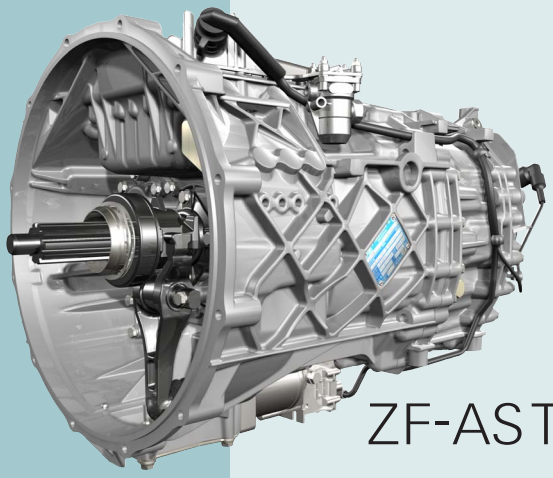
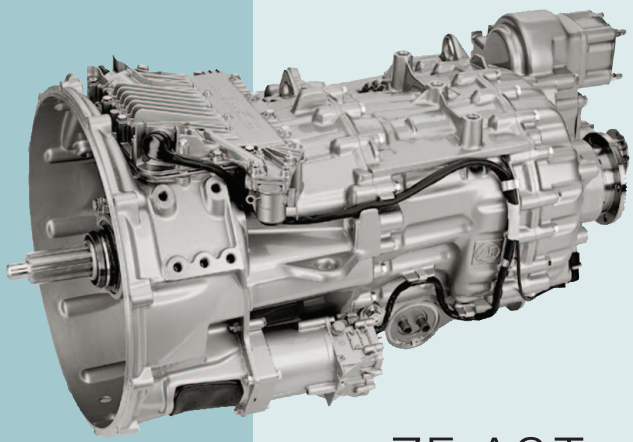
Technical Manual

for Installation, Function, and Initial Start-Up



ZF-AS Tronic



ZF-AS Tronic mid

1328 765 101g

Key

Item		Parameter	Possible interface problems in the event of non-compliance of specified limit values	Link / Resp. HB
	Mechanical interface			
1	Engine	Geometry of SAE 1		Chap. 4.1.7
		Torque arm		Chap. 4.1.8
		Bending and torsional vibration		Chap. 4.1.11 / 12
		Temperature		Chap.2 ff.
2	Transmission suspension	(optional)		Chap. 4.1.8
3	Output	Rotational irregularity	Engaging gears / Spline / Synchronizer unit	Chap. 4.1.10
		Nout max	Transmission damage, overspeed	2.2.3 ff.
4	Input shaft	Rotational irregularity	Engaging gears / Spline / Synchronizer unit	Chap. 4.1
		Minp max, Ninp max	Bearing damage / Gear damage	Chap. 2.2 ...
		Pilot bearing	Bearing damage in transm. / splitter group spline / transm. brake	Chap. 4.1.7
5	Clutch	Release forces / Travel	Clutch plate, release bearing, quality of setting off / gear shifting	Chap. 4.1.6
		Friction characteristics	Quality of setting off / gear shifting	Chap. 4.1.5
		Inertia torque	Transmission brake, splitter group synchronizer unit	Chap. 4.1.5
		Geometry	Collision	Chap. 4.1.6
	Electronic interface			
6	Transmission actuator	Connector on vehicle	See integration FMEA	Chap. 4.4.2 ff.
		Wiring	See integration FMEA	Chap. 4.1.17 / 18
		Accessibility	Additional costs for warranty are not reimbursed	Chap. 4.1.16
6a	Vehicle-CAN signal interface	Engine messages	See integration FMEA	Chap. 4.4.8
		ABS/EBS messages	See integration FMEA	
		Onboard computer / PTO messages	See integration FMEA	
		Speedo messages	See integration FMEA	
		Display messages	See integration FMEA	
		Diagnosis messages	Diagnosis capability	
		Speed range selector messages	See integration FMEA	
		CAN hardware interface	See integration FMEA	Chap. 4.4.4
6b	ZF-CAN signal interface	Messages ZF selector lever, ZF range selector module / ZF extension module	See integration FMEA	Agreement with ZF
		Interface / Application / testing	BUS use of capacity	
6c	K-LINE signal interface	Diagnosis messages	Diagnosis capability	Chap. 3.5 ff.
7	Neutral switch	Nominal voltage 24 V	Starter interlock or other vehicle functions	Chap. 4.4.7.1
8	Speedometer	Tachograph	Sensor selection	Chap. 4.4.7.2
	Pneumatic interface			
9	Transmission actuator	Pressure	Air pressure too low, cable cross-section too small, pneumatic boiler too small, no non-return valve, see integration FMEA	Chap. 4.5
10	Clutch actuator	Air quality	Dirt results in failure	
	Additional interface			
11	Heat exchanger	optional		Chap. 4.2.4
	Bypass valve			
12	ZF PTO (optional)	ZF Power Take Off Units (PTOs)		Chap. 2.5.2
		Connector on vehicle		Chap. 2.4.1.2 / Chap. 2.4.2.2
		Compressed air connection		Chap. 4.1.17 / Chap. 4.5
13	Transmission bleeding		Oil change interval, synchronizer damage / Corrosion / Water ingress (corrosion)	Chap. 4.3.7
	Ambient condition			
14	Oil	Approved oil grades	Cooling / Water / Bearing / Spline	Chap. 4.3 ff.
15	Corrosion protection			Chap. 4.7.3
16	Water (not fordable)			Chap. 4.1.15
17	Temperature			Chap. 4.2 ff.

2.2.5 Trucks Product Family 1: Technical Data 12-Speed / Overdrive

Number of forward gears:		12
Number of reverse gears:		2
Length in mm:		840
Ratio range:	Forwards	10.37 - 0.81
	Reverse	10.56 - 8.58

max. input torque (traction/coasting)*:	1 200 Nm / 840 Nm[1)]
Input speed:	max. 2 650 rpm (traction) max. 2 800 rpm (coasting)
Oil volume (in liters):	approx. 7.8
Weight:	185 kg**

Center of gravity: Refer to installation drawing (Section 4.1.1)

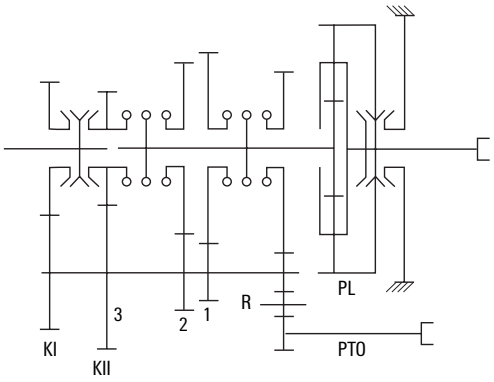
* Approximate value: Depends on type of vehicle and vehicle data as well as the prevailing operating conditions.
** Without peripherals, oil fill, PTOs, clutch, release fork, release shaft, release bearing, push rod, and clutch actuator. Weight: Release fork, release shaft, release bearing, push rod, and clutch actuator approx. 10 kg.
1) Under development: 1 200 Nm coasting torque.

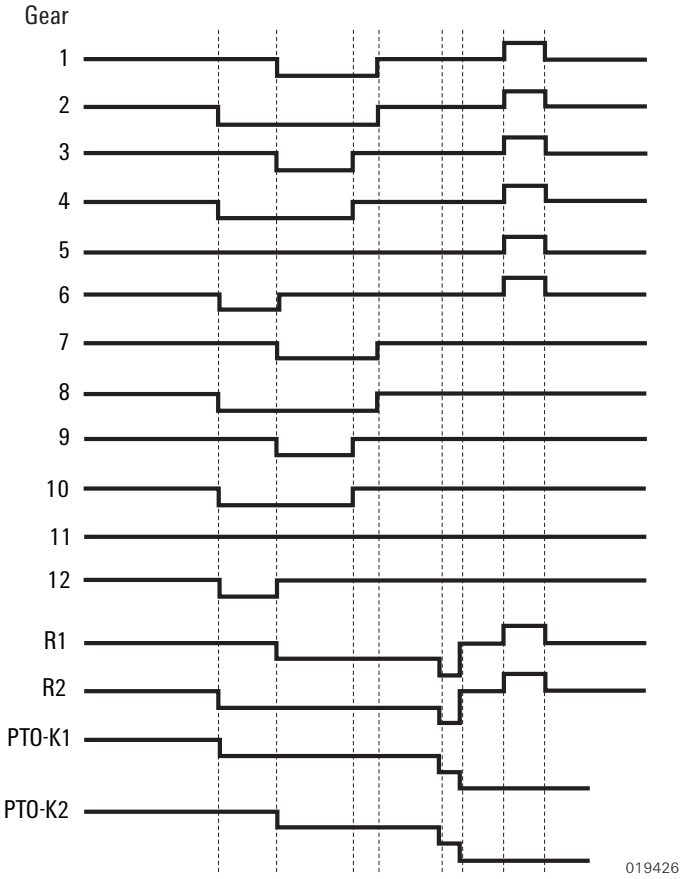
12-speed / overdrive

Gear	Ratio i	Gear ratio step	Inertia torque [1)] kgm²
1.	10.369		0.084
		1.230	
2.	8.428		0.108
		1.299	
3.	6.487		0.091
		1.230	
4.	5.273		0.118
		1.261	
5.	4.182		0.107
		1.230	
6.	3.399		0.143
		1.371	
7.	2.480		0.116
		1.230	
8.	2.015		0.156
		1.299	
9.	1.551		0.172
		1.230	
10.	1.261		0.241
		1.261	
11.	1.000		0.302
		1.230	
12.	0.813		0.437
R1	10.561		0.084
		1.230	
R2	8.584		0.107
N K1	–	–	0.105
N K2	–	–	0.075

1) Values relate to input end.

Powerflow diagram





2.2.15 BUS:
Technical Data 10-Speed / Direct Drive

Number of forward gears:		10
Number of reverse gears:		1
Length in mm:		898
Ratio range:	Forwards	9.59 - 1.0
	Reverse	11.41

max. input torque (traction/coasting)*:	2 000 - 2 700 Nm
Input speed:	max. 2 500 rpm (traction) max. 2 800 rpm (coasting)
Oil volume (in liters):	approx. 12 / approx. 21 (with Intarder)
Weight:	240 kg**

Center of gravity: Refer to installation drawing (Section 4.1.1)

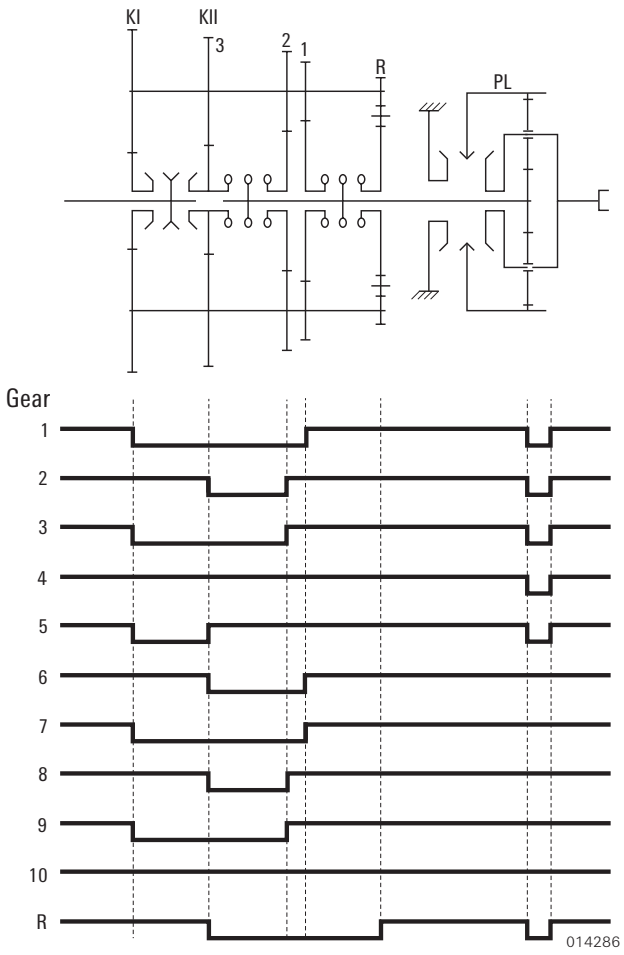
* Approximate value: Depends on type of vehicle and vehicle data as well as the prevailing operating conditions.
** Without peripherals, oil fill, Intarder, clutch, release fork, release shaft, release bearing, push rod, and clutch actuator. Weight: Release fork, release shaft, release bearing, push rod, and clutch actuator approx. 10 kg.

10-speed bus / direct drive

Gear	Ratio i	Gear ratio step	Inertia torque [1] kgm²
1.	9.590		0.186
		1.290	
2.	7.435		0.123
		1.285	
3.	5.784		0.195
		1.267	
4.	4.565		0.137
		1.285	
5.	3.552		0.218
		1.316	
6.	2.700		0.155
		1.285	
7.	2.101		0.247
		1.290	
8.	1.629		0.225
		1.285	
9.	1.267		0.362
		1.267	
10.	1.000		0.406
R	11.413		
N K1	–	–	0.181
N K2	–	–	0.115

1) Values relate to input end.

Powerflow diagram



2.5 Auxiliaries

2.5.1 Intarder

The Intarder is a hydrodynamic and therefore zero-wear transmission brake. Transmission of product families 3 and 4 and bus transmissions can be supplied with a ZF-Intarder.
The ZF-Intarder is not available for product families 1 and 2.

2.5.1.1 General

An overview of the system concept, structure, function, operating elements, function variants, periphery and safety functions, as well as installation and diagnosis information can be found in technical manual (order no. 6085 765 104).

– *A separate technical manual is available for the ZF-Intarder (order no. 6085 765 104 / CD 6085 766 104).*

2.5.1.2 Mechanical Interface

The Intarder is integrated in the ZF-AS Tronic transmission. The Intarder can only be retrofitted by converting the transmission. At the point of ordering the ZF-AS Tronic transmission, a decision must therefore be made regarding the additional delivery of an Intarder.

The installation of the SAE 1 flange in relation to the output flange is the same as with the ZF-AS Tronic without Intarder attachment.

– *The installation position of the transmission can be found in the standard installation drawings (refer to Section 4.1).*

Electronics supplied with the Intarder are housed in the dry area of the vehicle (e.g. driver's cab).

– *More information can be found in the ZF-Intarder technical manual order no. 6085 765 104.*

2.5.1.3 Oil Grade and Oil Fill

The Intarder and ZF-AS Tronic transmission share a common oil supply. The therefore increased oil volumes can be found in the Intarder technical manual (order no. 6085 765 104).

The ZF-AS Tronic with integrated Intarder may only be filled with the oils approved in List of Lubricants TE-ML 02.

– *List of Lubricants TE-ML 02 (refer to Section 4.3) provides information about the precise oil specification as well as the oil change intervals.*

2.5.1.4 Coolant Connection

An oil-water heat exchanger is fitted to the Intarder. This has to be included in the engine cooling water circuit.

– *More information can be found in the ZF-Intarder technical manual order no. 6085 765 104.*

2.5.1.5 Pneumatic Interface

The air connection for the ZF-Intarder may either be provided via the air reservoir of the ZF-AS Tronic transmission *(refer to Section 4.5)* or via a separate connection on the air reservoir for auxiliary consumers.

– *Refer to information provided in the ZF-Intarder technical manual order no. 6085 765 104.*

3.1.4 Gear Selection during Travel

During travel, a shift can be triggered automatically by the automatic drive program, or manually by the driver. The general shift processes of upshifts and downshifts are described in the next two sections.

3.1.4.1 Upshifts

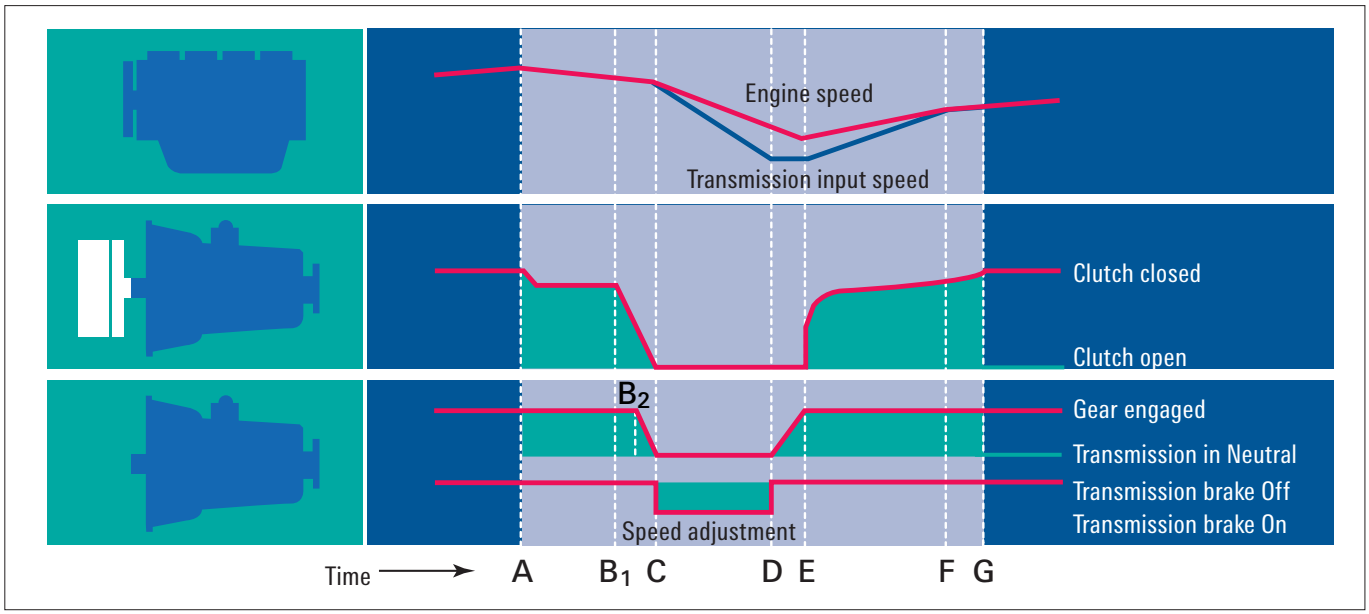


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Fig. 3.3

A → B_1	Partial opening of clutch and at the same time reduction in load by reducing the fuel injection volume.
B_1 → C	Rapid, complete opening of clutch once load reduction is complete.
B_2 → C	The transmission actuator deselects the present gear.
C	Sensors report “transmission in Neutral”.
C → D	Activation of transmission brake to adapt speed between transmission shift elements.
D	Deactivation of transmission brake once minimum difference in speed of transmission shift elements is reached.
D → E	Transmission actuator selects new gear.
E → F	The clutch closes again in parallel to the build-up of load.
F → G	Once clutch has closed completely, the shift procedure is complete.

3.3 ZF-AS Tronic Malfunction Concept

3.3.1 Principles

The ZF-AS Tronic is an automatic system, which unlike conventional driveline components, takes on all or some of the processes controlled by the driver. In some instances, responsibility for these processes passes from the driver to the system. In order to fully satisfy this level of responsibility, the ZF-AS Tronic transmission system has been subjected to a state-of-the-art technical system error analysis.

3.3.2 System Analyses Undertaken

- Risk analysis as defined in DIN V 19250
- Error tree analysis
- System FMEA
- Design FMEA
- Integration FMEA (part of the application)

Previously defined vehicle responses (commonly referred to as TOP EVENTS) which take various driving modes into consideration formed the starting point for analyzing conceivable malfunctions resulting from faults or errors occurring during correct system usage. The risk analysis as defined in DIN V 19250 resulted in requirement class 4 for the ZF-AS Tronic transmission system under unfavorable circumstances.

The following were defined as safe nominal statuses to be aimed for in the event of an error, depending on the driving mode:

- “driveline closed” during travel
- “driveline open” with vehicle at a standstill

The electronic system must have at least partial function for these nominal statuses to be set. If this is no longer the case, the system stabilizes in the present operating mode (failsafe mode).

The following were identified as safety-related malfunctions as defined in VDI/ VDE 3542 Page 1 in the risk analysis:

- Automatic setting off
- Setting off in opposite direction of travel
- Blocked driveline during travel

Errors which does not result in the aforementioned vehicle characteristics, affect the correct function of the ZF-AS Tronic and therefore vehicle reliability and availability.

The system responses to simple errors are described in a malfunction specification written specifically for the relevant application. Since the vehicle manufacturer is responsible for the interaction of all systems integrated in the vehicle (also in the event of error), the error responses of the ZF-AS Tronic are discussed and agreed upon with the manufacturer as part of a vehicle integrations FMEA. During this process, vehicle-related errors which can act on the ZF-AS Tronic are included in the analysis.

During development of the system, up-to-date quality assurance methods and tools have been and are being applied in accordance with state-of-the art technology. The function and service life of the mechanical and pneumatic components are designed accordingly and investigated through the use of tests.

System checks are carried out before and during operations so that redundancies and error protection systems are available if required. The avoidance of safety-related malfunction is reliably reached in individual instances. Attempts are made to achieve maximum possible vehicle availability for these individual instances when defining failure responses. Vehicle availability is not usually provided in instances of accidental multiple failure which cannot be systematically covered by the system. In such instances, the system is switched into the aforementioned nominal status. If it is no longer technically possible for the nominal status to be set, the last system status is retained.

4 Installation

4.1 Transmission Installation Investigation

4.1.1 Standard Transmission Installation Drawings

Trucks

- 12-speed product family 1 (SAE1) 1336 600 019
- 12-speed product family (SAE2) 1336 600 020
- 12-speed product family 2 (SAE1) 1336 600 021
- 12-speed product family 2 (SAE2) 1336 600 022
- 12-speed product family 3 without Intarder 1327 600 015
- 16-speed product family 3 without Intarder and 12-speed product family 4 without Intarder 1328 600 015
- Product families 3 and 4 without Intarder with heat exchanger 1328 600 038
- 12-speed product family 3 with Intarder (rear left heat exchanger) 1327 600 016
- 16-speed product family 3 with Intarder 12-speed product family 4 with Intarder (rear left heat exchanger) 1328 600 016

Buses

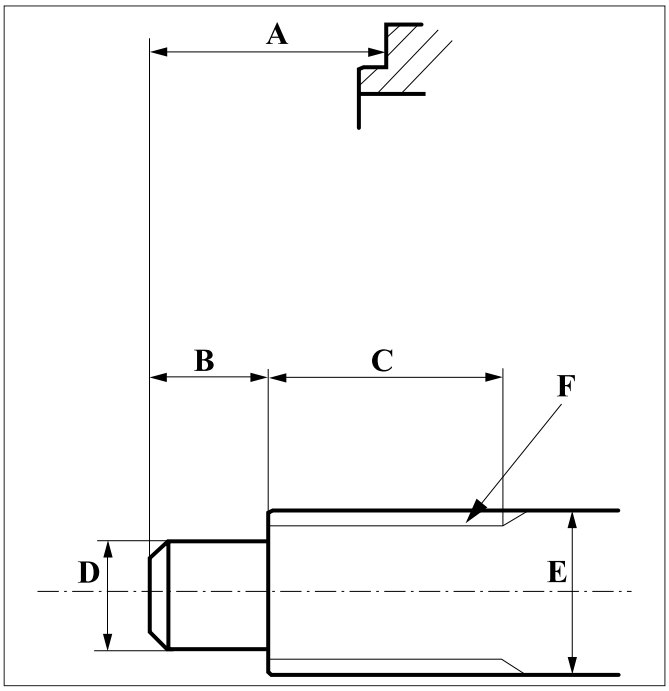
- 10-speed with Intarder 12-speed with Intarder (rear right heat exchanger) 1327 600 007

4.1.2 PTO + Emergency Steering Pump Installation Drawings*

- Product families 1+2 with NM AS/10 6091 611 001
- Product families 1+2 with NM AS/PL 6091 618 001
- Product families 1+2 with NH/1 6090 601 045
- Product families 1+2 with NH/4 6090 604 036
- Product families 3+ 4 with NAS/10 6091 610 003
- Product families 3+ 4 with NAS/PL 6091 615 007
- Product families 3 + 4 with NH/1 6090 601 031
- Product families 3 + 4 with NH/4 6090 604 024

* part list-related installation drawing is produced if required

4.1.3 Input Shafts



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Measurements of standard shaft:

Dimension	Engine connection SAE 1 [PF 1+2]	Engine connection SAE 1 [PF 3+4]	Engine connection SAE 2 [PF 1+2]
A	109 mm		107 mm
B	32 mm	31.75 mm	27 mm
C	75 mm	102.3 mm	75 mm
Ø D	25 f7 mm		25 f7 mm
Ø E	50.3 mm		44 mm
F	SAE 10 C 2“		SAE 10 C 1¾“

Other input shafts can be supplied at additional cost.

Permissible resultant deflection angle per joint.

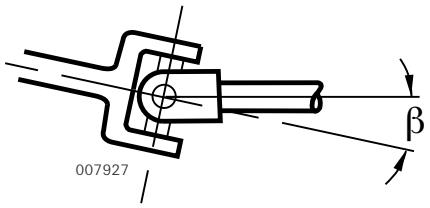
The resultant angle β_R must first be determined for spatial propshaft layouts using the following formula:

$$\tan \beta_R = \sqrt{\tan^2 \beta_H + \tan^2 \beta_V}$$

with β_H -deflection angle in horizontal view (outline view level),

with β_V -deflection angle in vertical view (elevation view level).

Here, the deflection angle β is defined as the angle between the rotary axles in front of and behind joint in the relevant level.



As a rough estimate, the angle β_R can also be determined from the diagram in Fig. 4.9.

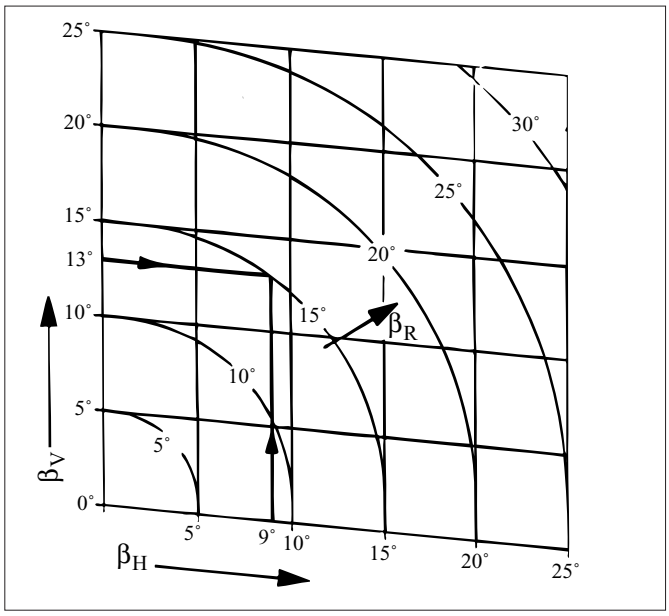


Fig. 4.9 Resultant deflection angle β_R for spatial propshaft arrangement

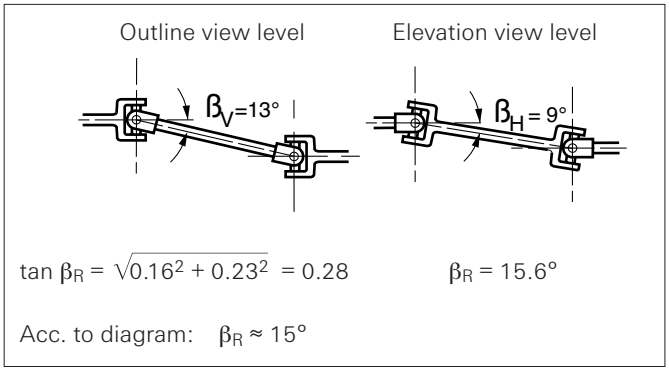


Fig. 4.10 Examples of calculations

The reliability of β_R depends on the type, size and speed of the propshaft, refer to Fig. 4.11.

CAUTION
For PTOs, the permissible deflection angle β_R must not exceed 7°.

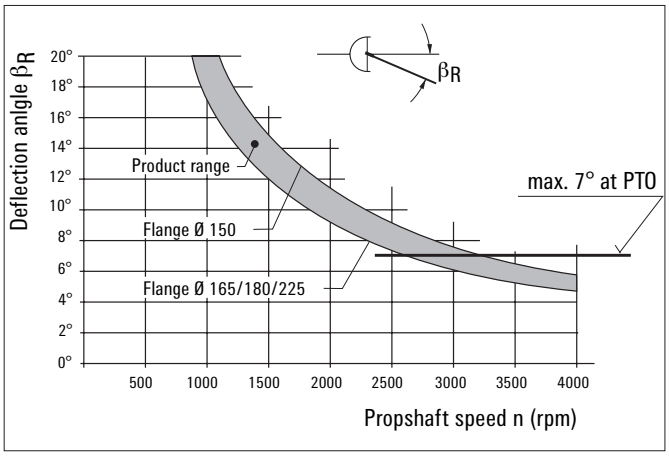


Fig. 4.11 Permissible propshaft deflection angle β_R

4.3 Filling With Oil

4.3.1 Oil Grade and Oil Change Interval

The ZF-AS Tronic transmission is supplied with an oil fill as standard.

The oil change intervals are co-ordinated to the relevant oil qualities (refer to TE-ML 02).
We recommend that you use "ZF-Ecofluid M".

– *Approved oils and the oil change intervals gained with them can be found in the most recent version of List of Lubricants TE-ML 02 (ZF no. 1205 754 102).*

4.3.2 Oil Fill Quantity

Correctly filling the oil is essential to the precise oil volume when changing oil (refer to Chapter 4.3.4). The volumes given in this table are only guidelines.

When a PTO or heat exchanger (PF 3+4) is fitted, the oil quantity in the transmission increases.

– *Reference is made to the oil volumes required in the installation drawings, the technical manual for the Intarder (ZF no. 6085 765 104) and the type sheets for PTOs (ZF no. 1328 757 151 and 1336 757 151).*

Oil quantities for ZF-ASTronic and ZF-ASTronic mid

Non-Intarder transmission	Initial fill or after repair (dry transmission)	Oil change or oil fill at OEM
All information is approximate information in liters.		
Product family 1	7,8	7,5
Product family 2	9,3	9
Product family 3 12-speed	12	11
Product family 3 16-speed	13	12
Product family 4 16-speed	13	12
Bus 10 and 12-speed	12	11

For oil fill quantities concerning **transmissions with Intarder**, refer to ZF-Intarder technical manual. Order no. 6085 765 104

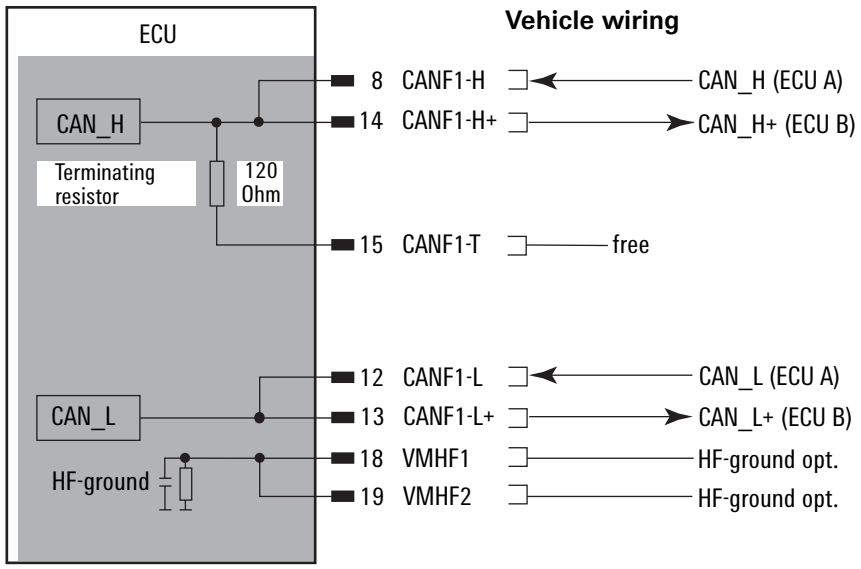


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Fig. 4.22 Transmission electronics as CAN BUS central consumer

4.4.5 Quality Requirements of Wiring

A distinction is made between two fundamental installation situations.

1. Wiring which is routed in the cab and/or in the vehicle frame.
2. Wiring which is routed on the ZF unit and/or directly next to the unit or engine. More stringent requirements apply here in terms of temperature, mechanical properties, resistance to media.

– *If the cable from the power supply connector (on the transmission actuator) is produced by the vehicle manufacturer, then technical customer information TKI 6029 705 003 should be noted.*

Routing and securing

Wiring in the vehicle should be routed so it

a) is not damaged

b) can be accessed at any time

The wiring should be routed and secured in a protected part of the vehicle. The cable must be secured at a maximum of 20 cm downstream of the transmission power supply connector. Loose hanging wiring is not permitted.

The connectors must not be tightened down too firmly. Ensure that the connectors and mating connectors are compatible and snapped in.

Also ensure that there are no relative movements, e.g. between vehicle frame and transmission, which damage the wiring.

The securing material must be selected ensuring that the wiring is neither squashed nor damaged or pre-damaged in any way.

CAUTION
A sufficient distance should be maintained from sources of heat, such as exhaust, heat exchanger etc. and/or thermal protection should be fitted.

– *Other techn. requirements can be found in TKI 6029 705 003.*

4.7.7 Delivery Check

– *A form is available for the delivery check.*

The ZF-Testman pro diagnosis tool (refer to Section 3.5) assists the delivery check process by means of special test stages:

- Testing while vehicle is stationary.
- Testing during test run.
- Interrogation of error memory.

Agreement should be reached on ZF training the assembly staff by the start of production.

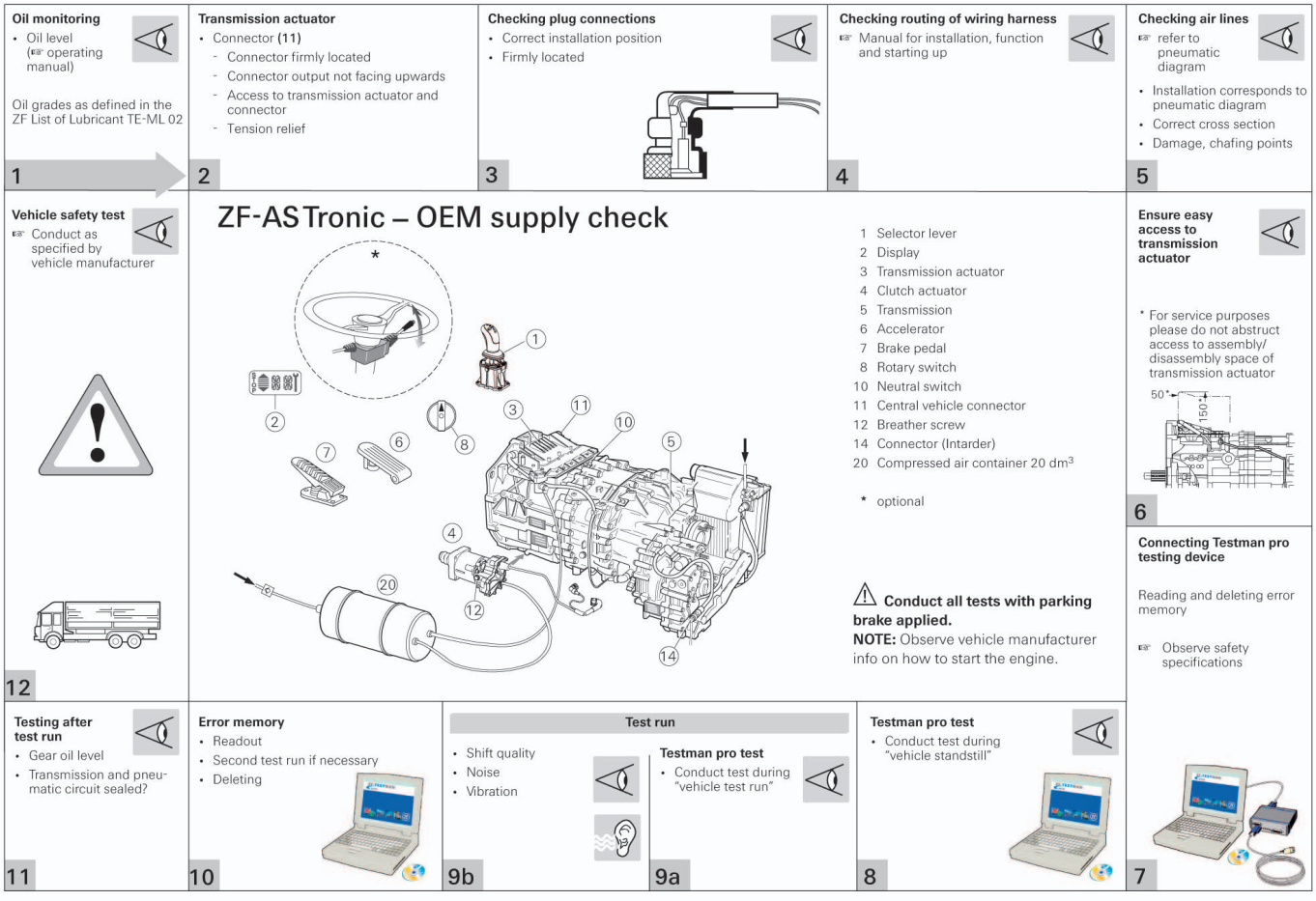

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Fig. 4.25 Form OEM supply check

4.9 Application and Documentation

4.9.1 Application

In the ZF-AS Tronic transmission system, the individual components (vehicle, engine, clutch, transmission, ECUs, drive program, etc.) are finely tuned to one another.

The system components are defined as part of the application and documented in a customer specification (*form 1328 755 001*). The customer specification is used in the application process

- to specify the parts list,
- to document the important application stages (e.g. FMEA, agreements on safety concept, malfunction responses) and
- system-interfaces (e.g. CAN).

The customer specification is confirmed by the customer and is the basis for application approval by ZF.

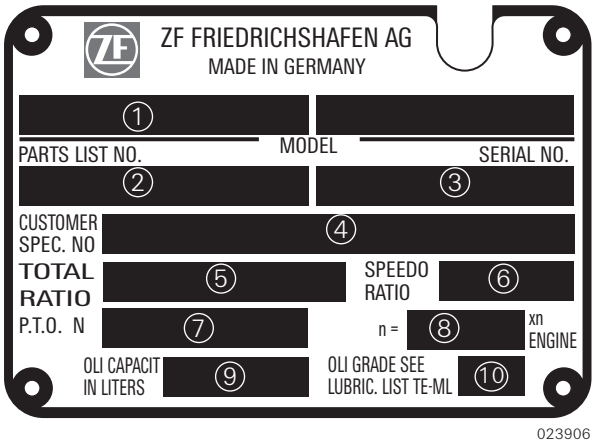
In order to prevent installation approval being revoked as a result of system-related modifications, modifications which impact on the transmission system have to be clarified early on with ZF.

4.9.2 ZF Documentation

The scope of supply is defined with the customer using the customer specification and documented in the ZF parts list. The parts list is available as computer extract.

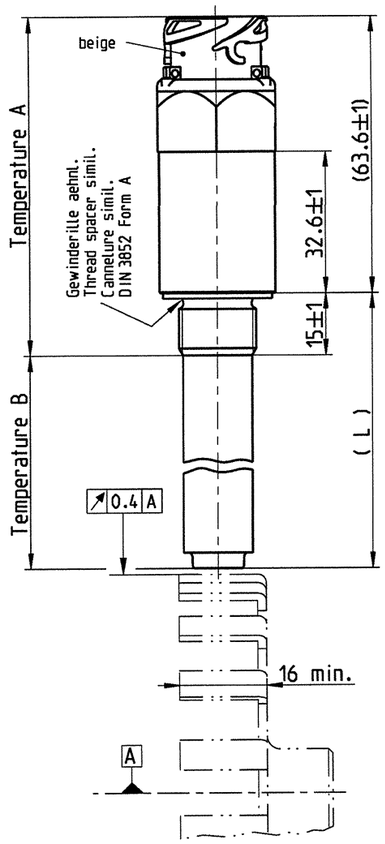
CAUTION
Before installation, always use the parts list number to check from the type plates whether the engine, transmission, and electronic control unit components correspond with the documentation. In other words, whether they match the details on the computer extract.
For correspondence and queries, always specify the parts list number and serial number of your ZF-AS Tronic (refer to type plate)!

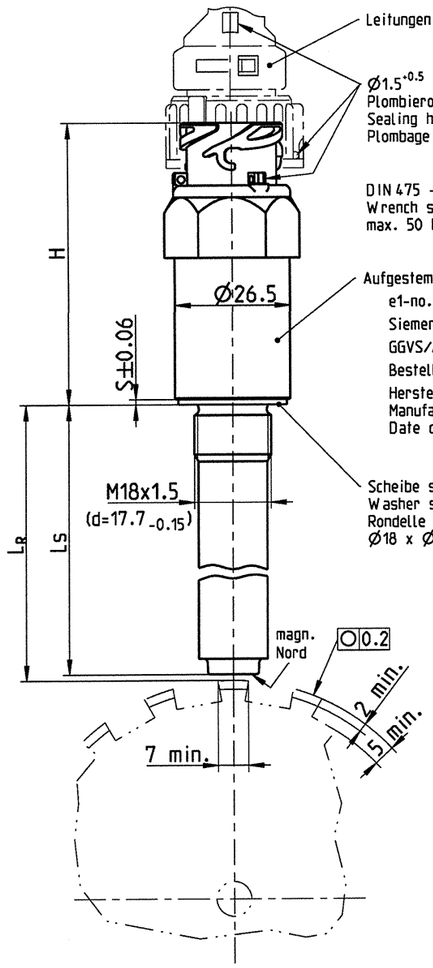
4.9.3 Type Plate



1 = Transmission type with number of gears
2 = Parts list no. of transmission
3 = Serial no. of transmission
4 = Customer order no., if known to ZF
5 = Transmission ratio
6 = Tachometer ratio [pulse/rev.]
7 = PTO type
8 = PTO ratio
9 = Approx. oil volume for initial fill
10 = Name of ZF List of Lubricant

Anschluss / Connection / Connexion
ISO 15170 - B1-4.1-Ag/K3





Leitungen / Cables

Ø1.5 +0.5
Plombieroesen zu Leitung und Fahrzeug
Sealing holes to cable and vehicle
Plombage sur cable et vehicule

DIN 475 - SW 27-1
Wrench size / Ouverture 27 mm
max. 50 Nm

Aufgestempelt / Stamped / Marque :
e1-no.
Siemens VDO Automotive AG Villingen
GGVS/ADR-No.
Bestell-Nr./Reference Version (VX.X)
Herstelldatum codiert (JJM)
Manufact. date coded (YYM)
Date de fabric. chiffree (AAM)

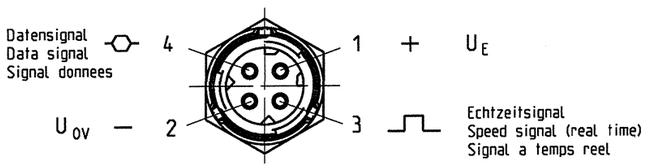
Scheibe s. Tabelle, unverlierbar
Washer see table, unlosable
Rondelle voir tableau, imperdable
Ø18 x Ø25 - St

Impulsrad
Werkstoff z.B. DC04 (=St4)
Luecke min. 1.5 x Stegbreite
Ueberdeckung Rad/Geber 100%

Impulse wheel
Material e.g. DC04 (=St4)
Gap min. 1.5 x tooth width
Overlap wheel/sensor 100%

Roue d'impulsions
Materiau p.e. DC04 (=St4)
Espace min. 1.5 x largeur de la dent
Recouvrement roue/generateur 100%

Installationsabweichungen muessen von Siemens VDO freigegeben werden
Divergent installations must be approved by Siemens VDO
Des installations divergentes doivent etre approuvees par Siemens VDO



Technische Daten / Technical Data / Donnees techniques

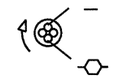
Spezifikation GGVS/ADR-Nr. e1-Nr.	Specification ADR-no. e1-no.	Specification ADR-no. e1-no.
		ISO 16844-3 (Motion sensor interface) Ex II2G EEx ib IIC T4 CE 0032 TÜV 02 ATEX 1842 X e1 023434 e1 175
Gehaeuse / Oberflaeche Deckel Betriebsspannung U_E Stromaufnahme Anschluss Frequenz (Echtzeitsignal)	Case / surface Cap Operating voltage U_E Current consumption Connection Frequency (real time signal)	Boitier / surface Couvercle Tension de service U_E Consommation de courant Connexion Frequence (signal a temps reel)
Stahl - Steel - Acier / Fe/Zn 12 C X5CrNiMo17-12-2 6.5 ... 9 V max. 15 mA massefrei / ground insulated / sans masse 1 ... 2000 Hz		
Betriebstemperatur A Betriebstemperatur B Lagertemperatur A Lagertemperatur B	Operating temperature A Operating temperature B Storage temperature A Storage temperature B	Temperature de service A Temperature de service B Temperature de stockage A Temperature de stockage B
-30°C ... +135°C / +120°C ADR (T4/part 4) -30°C ... +145°C / +120°C ADR (T4/part 4) -40°C ... +140°C -40°C ... +150°C		
Schutzart Dichtheit (Bereich L) * Schwingfestigkeit Ausgaenge kurzschlussfest Einstrahlfestigkeit Stoerspannungsschutz	Protection Tightness (range L) Vibration resistance Outputs short circuit protection Protection against irradiation Noise voltage protection	Protection Etancheite (zone L) Resistance aux vibrations Sorties resist. aux courts-circuits Resistance contre l'irradiation Compatibilite electromagnetique
EN 60529 - IP67+IP69K 0.5 bar Oel/Oil/Huile, 120°C, 100 h 30 g 28 V, 1 min (25°C) DIN 40839 T4 (100 V/m) DIN 40839 T1+T2 ueber/over/par TCO, T3 (T1-T3 Schaerfegrad IV)		
Nicht einsetzbar bei magn. Fremdfeldern > 2 mT	Not to be used in case of ext. magnetic fields > 2mT	Non utilisable en cas de champs magnetiques ext. > 2mT

KITAS 2171 funktioniert mit den TCO-Typen MTCO 1324 oder DTCO 1381. Nach erster Koppelung kein Typwechsel mehr moeglich!
KITAS 2171 works with the TCO types MTCO 1324 or DTCO 1381. After first pairing change of type not possible anymore!
KITAS 2171 fonctionne avec les types TCO MTCO 1324 ou DTCO 1381. Apres premiere connexion changement de type n'est plus possible!

* Schockfestigkeit: 1 000 g / 200 000 Schocks
Resonanzfrequenz 3 000 - 7 000 Hz
(von ZF ermittelt mit Getriebe 16S-151 SFA)

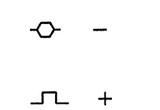
Leitung / Cable

Sternvierer
Spiral-4 quad



oder
or
ou

Paarig verseilt
Twisted pair / cable (2x2):



Schlaglaenge / Turn of cable / Vrillage:

max. 66 mm (=min 15 rev/m)	max. 40 mm (=min 25 rev/m)

Techn. Anhang / Technical appendix:
2171.70.002.00 EAD 001 (English)
2171.70.002.00 EAD 000 (Deutsch)

ADR installation:

Fuer GGVS/ADR-Einsatz Installations-Anleitung beachten :
For use in ADR-vehicles observe installation instructions :
o Pour emploi en ADR-vehicules a observer instr. d'install. :

MTCO 1324:	DTCO 1381:
TD00.1324.0162102 -English-	TD00.1381.0011002
TD00.1324.0162101 -Deutsch-	TD00.1381.0011001

(ZF-Zeichnungsnummer: 0501 214 767)

LR ±0.6	Ls +0.31 -0.16	(L)	Scheibe Washer Rondelle	H ±1	Bestell-Nr. Reference	(VDO-int. No.)	Gewicht Weight Poids	ZF-No. old	ZF-No.
137.0	135.6	136.8	1.2	64.8	2171.20 00 26 00	(2171.01.208.01)	177 g	~~0501 213 673~~	0501 214 773
90.2	88.8	90	1.2	64.8	2171.20 00 22 00	(2171.01.205.01)	147 g	~~0501 213 669~~	0501 214 769
63.4	62.0	63.2	1.2	64.8	2171.20 00 24 00	(2171.01.204.01)	130 g	~~0501 213 671~~	0501 214 771
64.6	63.2		---	63.6	2171.20 00 02 00	(2171.01.210.01)	128 g		
35.2	33.8	35	1.2	64.8	2171.20 00 25 00	(2171.01.203.01)	113 g	~~0501 213 672~~	0501 214 772
25.2	23.8	25	1.2	64.8	2171.20 00 23 00	(2171.01.202.01)	108 g	~~0501 213 670~~	0501 214 770
26.4	25.0		---	63.6	2171.20 00 01 00	(2171.01.209.01)	105 g		
19.4	18.0	19.8	1.8	65.4	2171.20 00 61 00	(2171.01.213.01)	107 g		
20.0	18.6		1.2	64.8	2171.20 00 21 00	(2171.01.201.01)	106 g	~~0501 213 668~~	0501 214 768

General tolerance ISO 2768-c
( ) Auxiliary dimension DIN 406 - 10
[ ] Unfinished dimension DIN 406 - 10 ✓
Theoretical dimension ISO 1101
Surface quality ISO 1302
Part edges ISO 13715
Tolerances DIN 7167

-	-	-	-
Datum *Date*	**Name** *Name*	**Aend.Nr.** *Mod.No.*	**Dokumentversion** *Document version*

Aenderungen / *Modifications*

Bemerkung *Remark*
Kpl. Sammelzeichnung

☒ **Fremdteildokumentation nach ZFN 903** *BOP documentation acc. to ZFN 903*

☐ **Kundenbestellzeichnung** *Customer's order drawing*

Benennung *Description*
IMPULSGEBER
PULSE SENSOR

Blatt / *Sheet* 1 **von** / *of* 1

04-11-23 **Freigabe-Datum** *Release date*
Colas M. **Unterschrift** *Signature*
ZF Friedrichshafen AG

Materialnummer *Item number* 0501 214 767
Materialversion *Item version*
Dokumentnummer *Document number* 0501 214 767
DIN A2

Document version	Previous version	Changed items	Change description (including number)
AA	-	-	ECM 2171.0410150 New

Diese Information ist lediglich eine technische Beschreibung des Produktes. Sie stellt keine Beschaffenheits- oder Haltbarkeitsgarantie im Sinne des Paragraphen 443 BGB dar.
This information is exclusively a technical description of the products. It is not meant or intends to be a special guarantee for a particular quality or durability with regard to section 443 BGB (German Civil Code).

Dimensions in millimetres
3D-Model VIL_2171-01-204-01_010.AA.0.developed.ASSEM
Drawing VIL_2171-92-201-01.AA.sap_released
Scale 1:1

	Date	Department
Designed by sigrid.albert@siemens.com	2004-10-15	SV I CV PD TS
Released by horst.plankenhorn@siemens.com	2004-10-15	SV I CV PD TS

SIEMENS VDO Automotive

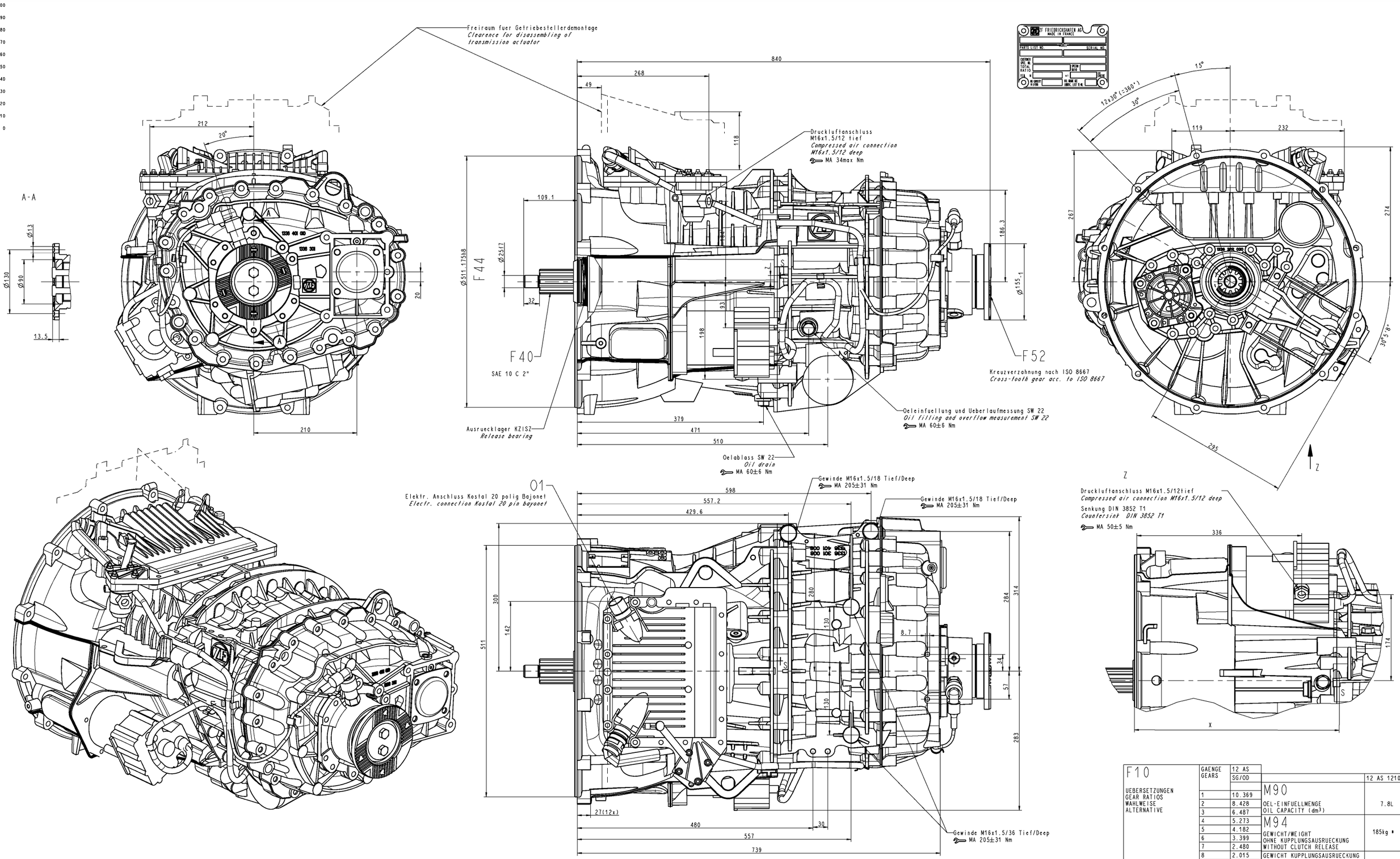
Designation
sensor KITAS 2171.20, customer dwg. (ZF)
Geber KITAS 2171.20, Kundenzeichnung (ZF)

Document key
2171.92.201.01 DRW 000 AA

Pages 1 of 1

Siemens VDO Automotive AG Villingen

CAD-System: PROE 2001 A2 : 2003-08



F10	GAENGE GEARS	12 AS SG/OD		12 AS 1210 TO
UEBERSETZUNGEN GEAR RATIOS WAHLWEISE ALTERNATIVE	1	10.369	M90	
	2	8.428	OEL-EINFUELLMENGE OIL CAPACITY (dm³)	7.8L
	3	6.487	M94	
	4	5.273	GEWICHT/WEIGHT OHNE KUPPLUNGSAUSRUECKUNG WITHOUT CLUTCH RELEASE	185kg *
	5	4.182		
	6	3.399		
	7	2.480		
	8	2.015	GEWICHT KUPPLUNGSAUSRUECKUNG (KUPPLUNGSTELLER+ GABEL+AUSRUECKLAGER) WEIGHT CLUTCH RELEASE (CLUTCH ACTUATOR+FORK+ RELEASE BEARING)	CA. 10kg
	9	1.551		
	10	1.261		
	11	1.00		
	12	0.813		
	R1	10.561		
	R2	8.584		

* Ohne Oelfuellung und ohne Nebenaggregate
Without oil fill and without auxiliary units

01

20 POL KOSTAL STIFT 20 PINS PIN SIDE

Modell vereinfacht dargestellt.
Nicht bemasste Bohrungen sind unverbindlich und koennen jederzeit entfallen.
Description of model simplified.
Undimensioned holes are not obligatory and may be omitted.

SCHWERPUNKT S CENTER OF GRAVITY	UM DIE ACHSE AROUND AXIS	TRAEGHEITSMOMENTE INERTIA TORQUE
12 AS 1210 TO		12 AS 1210 TO
419.2mm	X	3.59 kgm2
20.7mm	Y	9.98 kgm2
12.9mm	Z	10.37 kgm2

Technisches Handbuch beachten
Note technical manual

Dat.	05-11-17	05-11-21	-	-	-	-	-	-	-	Masse Mass kg	
Name	SCHEIN	LECOULTR	---	---	---	---	06-03-08	STETT	-	a	
	Bearb. Drawn	Konstr. Design	Funkt. Funct.	Norm Stand.	Fertig. Prod.	Vers. Teeth	Aend.Datum Mod.date	Name Name	Aend.Nr. Mod.No.	Dok.vers. Doc.vers.	

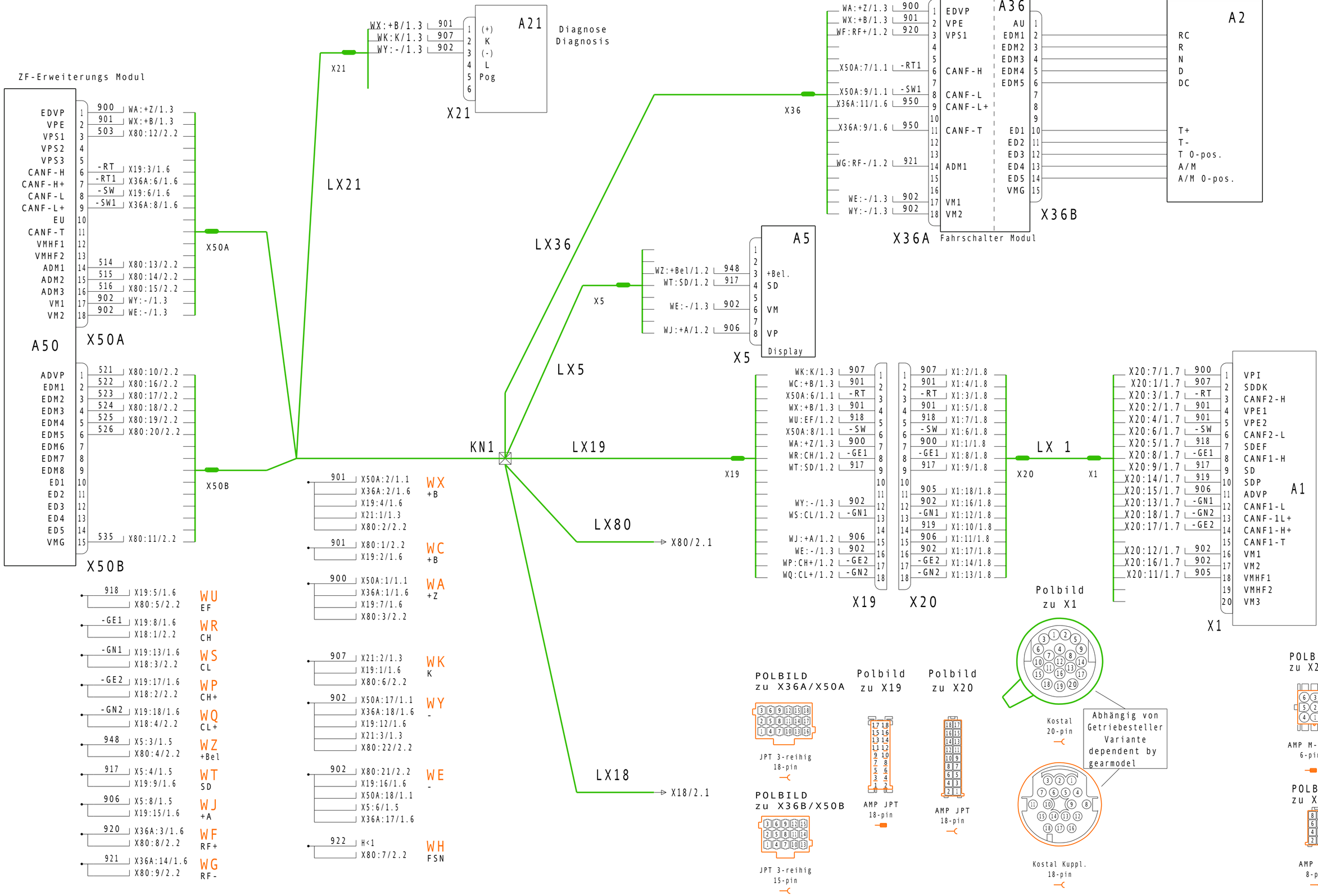
ZF Friedrichshafen AG

Technische Information
Technical information
AS 1210 SAE1 VERTRIEB
OHNE/WITHOUT NA

Benennung
Description
SCHALTGETRIEBE
GEARBOX

Achnl.Dokum.Nr. *Similar docu. no.* ---
CAD-System *CAD system* PRO/E
Rohteilnummer *Casting/forging No.* ---
Blatt *Sheet* 1 von *of* 1
Materialnummer *Item number* ---
Maßstab *Scale* 2:5
Dokumentnummer *Document number* 1336_600_019_INS001
DIN A0

abgeleitet von: 1336.600.019.INS001 EASSEM3



Ind.	Anz.	Nummer	Datum	Name			
					Bearbeit. *Drawn*	17.01.06	MOLLNAU
					Konstr. *Design*	17.01.06	MOLLNAU

Änderungen / *Modifications*

Techn. Information *Technical Information*
AS 2 Standart LKW

Ähnl. Zeichnung *Similar Draw.*

Benennung / *Description*
ANSCHLUSSPLAN
CONNECTION DIAG.

Zeichnungs-Nr. *Drawing-No.*
6029.713.158 __

ZF Friedrichshafen AG

Ind.	Blatt / *Sheet*	von / *of*	DIN
	1	2	2