work steps as well as different settings and test data as a result of technical further developments. We therefore recommend that work done on your ZF product be carried out only by skilled mechanics and fitters who have had their practical and theoretical knowledge updated on a regular basis at ZF.

The ZF service locations which have been put in place for you worldwide by ZF offer the following services:

- Well-trained specialized personnel
- Specified workshop equipment, e. g. special tools, diagnostic software, etc.
- Genuine ZF spare parts in accordance with the latest volume production specifications

ZF Friedrichshafen AG

Safety Instructions

General safety instructions

Read all safety instructions. Failure to comply with safety instructions may lead to material damage, serious injury, possibly even to death.

Intended use / liability / guarantee / warranty

The ZF product is exclusively designed for the purpose specified in the contract and agreed on at the time of delivery. Any other or extended form of use does not comply with this definition of intended use. ZF Friedrichshafen AG is not liable for any damage resulting from this. Instead, the user is fully liable for this risk. The intended use includes compliance with this documentation and other applicable documents in order to avoid malfunctions and damage in operation.

The ZF product is designed and produced in line with state-of-the-art technology and is safe to operate. However, this product may cause hazardous situations if used incorrectly by unauthorized, untrained, and uninstructed specialized staff or if not used for its intended purpose.

This version of the document complies with the relevant standards and regulations as well as with European product liability law.

We offer guarantee for the ZF product in accordance with our Terms and Conditions. Warranty claims cease to apply if damage and secondary damage result from incorrect and unprofessionally performed work. Work that is performed by unauthorized, untrained, and uninstructed specialized staff leads to ceasing of all warranty claims.

We offer warranty for the ZF product in accordance with our Terms and Conditions. Damage, secondary damage, defects, and possibly resulting costs are excluded from contractual liability or warranty in the event of non-compliance with one of the following points:

- All work must be performed in a professional manner.
- Work must only be performed by trained, instructed and authorized specialized staff.
- Only genuine ZF spare parts may be used which have been tested and released by ZF.
- Only genuine ZF accessories may be used which have been tested and released by ZF.
- Only genuine ZF special tools may be used which have been tested and released by ZF.
- Revisions and modifications on the ZF product must be approved by ZF.

In case of damage, immediate action is mandatory in order to restore full functionality and safety / operational safety of the ZF product and to minimize the extent of damage. In the event of non-compliance, ZF will not accept liability or warranty claims.

In case of damage, contact ZF Services and have the following data available:

- Product type, product parts list number, and serial number
- Total mileage
- Damage history
- Damage pattern

Specialized staff

Work must only be performed by trained and instructed specialized staff. As a result of specialized training and practical experience, the specialized staff must be capable of detecting risks and avoiding possible dangers which may be caused by the operation, maintenance, and repair of the ZF product.

To avoid injury to personnel and damage to ZF products, all safety regulations and legal requirements must be adhered to. The specialized staff must have read and understood these regulations prior to beginning work.

Country-specific safety, accident prevention, and environmental regulations apply irrespective of the instructions provided in this document.

Safety-relevant workwear is to be used for all work. Depending on the type of work, additional protection, e. g. protective goggles, protective gloves, a hard hat, and a skirt, is to be used. The workwear must fit properly and be tight so that it cannot get caught in turning or protruding parts.

After completion of repair work and inspections, the specialized staff must ensure that the ZF product is again functioning perfectly and is safe to operate.

The user/operator is responsible for assigning the corresponding section of the documentation to the correct target group. The former must ensure that the respective section of the documentation is stored in the immediate vicinity of the ZF product and that the relevant target group has access to it.

Handling of ZF products

Impermissible superstructures, add-ons, modifications, and changes to the ZF product may affect the ZF product's operational safety and are only permitted with the approval of ZF Friedrichshafen AG.

Unless explicitly permitted, no work may be performed while the engine is running.
Secure the engine against unintentional setting off and the vehicle against moving.
Attach a "Do not operate" sign which is visible for everyone!
Keep uninvolved parties away.

Always secure the ZF product before starting work according to specification and using suitable means.
Do not work on ZF products which are only held by a lifting device or a hoist.
Risk of injury from tilting or falling parts and/or tools.

- Do not walk under suspended loads.
- Keep distance.

Lifting and moving heavy parts without tools may lead to health damage or serious injury.

- Only use permitted means of transport, lifting equipment with sufficient load capacity, and suitable chain hoist.
- Observe safety regulations.

Increased risk of injury at contact with cooled down or heated parts. Only touch parts when wearing suitable protective gloves.

Noise

Wear suitable ear protection at all workplaces with a sound pressure level above 85 dB(A).

Country-specific safety and accident prevention regulations apply regardless of this.

Noise can mean a higher risk of accidents if the noise affects the perception of acoustic signals, warning calls, or other sounds alerting to danger.

Handling operating fluids and consumables

Increased risk of injury at contact with heated, cooled down, or caustic operating fluids and consumables (e. g. lubricants, cleaning agents, nitrogen).

- Prevent skin contact.
- Do not drink.
- Do not inhale vapors.
- Keep away from ignition sources, do not smoke.

Store operating fluids and consumables in suitable and correctly labeled containers.

Use suitable protective clothing, protective gloves, and protective goggles/face protection.

Pay attention to manufacturer's and accident prevention regulations.

Immediately seek medical assistance after contact with heated, cooled down, or caustic operating fluids and consumables.

Environment

Operating fluids and consumables must not be allowed to enter the soil, groundwater, or sewage system.

- Ask your local environmental protection agency for the safety data sheets of the relevant ZF products and observe these requirements.
- Collect operating fluids and consumables in a sufficiently large container.
- Dispose of operating fluids and consumables, waste, containers, soaked cleaning cloths, contaminated filters etc. in accordance with the regulations of the environmental protection laws.
- Pay attention to manufacturer's and accident prevention regulations.

When selecting operating fluids and consumables, bear in mind health risks, environmental compatibility, disposal regulations, and country-specific possibilities for approved disposal.

Signal words and symbols

This document contains particularly highlighted safety instructions which start with one of the following signal words depending on the danger's severity.

NOTE

Refers to special working procedures, methods, information, use of auxiliary equipment, etc.

CAUTION

Is used when the instructions are not complied with or not followed precisely and could lead to the product being damaged.

**DANGER!**

Is used when lack of care could result in personal injury or danger to life.

Product-related safety instructions**CAUTION**

The transmission must NOT be suspended by the input shaft OR by the output flange/add-on parts.

Instructions for Repair and Assembly

General notes

- Please read carefully through this documentation prior to starting repair or assembly work.
- Prior to starting repair or assembly work, please find out whether ZF Service Information on the ZF product is available. ZF Service Information can contain tests, supplements to the product or to repair processes which may not yet be included in this documentation. The ZF Service Information details are available from all ZF Service Centers or from the ZF-ServiceLine.
- In cases of doubt, always contact the relevant expert departments of the ZF Customer Service.
- All work on the ZF product must be performed expertly and under clean conditions.
- Use the specified special tools and equipment intended for the described working procedures.
- All work must be performed according to the described working procedure.
- Carefully cover opened ZF products to prevent the entry of foreign matter.
- Cover all parts that have been removed and that are reusable and protect them against dirt and damage.
- After completion of work and inspections, the specialized staff must ensure that the ZF product is again functioning perfectly and is safe to operate.

Cleaning the ZF product prior to disassembly

- Use an appropriate cleaning agent to thoroughly clean the ZF product prior to repair or assembly work. Thoroughly clean the angles and recesses of housing and cover.

CAUTION

Be careful when using a high-pressure cleaner on the ZF product.

Penetrating water might lead to operational disruption and damage to the ZF product.

Cleaning parts

- Thoroughly clean all reusable components after disassembly.
- Thoroughly remove sealing compound residue on sealing faces or retaining agent residue, e. g. in tapped holes or on splines.
- Thoroughly clean joining surfaces and check for damage.
- Thoroughly wash out blind holes and blind hole threads and remove contamination.
- Lubricating bores, oil clearance holes, oil ducts, bores for oil press fits, and lubricating grooves must be free from dirt, preservative, and foreign matter. If possible, blow through with compressed air. Check for free passage.
- Hose assemblies, oil tubes, and joining elements must be free from dirt, oil, and chafe marks. Dirty or oily parts must be thoroughly cleaned and, if necessary, blown through with compressed air. Replace damaged parts.
- Thoroughly clean all cavities and reliefs.
- All edges which can cause chip formation during assembly or represent a risk of injury for the fitter must be deburred.
- Carefully remove burrs or other similar rough surfaces using a honing stone.
- Thoroughly remove preservative from new parts (e. g. on bearing).

Reusing parts

Authorized, specialized staff assess whether parts can be reused.

- Replace parts if they are damaged.
- Replace parts if they are worn, e. g. rolling bearings, multidisks, thrust washers, etc.
- Replace parts if they have a permanent deformation.
- Replace parts if they have been overheated during operation or during disassembly.

Always replace:

- Bolts with reduced shank, seals, etc., and parts that are intended for single use only
- Sealing rings
- Safety plates
- Shaft sealing rings

The parts must be replaced with genuine ZF parts or parts released by ZF. Please refer to the spare parts catalog for the ZF product.

Reworking parts

Authorized, specialized staff assess whether parts need to be reworked or replaced.

Minor damage on reusable components can be removed and reworked with suitable special tools if the component's function is not impaired.

Minor damage includes:

- Indentation marks on sealing faces
- Score marks or burrs caused by the disassembly of the ZF product
- Frictional corrosion
- Paint and rust damage

If rework is needed on spacer washers or shims because of clearance settings, ensure that the reworked surface is level with the starting face and has the same surface quality.

Disassembly

- To avoid mixing up parts, the parts must be clearly assigned to the disassembled ZF product. In particular, this applies to gear parts, reusable spacer washers or shims, electronic components, etc.
- Assemblies which must not be disassembled or are only available as spare parts assembly are described accordingly. Please refer to the spare parts catalog for the ZF product.
- Inspect the parts during disassembly in order to find a potential cause of damage.

Assembly

Assemble the ZF product at a clean workplace. The order, settings, and tightening torques must be observed.

Bearings

The bearings' assembly specifications are described in the corresponding work step. After assembly, each mounted bearing must be lubricated with transmission oil.

Sealing

If a sealing agent* is recommended for sealing, then it is essential to adhere to the manufacturer's directions for use. A thin layer of sealing agent should be applied to the surfaces and coat them evenly. Do not allow sealing agent to enter oil ducts and oil bores. In the case of oil transfer channels and/or oil transfer bores in the sealing face areas, the sealing agent should be scraped off around the openings so that no sealing agent gets into the oil supply lines when the parts are pressed together.

Retaining agents

Only use retaining agents* if specified in the work step. Follow the safety instructions and the processing instructions of the manufacturer.

Transmission oil

Prior to initial operation, fill the transmission with transmission oil. For the procedure and approved oil grades, refer to the technical manual, the operating instructions, the type plate, and/or the latest List of Lubricants TE-ML. These documents are available from the ZF Service Centers and at www.zf.com.

* refer to Operating supplies and auxiliary materials

Tightening torques for screws and nuts, extract from ZFN 148

This standard applies to bolts according to DIN 912, DIN 931, DIN 933, DIN 960, DIN 961 as well as ISO 4762, ISO 4014, ISO 4017, ISO 8765, ISO 8676, and for nuts according to DIN 934 and ISO 4032, ISO 8673.

This standard contains data on tightening torques for screws/bolts and nuts of strength categories 8.8, 10.9, and 12.9, as well as nuts of strength categories 8, 10, and 12.

Surface condition of screws/nuts: Heat-treated blackened finish and oiled or galvanized and oiled.

The bolts are tightened using a calibrated torque wrench.

NOTE

Differing tightening torques are listed separately in the repair manual.

Coarse thread				Fine thread			
Measurement	Tightening torque in Nm for			Measurement	Tightening torque in Nm for		
Screw	8.8	10.9	12.9	Screw	8.8	10.9	12.9
Nut	8	10	12	Nut	8	10	12
M4	2,8	4,1	4,8	M8x1	24	36	43
M5	5,5	8,1	9,5	M9x1	36	53	62
M6	9,5	14	16,5	M10x1	52	76	89
M7	15	23	28	M10x1,25	49	72	84
M8	23	34	40	M12x1,25	87	125	150
M10	46	68	79	M12x1,5	83	120	145
M12	79	115	135	M14x1,5	135	200	235
M14	125	185	215	M16x1,5	205	300	360
M16	195	280	330	M18x1,5	310	440	520
M18	280	390	460	M18x2	290	420	490
M20	390	560	650	M20x1,5	430	620	720
M22	530	750	880	M22x1,5	580	820	960
M24	670	960	1100	M24x1,5	760	1100	1250
M27	1000	1400	1650	M24x2	730	1050	1200
M30	1350	1900	2250	M27x1,5	1100	1600	1850
				M27x2	1050	1500	1800
				M30x1,5	1550	2200	2550
				M30x2	1500	2100	2500

Status: August 1991

Tightening torques for hex head screws according to EN ISO 10644 and DIN EN 1665**CAUTION**

Depending on the screw design, different tightening torques for hex head screws are required:

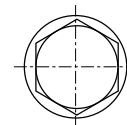
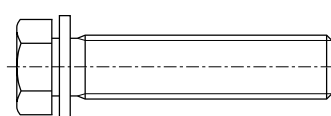
Screw with washer assembly according to EN ISO 10644

(hex head screw with washer)

M 8 = Tightening torque: **23 Nm**

M 10 = Tightening torque: **46 Nm**

M 12 = Tightening torque: **79 Nm**



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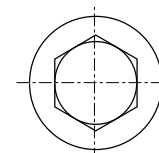
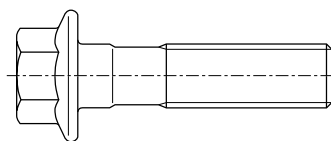
Flange-head screw according to DIN EN 1665

(hex head screw without washer)

M 8 = Tightening torque: **29 Nm**

M 10 = Tightening torque: **60 Nm**

M 12 = Tightening torque: **99 Nm**



033380

Designation ZF item number	Name	Quantity approx.	Application	Comment
Grease 0750 199 001	For example Spectron FO 20		Assembly aid, general	
Grease 0671 190 016	Techn. Vaseline 8420		Assembly aid, general	
Operating oil	Refer to TE-ML 20 List of Lubricants		Assembly aid, general	

NOTE: Inquire as to size of containers before ordering!

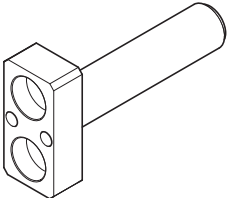
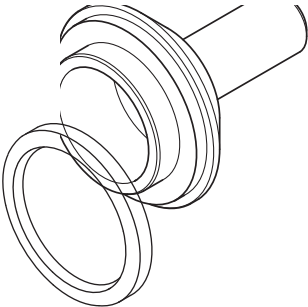
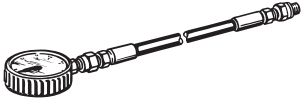
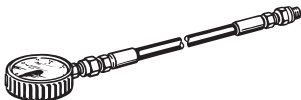
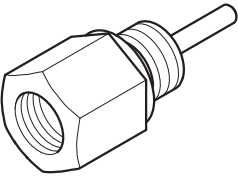
Image no.	Figure	Order no.	Application	Quantity	Comment
1		1X56 137 452 Adapter for safety plate at output flange		1	
2		1X56 138 625 Adapter for shaft sealing ring, output 1X56 138 590 Washer for the second position of shaft sealing ring, output		1 1	
3		1P01 136 670 Test gage 0 – 25 bar with connection socket M10x1		1	
4		1P01 137 856 Test gage 0 – 10 bar with connection socket M10x1		1	
5		1P82 139 839 Adapter for EcoLife test gage To be used at pressure measuring points PD8, PD6, A8, PHD, PVF		1	Refer to Chapter 2.7 Pressure test

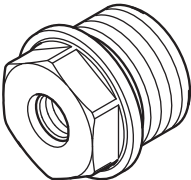
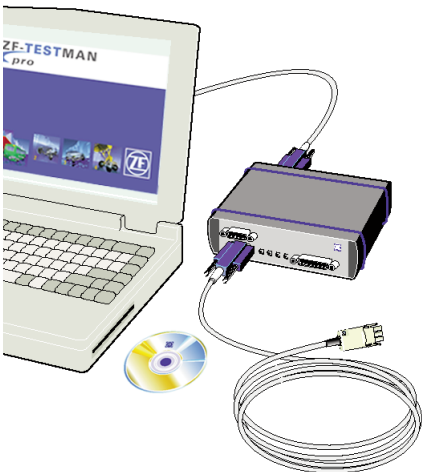
Image no.	Figure	Order no.	Application	Quantity	Comment
6		4181 302 009 Screw plug (without valve) for EcoLife test gage in combination with adapter 1P82 139 839 To be used at measuring connection Main pressure – PHD (2) and pressure upstream of filter – PVF (3)		1	Refer to Chapter 2.7 Pressure test
7		6008 006 002 68-pin terminal tester for troubleshooting in electrical part		1	
8		6008 208 550 Diagnostic system ZF-TESTMAN Service Edition (full version, only for ZF Service) Complete system without PC This includes: ZF-TESTMAN software 6008 208 500 on DVD The diagnostic tool 6008 208 100 comprises various connection cables including the DPA 05 diagnostic adapter		1	System requirements: - WIN. XP SP2 - WIN. Vista (32 & 64 Bit) - WIN. 7 (32 & 64 Bit) - WIN. 8 - IE 5.01 < - WIN. Installer 3.0 <
9		6008 208 500 Software ZF-TESTMAN Service Edition (full version, only for ZF Service) on DVD		1	

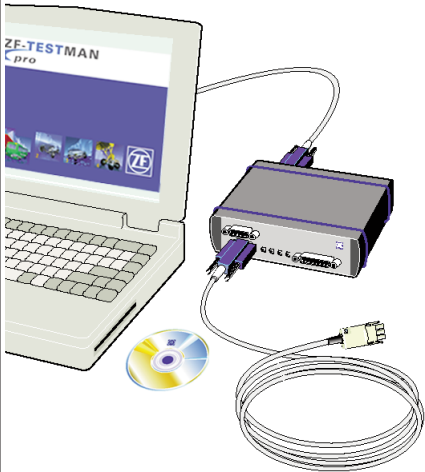
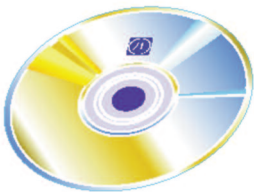
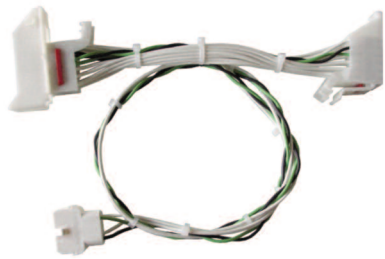
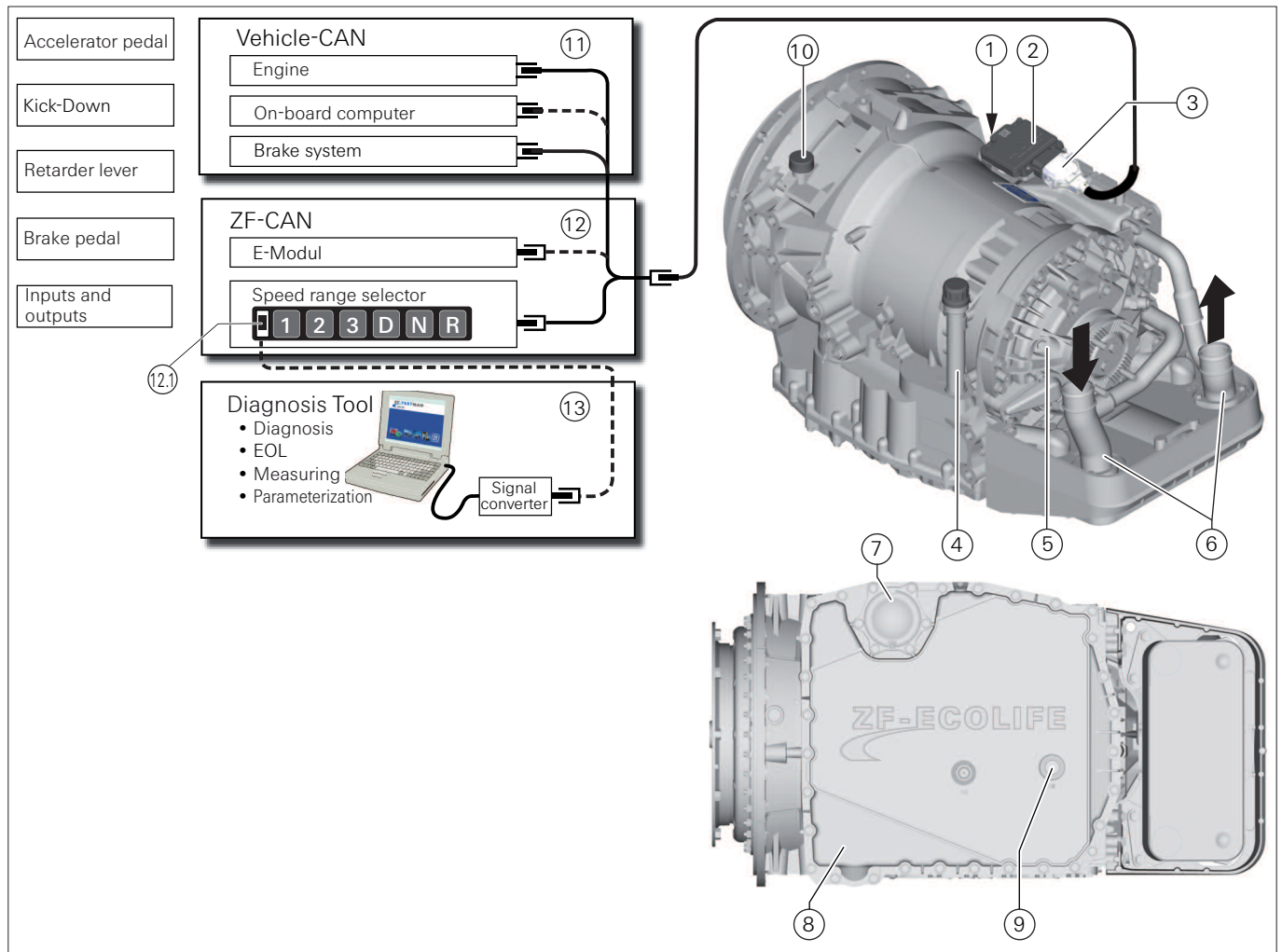
Image no.	Figure	Order no.	Application	Quantity	Comment
10		6008 208 450 Diagnostic system ZF-TESTMAN IAM Edition (customer version) Complete system without PC This includes: ZF-TESTMAN software 6008 208 400 on DVD The diagnostic tool 6008 208 100 comprises various connection cables including the DPA 05 diagnostic adapter		1	System requirements: - WIN. XP SP2 - WIN. Vista (32 & 64 Bit) - WIN. 7 (32 & 64 Bit) - WIN. 8 - IE 5.01 < - WIN. Installer 3.0 <
11		6008 208 400 Software ZF-TESTMAN IAM Edition (customer version) on DVD		1	
12		6008 206 038 Adapter cable between transmission control unit and terminal tester		1	
13		6008 206 039 Adapter cable between transmission connector and terminal tester		1	

Image no.	Figure	Order no.	Application	Quantity	Comment
14		6008 206 040 Adapter kit contains 6008 206 038 and 6008 206 039		1	
15		6008 206 042 T adapter between transmission control unit and vehicle-side connector with CAN2 interface and power supply		1	
16		6008 207 038 TMA table mode adapter for table mode-based programming of electronics		1	
17		6008 207 043 Adapter Diagnostic connection for ZF speed range selector		1	
18		6008 207 048 Adapter MAN diagnostic connection		1	

Classification of peripheral equipment



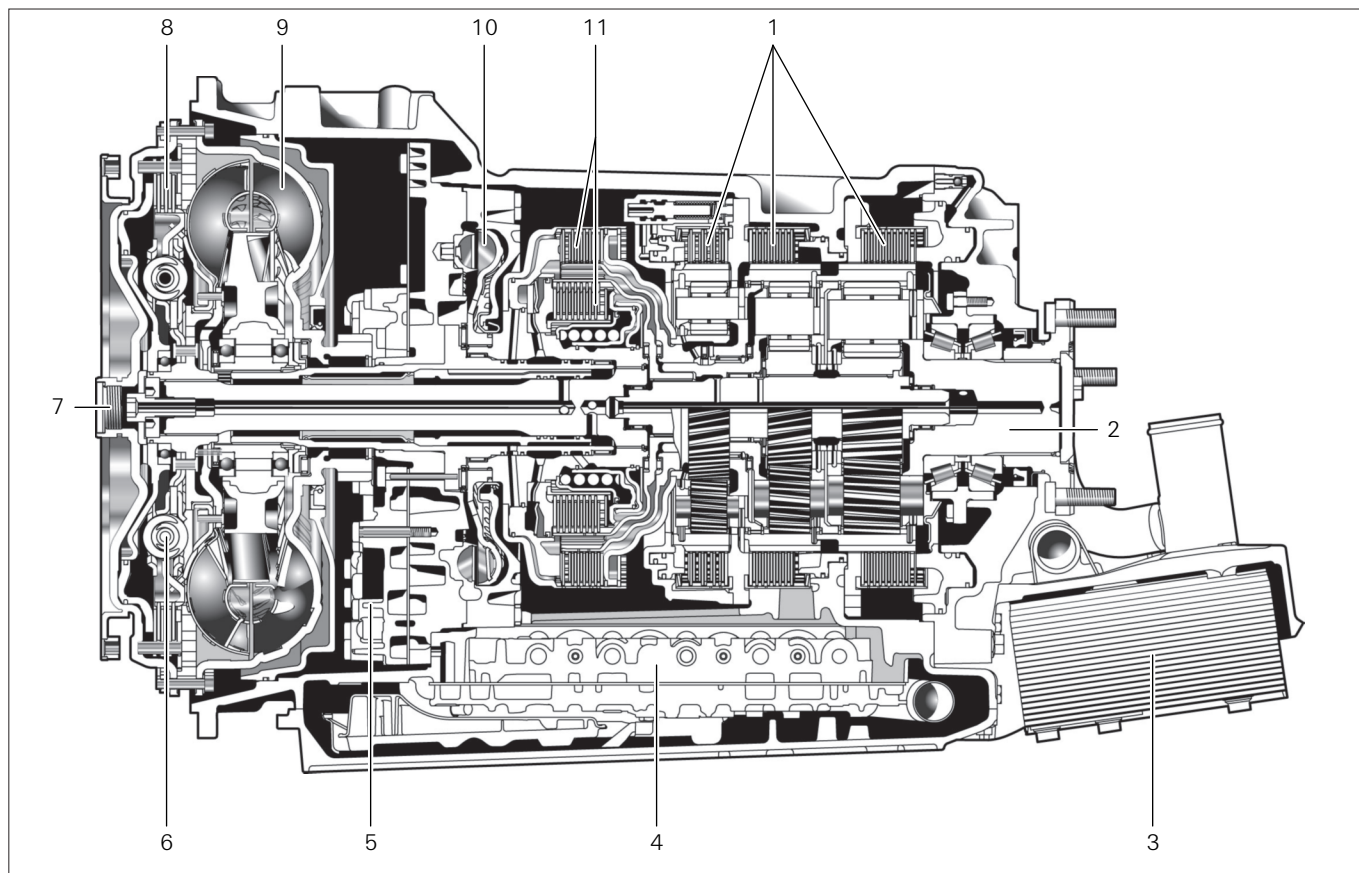
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- 1 Cable connection between electronic control unit and transmission
- 2 Electronic control unit
- 3 Electronic control unit's connector
- 4 Oil filler tube with dipstick
- 5 Impulse sensor for speedometer (optional at 10 o'clock/2 o'clock)
- 6 Cooling water connections
- 7 Pressure filter
- 8 Oil pan
- 9 Oil drain plug
- 10 Breather
- 11 Vehicle CAN
 - Engine/on-board computer/brake system
 - Accelerator pedal
 - Kickdown, retarder lever, step plate

- 12 ZF-CAN
 - E module 2 (optional)
 - Inputs
 - Kickdown, retarder lever, step plate
 - Outputs
 - Speed range selector (pushbutton range selector)
 - Inputs
 - Kickdown, retarder lever, step plate
 - Outputs
 - ZF diagnostic access (12.1)

- 13 Diagnostic tool, ZF-Testman
 - Diagnosis
 - EOL
 - Measurement
 - Parameterization

6 AP 1000 B, 6 AP 1200 B, 6 AP 1400 B, 6 AP 1700 B and 6 AP 2000 B



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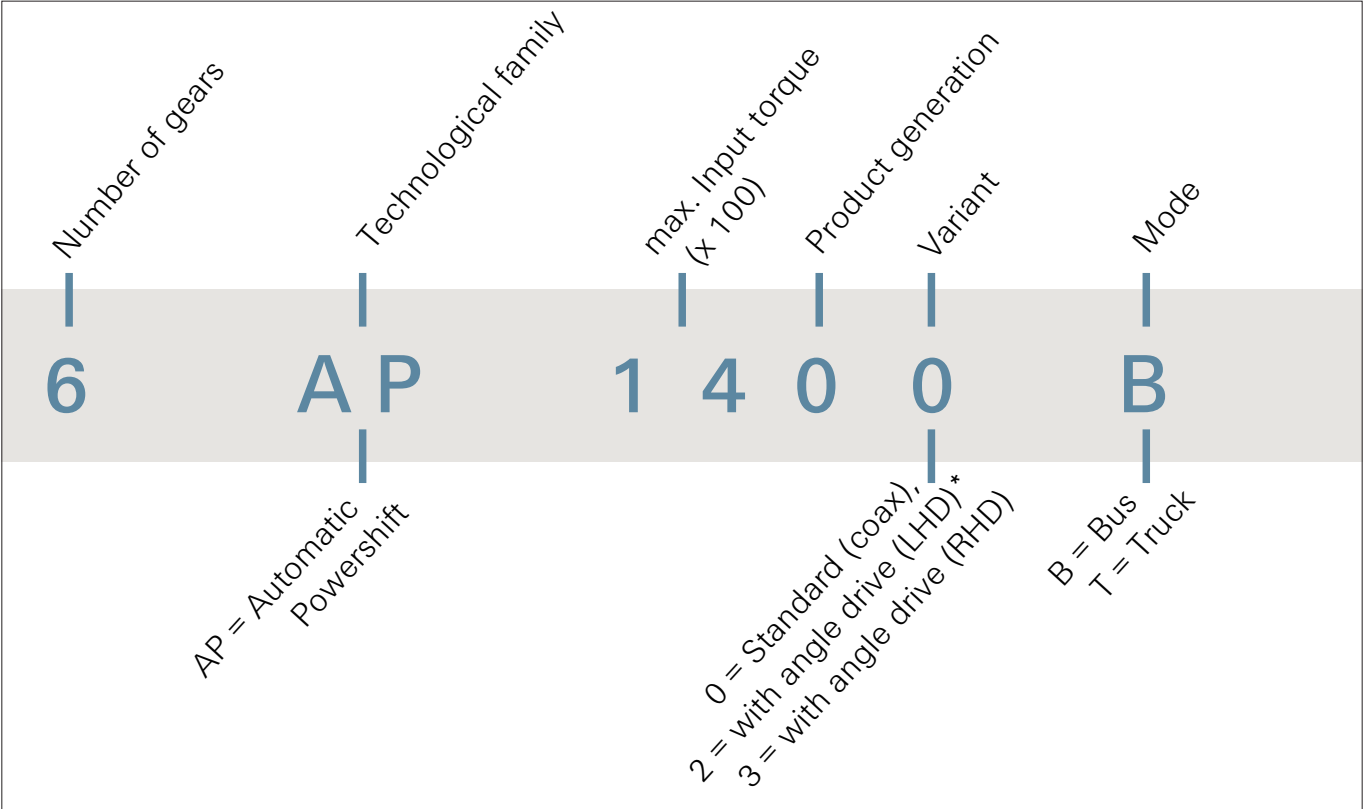
Key to drawing

- | | |
|--------------------------------|---|
| 1 Brakes D, E, F | 6 Torsional vibration damper |
| 2 Output | 7 Input |
| 3 Retarder oil cooler (ROC) | 8 Torque converter lock-up clutch (LuC) |
| 4 Hydraulic shift control unit | 9 Torque converter |
| 5 Oil pump | 10 Retarder |
| | 11 Clutches A, B |

ZF-EcoLife - Product designation

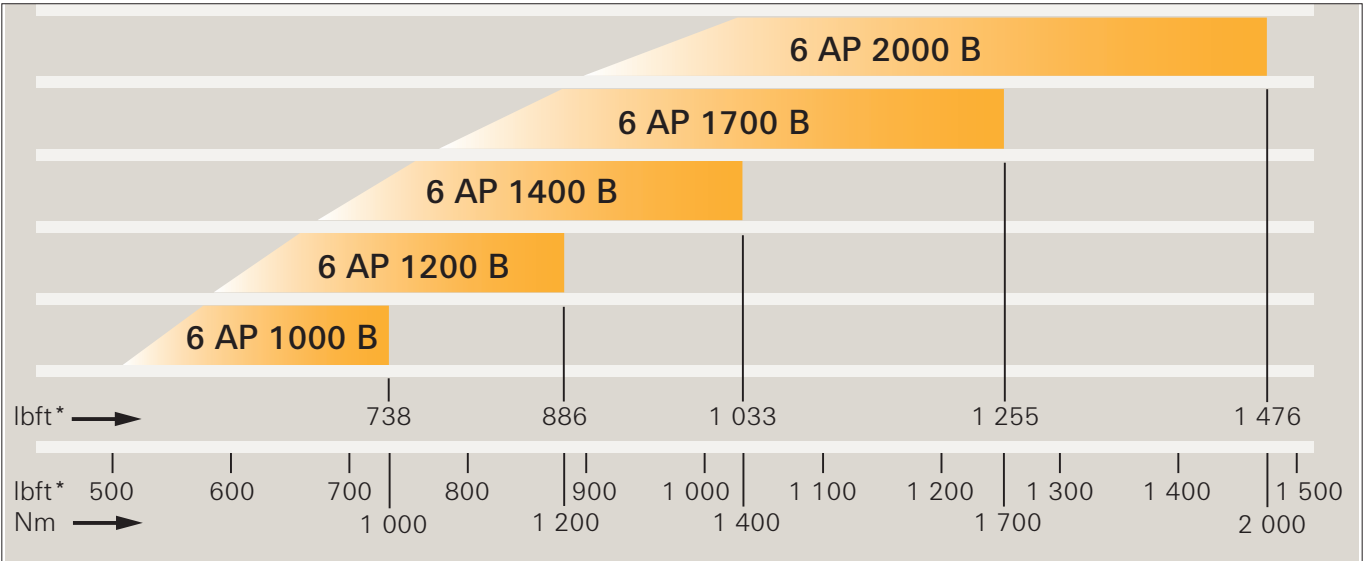
The entire ZF-EcoLife transmission family at a glance.

The new nomenclature: Clear and standardized for all ZF model ranges.



033293_1

Transmission types



* 1 Nm $\cong$ 0,738 lbft

033292

The installation conditions and connection points of all transmission types are identical.

Shift element combinations

The table shows the shift element combinations depending on the gears engaged and the ratios activated.

Clutch/brake combinations/ratios											
Gear	A	B	D	E	F	6 AP xx00 B			6 AP xx02 B; 6 AP xx03 B		
						i Gear	φ	φ total	i Gear	φ	φ total
1.	●				●	3.364		5.469	3.265		5.469
							1.762			1.762	
2.	●			●		1.909			1.853		
							1.343			1.343	
3.	●		●			1.421			1.380		
							1.421			1.421	
4.	●	●				1.000			0.971		
							1.389			1.389	
5.		●	●			0.720			0.699		
							1.171			1.171	
6.		●		●		0.615			0.597		
AIS 1.					●						
R			●		●	4.235			4.112		
AIS 2. ¹⁾				●							
AIS R ¹⁾					●						

1) AIS special versions

Permissible transmission input speeds*

Transmission type			6 AP 1000 B 6 AP 1200 B 6 AP 1400 B	6 AP 1700 B 6 AP 2000 B	6 AP xx02 B 6 AP xx03 B ²⁾
Speeds					
Minimum idling speed	$n_{\min}$	[rpm]	400	400	400
Maximum input speed	$n_{\max}$	[rpm]	2800 (1st to 5th gear)	2600 (1st to 5th gear)	2400 (1st to 5th gear)
			2100 (6th gear)	2100 (6th gear)	2100 (6th gear)

2) For increased input speeds at reduced input torques, refer to the technical manual 4181 765 101, Chapter 2.4.2.

* For latest data, reference the technical manual 4181 765 101, Chapter 2.4.2

1 Maintenance

1.1 Oil change intervals

NOTE

The pressure filter must be replaced at each oil change.
Only genuine ZF oil filters may be used.

Transmission oil change

Oil-change interval

List of Lubricants TE-ML 20

- Vehicle classification TE-ML 20.100, lubricant class 20C	every 120 000 km mileage/km or every 2 years ¹⁾
- Vehicle classification TE-ML 20.100, lubricant class 20E / 20F	every 240 000 km mileage/km or every 3 years ¹⁾
- Vehicle classification TE-ML 20.105, lubricant class 20E / 20F	every 180 000 km mileage/km or every 3 years ¹⁾
- Vehicle classification TE-ML 20.110, lubricant class 20F	every 120 000 km mileage/km or every 3 years ¹⁾

¹⁾ Depending on what occurs first.

1.2 Oil quantities

- | | |
|---|-------------------|
| • For oil change with standard oil drain
(draining time approx. 10 min.) | approx. 24 liters |
| • For oil change with VRM special oil drain system | approx. 17 litres |
| • For initial filling of the empty transmission | |
| - 6 AP 1000 B / 1200 B / 1400 B | approx. 38 liters |
| - 6 AP 1700 B / 2000 B | approx. 42 liters |
| - 6 AP 100x B / 120x B / 6 AP 140x B / 170x B | approx. 43 liters |

NOTE

These values are reference values! The oil quantity after the oil level check at operating temperature (90 °C) is definitive.

1.3 Oil grade

- The data in the ZF List of Lubricants TE-ML 20 are binding

Only oil of the 20C/20E/20F lubricant class may be used for filling of EcoLife transmissions.

The current List of Lubricants can be obtained directly from ZF or via the Internet at <http://www.zf.com>.

1.4 Oil level check

CAUTION

It is absolutely necessary to maintain the correct oil level:

- Insufficient oil quantities lead to malfunctions and damage of the transmission
- Excessive oil quantities lead to overheating of the transmission

DANGER

Insufficient oil quantities lead to partial or complete failure of the retarder, i.e. results in reduced braking effect or no braking effect at all.

The following general rules apply:

- Transmission delivered with status 'not oil-filled' must be filled with the specified oil volumes prior to initial operation.
- In order to ensure minimum oil volumes for initial operation or after an oil fill (e.g. oil change, repair), an initial check is to be conducted with cold transmission oil, refer to Chapter 1.4.1.
- The relevant oil level check is to be conducted at operating temperature (90 °C), also refer to Chapter 1.4.2.
- For options to heat up transmission oil, refer to Chapter 1.4.4.
- Oil level check at least quarterly
- Regular visual inspection of the transmission for signs of leakage

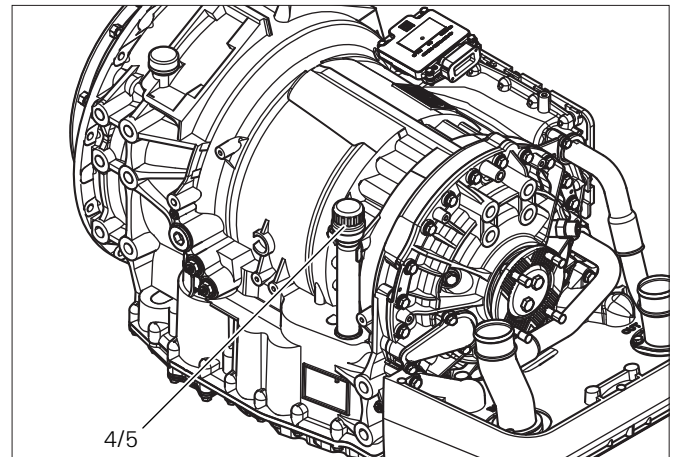


Fig. 1.1 Coaxial transmission

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- 4 Oil filler tube
- 5 Oil dipstick

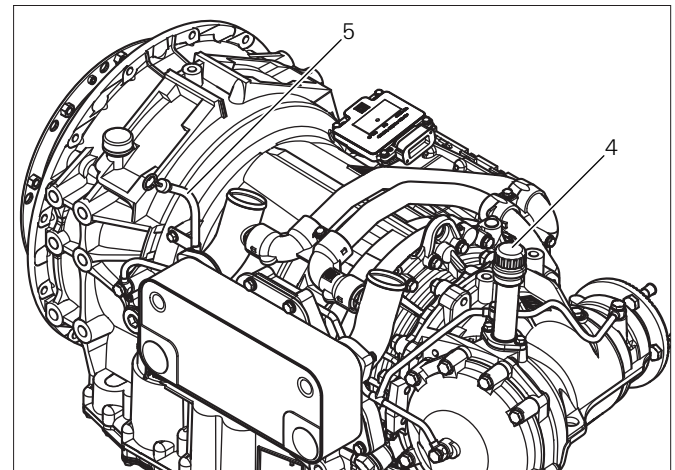


Fig. 1.2 Transmissions with angle drive of 80°, RHD

035560_1

- 4 Oil filler tube
- 5 Oil dipstick

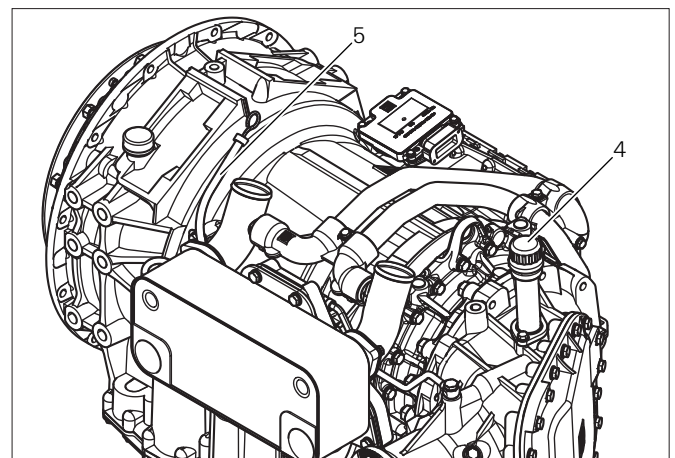


Fig. 1.3 Transmissions with angle drive of 80°, LHD

035561_1

- 4 Oil filler tube
- 5 Oil dipstick

1.4.1 Initial check of the oil level in order to ensure a minimum oil quantity

NOTE

For commissioning or after an oil filling (e.g. oil change, repair), an initial check of the oil level has to be conducted after engine start to ensure the minimum oil quantity.

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

- Vehicle is parked on level ground
- Shift speed range selector (pushbutton range selector) to "Neutral"
- Let engine run at 1 200 – 1 500 rpm for 15 to 20 seconds
- 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 level must be within "30 °C (cold)" range

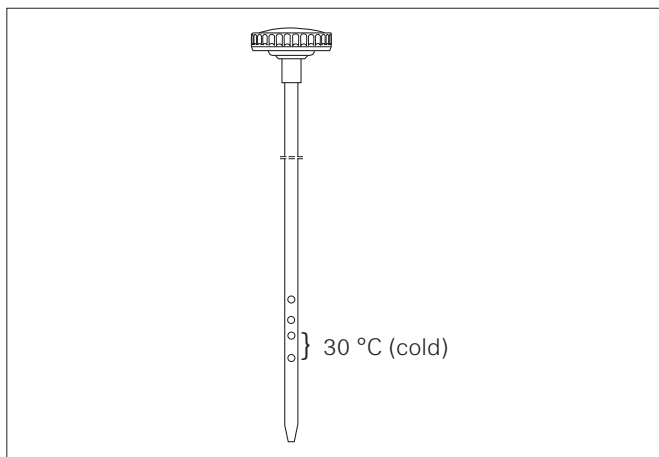


Fig. 1.4 Oil level in the "30 °C (cold)" range

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1.4.2 Check at operating temperature

Oil level check when transmission oil is hot (90 °C):

- Vehicle is parked on level ground
- Shift speed range selector (pushbutton range selector) to "Neutral"
- Let engine run at 1 200 – 1 500 rpm for 15 to 20 seconds
- 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 within "90 °C (hot)" range

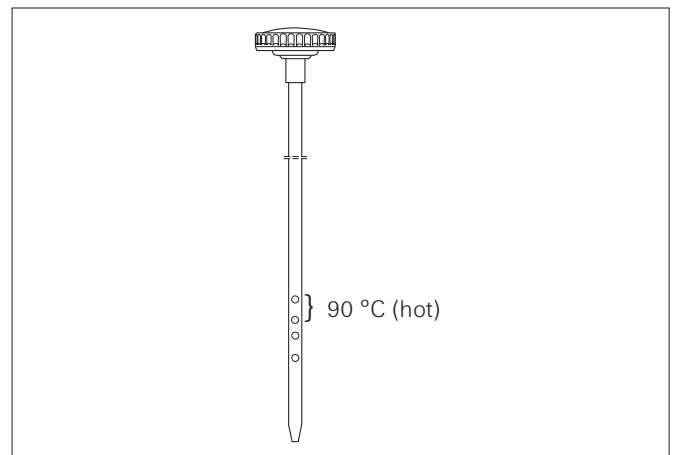


Fig. 1.5 Oil level in the "90 °C (hot)" range

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1.4.3 Electric oil level check

The Technical Customer Information "Electric Oil Level Sensor EcoLife, 4181 761 022" is obligatory.

1.4.4 Option for heating up transmission oil

The transmission oil can be heated up to the specified operating temperature for oil level check purposes by normal driving operation with retarder cycles until the oil sump temperature reaches 90 °C.

CAUTION

Max. permissible continuous oil temperature in oil sump is 120 °C and must not be exceeded.

When the operating temperature is reached carry out **"Check at Operating Temperature"** (Chapter 1.4.2).

1.5 Variant 1 – Oil change with standard oil drain

1.5.1 Oil drain



DANGER

Risk of burns!

Contact with hot transmission or hot transmission oil may result in burns.

Wear suitable protective clothing, protective gloves, and safety goggles/face protection.



DANGER

Environmental hazard!

When draining oil, oil can get into the environment!

Collect oil in a sufficiently large container and dispose of it in accordance with the regulations of the environmental protection laws.

NOTE

Drain oil only at operating temperature and at least for 10 minutes:

- Engine standstill
- Unscrew oil drain plug **(1)** and drain oil
- Change filters according to Chapter 2.1

NOTE

Pressure filter must be replaced when oil is changed.

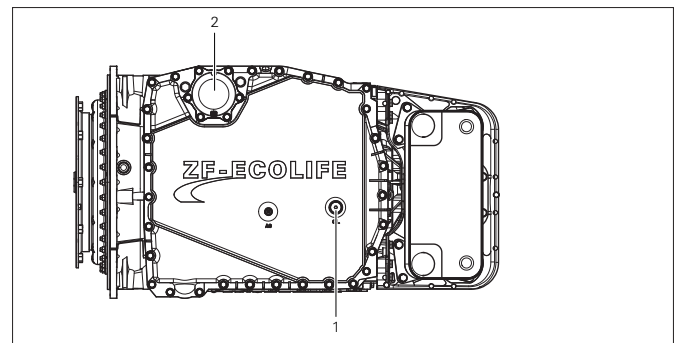


Fig. 1.6 Coaxial transmission with standard oil drain

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ZF angle drive 80° RHD / LHD

The angle drive does not have its own oil drain plug. Drain oil via main transmission's oil drain plug according to Chapter 1.5.

1.5.2 Oil fill

CAUTION

Always use genuine ZF oil drain plugs.
The torque converter drain valve is operated via the oil drain plug.

- Screw in oil drain plug **(1)** with new O-ring (refer to Fig. 1.6).
Tightening torque: **35 Nm**
- Fill in oil at oil filler tube **(4)** according to Chapter 1.2
- Check oil level at oil dipstick **(5)**; refer to Chapter 1.4
- For oil grade, see Chapter 1.3

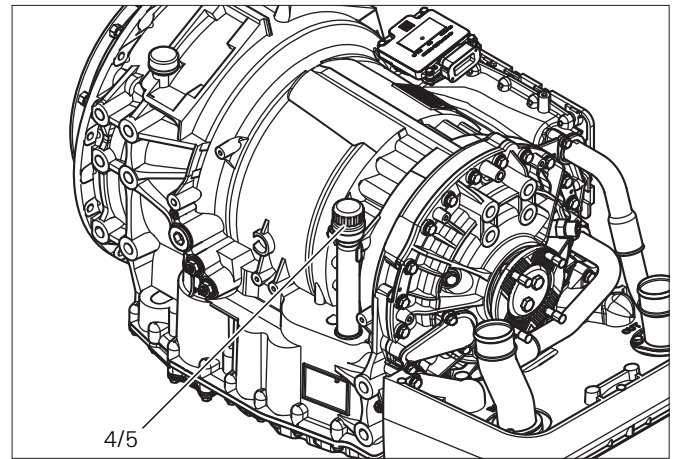


Fig. 1.7 Coaxial transmission

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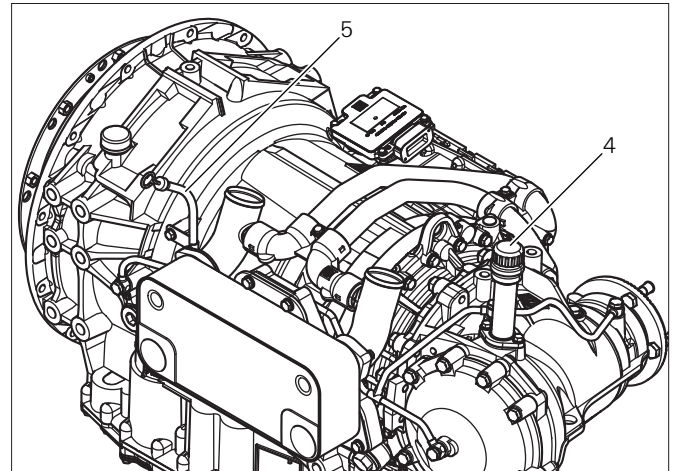


Fig. 1.8 Transmissions with angle drive of 80°, RHD

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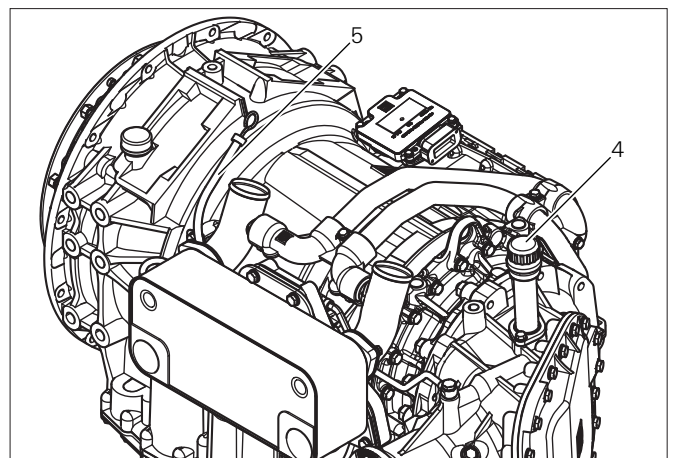


Fig. 1.9 Transmissions with angle drive of 80°, LHD

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1.6 Variant 2 – Oil change with VRM special oil drain

1.6.1 Oil drain



DANGER

Risk of burns!

Contact with hot transmission or hot transmission oil may result in burns.

Wear suitable protective clothing, protective gloves, and safety goggles/face protection.



DANGER

Environmental hazard!

When draining oil, oil can get into the environment!

Collect oil in a sufficiently large container and dispose of it in accordance with the regulations of the environmental protection laws.

NOTE

- Oil drain only at operating temperature.
- No torque converter draining for oil drain with the VRM special oil drain.
- For VRM special oil drain, harmonization and approval from the "Sales and Application" department is required for the specification of the oil and filter change intervals.

- Engine standstill
- Unscrew special screw plug (**6.1** or **6.2**, depending on installation position) and drain oil via quick plug system.
- Change filters according to Chapter 2.1.

NOTE

Pressure filter must be replaced when oil is changed.

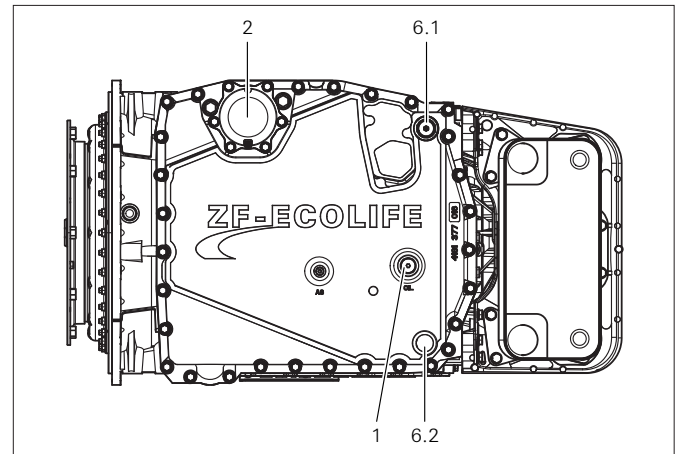


Fig. 1.10 Coaxial transmission with VRM special oil drain

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1.6.2 Oil fill

- Screw in special screw plug (**6.1** or **6.2**, depending on installation position); (refer to Fig. 1.10).
Tightening torque: **10 Nm**
- Fill in oil at oil filler tube (**4**) according to Chapter 1.2 (reference Figs. 1.7 up to 1.9).
- Check oil level at oil dipstick (**5**); refer to Chapter 1.4 (reference Figs. 1.7. up to 1.9).
- For oil grade, see Chapter 1.3.

2 Repair

2.1 Filter change

DANGER

Environmental hazard!

Oil can leak out and contaminate the environment!

Collect oil in a sufficiently large container and dispose of it in accordance with regulation of environmental protection laws.

Dispose of contaminated filters in accordance with regulations of environmental protection laws.

- 1 Switch off engine.

DANGER

Risk of burns!

Contact with hot transmission or hot transmission oil may result in burns.

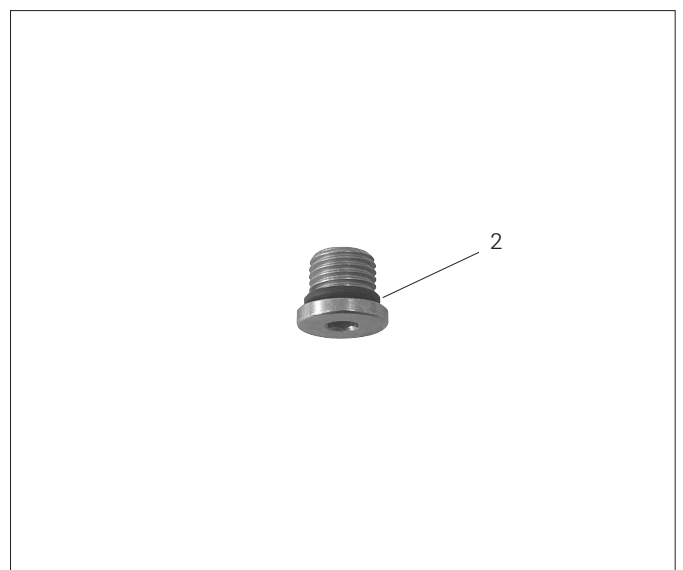
Wear suitable protective clothing, protective gloves, and safety goggles/face protection.

- 2 If available, unscrew screw plug (1) and drain oil from filter chamber. No screw plugs used anymore as of serial number 344696.



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- 3 Remove O-ring (2).



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⚠ DANGER**Risk of burns!****Contact with hot transmission or hot transmission oil may result in burns.****Wear suitable protective clothing, protective gloves, and safety goggles/face protection.**

- 4 Unscrew six hex head screws **(1)** from the filter cover **(2)**.

NOTE

Watch for possibly leaking residual oil when removing the filter cover.

- 5 Remove filter cover **(2)**.
- 6 Remove O-ring **(1)** of filter cover.



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- 7 Take out filter **(1)**.

NOTE

Check filter for contamination.

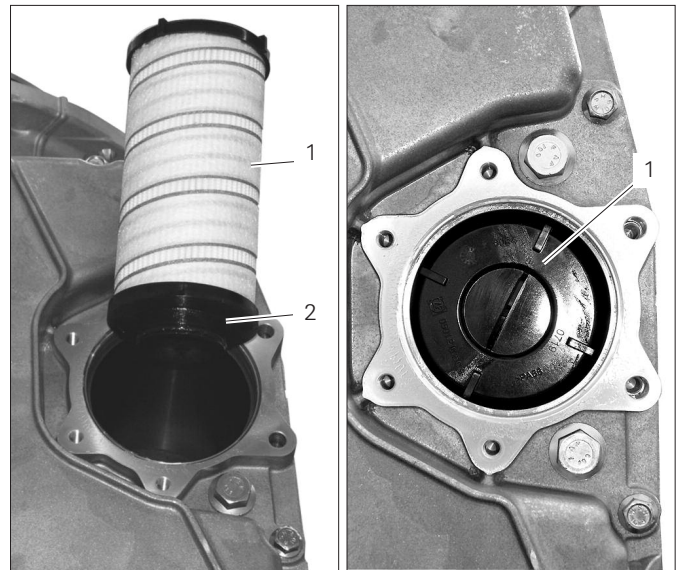


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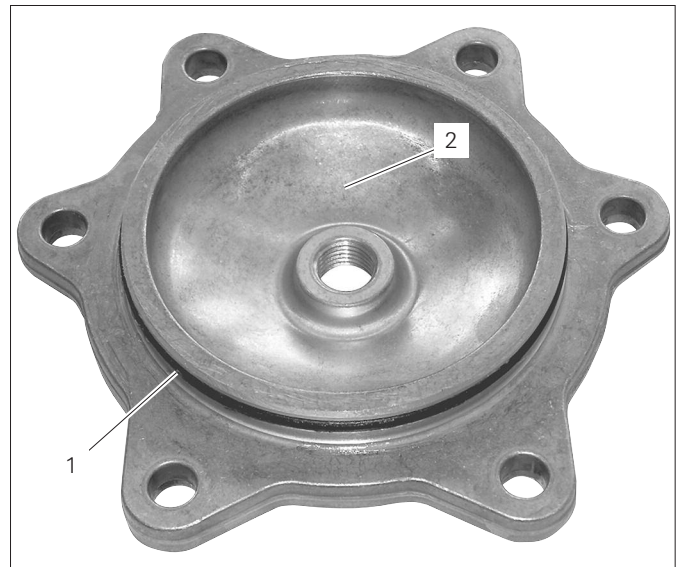
CAUTION

Use new filter. Ensure correct position of O-ring (2) on the filter.

- 8 Coat the O-ring (2) with technical Vaseline and insert new filter (1).

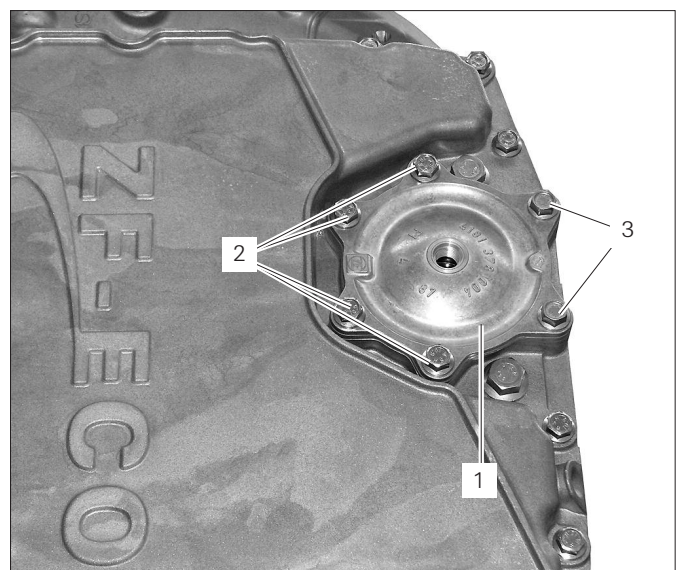


- 9 Coat new O-ring (1) with technical Vaseline.
- 10 Insert O-ring (1) into filter cover (2).



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- 11 Insert filter cover (1).
- 12 Screw in four M8x30 hex head screws (2) and tighten.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**
- 13 Screw in two M8x55 hex head screws (3) and tighten.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**



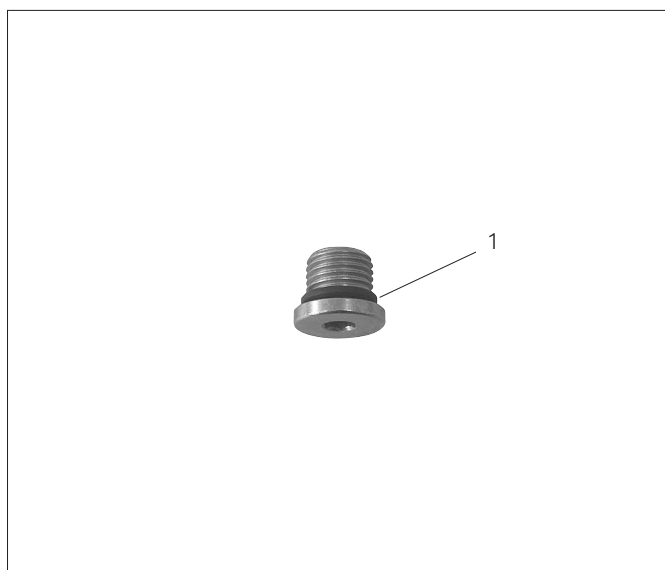
032292

14 Coat new O-ring **(1)** with technical Vaseline.

15 Fit new O-ring **(1)** to screw plug.

NOTE

No screw plugs used anymore as of serial number 344696.



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16 Screw M14x1.5 screw plug **(1)** into filter cover and tighten.

Tightening torque: **25 Nm**

NOTE

No screw plugs used anymore as of serial number 344696.

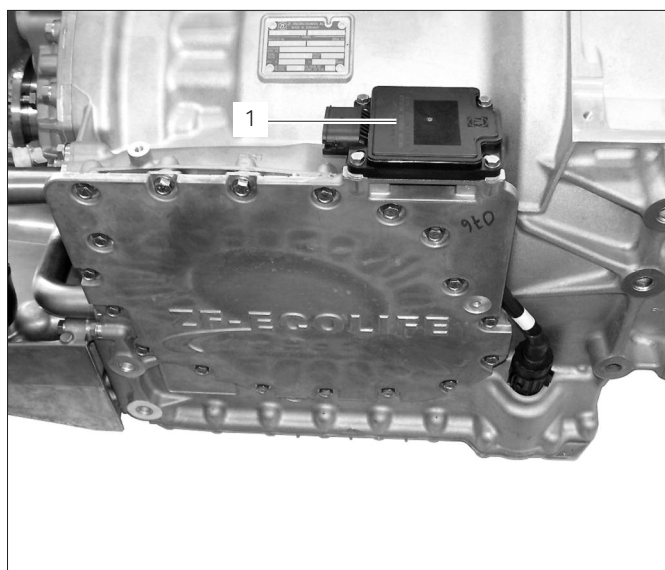


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2.2 Replacing electronic control unit

2.2.1 Removing electronic control unit

- 1 Unscrew the four hexagon screws **(1)** of the electronic control unit.



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- 2 Loosen securing device **(1)** and disconnect the connector.

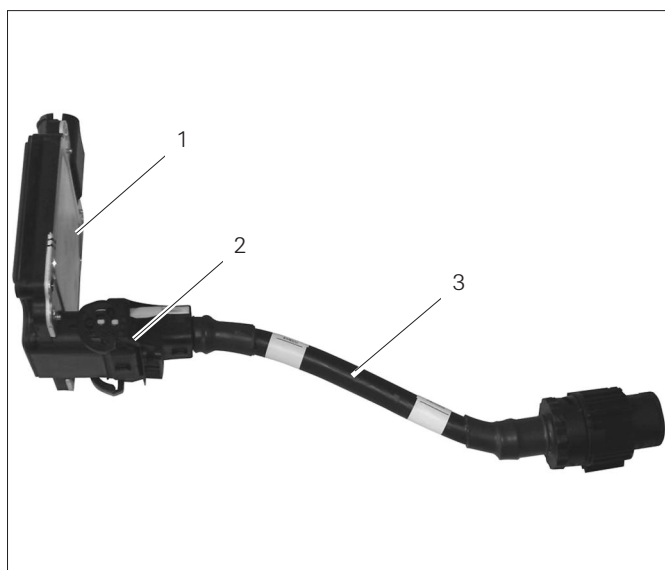
NOTE

The connector comes lose when turning the securing device counterclockwise.



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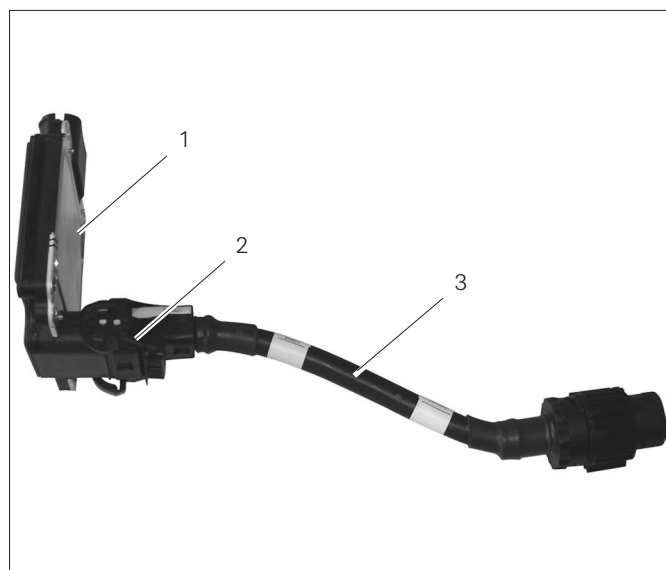
- 3 Take off the electronic control unit **(1)** together with the wiring harness **(3)**.
- 4 Open the connector's **(2)** safeguard and separate the connector **(2)** from the electronic control unit.



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2.2.2 Installing electronic control unit

- 1 Plug wiring harness (3) with connector (2) into the new electronic control unit (1) and close lock (2).

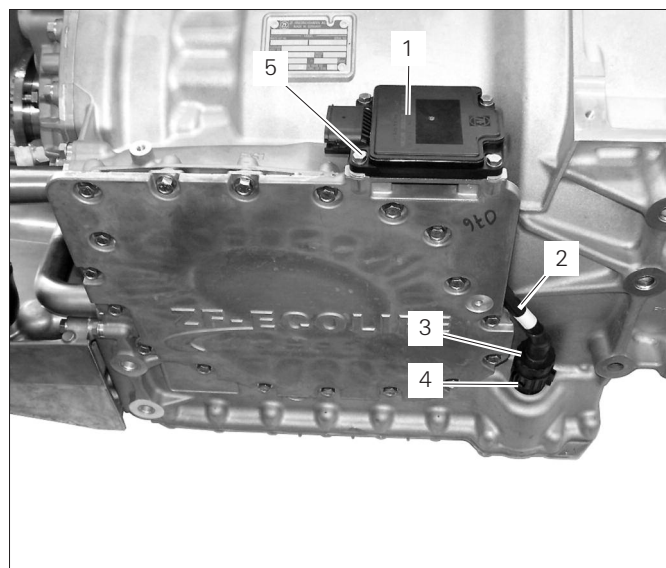


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CAUTION

The contact faces of the electronic control unit and the transmission must be even and clean; otherwise, electronic control unit might be damaged.

- 2 Position electronic control unit (1) with wiring harness (2) on the transmission.
- 3 Insert connector (3).
- 4 Turn in the securing device (4) in clockwise direction and snap it in.
- 5 Screw in four M6x26 hex head screws (5) and tighten.
Tightening torque: **9.5 Nm**



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2.3 Completely replacing the hydraulic shift control unit

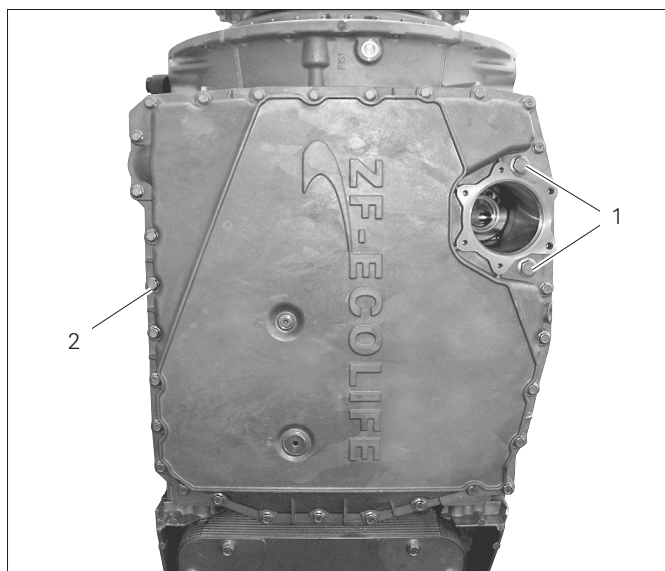
2.3.1 Removing oil pan

- 1 Remove cover (1) and filter according to Chapter 2.1 "Filter change".



032293

- 2 Unscrew two hex head screws (1).
- 3 Unscrew 29 hex head screws (2) from circumference of oil pan.



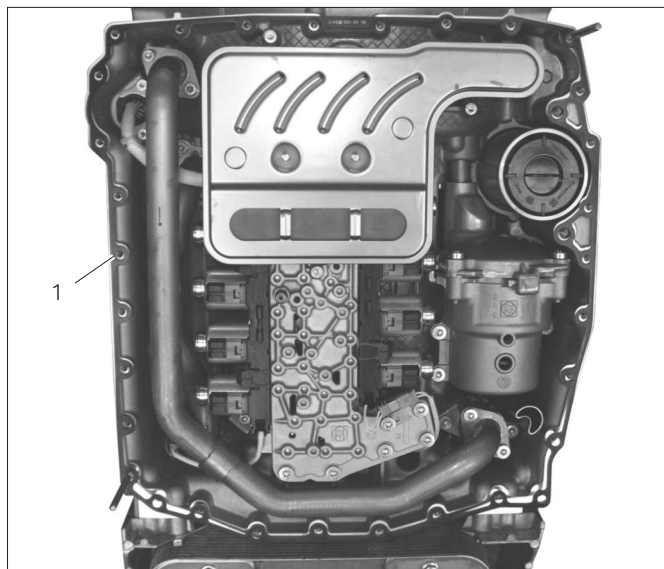
032267

- 4 Remove oil pan (1).



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- 5 Remove gasket **(1)** from oil pan.



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2.3.2 Removing suction filter

- 1 Unscrew three torx screws **(1, 2, 3)** from the suction filter **(4)**.

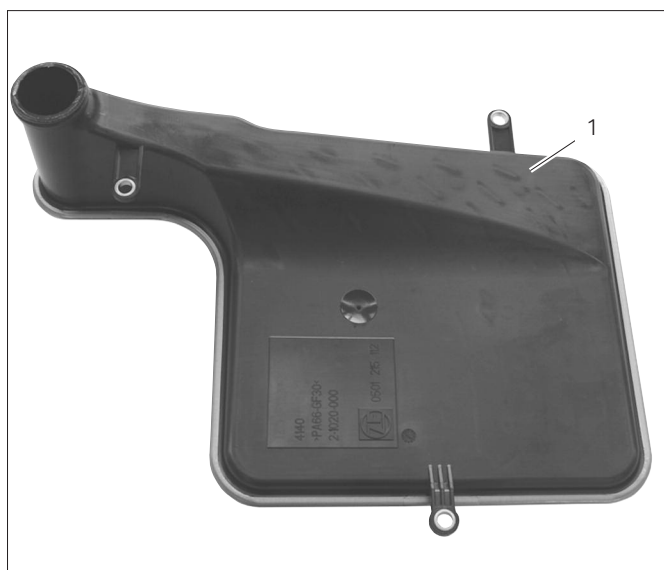
NOTE

If available, remove washer from underneath the torx screw **(3)**. No washers used anymore as of serial number 300214.



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- 2 Remove suction filter **(1)**.



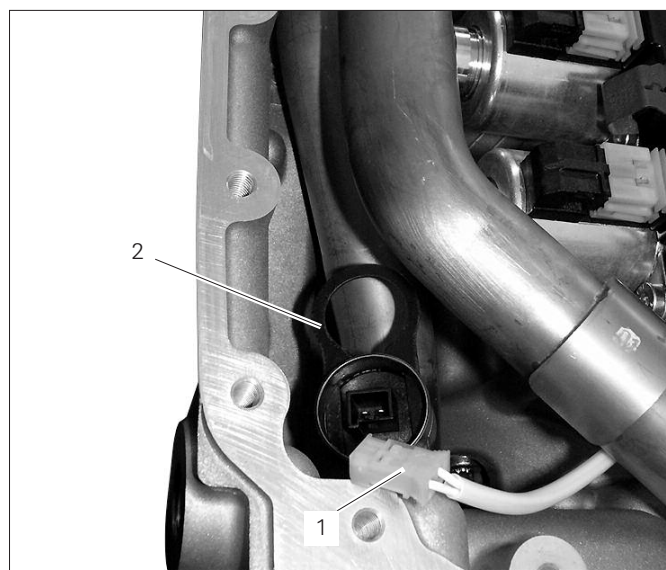
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2.3.3 Removing temperature sensor

CAUTION

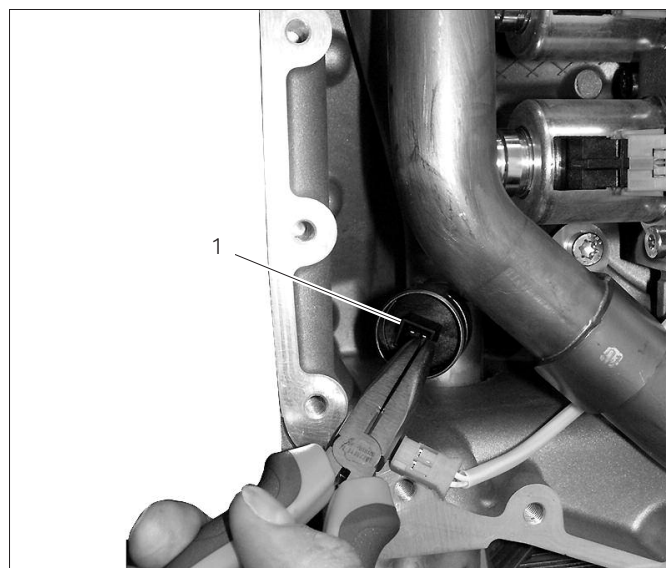
Do not pull on the cable. This could lead to damage of the connector.

- 1 Remove the temperature sensor's connector (1).
- 2 Remove retaining clamp (2).



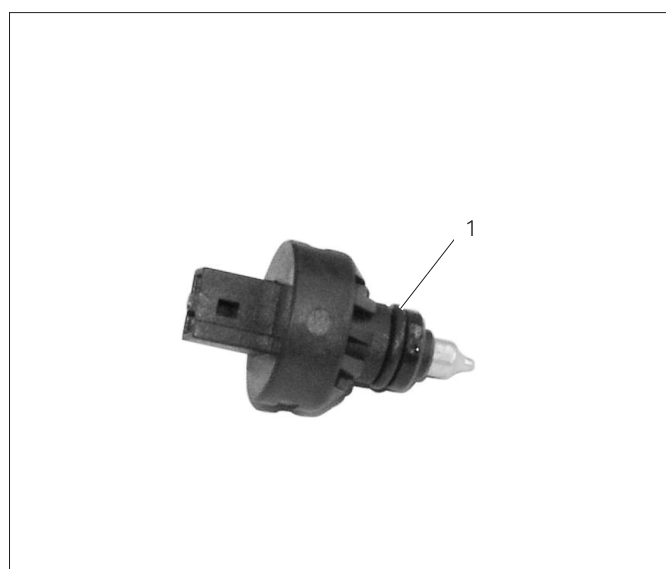
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- 3 Take out the temperature sensor (1).



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- 4 Remove the temperature sensor's O-ring (1).



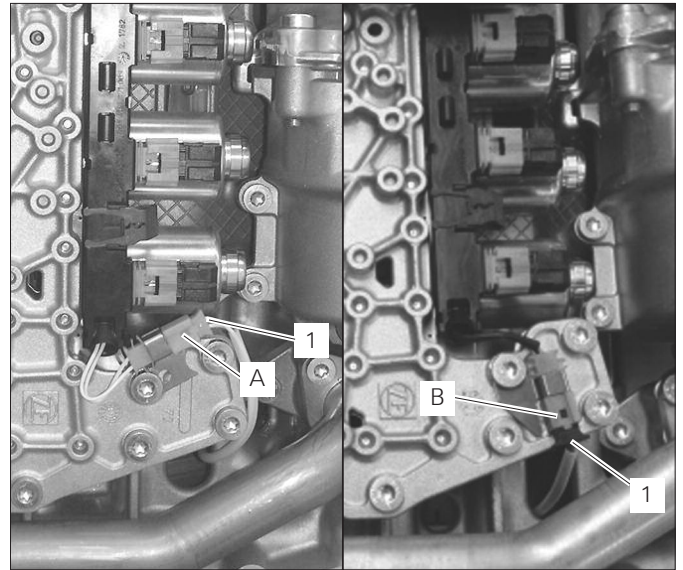
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2.3.4 Removing the hydraulic shift control unit

- 1 Pull out the speed sensor's output connector (1).

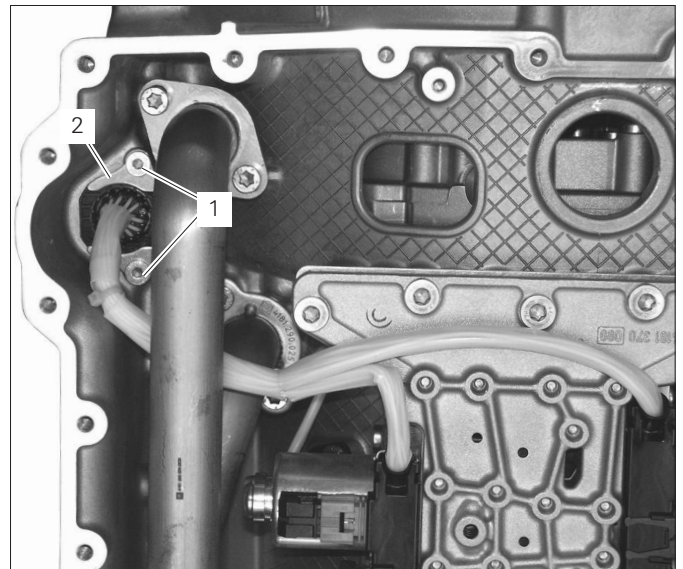
NOTE

Depending on the version, variant **A** or **B** (molded hose) is possible.



032276/035456

- 2 Unscrew two torx screws (1) from transmission connector mounting plate.
- 3 Remove the mounting plate (2).



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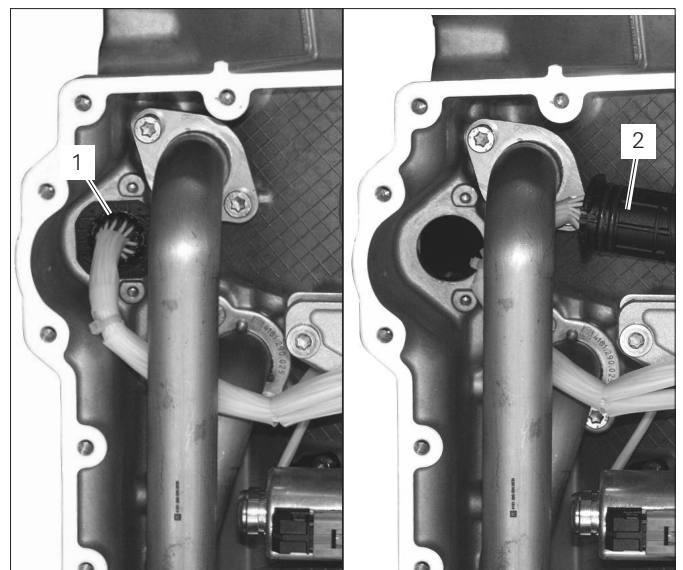
CAUTION

Do not pull on the cable. This could lead to damage of the connector.

- 4 Push out transmission connector (1) from behind.
- 5 Pass through the transmission connector (2) underneath oil pipe.

NOTE

In the case of a sand cast version, the transmission connector is routed through the oil tube.

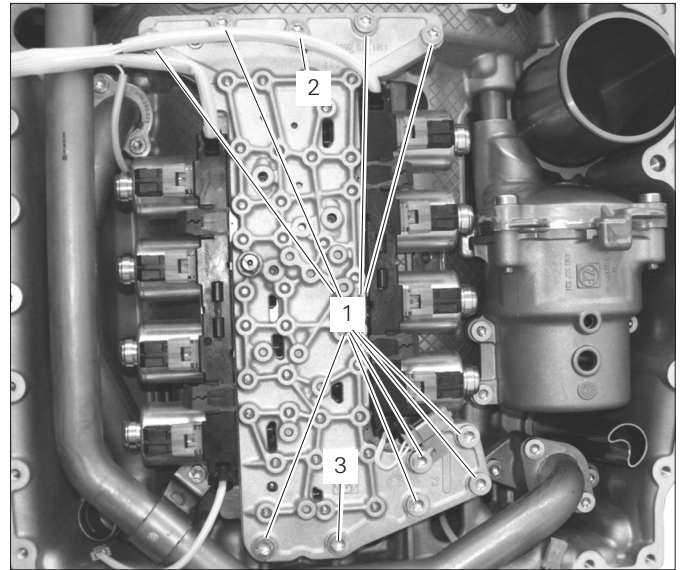


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CAUTION

In the event of overhead work with the transmission still installed, the hydraulic shift control unit must be prevented from falling down by means of two M8x100 auxiliary screws at position 2 and 3 before all torx screws (1) are removed.

- 6 Unscrew all torx screws (1) at the hydraulic shift control unit.



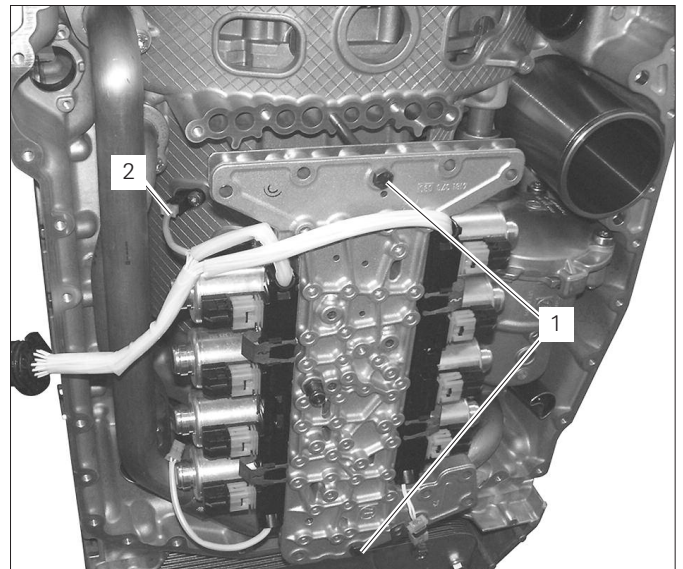
0032281

- 7 Place hydraulic shift control unit on screw heads of M8x100 auxiliary screws (1).

CAUTION

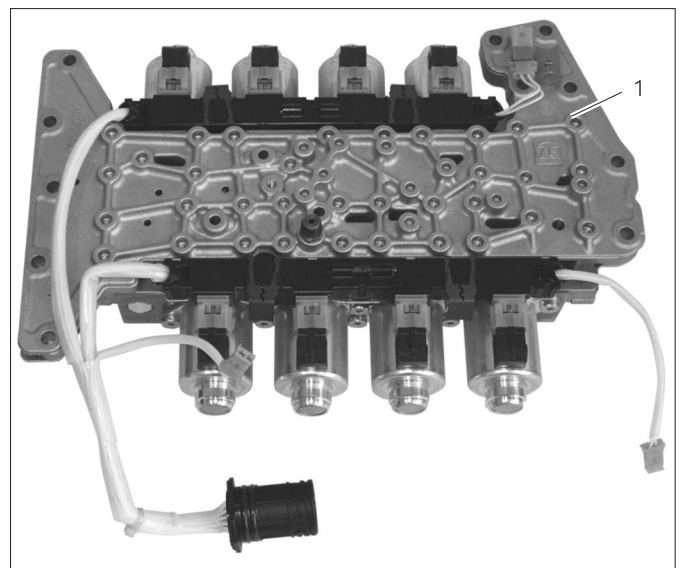
Do not pull on the cable. This could lead to damage of the connector.

- 8 Pull out the speed sensor's turbine connector (2).



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- 9 Unscrew M8x100 auxiliary screws and take out hydraulic shift control unit (1).



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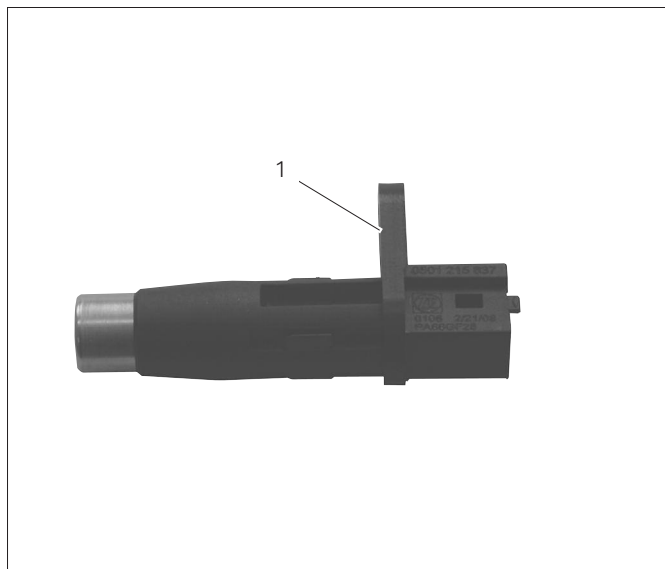
2.3.5 Removing speed sensor, turbine

- 1 Unscrew torx screw (1).



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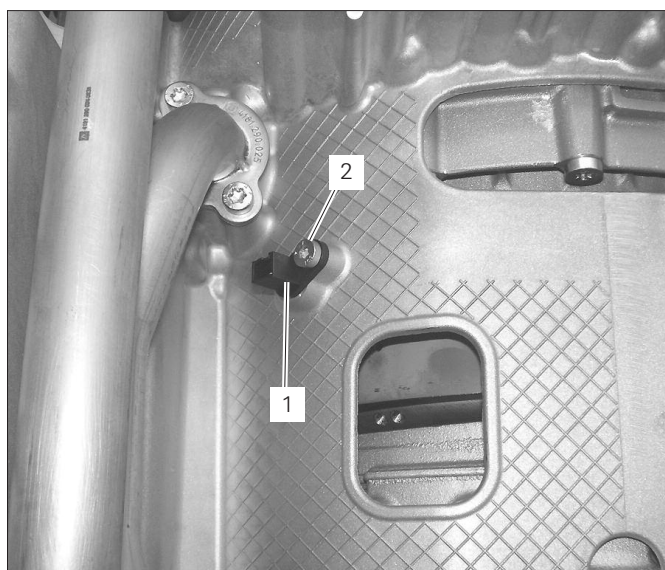
- 2 Take out the speed sensor, turbine (1).



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2.3.6 Installing speed sensor, turbine

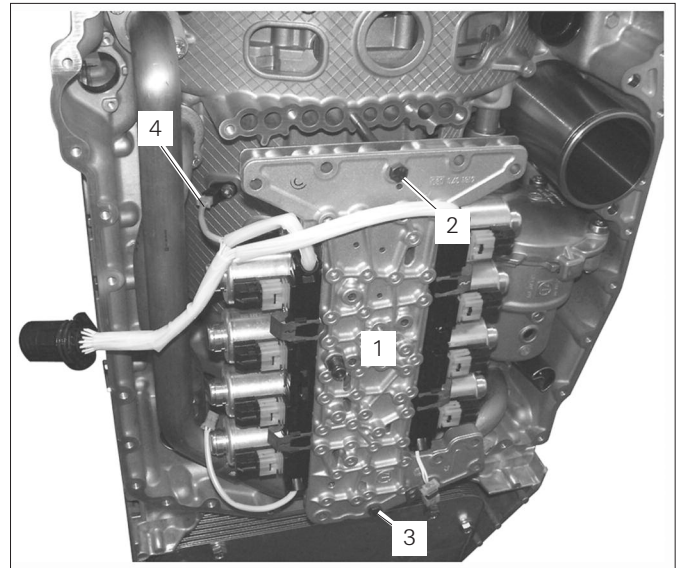
- 1 Insert the speed sensor (1) in the transmission housing.
- 2 Screw in M6x17 torx screw (2) and tighten. Tightening torque: **9.5 Nm**



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2.3.7 Installing the hydraulic shift control unit

- 1 Insert the hydraulic shift control unit **(1)** into the transmission housing and prevent it from falling down by means of two auxiliary screws **(2/3)**.
- 2 Insert the speed sensor's turbine connector **(4)**.

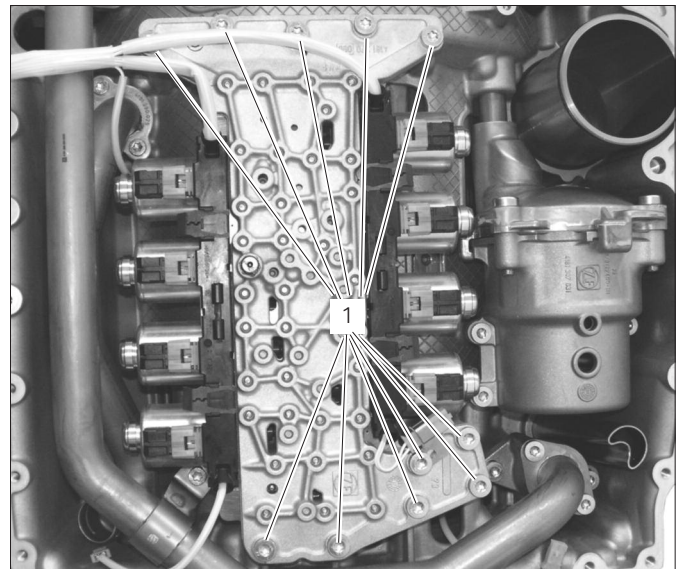


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NOTE

After screwing in first torx screws, auxiliary screws are removed again.

- 3 Screw eleven torx screws **(1)** into the hydraulic shift control unit and tighten. Tightening torque: **20 Nm**



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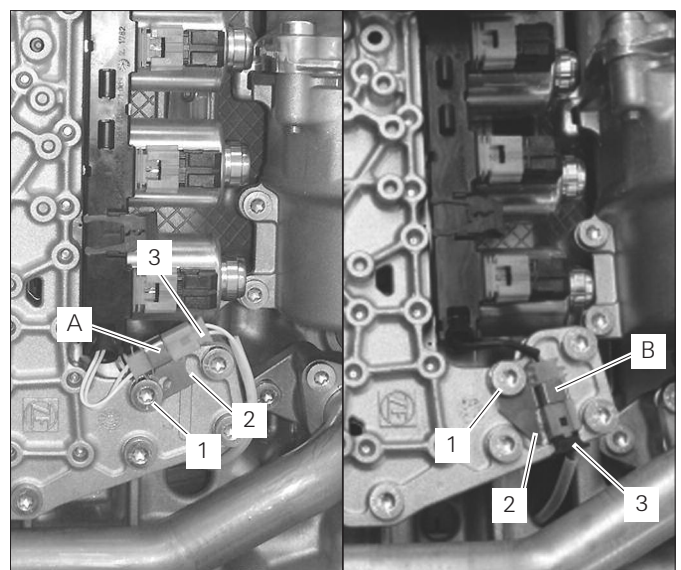
NOTE

When tightening the torx screw **(1)**, make sure position of retaining plate **(2)** (**A** or **B**) is correct.

- 4 Insert the speed sensor's output connector **(3)**.

NOTE

Depending on the version, variant **A** or **B** (molded hose) is possible.



032276/035456

- 5 Fit two new O-rings **(1)** to the transmission connector **(2)**. O-ring part number: 0501 325 589

NOTE

Mind anti-twist protection **(3)** for transmission connector.

- 6 Pass through the wiring harness with transmission connector **(2)** underneath oil pipe.

NOTE

In the case of a sand cast version, the transmission connector is routed through the oil tube.

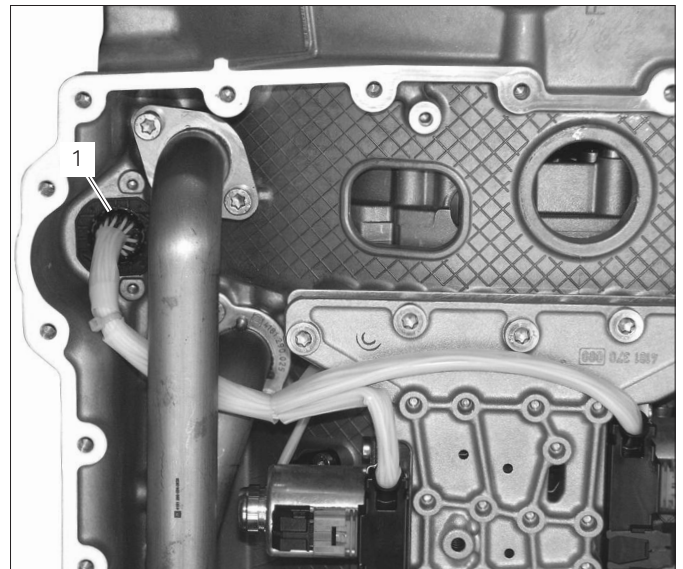


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- 7 Insert transmission connector **(1)**.

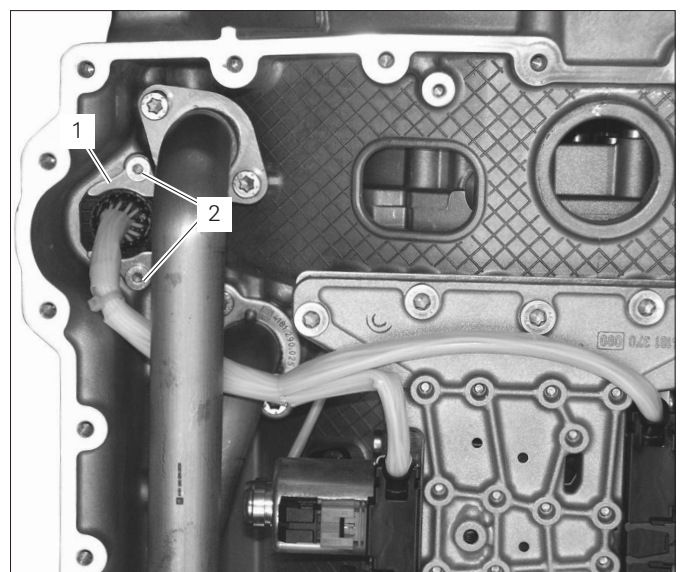
NOTE

Mind anti-twist protection for transmission connector.



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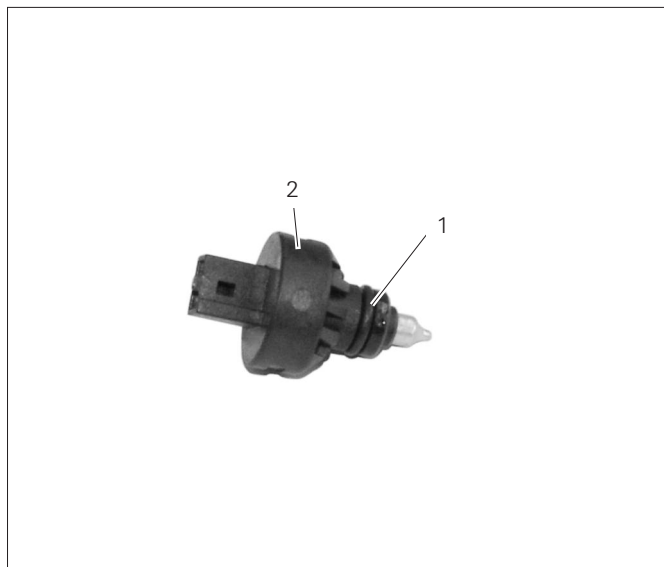
- 8 Put on the mounting plate **(1)**.
- 9 Screw in two M6x17 torx screws **(2)** and tighten.
Tightening torque: **9.5 Nm**



032990

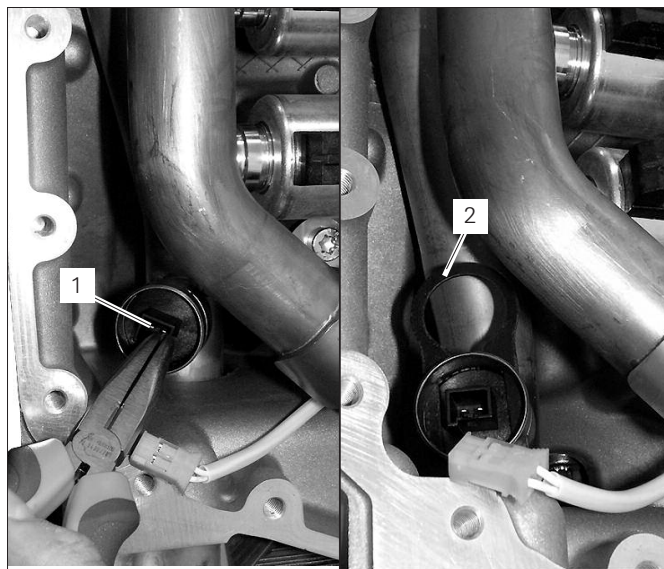
2.3.8 Installing temperature sensor

- 1 Coat new O-ring **(1)** of temperature sensor **(2)** with technical Vaseline.
- 2 Mount O-ring **(1)** on temperature sensor **(2)**.



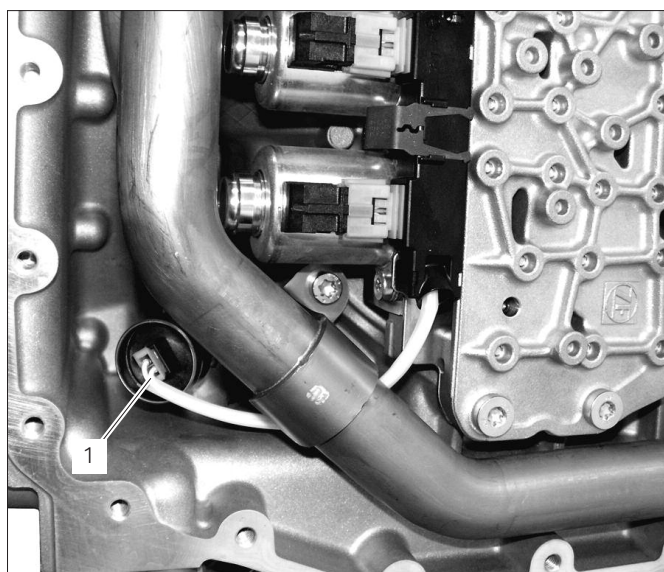
024198

- 3 Insert the temperature sensor **(1)**.
- 4 Fit retaining clip **(2)**.



032274 / 032273

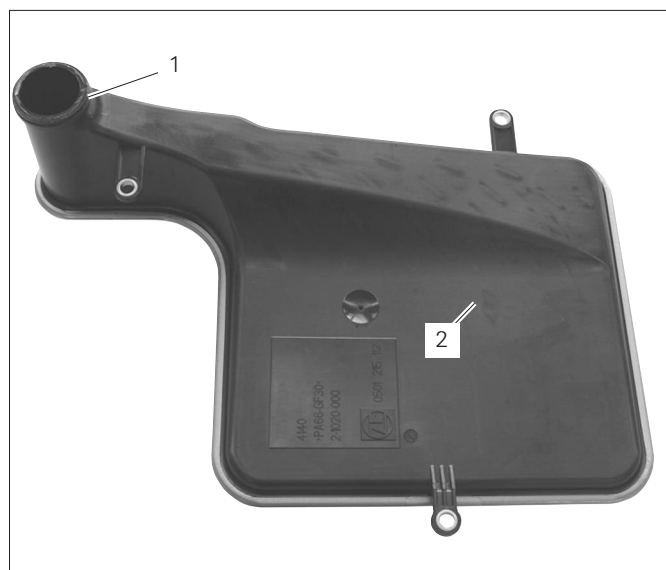
- 5 Plug in the temperature sensor's **(1)** connector.



032272

2.3.9 Installing the suction filter

- 1 Coat new O-ring **(1)** with technical Vaseline.
- 2 Fit O-ring **(1)** to suction filter **(2)**.



032271

CAUTION

When inserting the suction filter, the wiring harness must not be pinched.

- 3 Insert suction filter **(1)**.
- 4 Screw in two M6x25 torx screws **(2 and 3)**.
- 5 Screw in M6x25 torx screw **(4)** with washer and tighten all three screws.
Tightening torque: **9.5 Nm**

NOTE

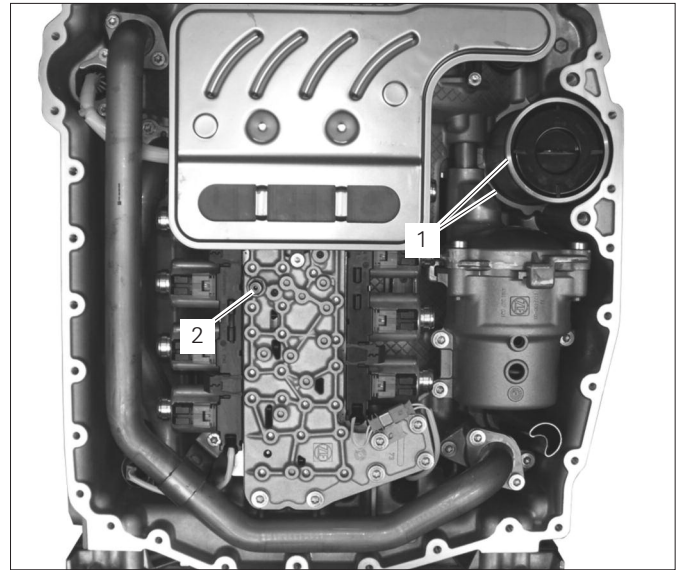
There must be a washer underneath the torx screw **(4)**. No washers used anymore as of serial number 300214.



032270

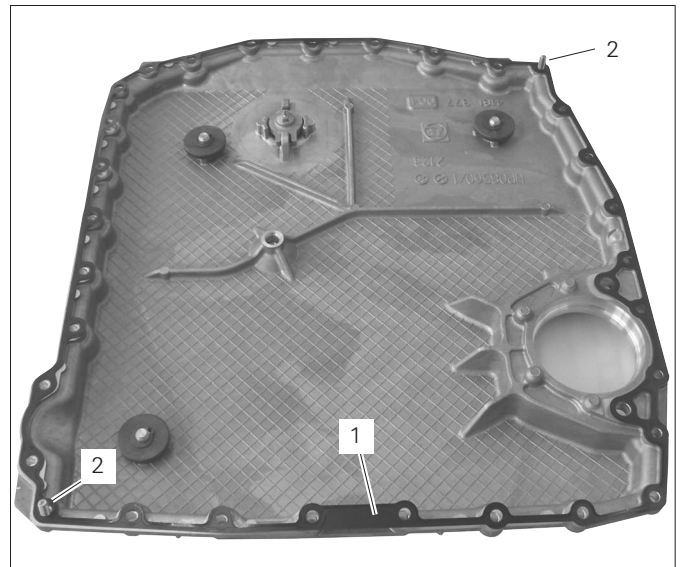
2.3.10 Attaching the oil pan

- 1 Check O-rings on oil tube **(1)** and at the valve **(2)**, replace if necessary. Coat O-rings with technical Vaseline.



032991

- 2 Place new seal **(1)** on the oil pan.
- 3 Insert two M8x30 hex head screws **(2)** into oil pan.



032288

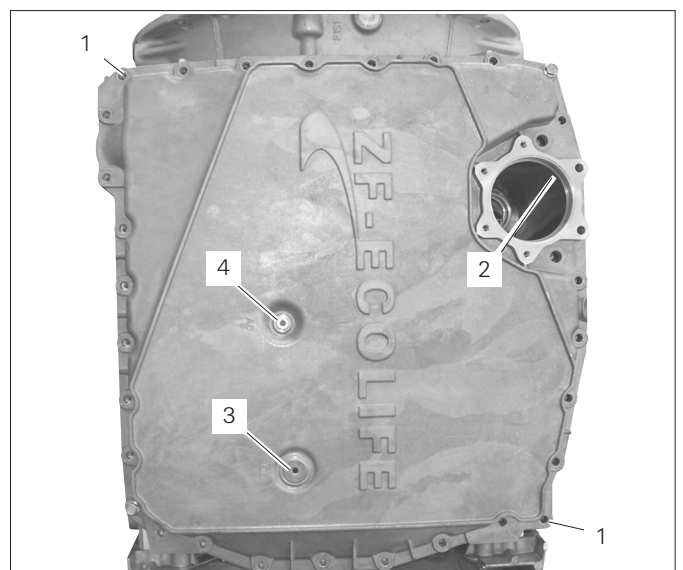
CAUTION

When putting on oil pan, ensure that O-ring of oil pipe (2) is positioned correctly and is not damaged.

- 4 Carefully put on oil pan and screw in two hex head screws **(1)**.

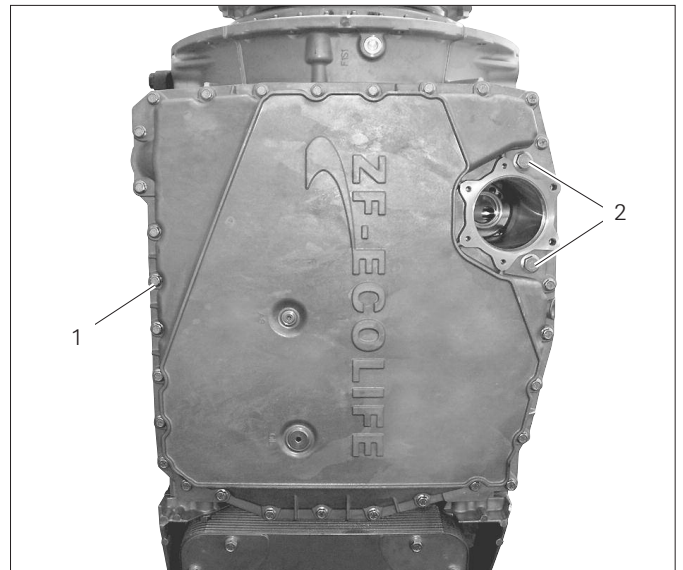
NOTE

In terms of the torque converter counter-pressure, the ball-and-socket bearing must correctly snap into place, namely the bore for the pressure measurement point **(3)**.



032290

- 5 Screw in remaining 27 M8x30 hex head screws **(1)** at circumference of oil pan – do not tighten yet.
- 6 Screw in two M12x55 hexagon screws **(2)** and tighten.
Tightening torque:
Screw with washer assembly: **79 Nm**
Flange head screw: **99 Nm**
- 7 Tighten all 29 M8x30 hex head screws **(1)** at circumference of oil pan.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**



032267

CAUTION

Use new filter. Ensure correct position of O-ring **(1)** on the filter.

- 8 Coat O-ring **(1)** with technical Vaseline and insert new filter **(2)**.



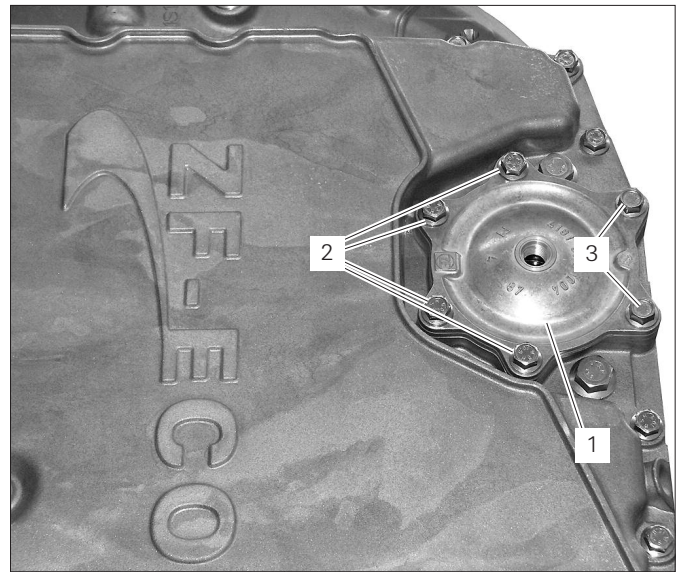
32721

- 9 Coat O-ring **(1)** with technical Vaseline.
- 10 Insert new O-ring **(1)** in the filter cover **(2)**.



032264

- 11 Insert filter cover **(1)**.
- 12 Screw in four M8x30 hex head screws **(2)** and tighten.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**
- 13 Screw in two M8x55 hex head screws **(3)** and tighten.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**



025016

- 14 Coat O-ring **(1)** with technical Vaseline.
- 15 Fit new O-ring **(1)** to screw plug.

NOTE

No screw plugs used anymore as of serial number 344696.



- 16 Screw in M14x1.5 screw plug **(1)** and tighten.
Tightening torque: **25 Nm**

NOTE

No screw plugs used anymore as of serial number 344696.

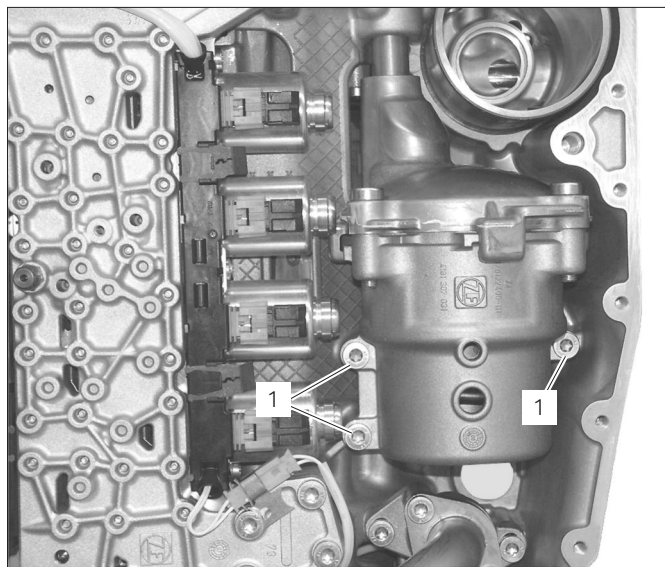


032293

2.4 Replacing retarder accumulator

2.4.1 Removing retarder accumulator

- 1 Unscrew three torx screws (1).

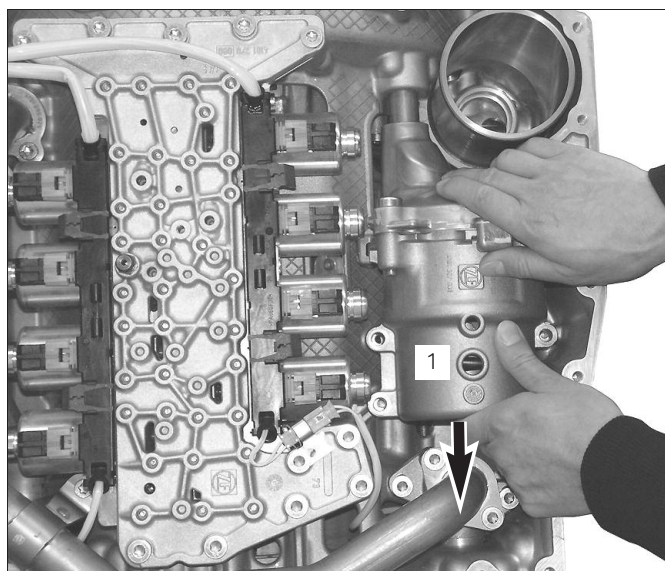


032316

- 2 Pull retarder accumulator (1) towards output (see arrow) and take out.

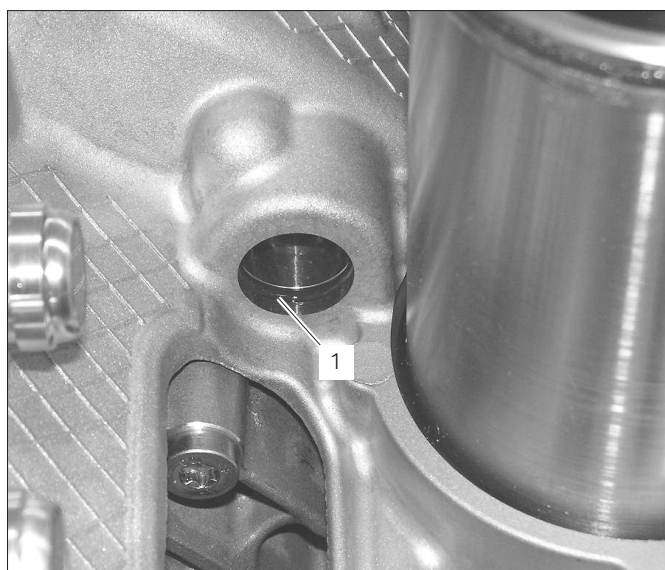
**DANGER**

Failure to do so could cause major injury!
Do not dismantle the retarder accumulator
without the special tools specified.
Failure to do so could cause major injury.



032317

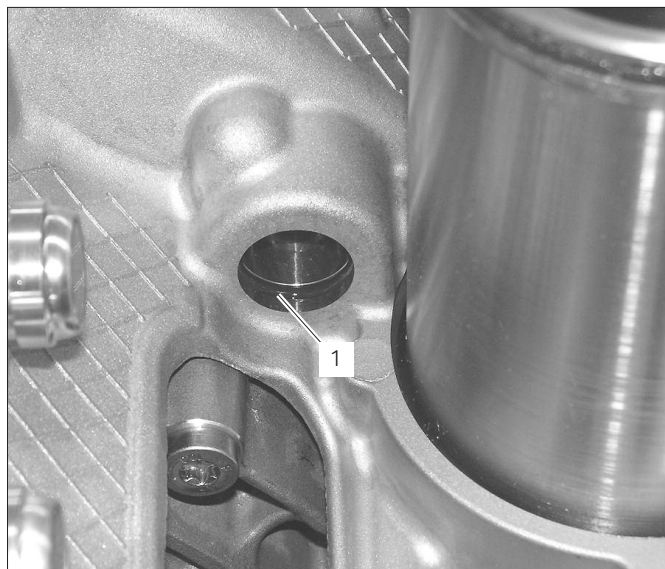
- 3 Remove O-ring (1).



032318

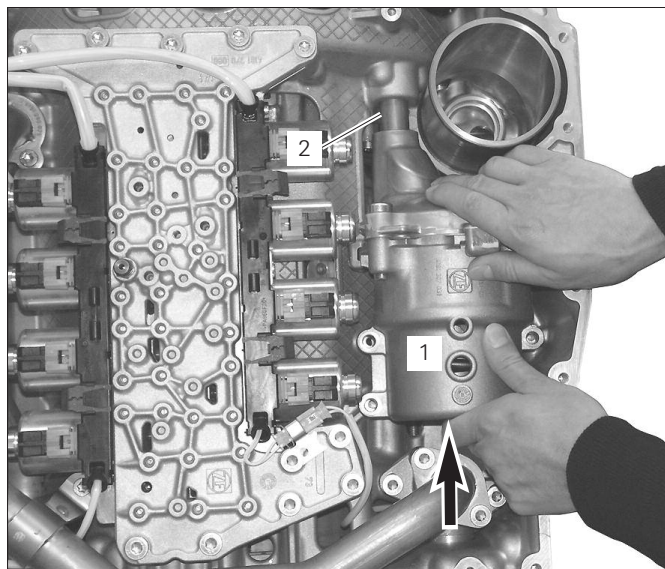
2.4.2 Installing the retarder accumulator

- 1 Coat new O-ring **(1)** with technical Vaseline and insert it.



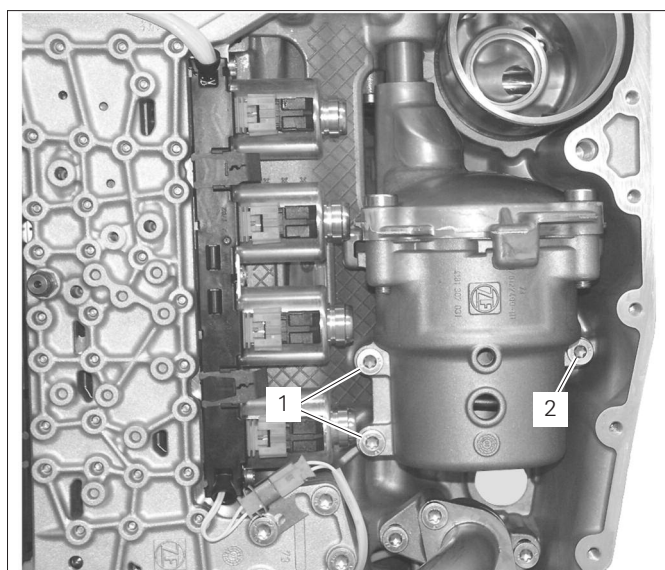
032318

- 2 Insert retarder accumulator **(1)** with tube **(2)** in housing bore.



032317

- 3 Screw in three M8x36 **(1, 2)** torx screws. Tightening torque: **20 Nm**

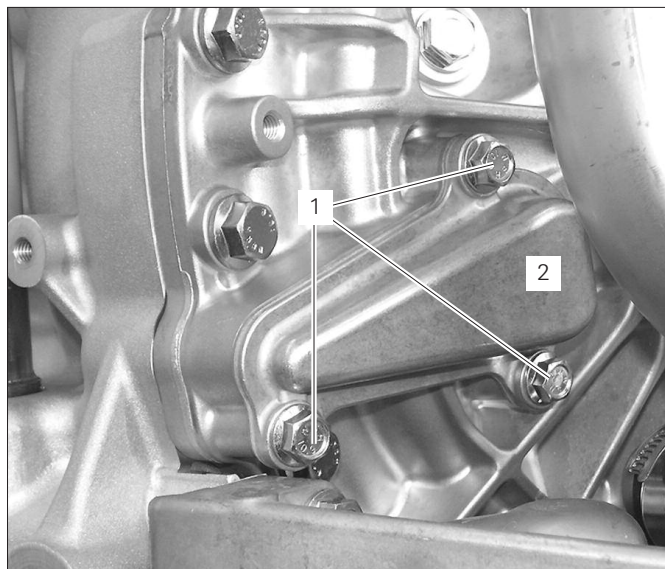


032316

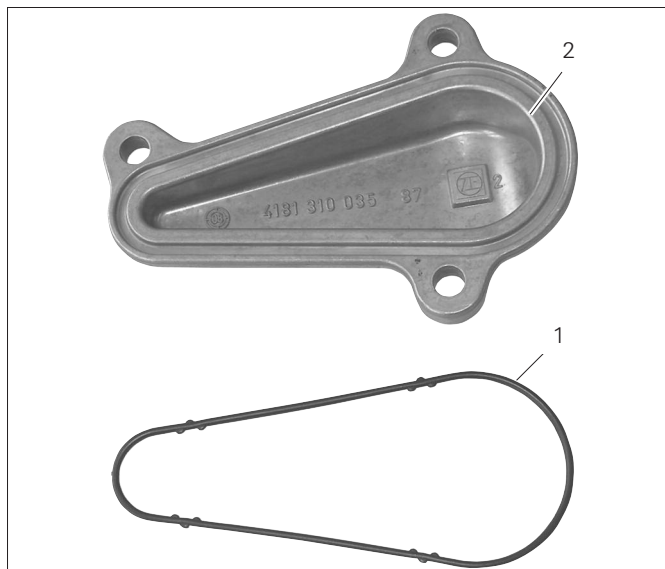
2.5 Replacing speed sensor, output

2.5.1 Removing speed sensor, output (coaxial transmission)

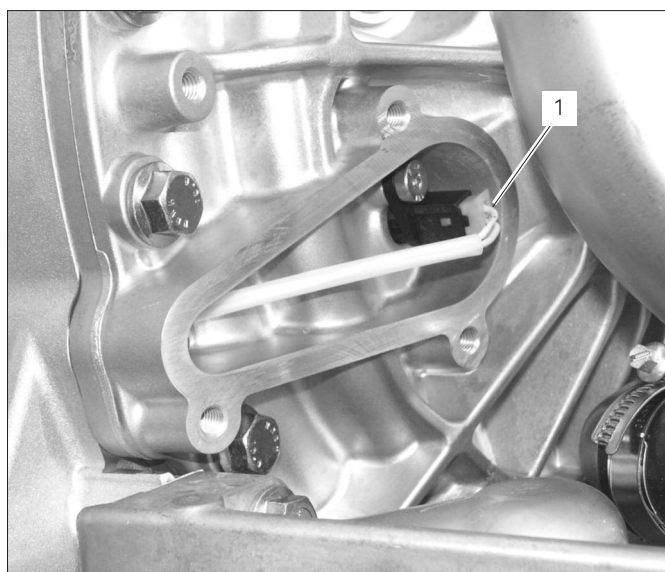
- 1 Remove three M8 hex head screws **(1)**.
- 2 Take off cover **(2)**.
- 3 Take out seal **(1)** from the speed sensor's **(2)** cover.
- 4 Disconnect connector **(1)**.



032309



032311



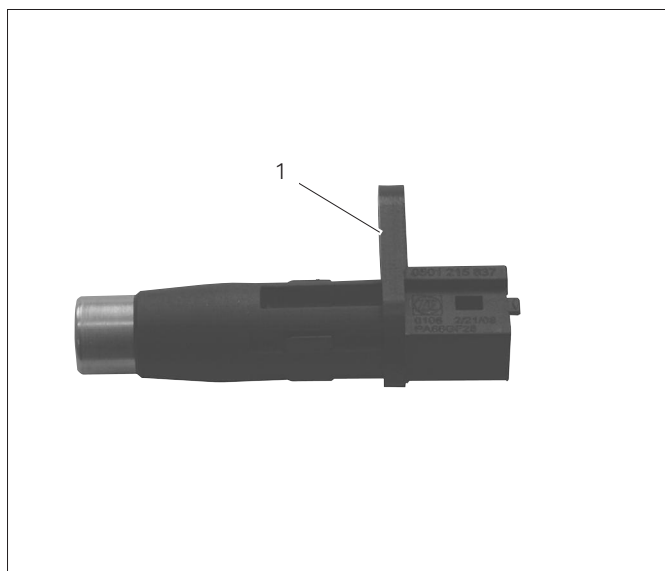
032312

- 5 Screw out one M6 torx screw **(1)**.



032313

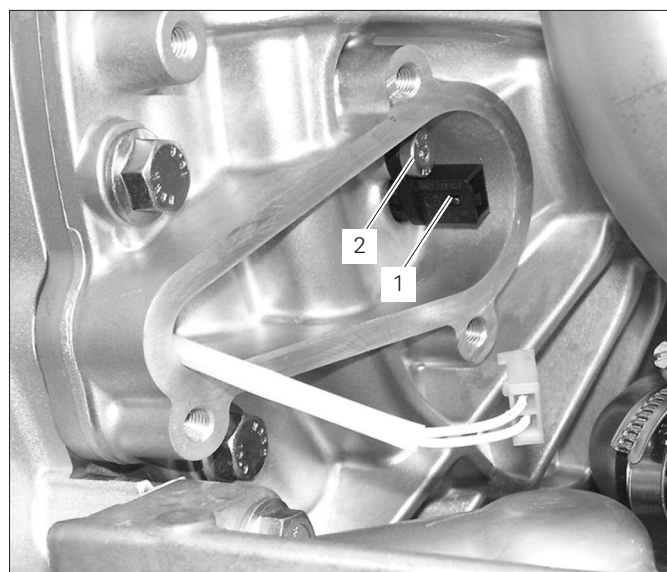
- 6 Take out the speed sensor, output **(1)**.



032286

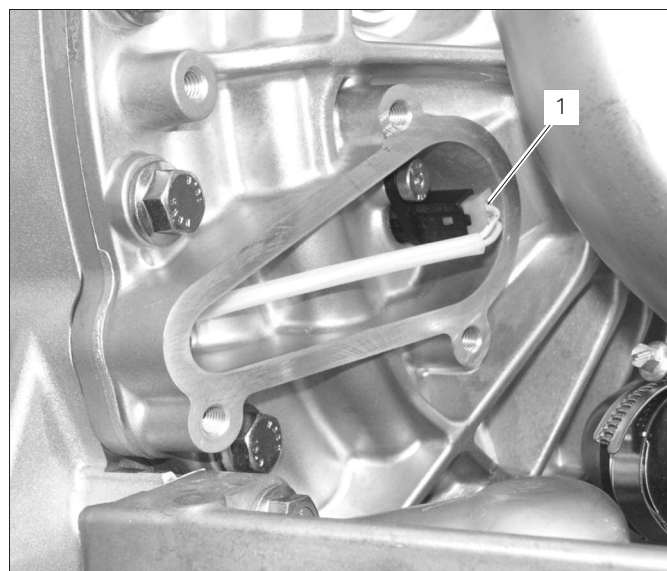
2.5.2 Installing speed sensor, output (coaxial transmission)

- 1 Insert the new speed sensor, output **(1)**.
- 2 Screw in M6x17 torx screw **(2)** and tighten. Tightening torque: **9.5 Nm**



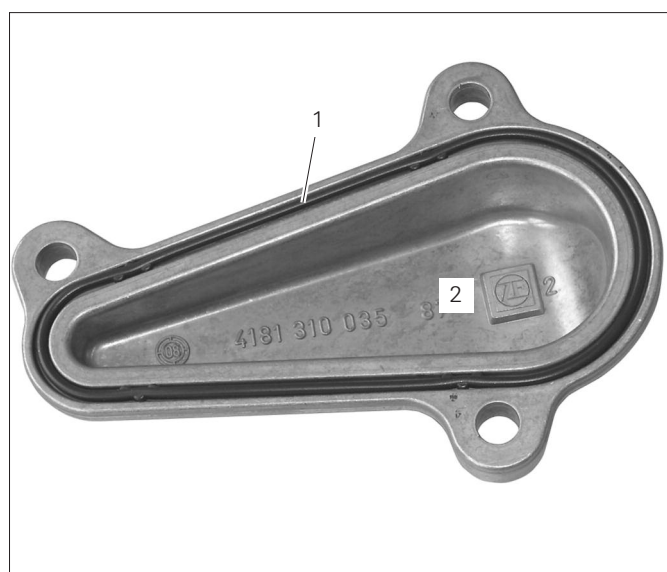
032313

- 3 Fit connector **(1)**.



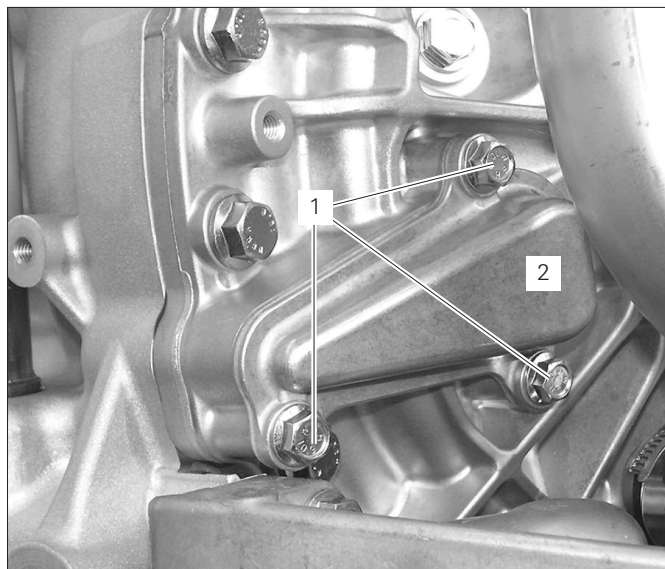
032312

- 4 Coat new seal **(1)** with technical Vaseline.
- 5 Insert seal **(1)** in the speed sensor's **(2)** cover.



032310

- 6 Fit cover **(1)**.
- 7 Screw in three M8x30 hex head screws **(2)** and tighten.
Tightening torque:
Screw with washer assembly: **23 Nm**
Flange-head screw: **29 Nm**



032309

2.5.3 Removing speed sensor, output (RHD / LHD angle drive)

- 1 Screw out screw plug (1).



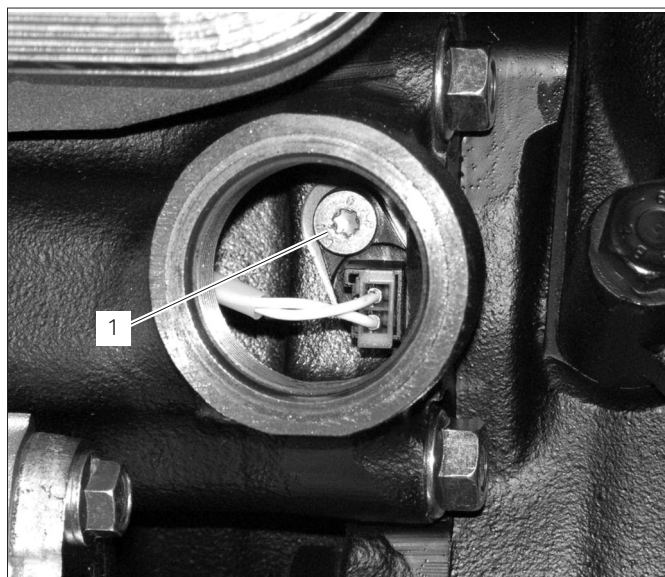
033063

- 2 Remove O-ring (1).



025042

- 3 Screw out one M6 torx screw (1).

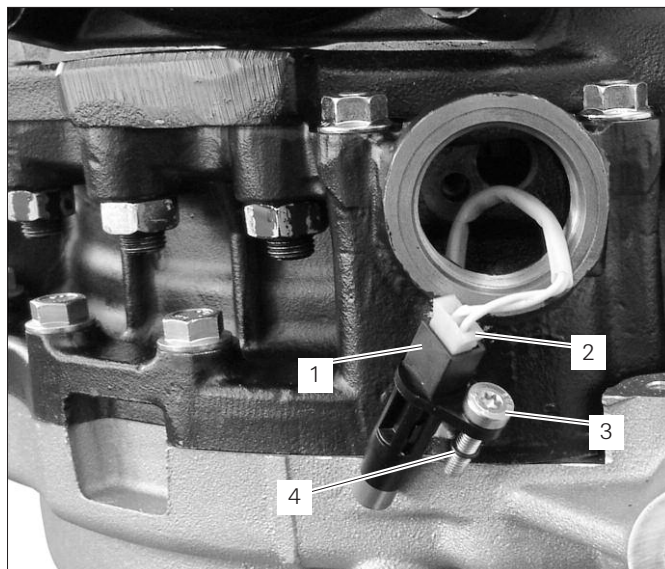


033064

- 4 Take out the speed sensor, output **(1)** with the cable.
- 5 Unplug connector **(2)** and remove speed sensor with screw **(3)** and O-ring **(4)**.

NOTE

The O-ring **(4)** serves as loss protection for the screw **(3)**.



030148

- 6 Remove screw **(1)** and O-ring **(2)**.



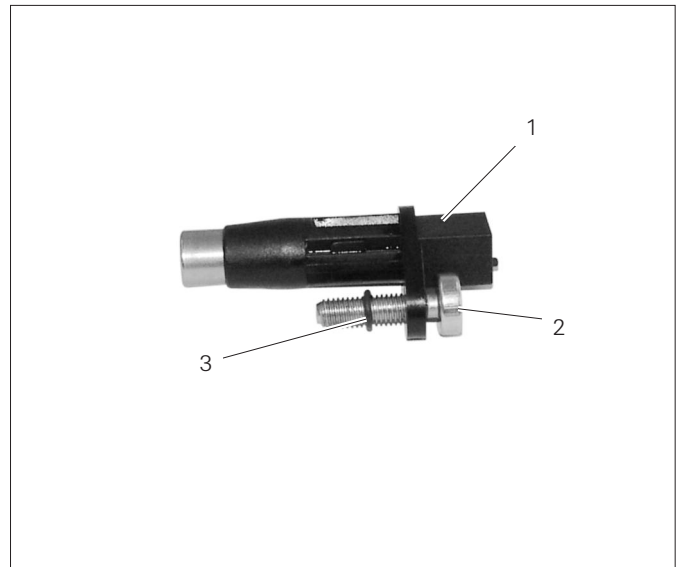
025043

2.5.4 Installing speed sensor, output (RHD / LHD angle drive)

- 1 Assemble speed sensor, output **(1)** with screw **(2)** and O-ring **(3)**.

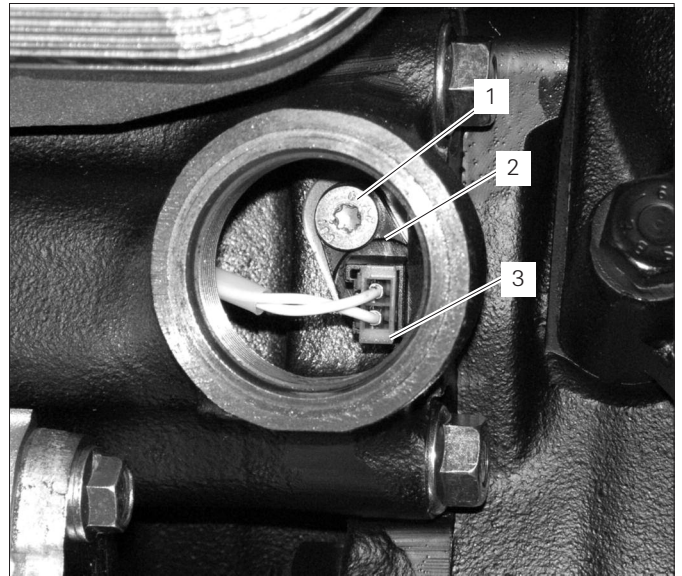
NOTE

The O-ring **(3)** serves as loss protection for the screw **(2)**.



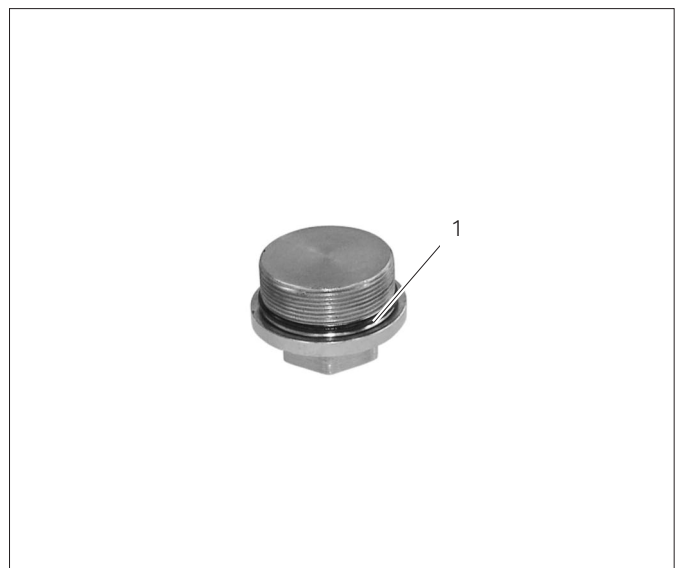
025043

- 2 Install inductive sensor, output **(2)** with M6x17 torx screw **(1)** and O-ring. Tightening torque: **9.5 Nm**
- 3 Fit connector **(3)**.



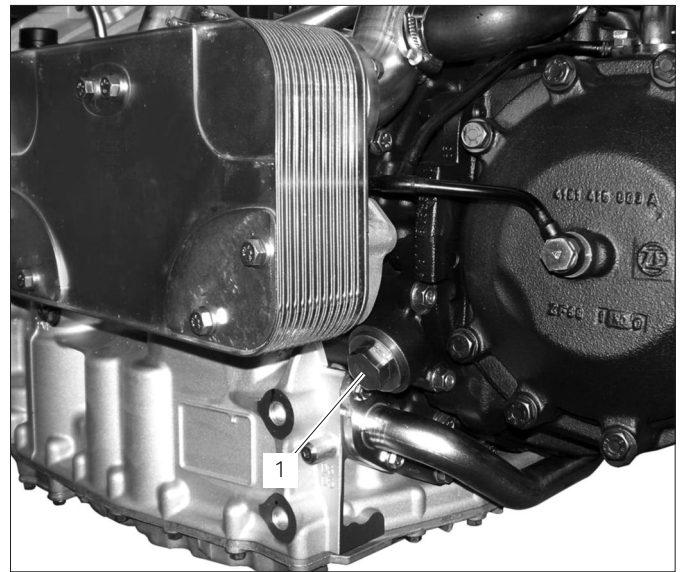
033064

- 4 Coat O-ring **(1)** with technical Vaseline.
- 5 Fit O-ring **(1)** to screw plug.



025042

- 6 Screw in M42x1.5 screw plug (1).
Tightening torque: **120 Nm**



033063

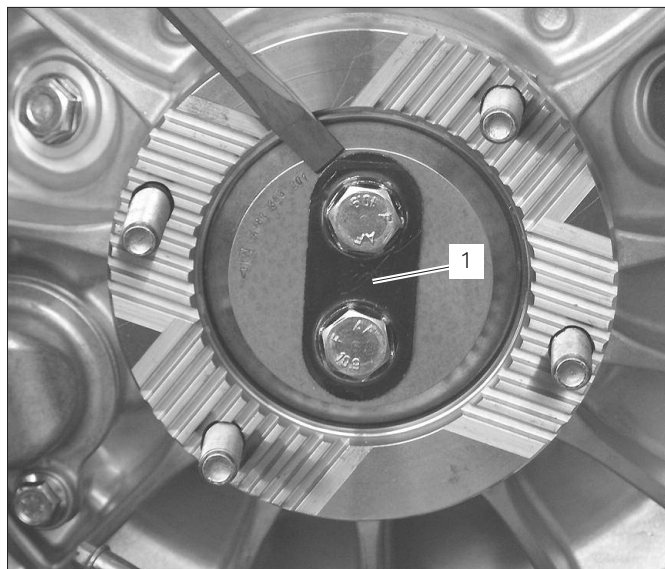
2.6 Replacing output shaft sealing ring

2.6.1 Removing shaft sealing ring

NOTE

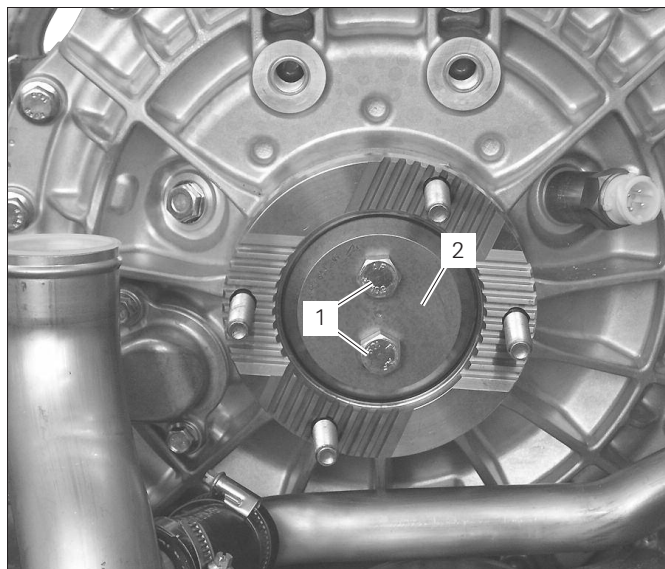
The procedure is identical for transmissions with angle drive.

- 1 If needed, remove the safety plate **(1)** by means of a small flat chisel.



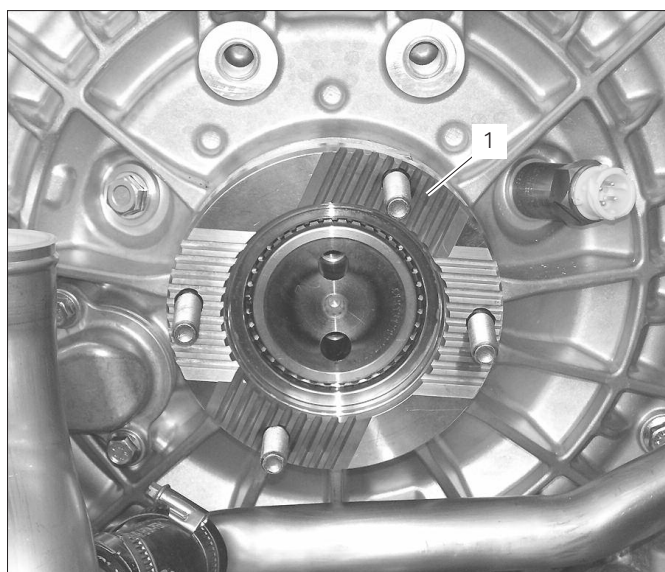
032307

- 2 Unscrew two hex head screws **(1)** from flange.
- 3 Remove fixing plate **(2)**.



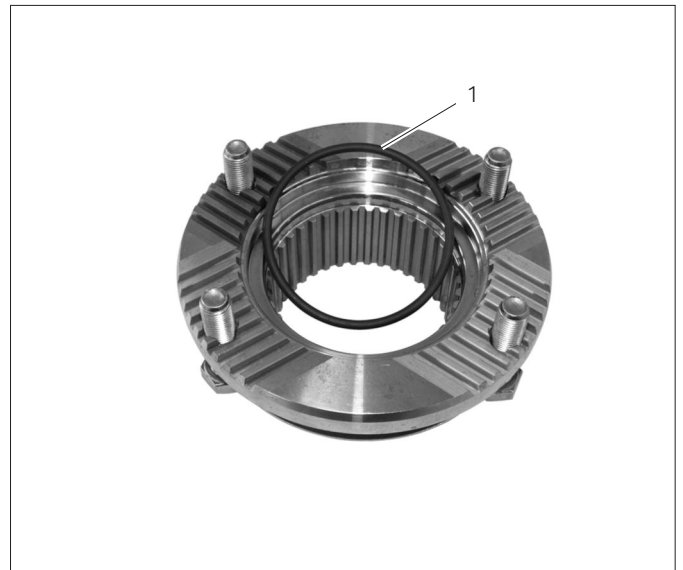
032295

- 4 Manually pull off output flange **(1)**.



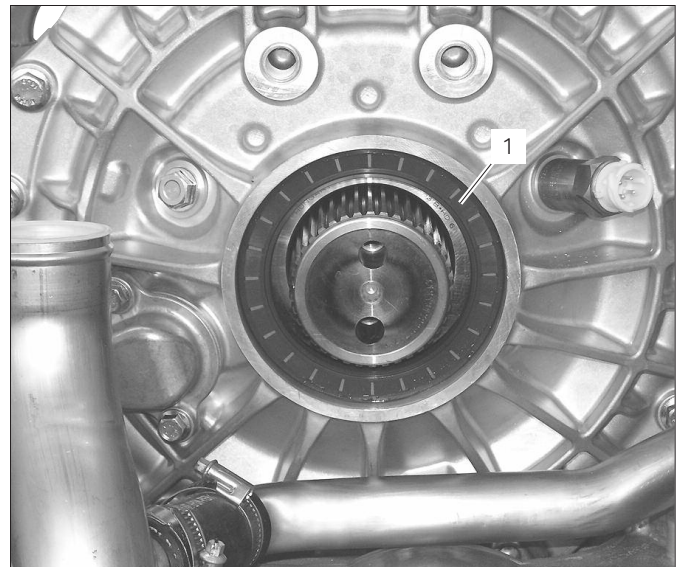
032297

- 5 Remove O-ring **(1)**.



034078

- 6 Remove shaft sealing ring **(1)** using a suitable tool.



032298

2.6.2 Installing shaft sealing ring

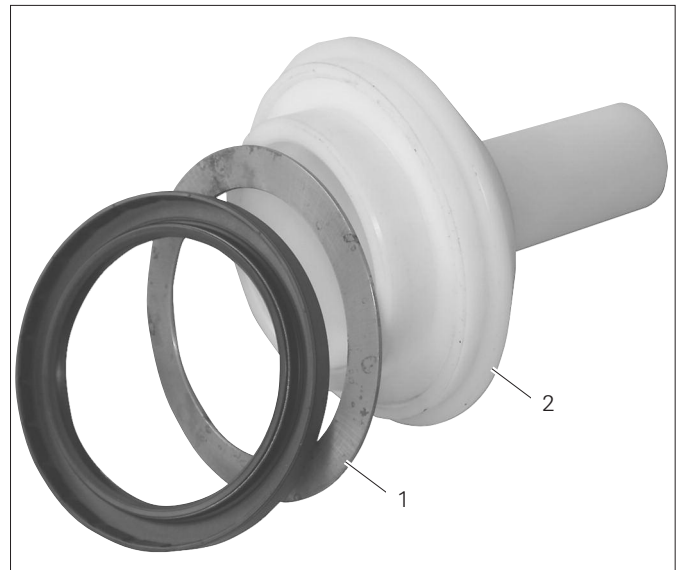
NOTE

The procedure is identical for transmissions with angle drive.

CAUTION

If the output flange shows running-in wear from the shaft sealing ring, the shaft sealing ring must be installed in the output housing in a new position.

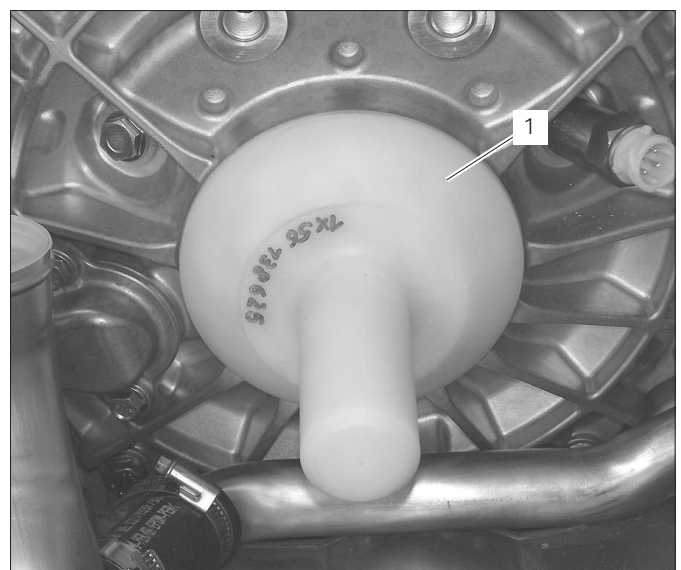
- 1 If required, fit washer **1X56 138 590 (1)** onto tool **1X56 138 625 (2)**.
- 2 Sprinkle shaft sealing ring's outside diameter with spirit (ethanol).
- 3 Position new shaft sealing ring **(1)** onto tool **1X56 138 625**.
- 4 Drive shaft sealing ring in until firmly home using tool **1X56 138 625 (1)**.



032303



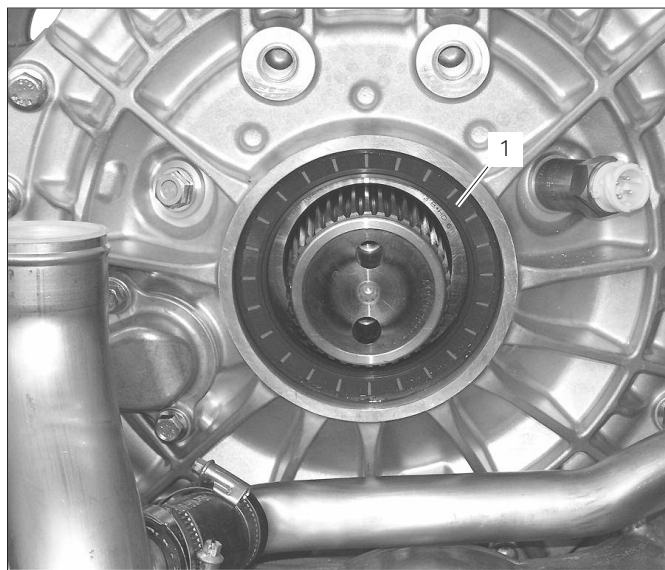
032302



032301

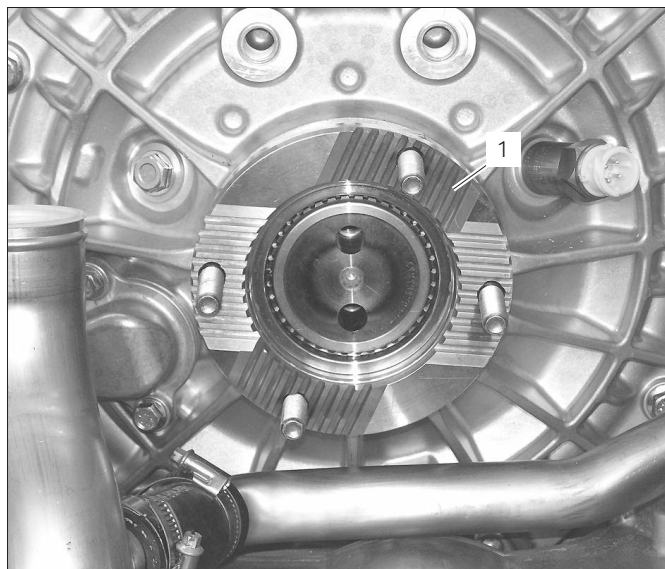
NOTE

The shaft sealing ring's **(1)** installation dimension is predetermined by the tool.



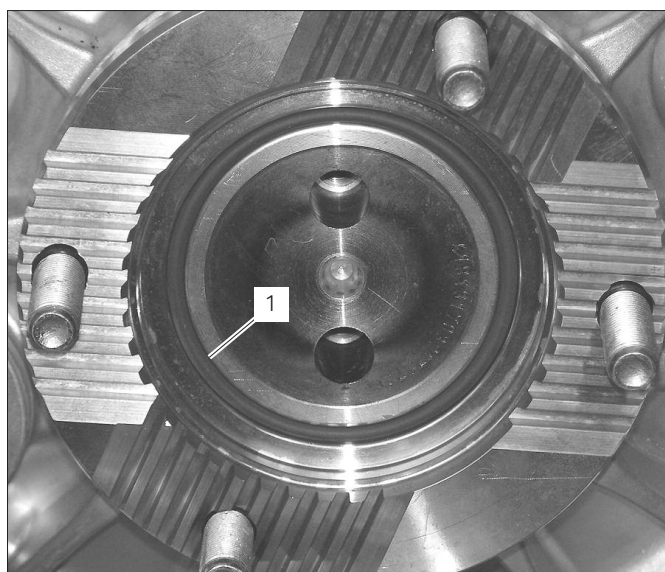
032298

- 5 Slide on output flange **(1)**.



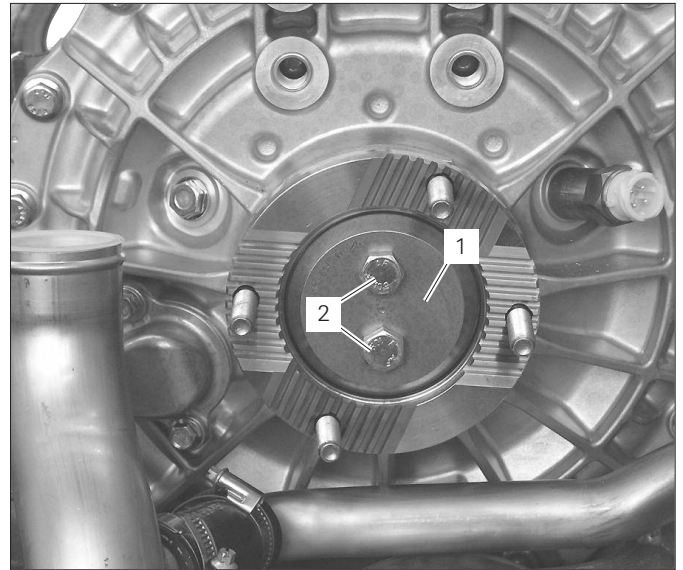
032297

- 6 Insert new O-ring **(1)** and press into groove.



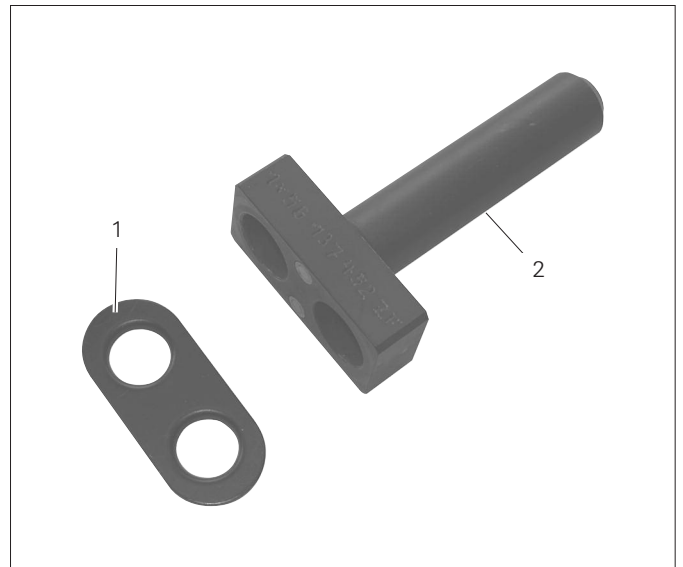
032296

- 7 Position fixing plate **(1)**.
- 8 Screw in two new M12x60 hex head screws **(2)** and tighten.
Tightening torque: **80 Nm**



032295

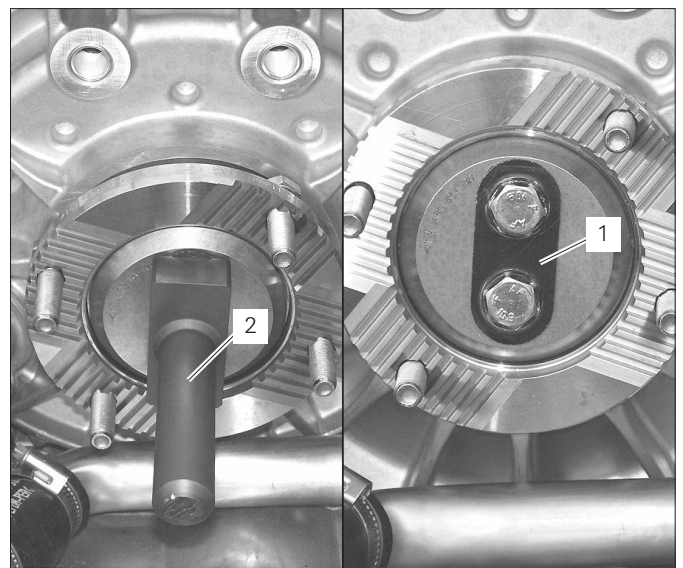
- 9 Place safety plate **(1)**, part no. 4132 304 015, onto tool **1X56 137 452 (2)**.



032304

**DANGER****Risk of injury!****Pushing on the safety plate (1) might produce a sharp-edged bur!****Carefully remove bur with a suitable tool.**

- 10 Push safety plate **(1)** onto M12 hex head screws until firmly home with pressure plate by using tool **(2)**.

CAUTION**Ensure cleanliness! Carefully remove chips and other abraded material.**

032305/032306

2.7 Pressure test

Pressure test with the transmission installed in the vehicle:

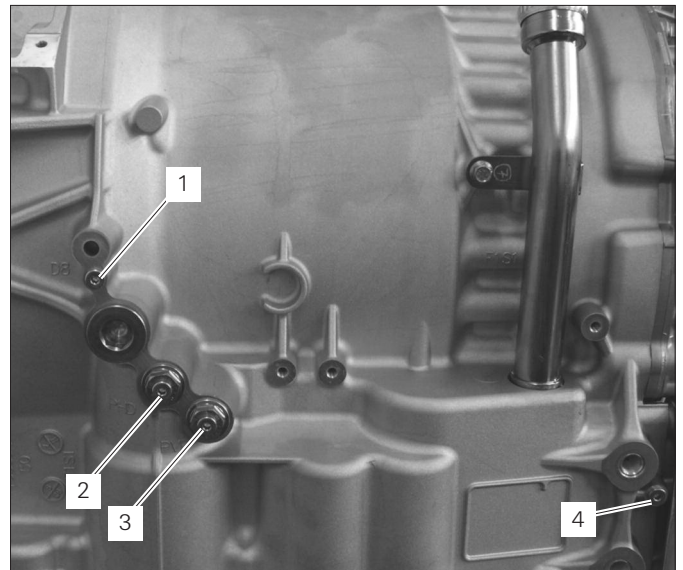
Pressure measuring connections:

- 1 = **PD8** Lubricating pressure
 - 2 = **PHD** Main pressure
 - 3 = **PVF** Pressure upstream of filter
 - 4 = **PD6** Measuring connection for pressure **downstream of** retarder oil cooler (ROC) is mounted at output end on all sand-cast and die-cast transmissions with ROC.
 - 4 = **PD5** Measuring connection for pressure **upstream of** retarder oil cooler (ROC) is flange-mounted laterally on all die-cast transmissions with ROC.
 - 5 = **A8** Torque converter counter-pressure
- Test gage **1P01 136 670** (up to 25 bar)
 Test gage **1P01 137 856** (up to 10 bar)

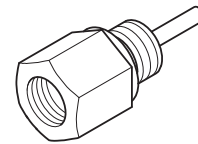
NOTE

The method for pressure testing at pressure measuring connections **PD8 (1)** and **PD5/6 (4)** described under work step 1 must be applied to all transmission housings prior to introduction of standard transmission housings 4181 302 025, starting from transmission no: 1020 (approx.). After that number, continuous testing is possible without removing non-return valves with adapter **1P82 139 839**.

- 1 Unscrew M10x1 screw plug at pressure measuring point **PD8 (1)** and depending on cooler mounting **PD5/6 (4)**, screw out non-return valves using a screwdriver, screw in adapter **1P82 139 839** with O-ring and connect test gage.
- 2 Unscrew M10x1 screw plug at pressure measuring point **A8 (5)**, screw in adapter **1P82 139 839** with O-ring and connect test gage.



032994



Adapter 1P82 139 839



032262

NOTE

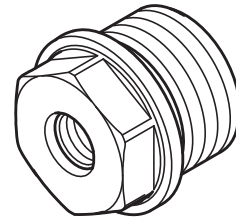
The method for pressure testing at pressure measuring point **PHD (2)** and **PVF (3)** described under work step 3 must be applied to all screw plugs prior to introduction of standard screw plug **4181 302 029**, or prior to introduction of die-cast transmissions.

After that, continuous testing is possible without changing screw plugs with adapters **1P82 139 839**.

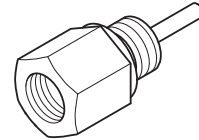
- 3 Unscrew SW 22 and/or SW 24 at pressure measuring point **PHD (2)** and/or **PVF (3)** and replace by screw plug **4181 302 009** (without valve).
Screw in adapter **1P82 139 839** with O-ring and connect test gage.
- 4 Carry out pressure test.
- 5 Remove test gage and adapter after completed pressure measurement.
- 6 Re-insert original SW 22 or SW 24 screw plug at **PHD (2)** or **PVF (3)**, respectively.
Tightening torque: **65 Nm**
Screw in M10x1 screw plug with new O-rings.
Tightening torque: **12 Nm**
- 7 Non-return valves do not have to be inserted anymore in pressure measuring point **PD8 (1)** and depending on cooler mounting **PD5/6 (4)**.
Screw in M10x1 screw plug with new O-rings.
Tightening torque: **12 Nm**
- 8 At pressure measuring point **A8 (5)**, screw in M10x1 screw plug with new O-ring.
Tightening torque: **12 Nm**

NOTE

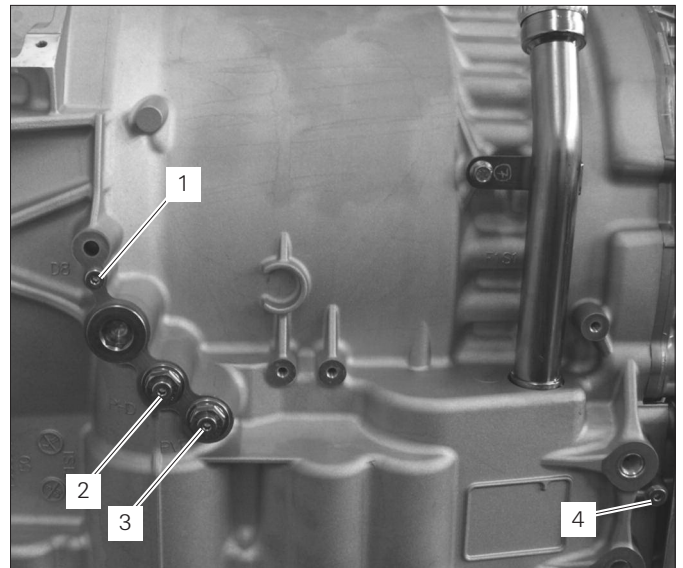
In the following, you will find an excerpt of the test record for KD functional tests. The **latest** test record for the EcoLife KD functional test can be ordered under print number 4181 754 103 or accessed on the ZF-ServiceLine.



Screw plug 4181 302 009 (without valve)



Adapter 1P82 139 839



032994



032262

2.7.1 System check at idling speed (turbine speed 620 rpm)

UG = lower limit
OG = upper limit

Gear	PHD (bar) UG – OG 8.0 – 12.0 ACTUAL	PA 8 (bar) UG – OG 5.0 – 6.5 ACTUAL	PD 5 / PD 6 (bar) UG – OG 1.0 – 2.0 ACTUAL	PD 8 (bar) UG – OG 0.4 – 1.5 ACTUAL	Psch. WTR* (bar) UG – OG 0.1 – 1.0 ACTUAL
N WK open**					

2.7.2 System check at high speed (turbine speed 2 200 rpm)

UG = lower limit
OG = upper limit

Gear	PHD (bar) UG – OG 10.0 – 12.0 ACTUAL	PA 8 (bar) UG – OG 5.0 – 6.5 ACTUAL	PD 5 / PD 6 (bar) UG – OG 3.0 – 5.0 ACTUAL	PD 8 (bar) UG – OG 1.8 – 3.0 ACTUAL	Psch. WTR* (bar) UG – OG 0.6 – 3.0 ACTUAL
N WK open**					

* Psch.WTR = Lubricating pressure angle drive

** WK = Torque converter lock-up clutch

3 Troubleshooting

3.1 Electronic control unit

CAUTION

Disconnecting the battery while the engine is running might destroy the electronic control unit!

Checking the ground and supply wires (ZF requirement):

- Ground (–), cable cross-section: 2.5 mm²
- Supply (+), cable cross-section: 2.5 mm²

CAUTION

Battery master switch in the vehicle:
When master switch is OFF, battery and generator must both be disconnected from vehicle electric system!

Otherwise, power supply to the electronic control unit needs to be assured via terminal 30/battery, even when master switch is OFF (power consumption < 1 mA, non-critical!).

The electronic control unit must not be operated without battery. Risk of destruction through overvoltage!

3.2 Test with terminal tester 6008 006 002

Use of terminal tester 6008 006 002 with adapter kit 6008 206 040.

For troubleshooting purposes, the terminal tester 6008 006 002 together with the adapter kit 6008 206 040 can be connected as follows: Either between the transmission cable and the electronic control unit or between the electronic control unit and the vehicle connector.



DANGER

Driving with terminal tester and adapter cable is only permitted for test purpose and is not allowed on public roads!

CAUTION

Do not supply voltage to the emergency switch, the inductive sensor, and the proportional valves (gear clutches, main pressure, and retarder), because this would cause short circuit and failure of affected components. The proportional valves can be supplied with a current of max. 900 mA.

Carry out resistance measurements according to "Pin assignment with measured values at EcoLife transmission".

NOTE

Resistance values can change with increasing and decreasing temperature.

The resistance value of solenoid valves **increases** with rising temperature.

Pin assignment with measured values at EcoLife transmission

Pin at trans- mission plug	EcoLife	Comment	EcoLife measured value (target value)
1	n_Tu	Turbine speed Resistance value cannot be measured, signal check with TestmanLife	-
2	n_Ab	Output speed Resistance value cannot be measured, signal check with TestmanLife	-
3	VPS1	Positive supply of control valves	-
4	TG_Sumpf	Sump temperature sensor	approx. 62 kohm between pin 4 and 15 at (°C, refer to page 3-3)
5	VPS2	Positive supply of control valves	-
6	-	-	-
7	-	-	-
8	RR3	Retarder control valve	10-15 ohm between pin 8 and 5 at 20 °C
9	WK	Torque converter lock-up clutch control valve	10-15 ohm between pin 9 and 5 at 20 °C
10	RHD	Main pressure control valve	10-15 ohm between pin 10 and 5 at 20 °C
11	-	-	-
12	B	Clutch B control valve	10-15 ohm between pin 12 and 5 at 20 °C
13	A	Clutch A control valve	10-15 ohm between pin 13 and 5 at 20 °C
14	-	-	-
15	GM1	Ground connection of sump temperature sensor	
16	-	-	-
17	GM2	Ground connection of retarder temperature sensor	-
18	TG_Ret	Retarder temperature sensor	approx. 124 kohm between pin 18 and 17 at (°C, refer to page 3-3)
19	F	Brake F control valve	10-15 ohm between pin 19 and 5 at 20 °C
20	-	-	-
21	AU +5V	Positive supply of output speed sensor	-
22	D	Brake D control valve	10-15 ohm between pin 22 and 5 at 20 °C
23	AU +5V	Positive supply of turbine speed sensor	-
24	E	Brake E control valve	10-15 ohm between pin 24 and 5 at 20 °C

Notes: Do not supply voltage of 24 V to control valves!

Tolerance table for sump temperature sensor

NTC temperature sensor

DKS 4261 thermometrics

Tolerance table – 40 °C to 150 °C

Temperature °C	R/R25	R nominal ohm	R minimum ohm	R maximum ohm
-40	33.0042179	1650061.2	1524759.4	1784945.9
-35	23.8370981	1191746.8	1104837.5	1284978.4
-30	17.4083136	870336.7	809406.5	935479.3
-25	12.8483939	642361.4	599208.4	688346.7
-20	9.5788331	478898.2	448040.3	511676.7
-15	7.2101341	360474.0	338206.1	384054.3
-10	5.4770683	273828.6	257620.4	290940.1
-5	4.1970599	209834.0	197939.9	222353.8
0	3.2431186	162141.2	153345.4	171373.0
5	2.5260344	126290.3	119738.1	133147.7
10	1.9825385	99117.9	94203.5	104247.0
15	1.5673486	78360.3	74650.3	82221.8
20	1.2477705	62382.9	59565.0	65307.9
25	1.0000000	49995.5	47842.9	52224.0
30	0.8065651	40324.6	38671.5	42031.6
35	0.6545420	32724.1	31448.2	34038.2
40	0.5342997	26712.6	25723.2	27728.9
45	0.4386094	21928.5	21158.0	22717.9
50	0.3620081	18098.8	17496.4	18714.4
55	0.3003397	15015.6	14543.0	15497.4
60	0.2504222	12520.0	12148.0	12898.2
65	0.2098044	10489.3	10195.6	10787.0
70	0.1765668	8828.5	8596.2	9063.5
75	0.1492890	7463.8	7279.6	7649.6
80	0.1267509	6337.0	6190.7	6484.1
85	0.1080586	5402.4	5286.2	5519.1
90	0.0924884	4624.0	4531.5	4716.5
95	0.0794644	3972.9	3887.5	4058.5
100	0.0685260	3426.0	3347.4	3505.0
105	0.0593035	2964.9	2892.7	3037.7
110	0.0514982	2574.7	2508.5	2641.6
115	0.0448682	2243.2	2182.5	2304.7
120	0.0392169	1960.7	1905.0	2017.1
125	0.0343832	1719.0	1668.0	1770.8
130	0.0302352	1511.6	1464.9	1559.2
135	0.0266644	1333.1	1290.3	1376.8
140	0.0235809	1178.9	1139.7	1219.1
145	0.0209103	1045.4	1009.4	1082.3
150	0.0185906	929.4	896.4	963.4

Retarder temperature sensor

Resistance value in kohm

Measured current: < 1.2 mA

°C	Min	Nominal	Max
-40	-	-	-
-20	830.7	1000.2	1203.7
0	281.3	329.4	385.6
20	108.3	123.8	141.4
40	46.39	51.88	57.98
60	21.73	23.83	26.12
80	10.98	11.84	12.75
100	5.9231	6.283	6.661
120	3.3786	3.533	3.692
140	2.0234	2.088	2.154
160	1.2498	1.289	1.329
180	0.7932	0.8275	0.8627

Adjusted at 150 °C 1.633 kohm

Tau 63: < 3 s
 Operating current: < 2.5 mA
 U_B: 5 V
 Temperature range: –40 °C to +160 °C
 (short-term +180 °C)

Measurement range: –20 °C to +180 °C
 Housing material: Ultramid TKR 4355 G7
 Color: black

3.3 Connect ZF-TESTMAN to diagnostic connector

Carefully take off diagnostic connector's protective cap to connect ZF-TESTMAN via the diagnostic connector (USB) on the speed range selector.

NOTE

Carefully lift protective cap on both sides (see arrows) by using a small slotted screwdriver.



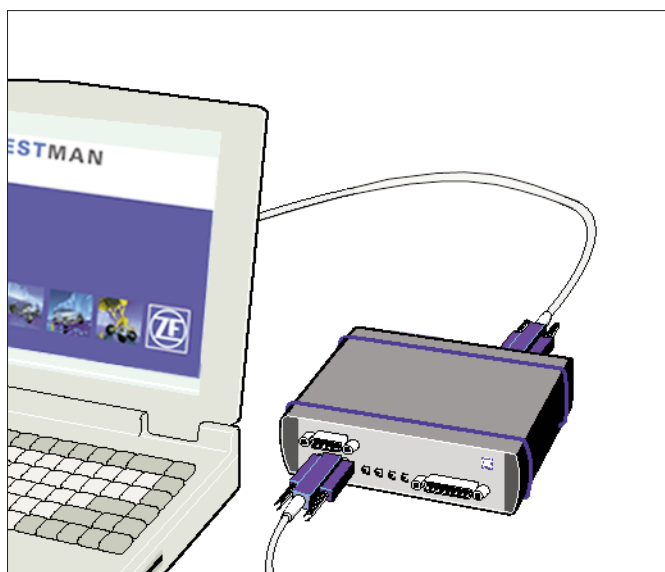
029415 / 032719

Connect adapter cable 6008 207 043 to diagnostic connector (USB).



6008 207 043 / 029417

Connect adapter cable 6008 207 043 to ZF-TESTMAN.



019940

3.4 ZF-TESTMAN diagnosis system

The ZF-TESTMAN diagnosis system can be used universally, i.e. on all diagnosable ZF vehicle systems.

All necessary, transmission-specific data required for a rapid and comprehensive diagnosis can be retrieved using the ZF-TESTMAN diagnosis system. Data are supplied on DVD and saved on the hard disk using an installation routine.

Targeted troubleshooting allows staff trained by ZF to rapidly find the error in the transmission system. After having identified the fault, the diagnosis system will propose remedial measures.

Communication between the transmission electronics and the interface adapter (DPA 05) is performed via CAN. Communication between interface adapter and PC is performed via USB, serial line, or online using mobile telephony. Each screen page can be printed out or saved for error documentation. The diagnosis software is available in different languages.

Scope of functions

- **Statistics data**

All the statistics data which is saved on the control unit is displayed.

- **Diagnosis**

Current fault display; read error memory; delete error memory; read identification data

- **Monitoring**

Tester (displays all digital inputs and outputs); display of digital and analog parameters, e.g. speeds, amperages, and voltages

- **Repair aids**

Tightening torques; setting data; special tools; test equipment.
Maintenance; servicing.
Pressures; circuit diagrams; electr. measured values.
As PDF file.

- **ZF telephone directory**

Telephone directory of all ZF service centers.

- **Vehicle configuration**

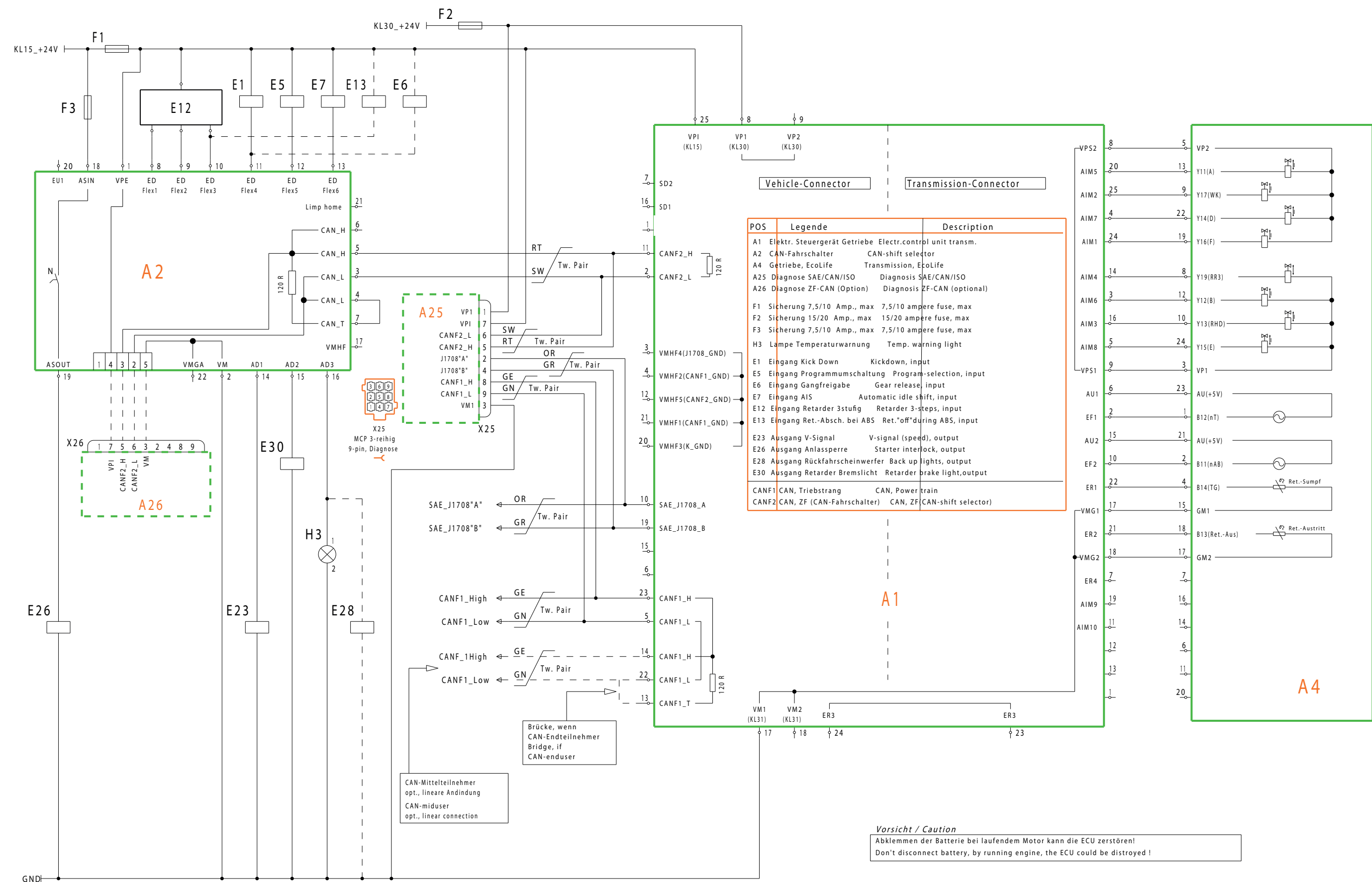
Depending on the product, all vehicle-specific data can be set here and/or driving programs can be selected and adapted.

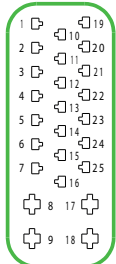
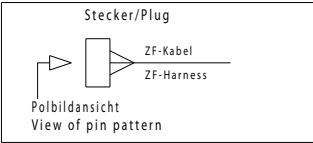
- **Programming (Flashing)**

Available programming files can be installed.

System requirements and scope of supply

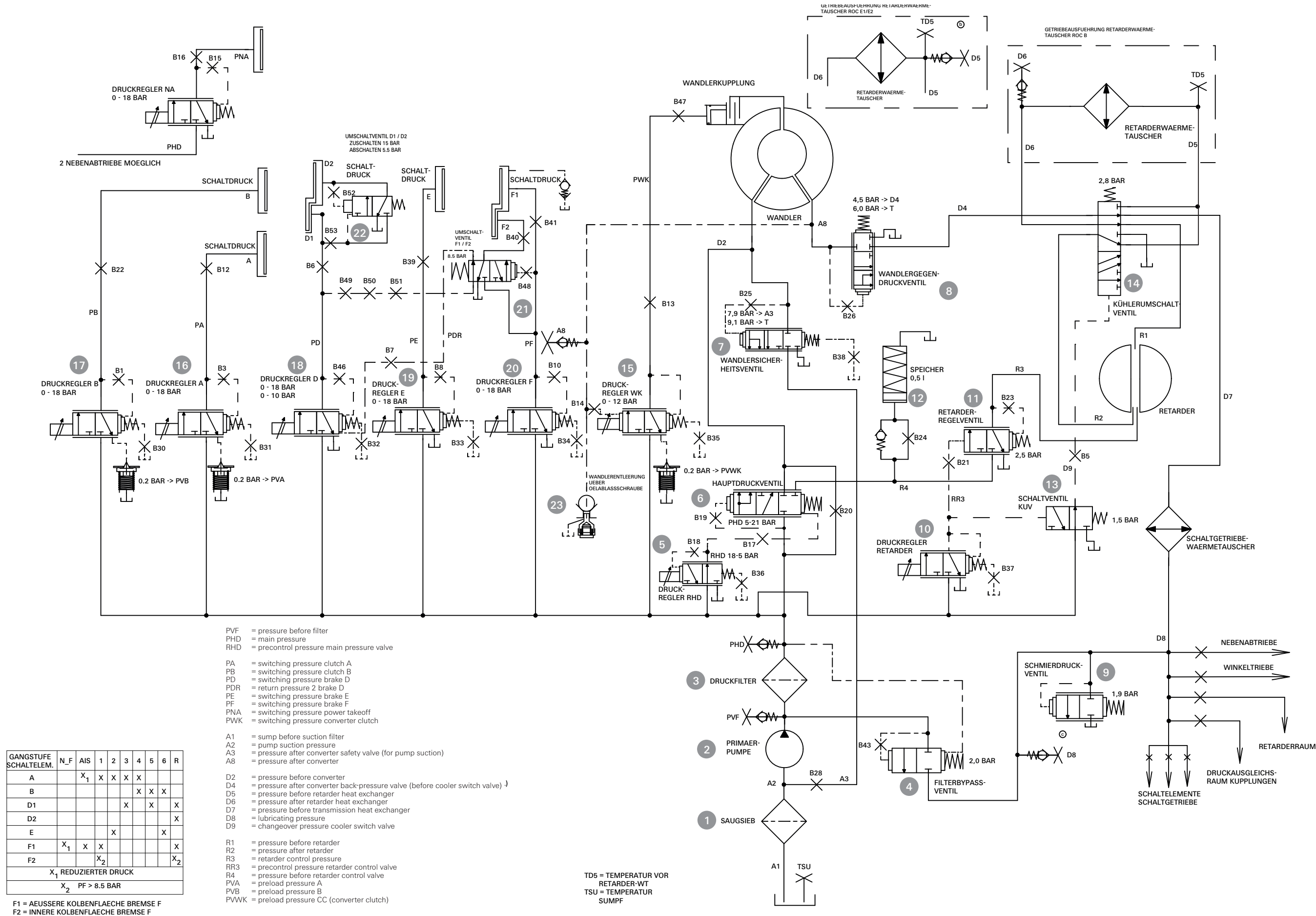
Refer to Operating Instructions: ZF-TESTMAN 6008.758.004 (DE) or 6008.758.104 (EN).



Verkabelung-Anforderungen	Harness-requirements	
Stecker, ECU, fahrzeugseitig Typ: 25pol, Kostal, Buchse (SLK/MLK) ZF-Best-Nr.: 6029 199 156 Hersteller: Fa. Kostal Hersteller Best-Nr.: siehe TKI 0000 702 303 ZF-Verarbeitungsspezifikation: 0501 700 453 ZF-Spezifikation: 6029 705 028 Kostal-Verarbeitungsspez: DOK 000 860 29 (verbindlich) <u>Achtung:</u> Der Kabelabgang am ECU-Stecker muss nach ca. 100mm befestigt werden ! Hierzu ist eine Gewindebohrung (M8) am Getriebe-Wärmetauscher vorgesehen	Plug, ECU, vehicle-part Type: 25pin, Kostal, female (SLK/MLK) ZF-Order-no.: 6029 199 156 Manufacturer: Co. Kostal Manufacturer order-no: See TCI 0000 702 303 ZF-processing-specification: 0501 700 453 ZF-specification: 6029 705 028 Kostal-processing-specific: DOK 000 860 29 (binding) <u>Attention:</u> The cable must be fixed ca. 100mm after cable-out from the ECU-plug ! For this is designed a threaded hole (M8) at the transmission heat-exchanger	 Kostal 25-pin, ECU 
Stecker, CAN-Fahrschalter Typ: 22pol, Tyco, Buchse, Jun.P.T., 2reihig ZF-Best-Nr.: 6029 199 132 Hersteller: Fa. Tyco Hesteller Best-Nr.: 929504-7 (Stecker-Gehäuse) Herteller Best-Nr.: 927771-3 (Kontaktbuchse)	Plug, CAN shift-seletor Type: 22pin, Tyco, female, jun.p.t., 2-array ZF-Order-no.: 6029 199 132 Manufacturer: Co. Tyco Manufacturer order-no: 929504-7 (plug-housing) Manufacturer order-no: 927771-3 (female terminal)	 AMP JPT 22-pin, FS
Stecker, Diagnose Typ: 9pol, Tyco, Buchse, MCP, 3reihig ZF-Best-Nr.: 6029 199 157 Hersteller: Fa. Tyco Hesteller Best-Nr.: 8-968971-1 (Stecker-Gehäuse) Herteller Best-Nr.: 1-968849-1 (Kontaktbuchse)	Plug, diagnoses Type: 9pin, Tyco, female, MCP, 3-array ZF-Order-no.: 6029 199 157 Manufacturer: Co. Tyco Manufacturer order-no: 8-968971-1 (plug-housing) Manufacturer order-no: 1-968849-1 (female terminal)	 X25 MCP 3-reihig 9-pin, Diagnose
Stecker, Bordnetz (Vorschlag-ZF) Typ: 15pol, Tyco, Buchse, MCP, 3reihig ZF-Best-Nr.: 6029 199 161 Hersteller: Fa. Tyco Hesteller Best-Nr.: 8-968973-1 (Stecker-Gehäuse) Herteller Best-Nr.: 1-968849-1 (Kontaktbuchse, 1,0qmm) Herteller Best-Nr.: 1-968851-1 (Kontaktbuchse, 2,5qmm)	Plug, vehicle interface (ZF proposal) Type: 15pin, Tyco, female, MCP, 3-array ZF-Order-no.: 6029 199 161 Manufacturer: Co. Tyco Manufacturer order-no: 8-968973-1 (plug-housing) Manufacturer order-no: 1-968849-1 (female terminal, 1,0qmm) Manufacturer order-no: 1-968851-1 (female terminal, 2,5qmm)	 MCP, 3-reihig 15-pin, Bordnetz
Leitungen, CAN-Schnittstellen Schnittstellen nach: SAE J1939 / SAE J 1708 Verdrilltes Leitungspaar: Schläge 32mm (32 S/m) Empfohlener Leiterquerschnitt: 1,0qmm	Wires, CAN-interface Interfaces according: SAE J1939 / SAE J 1708 Twisted pair wires: Twisted 32mm (32 S/m) Recommended wire cross-section: 1,0qmm	
Leitungen, BN(+)Kl.30, BN(-)Kl.31 Empfohlener Leiterquerschnitt: 2,50qmm Kl.30 (VPE1/VPE2), Pin 8 / 9 Kl.31 (VM1/VM2), Pin 17 / 18	Wires, power supply, Kl.30, Kl.31 Recommended wire cross-section: 2,5qmm Kl.30 (VPE1/VPE2), pin 8 / 9 Kl.31 (VM1/VM2), pin 17 / 18	
Leitungen, BN(+)Kl.15 und sonstige Empfohlener Leiterquerschnitt: 1,00qmm Kl.15 (VPI), Pin 25 und alle sonstigen Leitungen	Wires, power(+)Kl.15 and miscellaneous Recommended wire cross-section: 1,0qmm Kl.15 (VPI), pin 25 and all other wires	
<u>Hinweis:</u> Der Fahrzeughersteller (OEM) ist verantwortlich für die Auslegung der Verkabelung.	<u>Notice</u> The Vehicle manufacturer (OEM) is responsible for the construction of the harness.	







The hydraulic system converts electronic signals (commands) into the required hydraulic variables and ensures oil pressures/volumetric flows.

- Suction strainer **1**, pump **2**, and pressure filter **3**
Pump **2** sucks oil from the oil pan through the suction strainer **1** (only when the engine is running). The pressure filter **3** filters the oil supplied by the pump **2**.
- Pump charging **A3**
The effluent oil quantity **A3** at the converter safety valve **7** is directly fed into the pump suction port **A2** and increases the pressure level in the suction port. Pump charging is needed to reduce the suction vacuum and thus to raise the cavitation limit and efficiency of the pump **3**.
- Filter by-pass valve **4**
The filter by-pass valve **4** limits pressure loss in the pressure filter **3** to a specified value. When reaching the specified value, oil is fed into the lubricating system.
- RHD pressure regulator **5** and main pressure valve **6**
The proportional solenoid actuates the RHD pressure regulator **5** where pump pressure is applied. The proportional valve sets the pRHD pilot pressure depending on the control current of the transmission electronics. The pRHD pilot pressure acts on the controlled surface of the main pressure valve **6** and thus determines the main pressure level pHD. There is a by-pass bore between pHD and **D2** at the main pressure valve **6** to prevent torque converter internal pressure drop and to guarantee a minimum quantity of lubricating oil for the transmission.
- Torque converter safety valve **7**
The torque converter safety valve **7** limits pressure **D2** towards the torque converter to a specified value. The effluent oil quantity **A3** is directly fed to the pump suction port **A2** for charging the pump.
- Converter counter-pressure valve **8**
Pressure from the torque converter flows to the converter counter-pressure valve **8**. There, the torque converter internal pressure **A8** is set to a specified value. The A8 pressure is directed to the control surface of the lock-up clutch (WK) pressure regulator.
- Accumulator **12**
To reduce the retarder's response time, the accumulator oil quantity is fed into the retarder circuit by spring force. It is connected to **R4** and is charged during traction operation. When engaging the retarder, the pressure of the retarder pilot control increases and the cooler change-over control valve **13** switches. Now, the retarder control valve **11** charges the retarder; thus, R4 pressure drops below a specified limit. The accumulator **12** is activated and supports retarder filling. An orifice is installed in the filler line to make sure that the accumulator **12** does not immediately suck oil once the pressure rises again.
- Lock-up clutch pressure regulator **15**
The proportional solenoid actuates the lock-up clutch pressure regulator **15** where main pressure **pHD** is applied. The proportional solenoid is assisted by the torque converter's internal pressure **A8** acting on the controlled surface. The proportional valve sets the switching pressure **pWK** depending on the control current of the transmission electronics. Switching pressure acts on the pressure return surface supporting the return spring. This limits the maximum switching pressure **pWK** to a specified value. In an inactive condition, a pre-load valve prevents the switching element from running empty.

- Pressure regulator A **16**
The proportional solenoid actuates pressure regulator A **16** where main pressure **pHD** is applied. The proportional valve sets the switching pressure **pA** depending on the control current of the transmission electronics. Switching pressure **pA** acts on the pressure return surface supporting the return spring. This limits the maximum switching pressure **pA** to a specified value. In an inactive condition, a preload valve prevents the switching element from running empty.
- Pressure regulator B **17**
The proportional solenoid actuates pressure regulator B **17** where main pressure **pHD** is applied. The proportional valve sets the switching pressure **pB** depending on the transmission electronics. Switching pressure **pB** acts on the pressure return surface supporting the return spring. This limits the maximum switching pressure **pB** to a specified value. In an inactive condition, a preload valve prevents the switching element from running empty.
- Pressure regulator D **18**
The proportional solenoid actuates pressure regulator D **18** where main pressure **pHD** is applied. The proportional valve sets the switching pressure **pD** depending on the control current of the transmission electronics. Switching pressure **pFD** acts on the first pressure return surface supporting the return spring. This limits the maximum switching pressure **pD** to a specified value.
- Pressure regulator E **19**
The proportional solenoid actuates pressure regulator E **19** where main pressure **pHD** is applied. The proportional valve sets the switching pressure **pE** depending on the transmission electronics. Switching pressure **pE** acts on the pressure return surface supporting the return spring. This limits the maximum switching pressure **pE** to a specified value by feeding the excess oil into the sump. A by-pass at the main pressure valve 6 prevents pressure drop in the torque converter and guarantees the minimum oil quantity required for lubrication at the same time.
- Pressure regulator F **20**
The proportional solenoid actuates pressure regulator F **20** where main pressure **pHD** is applied. The proportional valve sets the switching pressure **pF** depending on the transmission electronics. Switching pressure **pF** acts on the pressure return surface supporting the return spring. This limits the maximum switching pressure **pF** to a specified value.
- Change-over valve F/D **21**
Switching pressure pF acts on the activating face of the change-over valve F/D **21**. Starting with a specified switching pressure **pF**, the change-over valve F/D **21** switches. Thus, piston surface F2 is switched on in the switching element F. Pressure regulator D **18** is switched to a higher control range.
- Change-over valve D1/D2 **22**
Switching pressure **pD** acts on the activating face of the change-over valve D1/D2 **22**. Starting with a specified switching pressure **pD**, the change-over valve D1/D2 **22** switches. Thus, the piston surface **D2** is activated in the switching element **D**.

- Torque converter drain valve **23**
The drain valve **23** is activated by removing the oil drain plug at the oil pan. Thus, a part of the oil in the torque converter is also drained when draining the transmission oil.
- Retarder pressure regulator **10**, retarder control valve **11**
The proportional solenoid actuates the retarder pressure regulator **10** where main pressure **pHD** is applied. The proportional valve sets the pilot pressure **pRR3** depending on the control current of the transmission electronics. The pilot pressure **pRR3** acts on the ruled surface of the retarder control valve **11** and thus determines the **pR3** main pressure level. The level of the retarder control pressure **pR3** determines the retarder effect. The retarder control pressure acts on the pressure return surface supporting the return spring. This limits the maximum retarder control pressure **pR3** to a specified value.
- Lubrication pressure valve **9**, cooler change-over switching valve **13**, cooler change-over valve **14**
(in the case of inactive retarder)
The retarder pressure regulator **10**, the retarder control valve **11**, and the cooler-change over switching valve **13** are non-pressurized. Via the cooler change-over switching valve **13**, main pressure **pHD** is transferred to the controlled surface of the cooler change-over valve **14**. The cooler change-over valve **14** is connected through. Coming from the converter back-pressure valve **8**, the oil **D4** reaches the retarder heat exchanger **27** via the cooler switch valve **14**. Coming from the retarder heat exchanger **27**, the oil reaches the transmission heat exchanger **26** via the cooler switch valve **14**. Subsequently, the cooled oil flows into the transmission for lubrication. Lubricating pressure is limited to a specified value by the lubricating pressure valve **9** by feeding the excess oil into the sump. A by-pass at the main pressure valve **6** helps prevent a pressure drop in the torque converter and guarantees the minimum oil quantity required for lubrication at the same time.
- Lubricating pressure valve **9**, cooler change-over switching valve **13**, cooler change-over valve **14**
(in the case of inactive retarder)
Retarder pilot pressure **pRR3** acts on the activating face of the cooler change-over switching valve **13**, which is deactivated when main pressure **pHD** on the activating face of the cooler change-over valve **14** reaches a specified value. The cooler change-over valve **14** is switched by spring force. From the converter counter-pressure valve **8**, the oil **D4** flows through the cooler change-over valve **14** to the transmission heat exchanger. Subsequently, the cooled oil flows into the transmission for lubrication. Lubricating pressure is limited to a specified value by the lubricating pressure valve **9** by feeding the excess oil into the sump. A by-pass at the main pressure valve **6** helps prevent a pressure drop in the torque converter and guarantees the minimum oil quantity required for lubrication at the same time.

5 Annex

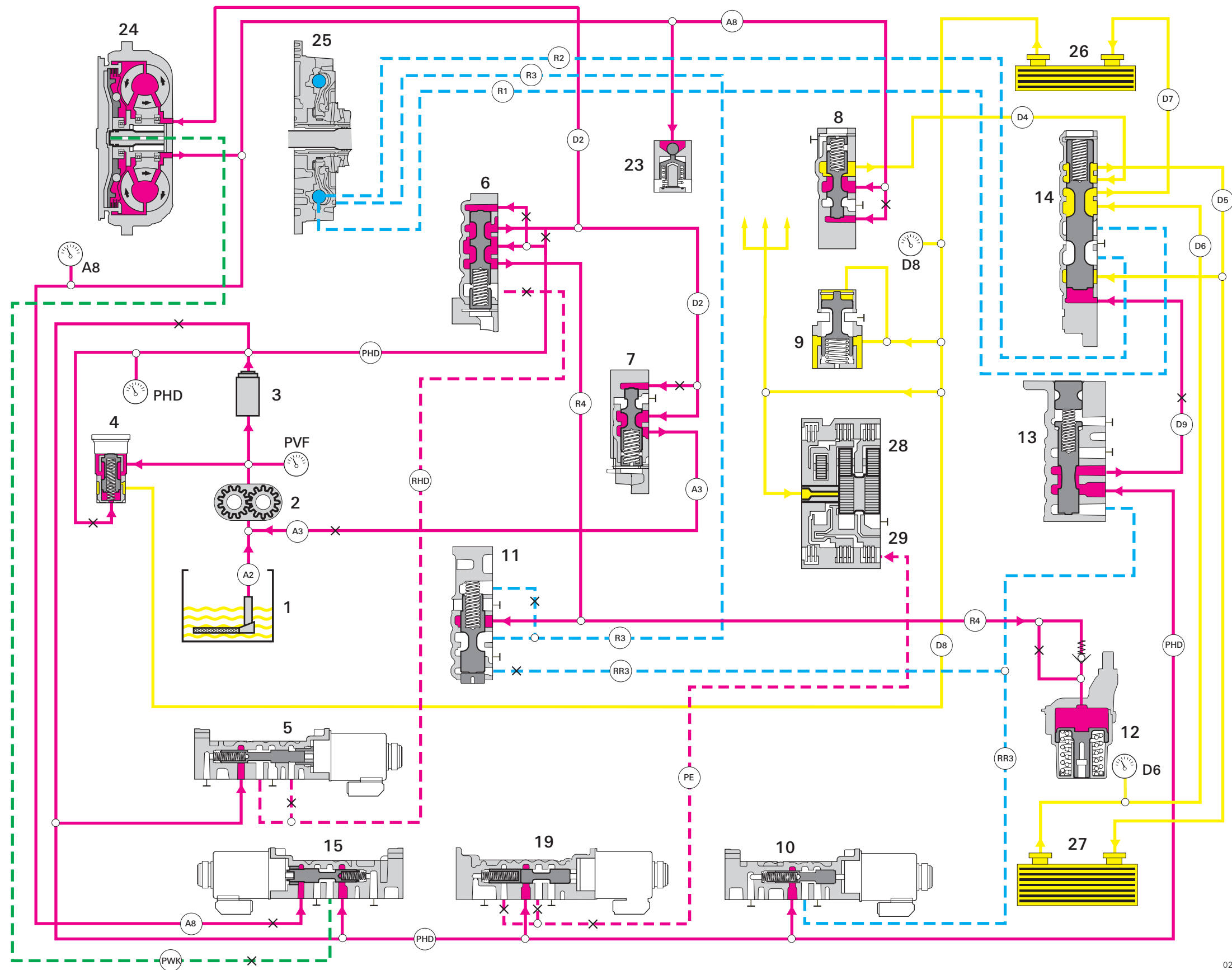
5.1 Overview of revisions

Index	Date of issue	Initiator	Chapter	Comments
a	2010-06	BKS-T	All chapters	complete revision
b	2011-10	TBCI	Preface	Tightening torques flanged hexagon bolt/screw with washer assembly
			1	Oil quantities
			2	Tightening torques flanged hexagon bolt/screw with washer assembly
		TMCC	4	Circuit diagram
c	2014-02	TUCI		CI cover page, CI back page, Copyright, Preface, Safety Instructions, Repair and Assembly Instructions Special tools: ZF-TESTMAN amended, 6008 001 021 omitted Ratios table: Added values for WTR [angle drive] Input speeds table: Added values for LHD
			1.1 / 1.3	Added lubricant class 20C
			1.2	Oil quantities (added special oil drain, VRM; updated WTR [angle drive])
			1.4	Added LHD; added electric
			1.4.4	Alternatives for normal vehicle operation omitted
			1.5 / 1.6	Added special oil drain, VRM
			2.1 / 2.3.10	Screw plug as of serial no. 344696 omitted
			2.3.2 / 2.3.9	Washer as of serial no. 300214 omitted
			2.3.4 / 2.3.7	Added molded hose variant Amended note on transmission connector cable routing
			2.5.3 / 2.5.4	Changed work step sequence (added screw loss protection section)
			2.6.1	Amended work steps
			2.6.2	Added a work step
			3.4	Complete revision
			4	Updated circuit diagram, connection diagram, and hydraulic diagram
			5 / 6	Added

6 Enclosed Documents

The documents enclosed are not subject to change management; they are for informational purposes only. Please turn to your contact if you need binding documents and drawings.

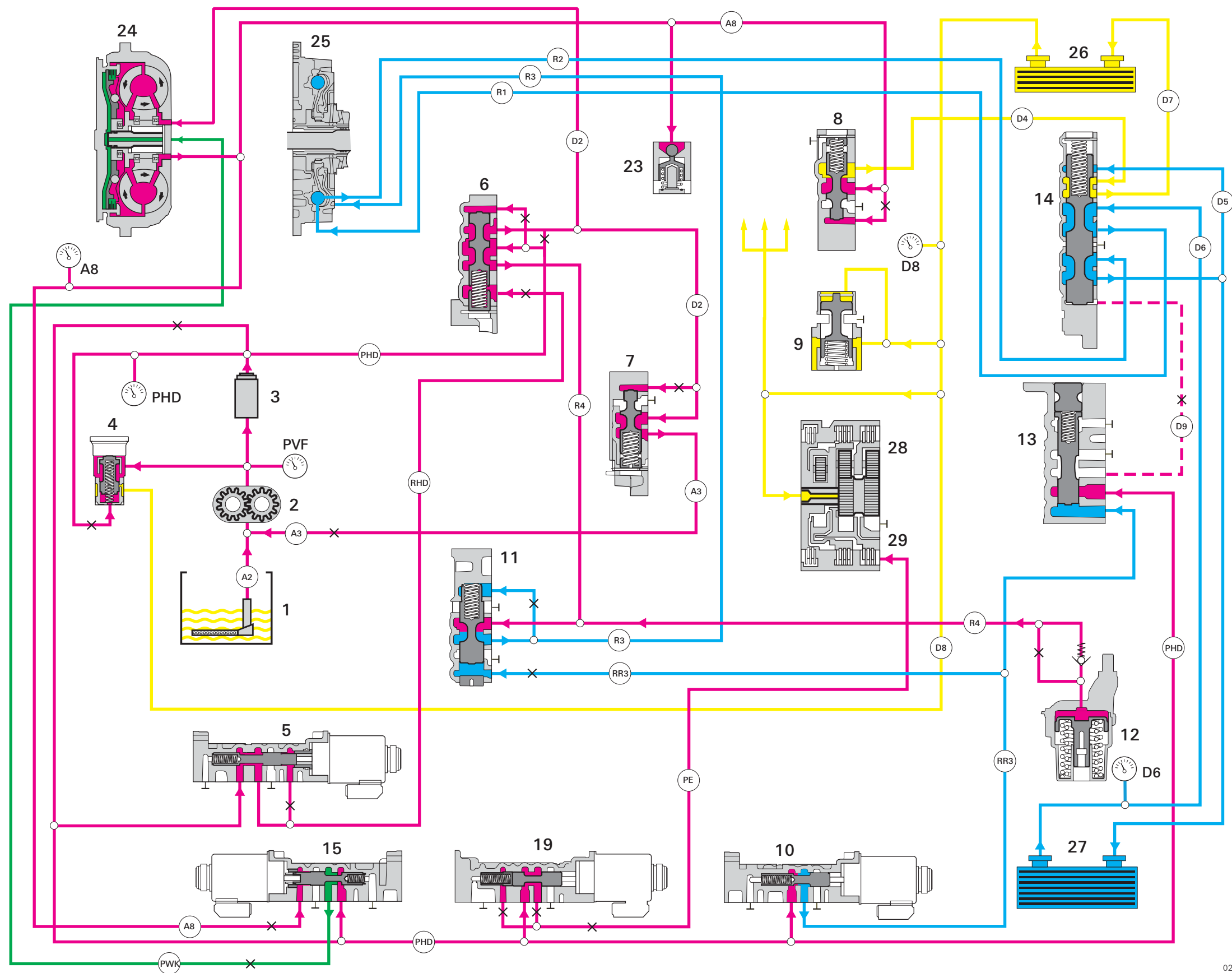
Document no.	Designation	Technical information
4181.753.101a	SD PDI EcoLife	Hydraulic 1 - Position opened
4181.753.102a	SD PDI EcoLife	Hydraulic 2 - Position locked



- 1 Suction strainer insert
- 2 Pump
- 3 Pressure filter
- 4 Filter bypass valve
- 5 Pressure regulator (RHD)
- 6 Main pressure valve (PHD)
- 7 Converter safety valve
- 8 Converter counter-pressure valve
- 9 Lubrication pressure
- 10 Pressure regulator retarder
- 11 Retarder control valve
- 12 Accumulator
- 13 Shift valve (KUV)
- 14 Cooler change-over valve (KUV)
- 15 Pressure regulator (WK)
- 16-20 Pressure regulator A, B, D, E, F
- 23 Torque converter drain valve
- 24 Torque converter
- 25 Retarder
- 26 Heat exchanger (TOC)
- 27 Heat exchanger (ROC)
- 28 Planet gear train
- 29 Clutches/Brakes A, B, D, E, F

029309_1

Subject to technical change without notice



- 1 Suction strainer insert
- 2 Pump
- 3 Pressure filter
- 4 Filter bypass valve
- 5 Pressure regulator (RHD)
- 6 Main pressure valve (PHD)
- 7 Converter safety valve
- 8 Converter counter-pressure valve
- 9 Lubrication pressure
- 10 Pressure regulator retarder
- 11 Retarder control valve
- 12 Accumulator
- 13 Shift valve (KUV)
- 14 Cooler change-over valve (KUV)
- 15 Pressure regulator (WK)
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- 23 Torque converter drain valve
- 24 Torque converter
- 25 Retarder
- 26 Heat exchanger (TOC)
- 27 Heat exchanger (ROC)
- 28 Planet gear train
- 29 Clutches/Brakes A, B, D, E, F

029310_1

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