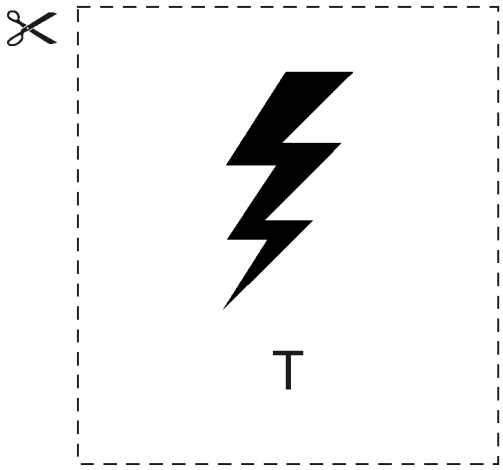


Electrical System

Common-rail Injection System EDC7

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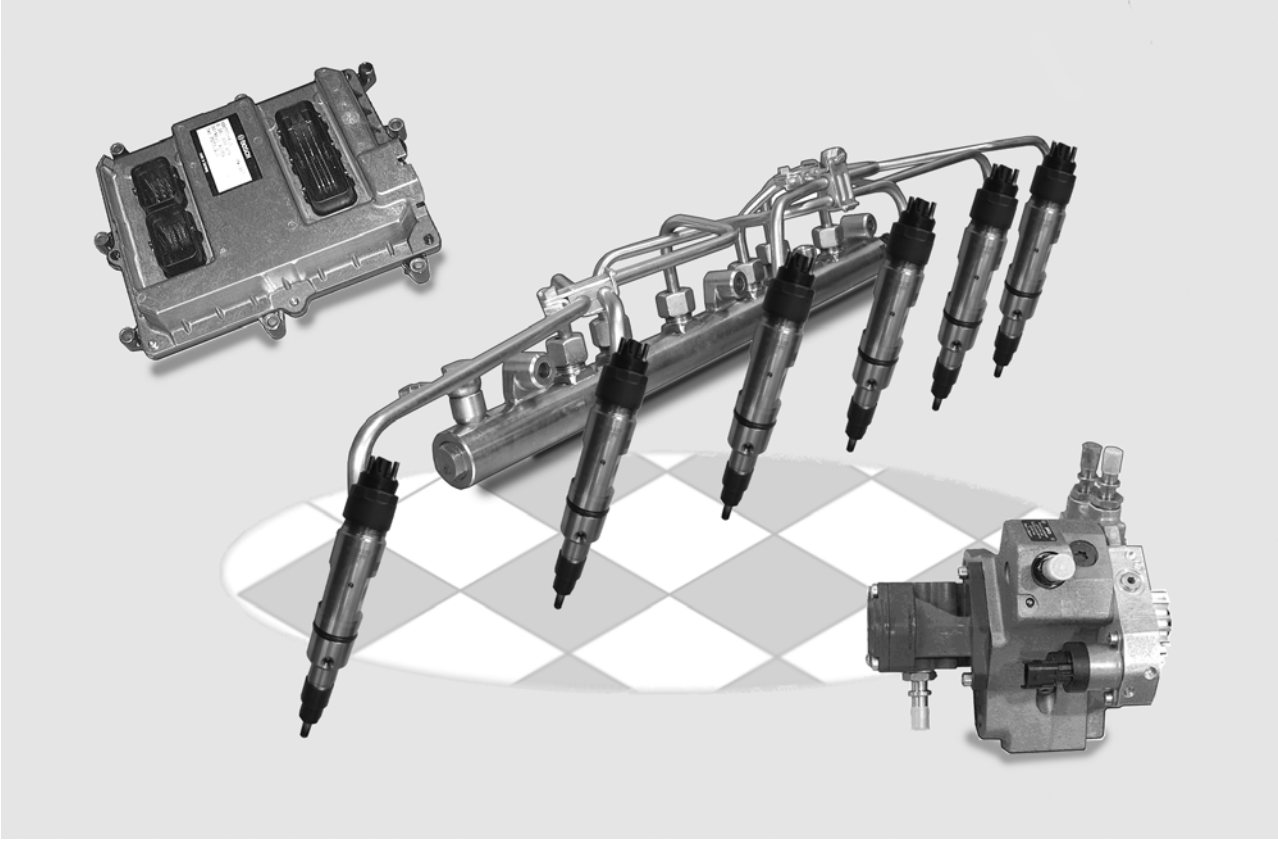
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Electrical System

Common-rail Injection System
EDC7



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PREFACE

This repair manual is intended to provide assistance in performing repairs correctly on vehicles and units. The technical details were correct at the time of going to press.

This publication assumes that persons who use it possess the requisite technical knowledge in handling vehicles and units.

Pictures and the corresponding descriptions are typical one-time representations; they do not always correspond to the unit or peripherals in question, but this does not mean they are incorrect. In such cases, plan and carry out the repair work in accordance with the sense of the instructions.

Repair work on complex add-on units should be entrusted to our customer service or to the customer service of the manufacturing company. Special reference is made to these units in the text.

Important instructions relating to safety and accident prevention are specially highlighted in the text as follows.



CAUTION
Type and source of danger
Refers to working and operating procedures which must be followed exactly in order to avoid exposing people to risk.



WARNING
Type and source of danger
Refers to working and operating procedures which must be followed exactly in order to avoid serious or irreparable damage to property.



Note
Explanatory description to aid understanding of the working and operating procedures involved.

Comply with general safety regulations when performing any repair work.

Best wishes from

MAN Nutzfahrzeuge AG

PRINTER'S IMPRINT

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Abbreviations

A

a	Acceleration
ABE	General certification
ABS	Anti-lock Braking System
ABV	Anti-skid system
AC	Air Conditioning
ACC	Adaptive Cruise Control
ACK	Acknowledge
ADC	Analogue-Digital Converter
ADR	European agreement for cross-border transport of dangerous goods by road (French title: Accord européen relatif au transport international des marchandises Dangereuses par Route)
AGB	Automatic road speed limiter
AGND	Analogue Ground
AGR	Exhaust Gas Recirculation (EGR)
AHK	Trailer coupling
AHV	Trailer brake valve
ALB	Automatic load balancing
AMA	Antenna mast system
AMR	Anisotrop Magneto Resistive
ANH	Trailer / semitrailer
AS	Automatic gearbox
ASD	Trailer socket
ASM	Trailer control module
ASR	Anti-spin regulator (traction control)
ASV	Trailer control valve
ATC	Automatic Temperature Control
ATF	Automatic Transmission Fluid
AU	Statutory exhaust emission test
AV	Exhaust valve
AVS	Automatic gear preselection

B

BA	Operator's manual
BBA	Service brake system
BBV	Service brake valve
BITE	Built-In Test Equipment
BKR	Brake power regulator
BUGH	Front heater
BV	Backup valve
BVA	Brake wear indicator
BVS	Brake wear sensor
BVV	Brake wear sensor supply
BW	German Army
BWG	Brake power sensor
BZ	Brake cylinder

C

CAN	Controller Area Network
CAN-H	CAN-high data line
CAN-L	CAN-low data line
CATS	Computer-assisted testing and diagnostic system
CBU	Central Brake Unit
CDC	Continuous Damping Control
CCVS	Cruise control vehicle speed
CKD	Completely Knocked Down
CNG	Compressed Natural Gas
CPU	Central Processing Unit
CRT	Continuously Regenerating Trap (exhaust muffler, two-way catalytic converter, diesel particulate filter)
CRC	Cyclic Redundancy Check

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CS Comfort Shift

D

DAHL Roof ventilator
DBR Auxiliary brake relay
DCU Dosing Control Unit (for AdBlue)
DF Speed sensor
DFÜ Data transmission
DIA Diagnosis and information display
DIAG Diagnosis, entire vehicle
DIAG - MUX Diagnosis, entire vehicle – central computer, Multiplex (buses and coaches only)
DIAK Diagnosis, K-line (data line)
DIAL Diagnosis, L-line (interrogation line)
DIAR Diagnosis, further interrogation
DIN German industrial standard
DKE Throttle valve increase (ASR control)
DKH Roof duct heating
DKL Roof flaps
DKR Throttle valve reduction (reduction request from ASR to EDC/EMS)
DKV Throttle valve specification (load sensor signal from pedal value sensor, EDC/EMS)
DLB Compressed air brake system
DM Diagnostic Message
DNR Drive Neutral Reverse (selector lever switch for automatic)
DPF Diesel particulate filter
DRM Pressure control module
DRS Rotational speed sensor
DS Pressure sensor
DSV Pressure control valve
DTC Diagnostic Trouble Code (OBD fault code)
DTCO Digital tachograph
DV Throttle valve
DWA Anti-theft warning system
DZG Speed sensor
DZM Rev counter

E

EBS Electronic brake system
ECAM Electronically Controlled Air Management
ECAS Electronically Controlled Air Suspension
ECE Emergency shut-off to ECE 36
ECU Electronic Control Unit
EDC Electronic Diesel Control
EDC S Electronic Diesel Control Slave
EDM Electronic diesel consumption meter
EDR Maximum speed governor
EEC Electronic engine controller
EEPROM Electrically erasable and programmable read-only memory
EFR Electronic shock absorber control
EFS Electric driver's seat
EHAB Electro-hydraulic shut-off device
ELAB Electrical shut-off device
ELF Electronically controlled air suspension
EMS Electronic throttle control (ETC)
EMV Electromagnetic compatibility (EMC)
EOL End-of-line (programming)
EP Injection pump
ER Engine retarder (engine brake)
ESAC Electronic Shock Absorber Control
ESP Electronic Stability Program
ESR Electric sun-blind

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EST	Electronic control unit
EV	Intake valve
EVB	Exhaust Valve Brake

F

FAP	Driver's area
FAQ	Frequently Asked Questions
FBA	Parking brake system
FBM	Pedal brake module
FDR	Vehicle dynamics control
FDF	Vehicle data file
FFR	Vehicle management computer
FGB	Road speed limiter (RSL)
FGR	Road speed governor (RSG)
FHS	Cab
FIN	Vehicle identification number (17 digits)
FM	Vehicle management
FMI	Failure mode identification
FMS	Fleet Management Standard (global telematics standard)
FMR	Vehicle/engine management
FOC	Front Omnibus Chassis (bus/coach chassis with front-mounted engine)
FSCH	Windscreen heater
FSG	Ground reinforcement system
FSH	Window/mirror heating
FTW	Driver's partition
FUNK	Radio communication unit
FZA	Destination system
FZNR	Vehicle number (7 digits)

G

GDK	Closed-loop diesel catalyst
GEN	Alternator
GET	Gearbox
GGVS	European agreement for cross-border transport of dangerous goods by road (French abbreviation: ADR)
GND	Ground
GP	Gearbox planetary gear group (range-change box)
GS	Gearbox control
GV	Gearbox splitter gear group (splitter box)

H

HA	Rear axle
HBA	Auxiliary brake system
HD-OBD	Heavy Duty On-Board Diagnosis
HDS	Urea dosing system
HGB	Maximum road speed limiter
HGS	Hydraulic gearshift
HLUE	Hydrostatic fan
HOC	Rear Omnibus Chassis (bus/coach chassis with rear-mounted engine)
HSS	Highside switch
HST	Main switchboard
HU	Main inspection
HYD	Hydronic auxiliary heater
HYDRIVE	Hydrostatic front axle drive
HYDRO	MAN Hydro Drive
HVA	Hydrostatic front axle drive
Hz	Hertz (number of cycles per second)
HZA	Bus stop indicator system
HZG	Auxiliary speed sensor

I

IBEL	Interior lighting

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IBIS Integrated on-board information system
IC Integrated Circuit
ID Identification
IMR Integrated mechanical relay (starter control)
INA Information indicator (e.g. check lamp)
INST Instrumentation
IR Individual control (ABS)
IRM Modified individual control (ABS)
ISO International Standards Organisation
IWZ Incremental angle/time measuring system

K
KBZ Combination brake cylinder
KFH Fuel filter heater
KITAS Kienzle intelligent tachograph sensor
KLI Air-conditioning system
KNEEL Kneeling
KSM Customer-specified control module (control unit for external data exchange)
KSW Customer's special request
KWP Key Word Protocol (protocol for MAN-cats diagnosis KWP 2000)

L
LBH Air reservoir
LCD Liquid Crystal Display
LDA Manifold-pressure compensator (boost control)
LDF Charge-pressure sensor
LDS Air spring/damper system
LED Light emitting diode
LF Air suspension
LGS Lane Guard System
LL Idling speed
LLA Idling speed increase
LLR Idling speed control
LNA Steering trailing axle
LNG Liquefied Natural Gas
LOE Steering oil monitor
LPG Liquefied Petroleum Gas
LSVA Distance-based heavy vehicle toll
LWR Headlight beam regulator
LWS Steering angle sensor

M
M-TCO Modular EU tachograph
MAB Solenoid valve shut-off (engine shut-off by high-pressure solenoid valve in injection pump)
MAN- cats MAN computer-assisted testing and diagnostic system
MAR Solenoid valve shut-off relay (redundant engine shut-off relay)
MDB Engine speed range
MES Fuel quantity actuator
ML Midline
MMI Man-machine interface
MOTB Engine brake
MP Motor power box (cable duct on engine block)
MR Engine governor - ASR
MSG Engine control unit (EDC)
MUX Central computer, Multiplex (bus/coach only)
MV Solenoid valve
MZ Diaphragm cylinder

N
n Speed
NA Power take-off (PTO)
NBF Needle movement sensor

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NES	New electronic structure
NFZ	Commercial vehicles
NLA	Trailing axle
NOx	Nitrogen oxides
NSL	Rear fog lamp
NSW	Fog lamps

O

OBD	On-Board Diagnosis
OBDU	Onboard Diagnostic Unit (subsystem of central on-board computer)
OC	Occurrence Count (frequency counter of a fault)
OEAB	Oil separator
OENF	Oil top-up

P

p	Pressure
P	Powertrain
PBM	Pulse Breadth Modulation (also see PWM)
P-Code	Powertrain code (fault code)
PDF	Particulate Diesel Filter
PLM	Programmable Logic Module
PM-Kat	Particulate matter catalytic converter
PSC	Pneumatic Supply Controller – Replacement for ECAM
PSG	Pump control unit (EDC)
PTM	Powertrain manager (replacement for FFR)
PTO	Power take-off
PWG	Pedal value sensor
PWM	Pulse Width Modulation (also see PBM)

R

RA	Repair manual
RAH	Interior heating
RAM	Random Access Memory
RAS	Rear Axle Steering
RAS-EC	Rear Axle Steering with Electronic Control
RDRA	Tyre pressure control system
RDS	Radio Data System
RET	Retarder
RET P	Primary retarder
RET S	Secondary retarder
RKL	Priority vehicle light
RKS	Tyre monitoring system – replaced by TPM
RLV	Relay valve
RME	Rape seed oil methyl ester (biodiesel)
ROM	Read Only Memory

S

SA	Special equipment
SAE	Society of Automotive Engineers
SAMT	Semi-automatic mechanical transmission
SB	Service outlet
SBW-RA	Steer By Wire Rear Axle (electronically controlled steering trailing axle)
SCR	Selective Catalytic Reduction
sec	Second
SER	Standard
SG	Control unit
SH	Select-high control (ABS)
SKD	Semi Knocked Down
SL	Select-low control (ABS)
SML	Side marker lights
SPN	Suspect Parameter Number
STA	Engine start/stop

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SWR	Headlight cleaning system

T

t	Time
TBM	On-board telematics module
TC	Traction Control
TCM	Trailer Control Module
TCO	Tachograph (MTCO, DTCO, TSU etc.)
TCU	Transmission Control Unit
TEPS	Twin Electronic Platform Systems (bus/coach only)
TGA	Trucknology Generation A
TGL	Trucknology Generation Light
TGM	Trucknology Generation Mid
TKU	Technical customer document
TMC	Traffic Message Channel
TPM	Tyre Pressure Module
TRS	Technical road transport directive
TSC	Torque Speed Control (braking torque)
TSU	Tachograph Simulating Unit (vehicles without MTCO/DTCO)
TUER	Door control

U

U_{Bat}	Battery voltage
UDF	Conversion file
UDS	Crash recorder

V

v	Road speed
VA	Front axle
VDF	Vehicle data file
VG	Transfer case or reference to defence equipment standards
VLA	Leading axle
VSM	Transfer case lock management

W

WA	Maintenance Manual
WAB	Water separator
WaPu	Water pump Intarder
WLE	Swap-body unit
WR	Warning relay
WS	Position sensor
WSK	Torque converter and clutch unit

Z

z	Braking rate/deceleration
ZBR	Central on-board computer
ZBRO	Central on-board bus computer
ZDR	Intermediate speed governor (ISG)
ZE	Central electrical system
ZFR	Auxiliary vehicle computer
ZR	Central computer
ZS	Central lubrication
ZUSH	Auxiliary heater
ZWS	Time-based maintenance system
λ	Slip
μ	Coefficient of friction
μC	Microcontroller (microprocessor)

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INTRODUCTION

SAFETY INSTRUCTIONS

General information

Only trained personnel are allowed to perform operating, maintenance and repair work on trucks, buses and coaches.

The following sections include summaries of important regulations, listed according to major topics, which must be complied with. The intention is to provide the knowledge needed to avoid accidents which could lead to injury, damage and environmental pollution. Please note that these are merely brief extracts taken from various accident prevention regulations. Of course, all other safety regulations must be followed and the necessary measures must be taken.

Additional references to danger are contained in the instructions at points where there is a potential danger.

Accidents may happen in spite of all precautionary measures having been taken. In such an eventuality, obtain immediate medical assistance from a doctor. This is particularly important if the accident involves skin contact with corrosive acid, fuel penetration under the skin, scalding by hot oil, antifreeze spraying into eyes, crushing of limbs etc.

1. Regulations for preventing accidents leading to injury to personnel

Checking, setting and repair work

– Secure units during their removal.
– Support the frame when working on the pneumatic or spring suspension system.
– Keep units, ladders, stairs, steps and the surrounding area free from oil and grease.
– Only use tools that are in perfect condition.
– Only authorised technical personnel are entitled to perform inspection, adjustment and repair work.

Working on the brake system

– A dust extractor must be used if dust is released when working on the brake system.
– Perform visual, function and effectiveness checks on the brake system after carrying out any work on it whatsoever. These checks must be made in accordance with the safety inspection (SP).
– Check the function of ABS/ASR systems using a suitable test system (e.g. MAN-cats).
– Collect any brake fluid that leaks out.
– Brake fluid is poisonous! Do not allow it to come into contact with food or open wounds.
– Treat hydraulic fluid/brake fluid as hazardous waste!
Comply with the safety regulations for preventing environmental pollution.

Working on vehicles with compressed natural gas (CNG) system

– Vehicles with a defective compressed natural gas system may not be brought into the workshop. This also applies to vehicles whose engine cannot be switched off by automatic emptying of the removal lines.
– When working on vehicles with a compressed natural gas system, set up a gas warning device above the vehicle roof and in the engine compartment above the pressure controller. Further gas warning devices must be carried by the persons working on the vehicle.
– Smoking is not allowed in areas where work on vehicles with compressed natural gas systems is carried out. All sources of ignition must be removed from these areas.
– Before carrying out welding work, the compressed gas tanks must be removed and the gas-carrying lines must be flushed with inert gas.
– Compressed gas tanks are only allowed to be exposed to temperatures up to 60° C in paint-drying booths. If the temperatures are any higher, the compressed gas tanks must be removed or degassed using an inert gas such as nitrogen. The gas-carrying lines must also be flushed with inert gas.

Working on the compressed natural gas (CNG) system

– Work on the compressed natural gas system may only be carried out by persons who have been specifically trained to do so.
– The working area for the compressed natural gas system must be equipped with an adequate ventilation system. The ventilation system must replace the air in the room with new air at least three times per hour.
– After exchanging standard-fit components of the compressed natural gas system using the prescribed procedures, check the assembly points for leaks. Perform these checks using leak indicator spray or a gas warning device.

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Engine operation
– Only authorised personnel are permitted to start and operate an engine.
– Do not approach moving parts of a running engine too closely and do not wear baggy clothing. Use an extractor system if working in enclosed spaces.
– Danger of burns when working on engines at operating temperature.
– Danger of scalding when opening the hot cooling circuit.

Suspended loads
– People are not allowed to stand below suspended loads.
– Only use suitable lifting and gear that is in perfect working order. Use lifting devices with sufficient load-carrying capacity.

Attachments and special bodies
– Comply with the safety instructions and regulations issued by the body manufacturer in question if attachments or special bodies are fitted.

Working on high-pressure lines
– Do not attempt to tighten or loosen pipe lines and hoses when they are under pressure (e.g. lubrication circuit, coolant circuit and hydraulic oil circuit).
Risk of injury due to pressurised fluids emerging!

Checking injector nozzles
– Wear suitable protective equipment.
– Do not hold any part of your body under the jet of fuel when checking the injector nozzles.
– Do not inhale fuel vapours. Ensure that there is adequate ventilation.

Working on the vehicle electrical system
– Do not disconnect batteries whilst the engine is running!
– Always disconnect batteries when working on the vehicle electronic system, central electrical system, alternator and starter! When disconnecting batteries, remove the negative terminals first. When connecting batteries, fit the positive terminals first.
– Always use suitable test lines and test adapters when measuring at plug connections!
– If temperatures of over 80°C are to be expected (e.g. in a drying oven after painting), switch the battery master switch to "OFF" and then remove the control units.
– The chassis is not intended for use as an earth return. If attachments are to be fitted to the vehicle (e.g. a wheelchair lift), additional earth (ground) lines with an adequate cross-section must be fitted as well. Otherwise the earth connection may be created along wire cables, wiring harnesses, gearbox shafts, gears etc. Severe damage could result.

Important! Battery gases are explosive!
– Oxyhydrogen gas may form in enclosed battery boxes. Take particular care after long journeys and after charging the batteries with a battery charger.
– When the batteries are disconnected this gas may be ignited by sparks produced by other continuously operating consumers, the tachograph etc. that cannot be shut down. Blow compressed air through the battery box before disconnecting the batteries!
– Always leave the batteries connected when towing the vehicle! Only tow the vehicle if the check lamps are still dimly lit but the battery starting power is not reached.
Do not use a rapid-charger to jump-start the vehicle!
– Always disconnect the positive and negative leads before charging and rapid-charging batteries!
– Do not rapid-charge lead-gel and maintenance-free batteries! (not in the case of "maintenance-free acc. to DIN") The maximum charging capacity is 10% of the indicated capacity per battery. In parallel circuits, the capacity is increased, in accordance with the total number of batteries connected in parallel.
– Risk of short-circuits due to incorrect battery polarity!
– Do not put metal objects (spanners, mole grips, etc.) on the batteries, since they may connect the terminals together. Risk of short-circuit!
– Disconnect the batteries and recharge them every 4 weeks if the vehicle is not in use for prolonged periods.

Caution! Battery acid is poisonous and corrosive!
– Wear appropriate protective clothing (gloves) when handling batteries.
Do not tilt batteries, acid may leak out. Similarly, do not tilt gel batteries.
– Measure voltage only using suitable measurement devices! The input resistance of a measuring device should be at least 10 MΩ.

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– Only disconnect and connect plug connections for electronic control unit when the ignition is switched off!

Electric welding
– Connect the “ANTIZAP SERVICE SENTRY” protection device (MAN item number 80.78010.0002) as described in the instructions accompanying the device.
– If this device is not available, disconnect the batteries and connect the positive cable to the negative cable in order to make a firm conductive connection.
– If the battery master switch is manually operated, move it to the driving position. If an electronic battery master switch is fitted, bridge “Negative” at the load-disconnecting relay contacts (jumper cable > 1mm^2) and “Positive” at the load-disconnecting relay load contacts. In addition, switch on many loads such as: starter switch (ignition) in driving position, hazard warning lights switch “on”, lighting switch in “driving lights on” position, ventilation blower in “maximum” position. The greater number of consumers that are switched on, the greater the protection.
After completing welding work, first switch off all the consumers and remove all jumpers (re-create original state), then connect the batteries.
– Always earth the welding equipment as close as possible to the welding area. Do not lay the cables to the welding equipment in parallel to electrical cables in the vehicle.

Working on plastic tubes – Danger of damage and fire!
– Mechanical or thermal loading of plastic tubes is not permitted.

Painting
– If paint spraying is to be carried out, do not expose the electronic components to high temperatures (max. 95 °C) for more than brief periods; a time of up to 2 hours is permissible at a maximum of 85 °C. Disconnect the batteries.
Painting of screw connections in the high-pressure section of the injection system is not permitted. Risk of dirt ingress in the event of repairs.

Working with the cab tilted forwards
– Keep the tilting area in front of the cab clear.
– Keep out of the area between the cab and the chassis during the tilting process. This is a danger area!
– Always tilt the cab past the tilting point and secure the cab using a support rod.

Working on the air-conditioning system
– Refrigerant fluids and vapours represent a health hazard, avoid contact with them and protect your eyes and hands.
– Do not drain gaseous refrigerants in enclosed rooms.
– Do not mix CFC-free refrigerant R 134a with R 12 (CFC) refrigerant.
– Dispose of refrigerant in accordance with regulations.

Working on airbag or belt tensioner units
– Work on airbag or belt tensioner units may only be carried out by staff who have verifiably completed a competence course at the MAN Service Academy.
– Mechanical loads, vibrations, heating to over 140° C and electrical pulses, including electrostatic discharge, can cause unintentional firing of the airbag or belt tensioner units.
– Hot gases are released explosively when the airbag or belt tensioner unit is fired. The non-mounted airbag or belt tensioner unit can be tossed around uncontrollably. This poses an injury risk to people in or near the cab.
– Risk of burns when touching the hot surfaces after the airbag has fired.
– Do not open a fired airbag.
– Do not touch a fired, destroyed airbag with your bare hands. Wear nitrile rubber gloves.
– Before all work and testing on airbag or belt tensioner units or work on the vehicle that can cause vibrations, switch off the ignition, remove the ignition key, disconnect the ground line from the battery and disconnect the power supply plug connection for the airbag and belt tensioner.
– Mount the driver airbag restraint system, MAN part number 81.66900-6035, on the airbag steering wheel in accordance with the operating instructions.
– Only use specially designated devices for testing airbag and belt tensioner units. Do not use test lamps, voltmeters or ohmmeters.
– After all work and tests, first switch off the ignition, then connect the plug connection(s) for airbag and belt tensioner. Then connect the battery. There must be no-one in the cab whilst this work is going on.
– Always deposit the airbags individually and with the impact cushion upwards.
– Do not treat airbags or belt tensioners with grease or cleaners.

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– Always store and transport airbag and belt tensioner units in their original packaging. Transport in the passenger compartment is not permitted.
– Always store airbag and belt tensioner units in lockable storage areas, up to a maximum of 200 kg.

Working on the independent heater
– Before commencing work, switch off the heater and allow all hot components to cool down.
– Ensure that suitable collecting containers are available and no sources of ignition are present when working on the fuel system.
– Keep suitable fire extinguishing equipment nearby and within easy reach!!
– The heater may not be operated in enclosed areas such as garages or workshops unless an extractor system is used.

2. Notes on preventing damage and premature wear on units

General information
– Units are only designed for their specified purpose - defined by the manufacturer (designated use): Any other use is classified as not in accordance with the designated use. The manufacturer is not liable for damage caused as a result of such other use. In the event of such other use, the user alone bears the risk.
– Designated use also includes compliance with the operating, maintenance and repair conditions specified by the manufacturer.
– The unit may only be used, maintained and repaired by persons who are familiar with it and are fully aware of the risks.
– Arbitrary changes to the engine mean that the manufacturer is no longer responsible for any damage incurred as a result of such changes.
– Similarly, tampering with the injection and control system can affect the unit's performance and exhaust-gas characteristics. This means that compliance with the statutory environmental requirements is no longer assured.
– If malfunctions occur, determine the cause and remedy the problem immediately.
– Clean units thoroughly before repairs, ensuring that all openings where dirt is not allowed to enter for safety or functioning reasons are closed.
– Never run a unit dry, in other words always make sure that it has been filled with oil before running it.
– Never run engines without coolant.
– Apply a suitable information sign to units that are not ready to be operated.
– Only use service products as per the MAN Recommended Service Products booklet, otherwise the manufacturer warranty will be invalidated.
Details of approved products can be found online at: http://www.man-mn.com/ > Products & Solutions > E-Business.
– Comply with the specified maintenance intervals.
– Do not fill engine/gear oil above the maximum level mark. Do not exceed the maximum permitted operational tilt.
– The special measures described in MAN Works Standard M 3069 Part 3 apply if buses or trucks are to be withdrawn from service or stored for a period longer than 3 months.

3. Limited liability for parts and accessories

General information
Only use accessories and genuine MAN parts that have been expressly approved by MAN Nutzfahrzeuge AG for your MAN vehicle. MAN Nutzfahrzeuge AG accepts no liability for any other products.

4. Regulations for avoiding injury and environmental contamination

Health protection precautions
Avoid prolonged, excessive or repeated skin contact with service products, excipients, thinners or solvents. Protect your skin using a suitable skin protection agent or protective gloves. Do not use service products, excipients, thinners or solvents to clean the skin. Apply a greasy skin cream after cleaning your skin.

Service products and excipients
Do not use food or drink containers for draining and storing service products or excipients. Comply with local-authority regulations when disposing of service products and excipients.

Coolant
Treat undiluted antifreeze as hazardous waste. Follow the instructions issued by the relevant local authority when disposing of used coolant (mixture of antifreeze and water).

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Cleaning the cooling circuit
Do not pour cleaning fluids and rinsing water down the drain if this practice is restricted by specific local regulations. However, the cleaning fluid and rinsing water must in all cases have been passed through an oil trap with a sludge trap.

Cleaning the filter insert
When blowing compressed air through the filter insert, make sure the filter dust is collected by a vacuum or is blown into a dust collection bag. Otherwise, use a respiratory protection mask. Wear rubber gloves or use a skin barrier hand cream when washing out the elements, because cleaning agents have aggressive grease-dissolving characteristics.

Engine/gear oil, filter cartridges, inserts and box-type filters, desiccant cartridges
Filter inserts, cartridges and box-type filters (oil and fuel filters, desiccant cartridges for the air dryer) are classified as hazardous waste. Comply with local-authority regulations when disposing of the above parts.

Used engine/gear oil
Lengthy or repeated skin contact with any type of engine/gear oil removes grease from the skin. This can cause dry skin, irritation or skin inflammation. In addition to these hazards, used engine oil contains dangerous materials which can trigger dangerous skin diseases. Wear gloves, especially when changing the oil.

Handling AdBlue®
AdBlue® is a synthetically produced 32.5 % urea/water solution which is used as an NOx reduction additive for diesel engines with SCR catalytic converter. AdBlue® is not a hazardous substance but does decompose into ammonium hydroxide and carbon dioxide when stored for prolonged periods. For this reason, AdBlue® is classified as a water hazard (water hazard class 1) in Germany and is not allowed to enter sewage or the ground. Ensure good ventilation in the workplace when working on the AdBlue® system. Do not eat, drink or smoke in the workplace. Avoid skin and eye contact with AdBlue®, thoroughly wash your hands and use a skin protection cream before taking breaks and before finishing work. If your skin comes into contact with AdBlue®, wash the skin using water and a skin cleaner, change out of dirty clothes immediately. If the skin is irritated, consult a doctor. If AdBlue® gets into your eyes, rinse your eyes with water or an eye-rinsing products for at least 10 minutes, keeping your eyelids open. Remove any contact lenses beforehand. If symptoms persist, consult a doctor. If AdBlue® is swallowed, consult a doctor immediately. Store AdBlue® containers closed in liquid-tight storage areas. The storage temperature must not exceed 25°C. Soak up leaked or spilt AdBlue® using binding agent and dispose of in the correct manner.

5. Information for working on the common rail system

General information
– A jet of fuel can cut through the skin. Risk of fire due to fuel atomisation.
– Never undo the screwed connections on the fuel high-pressure side of the common-rail system whilst the engine is running (high-pressure line from the high-pressure pump to/on the rail and on the cylinder head to the injector). Whilst the engine is running, the lines are constantly carrying fuel under a pressure of 1800 bar or more. Before the screw connections are opened, wait at least one minute until depressurisation has occurred, using MAN-cats to check the depressurisation on the rail as necessary.
– Avoid standing near the running engine.
– Do not touch the live parts at the injector electrical connection whilst the engine is running.
– Any changes to the original wiring can lead to the limit values specified in pacemaker regulations being exceeded. Examples of such changes include non-twisted injector wiring or the addition of the test box (contact box).
– There is no danger to operators and persons wearing a pacemaker if units with MAN common-rail engines are used for their intended, i.e. approved, purpose.
– A jet of fuel can cut through the skin. Risk of fire due to fuel atomisation.
– Never undo the screwed connections on the fuel high-pressure side of the common-rail system whilst the engine is running (injection line from the high-pressure pump to/on the rail and on the cylinder head to the injector).
– Avoid standing near the running engine.
– Whilst the engine is running, the lines are constantly carrying fuel under a pressure of 1800 bar or more.
– Before opening the screwed connections, wait for at least one minute so that the system can be depressurised.
– Check depressurisation of the rail using MAN-cats if necessary.
– Do not touch the live parts at the injector electrical connection whilst the engine is running.

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Information for people with pacemakers
– Any changes to the original engine wiring can lead to the limit values specified in pacemaker regulations being exceeded. Examples of such changes include non-twisted injector wiring or the addition of the test box (contact box).
– There is no danger to drivers and co-drivers wearing a pacemaker if the vehicle is used for its intended, i.e. approved, purpose.
– There is no danger to operators wearing a pacemaker if units with MAN common-rail engines are used for their intended, i.e. approved, purpose.
– In its original state, the product does not violate any of the currently known pacemaker limit values.

Danger of damage due to dirt ingress
– Diesel-injection systems consist of precision engineered components that are subject to extreme loads; Due to the highly precise nature of this technology, all work on the fuel system requires **the highest possible degree of cleanliness**.
– Even dirt particles **over 0.2 mm** can cause component failure.

Before commencing work on the clean side
– Clean the engine and engine compartment with the fuel system closed. Do not use a powerful jet when cleaning electrical components.
– Drive the vehicle into a clean area of the workshop where none of the work causes dust to be swirled up (sanding, welding, brake repairs, brake checks, performance tests etc.).
– Avoid air movements (possible swirling up of dust due to starting of engines, the workshop heating/ventilation system, due to draughts etc.).
– Clean and dry the area of the still closed fuel system using compressed air.
– Use a suitable extractor unit (industrial extractor unit) to remove loose dirt particles such as paint chippings and insulating material.
– Use a new and clean cover in areas of the engine compartment where dirt particles can become loose, e.g. tilted cab, bus engine compartment.
– Before removing any components, wash your hands and put on clean working clothes.

After opening the clean side
– The use of compressed air for cleaning is not permitted.
– During assembly, remove loose dirt using a suitable extractor unit (industrial extractor unit).
– Only lint-free cleaning cloths are allowed to be used on the fuel system.
– Clean tools and equipment before commencing work.
– Only use tools that show no signs of damage (cracked chrome coatings).
– Do not use materials such as cloths, cardboard or wood when removing and installing components as these materials can produce particles and fibres.
– If the undoing of connections causes the paint to chip (due to possible excess paint), carefully remove these paint chippings before fully undoing the connection.
– All removed components on the clean side of the fuel system must be plugged **immediately** at their connection openings using suitable caps.
– These caps must be stored in dustproof packaging until they are used and disposed of after they have been used once.
– Then store the components in a clean, sealed container.
– **Never** use used cleaning or test fluids for these components.
– New parts must not be removed from their original packaging until immediately before use.
– Work on removed components may only be carried out in a suitably equipped workplace.
– If removed parts are shipped, always use the new part's original packaging.

When carrying out work on bus engines, the instructions below must also be followed **without fail**:

Danger of damage due to dirt ingress
– Before opening the clean side of the fuel system:
  Clean the areas of the engine around pressure line fittings, injection lines, the rail and valve cover using compressed air.
– Remove the valve cover and then re-clean the areas of the engine around the pressure line fittings, injection lines and rail.
– Only loosen rail connections at first:
  Undo the union nuts on the rail connections and unscrew by 4 turns.
  Raise the rail connections using a special tool.
  Reason: only remove the rail connections completely once the injectors have been removed so that no dirt can fall into the injectors from above.

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– Remove the injectors.
– After removal, rinse out the injectors with a cleaning fluid, making sure that the high-pressure connection hole is facing downwards.
– Remove the rail connections by unscrewing their union nuts.
– Clean the injector hole in the cylinder head.

6. Limp-home program for units with electronic control units

General information
The units have an electronic control system that monitors the unit as well as itself (self-diagnosis).

As soon as a malfunction occurs, the malfunction is evaluated and one of the following measures is implemented automatically:

– Output of a fault message with fault code.
– Switchover to suitable default function for further operation, albeit with restrictions. Have malfunctions remedied by MAN after-sales immediately.
– If MAN-cats is used, the fault code is output directly.

7. Installation instructions

Installation of piping
– Mechanical deformation of piping is not permitted when performing installation work - risk of fracture!

Installation of gaskets
– Only use genuine MAN gaskets
– Make sure the mating faces are undamaged and clean.
– Do not use adhesives or sealing compounds. If necessary, to facilitate installation, use a little grease to stick the gasket to the part to be mounted.
– Tighten the bolts evenly to the specified tightening torque.

Installation of O-rings
– Only use genuine MAN O-rings
– Make sure the mating faces are undamaged and clean.

Engine overhaul
– A range of very different factors affect the engine service life. It is therefore not possible to indicate the exact number of operating hours or miles before a major overhaul is due.
– In our judgement, it is not advisable to open an engine or perform a major overhaul if the engine has good compression values and the following operating values have not changed significantly since they were measured and taken during the initial start-up:
– Charge pressure
– Exhaust gas temperature
– Coolant and lubricating oil temperature
– Oil pressure and oil consumption
– Smoke characteristics

The following criteria have a major influence on the engine service life:
– Correct power setting for the application type
– Correct installation
– Approval of the installation by authorised personnel
– Regular maintenance as per the maintenance schedule

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DEVICE DESCRIPTION

SYSTEM DESCRIPTION

General information

In recent years, diesel engines have faced increasingly stringent legislative and customer demands regarding environmental compatibility, fuel consumption, constant power-take off speeds as well as exhaust and noise emissions. This trend is set to continue in the future.

The common-rail injection system fulfils all the requirements that have to be met by state-of-the-art internal combustion engines.

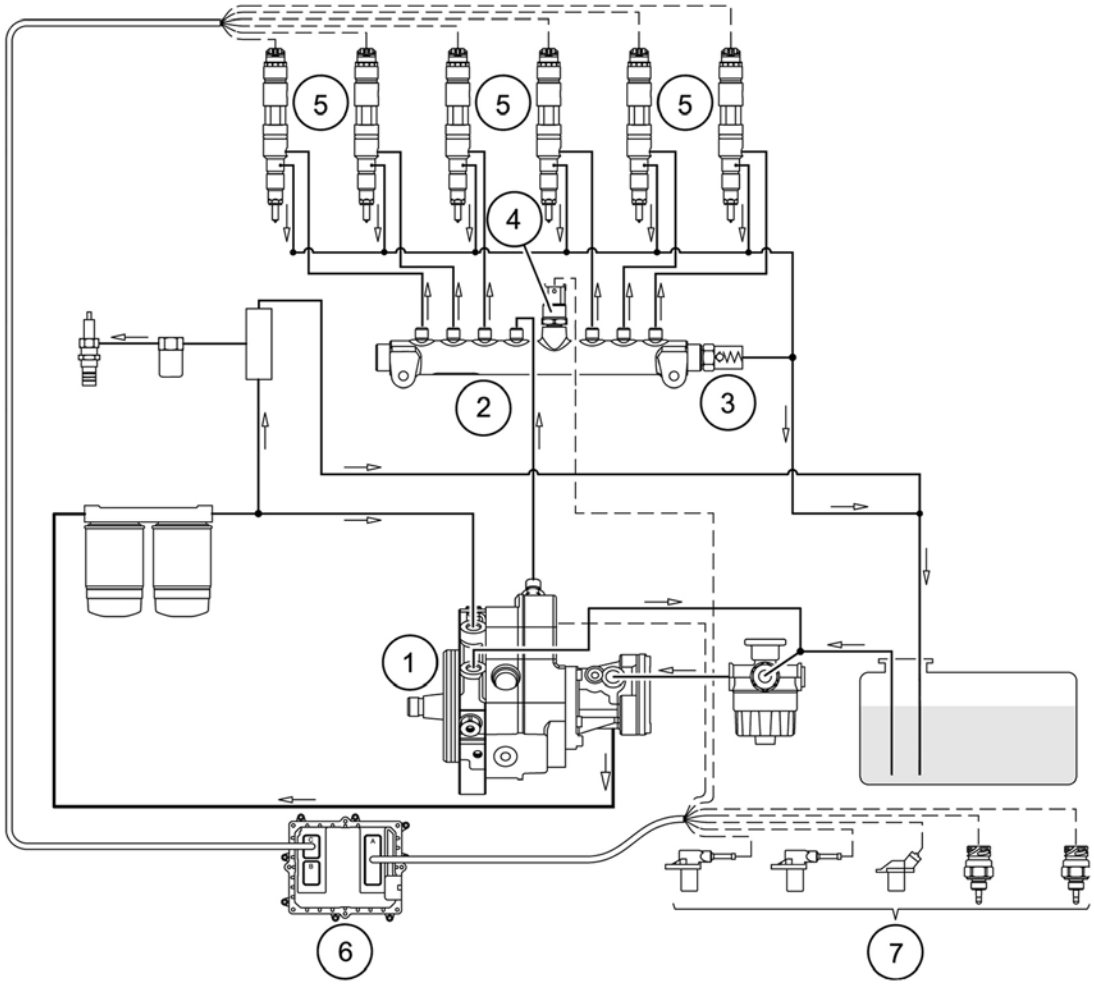
In conjunction with electronically controlled gearshift systems, anti-lock brake systems, anti-spin regulators and other systems for controlling the running gear or brakes etc., the EDC system can improve vehicle economy, increase driving comfort and take some of the burden off both the driver and the environment.

Structure and operation of the common-rail system

Efficient combustion is only possible if there is good mixture formation. This is where the injection system plays such a central role. The right quantity of fuel must be injected at the right time and with a high pressure. The common-rail system is a trend-setting high-pressure injection system which involves the separation of pressurisation and injection. The fuel for the individual cylinders comes from a shared accumulator which is constantly kept at high pressure. The accumulator is pressurised by a high-pressure pump. This pressure can be changed to suit the operating conditions in question. Each cylinder is equipped with an injector which is controlled by a solenoid valve. The injection quantity is determined by the outlet cross-section of the injector, the solenoid valve opening duration and the accumulator pressure. A system pressure of up to 1800 bar can be reached. Separation of the pressurisation and injection functions allows a better injection characteristic and, therefore, improves combustion development. Any injection pressure within the map can be selected. Multiple injections, i. e. pre-injections and post-injections, are possible. The fuel quantity, start of injection, pre-injection and post-injection are controlled by extremely fast solenoid valves. Another advantage of common-rail systems is that they can be fitted to existing engines without having to modify the cylinder head.

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Schematic diagram of the common-rail system

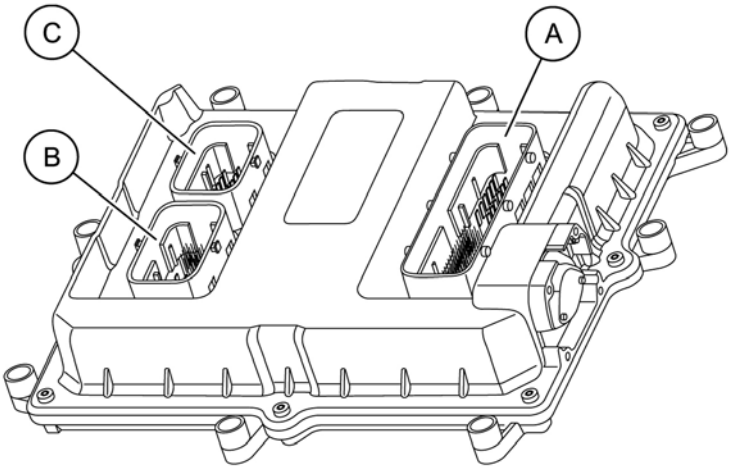


1 Quantity-controlled high-pressure pump
2 High-pressure accumulator (rail)
3 Pressure limiting valve
4 Rail-pressure sensor
5 Injectors
6 Electronic control unit
7 Further sensors and actuators

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FUNCTIONAL DESCRIPTION

Control unit, EDC7 (A435, A570)



(A) Engine connector, 89-pin
(B) Vehicle connector, 36-pin
(C) Injector connector, 16-pin

The main tasks of the EDC control unit are to control the injection quantity, control the point of injection and activate the starter. The optimal injection quantity and point of injection are calculated to ensure optimum combustion in all engine operating states.

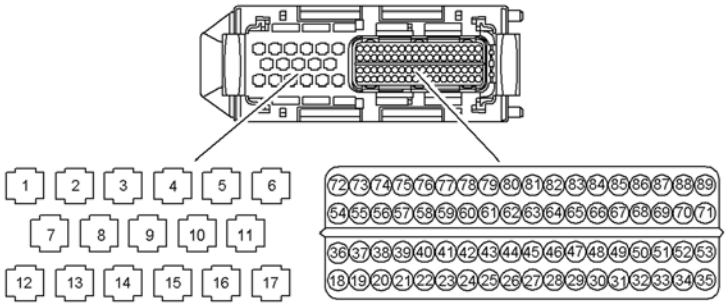
The control unit evaluates the sensor signals and then calculates the activation signals for the injectors.

The control unit (software/hardware) is designed for a maximum of six cylinders. A second control unit is therefore needed for operating a V-engine. The two control units communicate via CAN and operate in “Master/Slave” mode.

The control unit software contains the following function groupings:
– Fuel quantity setpoint formation, fuel metering
– Fuel pressure control with high-pressure pump
– Fuel pressure deactivation (limp-home function)
– Idling speed control
– Maximum speed control, smoke and torque limitation
– Adaptive individual cylinder torque control
– Cylinder shut-off
– Exhaust gas recirculation
– Air system / exhaust gas aftertreatment
– Exhaust gas temperature and exhaust gas management
– Charge pressure control (wastegate control)
– Signal acquisition and calculation of operating variables
– Diagnosis and monitoring functions
– OBD functionality

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Control unit, EDC7 C32 Euro 4/5 (A435) Pin assignment, engine connector A



Pin	Line no./colour	Function
A01	60034	Supply, control unit (battery +)
A02	60384	Activation, proportional valve, turbocharger 1 (PWM)
A03	31000	Ground, control unit (battery –)
A04	60383	Ground, proportional valve, turbocharger 1
A05	60401	Ground, shut-off/pressure-reducing valve, LT cooler
A06	60400	Activation, shut-off/pressure-reducing valve, LT cooler
A07	60035	Supply, control unit (battery +)
A08	60373	Activation, metering unit
A09	31000	Ground, control unit (battery –)
A10	60374	Ground, metering unit
A11	60340 / 60393	Ground, activation, uncontrolled EGR / proportional valve, controlled EGR (E-EGR)
A12	60036	Supply, control unit (battery +)
A13	60033	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16	60314	Activation, IMR (starter), high signal
A17	60367 / 60392	Supply, activation, uncontrolled EGR / proportional valve, controlled EGR (E-EGR)
A18	90316	Supply, activation, EGR throttle valve (CRT)
A19	31330	Activation, IMR (starter), low signal
A20	60137	Signal input, fuel low-pressure sensor
A21	60134	Signal input, oil pressure sensor
A22	60153	Feedback signal, EGR (for uncontrolled EGR only)
A23	60031	Ground, feedback signal, EGR (for uncontrolled EGR only)
A24	60156	Supply, oil pressure sensor (5V)
A25	60159	Supply, charge-pressure sensor (5V)
A26	—	Not used
A27	191	Exhaust gas aftertreatment CAN High
A28 - A31	—	Not used
A32	60180	Supply, position sensor (feedback), controlled EGR (5V)
A33 - A35	—	Not used

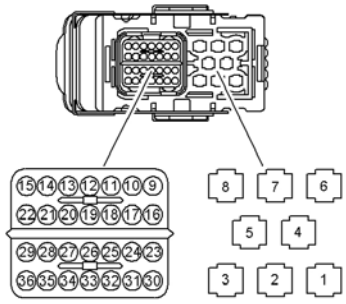
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Pin	Line no./colour	Function
A36	31000	Ground, activation, EGR throttle valve (CRT)
A37	60158	Ground, fuel low-pressure sensor
A38	60135	Ground, oil pressure sensor
A39	60182	Ground, position sensor (feedback), controlled EGR
A40	60155	Supply, fuel low-pressure sensor (5V)
A41	90126	Supply, exhaust gas differential/exhaust gas relative pressure sensor (5V)
A42	90005	Ground, feedback signal, EGR throttle valve (CRT)
A43	60161	Supply, rail-pressure sensor (5V)
A44	—	Not used (spare, signal output, camshaft speed)
A45	192	Exhaust gas aftertreatment CAN Low
A46 - A50	—	Not used
A51	90132	Check lamp, OBD (MIL)
A52 - A53	—	Not used
A54	grey/brown	Ground, speed sensor, camshaft
A55	grey/white	Ground, speed sensor, crankshaft
A56	—	Ground, temperature sensor, fuel (option)
A57	60100	Ground, temperature sensor, charge air upstream of cylinder inlet
A58	60101	Ground, coolant temperature sensor
A59	60127	Ground, exhaust gas differential/exhaust gas relative pressure sensor
A60	—	Not used
A61	60160	Ground, rail-pressure sensor
A62	60141	Ground, charge-pressure sensor (LDF6 and LDF6-T)
A63 - A64	—	Not used
A65	60191	Ground, temperature sensor, coolant, LT cooler
A66 - A69	—	Not used
A70	90121	Signal input, temperature sensor, charge air (integrated in charge-pressure sensor LDF6-T)
A71	—	Not used
A72	grey	Signal input, speed sensor, camshaft
A73	grey/green	Signal input, speed sensor, crankshaft
A74	—	Not used
A75	—	Signal input, temperature sensor, fuel (option)
A76	60151	Signal input, temperature sensor, charge air upstream of cylinder inlet
A77	60131	Signal input, coolant temperature sensor
A78	90128	Signal input, exhaust gas differential/exhaust gas relative pressure sensor
A79	90129	Feedback signal, EGR throttle valve (CRT)
A80	60162	Signal input, rail-pressure sensor
A81	60102	Signal input, charge-pressure sensor LDF6-T
A82	—	Not used
A83	—	Ground, engine oil temperature sensor (option)

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Pin	Line no./colour	Function
A84	60192	Signal input, temperature sensor, coolant, LT cooler
A85	—	Signal input, engine oil temperature sensor (option)
A86	—	Not used
A87	60181	Signal input, position sensor (feedback), controlled EGR
A88 - A89	—	Not used

Control unit EDC7 C32 Euro 4/5 (A435) Pin assignment, vehicle connector B

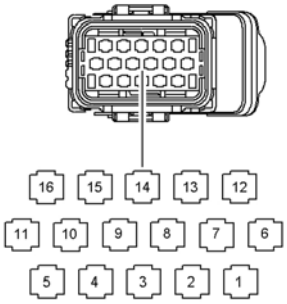


Pin	Line no./colour	Function
B01	—	Not used
B02	60394	Ground, compressed air shut-off valve
B03	—	Not used
B04	60398	Ground, proportional valve, turbocharger 2
B05	60397	Supply, heating, oxygen sensor ($+U_{bat}$)
B06	60395	Activation, compressed air shut-off valve
B07	—	Not used
B08	60396	Heater cycle, heating, oxygen sensor (–)
B09	—	Not used
B10	60187	Signal input, temperature, charge pressure/temperature sensor, LT cooler
B11	—	Not used
B12	90315	Activation, engine air flow sensor flap (CRT)
B13	60399	Activation, proportional valve, turbocharger 2 (PWM)
B14 - B17	—	Not used
B18	60190	Signal input, charge-pressure sensor, charge pressure/temperature sensor, LT cooler
B19	31000	Ground, engine air flow sensor flap (CRT)
B20	60188	Ground, charge pressure/temperature sensor, LT cooler
B21	green/black (160)	M-CAN low
B22	black/green (159)	M-CAN high
B23	60185	Virtual ground, oxygen sensor
B24	60183	Pump current, oxygen sensor
B25	185	HD-OBD-CAN high
B26	60100/90119	Ground, exhaust gas temperature sensor 1 (upstream of filter)
B27	90123	Ground, exhaust gas temperature sensor 2 (downstream of filter)

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Pin	Line no./colour	Function
B28	60189	Supply, charge pressure/temperature sensor, LT cooler (5 V)
B29	—	Not used
B30	60186	Nernst voltage, oxygen sensor
B31	60184	Trimming resistor (trim current) oxygen sensor
B32	186	HD-OBD-CAN low
B33	90122	Signal input, exhaust gas temperature sensor 1 (upstream of filter)
B34	90124	Signal input, exhaust gas temperature sensor 2 (downstream of filter)
B35	60201	ISO K-line
B36	15014	Supply, control unit (terminal 15)

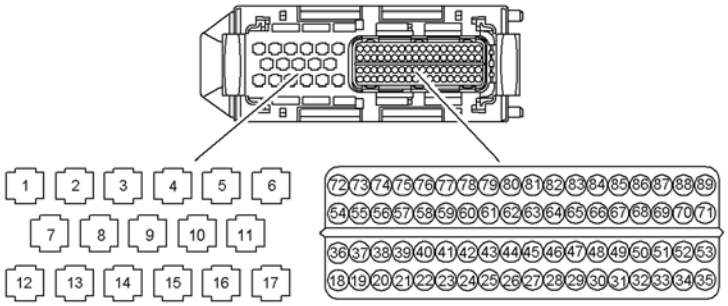
Control unit EDC7 C32 Euro 4/5 (A435) Pin assignment, injector connector C



Pin	Line no./colour	Function
C01	black	Injector, cylinder 5, high signal
C02	red	Injector, cylinder 6, high signal
C03	red	Injector, cylinder 4, high signal
C04	black	Injector, cylinder 1, high signal
C05	black	Injector, cylinder 3, high signal
C06	white/red	Injector, cylinder 2, low signal
C07 - C10	—	Not used
C11	red	Injector, cylinder 2, high signal
C12	white/black	Injector, cylinder 3, low signal
C13	white/black	Injector, cylinder 1, low signal
C14	white/red	Injector, cylinder 4, low signal
C15	white/red	Injector, cylinder 6, low signal
C16	white/black	Injector, cylinder 5, low signal

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Control unit EDC7 C32 Master Euro 5 V8 (A435) Pin assignment, engine connector A

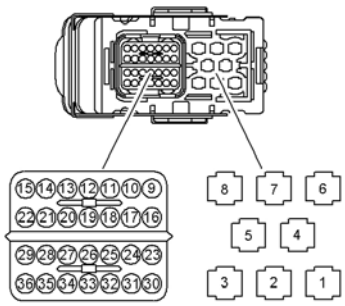


Pin	Line no./colour	Function
A01	60034	Supply, control unit (battery +)
A02	—	Not used
A03	31000	Ground, control unit (battery –)
A04 - A06	—	Not used
A07	60035	Supply, control unit (battery +)
A08	60373	Activation, metering unit
A09	31000	Ground, control unit (battery –)
A10	60374	Ground, metering unit
A11	—	Not used
A12	60036	Supply, control unit (battery +)
A13	60033	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16	60314	Activation, IMR (starter)
A17 - A19	—	Not used
A20	60137	Signal input, fuel low-pressure sensor
A21	60134	Signal input, oil pressure sensor 1
A22 - A23	—	Not used
A24	60156	Supply, oil pressure sensor 1 (5V)
A25	60159	Supply, charge-pressure sensor (5V)
A26	—	Not used
A27	brown/black	CAN high Master/Slave
A28 - A36	—	Not used
A37	60158	Ground, fuel low-pressure sensor
A38	60135	Ground, oil pressure sensor 1
A39	—	Not used
A40	60155	Supply, fuel low-pressure sensor (5V)
A41 - A42	—	Not used
A43	60161	Supply, rail-pressure sensor 1
A44	60546	Output, speed signal 2
A45	black/blue	CAN low Master/Slave

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Pin	Line no./colour	Function
A46 - A50	—	Not used
A51	90132	Check lamp, OBD (MIL)
A52 - A53	—	Not used
A54	grey/brown	Ground, speed sensor, camshaft
A55	grey/white	Ground, speed sensor, crankshaft
A56 - A57	—	Not used
A58	60101	Ground, coolant temperature sensor
A59 - A60	—	Not used
A61	60160	Ground, rail-pressure sensor 1
A62	60141	Ground, charge-pressure sensor
A63 - A69	—	Not used
A70	90121	Signal input, temperature sensor, charge air (integrated in charge-pressure sensor LDF6-T)
A71	—	Not used
A72	grey	Signal input, speed sensor, camshaft
A73	grey/green	Signal input, speed sensor, crankshaft
A74	60545	Output, speed signal 1
A75 - A76	—	Not used
A77	60131	Signal input, coolant temperature sensor
A78 - A79	—	Not used
A80	60162	Signal input, rail-pressure sensor 1
A81	60102	Signal input, charge-pressure sensor
A82 - A89	—	Not used

Control unit EDC7 C32 Master Euro 5 V8 (A435) Pin assignment, vehicle connector B

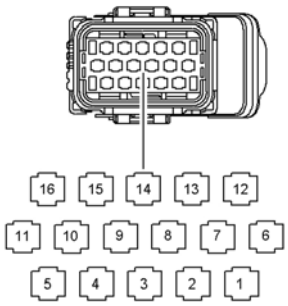


Pin	Line no./colour	Function
B01 - B20	—	Not used
B21	160	M-CAN low
B22	159	M-CAN high
B23 - B24	—	Not used
B25	191	Exhaust gas aftertreatment CAN High
B26	90116	Ground, exhaust gas temperature sensor 1 (upstream of AdBlue® mixer)
B27 - B31	—	Not used

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Pin	Line no./colour	Function
B32	192	Exhaust gas aftertreatment CAN Low
B33	90115	Signal input, exhaust gas temperature sensor 1 (upstream of AdBlue® mixer)
B34	—	Not used
B35	60201	ISO K-line
B36	15014	Supply, control unit (terminal 15)

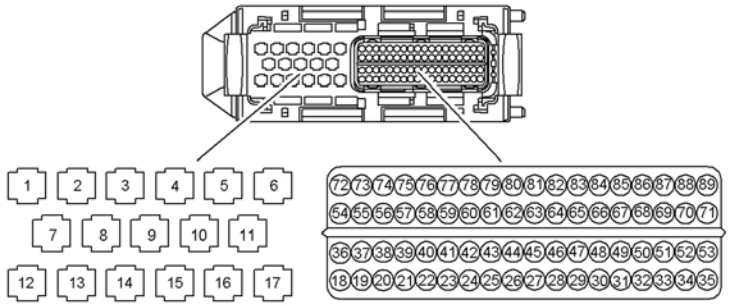
Control unit EDC7 C32 Master Euro 5 V8 (A435) Pin assignment, injector connector C



Pin	Line no./colour	Function
C01	brown	Injector, cylinder 2, High signal
C02	brown	Injector, cylinder 4, High signal
C03	—	Not used
C04	brown	Injector, cylinder 1, High signal
C05	brown	Injector, cylinder 3, High signal
C06 - C08	—	Not used
C09	60661	Coding Master/Slave
C10	60661	Coding Master/Slave
C11	—	Not used
C12	black	Injector, cylinder 3, Low signal
C13	black	Injector, cylinder 1, Low signal
C14 - C15	—	Not used
C16	green/black	Injector, cylinder 2, Low signal

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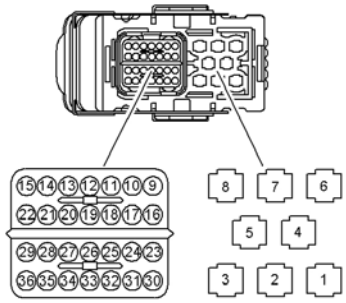
Control unit EDC7 C32 Slave Euro 5 V8 (A570) Pin assignment, engine connector A



Pin	Line no./colour	Function
A01	60039	Supply, control unit (battery +)
A02	—	Not used
A03	31000	Ground, control unit (battery –)
A04 - A06	—	Not used
A07	60038	Supply, control unit (battery +)
A08	—	Not used
A09	31000	Ground, control unit (battery –)
A10 - A11	—	Not used
A12	60037	Supply, control unit (battery +)
A13	60040	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16 - A20	—	Not used
A21	60178	Signal input, oil pressure sensor 2
A22 - A23	—	Not used
A24	60177	Supply, oil pressure sensor 2 (5V)
A25 - A26	—	Not used
A27	brown/black	CAN High Master/Slave
A28 - A37	—	Not used
A38	60176	Ground, oil pressure sensor 2
A39 - A42	—	Not used
A43	60165	Supply, rail-pressure sensor 2 (5V)
A44	—	Not used
A45	black/blue	CAN Low Master/Slave
A46 - A60	—	Not used
A61	60164	Ground, rail-pressure sensor 2
A62 - A71	—	Not used
A72	60546	Signal input, speed signal 1
A73	60545	Signal input, speed signal 2
A74 - A79	—	Not used
A80	60163	Signal input, rail-pressure sensor 2
A81 - A89	—	Not used

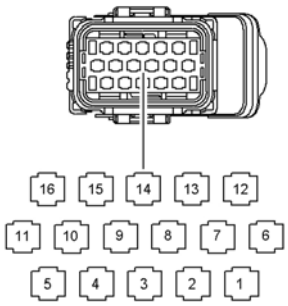
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Control unit EDC7 C32 Slave Euro 5 V8 (A570) Pin assignment, vehicle connector B



Pin	Line no./colour	Function
B01 - B20	—	Not used
B21	160	M-CAN Low
B22	159	M-CAN High
B23 - B24	—	Not used
B25	185	HD-OBD-CAN High
B26 - B31	—	Not used
B32	186	HD-OBD-CAN low
B33 - B34	—	Not used
B35	60205	ISO K-line
B36	15014	Supply, control unit (terminal 15)

Control unit EDC7 C32 Slave Euro 5 V8 (A570) Pin assignment, injector connector C



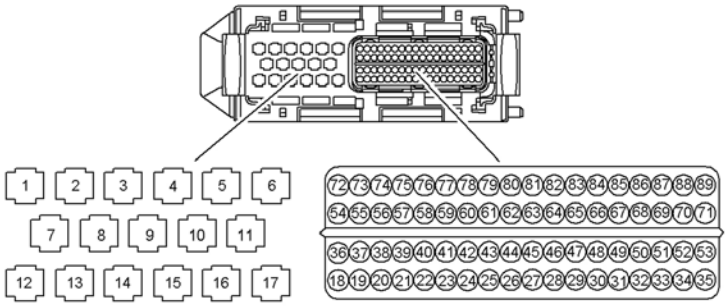
Pin	Line no./colour	Function
C01	brown	Injector, cylinder 7, High signal
C02	brown	Injector, cylinder 8, High signal
C03	—	Not used
C04	brown	Injector, cylinder 5, High signal
C05	brown	Injector, cylinder 6, High signal
C06	—	Not used
C07	60662	Coding, Slave
C08	60662	Coding, Slave
C09 - C11	—	Not used
C12	green/black	Injector, cylinder 6, Low signal
C13	black	Injector, cylinder 5, Low signal

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Pin	Line no./colour	Function
C14	—	Not used
C15	green/black	Injector, cylinder 8, Low signal
C16	—	Not used

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Control unit EDC7 C3 Euro 3 (A435) Pin assignment, engine connector A

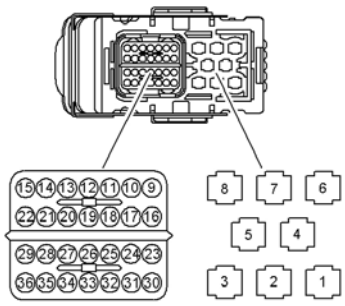


Pin	Line no./colour	Function
A01	60034	Supply, control unit (battery +)
A02	—	Not used
A03	31000	Ground, control unit (battery –)
A04 - A05	—	Not used
A07	60035	Supply, control unit (battery +)
A08	60373	Activation, metering unit
A09	31000	Ground, control unit (battery –)
A10	60374	Ground, metering unit
A11	60340	Ground, activation, uncontrolled EGR
A12	60036	Supply, control unit (battery +)
A13	60033	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16	60314	Activation, IMR (starter), High signal
A17	60367	Supply, activation, uncontrolled EGR
A18	—	Not used
A19	31330	Activation, IMR (starter), Low signal
A20	60137	Signal input, fuel low-pressure sensor
A21	60134	Signal input, oil pressure sensor
A22	60153	Feedback signal, EGR
A23	60031	Ground, feedback signal, EGR
A24	60156	Supply, oil pressure sensor (5V)
A25	60159	Supply, charge-pressure sensor (5V)
A26 - A36	—	Not used
A37	60158	Ground, fuel low-pressure sensor
A38	60135	Ground, oil pressure sensor
A39	—	Not used
A40	60155	Supply, fuel low-pressure sensor (5V)
A41 - A42	—	Not used
A43	60161	Supply, rail-pressure sensor (5V)
A44	—	Not used (spare, signal output, camshaft speed)

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Pin	Line no./colour	Function
A45 - A53	—	Not used
A54	grey/brown	Ground, speed sensor, camshaft
A55	grey/white	Ground, speed sensor, crankshaft
A56	—	Not used
A57	60100	Ground, temperature sensor, charge air
A58	60101	Ground, coolant temperature sensor
A59 - A60	—	Not used
A61	60160	Ground, rail-pressure sensor
A62	60141	Ground, charge-pressure sensor
A63 - A71	—	Not used
A72	grey	Signal input, speed sensor, camshaft
A73	grey/green	Signal input, speed sensor, crankshaft
A74 - A75	—	Not used
A76	60151	Signal input, temperature sensor, charge air
A77	60131	Signal input, coolant temperature sensor
A78 - A79	—	Not used
A80	60162	Signal input, rail-pressure sensor
A81	60102	Signal input, charge-pressure sensor
A82 - A89	—	Not used

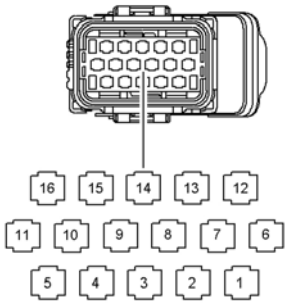
Control unit EDC7 C3 Euro 3 (A435) Pin assignment, vehicle connector B



Pin	Line no./colour	Function
B01 - B20	—	Not used
B21	green/black (160)	M-CAN Low
B22	black/green (159)	M-CAN High
B23 - B34	—	Not used
B35	60201	ISO K-line
B36	15014	Supply, control unit (terminal 15)

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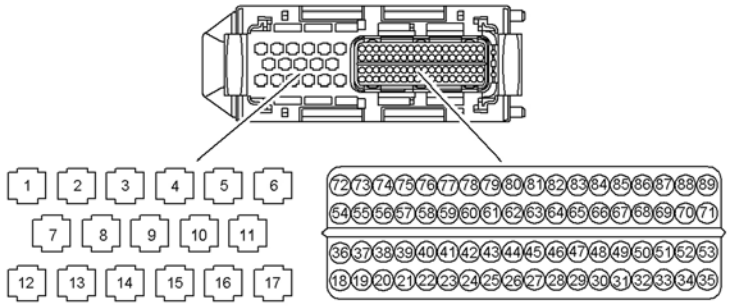
Control unit EDC7 C3 Euro 3 (A435) Pin assignment, injector connector C



Pin	Line no./colour	Function
C01	black	Injector, cylinder 5, High signal
C02	Red	Injector, cylinder 6, High signal
C03	Red	Injector, cylinder 4, High signal
C04	black	Injector, cylinder 1, High signal
C05	black	Injector, cylinder 3, High signal
C06	white/red	Injector, cylinder 2, Low signal
C07 - C10	—	Not used
C11	red	Injector, cylinder 2, High signal
C12	white/black	Injector, cylinder 3, Low signal
C13	white/black	Injector, cylinder 1, Low signal
C14	white/red	Injector, cylinder 4, Low signal
C15	white/red	Injector, cylinder 6, Low signal
C16	white/black	Injector, cylinder 5, Low signal

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Control unit EDC7 C3 Master Euro 3 V10 (A435) Pin assignment, engine connector A

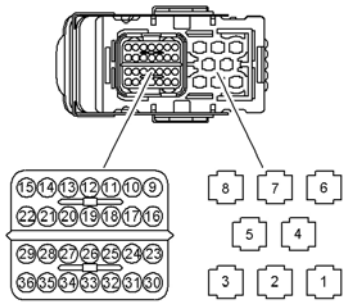


Pin	Line no./colour	Function
A01	60034	Supply, control unit (battery +)
A02	—	Not used
A03	31000	Ground, control unit (battery –)
A04 - A06	—	Not used
A07	60035	Supply, control unit (battery +)
A08	60373	Activation, metering unit 1
A09	31000	Ground, control unit (battery –)
A10	60374	Ground, metering unit 1
A11	60340	Ground, EGR controller
A12	60036	Supply, control unit (battery +)
A13	60033	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16	60314	Activation, IMR (starter), High signal
A17	60367	Activation, EGR controller
A18	—	Not used
A19	31330/31321	Activation, IMR (starter), low signal
A20	60137	Signal input, fuel low-pressure sensor
A21	60134	Signal input, oil pressure sensor
A22	60153	Feedback, EGR position sensor
A23	60031	Supply, EGR position sensor (5V)
A24	60156	Supply, oil pressure sensor (5V)
A25	60159	Supply, charge-pressure sensor (5V)
A26	—	Not used
A27	brown/black	CAN High Master/Slave
A28 - A36	—	Not used
A37	60158	Ground, fuel low-pressure sensor
A38	60135	Ground, oil pressure sensor
A39	—	Not used
A40	60155	Supply, fuel low-pressure sensor (5V)
A41 - A42	—	Not used

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Pin	Line no./colour	Function
A43	60161	Supply, rail-pressure sensor 1
A44	60546	Output, speed signal 2
A45	black/blue	CAN Low Master/Slave
A46 - A53	—	Not used
A54	grey/brown	Ground, speed sensor, camshaft
A55	grey/white	Ground, speed sensor, crankshaft
A56	—	Not used
A57	60100	Ground, temperature sensor, charge air
A58	60101	Ground, coolant temperature sensor
A59 - A60	—	Not used
A61	60160	Ground, rail-pressure sensor
A62	60141	Ground, charge-pressure sensor
A63 - A71	—	Not used
A72	grey	Signal input, speed sensor, camshaft
A73	grey/green	Signal input, speed sensor, crankshaft
A74	60545	Output, speed signal 1
A75	—	Not used
A76	60151	Signal input, temperature sensor, charge air
A77	60131	Signal input, coolant temperature sensor
A78 - A79	—	Not used
A80	60162	Signal input, rail-pressure sensor
A81	60102	Signal input, charge-pressure sensor
A82 - A89	—	Not used

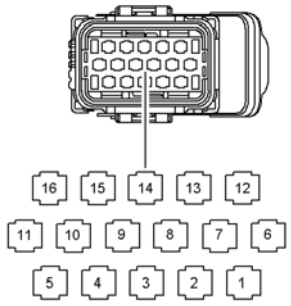
Control unit EDC7 C3 Master Euro 3 V10 (A435) Pin assignment, vehicle connector B



Pin	Line no./colour	Function
B01 - B20	—	Not used
B21	160	M-CAN Low
B22	159	M-CAN High
B23 - B34	—	Not used
B35	60201	ISO K-line
B36	15014	Supply, control unit (terminal 15)

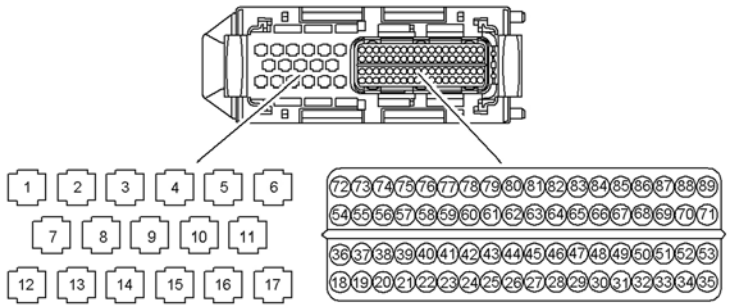
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Control unit EDC7 C3 Master Euro 3 V10 (A435) Pin assignment, injector connector C



Pin	Line no./colour	Function
C01	brown	Injector, cylinder 5, high signal
C02	brown	Injector, cylinder 3, high signal
C03	—	Not used
C04	brown	Injector, cylinder 1, high signal
C05	black	Injector, cylinder 2, high signal
C06	black	Injector, cylinder 4, low signal
C07 - C08	—	Not used
C09	60561	Coding, Master/Slave
C10	60561	Coding, Master/Slave
C11	brown	Injector, cylinder 4, high signal
C12	brown	Injector, cylinder 2, low signal
C13	green/black	Injector, cylinder 1, low signal
C14	—	Not used
C15	green/black	Injector, cylinder 3, low signal
C16	green/black	Injector, cylinder 5, low signal

Control unit EDC7 C3 Slave Euro 3 V10 (A570) Pin assignment, engine connector A

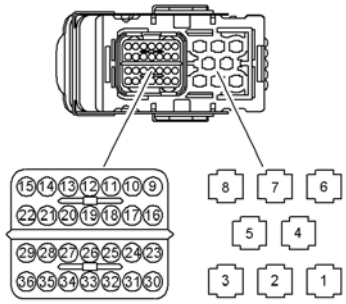


Pin	Line no./colour	Function
A01	60039	Supply, control unit (battery +)
A02	—	Not used
A03	31000	Ground, control unit (battery –)
A04 - A06	—	Not used
A07	60038	Supply, control unit (battery +)
A08	60375	Activation, metering unit 2

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Pin	Line no./colour	Function
A09	31000	Ground, control unit (battery –)
A10	60376	Ground, metering unit
A11	—	Not used
A12	60037	Supply, control unit (battery +)
A13	60040	Supply, control unit (battery +)
A14	31000	Ground, control unit (battery –)
A15	31000	Ground, control unit (battery –)
A16 - A26	—	Not used
A27	brown/black	CAN High Master/Slave
A28 - A42	—	Not used
A43	60165	Supply, rail-pressure sensor (5V)
A44	—	Not used
A45	black/blue	CAN Low Master/Slave
A46 - A60	—	Not used
A61	60164	Ground, rail-pressure sensor
A62 - A71	—	Not used
A72	60545	Signal input, speed signal 1
A73	60546	Signal input, speed signal 2
A74 - A79	—	Not used
A80	60163	Signal input, rail-pressure sensor
A81 - A89	—	Not used

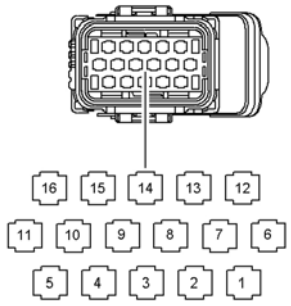
Control unit EDC7 C3 Slave Euro 3 V10 (A570) Pin assignment, vehicle connector B



Pin	Line no./colour	Function
B01 - B20	—	Not used
B21	160	M-CAN Low
B22	159	M-CAN High
B23 - B34	—	Not used
B35	60205	ISO K-line
B36	15014	Supply, control unit (terminal 15)

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Control unit EDC7 C3 Slave Euro 3 V10 (A570) Pin assignment, injector connector C



Pin	Line no./colour	Function
C01	brown	Injector, cylinder 10, high signal
C02	brown	Injector, cylinder 8, high signal
C03	—	Not used
C04	brown	Injector, cylinder 6, high signal
C05	black	Injector, cylinder 7, high signal
C06	black	Injector, cylinder 9, low signal
C07	60562	Coding, Slave
C08	60562	Coding, Slave
C09 - C10	—	Not used
C11	brown	Injector, cylinder 9, high signal
C12	brown	Injector, cylinder 7, low signal
C13	green/black	Injector, cylinder 6, low signal
C14	—	Not used
C15	green/black	Injector, cylinder 8, low signal
C16	green/black	Injector, cylinder 10, low signal

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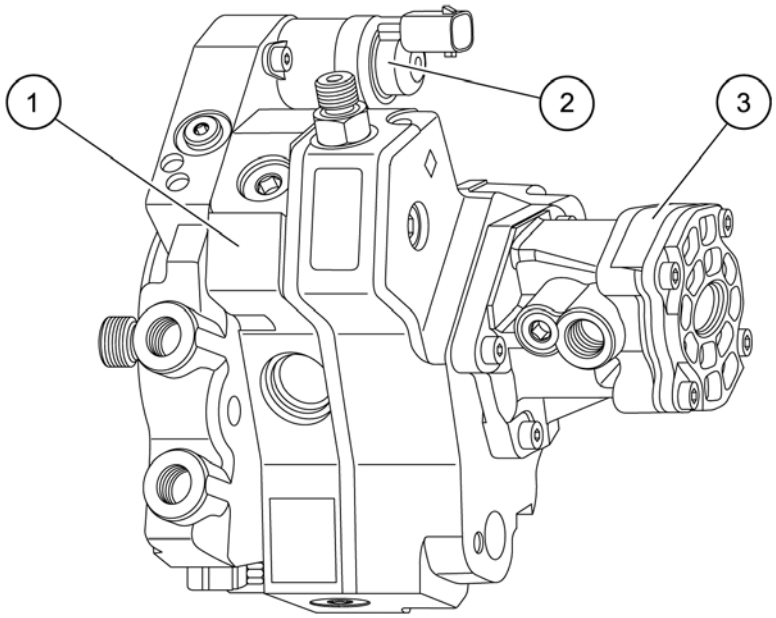
High-pressure pump
The tasks of the high-pressure pump are to generate the high pressure required for injection and to supply an adequate quantity of fuel in all operating states. The high-pressure pump is driven by the engine and, in the case of D08 and D28 in-line engines, is mounted in the same position on the engine as a conventional injection pump. The D20/D26 engine is a new design with overhead camshaft. The high-pressure pump is driven by spur gears. The same spur gear drive also drives the alternator, the water pump and, if fitted, the air-conditioning compressor on the front side of the engine by means of a pulley.

The fuel is forced from a pre-supply pump to the fuel service centre via fuel lines and then into the high-pressure pump “suction chamber” via the metering unit. The pre-supply pump is flange-mounted on the high-pressure pump. The metering unit (MProp) is mounted on the suction side of the high-pressure pump. The metering unit is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail).

Currently two high-pressure pump variants of differing design are used:

– Radial piston pump CP3.3, CP3.4
– In-line piston pump CP9V4

High-pressure pump CP3



(1) High-pressure pump
(2) Metering unit (MProp)
(3) Delivery pump

The high-pressure pump CP3 is a radial piston pump with 3 cylinders. This pump is used in the case of D08, D20, D26 and D28 in-line engines as well as D2868 V8 engines. Depending on the application, high-pressure pumps with fuel lubrication or high-pressure pumps with engine oil lubrication can be used.

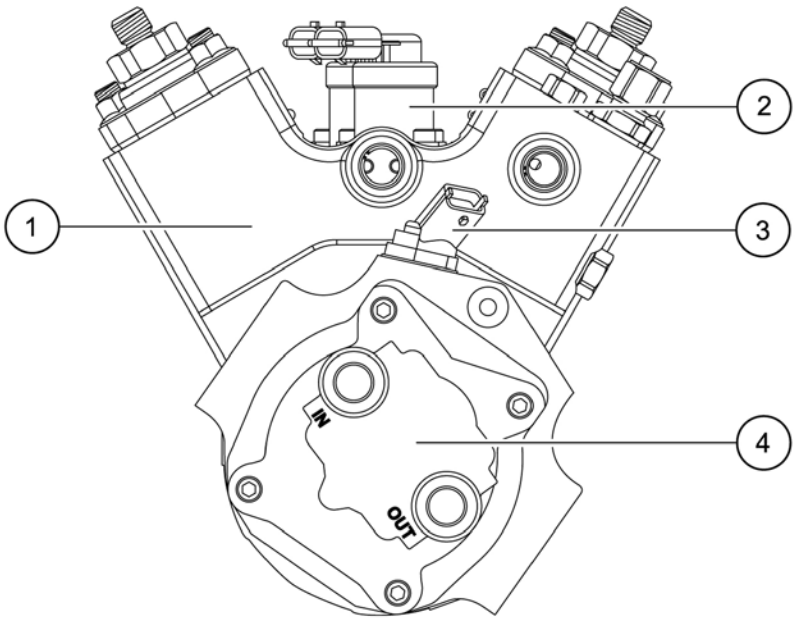
Fuel lubricated pumps CP3.4+ are generally used for Euro 4 engines. In the case of Euro 5/EEV engines with 1800 bar system pressure, fuel-lubricated pumps CP3.4H+ are used for D20/D26 engines and fuel-lubricated pumps CP3.3NHH+ are used for D08 engines.

The ratio relative to the crankshaft is 1:1.33 in the case of D08 engines and 1:1.67 in the case of D20, D26 and D28 engines, i.e. the high-pressure pump rotates faster than the crankshaft.

Note: After the pump is exchanged, the fuel system must be bled before the first start (also see Operator's Manual, “Do-it-yourself jobs, fuel system” section). Fuel-lubricated pumps do not require an initial fill with fuel. In the case of oil-lubricated pumps, bleeding can only be performed with the high-pressure-pump return line pulled off and closed due to the hot/cold circuit.

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CP9V4 high-pressure pump



(1) High-pressure pump
(2) Metering unit (2 pcs., one per bank of cylinders)
(3) Speed sensor (crankshaft speed acquisition)
(4) Supply pump

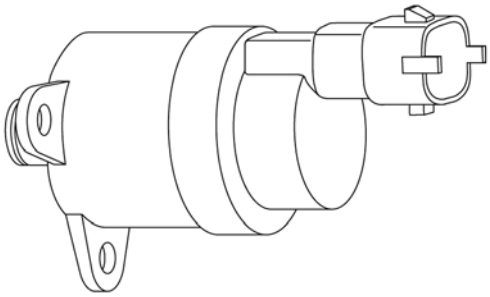
The CP9V4 high-pressure pump is an in-line piston pump with 4 cylinders arranged in a V-shape. This pump is used in the case of D2848, D2840 and D2842 series V engines.

The ratio relative to the crankshaft is 2:1, i.e. this pump rotates at the camshaft speed, that is to say half as fast as the crankshaft.

Note: The designation of the high-pressure pump has changed. Previous name: CP2/4, current designation: CP9V4.

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Metering unit (proportional valve for fuel, MProp) (Y332, Y356)



The metering unit (MProp) is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail). The metering unit is located on the low-pressure side (input side) of the high-pressure pump and is screwed into the CP3 high-pressure pump housing. The CP2/4 or CP9V4 high-pressure pump for the V-engine is equipped with two metering units as two high-pressure accumulators are controlled in this case (one high-pressure accumulator per bank of cylinders).

The metering unit is controlled using a PWM output (pulse width modulated signal):

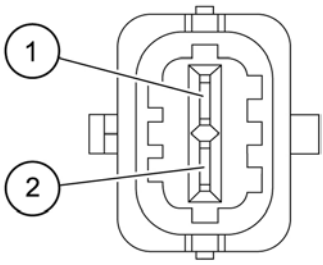
Duty factor 100%	Metering unit closed (zero fuel quantity delivery)
Duty factor 0%	Metering unit open (maximum delivery)

The control circuit consists of a rail-pressure sensor, control unit and metering unit.

Terminology note: The metering unit can also be designated “MProp”. Both terms are used in this manual. MProp is the German abbreviation for (fuel) quantity proportional valve.

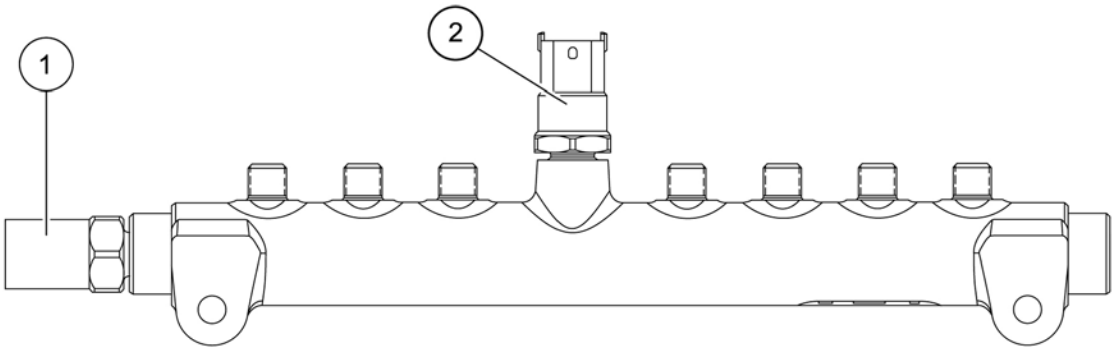
Pin assignment

Pin	Line number	Function	Control unit A435 pin	Control unit A570 pin
1	60373/60375	Input signal, PWM	A08	A08
2	60374/60376	Ground	A10	A10



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High-pressure accumulator (rail)



The name “common rail” is derived from the design and functioning of the high-pressure accumulator. The fuel is injected into the individual cylinders via this common accumulator which is also a fuel distributor or distributor rail. Here the fuel is constantly under high pressure and only needs to be drawn at the right time.

The high-pressure accumulator has the following tasks:

– Storing the fuel
– Preventing pressure fluctuations

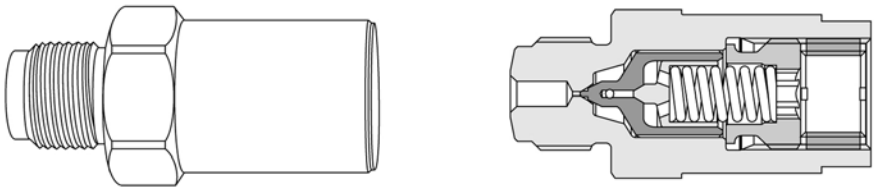
The high-pressure accumulator is a pipe made from forged steel. The diameter and length of this pipe depends on the engine. To prevent pressure fluctuations, the largest possible volume must be aimed for, i.e. pipe as long as possible and pipe diameter as large as possible. However, a small volume is better for fast starting of the engine. Therefore, the volume has to be configured as precisely as possible to suit the engine in question. The illustration above is therefore a configuration example only. The pressure limiting valve (1) and the rail-pressure sensor (2) are also mounted on the high-pressure accumulator.

The fuel flows from the high-pressure pump to the high-pressure accumulator via a line. There is a port on the high-pressure accumulator for each cylinder. The fuel flows to the injector via this port and a line.

Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail.

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Pressure-limiting valve



The pressure limiting valve is mounted on the high-pressure accumulator (rail) and functions as a pressure relief valve with pressure limiting. The pressure limiting valve limits the pressure in the rail. If the pressure is too high, it uncovers a discharge hole. At normal operating pressure, a spring pushes a piston tight into the valve seat so that the rail remains closed. Only once the maximum system pressure is exceeded is a piston pressured against a spring by the pressure in the rail.

The pressure limiting valve consists of two pistons. If the rail pressure is too high (at approx. 1800 bar) the first piston moves and uncovers part of a cross-section permanently so that the fuel can flow out of the rail. The rail pressure is then kept constant at around 700 to 800 bar. The engine continues running and the vehicle can be driven to the nearest MAN Service outlet at reduced full-load quantity.

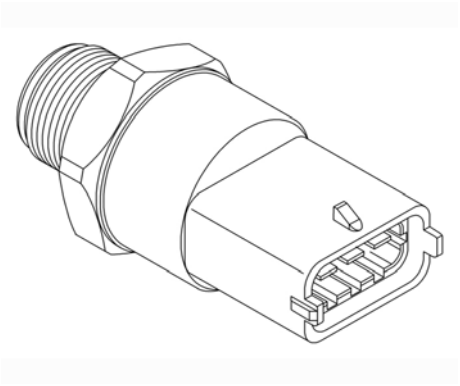
The pressure limiting valve does not close again until the engine has been stopped and the rail pressure has fallen below 50 bar, i.e. once it has opened, the 2nd stage remains open for as long as the engine is running.

If the pressure limiting valve does not open quickly enough, it is forced open. To force open the pressure limiting valve, the fuel metering unit is opened by interrupting the voltage supply and the drawing of fuel via the injectors is blocked. The rail pressure rises rapidly until the pressure limiting valve opening pressure is reached. If forcing open the valve does not bring about the desired success, e.g. due to jamming of the pressure limiting valve, the engine is stopped.

Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail. The PLV has the same function as the previous part and can be replaced as before.

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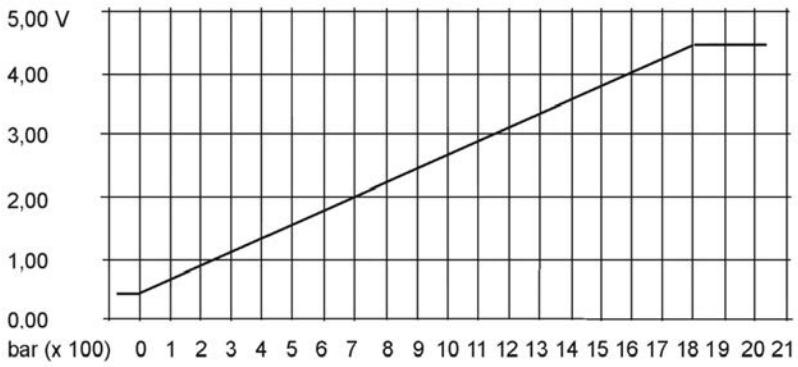
Rail-pressure sensor (B487, B514)



The rail-pressure sensor monitors the fuel pressure in the high-pressure accumulator (rail). The aim is to ensure a specified pressure for the operating point concerned in the high-pressure accumulator (rail). The rail-pressure sensor is mounted on the high-pressure accumulator.

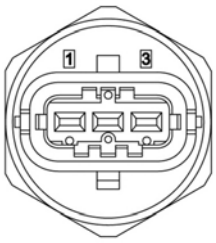
D2840 series engines (V-engines) have two high-pressure accumulators fitted (one for each bank of cylinders). Therefore there are also two rail-pressure sensors.

Sensor curve



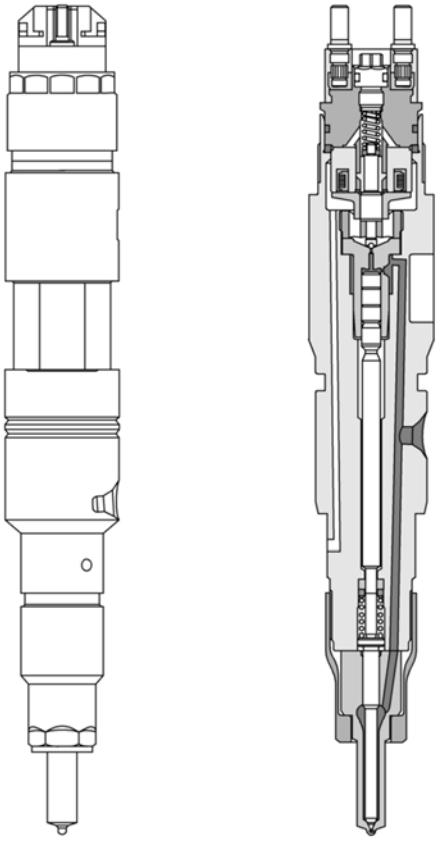
Pin assignment

Pin	Line no.	Function	Control unit A435 pin	Control unit A570 pin
1	60160/60164	Sensor ground	A61	A61
2	60162/60163	Output signal	A80	A80
3	60161/60165	Voltage supply 5 V	A43	A43



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Injector (Y341 - Y350)



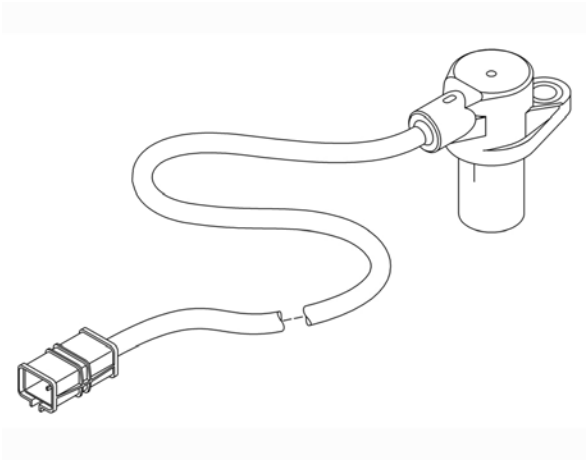
The injector is used to inject fuel into the combustion chamber. The EDC 7 specifies the injection period (injector coil activation period for pre-injection, main injection and possibly post-injection) and the injection point and activates an extremely fast solenoid valve in the injector. The solenoid valve armature opens or closes the control chamber discharge throttle. If the discharge throttle is open, the pressure in the control chamber falls and the injector needle opens. If the discharge throttle is close, the pressure in the control chamber rises and the injector needle is closed. The opening behaviour of the injector needle (opening and closing speed) is therefore determined by the feed and discharge throttle in the injector control chamber.

The injector leakage quantity (leakage via discharge throttle and injector needle) is returned to the tank via the return line. The exact injection quantity is determined by the outlet cross-section of the injector, the solenoid valve opening duration and the accumulator pressure.

Important note when exchanging injectors: When exchanging, ensure that injectors with the same Bosch number are installed again. There are currently two types of injectors. **It is not possible to replace “old” injectors with “new” injectors! Do not mix!** If it is necessary to change over to the latest type of injectors, the rail must be replaced and the control unit reprogrammed. Note Service Information 132400!

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Crankshaft speed sensor (speed increment sensor) (B488)



This sensor on the flywheel is used to measure (calculate) the crankshaft angle (crank angle). This information is vital for ensuring the correct activation point of the injectors for the individual cylinders.

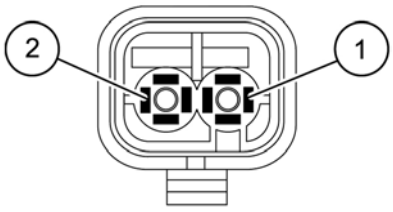
The pulse-generating wheel is designed as an increment wheel. This speed sensor is therefore referred to as a speed increment sensor. The increment wheel is part of the flywheel and has 60 –2 = 58 holes (6x5 mm) spaced at 6° intervals. Two of the holes are missing in order to form a gap. The purpose of the gap is to determine the 360° crank angle of the engine (one crankshaft revolution) and is assigned to a defined cylinder 1 crankshaft position. The engine can also start with crankshaft sensor only or with camshaft sensor only. In the case of operation with crankshaft sensor only, test injections are carried out at gas flow TDC and ignition TDC as the EDC without camshaft sensor first has to locate the correct ignition TDC. If the control unit detects a speed reaction (ignition), it has found the correct TDC. The engine then starts and runs as with both sensors.

The speed increment sensor consists of a permanent magnet and a coil with a large number of windings. The magnet “touches” the rotating component – in this case the increment wheel mounted on the crankshaft – with its magnetic field. The current flow is amplified whenever a hole moves past the sensor. The current flow is weaker in the gaps in-between. This gives rise to an inductive voltage in the sensor coil. This voltage is evaluated by the ECU. The gap between the sensor and the increment wheel is approx. 1 mm.

Note: The first half wave must be positive, otherwise a fault is entered: SPN 3753.

Pin assignment

Pin	Cable colour	Function	Control unit A435 pin
1(2)	yellow (grey/green)	Output signal	A73
2(1)	black (grey/white)	Sensor ground	A55

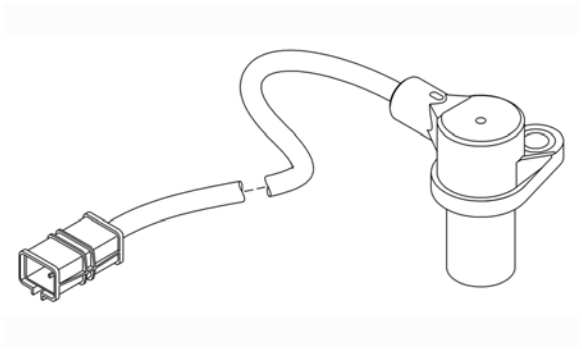




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Camshaft speed sensor (speed segment sensor) (B489)



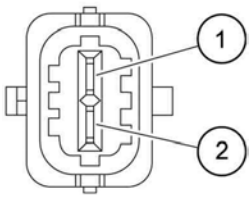


The camshaft controls the engine intake and exhaust valves. It rotates at half the speed of the crankshaft. Its position determines whether a piston is in the compression stroke or the exhaust stroke whilst it moves towards TDC. This information cannot be obtained based on the crankshaft position during starting. However, when driving, the information generated by the speed increment sensor on the crankshaft is sufficient for determining the engine state. This means that, if the speed sensor on the camshaft fails during driving, the control unit is still aware of the engine state. The pulse-generating wheel is designed as a segment wheel and is driven by the camshaft. This speed sensor is therefore referred to as a speed segment sensor. The segment wheel is also referred to as a phase wheel. It has one phase mark per cylinder (e.g. 6 marks in the case of 6-cylinder engines or 4 marks in the case of 4-cylinder engines) and a synchronisation mark. The phase mark is a tooth on the phase wheel. The phase marks are equally spread around the phase wheel. The synchronisation mark is an additional mark on the phase wheel right behind one of the phase marks. Its purpose is to determine the engine angle position within 720° crank angle. The engine can also start with camshaft sensor only or with crankshaft sensor only. In the case of operation with crankshaft sensor only, test injections are carried out at gas flow TDC and ignition TDC as the EDC without camshaft sensor first has to locate the correct ignition TDC. If the control unit detects a speed reaction (ignition), it has found the correct TDC. The engine then starts and runs as with both sensors. In the case of operation with camshaft sensor only, angle corrections are stored in the control unit so that the injection point can also be determined correctly without precisely calculating the crank angle using the increment sensor. The speed segment sensor has the same design and operation as the speed increment sensor for acquiring the crankshaft speed. **Signal sequence:** At pin 2, the 1st half wave appears positive when a magnetically conductive material passes by.

Notes:
- The first half wave must be positive, otherwise a fault is entered: SPN 3752
- In D2840/42 and D2848 series V engines, the sensor is mounted in the housing of high-pressure pump CP9V4
- In the case of D2876 series engines, the sensor with cable is used

Pin assignment

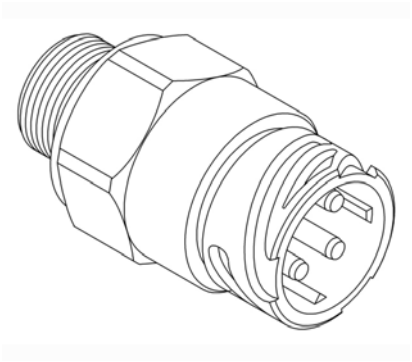
Pin	Cable colour	Function	Control unit A435 pin
1(2)	yellow (grey)	Output signal	A72
2(1)	black (grey/brown)	Sensor ground	A54





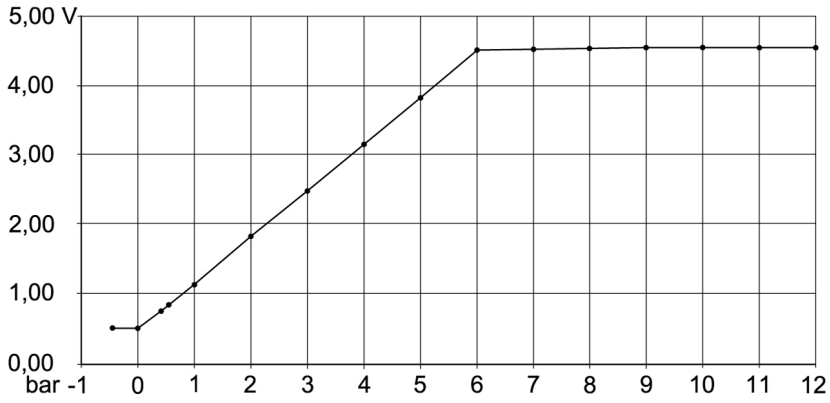
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Oil pressure sensor (B104)



The oil pressure sensor protects the engine. It monitors the oil pressure. The pressure measuring range is from 0 bar (0.5 V) to 6 bar (4.5 V).

Sensor curve



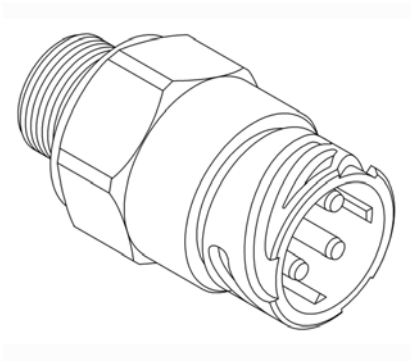
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60156	Supply voltage 5 V	A24
2	60135	Sensor ground	A38
3	60134	Output signal	A21
4	—	—	—



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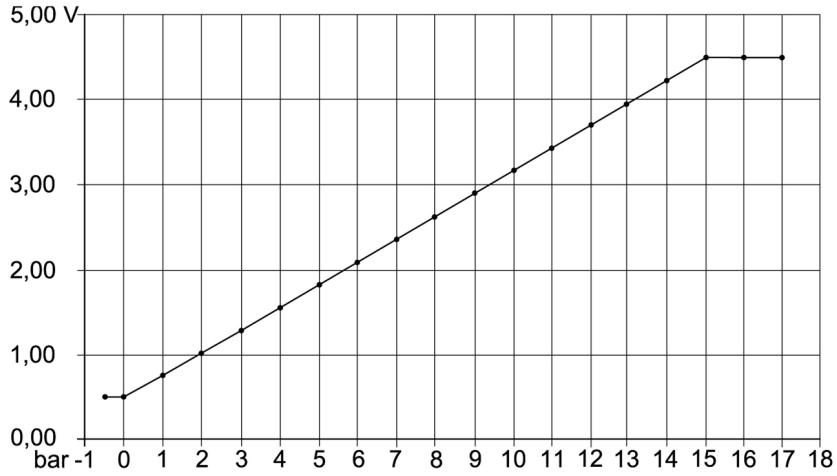
Fuel pressure sensor (B377)



The fuel pressure sensor monitors the fuel pressure at the pump feed (low-pressure side). The pressure measuring range is from 0 bar (0.5 V) to 15 bar (4.5 V).

Note: The sensor was not initially installed in D08 series engines.

Sensor curve



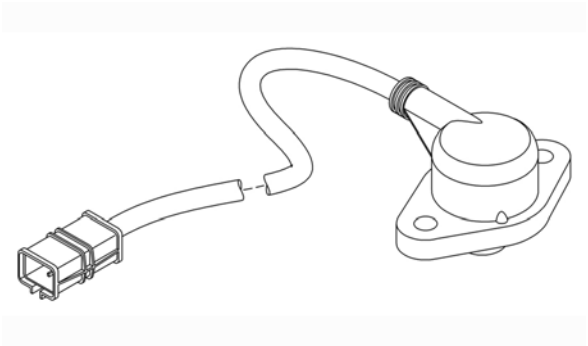
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60155	Supply voltage 5 V	A40
2	60158	Sensor ground	A37
3	60137	Output signal	A20
4	—	—	—



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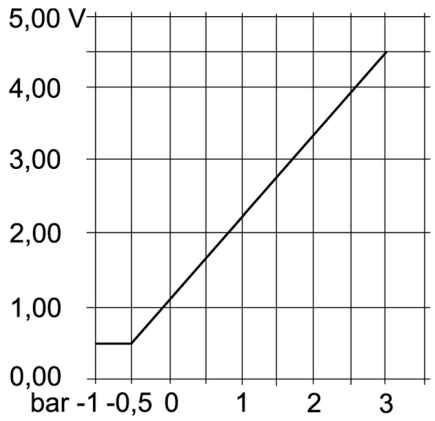
Kavlico charge-pressure sensor (B125)



The charge-pressure sensor measures the absolute charge pressure. The sensor element and an electronic control unit (for signal amplification and temperature compensation) are integrated on a silicon chip. The active surface of the silicon chip is exposed to a reference vacuum. The intake manifold pressure is forwarded via a discharge stub to the rear of the diaphragm which is resistant to the measuring medium.

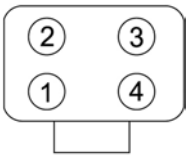
The charge-pressure sensor is mounted on the intake manifold. If the charge-pressure sensor is classified as defective (SPN 102), a default value is specified, i. e. an intact sensor is simulated. There are therefore no operating restrictions.

Sensor curve



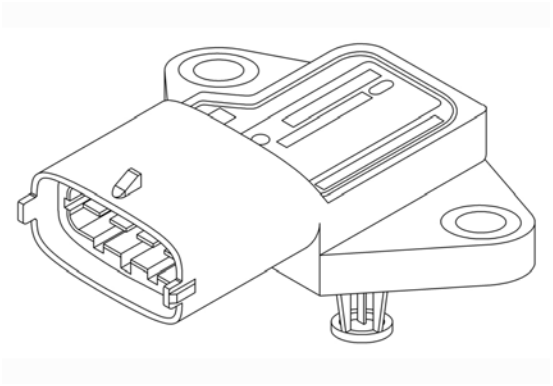
Pin assignment

Pin	Cable colour	Line number	Function	Control unit A435 pin
1	—	—	Not used	—
2 (3)	green	60141	Sensor ground	A62
3 (2)	red	60159	Supply voltage 5 V	A25
4 (1)	black	60102	Output signal	A81



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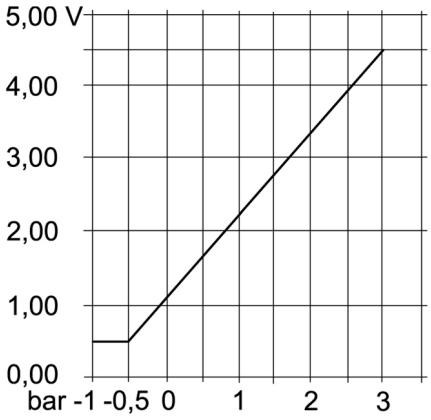
Bosch LDF 6 charge-pressure sensor (B125)



The Bosch LDF 6 charge-pressure sensor has been/will be introduced for all model series. The Kavlico sensor will continue to be fitted as standard for discontinued engine designs.

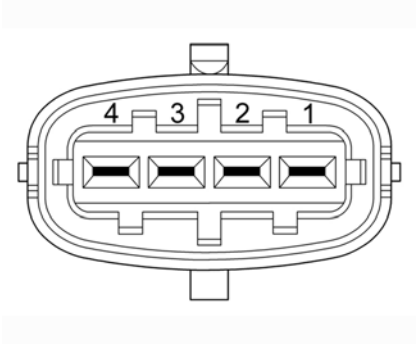
Operation and the sensor curve are exactly the same as for the Kavlico sensor.

Sensor curve



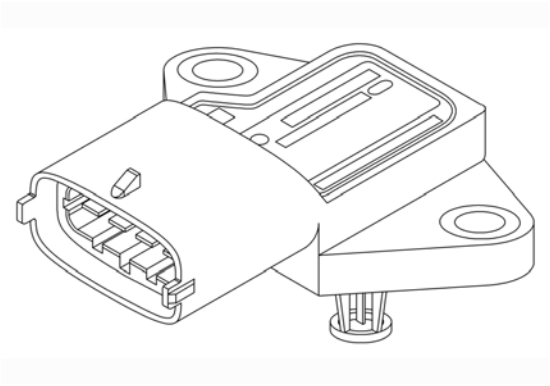
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60141	Sensor ground	A62
2	—	Not used	—
3	60159	Supply voltage 5 V	A25
4	60102	Output signal	A81



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Bosch LDF 6T charge-pressure sensor (B623, B694)



The Bosch LDF 6T charge-pressure sensor is used in D08 and D20/D26 series Euro 4/5 engines. The LDF 6T charge-pressure sensor is also equipped with a temperature sensor. Together with the charge air temperature sensor (B123), its purpose is to monitor EGR. The LDF 6T is fitted upstream of the EGR inlet line whilst the charge air temperature sensor is fitted downstream of the inlet line. The different temperatures of the two sensors enables the plausibility of the EGR rate to be checked.

In the case of D20/D26 engines which meet the requirements of the Euro 5 emission standard without MAN AdBlue® system, a further charge air/temperature sensor (B694) is installed to monitor the low-temperature circuit.

If the MAN AdBlue® system is fitted, the LDF 6T pressure and temperature information is used to calculate the air-mass flow. The charge air temperature sensor (B123) is not fitted in these systems.

Measured values

Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohms	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

Pin assignment, B623

Pin	Line number	Function	Control unit A435 pin
1	60141	Sensor ground	A62
2	90121	Output signal, temperature	A70
3	60159	Supply voltage 5 V	A25
4	60102	Output signal, charge pressure	A81

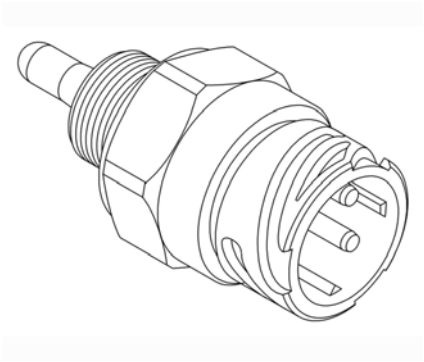
Pin assignment, B694

Pin	Line number	Function	Control unit A435 pin
1	60188	Sensor ground	B20
2	60187	Output signal, temperature	B10
3	60189	Supply voltage 5 V	B28
4	60190	Output signal, charge pressure	B18

The connector pattern and sensor curve for charge pressure are identical to the LDF 6 sensor (B125)

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Charge air temperature sensor (B123)



The charge air temperature sensor monitors the exhaust gas recirculation together with the charge air temperature sensor LDF 6T (B623). The LDF 6T is fitted upstream of the EGR inlet line whilst the charge air temperature sensor (B123) is fitted downstream of the inlet line. The different temperatures of the two sensors enables the plausibility of the EGR rate to be checked.

If MAN AdBlue® system is fitted, the charge air temperature sensor B123 is not installed.

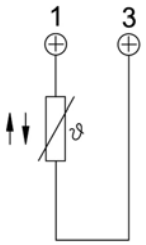
Measured values

Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohms	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

Pin assignment

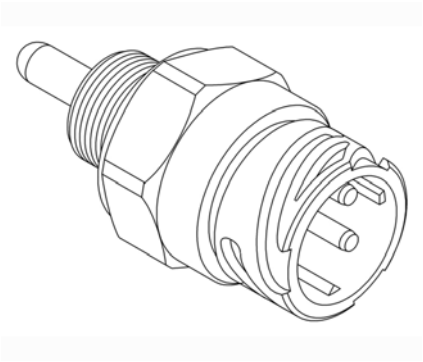
Pin	Line number	Function	Control unit A435 pin
1	60151	Output signal	A76
2	—	Not used	—
3	60100	Sensor ground	A57
4	—	Not used	—





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Coolant temperature sensor (B124, B1049)



The coolant temperature sensor B124 provides the control unit with information about the coolant temperature. The control unit calls up various engine operating maps, depending on the coolant temperature.

In the case of D20/D26 engines which meet the requirements of the Euro 5 emission standard without MAN AdBlue® system, a further coolant temperature sensor (B1049) is installed to monitor the low-temperature circuit.

Measured values

Temperature in °C	120	100	80	60	40	20	0	–20	–40
Resistance in ohms	112	186	322	595	1175	2500	5896	15462	45313
Voltage in volts	0.643	0.982	1.480	2.170	2.980	3.740	4.300	4.613	4.754

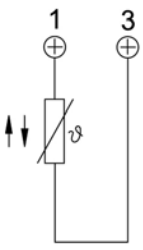
Pin assignment, B124

Pin	Line number	Function	Control unit A435 pin
1	60131	Output signal	A77
2	—	Not used	—
3	60101	Sensor ground	A58
4	—	Not used	—

Pin assignment, B1049

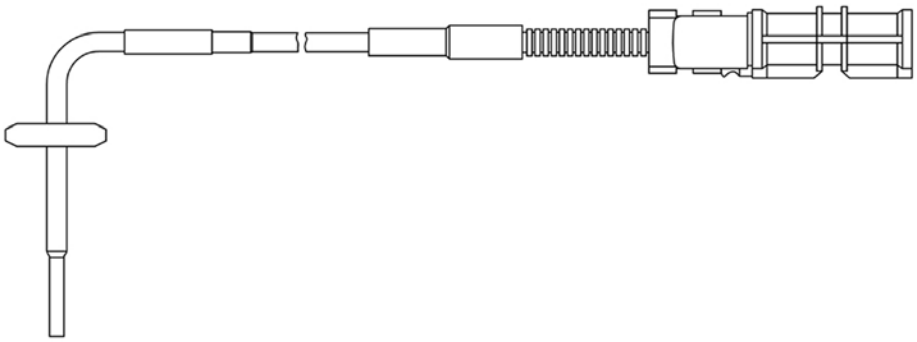
Pin	Line number	Function	Control unit A435 pin
1	60191	Output signal	A65
2	—	Not used	—
3	60192	Sensor ground	A84
4	—	Not used	—





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Exhaust gas temperature sensor (B561, B633)



The temperature sensor B561 monitors the exhaust gas temperature upstream of the PM catalytic converter (EGR system). The temperature sensor B633 monitors the exhaust gas temperature upstream of the catalytic converter (MAN AdBlue® system). The sensors are identical. Depending on the engine (LF, LOH, LUH), the straight version of the temperature sensor B561 may also be fitted.

Note: In D08 series engines with OBD stage 1, the temperature sensor B561 is omitted following the introduction of the software version P362V25. However, in the case of OBD Stage 1 with NOx monitoring measurement, the sensor for dew point detection and, therefore, for activating the oxygen sensor, has been re-introduced.

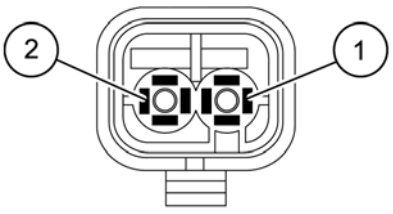
Dew point detection: During normal operation, the oxygen sensor's operating temperature is 780°C. After the engine is started, there is a risk of the oxygen sensor ceramic being damaged or destroyed by condensing water. To ensure that no further droplets form, the amount of heat generated (function of exhaust gas mass flow rate and temperature) is determined. Oxygen sensor heating is enabled depending on the amount of heat generated.

Measured values

Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

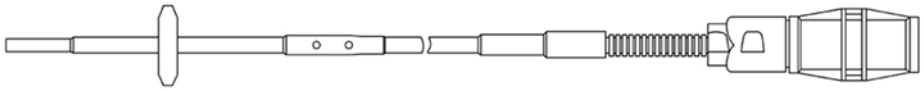
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	90122/90115	Output signal	B33
2	90119/90116	Sensor ground	B26



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Exhaust gas temperature sensor (B561, B634)



The temperature sensor B561 monitors the exhaust gas temperature upstream of the PM catalytic converter (EGR system). The temperature sensor B634 monitors the exhaust gas temperature downstream of the catalytic converter (MAN AdBlue® system). The sensors are identical. Depending on the engine (LF, LOH, LUH), the angled version of the temperature sensor B561 may also be fitted.

Note: In D08 series engines with OBD stage 1, the temperature sensor B561 is omitted following the introduction of the software version P362V25. However, in the case of OBD Stage 1 with NOx monitoring measurement, the sensor for dew point detection and, therefore, for activating the oxygen sensor, has been re-introduced.

Dew point detection: During normal operation, the oxygen sensor's operating temperature is 780°C. After the engine is started, there is a risk of the oxygen sensor ceramic being damaged or destroyed by condensing water. To ensure that no further droplets form, the amount of heat generated (function of exhaust gas mass flow rate and temperature) is determined. Oxygen sensor heating is enabled depending on the amount of heat generated.

Measured values

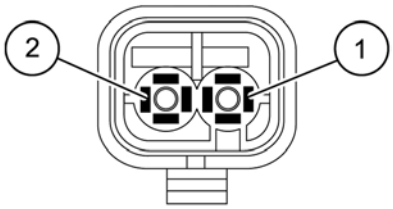
Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

Pin assignment, B561

Pin	Line number	Function	Control unit A435 pin
1 (2)	90122	Output signal	B33
2 (1)	90119	Sensor ground	B26

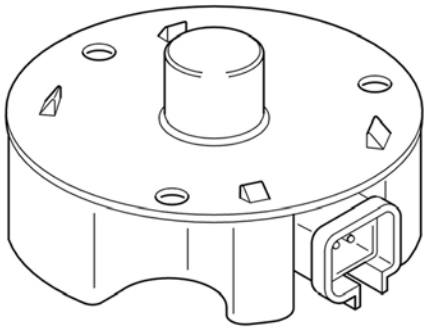
Pin assignment, B634

Pin	Line number	Function	Control unit A808 pin
1 (2)	90117	Sensor ground	22
2 (1)	90118	Output signal	23



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AdBlue® fill level/temperature sensor (B628)

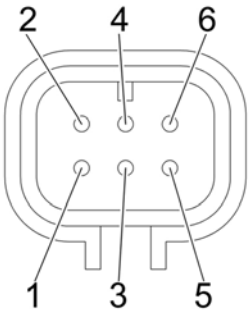


The sensor monitors the fill level and the temperature in the AdBlue® tank. The fill level is determined based on an ultrasonic measurement process (i.e. by means of acoustic waves). An NTC thermistor is used to determine the temperature. The sensor communicates with the AdBlue® dosing control unit DCU 15 via CAN bus.

Pin assignment

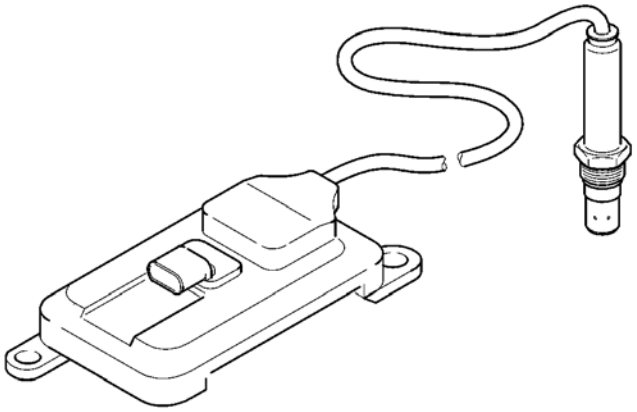
Pin	Line number	Function	Connection
1	195/90008	Supply, sensor (term. 15)	Fuse F894
2	196/3100	Ground	Earthing point, cab X1644
3	191	Exhaust gas CAN High (jumpered with pin 5)	EDC control unit A435 pin A27
4	192	Exhaust gas CAN Low (jumpered with pin 6)	EDC control unit A435 pin A45
5	191	Exhaust gas CAN High (jumpered with pin 3)	AdBlue control unit A808, pin 8
6	192	Exhaust gas CAN Low (jumpered with pin 4)	AdBlue control unit A808, pin 7

Note: in the case of EDC7 C32 Master/Slave, the exhaust CAN is on pin B25 (line 191) and pin B32 (line 192) of the Master control unit A435.



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NOx sensor (B994)



In engines with MAN AdBlue® system, the NOx sensor measures the nitrogen oxide concentration and the oxygen content in the exhaust gas stream.

The operating principle of the NOx sensor is based on the decomposition of nitrogen oxide by means of a catalytically active electrode.

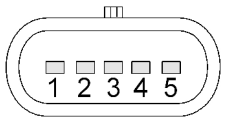
The measurement of the oxygen produced here is known from the linear oxygen sensor. The layout of the multi-layer Zirconium dioxide sensor ceramic (ZrO_2) includes two chambers: In the first chamber, the oxygen contained in the exhaust gas is reduced or increased to a constant partial pressure of several 10 ppm by applying a pump current. The necessary current is proportional to the air ratio reciprocal value. In the second chamber, the NOx reduction takes place at the measuring electrode. The current required for keeping the electrode area free of oxygen is proportional to the nitrogen oxide concentration and forms the measuring signal.

The sensor electronics provide the measured gas concentrations for other control units via the exhaust gas CAN. The measured values are evaluated in the AdBlue® dosing control unit. The NOx sensor is equipped with an electrical heating element that is activated when the ignition is switched on. Any requests for switching the heating element on or off are sent by the AdBlue® dosing control unit via the exhaust gas CAN.

Pin assignment

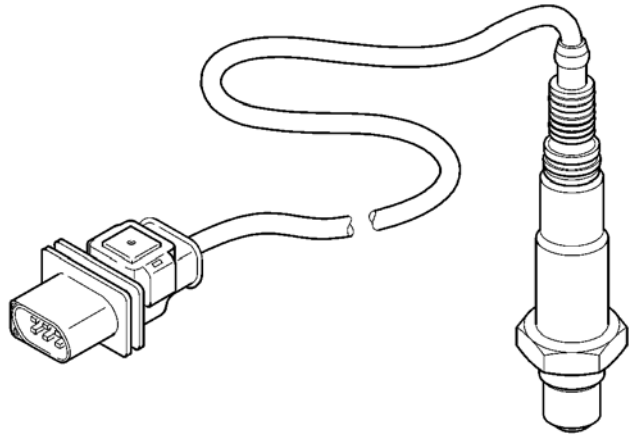
Pin	Line number	Function	Connection
1	195/90008	Supply $+U_{bat}$	Fuse F894 (term. 15)
2	196/31000	Sensor ground	Earthing point, cab, next to central electrical system X1644
3	192	Exhaust gas CAN Low	EDC control unit A435 pin A45
4	191	Exhaust gas CAN High	EDC control unit A435 pin A27
5	—	Not used	—

Note: in the case of EDC7 C32 Master/Slave, the exhaust CAN is on pin B25 (line 191) and pin B32 (line 192) of the Master control unit A435.



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Oxygen sensor (B322)

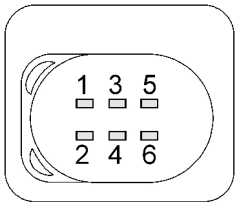


The oxygen sensor is used in engines with externally cooled exhaust gas recirculation, as an alternative method to measuring by means of NOx sensor. The basis of this monitoring concept for engines with exhaust gas recirculation is the primary dependence of the NOx emissions on the oxygen content and the charge mass (air mass and mass of the recirculated exhaust gas) in the cylinder at stationary operating points.

The oxygen sensor measures the difference in oxygen concentration between the ambient air and the exhaust gas stream. This means that the measuring signal emitted by the sensor is a direct indicator of the air ratio in the exhaust gas. Heating of the sensor even allows analysis of the air ratio for exhaust gas temperatures of around 150 °C. The LSU 4.9 oxygen sensor used here is a broadband sensor, i. e., it is possible to measure infinitely variable lambda values between λ = 0.65 and air. This is possible because a practically linear “pump current” serves as a variable for the control unit. The broadband sensor has two cells: one pump cell and one sensor cell (Nernst concentration cell). The pump current is used to pump in as many oxygen ions as required until there is a voltage value of 450 mV between the electrodes in the reference air duct and in the measuring cell. The pump current is the variable for the lambda value. Therefore, a corresponding evaluation circuit is able to use the oxygen sensor for monitoring the EGR rate. The EGR rate has a direct effect on the NOx values (an insufficient EGR rate leads to an excessive NOx concentration and SPN 3930 is set).

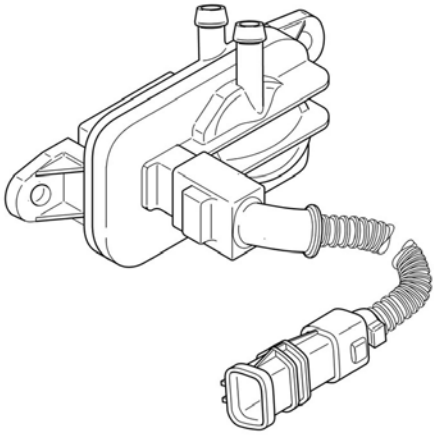
Pin assignment

Pin	Line number / line colour	Function	Control unit A435 pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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Exhaust gas differential pressure sensor (B565)



The exhaust gas differential pressure sensor monitors the pressure drop (differential pressure) over the two connecting points on the measurement section in the case of vehicles with CRT filter. Compared to the exhaust gas relative pressure, the differential pressure is a better indicator of the pressure drop, as the varying ambient pressure is discounted.

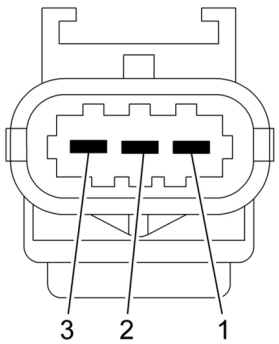
Note: In the case of vehicles with PM catalytic converter, the exhaust gas differential pressure sensor was temporarily used as a back-up solution in the configuration of a relative pressure sensor in place of the exhaust gas relative pressure sensor.

Measured values

Pressure in kPa	0.0	5.0	10	15	20	30	40	50	65
Voltage in volts	0.50	0.90	1.30	1.70	2.10	2.90	3.70	4.50	4.50

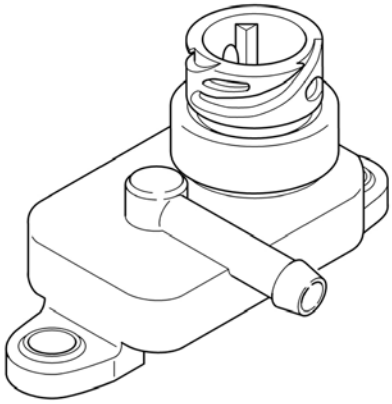
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	90126	Supply voltage 5 V	A41
2	90127	Sensor ground	A59
3	90128	Output signal	A78



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Exhaust gas relative pressure sensor (B683)



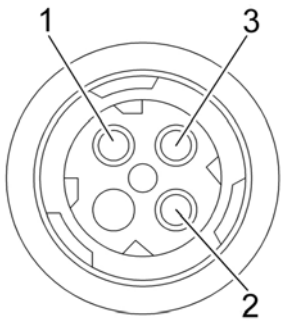
The exhaust gas relative pressure sensor has the same electrical interface as the exhaust gas differential pressure sensor. However, it only measures the relative pressure of the exhaust gas, i.e. the pressure currently existing against atmospheric pressure. The differential pressure sensor, on the other hand, shows the pressure drop over the two connecting points on the measurement section (filter system or catalytic converter system). The exhaust gas relative pressure sensor replaces the exhaust gas differential pressure sensor (except CRT filter).

Measured values

Pressure in kPa	0.0	5.0	10	15	20	30	40	50	65
Voltage in volts	0.50	0.90	1.30	1.70	2.10	2.90	3.70	4.50	4.50

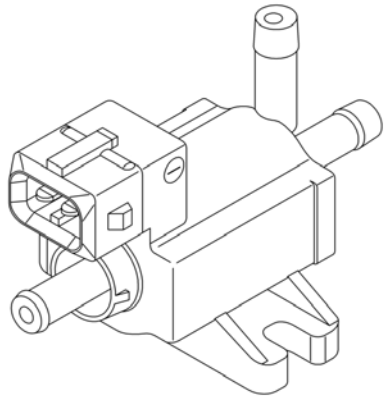
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	90126	Supply voltage 5 V	A41
2	90127	Sensor ground	A59
3	90128	Output signal	A78



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Turbocharger pulse valve (Y340, Y493)



The pulse valves for turbocharger 1 (Y340) and turbocharger 2 (Y493) are activated by the EDC control unit by means of PWM output (pulse width modulated signal). in line with these signals, the pulse valve concerned varies the pressure at the turbocharger wastegate capsule and, therefore, the position of the wastegate flap, i.e. the charge pressure. The PWM signal limit values are between 0 % corresponding to maximum opened wastegate (minimum charge pressure) and 100 %, i. e. wastegate closed (maximum charge pressure).

D08 series engines with 2-stage turbocharging only have one pulse valve (Y340) installed to control the charge pressure at the high-pressure compressor by means of wastegate. Series D20/D26 engines which meet the requirements of the Euro 5 emission standard without MAN AdBlue® system (in-engine EGR) use 2-stage turbocharging with intercooling. Here a further pulse valve (Y493) is installed for charge pressure control at the low-pressure compressor by means of wastegate. This wastegate is needed to operate the low-pressure stage in the optimum efficiency range in the event of high exhaust gas mass flow rates.

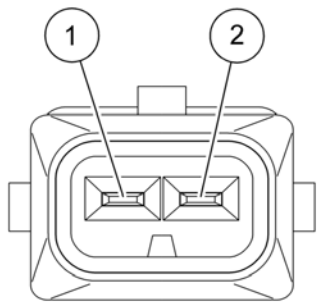
In the 2-stage supercharging system, the exhaust gas first flows through a small turbocharger (high-pressure stage) and then through a larger turbocharger (low-pressure stage). The high-pressure stage allows a high charge pressure to build up, even at low revs, meaning that the high amount of air required for low-particulate combustion is achieved. The intercooling is required to limit the charge air temperatures during compression and thus prevent coking (carbon deposits) of the compressor wheel and the compressor housing. The intercooling also increases the high-pressure compressor's efficiency.

Pin assignment, Y430

Pin	Line number	Function	Control unit A435 pin
1 (+)	60383	Activation +	A04
2 (–)	60384	Activation –	A02

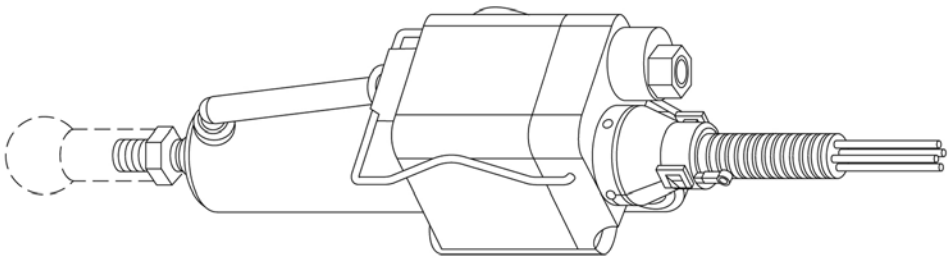
Pin assignment, Y493

Pin	Line number	Function	Control unit A435 pin
1 (+)	60398	Activation +	B04
2 (–)	60399	Activation –	B13



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Exhaust gas recirculation (EGR) controller (Y280)



In the case of cooled external exhaust gas recirculation, a small part branches off from the main exhaust gas flow and flows through a special heat exchanger. The now cooled exhaust gas is mixed with the fresh air in the intake tract via a valve system on the engine front side. The combustion temperature therefore remains lower. Less nitrogen oxide (NO_X) is produced. The EGR controller is activated by the EDC control unit. EGR is deactivated under certain temperature conditions, firstly to prevent the condensation of sulphurous acids at low charge air temperatures and secondly to prevent excessive heating of the charge air by the recirculated exhaust gas. The EGR controller has a built-in dry-reed contact which monitors the EGR flap position, to detect whether the EGR flap is open or closed.

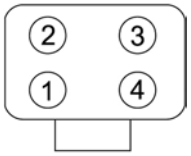
The exhaust gas recirculation controller (EGR controller) consists of the following components:

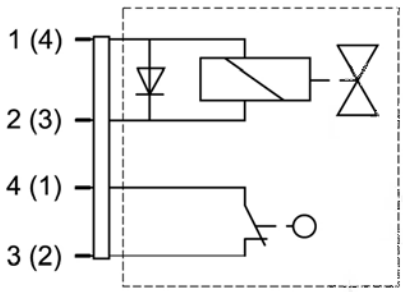
– Compressed air cylinder for actuating the exhaust gas recirculation flap
– Solenoid valve for activating the cylinder
– Dry-reed contact for piston position feedback

Note: In the rest position (piston retracted), the dry-reed contact is closed. Please observe the different representation on the wiring diagrams.

Pin assignment

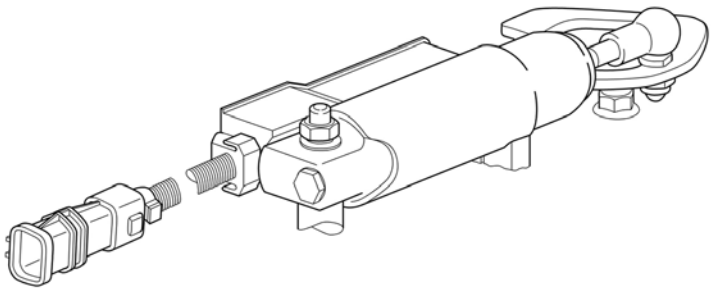
Pin	Cable colour	Line number	Function	Control unit A435 pin
1 (4)	grey	60340	Activation –	A11
2 (3)	black	60367	Activation +	A17
3 (2)	white	60031	Feedback +	A23
4 (1)	yellow	60153	Feedback	A22





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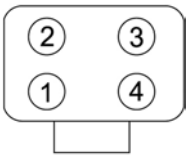
Position-controlled EGR controller (E-EGR) with travel sensor (B673)



In the case of position-controlled exhaust gas recirculation, the pneumatic EGR positioning cylinder (E-EGR) varies the position of the EGR flap infinitely. This means that the amount of recirculated exhaust gas can be metered as required, depending on the engine operating state. This results in extremely low pollutant emissions across the entire engine operating range. Fuel consumption can be further reduced, especially during dynamic engine operation. The EGR flap position is monitored by the travel sensor mounted on the positioning cylinder (B673).

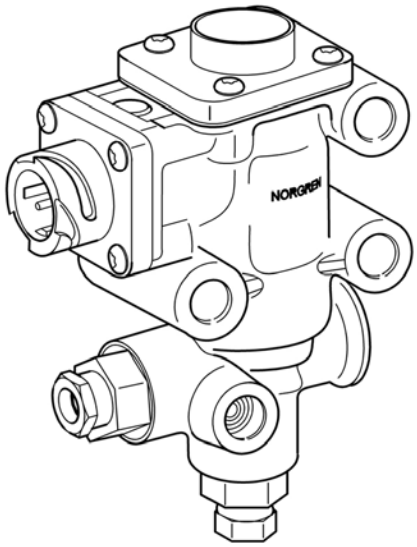
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1 (4)	60182	Ground, position sensor	A39
2 (3)	60181	Output signal	A87
3 (2)	60180	Supply voltage 5 V	A32
4 (1)	—	Not used	—



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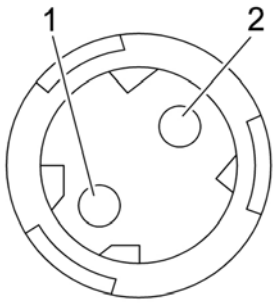
Proportional valve E-EGR (Y458)



The proportional valve (Y458) controls the position-controlled EGR controller (E-EGR). The operating medium is air at a minimum operating pressure of about 7 bar. A duty factor parameter is specified by the EDC control unit as an activation signal.

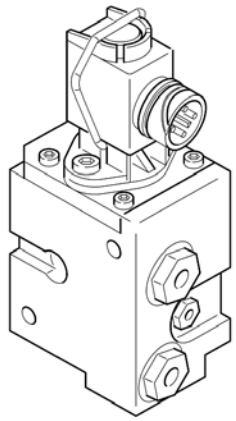
Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60392	Ground	A17
2	60393	Proportional valve activation	A11



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Compressed air shut-off valve (Y460)



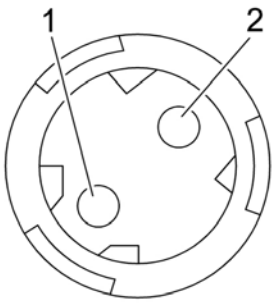
The compressed air shut-off valve (Y460) supplies the E-EGR, EVBec and Pritarder systems with compressed air, while the engine is running and is closed when de-energised. This prevents a pressure loss when the engine is stopped.

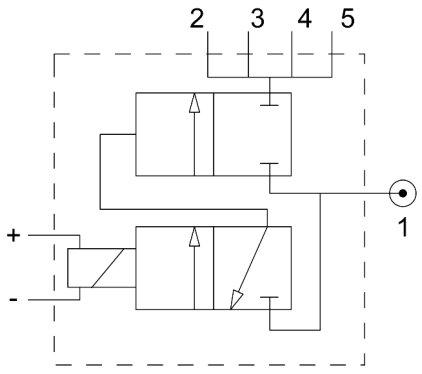
The valve is mounted on the engine and controlled by the EDC control unit.

Depending on the vehicle, activation can also be via a separate relay that is activated when the engine is running (term. D+) and switches through term. 15. This valve is mounted on the solenoid valve block on the frame crossmember.

Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60395	Pressure shut-off valve activation	B06
2	60394	Ground	B02

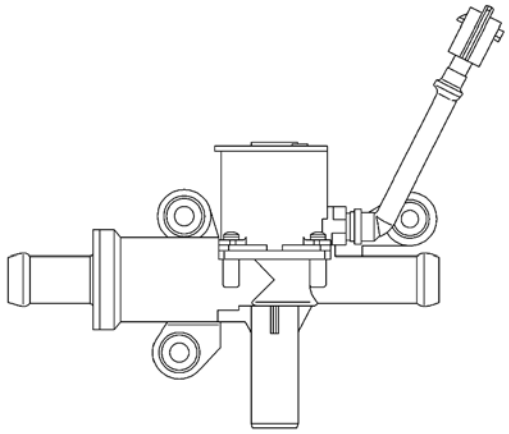




1 Connection, reservoir line
2 Not used
3 Connection, PriTarder
4 Connection, EVBec
5 Connection, E-AGR

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Shut-off/pressure-reducing valve, LT cooler (Y496)

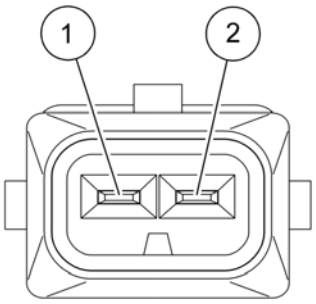


The combined shut-off and pressure-reducing valve prevents engine cooling during cold operation by shutting off and limits the pressure (max. 2 bar) for the low-temperature coolant radiator (LT cooler).

The LT cooler and the fan are used for recooling the engine coolant and the low-temperature water for indirect cooling of the charge air, taking account of the conditions due to the Euro 5 emission standard.

Pin assignment

Pin	Line number	Function	Control unit A435 pin
1	60400	Activation	A06
2	60401	Ground	A05

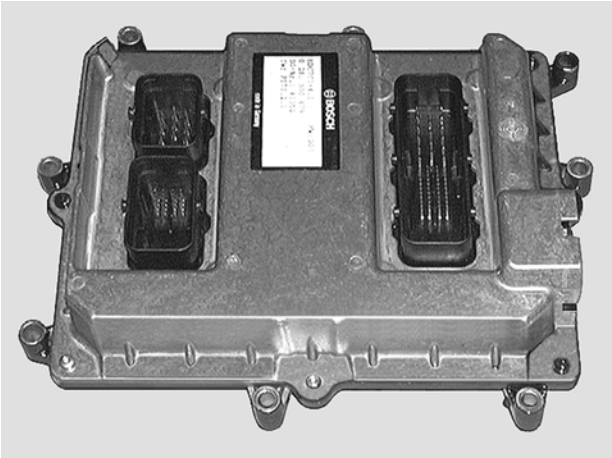


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COMPONENT DESCRIPTION / INSTALLATION POSITIONS

Control unit EDC7 (A435, A570)

Description
The main task of the EDC control unit is to control the correct injection of fuel and to adapt this control to the different operating conditions and therefore to control the engine output and emissions. The control unit (software/hardware) can be used for a maximum of six cylinders. A second control unit is therefore required for operating an engine with more than six cylinders. The two control units communicate via CAN and operate in “Master/Slave” mode.

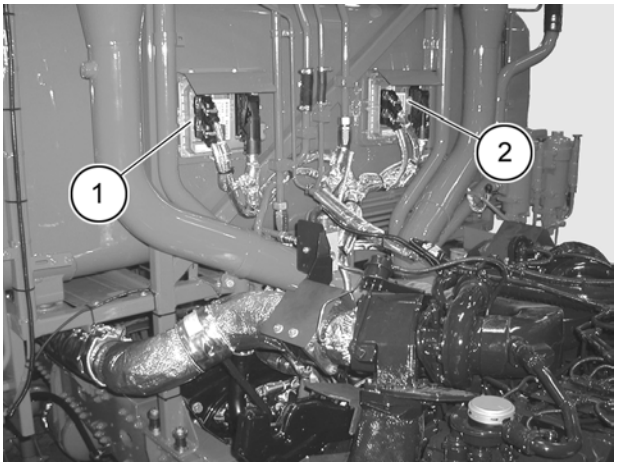


Installation position



The control unit is mounted on the side of the engine block in in-line engines. This picture shows an installation example on a D20 engine.

D2840 V10 engine

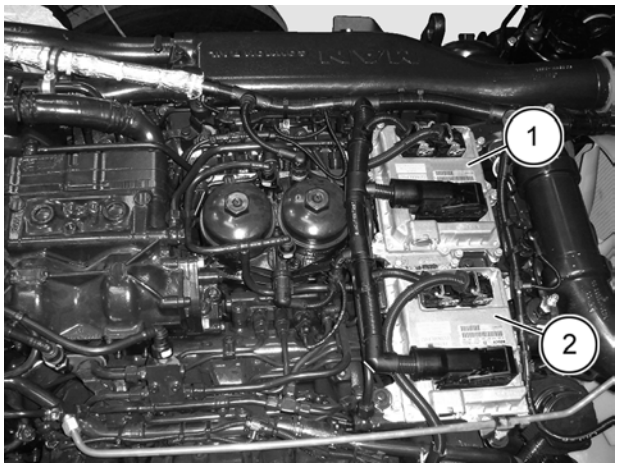


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The control units are located on a carried behind the cab. This picture shows the installation positions with the cab tilted.

1 Master control unit (right, as seen looking in direction of travel)
2 Slave control unit (left, as seen looking in direction of travel)

D2868 V8 engine



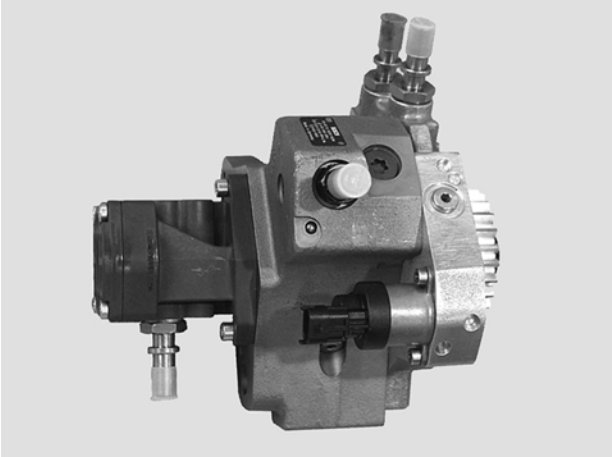
The control units are attached to the engine under a cover.

1 Slave control unit (left, as seen looking in direction of travel)
2 Master control unit (right, as seen looking in direction of travel)

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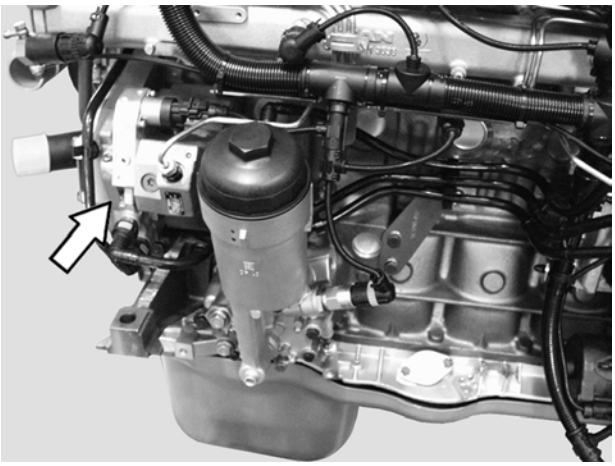
CP3.4 high-pressure pump

Description
The CP3.4 high-pressure pump is a radial piston pump with 3 cylinders. This pump is used in the case of D08, D20, D26 and D28 in-line engines as well as D2868 V8 engines.



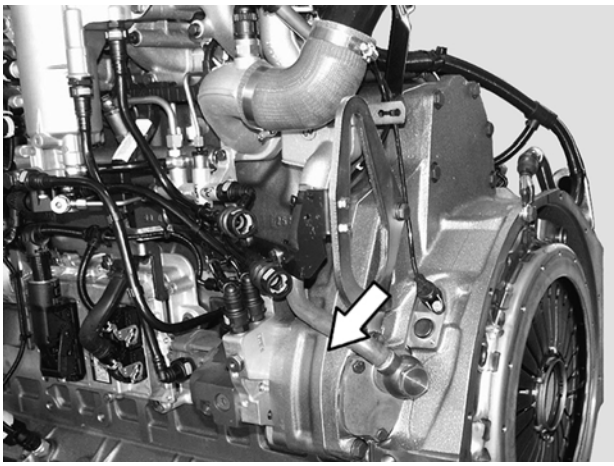
Installation position

D08 engine



The high-pressure pump is driven by the engine and is mounted in the same position on the engine as a conventional injection pump.

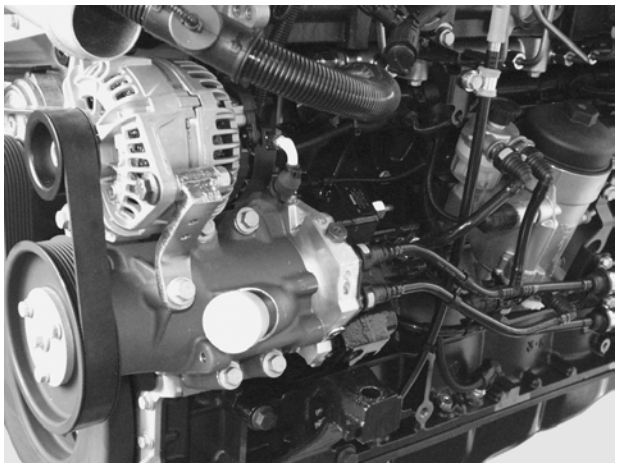
D28 in-line engine



The high-pressure pump is driven by the engine and is mounted in the same position on the engine as a conventional injection pump.

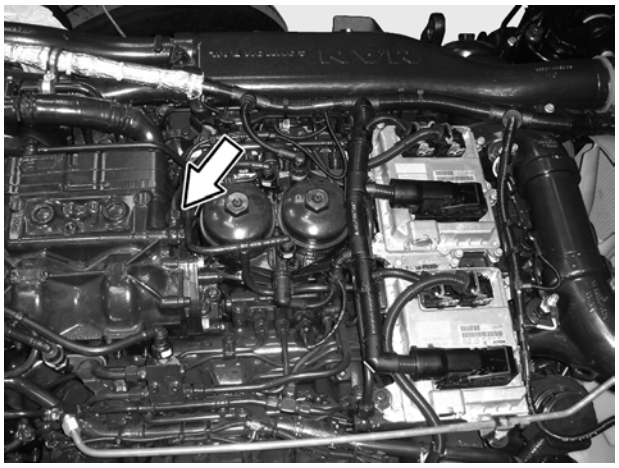
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D20/D26 engine



The D20/26 engine is a new design with overhead camshaft. The high-pressure pump is driven by spur gears. The same spur gear drive also drives the alternator, the water pump and, if fitted, the air-conditioning compressor on the front side of the engine by means of a pulley.

D2868 V8 engine



The high-pressure pump is located below the air compressor and can only be accessed after the air compressor has been removed.

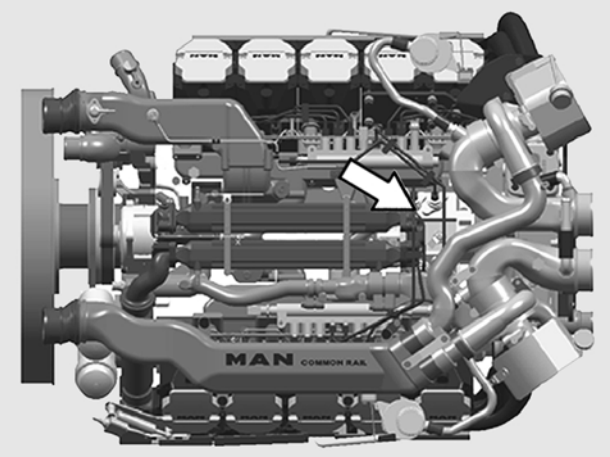
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CP9V4 high-pressure pump

Description
The CP9V4 high-pressure pump is an in-line piston pump with 4 cylinders. This pump is used in the case of D 2840 series engines (V10 engines).



Installation position



The high-pressure pump is driven by the engine and is mounted in the same position on the engine as a conventional injection pump.

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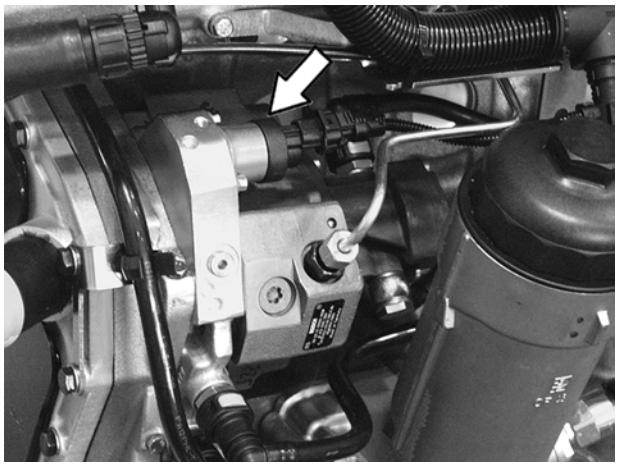
Metering unit (MProp) (Y332, Y356)

Description
The metering unit (MProp) is an actuator for controlling the fuel pressure in the high-pressure accumulator (rail).



Installation position

CP3.4 high-pressure pump



The metering unit is located on the low-pressure side of the high-pressure pump and is screwed into the high-pressure pump housing.

CP9V4 high-pressure pump



The CP9V4 high-pressure pump for the V10 engine is equipped with two metering units as two high-pressure accumulators are controlled in this case (one high-pressure accumulator per bank of cylinders).

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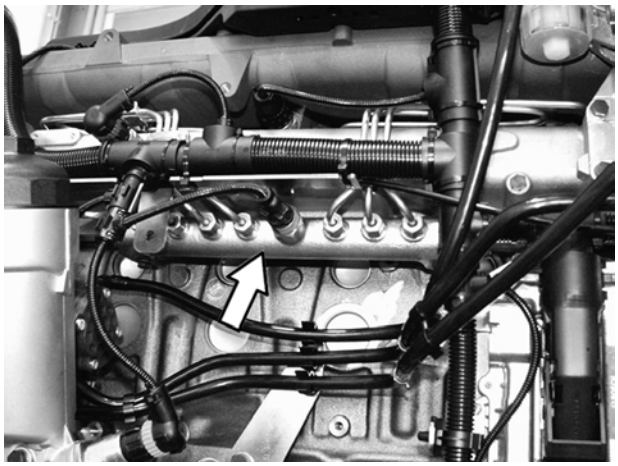
High-pressure accumulator (rail)

Description
The name “common rail” is derived from the design and functioning of the high-pressure accumulator. The fuel is injected into the individual cylinders via this common accumulator which is also a fuel distributor or distributor rail. Here the fuel is constantly under high pressure and only needs to be drawn at the right time.

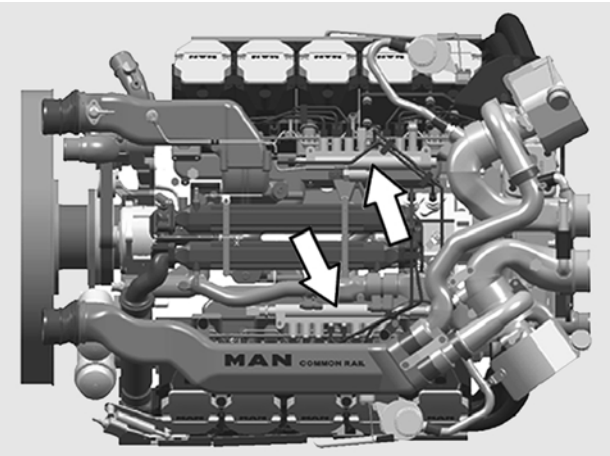


Installation position

D08, D20 and D28 in-line engine



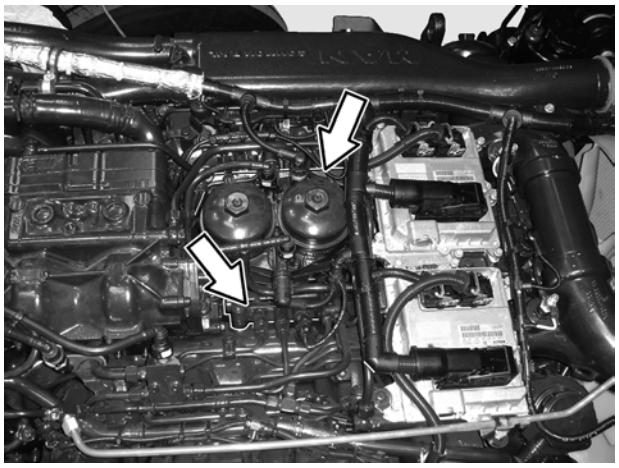
D2840 V10 engine



D2840 series engines (V10 engines) have two high-pressure accumulators fitted (one for each bank of cylinders).

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D2868 V8 engine



D2868 series engines (V8 engines) have two high-pressure accumulators fitted (one for each bank of cylinders).

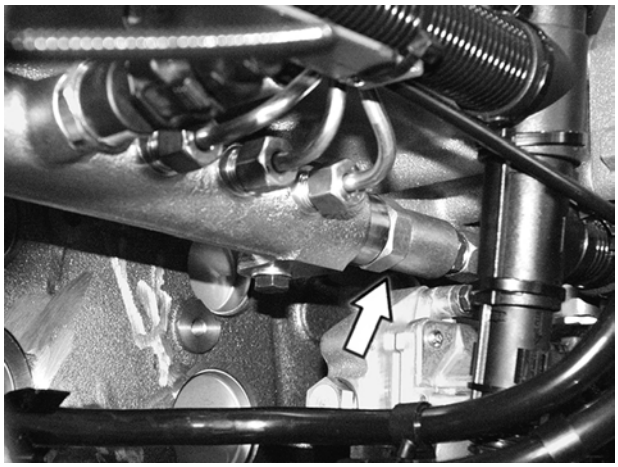
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Pressure limiting valve

Description
The pressure limiting valve limits the pressure in the rail. If the pressure is too high, it uncovers a discharge hole. The pressure limiting valve functions as a pressure relief valve.



Installation position



The pressure limiting valve is mounted on the high-pressure accumulator (rail). This picture shows an installation example on a D08 engine.

Note: As part of further technical development, the pressure limiting valve has been integrated in the high-pressure accumulator to form an integrated unit with the rail. The PLV has the same function as the previous part and can be replaced as before.

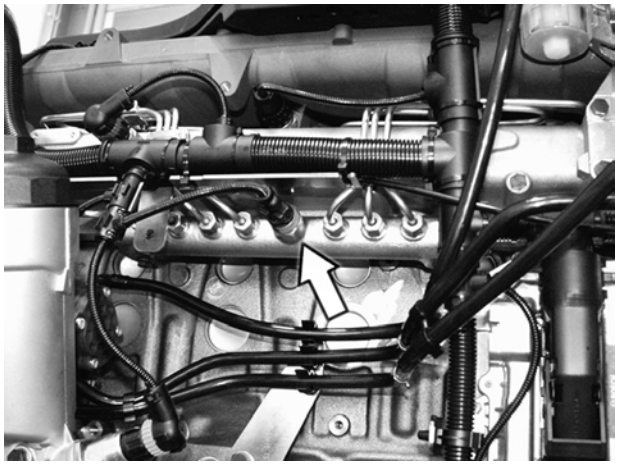
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Rail-pressure sensor (B487, B514)

Description
The rail-pressure sensor monitors the fuel pressure in the high-pressure accumulator (rail). Two high-pressure accumulators (one per cylinder bank) are installed in V engines. Therefore there are also two rail-pressure sensors.



Installation position



The rail-pressure sensor is mounted on the high-pressure accumulator (rail). This picture shows an installation example on a D08 engine.

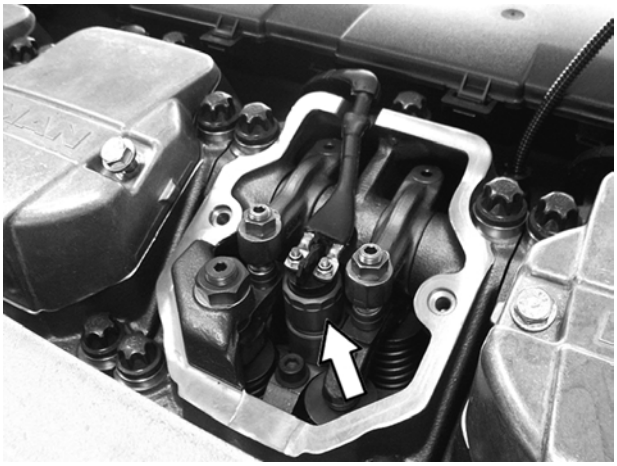
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Injector (Y341 - Y350)

Description
The injector is used to inject fuel into the combustion chamber. The EDC 7 control unit specifies the injection quantity and the injection point and activates an extremely fast solenoid in the injector. The solenoid opens the valve and the fuel is injected into the combustion chamber using the pressure in the high-pressure accumulator.



Installation position



The injectors are located at the same position as the conventional injectors in the cylinder head. This picture shows an installation example on a D28 engine.

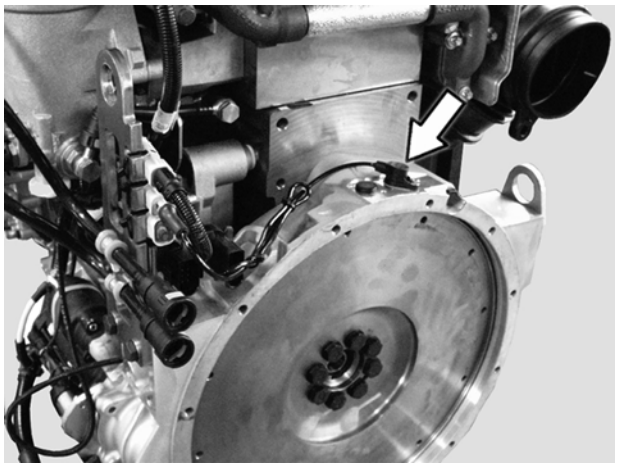
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Crankshaft speed sensor (speed increment sensor) (B488)

Description
The speed increment sensor records the engine crankshaft speed and forwards this information to the control unit in the form of an induced voltage.



Installation position



The speed increment sensor is mounted on the flywheel housing. This picture shows an installation example on a D08 engine.

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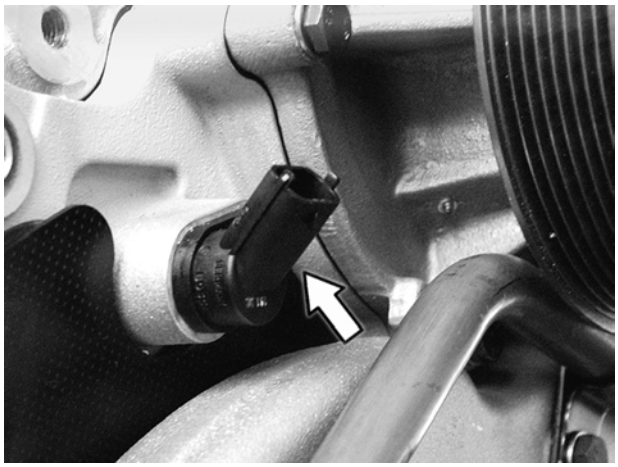
Camshaft speed sensor (speed segment sensor) (B489)

Description
The speed segment sensor records the engine camshaft speed and forwards this information to the control unit in the form of an induced voltage.



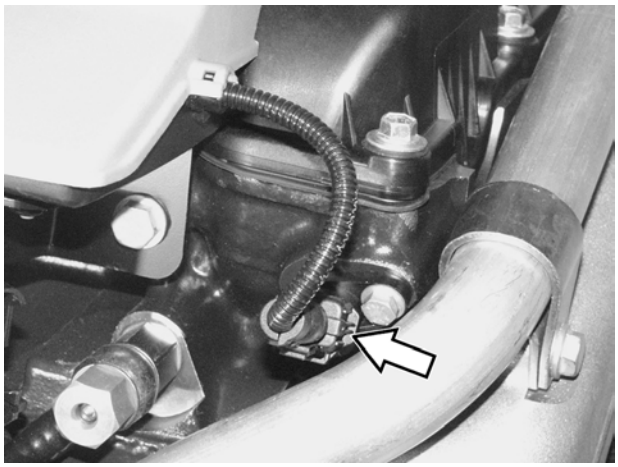
Installation position

D08 engine



The speed segment sensor is mounted on the end of the engine on the camshaft drive.

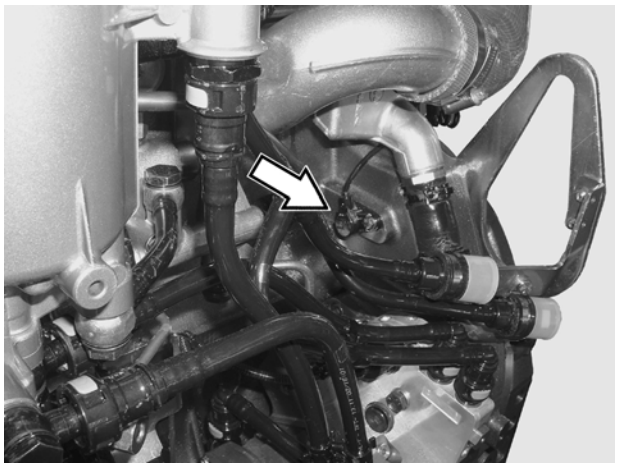
D20 engine



The speed segment sensor is mounted at the cylinder head in the camshaft drive area.

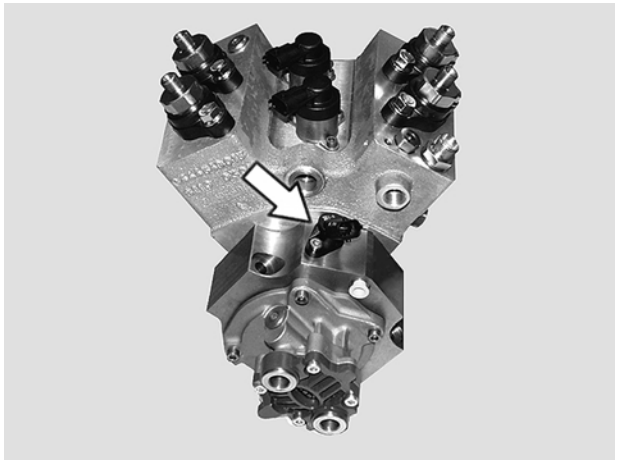
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D28 in-line engine



The speed segment sensor is located above the high-pressure pump.

D28 V10 engine



The speed segment sensor is mounted in the high-pressure pump housing.

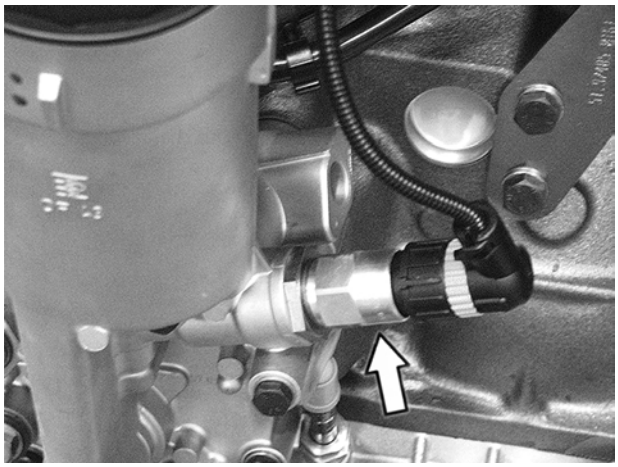
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Oil pressure sensor (B104)

Description
The oil pressure sensor protects the engine. It monitors the oil pressure.



Installation position



The oil pressure sensor is mounted on the oil filter. This picture shows an installation example on a D08 engine.

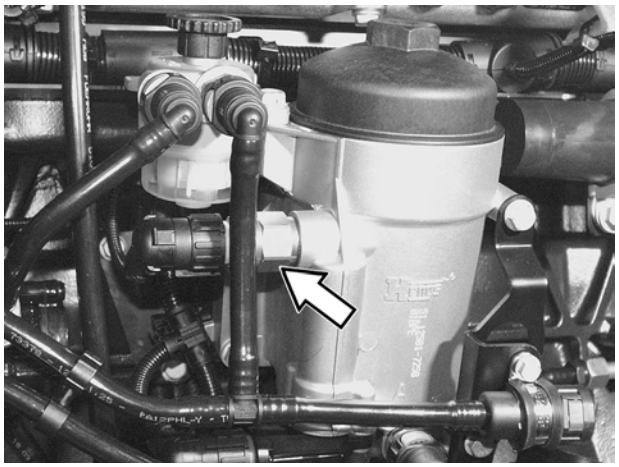
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Fuel pressure sensor (B377)

Description
The fuel pressure sensor monitors the fuel pressure at the pump feed (low-pressure side). The sensor was not installed in the first D08 series engines.

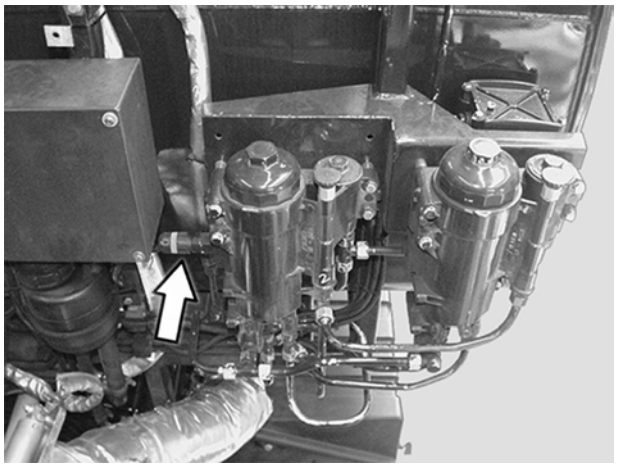


Installation position



The fuel pressure sensor is mounted on the fuel service centre. This picture shows an installation example on a D20 engine.

D2840 V10 engine



The fuel pressure sensor is mounted on one of the fuel service centres. The fuel service centres are mounted on the carrier behind the cab.

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D2868 V8 engine



The fuel pressure sensor is mounted on the fuel filter.

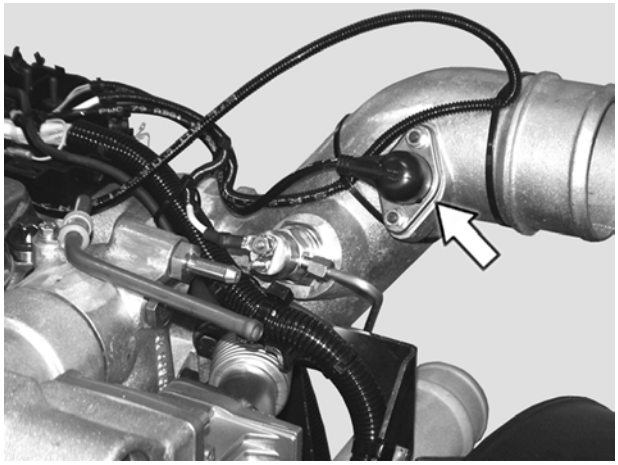
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Kavlico charge-pressure sensor (B125)

Description
The charge-pressure sensor measures the absolute charge pressure.



Installation position



The charge-pressure sensor is mounted on the intake manifold. This picture shows an installation example on a D28 engine.

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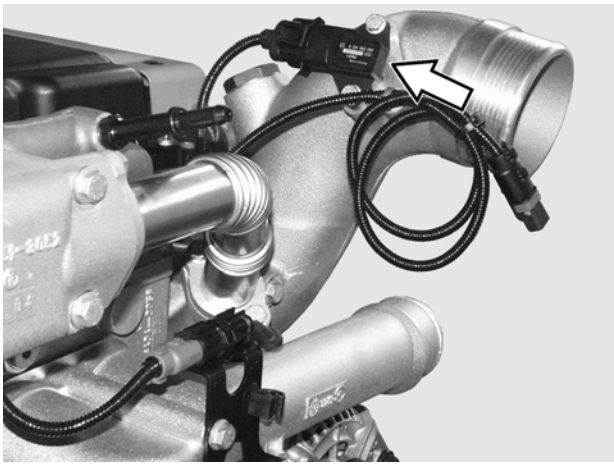
Bosch LDF 6, LDF 6T charge-pressure sensor (B125, B623, B694)

Description
The LDF 6 charge-pressure sensor measures the absolute charge pressure.

A temperature sensor is also integrated in the LDF 6T charge-pressure sensor. Together with the charge air temperature sensor (B123), its purpose is to monitor EGR in the Euro 4 engines. In the case of D20/D26 engines which meet the requirements of the Euro 5 emission standard without MAN AdBlue® system, a further charge air/temperature sensor (B694) is installed to monitor the low-temperature circuit.



Installation position



The charge-pressure sensor is mounted on the intake manifold. This picture shows an installation example on a D20 engine.

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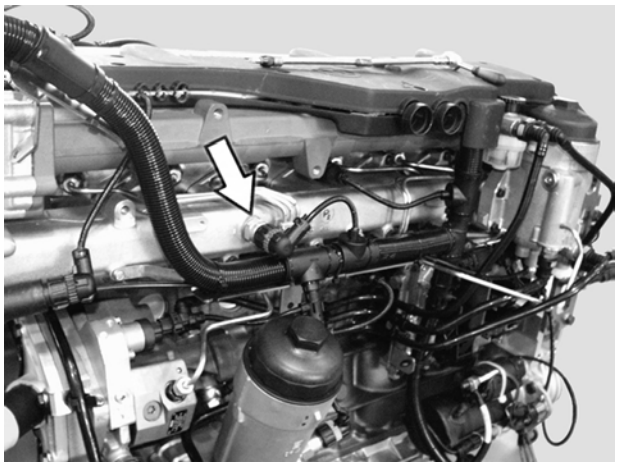
Charge air temperature sensor (B123)

Description
The charge air temperature sensor monitors the exhaust gas recirculation together with the charge air temperature sensor LDF 6T (B623).



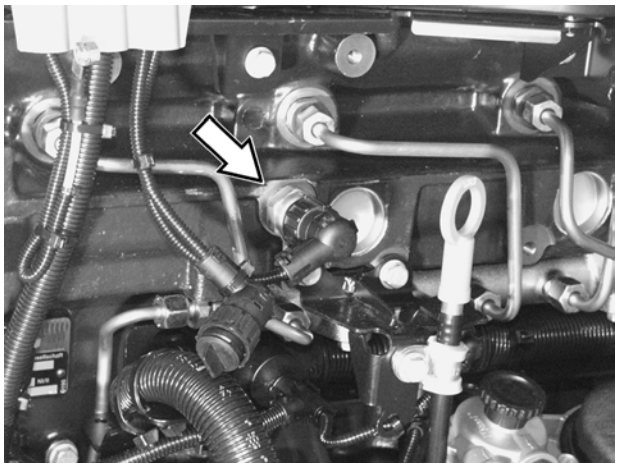
Installation position

D08 engine



The charge air temperature sensor is mounted on the intake manifold.

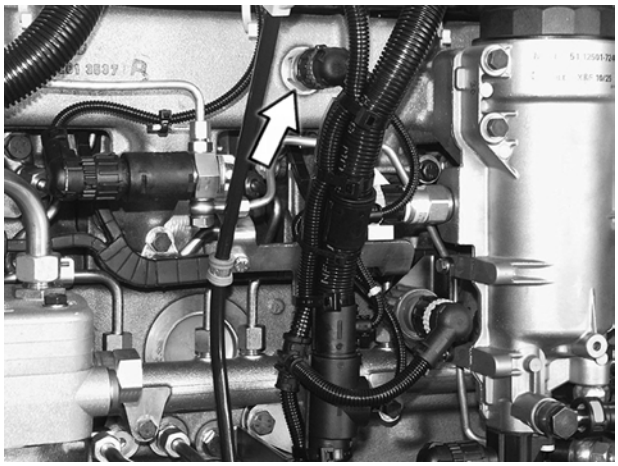
D20 engine



The charge air temperature sensor is mounted on the intake manifold.

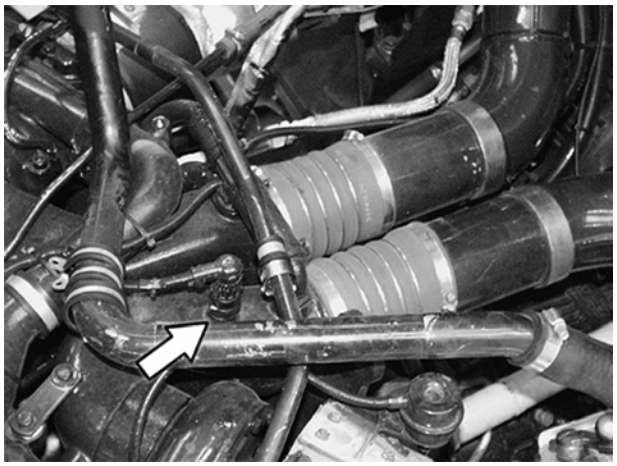
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D28 in-line engine



The charge air temperature sensor is mounted on the intake manifold.

D28 V10 engine



The charge air temperature sensor is mounted on the intake manifold.

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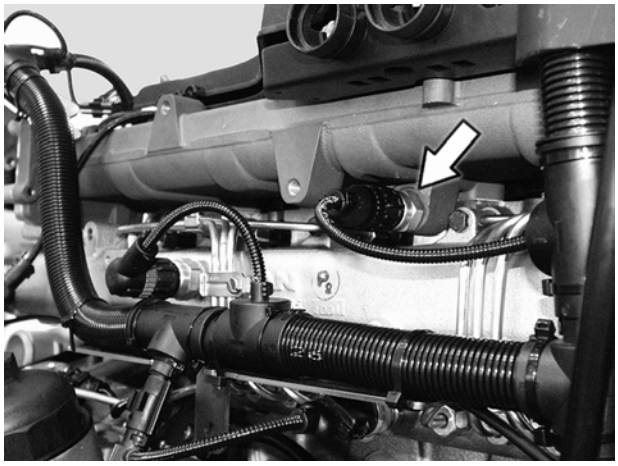
Coolant temperature sensor (B124, B1049)

Description
The coolant temperature sensor provides the control unit with information about the coolant temperature. The control unit calls up various engine operating maps, depending on the coolant temperature. In the case of D20/D26 engines which meet the requirements of the Euro 5 emission standard without MAN AdBlue® system, a further coolant temperature sensor (B1049) is installed to monitor the low-temperature circuit.



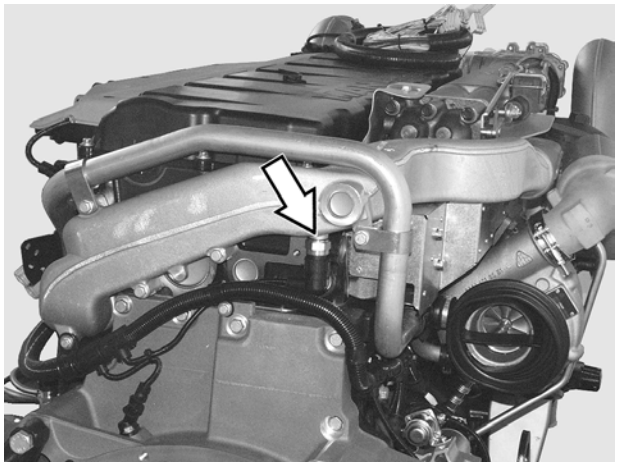
Installation position

D08 engine



The coolant temperature sensor is located in the coolant circuit in the case of D08 engines without EGR. This picture shows an installation example on a D08 engine with EGR. Here the temperature sensor is screwed into the EGR module which doubles up as a water distributor.

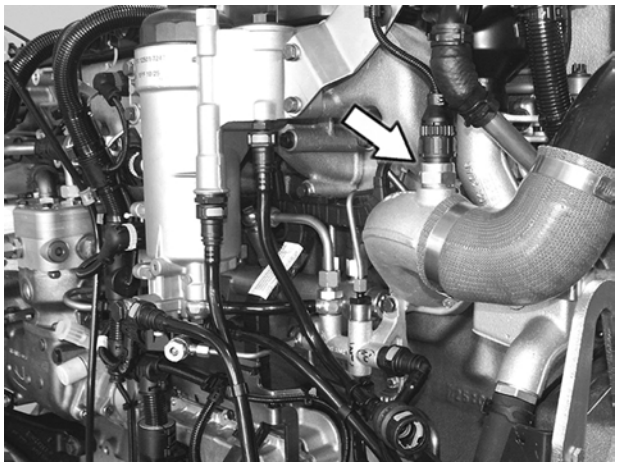
D20 engine



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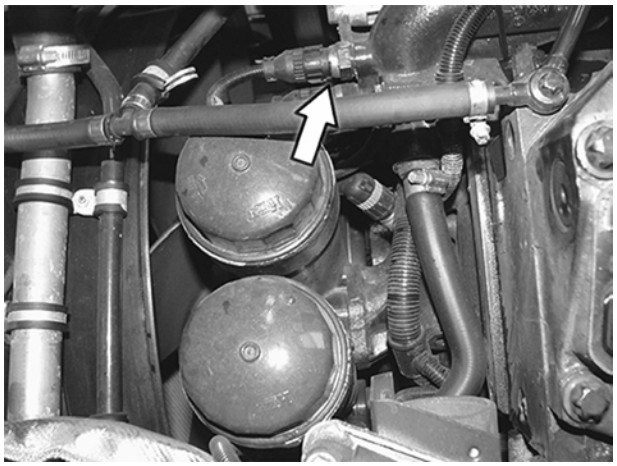
The coolant temperature sensor is located in the cooling circuit.

D28 in-line engine



The coolant temperature sensor is located in the cooling circuit.

D28 V10 engine



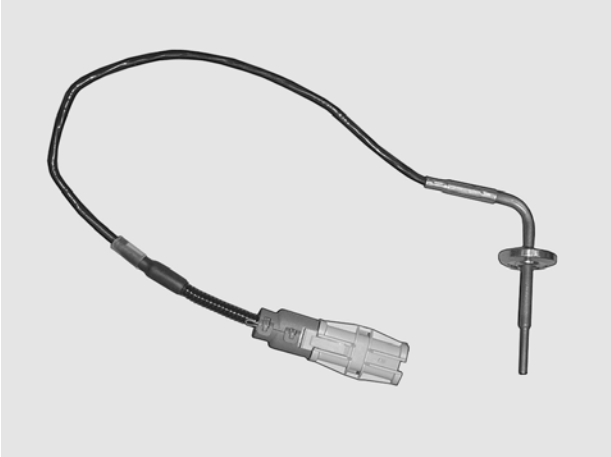
The coolant temperature sensor is located in the cooling circuit.

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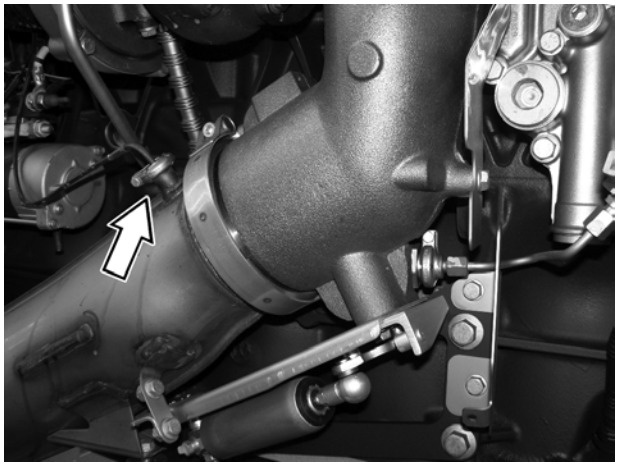
Exhaust gas temperature sensor (B561, B633)

Description
The temperature sensor B561 monitors the exhaust gas temperature upstream of the PM catalytic converter (EGR system). The temperature sensor B633 monitors the exhaust gas temperature upstream of the catalytic converter (MAN AdBlue® system). The sensors are identical. Depending on the engine (LF, LOH, LUH), the straight version of the temperature sensor B561 may also be fitted.

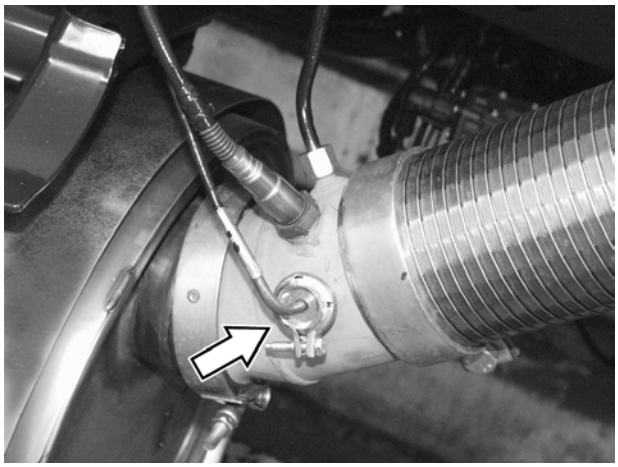
Note: Series D08 engines with OBD Stage 1 do not have the temperature sensor B561 fitted. However, it is installed again for OBD Stage 1 with NOx monitoring measurement.



Installation position



The temperature sensor B633 is mounted on the AdBlue mixer upstream of the catalytic converter.



Temperature sensor B561 is mounted upstream of the PM catalytic converter. This illustration shows a sample installation on a bus chassis (HOC).

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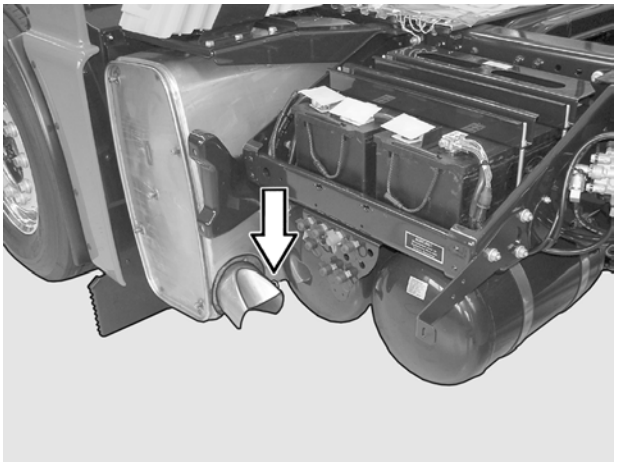
Exhaust gas temperature sensor (B561, B634)

Description
The temperature sensor B561 monitors the exhaust gas temperature upstream of the PM catalytic converter (EGR system). The temperature sensor B634 monitors the exhaust gas temperature downstream of the catalytic converter (MAN AdBlue® system). The sensors are identical. Depending on the engine (LF, LOH, LUH), the angled version of the temperature sensor B561 may also be fitted.

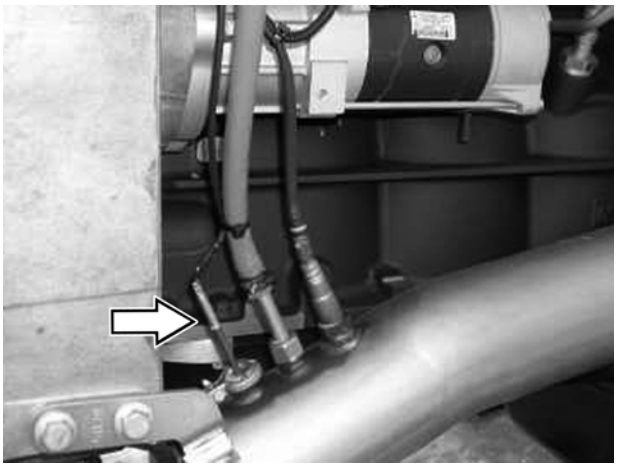
Note: Series D08 engines with OBD Stage 1 do not have the temperature sensor B561 fitted. However, it is installed again for OBD Stage 1 with NOx monitoring measurement.



Installation position



The temperature sensor B634 is mounted in the exhaust silencer tailpipe downstream of the catalytic converter.



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Temperature sensor B561 is mounted upstream of the PM catalytic converter. This illustration shows a sample installation on a TGX series truck.

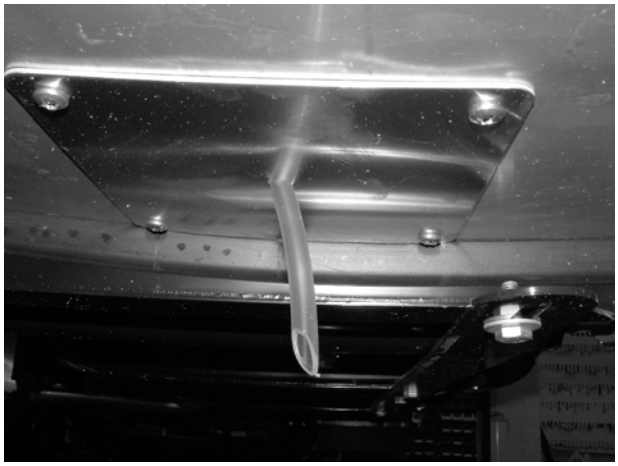
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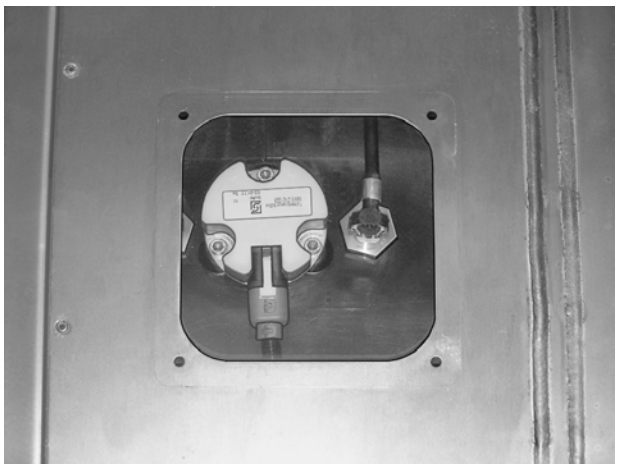
AdBlue® fill level/temperature sensor (B628)

Description
The sensor monitors the fill level and the temperature in the AdBlue® tank. The sensor communicates with the DCU 15 control unit via CAN bus.



Installation position





The AdBlue® fill level/temperature sensor is located in the AdBlue® tank and can be accessed from outside through a service cover.

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NOx sensor (B994)

Description
In engines with MAN AdBlue® system, the NOx sensor measures the nitrogen oxide concentration in the exhaust gas stream.



Installation position



The sensor is located in the exhaust muffler. The accompanying evaluation electronics are connected to the sensor by means of a cable and are mounted securely on the frame. This illustration shows a sample installation on a removed muffler.

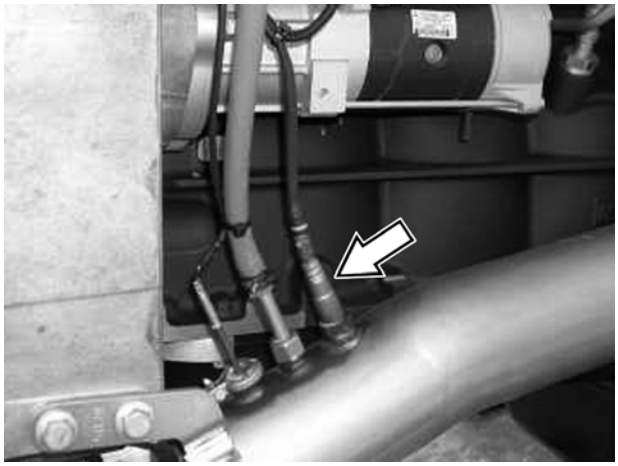
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Oxygen sensor (B322)

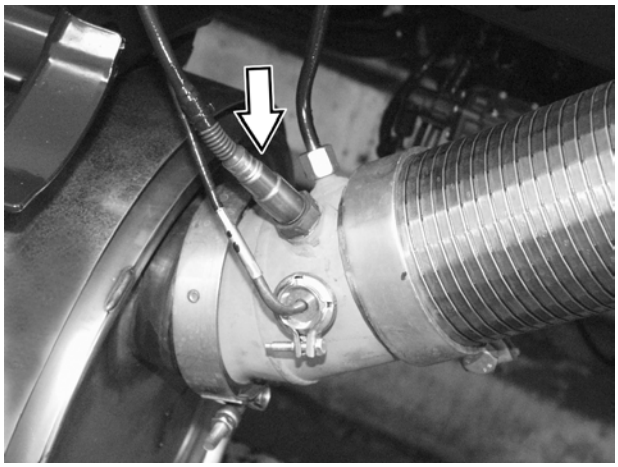
Description
The oxygen sensor measures the difference in oxygen concentration between the ambient air and the exhaust gas stream in engines with EGR. This gives an indication of the NOx emissions.



Installation position



This illustration shows a sample installation on a TGX series truck.



This illustration shows a sample installation on a bus chassis (HOC).

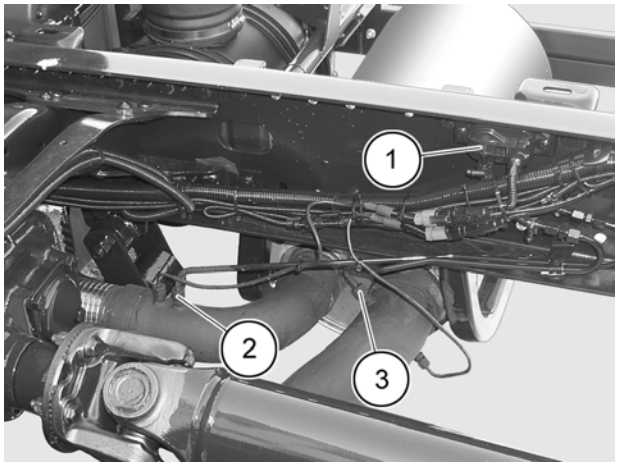
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Exhaust gas differential pressure sensor (B565)

Description
The exhaust gas differential pressure sensor monitors the differential pressure above the particulate filter (CRT filter).



Installation position



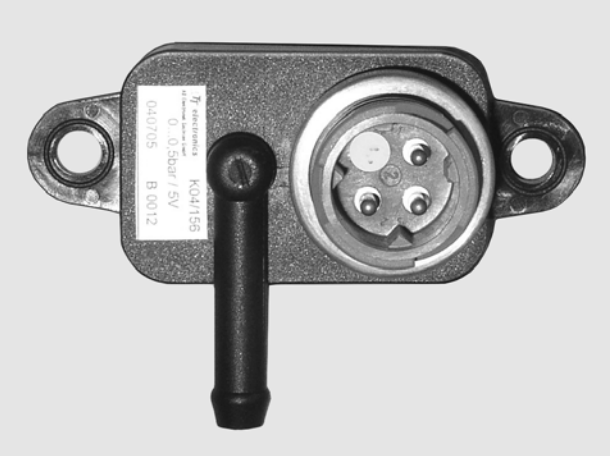
(1) Exhaust gas differential pressure sensor (B565)
(2) Measuring point upstream of filter
(3) Measuring point downstream of filter

This figure shows a sample installation.

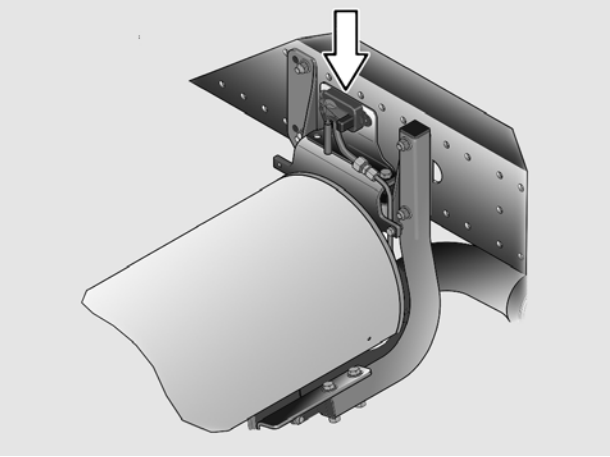
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Exhaust gas relative pressure sensor (B683)

Description
The exhaust gas relative pressure sensor has the same electrical interface as the exhaust gas differential pressure sensor. However, it only measures the relative pressure of the exhaust gas, i.e. the pressure currently existing against atmospheric pressure.



Installation position

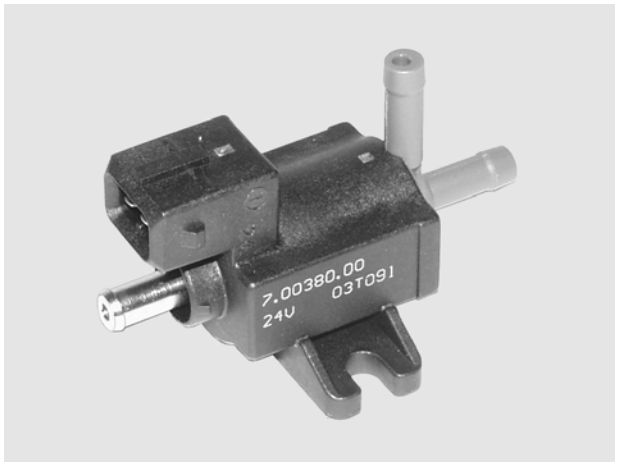


This figure shows a sample installation.

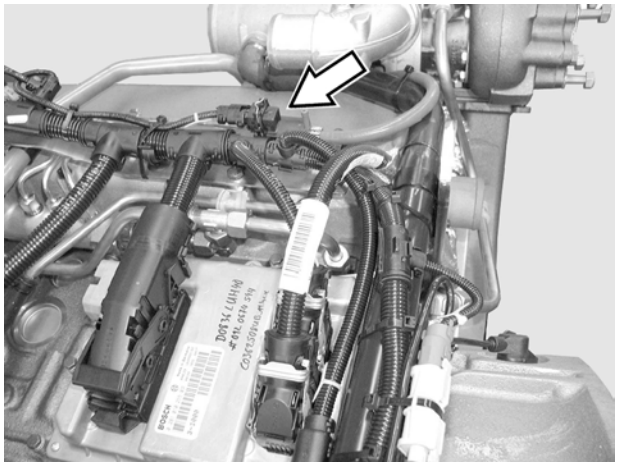
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Turbocharger pulse valve (Y340, Y493)

Description
The turbocharger pulse valve is used for controlling the charge pressure at the specified operating points.



Installation position



This picture shows an installation example on a D0836 LUH engine.

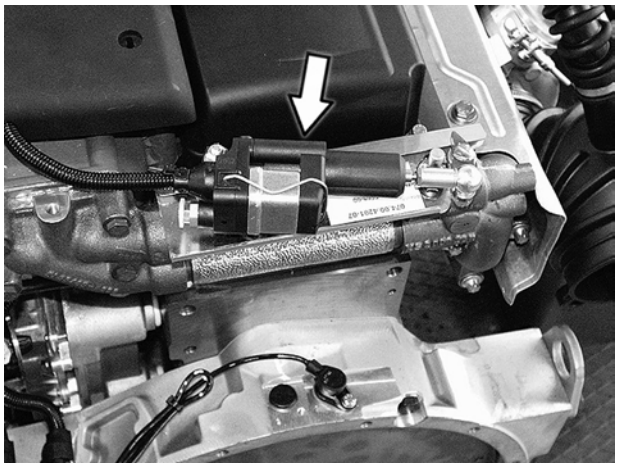
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Exhaust gas recirculation (EGR) controller (Y280)

Description
Exhaust gas recirculation lowers the nitrogen oxide (NOx) content in the exhaust gases by reducing the excess oxygen and lowering the peak temperatures and pressures.



Installation position

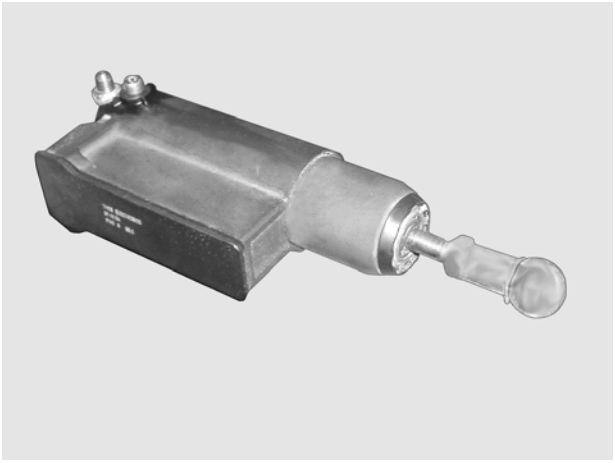


This picture shows an installation example on a D08 engine.

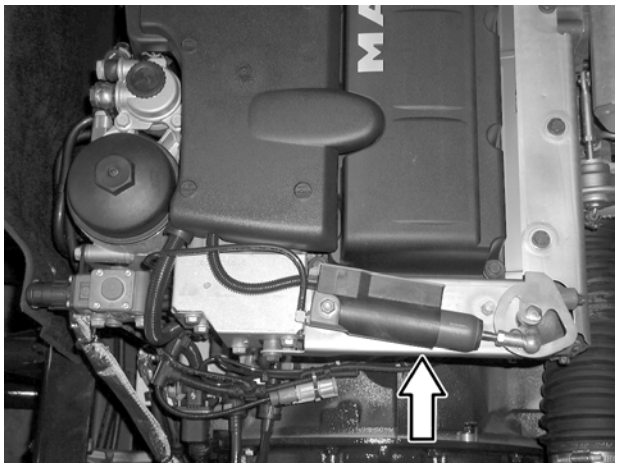
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Position-controlled EGR controller (E-EGR) with travel sensor (B673)

Description
The position-controlled EGR controlled (E-EGR) actuates the exhaust gas recirculation flap. The position of the EGR flap is acquired for the purpose of internal signal processing. This information is provided by the travel sensor mounted on the actuator cylinder (B673).



Installation position



This picture shows an installation example on a D0836 series engine.

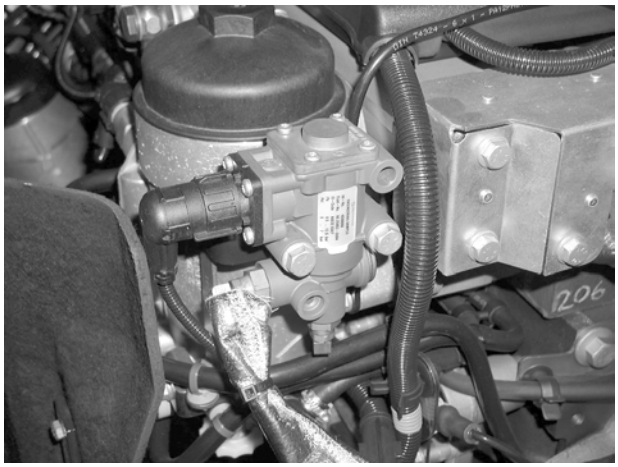
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Proportional valve E-EGR (Y458)

Description
The proportional valve (Y458) controls the position-controlled EGR controller (E-EGR). The operating medium is air at a minimum operating pressure of about 7 bar. A duty factor parameter is specified by the EDC control unit as an activation signal.



Installation position

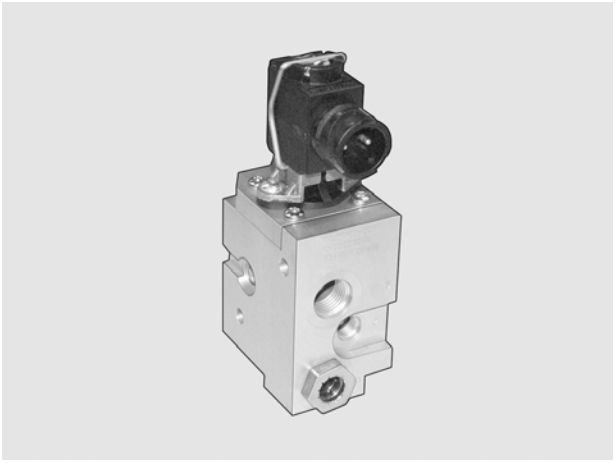


This picture shows an installation example on a D0836 series engine.

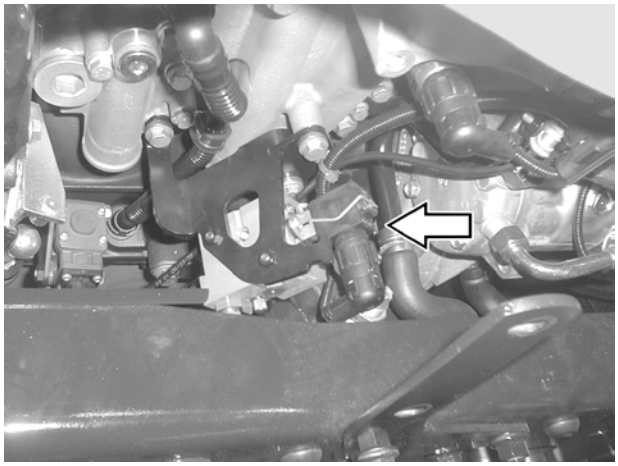
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Compressed air shut-off valve (Y460)

Description
The compressed air shut-off valve supplies the E-EGR, EVBec and PriTarder systems with compressed air when the engine is running.



Installation position



This picture shows an installation example on a D2066 LF series engine.

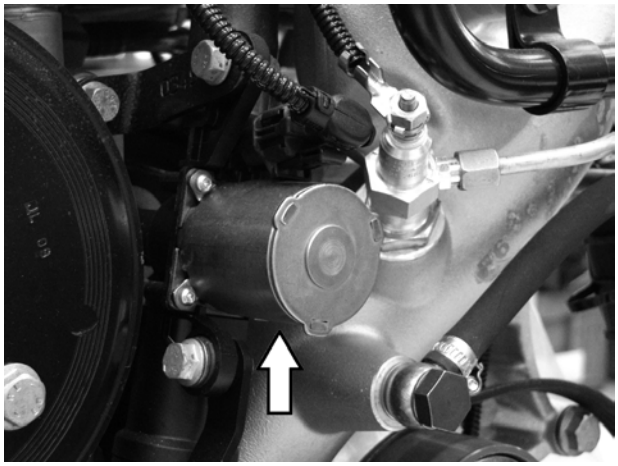
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Shut-off/pressure-reducing valve, LT cooler (Y496)

Description
The combined shut-off and pressure-reducing valve prevents engine cooling during cold operation by shutting off and limits the pressure (max. 2 bar) for the low-temperature coolant radiator (LT cooler).



Installation position



This picture shows an installation example on a D0836 series engine.

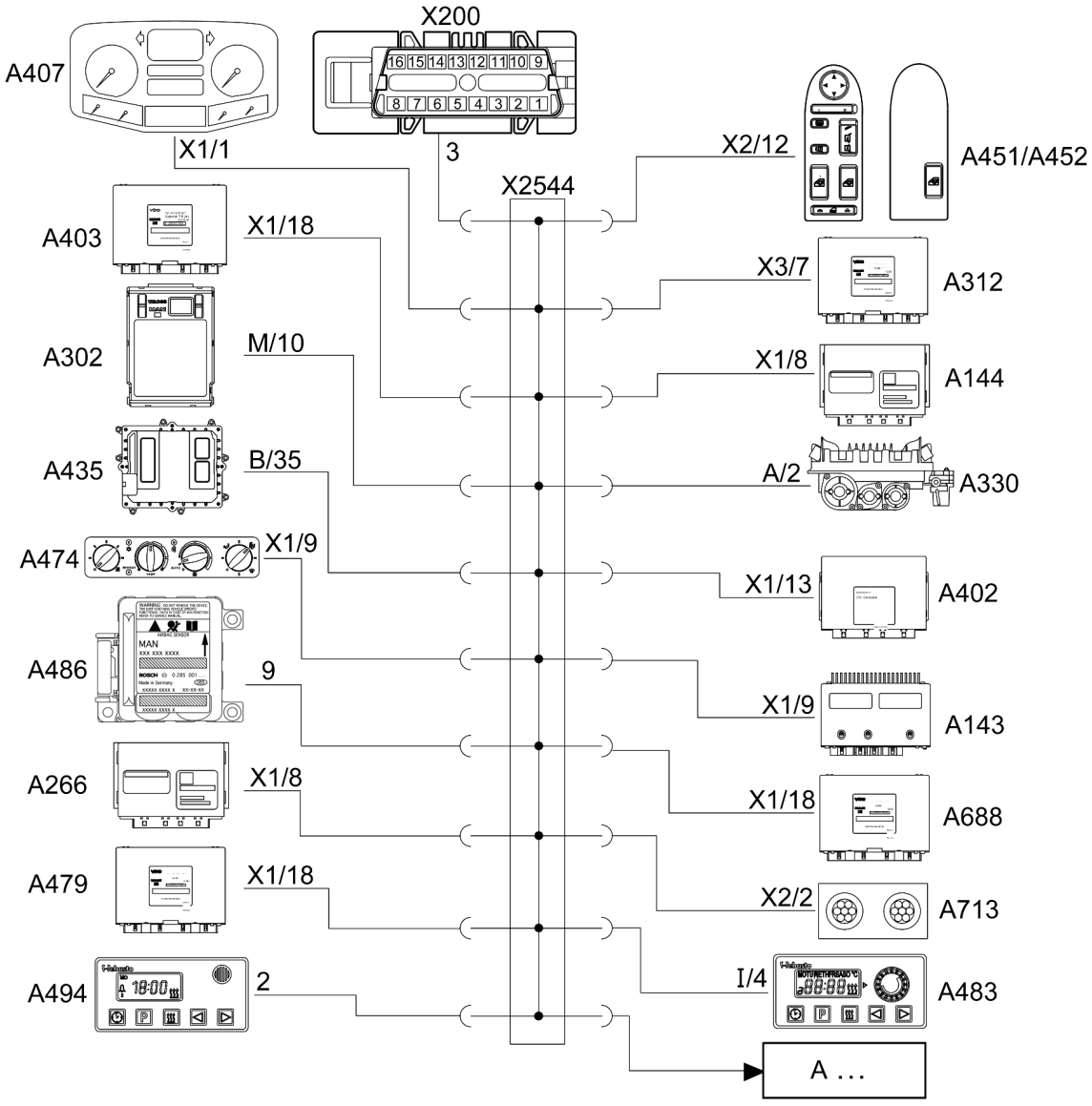
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DIAGNOSIS

K-line system structure, diagnosis sockets

Most control units testable using MAN-cats are connected with diagnosis socket X200 pin 3 / 4 via a K-line. The diagnostic system stimulates a specific control unit via the K-line. The control unit replies and digitally transfers the faults stored in the diagnostic memory via the K-line.

“KWP-on-CAN” control units, e. g. TBM or ECAS 2, do not have a K-line. Control units with KWP-on-CAN diagnosis are stimulated by the vehicle management computer K-line. The vehicle management computer opens a gateway to the control unit in question via the CAN.



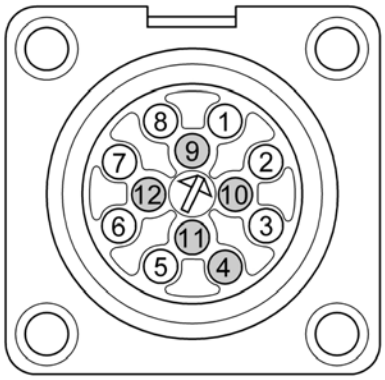
(A143) Electronic air suspension (ECAS); Note – ECAS2 has KWP-on-CAN diagnosis
(A144) Control, retarder / Intarder
(A266) Control unit, torque converter and clutch system/retarder
(A302) Central computer 2
(A312) Customer-specified control module
(A330) Gearbox control, Tipmatic AS-Tronic
(A402) Electronic brake system (EBS); Note – EBS5 has KWP-on-CAN diagnosis
(A403) Vehicle management computer
(A407) Instrumentation
(A435) Electronic diesel injection
(A451) Door module, driver side
(A452) Door module, co-driver side
(A474) Air-conditioning system
(A479) Control unit, ACC
(A483) Auxiliary air heater
(A486) Control unit, airbag
(A494) Auxiliary water heater
(A688) Additional vehicle computer (for heavy-duty tractor only)
(A713) Control unit in distributor unit (air-conditioning system with auxiliary air conditioning)
(A . . .) Other systems can be networked

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(X200) Diagnostic socket
(X2544) Potential distributor, 21-pin, K-line

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Diagnosis socket, 1st version (X200)
MAN-cats® can be used to read out the diagnostic memory of all connected control units via the diagnosis socket.



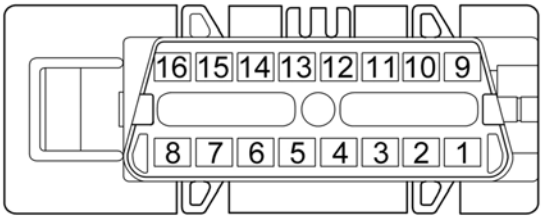
Pin assignment

Pin	Line number	Function
1	— (185)	Not used (option HD-OBD-CAN high)
2	— (186)	Not used (option HD-OBD-CAN low)
3	—	Not used
4	16202	K-line
5	—	Not used
6	—	Not used
7	—	Not used
8	—	Not used
9	31000	Ground, terminal 31
10	30009	Voltage supply, terminal 30
11	16000	Voltage supply, terminal 15
12	59101	Speed signal, alternator, term. W

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Diagnosis socket HD-OBD (X200)
The HD-OBD 16-pin diagnosis socket to ISO 15031-3 replaces the previously used 12-pin MAN diagnosis socket.

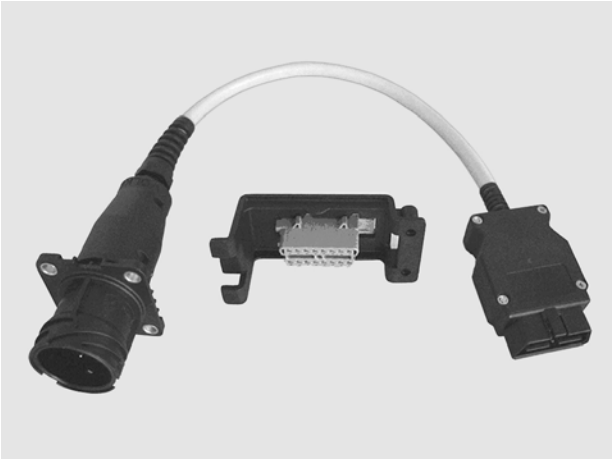
This OBD standardisation will, for the first time, allow almost all vehicles to have a standardised diagnostic system for exhaust gas-related components.



Pin assignment

Pin	Line number	Function
1	59101	Speed signal, alternator, term. W
2	—	Not used
3	16202	K-line
4	31000	Ground, terminal 31
5	—	Not used
6	185	HD-OBD-CAN high
7	—	Not used
8	16000	Voltage supply, terminal 15
9 - 13	—	Not used
14	186	HD-OBD-CAN low
15	—	Not used
16	30009	Voltage supply, terminal 30

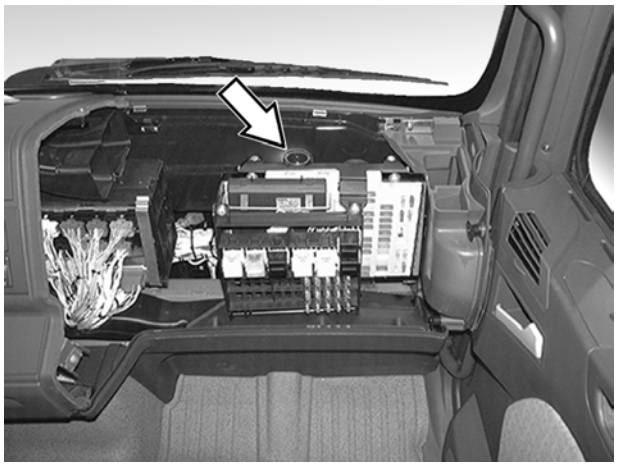
Adapter cable, HD-OBD



There is an adapter cable available for MAN-cats applications. This cable can be ordered by quoting item number 07.98901-0002 using the “MAN-cats II – spare parts” order form. The adapter cable is supplied as standard with all newly ordered diagnostic systems.

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Diagnosis socket installation position - TGA, TGL, TGM
Before



The diagnosis socket is located on the rear side of the central electrical system.

Now



The diagnosis socket is located behind a cover below the cup holder on the co-driver's side.

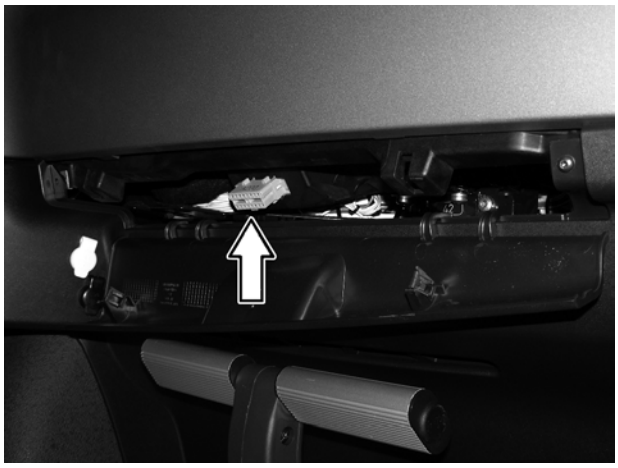
HD-OBD



The HD-OBD diagnosis socket is located behind a cover below the cup holder on the co-driver's side. The installation position and the position designation (X200) remain unchanged as this diagnosis socket replaces the previous one.

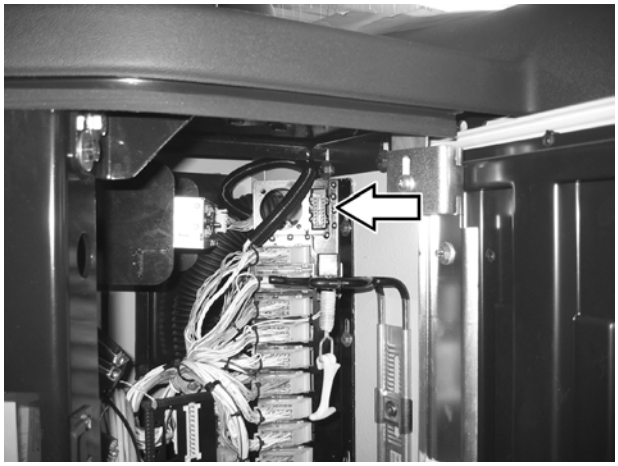
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Diagnosis socket installation position - TGX, TGS



The HD-OBD diagnosis socket is located behind a flap above the co-driver's footwell.

Installation of diagnosis socket for regular-service buses



The HD-OBD diagnosis socket is located at the front entrance in the fire extinguisher compartment.

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Faults and fault memory
The system runs continuous self-tests. A signal range check is performed for this purpose. During this check, the system polls all signals to determine that they are present and plausible. Polling is performed based on a specific time frame (specified by the software). The control unit itself is also checked continuously during the entire program run time. The first check always takes place when the ignition is switched on (checksum test). If faults occur during operation, these faults are saved to the diagnostic memory and a message appears on the driver's display.

The following processes take place when faults are stored:
– Identification of the fault code (SPN)
– Identification of the fault type (FMI)
– Assignment of the fault priority
– Recording of the fault frequency
– Recording of the boundary conditions (two ambient conditions) at the point when the fault was categorised.
Sporadic faults are recorded by a self-healing counter after they have disappeared for the first time. This means the system sets a specific frequency number and this number is decremented by one each time the vehicle is started. If the fault stops occurring and the counter reaches the value zero, the corresponding fault block is deleted and moved along to any other fault blocks present.

The following actions are initiated automatically depending on the evaluation of a fault which has occurred:
– Changeover to a suitable default function to permit continued driving, although with some restrictions. This allows the vehicle to be driven to the nearest MAN Service workshop.
– Immediate engine stop if required for safety reasons.
As soon as a fault occurs, a fault block is stored in the diagnostic memory or an already existing fault is updated. In addition, this fault block is sent via CAN bus to the OBDU (On-Board Diagnostic Unit), which is part of the central on-board computer, via the vehicle management computer.

This message contains the following information:
– Fault detection = SPN (Suspect Parameter Number)
– Ambient condition 1 = SPN1 with accompanying measured value
– Ambient condition 2 = SPN2 with accompanying measured value
– Fault type (cause) = FMI (Failure Mode Identification)
– Fault priority = PRIO (Priority)
Each individual fault is therefore assigned a priority because the faults diagnosed and stored by the control unit can involve different risks.

PRIO	Instrumentation reaction	Significance
1	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display	Drivability and/or safety is endangered. Stop immediately
2	Central fault lamp shows **steady red light** whilst driving and when stationary	Go to workshop immediately
3	Central fault lamp shows **steady yellow light** when stationary	Measures required before commencing to drive. Driving safety not restricted
4	No display	Fault with no effect on road safety
5	Central fault lamp shows **steady yellow light** whilst driving and when stationary	Fault does not need to be remedied immediately. Have the fault remedied during the next visit to the workshop

The display only ever shows one fault at a time:
– The fault with the highest priority appears on the display
– If a fault with a lower priority occurs, the message is not displayed for the driver and the current message remains on the display.

OBD diagnostic memory
The OBD diagnostic memory is designed as an additional module over and above the existing diagnostic memory.

In engines with externally cooled EGR, an additional OBD fault memory is integrated in the EDC7 C32 engine control unit. In engines with MAN-AdBlue® system, there is an OBD diagnostic memory integrated in the

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EDC7 C32 engine control unit and an additional OBD diagnostic memory integrated in the DCU15 AdBlue® dosing control unit.

Emissions-related faults are always stored first in the “normal” diagnostic memory with SPN fault number, date and time and then, after a delay (debounced over 3 driving cycles), also in the OBD diagnostic memory with the standardised 5-digit P Code. The OBD malfunction indicator lamp (MIL) starts to come on as the fault is being stored in the OBD diagnostic memory.

Once an emissions-related fault is no longer active in the exhaust gas system (not from the NOx verification measurement), the OBD malfunction indicator lamp (MIL) remains lit for a further 3 driving cycles or 24 hours of engine operating time before going out. If a fault remains non-active, it is classified as "OK" after 40 warm-up cycles / 100 operating hours and then deleted from the diagnostic memory.

Warm-up cycle: The engine is operated until the coolant temperature has risen by at least 22 °C compared to the temperature at the time the engine was starter and has reached at least 70 °C.

Fault from the NOx verification measurement
Faults within the framework of the NOx verification measurement and from monitoring of the exhaust gas CAN are debounced by means of NOx monitoring cycles. Depending on the fault, the OBD fault lamp (MIL) flashes, a fault is entered in the long-term diagnostic memory and/or the torque is reduced.

As long as there is an entry in the diagnostic memory, the number of engine operating hours during which the OBD fault lamp (MIL) flashes is measured and added up.

If the control unit detects that a fault within the framework of the NOx verification measurement is no longer active, the OBD fault lamp (MIL) is deactivated or the cycle counter is reset at the end of the NOx monitoring cycle (after approx. 15 minutes or when the ignition is switched off). Once a fault is no longer present, the diagnostic memory entry and the time during which the OBD fault lamp (MIL) was activated are retained for a further 400 days or 9600 operating hours.

Note: In total there are three diagnostic memories (EDC/AdBlue, HD-OBD and non-erasable long-term diagnostic memory). The OBD Scantool only deletes entries (P codes) in the separate OBD diagnostic memory. Entries (SPNs) in the "normal" diagnostic memory have to be deleted as usual using MAN-cats® in the system concerned or under "Entire vehicle diagnostic memory".

Deleting the OBD diagnostic memory
In the case of the EDC control unit, the MAN diagnostic memory and the OBD diagnostic memory must be deleted separately after a fault has been repaired. All OBD-relevant information can be checked using a standardised OBD tester or using the MAN-cats® menu item "Workshop routines" "Exhaust gas-related diagnosis (HD- OBD)". This menu item can also be used to delete the OBD fault memory. Memory entries (SPNs) in the "normal" diagnostic memory must be deleted as usual using MAN-cats® in the system concerned or under "Entire vehicle diagnostic memory".

In the case of the MAN AdBlue® system, the OBD diagnostic memory in the AdBlue® dosing control unit DCU15 is deleted automatically when the MAN diagnostic memory is deleted.

Torque limiter
Since the D26 series engines with externally cooled EGR have NOx emissions lower than 7 g/kWh if exhaust gas recirculation fails (in-engine NOx reduction), the legally required torque reduction only takes place in the event of NOx monitoring system faults, i.e. 50 hours after failure of the oxygen sensor. A corresponding sensor failure is indicated to the driver immediately after the fault occurs by flashing of the MIL and a fault is entered in the diagnostic memory. This entry in the fault memory cannot be deleted for 400 days or 9600 operating hours.

In D20 series engines, the torque is also reduced when the oxygen sensor monitoring detects an insufficient EGR rate and, therefore, an excessive NOx concentration (SPN 3930). The reduction takes place after confirmation that a fault has occurred, i.e. when the fault occurs in 3 successive driving cycles. This means that the SPN number is indicated on the display immediately after the fault first occurs in the first driving cycle, while the MIL does not start flashing and the torque is not reduced until after the third driving cycle.

A driving cycle consists of engine start, engine operation and engine off. For a fault path, a driving cycle is not reached until this fault path has also been tested.

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Withdrawal of torque limiting and resetting of MIL
As the long-term diagnostic memory cannot be deleted, MAN has made it possible to use MAN-cats® to reset the fault reaction (flashing MIL and torque reduction) using the menu item “EDC7C32 diagnosis selection menu” “Withdrawal of torque limiting” following the repair of a fault in the EDC7 or in the AdBlue® system (DCU15). Following the reset, MAN-cats® stores the date, time and fingerprint in the control unit.

Fault indication MAN-cats®
All faults as well as the memory status, the fault status, the fault frequency, the priority and the two environmental conditions (SPN1 and SPN2) are indicated when the diagnostic memory is read out by means of MAN-cats®. The mileage, the date and the time are recorded by the time clock the first time a fault occurs. These data are supplied by the tachograph by means of CAN message. The recorded time is UTC (Coordinated Universal Time), i.e. not local time! UTC is the current world time and is a substitute for Greenwich Mean Time (GMT). The time zones are indicated as plus or minus UTC (e.g. UTC+2 is the same as CEST = Central European Summer Time).

Status displays, FMI (Failure Mode Identification)

 FMI 0: Fault not specified	 FMI 6: Short-circuit to +UBat	 FMI 12: Discontinuity or short-circuit to +Ubat
 FMI 1: Too high	 FMI 7: Short-circuit	 FMI 13: Discontinuity or short-circuit to ground
 FMI 2: Too low	 FMI 8: Signal defective	**Memory status**  No fault
 FMI 3: Implausible	 FMI 9: Device fault	 Fault stored
FMI 4: No signal present	 FMI 10: Discontinuity	 Sporadic fault
 FMI 5: Short-circuit to ground	 FMI 11: Loose contact	 Fault active and stored

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SPN list EDC7 (C32 and C3)

SPN	SPN-Plain text
	Description
81	**Exhaust gas differential pressure or exhaust gas relative pressure**
	Monitoring for loose contact or plausibility of the rate of change of exhaust gas differential pressure, excessive or insufficient differential pressure **Remarks:** not for OEM engines
94	**Fuel supply pressure**
	Monitoring to check whether fuel supply pressure is in the normal range (blocked filter, excessive vacuum in the suction line, defective pre-supply pump, air in the system) **System response:** problems in the fuel feed line, engine can stop
98	**Oil level**
	Monitoring for excessive or insufficient oil level **Remarks:** For marine engines only
100	**Oil pressure**
	Monitoring for insufficient oil pressure, loose contact or plausibility of rate of change of the oil pressure
102	**Charge pressure downstream of cooler (in charge-air pipe)**
	Monitoring for loose contact or plausibility of rate of change of charge pressure. Change compared to simulated charge pressure at temperature < threshold. Comparison with atmospheric pressure signal
105	**Charge-air temperature upstream of cylinder inlet (downstream of EGR)**
	Monitoring for loose contact or plausibility of the rate of change of charge-air temperature, excessive or insufficient temperature
108	**Atmospheric pressure**
	Monitoring for loose contact or plausibility of rate of change of atmospheric pressure
110	**Coolant temperature**
	Monitoring for loose contact or plausibility of the rate of change of coolant temperature, excessive or insufficient temperature **System response:** Torque reduction if temperature is too high
168	**Battery voltage acquisition**
	Monitoring of the voltage limits
171	**Ambient air temperature**
	Monitoring for loose contact or plausibility of the rate of change of ambient air temperature, excessive or insufficient temperature
173	**Exhaust gas temperature upstream of exhaust gas aftertreatment**
	Monitoring for loose contact or plausibility of the rate of change of exhaust gas temperature, excessive or insufficient temperature **Remarks:** Not for OEM engines
175	**Fuel temperature**
	Sensor not currently installed **Remarks:** For OEM engines, only monitoring
175	**Oil temperature**
	Oil temperature monitoring
190	**Engine speed**
	Defect in camshaft or crankshaft speed path

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SPN	SPN-Plain text
	Description
609	**CAN module 1**
	CAN module 1 Busoff state **System response:** stand-alone mode (=idle)
651	**BANK 1 INJECTOR 1 (4-cylinder engine: Cylinder 1; 6-cylinder engine: Cylinder 1; 8-cylinder engine Master: Cylinder 1, Slave: Cylinder 5; 10-cylinder engine Master: Cylinder 1, Slave: Cylinder 6; 12-cylinder engine Master: Cylinder 1, Slave: cylinder 12)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 651), but another current path for this cylinder bank (e.g. 653 or 655) may be affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (651, 653 and 655) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).

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SPN	SPN-Plain text
	Description
652	**BANK 2 INJECTOR 1 (4-cylinder engine: Cylinder 3; 6-cylinder engine: Cylinder 5; 8-cylinder engine Master: Cylinder 2, Slave: Cylinder 7; 10-cylinder engine Master: Cylinder 5, Slave: Cylinder 10; 12-cylinder engine Master: Cylinder 5, Slave: Cylinder 8)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 652), but another current path for this cylinder bank (e.g. 654 or 656) may be affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (652, 654 and 656) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).

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SPN	SPN-Plain text
	Description
653	**BANK 1 INJECTOR 2 (4-cylinder engine: Cylinder 4; 6-cylinder engine: Cylinder 3; 8-cylinder engine Master: Cylinder 3, Slave: Cylinder 6; 10-cylinder engine Master: Cylinder 2, Slave: Cylinder 7; 12-cylinder engine Master: Cylinder 3, Slave: Cylinder 10)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 653), but another current path for this cylinder bank (e.g. 651 or 655) may be affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (651, 653 and 655) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).

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SPN	SPN-Plain text
	Description
654	**BANK 2 INJECTOR 2 (4-cylinder engine: Cylinder 2; 6-cylinder engine: Cylinder 6; 8-cylinder engine Master: Cylinder 4, Slave: Cylinder 8; 10-cylinder engine Master: Cylinder 3, Slave: Cylinder 8; 12-cylinder engine Master: Cylinder 6, Slave: Cylinder 7)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 654), but another current path for this cylinder bank (e.g. 652 or 656) may be affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (652, 654 and 656) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).

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SPN	SPN-Plain text
	Description
655	**BANK 1 INJECTOR 3 (6-cylinder engine: Cylinder 2; 10-cylinder engine Master: Cylinder 4, Slave: Cylinder 9; 12-cylinder engine Master: Cylinder 2, Slave: Cylinder 11)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 655), but another current path for this cylinder bank (e.g. 651 or 653) may be affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (651, 653 and 655) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 1 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).

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SPN	SPN-Plain text
	Description
656	**BANK 2 INJECTOR 3 (6-cylinder engine: Cylinder 4; 12-cylinder engine Master: Cylinder 4, Slave: Cylinder 9)**
	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults – No signal present (FMI 4) = Cable discontinuity – Too high (FMI 1) = Short circuit or other electrical fault **Note:** There are different system responses, depending on the version of the EDC control unit: **System response EDC 7 C3:** Here all indicated FMIs must be evaluated as “general electrical faults”. The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. a certain current path is indicated using an SPN (e.g. 656), but another current path for this cylinder bank (e.g. 652 or 656) may be affected. – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP). **System response EDC 7 C32:** The “No signal present” fault is generally assigned to the appropriate current path using SPN. All other faults are only displayed for a “particular bank”, i.e. all SPNs (652, 654 and 656) for this bank are displayed in spite of the fact that possibly only one current path is affected – If there is a cable discontinuity in a current path, only the defective injector is switched off so there is no injection at this cylinder Consequence: The run-up test (TRUP) can be performed and displays the affected current path. – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off so there is no injection at all cylinders of bank 2 Consequence: The run-up test (TRUP) is cancelled with a fault message in inline engines (e. g. a 6-cylinder inline engine only continues to run on three cylinders, and then only on two cylinders for TRUP).
959	**Time/Date: Seconds invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in seconds not available
960	**Time/Date: Minutes invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in minutes not available
961	**Time/Date: Hours invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in hours not available
962	**Time/Date: Days invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in days not available
963	**Time/Date: Months invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in months not available
964	**Time/Date: Years invalid**
	Vehicle management computer sends invalid numerical value **System response:** time in years not available

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SPN	SPN-Plain text
	Description
1079	**Supply for rail-pressure sensor**
	Checking for short-circuit to ground or +Ubat and discontinuity **System response:** sensor may supply no values or incorrect values. Pressure limiting valve opens, engine keeps running with 800 bar rail pressure. Limiting: D08: 100 mg/stroke, D20: 150 mg/stroke, D26 and D28: 180 mg/stroke
1080	**Supply for fuel low pressure, charge pressure, oil pressure and exhaust gas relative pressure sensor**
	Checking for short-circuit to ground or +Ubat and discontinuity **System response:** sensor may supply no values or incorrect values
1131	**Charge air temperature downstream of cooler (in charge air pipe)**
	Monitoring for loose contact or plausibility of the rate of change of charge air temperature; excessive or insufficient temperature
2039	**FFR1: Timeout**
	FFR1 message not received **System response:** stand-alone mode (=idle)
3004	**EGR: steady-state deviation**
	Desired position of flap acc. to duty factor does not match actual position acc. to dry-reed contact
3007	**DM4 request invalid**
	Invalid vehicle management computer request to send a DM4 message (diagnostic memory) **System response:** Diagnostic memory cannot be read out
3009	**Engine overrevving**
	Check to determine whether limit speed has been exceeded **System response:** Injection is blocked until revs are lower than the specified engine speed threshold. D20 and D26 limit: 2800 rpm
3014	**Main relay (inside control unit)**
	Fault if the control unit is still energised after a certain time following deactivation of terminal 15 **System response:** none. If the main relay is blocked, the battery may discharge over a period of time
3016	**FFR1: Bit error zero quantity due to engine brake**
	FFR1 sends invalid numerical value **System response:** no engine brake function
3017	**FFR1: Bit error desired torque**
	Vehicle management computer sends invalid numerical value **System response:** engine starts idling
3018	**FFR1: Bit error top-speed governor parameter ID**
	FFR1 sends incorrect numerical value **System response:** control parameter set “0” is activated
3020	**FFR1: Bit error, EDR desired value**
	FFR1 sends invalid numerical value **System response:** EDR reduction is cancelled
3022	**FFR1: ISG desired value**
	FFR1 sends invalid numerical value **System response:** ISG desired value is set to 0 rpm, i.e. engine does not go into ISG mode
3023	**FFR1: Bit error, request “MEOS” (Momentary Engine Overspeed)**
	FFR1 sends invalid numerical value **System response:** “MEOS” request is cancelled

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SPN	SPN-Plain text
	Description
3024	**FFR1: Bit error, request ramps off**
	FFR1 sends invalid numerical value **System response:** EDC-internal ramps are reactivated
3025	**FFR1: Checking of check bits (Reserved Bits and Bytes)**
	FFR1 does not send a “1” in the reserved message locations **System response:** none
3029	**FFR2: Bit error, idling desired value**
	FFR2 sends invalid numerical value **System response:** engine goes to EDC-internal idling speed
3030	**FFR2: Bit error, idling control parameter ID**
	FFR2 sends invalid numerical value **System response:** Idling control parameter set “0” is activated
3031	**FFR2: Idling control desired value too high**
	FFR2 requests idling speed greater than 800 rpm **System response:** Maximum possible idling speed (800 rpm) is achieved
3032	**FFR2: Bit error, request, stand-alone**
	FFR2 sends invalid numerical value **System response:** EDC goes into stand-alone mode (idling)
3033	**FFR2: Bit error, start request**
	FFR2 sends invalid numerical value **System response:** No starter activation
3034	**FFR2: Bit error, request engine stop**
	FFR2 sends invalid numerical value **System response:** Engine is not stopped by vehicle management computer
3035	**FFR2: Checking of check bits (Reserved Bits and Bytes)**
	FFR2 does not send a “1” in the reserved message locations **System response:** None
3038	**FFR3: Bit error, standstill info**
	FFR3 sends invalid numerical value **System response:** “Vehicle moving” output despite vehicle being at standstill, control unit programming only possible in the case of CAN interruption
3039	**FFR3: Checking of check bits (Reserved Bits and Bytes)**
	FFR3 does not send a “1” in the reserved message locations **System response:** None
3045	**Starter activation defective**
	Voltage drop in the battery too low during start **System response:** Fault in starter path. It may not be possible to start the engine (starter defective, IMR relay defective, wiring defective)
3046	**Atmospheric pressure sensor**
	Monitoring for voltage limits and AP blocking **System response:** If charge-pressure sensor is defective: Default value 1000 mbar, otherwise the same as the charge pressure at idling
3063	**Run-on not complete**
	The last two run-on operations were not completed correctly

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SPN	SPN-Plain text
	Description
3064	**Stand alone mode, EDC**
	Communication with the vehicle management computer not possible or Stand-Alone request from vehicle management computer **System response:** stand-alone mode (=idle)
3069	**Redundant speed monitoring**
	The separate calculation of the revs deviates excessively from the actual engine revs **System response:** A recovery (control unit reset) is performed
3076	**Immobiliser enable: No quantity due to invalid vehicle management computer ID**
	EDC control unit receives incorrect ID number from the vehicle management computer **System response:** Starter engages, EDC does not release quantity, engine does not start
3077	**Immobiliser enable: No quantity due to timeout when sending the vehicle management computer ID**
	The vehicle management computer sends the vehicle management computer ID uninterruptedly to the EDC control unit for a defined time with the status “Not yet ready”, i. e. the EDC control unit does not detect a vehicle management computer ID number within a defined time period **System response:** Starter engages, EDC does not release quantity, engine does not start
3081	**Charge pressure controller shut-off**
	Desired charge pressure cannot be set **System reaction:** engine speed reduction, torque reduction to 1800 rpm and 100 mg/stroke
3082	**Plausibility, oil pressure sensor**
	At standstill sensor indicates oil pressure > 500 mbar or, when the engine is running, the same oil pressure at different engine speeds
3083	**Plausibility of rail-pressure sensor**
	Monitoring to check whether rail pressure falls to atmospheric pressure level when engine is stationary
3085	**Vehicle distance invalid**
	The absolute distance covered is not available as an ambient condition for the fault memory **System response:** Tachograph or vehicle management computer does not send vehicle distance message
3086	**EGR adjuster position, limit position**
	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking **System response/remarks:** Active EGR specified as default value. Not for OEM engines
3087	**Oil pressure sensor**
	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking **System response:** Output, default value: 1 bar
3088	**Charge-pressure sensor downstream of cooler (in charge air pipe)**
	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking **System response:** Output of a simulated charge pressure as default value
3089	**Charge air temperature sensor upstream of cylinder inlet (downstream of EGR)**
	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking
3091	**Coolant temperature sensor**
	Monitoring of the voltage limits (sensor voltage) and AP blocking **System response:** Output, default value: 100.4 °C, torque reduction 10%
3092	**TIME/DATE: Timeout**
	Monitoring for timeout of date information (day/month/year etc.) **System response:** Variables are frozen to values before timeout

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SPN	SPN-Plain text
	Description
3093	**TIME/DATE: Reserved Bits and Bytes**
	TIME/DATE message does not send a “1” in the reserved message locations **System response:** none
3097	**Fuel temperature sensor**
	Sensor not currently installed
3099	**Rail-pressure sensor**
	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking **System response:** Output, default value: 800 bar, pressure limiting valve opens, engine keeps running with 800 bar rail pressure. Limiting: D08: 2000 rpm; 100 mg/stroke, D20: 130-150 mg/stroke, D26: 180 mg/stroke
3100	**Fuel low-pressure sensor (supply pressure)**
	Monitoring of the voltage limits (sensor voltage) and AP blocking
3671	**Error when reading in EEPROM**
	EEPROM checksum check defective because EEPROM is defective or saving was interrupted during last run-on
3673	**CAN module 2 (OBD-CAN)**
	CAN module 2 Busoff state **Note:** In the case of EDC7 C32 Master/Slave, OBD-CAN is on pin B25 (line 185) and pin B32 (line 186) of the **Slave** control unit and A-CAN (exhaust gas aftertreatment CAN) on pin B25 (line 191) and pin B32 (line 192) of the **Master** control unit **System response:** No communication with OBD socket
3673	**CAN module 2 (Master/Slave CAN V-engine)**
	CAN module 2 Busoff state **System response:** Slave control unit blocks injection quantity, engine keeps running with one bank of cylinders (output halved) **Note:** In the case of EDC7 C32 Master/Slave, M/S-CAN (connection between Master control unit and Slave control unit) is on pin A27 and Pin A45. In the case of EDC7 C32 in-line engine with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on pin A27 (line 191) and pin A45 (line 192).
3674	**FFR1: Bank shut-off, Byte 8/Bit 5-8**
	Vehicle management computer sends invalid value **System response:** No cylinder bank shut-off in case of Master/Slave V-engines
3676	**Defective redundant shut-off device (run-on test)**
	Checking of output stage shut-off to the injectors in run-on **System reaction:** Engine stops
3678	**Booster voltage capacitor bank 1**
	Monitoring of booster voltage for voltage limits, short circuit and plausibility
3679	**Booster voltage capacitor bank 2**
	Monitoring of booster voltage for voltage limits, short circuit and plausibility
3693	**Booster voltage**
	Insufficient voltage for injector activation **System response:** Problems with pre-injection, main injection and post-injection
3687	**Pressure limiting valve does not open**
	Monitoring to check whether pressure limiting valve opens **System response:** Engine stops

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SPN	SPN-Plain text
	Description
3732	**Defect classification for initialisation (overvoltage test)**
	Test device for overvoltage test not OK
3735	**Internal temperature EDC control unit**
	Monitoring of voltage limits and AP blocking **System response:** Output, default value: 60 °C
3736	**Output stage shut-off by EDC hardware**
	Fault in watchdog communication or overvoltage **System response:** Engine stops
3737	**Initialisation in case of Master/Slave mode**
	Monitoring of Master/Slave when ignition ON **System response:** None, engine runs as usual
3738	**Rotational irregularity too great: 4-cylinder engine: cyl. 1; 6-cylinder engine: cyl. 1; 8-cylinder engine: Master cyl. 1, Slave cyl. 5; 10-cylinder engine: Master cyl. 1, Slave cyl. 6; 12-cylinder engine: Master cyl. 1, Slave cyl. 12**
	Injection quantity deviation at cylinder in question
3739	**Rotational irregularity too great: 4-cylinder engine: cyl. 3; 6-cylinder engine: cyl. 5; 8-cylinder engine: Master cyl. 2, Slave cyl. 7; 10-cylinder engine: Master cyl. 5, Slave cyl. 10; 12-cylinder engine: Master cyl. 5, Slave cyl. 8**
	Injection quantity deviation at cylinder in question
3740	**Rotational irregularity too great: 4-cylinder engine: cyl. 4; 6-cylinder engine: cyl. 3; 8-cylinder engine: Master cyl. 3, Slave cyl. 6; 10-cylinder engine: Master cyl. 2, Slave cyl. 7; 12-cylinder engine: Master cyl. 3, Slave cyl. 10**
	Injection quantity deviation at cylinder in question
3741	**Rotational irregularity too great: 4-cylinder engine: cyl. 2; 6-cylinder engine: cyl. 6; 8-cylinder engine: Master cyl. 4, Slave cyl. 8; 10-cylinder engine: Master cyl. 3, Slave cyl. 8; 12-cylinder engine: Master cyl. 6, Slave cyl. 7**
	Injection quantity deviation at cylinder in question
3742	**Rotational irregularity too great: 6-cylinder engine: cyl. 2; 10-cylinder engine: Master cyl. 4, Slave cyl. 9; 12-cylinder engine: Master cyl. 2, Slave cyl. 11**
	Injection quantity deviation at cylinder in question
3743	**Rotational irregularity too great: 6-cylinder engine: cyl. 4; 12-cylinder engine: Master cyl. 4, Slave cyl. 9**
	Injection quantity deviation at cylinder in question
3744	**Highside, output stage, exhaust gas recirculation throttle valve**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
3745	**Highside, output stage, charge pressure**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
3746	**Highside, output stage, exhaust gas recirculation**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
3748	**Highside, output stage, metering unit, high-pressure pump**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$, discontinuity **System response:** Shut-off of output stage (reversible), pressure limiting valve opens, engine keeps running at 800 bar rail pressure. Limiting: D20: 150 mg/stroke, D26: 180 mg/stroke
3749	**Highside, output stage, engine air flow sensor flap**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$, discontinuity

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SPN	SPN-Plain text
	Description
3751	**Highside, output stage, starter relay**
	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$, discontinuity
3752	**Camshaft speed sensor (segment sensor)**
	No signal or incorrect pulse sequence, sensor reverse polarity **System response:** Engine keeps running with increment sensor. Longer start time required before ignition TDC is determined by control unit
3753	**Crankshaft speed sensor (increment sensor)**
	No signal or incorrect pulse sequence, sensor reverse polarity **System response:** Engine keeps running with segment sensor
3754	**Watchdog fault, system start**
	Watchdog test failed **System response:** Engine does not start / stopped
3755	**Plausibility check, fuel pressure**
	Monitoring for sticking sensor **System response:** none
3756	**Supply voltage, EGR feedback**
	Checking for short-circuit to ground or $+U_{bat}$ and discontinuity **System response/remarks:** Sensor supplies no values or incorrect values
3758	**Send fault, message position 2 to partner control unit**
	Master-Slave communication (V-engine) fault. Possibly due to excessive bus load **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3759	**Send fault, message position 3 to partner control unit**
	Master-Slave communication (V-engine) fault. Possibly due to excessive bus load **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3760	**Send fault, message position 4 to partner control unit**
	Master-Slave communication (V-engine) fault. Possibly due to excessive bus load **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3761	**Send fault, message position 5 to partner control unit**
	Master-Slave communication (V-engine) fault. Possibly due to excessive bus load **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3762	**CAN Master/Slave decoder (CAMD): CAMD-ANA, message position, timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3763	**CAN Master/Slave decoder (CAMD): CAMD-CMOL, message position, timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3764	**CAN Master/Slave decoder (CAMD): CAMD-CONTROL, message position, timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)

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SPN	SPN-Plain text
	Description
3765	**CAN Master/Slave decoder (CAMD): CAMD-FFR1, Timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Engine keeps running as usual, no reaction
3766	**CAN Master/Slave decoder (CAMD): CAMD-FFR2, Timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Engine keeps running as usual, no reaction
3767	**CAN Master/Slave decoder (CAMD): CAMD-FFR3, Timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Engine keeps running as usual, no reaction
3768	**CAN Master/Slave decoder (CAMD): CAMD-initialisation**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Engine keeps running as usual, no reaction
3769	**CAN Master/Slave decoder (CAMD): CAMD-LIMIT, message position, timeout**
	Master-Slave communication (V-engine) fault. CAN Master/Slave decoder receive fault **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3771	**Master/Slave, CAN error in partner control unit**
	Master or Slave fault during receive, vehicle management computer CAN **System response:** Partner control unit sends messages via Master/Slave CAN
3772	**Monitoring, terminal 15, Master/Slave**
	Checking whether Master and Slave detect ignition “ON”
3773	**Operating mode change error, Master/Slave**
	Checking of operating mode between Master and Slave
3775	**Rail pressure monitoring**
	Monitoring for excessive (1) or insufficient (2) rail pressure **System response:** Re 1: Pressure limiting valve forced open. Re 2: Engine stops due to missing rail pressure. Limiting: D08: 2000 rpm; 100 mg/stroke, D20: 130-150 mg/stroke, D26: 180 mg/stroke
3776	**Positive system deviation**
	Insufficient rail pressure cannot be corrected **System response:** Problems with fuel supply control, engine can stop. Limiting: D08: 100 mg/stroke, D20: 150 mg/stroke, D26: 180 mg/stroke
3777	**Negative system deviation**
	Excessive rail pressure cannot be corrected **System response:** Problems with fuel return line, pressure limiting valve can open
3778	**Rail pressure: Leakage under overrun/trailing throttle conditions**
	Monitoring for leakage in the high-pressure hydraulic system under overrun/trailing throttle conditions **System response:** Problems with fuel return line, pressure limiting valve can open. Limiting: D08: 100 mg/stroke, D20: 130-150 mg/stroke, D26: 180 mg/stroke
3779	**Rail pressure: Leakage due to quantity compensation**
	Monitoring for leakage in high-pressure hydraulic system **System response:** High-pressure side leaking, engine stops, lack of power, risk of fire. Limiting: D08: 100 mg/stroke, D20: 130-150 mg/stroke, D26: 180 mg/stroke

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SPN	SPN-Plain text
	Description
3780	**Rail pressure: High controller output idling**
	Monitoring for rail pressure controller idling **System response:** Engine can stop due to insufficient rail pressure
3781	**Pressure limiting valve open (pressure too high)**
	Monitoring for open pressure limiting valve **System response:** Rail pressure 700 – 800 bar. Limiting: D08: 2000 rpm; 100 mg/stroke, D20: 150 mg/stroke, D26: 180 mg/stroke
3782	**Fuel supply pressure, dynamic**
	Monitoring for fluctuating supply pressure **System response:** Possibly air in the system
3783	**FFR2: Bit error NORD-desired acceleration (electronic noise management NORD = NOise ReDuction)**
	The purpose of the electronic noise management is to reduce noise emissions. **System response:** The permitted engine acceleration is not exceeded due to a reduction in the injection quantity, both torque and noise emissions are limited
3784	**Bit error smoke ID**
	CAN receive message from FFR for selection of a smoke map when exhaust gas recirculation not active
3785	**Monitoring of particulate filter/PM catalytic converter**
	Exhaust gas differential pressure too high or too low **System response/description:** Too high: Have filter cleaned. Too low: Particulate filter/PM catalytic converter not fitted or burned
3786	**Particulate filter temperature limits**
	Filter temperature during forced regeneration too high or too low **System response:** Too high: Power reduction. Too low: None
3787	**No particulate filter regeneration**
	Forced generation not successful **System response:** e.g. filter contaminated with oil that cannot be regenerated
3789	**Exhaust gas differential pressure sensor or exhaust gas relative pressure sensor**
	Monitoring for voltage limits and AP blocking **System response:** Specification of a default value
3790	**Exhaust gas differential pressure or exhaust gas relative pressure plausibility**
	The sensor is defective if, when the speed = 0, the exhaust gas pressure is above the defined threshold or, in the case of two speeds, the pressure differential is below the defined threshold.
3792	**Exhaust temperature sensor upstream of exhaust gas aftertreatment**
	Monitoring for voltage limits and AP blocking **System response:** Specification of a default value
3793	**Exhaust temperature sensor downstream of exhaust gas aftertreatment, physical**
	Monitoring for loose contact or plausibility of the rate of change of this temperature, excessive or insufficient temperature
3794	**Exhaust temperature sensor downstream of exhaust gas aftertreatment**
	Monitoring for voltage limits and AP blocking
3795	**Exhaust gas recirculation throttle valve**
	Desired and actual position of the valve do not match (not fitted in case of D08)

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SPN	SPN-Plain text
	Description
3796	**Highside, output stage, exhaust gas recirculation 2**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, discontinuity
3797	**Highside output stage oxygen sensor**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, discontinuity
3798	**Output stage, OBD lamp (MIL)**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, discontinuity
3800	**Highside output stage, wastegate on low-pressure turbocharger**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, discontinuity
3801	**Highside output stage, shut-off valve for LT circuit**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, discontinuity
3802	**Highside output stage stop valve compressed air (compressed-air shut-off valve)**
	Monitoring of the output stage for short-circuit to ground or +U_{bat}, line discontinuity
3803	**Send fault, CAN1 (vehicle management computer/EDC-CAN)**
	Send fault, engine CAN (possibly due to excessive bus load) **System response:** EDC1 or EDC2 or EDC3 message info not available in vehicle management computer
3804	**Timeout fault, CAN1 (vehicle management computer/EDC-CAN)**
	Receipt of one of the messages FFR1, FFR2, FFR3 or Time/Date from vehicle management computer not possible **System response:** Vehicle management computer requests not implemented
3805	**Send fault, CAN2 (Master/Slave CAN)**
	Master-Slave communication fault (V-engine). Possibly due to excessive bus load **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
3806	**Timeout error, CAN2 (OBD CAN)**
	Fault in communication with OBD socket **Note:** In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, OBD-CAN is on pin B25 (line 185) and pin B32 (line 186) of the **Slave** control unit and A-CAN (exhaust gas aftertreatment CAN) on pin B25 (line 191) and pin B32 (line 192) of the **Master** control unit
3806	**Timeout error, CAN2 (Master/Slave CAN V-engine)**
	Master-Slave communication fault (V-engine). CAN Master/Slave decoder receive fault **System response:** Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved) **Note:** In the case of EDC7 C32 Master/Slave, M/S-CAN (connection between Master control unit and Slave control unit) is on pin A27 and Pin A45. In the case of EDC7 C32 in-line engine with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on pin A27 (line 191) and pin A45 (line 192).
3807	**Fault, FFR1 (vehicle management computer/EDC-CAN)**
	Vehicle management computer sends invalid value in FFR1
3808	**Fault, FFR2 (vehicle management computer/EDC-CAN)**
	Vehicle management computer sends invalid value in FFR2
3809	**Fault, FFR3 (vehicle management computer/EDC-CAN)**
	Vehicle management computer sends invalid value in FFR3

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SPN	SPN-Plain text
	Description
3810	**Fault, Time/Date (vehicle management computer/EDC-CAN)**
	Vehicle management computer sends invalid numerical value **System response:** Time not available
3811	**Exhaust gas temperature plausibility upstream of exhaust gas aftertreatment**
	Monitoring for sensor drift when ignition on, i. e. whether exhaust gas temperature has dropped to ambient temperature with the engine stopped. Monitoring in operation for whether the sensor is installed, i. e. the temperature is too high at low load and too low at high load
3812	**Exhaust gas temperature plausibility downstream of exhaust gas aftertreatment**
	Monitoring for sensor drift when ignition on, i. e. whether exhaust gas temperature has dropped to ambient temperature with the engine stopped. Monitoring in operation for whether the sensor is installed, i. e. the temperature is too high at low load and too low at high load
3813	**Starter monitoring (starter protection)**
	Monitoring of starting duration **System reaction:** The warming of the starter is evaluated in the control unit, depending on the starter actuation time. If the starter is actuated for longer than 30 seconds without interruption and the engine does not start, the fault message SPN 3813 appears on the display. This fault message remains active until it can be assumed that the starter has cooled down enough. The message is active for 10 minutes per 30-second actuation. This fault has no other effects and the fault message disappears automatically after the specified time has elapsed.
3814	**Recording of control unit switch-off duration**
	Calculation and monitoring of the switch-on and switch-off point and the switch-off duration of the control unit. Unable to determine switch-off duration **System reaction:** This fault occurs when a new start attempt takes place in the after-run time during the engine stopping phase. This fault has no other effects and was changed with the introduction of software V27
3819	**CAN module 3 (exhaust gas aftertreatment CAN)**
	CAN module 3 Busoff state **Note:** In the case of EDC7 C32 in-line engine with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave, M/S-CAN (connection between Master control unit and Slave control unit) is on pin A27 and Pin 45.
3819	**CAN module 3 (exhaust gas aftertreatment CAN Master/Slave V-engine)**
	CAN module 3 Busoff state **Note:** In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, A-CAN (exhaust gas aftertreatment CAN) is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit and the OBD-CAN on pin 25 (line 185) and pin 32 (line 186) of the **Slave** control unit
3820	**Byte monitoring, CAN 1 (oil and ambient air temperature)**
	Monitoring of CAN 1 (oil and ambient air temperature) for bit error. At least one of these CAN messages is not plausible
3821	**Byte monitoring CAN 3 (exhaust gas aftertreatment CAN)**
	Monitoring of CAN 3 (exhaust gas temperature, AdBlue level and AdBlue temperature) for bit errors. At least one of these CAN messages is not plausible **Note:** In the case of EDC7 C32 in-line engine with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave, M/S-CAN (connection between Master control unit and Slave control unit) is on pin A27 and Pin 45.

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SPN	SPN-Plain text
	Description
3821	**Byte monitoring CAN 3 (exhaust gas aftertreatment CAN Master/Slave V-engine)**
	Monitoring of CAN 3 (exhaust gas temperature, AdBlue level and AdBlue temperature) for bit errors. At least one of these CAN messages is not plausible **Note:** In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, A-CAN (exhaust gas aftertreatment CAN) is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit and the OBD-CAN on pin 25 (line 185) and pin 32 (line 186) of the **Slave** control unit
3822	**Timeout error, CAN 3 (exhaust gas aftertreatment CAN)**
	Monitoring of CAN 3 for timeout errors. No reception of one of the following messages possible: IEC, ATI, DM1-DCU, TSC1-DCU **Note:** In the case of EDC7 C32 in-line engine with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave, M/S-CAN (connection between Master control unit and Slave control unit) is on pin A27 and Pin 45.
3822	**Timeout error CAN 3 (exhaust gas aftertreatment CAN Master/Slave)**
	Monitoring of CAN 3 for timeout errors. No reception of one of the following messages possible: IEC, ATI, DM1-DCU, TSC1-DCU **Note:** In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, A-CAN (exhaust gas aftertreatment CAN) is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit and the OBD-CAN on pin 25 (line 185) and pin 32 (line 186) of the **Slave** control unit
3823	**Misfiring at several cylinders**
3830	**Misfiring status, 4-cylinder engine: Cylinder 1; 6-cylinder engine: Cylinder 1; Slave, 8-cylinder engine: Cylinder 5; 10-cylinder engine: Cylinder 6; 12-cylinder engine: Cylinder 12**
3831	**Misfiring status, 4-cylinder engine: Cylinder 3; 6-cylinder engine: Cylinder 5; Slave, 8-cylinder engine: Cylinder 7; 10-cylinder engine: Cylinder 10; 12-cylinder engine: Cylinder 8**
3832	**Misfiring status, 4-cylinder engine: Cylinder 4; 6-cylinder engine: Cylinder 3; Slave, 8-cylinder engine: Cylinder 6; 10-cylinder engine: Cylinder 7; 12-cylinder engine: Cylinder 10**
3833	**Misfiring status, 4-cylinder engine: Cylinder 2; 6-cylinder engine: Cylinder 6; Slave, 8-cylinder engine: Cylinder 8; 10-cylinder engine: Cylinder 8; 12-cylinder engine: Cylinder 7**
3834	**Misfiring status, 6-cylinder engine: Cylinder 2; Slave, 10-cylinder engine: Cylinder 9; 12-cylinder engine: Cylinder 11**
3835	**Misfiring status, 6-cylinder engine: Cylinder 4; Slave, 12-cylinder engine: Cylinder 9**
3836	**Acquisition, lambda value, physical**
	Monitoring for loose contact or plausibility of rate of change of the signal
3837	**Acquisition of lambda value**
	Monitoring for voltage limits and AP blocking
3838	**Internal resistance, oxygen sensor, physical**
	Monitoring for loose contact or plausibility of rate of change of the internal resistance
3839	**Oxygen sensor internal resistance**
	Monitoring for voltage limits and AP blocking

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SPN	SPN-Plain text
	Description
3843	**Coolant temperature plausibility check**
	Monitoring for sensor drift when ignition on, i. e. whether exhaust gas temperature has dropped to ambient temperature with the engine stopped. Monitoring in operation for whether the sensor is installed, i. e. the temperature is too high at low load and too low at high load
3844	**Verification, charge-air temperature upstream of cylinder inlet (downstream of EGR)**
	Monitoring for sensor drift with the ignition on, i. e. whether the temperature upstream of cylinder inlet has dropped to the coolant temperature with the engine stopped. Monitoring during operation for whether the sensor is fitted (temperature is not allowed to deviate excessively from the charge air temperature upstream of engine)
3845	**Plausibility check, ambient air temperature**
	Monitoring for sensor drift with the ignition on, i. e. whether the ambient air temperature has dropped to the coolant temperature with the engine stopped. Monitoring during operation for whether the sensor is fitted (temperature is not allowed to deviate excessively from the charge air temperature upstream of engine)
3846	**Control unit configuration**
	Monitoring of Master/Slave control unit configuration
3847	**Charge air temperature sensor downstream of cooler (in charge air pipe)**
	Monitoring for voltage limits and AP blocking
3849	**SCR catalytic converter not installed**
	Monitoring during operation for whether the sensor is fitted in the exhaust (not fitted if excessively low temperature is measured under high load).
3850	**Position deviation, closed EGR**
	Zero point adaptation invalid
3851	**Position sensor, EGR flap**
	Monitoring for voltage limits and AP blocking
3852	**Plausibility check of EGR by temperature**
	Charge-air temperature upstream of cylinder inlet deviates too much from the temperature downstream of the cooler
3853	**Steady-state deviation position controlled EGR**
	The system deviation amount is too large
3854	**EDC internal temperature sensor 2**
	Monitoring for voltage limits and AP blocking
3855	**Oxygen sensor lines**
	Monitoring for short-circuit to ground or +Ubat and discontinuity
3856	**Oxygen sensor calibration**
	Monitoring for excessive or insufficient oxygen sensor correction value
3857	**Oxygen sensor SPI communication**
	Monitoring for control unit faults. Fault in evaluation module-main computer communication. The oxygen sensor evaluation module communicates with the main computer via SPI (Serial Peripheral Interface). The module controls the reading-out and setting of the oxygen sensor evaluation module's internal index following a request by the software
3858	**Oxygen sensor temperature**
	Monitoring for excessive (> 800 °C) or insufficient (< 600 °C) oxygen sensor temperature

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SPN	SPN-Plain text
	Description
3859	**Oxygen sensor temperature calibration**
	Monitoring for excessive or insufficient temperature correction value
3863	**Trailing throttle monitoring**
	The injector stage activation duration is too great in trailing-throttle condition. The purpose of trailing throttle monitoring is to check the plausibility of the current activation duration for the injector output stages under certain operation conditions according to the maximum permitted activation duration for the current revs **System response:** In the event of a fault, it is assumed that a control unit is not operating correctly and a recovery is triggered (control unit reset)
3864	**Monitoring of P1 injection**
	Battery voltage too low for performing pre-injection **System response:** First pre-injection P1 is suppressed
3865	**Monitoring of P2 injection**
	Battery voltage too low for performing a second pre-injection **System response:** Second pre-injection P2 is suppressed
3866	**Monitoring of M1 injection**
	Battery voltage too low for performing a second main injection **System response:** Second main injection M2 is suppressed
3867	**Monitoring of P0 injection**
	Battery voltage too low for performing post-injection **System response:** Post-injection P0 is suppressed
3868	**Charge air temperature downstream of intercooler plausibility**
	Monitoring for sensor drift with the ignition on, i. e. whether the charge air temperature has dropped to the coolant temperature with the engine stopped. Monitoring during operation for whether the sensor is fitted (two different charge pressures must produce two different temperatures)
3871	**Plausibility check of the EDC control unit internal temperature**
	Monitoring for sensor drift with the ignition on, i. e. whether the “EDC internal temperature” has dropped to the coolant temperature with the engine stopped
3872	**Plausibility check of the EDC control unit internal temperature 2 (heat sink bracket temperature)**
	Monitoring for sensor drift with the ignition on, i. e. whether the “EDC internal temperature 2” has dropped to coolant temperature with the engine stopped
3873	**Recovery monitoring**
	The EDC control unit was in an undefined condition. A reset was performed
3874	**Quantity correction value too large: Segment 0**
	Injector is contaminated or leaking
3875	**Quantity correction value too large: Segment 1**
	Injector is contaminated or leaking
3876	**Quantity correction value too large: Segment 2**
	Injector is contaminated or leaking
3877	**Quantity correction value too large: Segment 3**
	Injector is contaminated or leaking
3878	**Quantity correction value too large: Segment 4**
	Injector is contaminated or leaking

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SPN	SPN-Plain text
	Description
3879	**Quantity correction value too large: Segment 5**
	Injector is contaminated or leaking
3880	**12V output stage for LIN-Bus**
3919	**Fault status, NOx sensor heating**
	Monitoring for short-circuit, discontinuity and plausibility
3920	**Fault status, NOx concentration**
	Monitoring for short-circuit, discontinuity and plausibility
3921	**Fault status, O_2 concentration**
	Monitoring for short-circuit, discontinuity and plausibility
3923	**Coolant temperature 2**
	Monitoring for loose contact or plausibility of this temperature, excessive or insufficient temperature
3925	**Coolant temperature sensor 2**
	Monitoring of voltage limits and AP blocking
3926	**Gradient monitoring RPS (rail-pressure sensor)**
	Monitoring for loose contact of signal from rail-pressure sensor
3927	**Oxygen sensor not installed in exhaust pipe**
	The measured lambda value is too low
3929	**Monitoring of exhaust gas recirculation with lambda (MIL fault)**
	MIL request without blocking of EGR; MIL request with blocked EGR; MIL request directly from blocked EGR; MIL request directly from defective EGR. The lambda value is checked to diagnose the NOx monitoring system. Depending on limit values and the EGR status, it is decided whether the MIL lamp should be activated or the output should be reduced. **System reaction:** MIL request if lambda limit value is exceeded
3930	**Monitoring of EGR with lambda (PR = power reduction fault)**
	PR request without blocking of EGR; PR request with blocked EGR; PR request directly from blocked EGR; PR request directly from defective EGR. The lambda value is checked to diagnose the NOx monitoring system. Depending on limit values and the EGR status, it is decided whether the MIL lamp should be activated or the output should be reduced (PR = power reduction = engine output reduction). If oxygen sensor monitoring reveals that the EGR rate is too low and, therefore, that the NOx concentration is too high, the torque is reduced (PR request) **System reaction:** Engine output reduction request if lambda limit value is exceeded
3931	**Lowside output stage, intake air throttle valve**
	Monitoring of the output stage for short-circuit to ground or +Ubat, line discontinuity
3932	**Lowside output stage, charge pressure control**
	Monitoring of the output stage for short-circuit to ground or +Ubat, line discontinuity
3936	**Charge pressure too high**
	The maximum permitted charge pressure, depending on the rpm and valve position, is exceeded

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SPN	SPN-Plain text
	Description
3938	**Oxygen sensor not adaptable**
	Monitoring for excessive or insufficient correction factor. The “oxygen sensor adaptation” function is used for increasing the accuracy of the measured oxygen concentration / the lambda value calculated on this basis, i. e., in order to obtain the accuracy of NOx monitoring required by law, without risking misdiagnosis when exhaust gas recirculation is intact, the oxygen sensor acquisition is calibrated based on the oxygen content in the ambient air with the engine in trailing-throttle condition. This means the sensor tolerances and a sensor drift are compensated for by the control unit acquisition software
3942	**Charge pressure downstream of low-pressure intercooler**
	Monitoring for loose contact or plausibility of rate of change of this charge pressure
3943	**Charge-pressure sensor downstream of low-pressure intercooler**
	Monitoring of the voltage limits, AP blocking and plausibility
3944	**Charge air temperature downstream of low-pressure intercooler**
	Monitoring for loose contact or plausibility of the rate of change of this temperature, excessive or insufficient temperature
3945	**Charge air temperature sensor downstream of low-pressure intercooler**
	Monitoring of the voltage limits, AP blocking and plausibility
3946	**High-pressure intercooler**
	Sticking thermostat in high-pressure intercooler or malfunction in NT cooler shut-off /pressure-reducing valve **System response:** Limiting for D08: 100 mg/stroke
3947	**Low-pressure intercooler**
	Sticking thermostat in low-pressure intercooler or malfunction in NT cooler shut-off /pressure-reducing valve
3963	**Global LIN error**
	Monitoring for available signal **Remarks:** For marine engines only
3964	**LIN timeout error**
	Monitoring for available signal **Remarks:** For marine engines only
3965	**LIN defect status**
	Monitoring for available signal **Remarks:** For marine engines only
3966	**Oil level probe self-diagnosis**
	Monitoring for plausibility **Remarks:** For marine engines only
3972	**Monitoring for insufficient NOx value**
	Lambda value too small (FMI 1) or lambda value too small and EGR inactive (FMI 2)
3973	**Charge pressure in high-pressure circuit**
	The charge pressure is too high (FMI 1) or too low (FMI 2)
3974	**Charge pressure in low-pressure circuit**
	The charge pressure is too high (FMI 1) or too low (FMI 2)
3975	**Monitoring of the sensor lines for discontinuity**
	Discontinuity in the IP line (FMI 3), the Nernst line (FMI 8) or on the virtual ground (FMI 7)

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SPN	SPN-Plain text
	Description
3976	**Defect status Lambda Sensor Dynamic Check**
	Dynamic monitoring of the oxygen concentration. Change too sluggish during load-no load transition. Reason: Ageing of the oxygen sensor
3978	**Oxygen sensor electrical defect**
	Recording module or output stage for oxygen sensor is electrically defective
3979	**Deactivated/removed oxygen sensor**
	A removed or deactivated oxygen sensor was detected
3980	**Oil pressure adaptation fault**
	Oil pressure sensor drift at 0 bar
3981	**Exhaust gas backpressure too high**
	See notes in the Operator's Manual Only for D08. Text should be indicated on vehicle display
3983	**Device fault, electrical EGR controller**
	“EGR connector is defective” received via the exhaust gas CAN

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Test step list EDC7 C32 Euro 4 (4-cylinder and 6-cylinder)

Service company:	**Tested by:**
Customer:	**First registered:**
Vehicle type:	**Chassis no.:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage:	**Date:**

Use MAN-cats® to produce a diagnostic memory extract from the vehicle management computer and the EDC control unit to accompany the completed test step list.

1. Tests with the engine stopped (ignition OFF, EDC control unit not connected)
– Engine temperature ≈ 20 °C
– Control unit not connected (!!!), wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts)**

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Earthing	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Earthing	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 1 upstream of filter Earthing	B33 B26	B26 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Oxygen sensor *	B08 B24 B05 B23 B05	B05 B31 A03 A03 B23	2 - 4 Ω 30 - 300 Ω >10 MΩ >10 MΩ >1 MΩ	..... Ω ..... Ω ..... MΩ ..... MΩ ..... MΩ
Charge air temperature sensor ground (upstream of cylinder inlet)	A57	A03	>10 MΩ	..... MΩ
Water temperature sensor ground	A58	A03	>10 MΩ	..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>10 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>10 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
Exhaust gas relative pressure sensor ground	A59	A03	>10 MΩ	..... MΩ
Ground **feedback signal controlled EGR (E-EGR)**	A39	A03	>10 MΩ	..... MΩ
EGR activation (prop. valve E-EGR)	A17	A11	25 - 110 Ω	..... Ω
CAN connection to vehicle management computer	B22	B21	115 - 125 Ω	..... Ω
CAN connection to OBD socket	B25	B32	115 - 125 Ω	..... Ω
Compressed air shut-off valve (only if connected to EDC control unit)	B06	B02	25 - 260 Ω	..... Ω
Engine air flow sensor flap (only if CRT filter is fitted)	B12	B19	40 - 110 Ω	..... Ω

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Description	PIN	PIN	Desired value	Actual value
Proportional valve, turbocharger *	A02	A04	80 - 100 Ω	..... Ω
IMR relay (starter activation)	A16	A19	15 - 30 Ω	..... Ω

Description	4-cylinder	6-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 3	Cylinder 5	C01	C16	<2 Ω	..... Ω
	Cylinder 2	Cylinder 6	C02	C15	<2 Ω	..... Ω
	—	Cylinder 4	C03	C14	<2 Ω	..... Ω
	Cylinder 1	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 4	Cylinder 3	C05	C12	<2 Ω	..... Ω
	—	Cylinder 2	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 3	Cylinder 5	C16	A03	>10 MΩ	..... MΩ
	Cylinder 2	Cylinder 6	C15	A03	>10 MΩ	..... MΩ
	—	Cylinder 4	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 4	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	—	Cylinder 2	C11	A03	>10 MΩ	..... MΩ

***** Not fitted to all versions

1.1 Checking activation of the OBD malfunction indicator lamp (MIL)
This test is only performed if the MIL is activated by the EDC output stage.

Connect pin A51 to pin A01. Now the MIL must light up. The MIL must go out again when the connection is broken.

2. Tests with the engine stopped or running and with the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Oxygen sensor	B23	A03	2.30 - 2.70 V	.....		At standstill
Charge air temperature sensor (upstream of cylinder inlet)	A76	A57	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Charge air temperature sensor (integrated in the charge-pressure sensor)	A70	A62	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Exhaust gas temperature sensor 1 upstream of filter	B33	B26	1.08 - 2.30 V	.....	20 - 700 °C	Idling

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Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81 A81	A62 A62	0.94 - 1.20 V 1.10 - 1.70 V	....	PWG min PWG max	Idling High idling
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1.20 - 4.35 V	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	1.00 - 2.50 V	.....	2.0 - 3.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Signal, rail-pressure sensor	A80	A61	1.01 - 1.70 V 0.2 - 0.8 V	....	200 - 540 bar approx. 0 bar	Idling Standstill
Supply, exhaust gas relative pressure/exhaust gas differential pressure sensor	A41	A59	4.75 - 5.25 V	.....		Idling
Signal, exhaust gas relative pressure/exhaust gas differential pressure sensor	A78	A59	0.40 - 0.70 V	.....	0 - 50 mbar	Idling
Feedback signal controlled EGR (E-EGR)	A32 A87	A39 A39	4.75 - 5.25 V 0.50 - 0.80 V	.....		Idling Idling

3. Tests with the engine stopped or running and with the vehicle at a standstill (at operating temperature)

– Engine temperature > 70 °C
– CRT filter temperature > 300 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Exhaust gas differential pressure sensor supply (if CRT filter installed)	A41	A59	4.75 - 5.25 V	.....	> 30 mbar	high idle ~ 2150 rpm
Exhaust gas differential pressure sensor signal (if CRT filter installed)	A78	A59	> 0.6 V *	.....		
Engine air flow sensor flap signal (if CRT filter installed)	B12	B19	U_{BAT}	....	Closed	Idling Trailing throttle /overrun**

* The voltage between the signal PINs must rise as the engine speed increases, otherwise the pneumatic connections on the differential pressure sensor may be interchanged!

** Check trailing throttle/overrun function whilst driving or rolling (accelerate vehicle and release accelerator pedal => engine air flow sensor flap closed and EGR flap open).

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4. Check the main relay

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36	A03	U_{BAT}	.....	Ignition ON
	B36	A03	0 V	.....	Ignition OFF
	A40	A03	4.75 - 5.25 V	.....	Ignition ON
	A40	A03	0 V	.....	Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off

5. Deleting the diagnostic memory
Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any errors in the memory when the ignition is switched back on. Otherwise, search for the error and remedy the problem.

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Test step list EDC7 C32 Euro 5 with in-engine EGR (4-cylinder and 6-cylinder)

Service company:	**Tester:**
Customer:	**First registration:**
Vehicle type:	**Chassis no.:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage:	**Date:**

Use MAN-cats® to produce a diagnostic memory extract from the vehicle management computer and the EDC control unit to accompany the completed test step list.

1. Tests with the engine stopped (ignition OFF, EDC control unit not connected)
– Engine temperature ≈ 20 °C
– Control unit not connected (!!!), wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts)**

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Grounding	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Grounding	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit ZME (MProp) Grounding	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 1 upstream of filter Grounding	B33 B26	B26 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Oxygen sensor	B08 B24 B05 B23 B05	B05 B31 A03 A03 B23	2 - 4 Ω 30 - 300 Ω >10 MΩ >10 MΩ >1 MΩ	..... Ω ..... Ω ..... MΩ ..... MΩ ..... MΩ
Charge air temperature sensor 1 ground (upstream of cylinder intake)	A57	A03	>10 MΩ	..... MΩ
Water temperature sensor ground	A58	A03	>10 MΩ	..... MΩ
Low-temperature water temperature sensor ground	A65	A03	>10 MΩ	..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Low-temperature charge-pressure sensor ground	B20	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>10 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>10 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
Exhaust gas relative pressure sensor ground	A59	A03	>10 MΩ	..... MΩ
Feedback signal controlled EGR (E-EGR) ground	A39	A03	>10 MΩ	..... MΩ
EGR activation (prop. valve E-EGR)	A17	A11	25 - 110 Ω	..... Ω
CAN connection to vehicle management computer	B22	B21	115 - 125 Ω	..... Ω
CAN connection to OBD socket	B25	B32	115 - 125 Ω	..... Ω
Compressed-air shut-off valve	B06	B02	25 - 260 Ω	..... Ω

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Description	PIN	PIN	Desired value	Actual value
Shut-off/pressure-reducing valve, LT cooler	A06	A05	20 - 28 Ω	..... Ω
Turbocharger 1 pulse valve (high pressure)	A02	A04	80 - 100 Ω	..... Ω
Turbocharger 2 pulse valve (low pressure)	B13	B04	80 - 100 Ω	..... Ω
Engine air flow sensor flap (only if CRT filter is fitted)	B12	B19	40 - 110 Ω	..... Ω
IMR relay (starter control)	A16	A19	15 - 30 Ω	..... Ω

Description	4-cylinder	6-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 3	Cylinder 5	C01	C16	<2 Ω	..... Ω
	Cylinder 2	Cylinder 6	C02	C15	<2 Ω	..... Ω
	—	Cylinder 4	C03	C14	<2 Ω	..... Ω
	Cylinder 1	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 4	Cylinder 3	C05	C12	<2 Ω	..... Ω
	—	Cylinder 2	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 3	Cylinder 5	C16	A03	>10 MΩ	..... MΩ
	Cylinder 2	Cylinder 6	C15	A03	>10 MΩ	..... MΩ
	—	Cylinder 4	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 4	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	—	Cylinder 2	C11	A03	>10 MΩ	..... MΩ

1.1 Checking activation of the OBD malfunction indicator lamp (MIL)
This test is only performed if the MIL is activated by the EDC output stage.

Connect pin A51 to pin A01. Now the MIL must light up. The MIL must go out again when the connection is broken.

2. Tests with the engine stopped or running and with the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN–	Desired value	Actual value	Remarks	Speed
Control unit supply	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Oxygen sensor	B23	A03	2.30 - 2.70 V	.....		Standstill
Charge air temperature sensor (upstream of cylinder inlet)	A76	A57	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Charge air temperature sensor (integrated in the charge-pressure sensor)	A70	A62	4.20 - 2.20 V	.....	0 - 60 °C	Idling

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Description	PIN+	PIN–	Desired value	Actual value	Remarks	Speed
Charge air temperature sensor (integrated in the low-temperature charge-pressure sensor)	B10	B20	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Low-temperature water temperature sensor	A84	A65	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Exhaust gas temperature sensor 1 upstream of filter	B33	B26	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81 A81	A62 A62	1.05 - 1.11 V 1.05 - 2.20 V	....	PWG min PWG max	Idling High idle
Low-temperature charge-pressure sensor reference voltage	B28	B20	4.75 - 5.25 V	.....		Idling
Low-temperature charge-pressure sensor	B18 B18	B20 B20	1.05 - 1.11 V 1.05 - 1.62 V	....	PWG min PWG max	Idling High idle
Oil pressure sensor supply	A24	A38	4.75 - 5.25 V	.....		Idling
Oil pressure sensor signal	A21	A38	1.20 - 4.35 V	.....	1.5 - 5.4 bar	Idling
Fuel pressure sensor supply	A40	A37	4.75 - 5.25 V	.....		Idling
Fuel pressure sensor signal	A20	A37	1.00 - 2.50 V	.....	2.0 - 3.5 bar	Idling
Rail-pressure sensor supply	A43	A61	4.75 - 5.25 V	.....		Idling
Rail-pressure sensor signal	A80	A61	0.83 - 1.70 V 0.2 - 0.8 V	....	200 - 540 bar approx. 0 bar	Idling Standstill
Exhaust gas relative pressure sensor/exhaust gas differential pressure sensor supply	A41	A59	4.75 - 5.25 V	.....		Idling
Exhaust gas relative pressure sensor signal	A78	A59	0.40 - 0.90 V	.....	0 - 50 mbar	Idling
Exhaust gas differential pressure sensor signal (if CRT filter installed)	A78	A59	0.40 - 0.70 V	.....	0 - 50 mbar	Idling
Feedback signal controlled EGR (E-EGR)	A32 A87	A39 A39	4.75 - 5.25 V 0.50 - 0.90 V	.....		Idling Idling

3. Tests with the engine stopped or running and with the vehicle at a standstill (at operating temperature)

– Engine temperature > 70 °C
– CRT filter temperature > 300 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?

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Description	PIN+	PIN–	Desired value	Actual value	Remarks	Speed
Exhaust gas differential pressure sensor supply (if CRT filter installed)	A41	A59	4.75 - 5.25 V	.....	> 30 mbar	high idle ~ 2150 rpm
Exhaust gas differential pressure sensor signal (if CRT filter installed)	A78	A59	> 0.6 V *	.....		
Engine air flow sensor flap signal (if CRT filter installed)	B12	B19	U_{BAT}	.....	closed	Idling
				.....		Deceleration /overrun**

* The voltage between the signal PINs must rise as the engine speed increases, otherwise the pneumatic connections on the differential pressure sensor may be interchanged!

** Check deceleration/overrun function whilst driving or rolling (accelerate vehicle and release accelerator pedal => engine air flow sensor flap closed and EGR flap open).

4. Check the main relay

Description	PIN+	PIN–	Desired value	Actual value	Remarks
Main relay	B36	A03	U_{BAT}	.....	Ignition ON
	B36	A03	0 V	.....	Ignition OFF
	A40	A03	4.75 - 5.25 V	.....	Ignition ON
	A40	A03	0 V	.....	Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off.

5. Delete the diagnostic memory
Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

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Test step list EDC7 C32 Euro 5 in combination with MAN AdBlue® system (4-cylinder and 6-cylinder)

Service company:	**Tester:**
Customer:	**First registration:**
Vehicle type:	**Chassis no.:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage (km):	**Date:**

Use MAN-cats® to produce a diagnostic memory extract from the vehicle management computer and the EDC control unit to accompany the completed test step list.

1. Measurements at engine control unit EDC7 C32

1.1 Tests with the engine stopped (ignition OFF, EDC control unit not connected)
– Engine temperature ≈ 20 °C
– EDC control unit not (!!!) connected, wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts.)**

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Earthing	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Earthing	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 1 upstream of cat. converter* Earthing	B33 B26	B26 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 2 downstream of cat. converter* Earthing	B34 B27	B27 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Water temperature sensor ground	A58	A03	>10 MΩ	..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>10 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>10 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
CAN connection to vehicle management computer (M-CAN)	B22	B21	115 - 125 Ω	..... Ω
CAN connection to OBD socket and DCU15 (Version P362 V27-V41 with separate exhaust gas CAN and OBD-CAN)	B25	B32	115 - 125 Ω	..... Ω
CAN connection to OBD socket, DCU15, AdBlue® level sensor and NOx sensor (Version P362 V25 with shared exhaust gas CAN and OBD-CAN)	B25	B32	115 - 125 Ω	..... Ω
CAN connection to DCU15, AdBlue® level sensor and NOx sensor (Version P362 V27-V41 with separate exhaust gas CAN and OBD-CAN)	A27	A45	115 - 125 Ω	..... Ω
IMR relay (starter activation)	A16	A19	15 - 30 Ω	..... Ω

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***** Exhaust gas temperature sensors can be connected to the EDC control unit and to the AdBlue® dosing control unit DCU15

Description	4-cylinder	6-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 3	Cylinder 5	C01	C16	<2 Ω	..... Ω
	Cylinder 2	Cylinder 6	C02	C15	<2 Ω	..... Ω
	—	Cylinder 4	C03	C14	<2 Ω	..... Ω
	Cylinder 1	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 4	Cylinder 3	C05	C12	<2 Ω	..... Ω
	—	Cylinder 2	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 3	Cylinder 5	C16	A03	>10 MΩ	..... MΩ
	Cylinder 2	Cylinder 6	C15	A03	>10 MΩ	..... MΩ
	—	Cylinder 4	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 4	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	—	Cylinder 2	C11	A03	>10 MΩ	..... MΩ

1.1.1 Checking activation of the OBD malfunction indicator lamp (MIL)
This test is only performed if the MIL is activated by the EDC output stage.

Connect pin A51 to pin A01. Now the MIL must light up. The MIL must go out again when the connection is broken.

1.2 Tests with the engine stopped or running and the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Exhaust gas temperature sensor 1 upstream of cat. converter*	B33	B26	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Exhaust gas temperature sensor 2 downstream of cat. converter*	B34	B27	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81 A81	A62 A62	0.94 - 1.20 V 1.10 - 2.20 V	....	PWG min PWG max	Idling High idling
Charge air temperature sensor (integrated in charge-pressure sensor)	A70	A62	4.20 - 2.20 V	.....	0 - 60 °C	Idling

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Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1,20 - 4,35	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	1.00 - 2.50 V	.....	1.9 - 7.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Signal, rail-pressure sensor	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling Standstill

***** Exhaust gas temperature sensors can be connected to the EDC control unit and to the AdBlue® dosing control unit DCU15

1.3 Check the main relay

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36	A03	U_{BAT}	.....	Ignition ON
	B36	A03	0 V	.....	Ignition OFF
	A40	A03	4.75 - 5.25 V	.....	Ignition ON
	A40	A03	0 V	.....	Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off.

1.4 Delete the diagnostic memory
Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

2. Measurements at AdBlue® dosing control unit DCU15
The EDC wiring harness adapter is connected between the AdBlue® dosing control unit DCU15 and the wiring harness (only vehicle connector B)

2.1 Tests with the engine stopped (ignition off, control unit not connected)
– Engine temperature ≈ 20 °C
– DCU15 control unit not (!!!) connected, wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts.)**

Description	PIN	PIN	Desired value	Actual value
Temperature sensor, intake air (integrated in air humidity sensor)	18	19	600 - 2200 Ω	..... Ω
Exhaust gas temperature sensor 1 upstream of cat. converter* Earthing	25 24	24 3	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 2 downstream of cat. converter* Earthing	23 22	22 3	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Dosing module Earthing	27 26	26 3	12 - 18 Ω >10 MΩ	..... Ω ..... MΩ
Coolant valve, AdBlue® heater circuit	31	6	25 - 60 Ω	.....Ω

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2.2 Tests with the engine stopped or running and the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	1 2	3 3	U_{BAT} U_{BAT}	....		Idling Idling
Ignition	9	3	U_{BAT}	.....		Idling
Supply, air humidity sensor	21	19	4.75 - 5.25 V	.....		Idling
Signal, air humidity sensor	18	19	0.75 - 2.05 V	.....		Idling
Signal, intake air temperature (integrated in air humidity sensor)	20	19	1.50 - 3.20 V	.....		Idling
Exhaust gas temperature sensor 1 upstream of cat. converter*	25	24	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Exhaust gas temperature sensor 2 downstream of cat. converter*	23	22	1.08 - 2.30 V	.....	20 - 700 °C	Idling

***** Exhaust gas temperature sensors can be connected to the EDC control unit and to the AdBlue® dosing control unit DCU15

2.3 Delete the diagnostic memory
Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

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Test step list EDC7 C32 Master/Slave Euro 5 in combination with MAN AdBlue® system (V8 engine)

Service company:	**Tester:**
Customer:	**First registration:**
Vehicle type:	**Chassis no.:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage (km):	**Date:**

Use MAN-cats® to produce a diagnostic memory extract from the vehicle management computer and the EDC control unit to accompany the completed test step list.

1. Measurements at engine control unit EDC7 C32

1.1 Tests with the engine stopped (ignition OFF, EDC control unit not connected)
– Engine temperature ≈ 20 °C
– EDC control unit not connected (!!!), wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts.)**

1.1.1 Master control unit

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Earthing	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Earthing	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 1 upstream of cat. converter* Earthing	B33 B26	B26 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 2 downstream of cat. converter* Earthing	B34 B27	B27 A03	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Water temperature sensor ground	A58	A03	>10 MΩ	..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>10 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>10 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
CAN connection to vehicle management computer (M-CAN)	B22	B21	115 - 125 Ω	..... Ω
CAN connection to DCU15, AdBlue® fill level sensor and NOx sensor (exhaust gas CAN)	B25	B32	115 - 125 Ω	..... Ω
IMR relay (starter activation)	A16	A19	15 - 30 Ω	..... Ω

***** Not fitted to all versions

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Description	8-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 2	C01	C16	<2 Ω	..... Ω
	Cylinder 4	C02	C15	<2 Ω	..... Ω
	—	C03	C14	<2 Ω	..... Ω
	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 3	C05	C12	<2 Ω	..... Ω
	—	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 2	C16	A03	>10 MΩ	..... MΩ
	Cylinder 4	C15	A03	>10 MΩ	..... MΩ
	—	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	—	C11	A03	>10 MΩ	..... MΩ

1.1.2 Slave control unit

Description	PIN	PIN	Desired value	Actual value
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>10 MΩ	..... MΩ
CAN connection to vehicle management computer (M-CAN)	B22	B21	115 - 125 Ω	..... Ω
CAN connection to OBD socket and DCU15 (OBD-CAN)	B25	B32	115 - 125 Ω	..... Ω

Description	8-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 7	C01	C16	<2 Ω	..... Ω
	Cylinder 8	C02	C15	<2 Ω	< 2 Ω
	—	C03	C14	<2 Ω	..... Ω
	Cylinder 5	C04	C13	<2 Ω	..... Ω
	Cylinder 6	C05	C12	<2 Ω	..... Ω
	—	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 7	C16	A03	>10 MΩ	..... MΩ
	Cylinder 8	C15	A03	>10 MΩ	..... MΩ
	—	C14	A03	>10 MΩ	..... MΩ
	Cylinder 5	C13	A03	>10 MΩ	..... MΩ
	Cylinder 6	C12	A03	>10 MΩ	..... MΩ
	—	C11	A03	>10 MΩ	..... MΩ

1.1.3 CAN and speed connection from Master to Slave control unit

Description	Master control unit PIN	Slave control unit PIN	Desired value	Actual value
CAN 2 High	A27	A27	< 2 Ω	..... Ω
CAN 2 Low	A45	A45	< 2 Ω	..... Ω

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Description	Master control unit PIN	Slave control unit PIN	Desired value	Actual value
Speed 1	A74	A73	< 2 Ω	..... Ω
Speed 2	A44	A72	< 2 Ω	..... Ω

1.2 Tests with the engine stopped or running and the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

1.2.1 Master control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Exhaust gas temperature sensor 1 upstream of cat. converter*	B33	B26	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Exhaust gas temperature sensor 2 downstream of cat. converter*	B34	B27	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81 A81	A62 A62	0.94 - 1.20 V 1.10 - 2.20 V	....	PWG min PWG max	Idling High idling
Charge air temperature sensor (integrated in charge-pressure sensor)	A70	A62	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1,20 - 4,35	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	1.00 - 2.50 V	.....	1.9 - 7.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Signal, rail-pressure sensor	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling Standstill

***** Not fitted to all versions

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1.2.2 Slave control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1,20 - 4,35	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	1.00 - 2.50 V	.....	1.9 - 7.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Rail-pressure sensor signal	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling At standstill

1.3 Checking the main relay

1.3.1 Master control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36 B36 A40 A40	A03 A03 A03 A03	U_{BAT} 0 V 4.75 - 5.25 V 0 V	....	Ignition ON Ignition OFF Ignition ON Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off.

1.3.2 Slave control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36 B36 A40 A40	A03 A03 A03 A03	U_{BAT} 0 V 4.75 - 5.25 V 0 V	....	Ignition ON Ignition OFF Ignition ON Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off.

1.4 Delete the diagnostic memory

Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

2. Measurements at AdBlue® dosing control unit DCU15

The EDC wiring harness adapter is connected between the AdBlue® dosing control unit DCU15 and the wiring harness (only vehicle connector B)

2.1 Tests with the engine stopped (ignition off, control unit not connected)

– Engine temperature ≈ 20 °C
– DCU15 control unit not (!!!) connected, wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter

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– NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts.)

Description	PIN	PIN	Desired value	Actual value
Temperature sensor, intake air (integrated in air humidity sensor)	18	19	600 - 2200 Ω	..... Ω
Exhaust gas temperature sensor 1 upstream of cat. converter Earthing	25 24	24 3	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Exhaust gas temperature sensor 2 downstream of catalytic converter Earthing	23 22	22 3	200 - 700 Ω >10 MΩ	..... Ω ..... MΩ
Dosing module Earthing	27 26	26 3	12 - 18 Ω >10 MΩ	..... Ω ..... MΩ
Coolant valve, AdBlue® heater circuit	31	6	25 - 60 Ω	.....Ω

2.2 Tests with the engine stopped or running and the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Supply, control unit	1 2	3 3	U_{BAT} U_{BAT}	....		Idling Idling
Ignition	9	3	U_{BAT}	.....		Idling
Supply, air humidity sensor	21	19	4.75 - 5.25 V	.....		Idling
Signal, air humidity sensor	18	19	0.75 - 2.05 V	.....		Idling
Signal, intake air temperature (integrated in air humidity sensor)	20	19	1.50 - 3.20 V	.....		Idling
Exhaust gas temperature sensor 1 upstream of cat. converter*	25	24	1.08 - 2.30 V	.....	20 - 700 °C	Idling
Exhaust gas temperature sensor 2 downstream of cat. converter*	23	22	1.08 - 2.30 V	.....	20 - 700 °C	Idling

***** Exhaust gas temperature sensors can be connected to the EDC control unit and to the AdBlue® dosing control unit DCU15

2.3 Delete the diagnostic memory
Delete the diagnostic memory using MAN-cats® after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

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Test step list EDC7 C3 Euro 3 (4-cylinder and 6-cylinder)

Service company:	**Tested by:**
Customer:	**First registration:**
Vehicle type:	**Chassis number:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage (km):	**Date:**

MAN-cats must be used to produce an extract of the vehicle management computer and EDC control unit diagnostic memory to accompany the completed test step list.

1. Tests with the engine stopped (ignition off, control unit not connected)
– Engine temperature ≈ 20 °C
– Control unit not connected (!!!), wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts)**

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Earthing	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Earthing	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Water temperature sensor ground	A58	A03	>10 MΩ	..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>3 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>3 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
EGR activation	A17	A11	25 - 110 Ω	..... Ω
CAN connection to vehicle management computer	B22	B21	115 - 125 Ω	..... Ω
IMR relay (starter activation)	A16	A19	15 - 30 Ω	..... Ω

Description	4-cylinder	6-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 3	Cylinder 5	C01	C16	<2 Ω	..... Ω
	Cylinder 2	Cylinder 6	C02	C15	<2 Ω	..... Ω
	—	Cylinder 4	C03	C14	<2 Ω	..... Ω
	Cylinder 1	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 4	Cylinder 3	C05	C12	<2 Ω	..... Ω
	—	Cylinder 2	C06	C11	<2 Ω	..... Ω

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Description	4-cylinder	6-cylinder	PIN	PIN	Desired value	Actual value
Ground Injectors	Cylinder 3	Cylinder 5	C16	A03	>10 MΩ	..... MΩ
	Cylinder 2	Cylinder 6	C15	A03	>10 MΩ	..... MΩ
	—	Cylinder 4	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 4	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	—	Cylinder 2	C11	A03	>10 MΩ	..... MΩ

***** Not fitted to all versions

2. Tests with the engine stopped or running and the vehicle at a standstill
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed (rpm)
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Charge air temperature sensor (upstream of cylinder inlet)	A76	A57	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	20 - 90 °C	Idling
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81 A81	A62 A62	0.94 - 1.20 V 1.10 - 1.40 V	....	PWG min PWG max	Idling High idling
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1.20 - 4.35 V	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	0.95 - 3.00 V	.....	2.0 - 3.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Signal, rail-pressure sensor	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling Standstill

3. Check the main relay

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36 B36 A40 A40	A03 A03 A03 A03	U_{BAT} 0 V 4.75 - 5.25 V 0 V	....	Ignition ON Ignition OFF Ignition ON Ignition OFF

Pin A40 must switch to 0 Volt with a delay of 0.5 to 5 seconds after the ignition has been switched off.

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4. Delete the diagnostic memory

Delete the diagnostic memory using MAN-cats after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

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Test step list EDC7 C3 Master-Slave Euro 3 (10-cylinder and 12-cylinder V engine)

Service company:	**Tested by:**
Customer:	**First registered:**
Vehicle type:	**Chassis no.:**
Engine model:	**Engine no.:**
CR high-pressure pump:	**Control unit no.:**
Mileage:	**Date:**

MAN-cats must be used to produce an extract of the vehicle management computer and EDC control unit diagnostic memory to accompany the completed test step list.

1. Tests with the engine stopped (ignition off, control unit not connected)
– Engine temperature ≈ 20 °C
– Control unit not connected (!!!), wiring harness adapter connected
– Measure the resistance between PIN+ and PIN- using a multimeter
– **NEVER MEASURE AT THE PLUG CONTACTS THEMSELVES WITHOUT USING SUITABLE TEST PROBES! (Danger of bending open the contacts)**

1.1 Master control unit

Description	PIN	PIN	Desired value	Actual value
Speed increment sensor (crankshaft) Earthing	A73 A55	A55 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Speed segment sensor (camshaft) Earthing	A72 A54	A54 A03	0.75 - 1.1 kΩ >10 MΩ	..... kΩ ..... MΩ
Metering unit ZME 1 (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Charge air temperature sensor Earthing	A76 A57	A57 A03	2 - 6 kΩ >10 MΩ	..... kΩ ..... MΩ
Water temperature sensor Earthing	A77 A58	A58 A03	2 - 6 kΩ >10 MΩ	..... kΩ ..... MΩ
Charge-pressure sensor ground	A62	A03	>10 MΩ	..... MΩ
Oil pressure sensor ground	A38	A03	>3 MΩ	..... MΩ
Fuel pressure sensor ground	A37	A03	>3 MΩ	..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
EGR feedback signal ground	A22	A03	>10 MΩ	..... MΩ
EGR activation	A17	A11	80 - 110 Ω	..... Ω
EGR feedback	A23	A22	<1 Ω	..... Ω
CAN connection to vehicle management computer	B22	B21	110 - 130 Ω	..... Ω
IMR relay (starter activation)	A16	A19	15 - 30 Ω	..... Ω

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Description	10-cylinder	12-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 5	Cylinder 5	C01	C16	<2 Ω	..... Ω
	Cylinder 3	Cylinder 6	C02	C15	<2 Ω	..... Ω
	—	Cylinder 4	C03	C14	<2 Ω	..... Ω
	Cylinder 1	Cylinder 1	C04	C13	<2 Ω	..... Ω
	Cylinder 2	Cylinder 3	C05	C12	<2 Ω	..... Ω
	Cylinder 4	Cylinder 2	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 5	Cylinder 5	C16	A03	>10 MΩ	..... MΩ
	Cylinder 3	Cylinder 6	C15	A03	>10 MΩ	..... MΩ
	—	Cylinder 4	C14	A03	>10 MΩ	..... MΩ
	Cylinder 1	Cylinder 1	C13	A03	>10 MΩ	..... MΩ
	Cylinder 2	Cylinder 3	C12	A03	>10 MΩ	..... MΩ
	Cylinder 4	Cylinder 2	C11	A03	>10 MΩ	..... MΩ

1.2 Slave control unit

Description	PIN	PIN	Desired value	Actual value
Metering unit ZME 2 (MProp) Earthing	A08 A10	A10 A03	2.5 - 4.5 Ω >10 MΩ	..... Ω ..... MΩ
Rail-pressure sensor ground	A61	A03	>10 MΩ	..... MΩ
CAN connection to vehicle management computer	B22	B21	110 - 130 Ω	..... Ω

Description	10-cylinder	12-cylinder	PIN	PIN	Desired value	Actual value
Injectors	Cylinder 10	Cylinder 8	C01	C16	<2 Ω	..... Ω
	Cylinder 8	Cylinder 7	C02	C15	<2 Ω	..... Ω
	—	Cylinder 9	C03	C14	<2 Ω	..... Ω
	Cylinder 6	Cylinder 12	C04	C13	<2 Ω	..... Ω
	Cylinder 7	Cylinder 10	C05	C12	<2 Ω	..... Ω
	Cylinder 9	Cylinder 11	C06	C11	<2 Ω	..... Ω
Ground Injectors	Cylinder 10	Cylinder 8	C01	A03	>10 MΩ	..... MΩ
	Cylinder 8	Cylinder 7	C02	A03	>10 MΩ	..... MΩ
	—	Cylinder 9	C03	A03	>10 MΩ	..... MΩ
	Cylinder 6	Cylinder 12	C04	A03	>10 MΩ	..... MΩ
	Cylinder 7	Cylinder 10	C05	A03	>10 MΩ	..... MΩ
	Cylinder 9	Cylinder 11	C06	A03	>10 MΩ	..... MΩ

1.3 CAN and speed connection from Master to Slave control unit

Description	Master control unit PIN	Slave control unit PIN	Desired value	Actual value
CAN 2 high	A27	A27	<2 Ω	..... Ω
CAN 2 low	A45	A45	<2 Ω	..... Ω

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Speed 1	A74	A73	<2 Ω	..... Ω
Speed 2	A44	A72	<2 Ω	..... Ω

1.4 CAN resistance values
– Both control units are connected again
– The wiring harness adapter is connected to the Master or Slave control unit

Description	PIN	PIN	Desired value	Actual value
CAN connection from Master and Slave control unit to vehicle management computer	B22	B21	50 - 70 Ω	..... Ω
CAN connection from Master to Slave control unit	A27	A45	50 - 70 Ω	..... Ω

2. Tests with the engine stopped or running and with the vehicle at a standstill
2.1 Master control unit

– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?
Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed (rpm)
Signal, rail-pressure sensor	A80	A61	0.2 - 0.8 V	.....	approx. 0 bar	Standstill
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Charge air temperature sensor (only in engines with external exhaust gas recirculation)	A76	A57	4.20 - 2.20 V	.....	0 - 60 °C	Idling
Water temperature sensor	A77	A58	3.74 - 1.22 V	.....	30 - 90 °C	Idling
Fuel temperature sensor	A75	A56	3.74 - 1.22 V	.....	30 - 90 °C	Idling
Charge-pressure sensor reference voltage	A25	A62	4.75 - 5.25 V	.....		Idling
Charge-pressure sensor	A81	A62	0.94 - 1.20 V	.....		Idling
Supply, oil pressure sensor	A24	A38	4.75 - 5.25 V	.....		Idling
Signal, oil pressure sensor	A21	A38	1.20 - 4.35 V	.....	1.5 - 5.4 bar	Idling
Supply, fuel pressure sensor	A40	A37	4.75 - 5.25 V	.....		Idling
Signal, fuel pressure sensor	A20	A37	0.95 - 3.00 V	.....	2.0 - 3.5 bar	Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Signal, rail-pressure sensor	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling Standstill

2.2 Slave control unit
– Engine temperature > 30 °C
– Wiring harness adapter connected to control unit
– Read out diagnostic memory, no fault present?

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Measure the voltage between PIN+ and PIN- using a multimeter

Description	PIN+	PIN-	Desired value	Actual value	Remarks	Speed
Signal, rail-pressure sensor	A80	A61	0.2 - 0.8 V	.....	approx. 0 bar	Standstill
Supply, control unit	A01 A07 A12 A13	A03 A09 A14 A15	U_{BAT} U_{BAT} U_{BAT} U_{BAT}	....		Idling Idling Idling Idling
Ignition	B36	A03	U_{BAT}	.....		Idling
Supply, rail-pressure sensor	A43	A61	4.75 - 5.25 V	.....		Idling
Rail-pressure sensor signal	A80	A61	1.01 - 1.60 V 0.2 - 0.8 V	....	200 - 400 bar approx. 0 bar	Idling At standstill

3. Check the main relay
3.1 Master control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36 B36 A40 A40	A03 A03 A03 A03	U_{BAT} 0 Volt 4.75 - 5.25 V 0 volts	....	Ignition ON Ignition OFF Ignition ON Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off

3.2 Slave control unit

Description	PIN+	PIN-	Desired value	Actual value	Remarks
Main relay	B36 B36 A40 A40	A03 A03 A03 A03	U_{BAT} 0 volts 4.75 - 5.25 V 0 volts	....	Ignition ON Ignition OFF Ignition ON Ignition OFF

Pin A40 must switch to 0 volts with a delay of 0.5 to 5 seconds after the ignition has been switched off

4. Delete the diagnostic memory
Delete the diagnostic memory using MAN-cats after completing the tests. There must not be any faults in the memory when the ignition is switched back on. Otherwise, search for the fault and remedy the problem.

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Hydraulic test step list

Basic information about troubleshooting
Before working on the common-rail system, always first back up the diagnostic memory, even if this does not seem necessary at first. Otherwise, warranty claims will be rejected!

Rail-pressure sensor, pressure limiting valve, fuel metering unit and gear pump (delivery pump) are available as individual components and are also allowed to be renewed individually.

It is basically necessary to differentiate between two types of fault when troubleshooting EDC7 systems:
– Faults in the fuel system (low-pressure or high-pressure side)
– Faults in the electrical system
If an EDC7 engine does not start despite the engine being turned over by the starter motor, there is no point trying to tow-start the engine. It is better to connect MAN-cats®, read out the fault memory and use "Monitoring" to check whether the EDC control unit is detecting speed signals and if rail pressure is being established.

The following rule therefore applies:
– No fuel is being injected if both speed signals are missing (crankshaft and camshaft)
– No rail pressure is being established if low pressure < 3 bar
– The injectors are not being activated at rail pressure < 200 bar

However, the same thing applies:
– Without fuel (sucking air or tank empty) no injection

Catalogue of questions for problematic cases

Procedures:
– Backup the entire diagnostic memory of all control units in the vehicle
– Perform precise fault identification using the **SPN list** and the **troubleshooting program**
– Fuel supply guaranteed? Pressure in low-pressure circuit according to specifications? See **Hydraulic test step list** for more information
– Perform an electrical system check. See **Electrical test step list** for more information

Additional questions
– Is the control unit being supplied with battery voltage?
– Is MAN-cats diagnosis possible?

When does the fault occur?
– At engine start/stop or when engine running normally
– In what speed range
– In what gear or gear shift
– When accelerating or suddenly decelerating
– Continuous or sporadic problem
– Duration (approx. milliseconds, seconds, minutes, etc.)
– Only under certain operating conditions such as cold, heat, wet
– On uphill and/or downhill slopes
– Vehicle load status
– Fuel used (diesel EN 590, RME, FAME, kerosene, etc.)
– Is there information available about: Oil temperature / cooling water temperature / charge air temperature
– Has an increase or excessive decrease in oil level been recorded
– Engine behaviour: Surging/not running smoothly/coughing/misfiring, black smoke, blue smoke, white smoke
– Fault messages in the instrument cluster
– Are there any other faults which are not directly related to the problem (AS-Tronic/TipMatic, customer-specified module, EBS)
– If the engine does not start despite the starter motor turning: Does the engine start if the fuel metering unit on the high-pressure pump is electrically disconnected?
Note: Repeated constrained opening of the pressure limiting valves for tests (by electrically disconnecting the fuel metering unit) results in an unavoidable reduction in the opening pressure of the pressure limiting valve (PLV). The PLV must then be renewed if necessary.
– Is the control unit temperature > 100 °C? Read out the maximum temperature with MAN-cats®

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– Is there oil in the control unit plug of the injector wiring harness? Possible display of SPN 651 to 656, short circuits due to engine oil
– Have the plugs on the control unit been checked (bent-back pins, splayed contacts, etc.)?
– Is it certain that both the camshaft and crankshaft speed sensors are supplying correct signals? Is the polarity correct? Status of the sensor end faces; installation status: 0.5 to 1.5 mm
– Check the speed signals in Monitoring.
Note: The bar display in MAN-cats does not change if there is no crankshaft speed signal. Therefore check the entry in the fault memory
– Status messages in Monitoring, speeds with system intact: “Synchronisation performed”, “No error”, “Normal status”

Frequent faults and information about correcting them
If fault numbers **3775-2, 3776, 3777, 3778, 3779, 3780, 3781 occur individually or in combination**, proceed as follows:

Note: Faults 94-1 or 94-2 are **not** allowed to be present here.

See Service Information 252400, 298100 and 334700.

1st step	– Check the electrical cables and plugs to the fuel metering unit and to the rail-pressure sensor – If no fault entry except SPN 3781: it is very likely that, rather than an electrical fault, there is excessive pressure in the return line to the fuel tank. Measure the pressure as close to the fuel service centre as possible. Desired value: < 0.2 bar. In the case of **all** faults where the pressure limiting valve is forced open (e.g. SPN 3777, 3781), a blocked return line (e.g. broken line etc.) to the fuel tank can also be the cause of the fault (in the case of fuel-lubricated high-pressure pumps)
2nd step	– If a high rail pressure controller output value of 10-14 % is recorded when idling with the engine warm (coolant at least 70°C), exchange the metering unit – Re-install the original metering unit and continue from step 3 if there is no value change to < 6%.
3rd step	– Measure the total leakage volume of the injectors and the pressure limiting valve (PLV) – Check the PLV for leaks if the volume is too high. (PLV must not leak, a few drops are permissible) – Fit a new PLV if it is leaking and repeat the total leakage volume measurement. Check the rail pressure controller output value is < 6% – If the PLV is not leaking or only a few drops emerge, measure the injectors' individual leakage
4th step	If the rail pressure controller output value was measured between 6 and 10 % in test step 2: – Fit a new metering unit now To exclude a temporarily jamming metering unit, see the metering unit instructions
5th step	– Fit a new rail-pressure sensor (only with SPN 3781)
6th step	– Measure the delivery volume of the high-pressure pump If the volume is too low: – Exchange the high-pressure pump If the volume is OK: – Consult the specialist department responsible

Note: High-pressure pump and metering unit are matched to one another in production. Therefore, always use a replacement fuel metering unit for this test. Never use the fuel metering unit with another high-pressure pump (for example from another vehicle). To perform this test, it is recommended that each workshop should purchase a replacement metering unit for each variant as a test component.

A functioning metering unit controls in a very narrow range, i.e. the percentage value indicated in monitoring only fluctuates by a few tenths of a percentage point at idling speed. If the value jumps by several percentage points, it must be assumed that the metering unit is jamming.

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Replacement metering unit combination:

Application	Replacement metering unit MAN item number	Standard metering unit Bosch item number
D2876 with CP3.4	51.12505-0024	0 928 400 543
D2066/D0834/D0836 with CP3.4	51.12505-0027	0 928 400 617
D20/D26 with CP3.4+	51.12505-0030	0 928 400 662
D20/D26 with CP3.4+ with lubrication package	51.12505-0033	0 928 400 705
D20/D26 with CP3.4H+ (1800 bar) with lubrication package	51.12505-0034	0 928 400 737
D0834/D0836 with CP3.3	51.12505-0037	0 928 400 683
D2868/62 with CP3.4	51.12505-0039	0 928 400 740
D2842 LE with CP9V4 (CP2/4)	51.12902-7023	0 928 400 573
D2840 LF/D2848 LE with CP9V4 (CP2/4)	51.12902-7024	0 928 400 629

Note 1: The standard metering unit is not available as a replacement part. The Bosch item number indicated here is only designed to make it easier to locate the correct replacement metering unit.

Note 2: The change from CP3.4+ to CP3.4+ with lubrication package (Anti Wear Package) depends on what is available rather than being engine type-specific. For the workshop, this means that you first have to look at the pump, which standard fuel metering pump is installed, to determine the suitable replacement metering unit (see table)

General instructions for troubleshooting in the fuel area

Procedure for “engine starts poorly”

Basically it should be remembered that a common rail system takes longer to start than an EDC system with an injection pump, due to the nature of its design. In a common-rail system, the low-pressure and high-pressure systems must be pressurised before each engine start. As a result, start times of up to 3 seconds can be considered normal.

There can be many faults that cause a common rail engine to need significantly longer before starting:

– Leakage in the fuel system
  In the common rail system, there is no separation between supply and return when stationary, leakage at **any** point in the fuel system causes the fuel system to run empty. Consequence: Long starting times (up to 30 s). Starting behaviour was significantly improved by the introduction of a return stop (“green” quick coupling in the supply line at the transition between the engine and chassis): Starting time now only about 2 seconds.
  Engines with external hot/cold circuit (D20 / D28 Euro 3): The fuel does not run back into the tank even when there are leakages (e.g. in the return). Exception: Leakage between return stop and supply unit in the tank.
  Engines with an internal hot/cold circuit (D08 and D20 from Euro 4): These engines are equipped with a fuel-lubricated high-pressure pump. If there is a leakage at any point in the fuel system (even in the return), the fuel service centre can run empty through the return of the high-pressure pump.
– Overflow valve in the high-pressure pump: Defective, leaking, foreign bodies on seal seat
– Breather hole in fuel service centre clogged or not included, therefore fault message: 94-2, i.e. fuel supply pressure too low

  Symptoms: the start problems mostly occur after exchange of the filter insert. If the low-pressure circuit is pumped up using the hand pump, the engine starts relatively normally. There are start problems again a few minutes after the engine is stopped.
  Cause: An air bubble remains in the fuel service centre due to the missing or clogged breather hole. After the engine is stopped, this expands again and presses the fuel out of the fuel service centre. This means that, during starting, it takes a very long time for the initial fuel pressure to be built up again on the low-pressure side.

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Procedure for “engine does not start”
– The starter does not mesh if there is an interruption in the engine CAN, cabling problem to the IMR, IMR defect or problems with the cabling to terminal 50 of the vehicle management computer
– The engine is not turned over by the starter if the immobiliser ID in the vehicle management computer is incorrect. The “Immobiliser active” symbol appears on the display
– If there is no speed signal from the camshaft and crankshaft sensors, the engine turns the starter for 900 ms before breaking off with “Dummy shift detection”
– If the EDC/vehicle management computer pairing is incorrect, the engine is turned over by the starter, but injection is not enabled by the EDC (engine does not start)
– If there are faults in the speed detection of the camshaft system, EDC7 attempts to ascertain the ignition TDC by "test injections" in the ignition and gas flow TDC (greater rotational acceleration of the flywheel when ignition takes place) and thereby to start the engine with the crankshaft speed system alone. This explains the longer starting duration

If an EDC7 engine does not start despite the engine being turned over by the starter motor, there is no point trying to tow-start the engine. It is better to connect MAN-cats, read out the fault memory and use “Monitoring” to check whether the EDC control unit is detecting speed signals and if rail pressure is being established.

The following rule therefore applies:
– No fuel is being injected if both speed signals are missing (crankshaft and camshaft)
– No rail pressure is being established if low pressure < 3 bar
– The injectors are not being activated at rail pressure < 200 bar

However, the same thing applies:
– Without fuel (sucking air or tank empty) no injection

Injector activation does not take place until the actual rail pressure exceeds 200 bar, i. e. the engine will not start if the actual rail pressure is too low. If this actual rail pressure is not reached, the following causes are possible:
– Air in the low-pressure system/fuel filter, perform leak check
– Not bled correctly after fuel filter change
– Pre-supply pump defective and does not build up pre-pressure, check low pressure
– Overflow valve in high-pressure pump defective, leaking. Check low pressure
– Total leakage volume of injectors and PLV under the existing start conditions
– Leakage between rail and injector, leakage check based on leakage oil return of the injectors. In case of a leak: Fit new rail connections
– Injector damage (no longer closes), leakage check based on leakage oil return of the injectors
– High-pressure pump damage (check delivery of high-pressure pump)

Procedure

1st step	– Fault in the low-pressure system if faults 94-1 or 94-2 are present. Check the low-pressure system
2nd step	– Use MAN-cats to check the rail pressure buildup during the start procedure. – If no pressurisation >350bar, continue with step 3 – If rail pressure is OK, there is an electrical fault (fault memory, test step list / compression test with MAN-cats®)
3rd step	– Measure the total leakage volume of the injectors and the pressure limiting valve – Check the PLV for leaks if the volume is too high. (PLV must not leak, a few drops are permissible) – Fit a new PLV if it is leaking and repeat the total leakage volume measurement – Continue from step 5 if the total leakage volume is OK
4th step	– Measure the individual leakage volume of the injectors – Loosen and retighten the rail connection if there is a faulty cylinder – Fit a new injector and rail if the individual leakage volume remains high
5th step	– Install a replacement fuel metering unit for a test – Fit a new high-pressure pump if this is also unsuccessful

With CR engines that run on fatty acid methyl ester (FAME) or vegetable oil, start problems may occur after the warm engine has been stopped.

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Cause: The injectors clog up due to FAME which, although it conforms to DIN EN 14214, does not have the same fatty acid amounts as rape seed methyl ester (RME). There is also biodiesel - also RME - of differing quality.

Remedy:
– Start the engine with the metering unit disconnected
  If the engine starts:
– flush the fuel system with DIN EN 590 diesel and perform an extensive test drive with diesel
– Perform a rev-up test with diesel fuel. If this is OK, recommend that the customer continue driving with diesel fuel to DIN EN 590 as customer's fuel may lead to the same problem occurring again
– If the engine does not start or starts running irregularly after a short time, fit new injectors. In this case too, recommend that the customer continue driving with diesel fuel as customer's fuel may lead to the same problem occurring again

Procedure for “excess pressure in the fuel tank”

If the driver complains that opening the tank cap results in the cap being shot out due to high pressure and that exhaust gas emerges from the pipe, the cause is presumably as follows: One of the injectors in the cylinder head has come loose, allowing combustion gases to enter the leakage oil system and, through the leakage oil line, into the tank

Remedy:
– Remove the valve cover and check the injectors for a broken pressure flange
– Remove the affected injector
– Fit new sealing rings, pressure flange and rail connection
– Reinstall the injector according to the regulations

Note: If the lower injector seal is leaking, the exhaust gas will also carry combustion soot into the fuel tank. A greater or lesser quantity of soot will have been transported into the fuel tank depending on how long the vehicle was driven with this fault, and will cause the fuel filter in the fuel service centre to block up. This will result in another breakdown. Therefore, the following procedure is advised: Change the fuel filter every week during the initial period after this repair. In extreme cases, it is necessary to pump all the fuel out of the tank and fill with new fuel. Sometimes, the tank also has to be cleaned.

Procedure for “white smoke from engine”

A fault in the common rail system rarely causes the “white smoke from engine” complaint.

Therefore, in this case always check the flame start system for leaks first:
– Electrically isolate the flame start system solenoid valve
– Remove the fuel line between the solenoid valve and flame glow plug

If the engine still outputs white smoke, proceed as for the “engine does not run smoothly” complaint.

Procedure for “black smoke from engine”

The operating state at the time black smoke occurred must be determined without fail:
– Is the engine still smoking?
– Does it only smoke when accelerating?

The following possible causes have been found to date:
– Assembly fault, injector twisted
– Leak between combustion chamber and leakage oil, lower seal of injector (CU sealing ring) leaking
– Injector wear (high leakage quantity)
– Incorrect nozzle protrusion

If black smoke is indeed seen during a test run, we therefore recommend the following procedure:
– Read out the EDC7 fault memory

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– If there are faults entered, look through them according to the troubleshooting instructions and repeat the test drive

If there is still black smoke but no faults entered in the fault memory:
– Experience shows that black smoke in engines with low mileage can be caused by injectors that are twisted during installation
Remedy: Loosen all rail and injector attachments and then retighten them as prescribed. If this step does not achieve the desired success, the main cause could be worn injectors, especially in the case of acceleration smoke.
Therefore, perform individual measurement of the leakage quantity and renew the injector concerned.
– In the case of previous turbo damage, oil may also have been supplied into the exhaust silencer. This could also lead to black smoke when accelerating.
Remedy: Fit new exhaust.

If there is still black smoke:
– perform the rev-up test at least twice

If the run-up test is inconclusive:
– Remove all injectors and
– check the seal in the nozzle area (CU sealing ring) for traces of powder
– Check the diameter of the CU sealing rings

If you discover that one or more injectors are leaking and/or the diameter of CU sealing rings is too large:
– Fit new sealing rings and rail connections and reinstall the injectors according to the instructions
– Perform a test drive

If black smoke still occurs or no leak is found at the lower seal of the injector:
– Fit new all injectors and rails, fit new sealing rings and install according to the regulations.

Note: If the lower injector seal is leaking, the exhaust gas will also carry combustion soot into the fuel tank. A greater or lesser quantity of soot will have been transported into the fuel tank depending on how long the vehicle was driven with this fault, and will cause the fuel filter in the fuel service centre to block up. This will result in another breakdown. Therefore, the following procedure is advised: Change the fuel filter every week during the initial period after this repair. In extreme cases, it is necessary to pump all the fuel out of the tank and fill with new fuel. Sometimes, the tank also has to be cleaned.

Procedure for “engine knock”

The “Engine knock” complaint usually indicates an injector fault. In this case, therefore, perform a compression and run-up test.

Note: Only perform the rev-up test with the engine warm, otherwise there will be misdiagnosis. If the fault cannot be determined using the rev-up test or if the engine is too cold for the rev-up test, use the contact box to disconnect individual cylinders when the engine is running and pinpoint the defective injector in this way.

Alternatives:
– Gradually disconnect the connections directly at the injector for each individual cylinder, refit the valve cover and start the engine
– In future it will be possible to shut off individual cylinders using MAN-cats®

Procedure for “engine knock”

The “Engine knock” complaint usually indicates mechanical damage (valve damage, seizure, etc.). In this case, therefore, perform the compression test.

Procedure for “engine does not run smoothly”

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In case of the following complaints:
– Engine does not run smoothly
– Unusual running noises
– Poor engine power
– White smoke and engine not running smoothly at 800 rpm to 1100 rpm in the warm-up phase

follow the procedure below:
– Flash the EDC control unit (see Service Information 249800)
– Perform a compression test
  Indication of a mechanical defect, e.g. valve damage or seizure
– Perform a rev-up test
  Indication of a defect on the injectors if the compression test indicates the engine is OK
– Correction quantities
  in the “Cylinder monitoring” in connection with the compression and run-up test, to confirm the results of the compression / run-up test
  Note: It is not possible to check the correction quantities in the case of D08 engines.
– If the compression and run-up test did not indicate any cause, connect the terminal tester, disconnect individual injectors electrically and use this method to locate the cylinder which is producing the abnormal noise

Test conditions: Cooling water temperature min. 75 °C. Always perform the compression test first. After the run-up test, switch the ignition off and then check the correction quantities. In addition, it is important that the air compressor or the fan does not switch on during the test.

Further notes: If **the return pressure is too high** (> 0.2 bar), there may be problems with the rail pressure control. Important: The return pressure must be measured near the engine!

No diagnosis is possible using MAN-cats®. Diagnosis is only possible using a new special tool for connecting a pressure gauge (T-piece), suitable for all CR engines.

Rail restrictor damage
Vehicles with CR engine can have one or more restrictors (reducer bore at each output to the injectors on the rail) which come loose, slip or break. This leads to follow-on damage: a defective injector. If the rail restrictor damage is not detected or remedied, the new injector will also be destroyed!

Effects: Injector defective, splitter, broken, irregular engine running, black smoke, fuel consumption too high, repeat injector damage.

Detection: If there is injector damage with the above symptoms, also check the restrictor inserts in the rail by visually comparing when the injection lines are removed. Checking using "drill" is not permitted as there are different rail versions with different bore diameters and there is a risk of dirt ingress or damage.

Remedy: Fit an entire new rail and also renew all the following components on the affected cylinders (with defective restrictor) (injection line, rail connection, injector). Experience has shown that it is not necessary to also fit new components for the other cylinders.

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Check fuel pressure by means of pressure measuring lines on D2876 engine
The measuring points described here **apply to the D2876 in-line engine series only.** For these measurements there are two pressure measuring lines available. These can be fitted with the same fuel pressure sensors as those that are screwed into the fuel service centre. This means that it is possible to show the measuring result in the MAN-cats monitoring system after disconnecting the electrical connection at the fuel service centre fuel pressure sensor (B377) and plugging it into the sensors concerned at the measuring lines. This means that no additional dial gauges and adapters are required. The pressure measuring lines can be obtained by quoting item number 80.99605-5000.

Note: A new, enhanced version of the above-mentioned pressure measuring lines has been developed. This version has a test adapter for connecting a pressure gauge and can be used universally for measuring pressure in all common-rail engines. The test adapter can be obtained by quoting item number 80.99605-6030.

The test values for the fuel supply pressure (feed line) apply to all engines. The supply pressure should be 5.0 to 6.0 bar at idling, assuming the filter is clean. At governed maximum speed when the vehicle is stationary, it should be 7.0 bar. The pressure is measured between the fuel service centre and the high-pressure pump.

Measuring point 1
Measuring point 1 at the flame start system is equivalent to a measuring point upstream of the CP3.4 high-pressure pump. However, the likelihood of dirt ingress on the clean side is much lower here. This measuring point can be used to detect a defective pressure retaining valve in the CP3.4 (pressure at ~5-6 bar relative). However, requirements include the checking of the correct hollow screw with 0.5 mm throttle bore to the flame start output and the correct BS sealing rings at this point. This fault always involves subsequent fault entries in the control unit, which concern the rail pressure control and, in the event of power request, lead to rail pressure failure and loss of power. If the power request is cancelled, the rail pressure can “recover” but the reaction would be the same the next time power were requested.

Measurement is at the flame start system output, sealed off from the return line. In this case the flame start system pressure retaining valve (~1.3 bar) must be unscrewed and replaced by the pressure measuring line with fuel pressure sensor.

Desired value: 6 to 9 bar (MAN-cats monitoring)

Measured pressure: 0 to 1 bar

In this case, the pressure retaining valve (5 to 6 bar) in the high-pressure pump is open permanently (defective) because:

– When the pressure retaining valve is open, the entire fuel quantity flows directly to the return line (pre-filter)
– This causes a high fuel delivery rate through the filter. This may cause a significant drop in pressure, meaning that the pressure value at the filter input appears normal

Measured pressure: 1 to 2 bar

In this case, an incorrect hollow screw in the supply to the flame start system (without additional 0.5 mm hole), leaking BS sealing rings or incorrect sealing rings (copper rings) may be the cause.

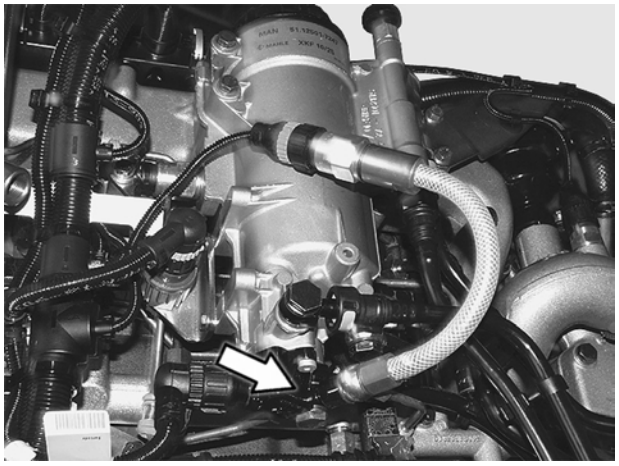
– These leaks cause a large quantity of fuel to flow directly to the return line.
– This causes a high fuel delivery rate through the filter. This may cause a significant drop in pressure, meaning that the pressure value at the filter input appears normal

Measuring point 2
Measuring point 2 on the injector return side is used to check the pressure retaining valve (1.2...1.4 bar relative) and possible blockages on the return side. In the event of high leakage return pressures in excess of 4 bar absolute, the engine reacts by increasing the fuel quantity and, therefore, increasing the power. A fault at this point does not lead to a fault being entered in the control unit.

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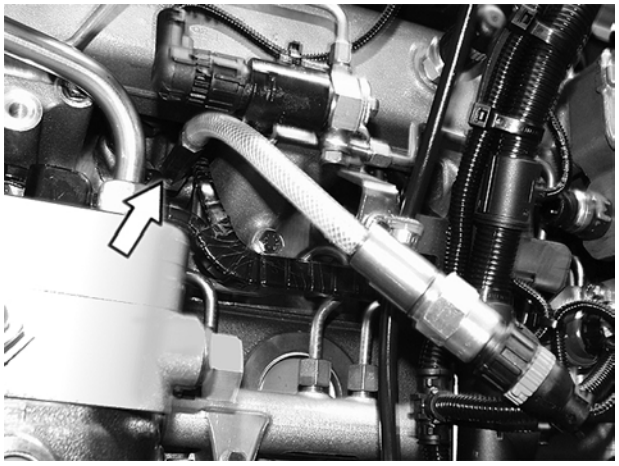
Installation positions

D2876 engine
Measuring point 1



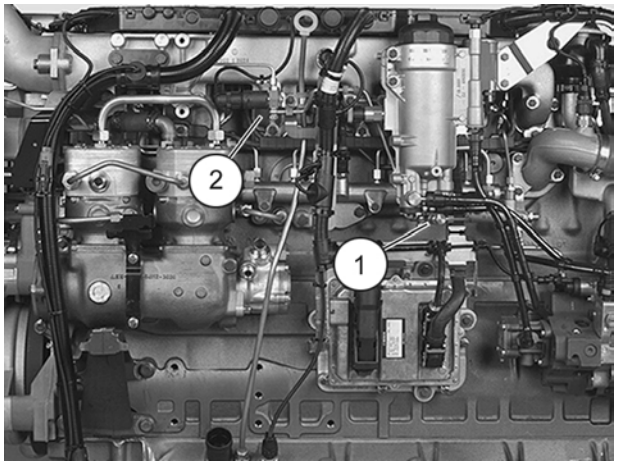
Flame start system output, sealed off from the return line

Measuring point 2



Injector return side (leakage oil line), cylinder 2

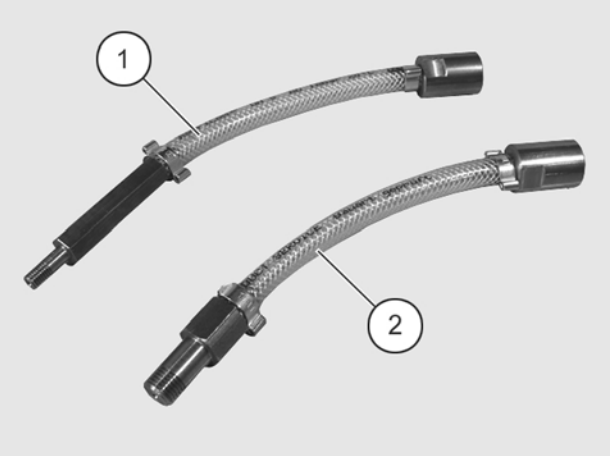
General view



1 Measuring point 1
2 Measuring point 2

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Pressure measuring lines



1 Injector return line
2 Output, flame start system

The pressure measuring lines can be obtained by quoting item number 80.99605-5000.

Test adapter for pressure measurement



A new, enhanced version of the above-mentioned pressure measuring lines has been developed. This version has a test adapter for connecting a pressure gauge and can be used universally for measuring pressure in all common-rail engines.

The test adapter can be obtained by quoting item number 80.99605-6030.

CR engine diagnosis case

There are several versions of the diagnosis case:
– The **standard case LE-MAN02** contains everything that is required for checking all MAN CR in-line engines (i.e. the content of variants before 08/2007 incl. supplementary kit LE-MANEK01)
Diagnosis cases delivered before August 2007 can only be used to a limited extent as connections required for D08 and D20 / D26 Euro 4 and Euro 5 are not included.
This is why a
– **supplementary kit LE-MANEK01** was produced. This means that diagnosis cases delivered before August 2007 can be upgraded, thus allowing the checking of all MAN CR in-line engines
– **Supplementary kit LE-MANEK02** is a complete case for checking MAN CR V engines. However, this case requires a complete standard case, i.e. also the supplementary kit LE-MANEK01, if the case was purchased before August 2007
The diagnosis case can be obtained from Friedrich Lehnert, Hofgartenstrasse 18, D-74196 Neuenstadt.

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TROUBLESHOOTING IN THE LOW-PRESSURE SYSTEM
In case of starting problems, complaints about performance and/or inadequate rail pressure, first measure the pressure in the low-pressure system.

Check the fuel pressure upstream of the filter with MAN-cats® Monitoring

1. Is the fuel pressure at idling speed at least 5.5 bar?	
If yes: – Continue from point 2	**If no:** – If the fuel pressure is less than 5 bar, check the removal unit in the fuel tank and the pipe to the primary delivery pump for leaks – If the fuel pressure is greater than 8.5 bar, fit a new fuel filter and measure again
2. Is the fuel pressure now OK?	
If yes: – Continue from point 3	**If no:** – For D28 engines only: An incorrect fuel line connector may have been installed in the connection to the frame start system (correct: Fuel line connector 0.5 mm throttle port). In addition, the cause may also be a leaking BS sealing ring or an incorrect sealing ring (CU sealing ring). This only has an effect at < 900 rpm
3. Does the pressure limiting valve (PLV) leak when the engine is running? (A few drops are permitted)	
If yes: – Continue from point 4	**If no:** – Perform a leak test on the pressure limiting valve (PLV) – Fit a new pressure limiting valve
4. Carry out a functional test on the high-pressure pump overflow valve. Desired pressure: < 4 bar	

Note: Many vehicles have a SEPAR primary fuel filter installed. Fit a new filter insert if the primary fuel pressure is too low. **Important:** The filter inserts for SEPAR filters with and without heating are different.

Overflow valve check
This overflow valve (see number 13 in the general fuel diagram) restricts or regulates the primary pressure in the low-pressure circuit.

Opening pressure at engine idling speed (dynamic): 5.5 to 6.0 bar

Desired value when the engine is switched off (static): approx. 4 bar

Its functional capability has a major influence on starting behaviour. The inspection can be performed relatively easily in oil-lubricated pumps (Euro 3 engines). Fuel-lubricated pumps with internal hot/cold circuit are installed from Euro 4 onwards. This means the overflow valve can only be checked after removing the delivery pump.

Procedure for oil-lubricated high-pressure pump
– Disconnect the connection line from the fuel service centre to the high-pressure pump directly at the high-pressure pump and install test adapter 80.99605-6030 with pressure gauge, measuring range 0 to 10 bar
– Remove the return line of the hot/cold circuit at the high-pressure pump “OUT” connection and fit a dummy plug here
– Use the hand pump to increase the pressure in the low-pressure circuit until the overflow valve opens and fuel emerges at the “OUT” connection
– Read off the opening pressure on the pressure gauge during the pumping process. Desired value (static) approx. 4 bar

Procedure for fuel-lubricated high-pressure pump
As already mentioned, a high-pressure pump lubricated with fuel is installed from Euro 4 onwards. These pumps have an internal hot/cold circuit. It is therefore not possible to test the overflow valve at the “OUT” connection as described above.

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– Disconnect the connection line from the fuel service centre to the high-pressure pump directly at the high-pressure pump and install test adapter 80.99605-6030 with pressure gauge, measuring range 0 to 10 bar
– Use the hand pump to increase the pressure in the low-pressure circuit until the overflow valve opens
– Read off the opening pressure on the pressure gauge during the pumping process. Desired value (static) approx. 4 bar
– If you suspect leaks, fit a new overflow valve (13) and repeat the test

Pressure retaining valve test
This valve (see item 11 on the general fuel diagram for the oil-lubricated high-pressure pump) ensures a backpressure of approx. 1.2 to 1.4 bar rel. pressure in the injector leakage oil return. Its functional capability has no effect on engine starting; it is merely required for correct operation of the injectors with **single-piece armature**.

The pressure retaining valve is only installed in the case of CRIN2 with single-piece armature. From the production start of D20 Euro 4 (10/2004) onwards, injector -6064 (2-piece armature) is installed. And this injector is also installed for Euro 4 OBD LF31... and for Euro 5 (brought forward) LF21. The pressure retaining valve is therefor omitted in these engines. No injectors with 2-piece armatures are installed in Euro 3 engines. The pressure retaining valve is therefore still installed in Euro 3 engines.

The pressure retaining valve is only tested when removed. It is important that the valve opens and is not blocked.

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TROUBLESHOOTING IN THE HIGH-PRESSURE SYSTEM

It is essential for the low-pressure system to function correctly in order for the high-pressure system to do so. If you suspect a fault in the high-pressure system, we recommend primarily checking for leaks in the high-pressure area by means of the leakage volume.

Checking the leakage volume

Returning leakage oil is a feature of the system and is therefore normal. However, the volume per unit of time can provide important information for troubleshooting. It is of fundamental importance to distinguish between leakage oil with the engine running and leakage oil during the starting phase. In addition, take account of whether the engine is equipped with a flame start system or not.

In MAN common rail engines, the constituents of the leakage oil flowing back to the tank are made up as follows:

– Permanent ventilation volume from the fuel service centre
– Leakage oil from the injector area
– Leakage oil from the pressure limiting valve on the rail if this is leaking (defective)
  Note: A few drops of fuel are allowed to escape when the engine is running.
– Breakaway delivery of the pressure limiting valve for the flame start system

For troubleshooting purposes, it is therefore important to differentiate the source of the possible increased leakage oil volume. Relatively straightforward testing methods are described below in order to permit rapid assessment without excessive preparation time, together with the guidance values for leakage oil volumes of correctly functioning engines. Every common rail system is very susceptible to dirt, therefore test methods have been worked out in which there is no need to open the clean side of the low-pressure area or the high-pressure system. Only in one single measurement is it necessary to remove individual high-pressure lines

Note: Always delete the fault memory after inspection work!

Measurement of the total leakage volume

Total leakage volume includes any fuel quantity which flows back from

– the **injectors** and from the
– **Pressure limiting valve**
  to the fuel tank at **engine idling speed**

During this test, therefore, it is important to prevent the measuring result being falsified by fuel flowing back from the permanent ventilation of the fuel service centre and the breakaway delivery of the pressure limiting valve for the flame start system.

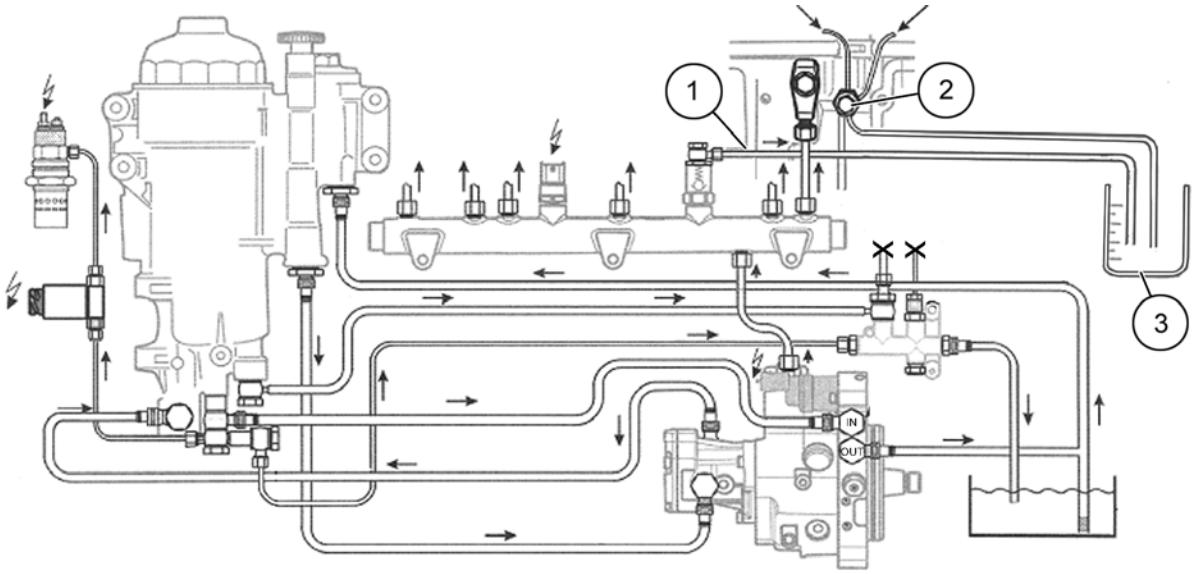
For this reason, suitable measures must be implemented when measuring the total leakage volume to ensure that only the possibly present leakage volume of the pressure limiting valve and that of the injectors flows into the measuring container. With some engine models, it is not always possible to measure the total leakage volume at a single connection point. In the case of D28 and D08 engines, the volumes from two different connection points must be brought together in the measuring container.

Preparations

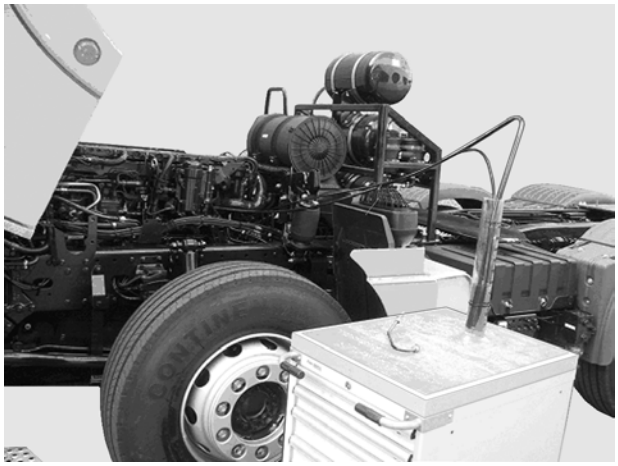
The measurement setup is the same as for measuring the leakage oil from the injectors and the pressure limiting valve (PLV). The only difference is that both PA tubes are connected at the same time and the volumes are counted together.

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Principle view of the measurement setup, D28 engine



1 Return from pressure limiting valve
2 Leakage oil return from the injectors
3 Measuring beaker (min. 1000 ml, 10 ml gradations)



Measurement and evaluation for all engine models
Do not start the measurement until constant leakage volumes are emerging from the measuring line – or both measuring lines in the case of D08 and D28 engines. Make sure the measuring lines do not project into the fuel otherwise the measuring result will be falsified.

Procedure:
– The connection plug of the MProp on the high-pressure pump remains connected
– Start the engine
– Engine running at idling speed
– Measure the total leakage volume

Return volume at idling speed, rail pressure 500 bar, engine at operating temperature

D0836, D20, D26, D28	approx. 70 ml per minute
D0834	approx. 50 ml per minute ***)**
D2868 LF02/03 (V8)	approx. 45 ml per minute and cylinder bank
D2840 LF25 (V10)	approx. 55 ml per minute and cylinder bank
D2842 LF10 (V12)	approx. 70 ml per minute and cylinder bank

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***)** Some D0834 engines have a rail pressure of only 360 bar when idling. For these engines, set the limit at approx. 40 ml per minute.

As already mentioned, this measuring method checks the leakage volume of the pressure-limiting valve and the injectors with the engine at idling speed. An **excessive return volume** therefore indicates a **fault in the injector area or a leaking pressure-limiting valve**. It is therefore necessary to check the pressure-limiting valve and the injectors separately when performing individual measurements.

There is a risk of a falsified measurement in fuel-lubricated high-pressure pumps! When checking the total leakage volume, it is important that the return ("OUT" connection) from the high-pressure pump to the fuel tank is sealed and the emerging fuel is channeled through a separate line into a container for collection. The measuring result will not be correct if this is not done.

The OUT connection to the pump must not be closed off, otherwise the pump will no longer be lubricated.

Note: It is relatively easy to eliminate up to 90% of all increased leakage in engines with a low mileage: Loosen all rail and injector attachments and then retighten them in accordance with the regulations. If this does not prove successful, perform an individual leakage volume measurement and renew the affected rail connection.

If the "rail pressure controller output value" in "pressures" monitoring changes after the engine is started, this indicates a leak in the pressure fitting area. For example: The value is around 8% immediately after the engine is started but increases to 25% after the engine has only been running for a short time. If this value hardly changes at all, the leak is likely to be in one or more of the injectors. In the case of a time-value repair (vehicles with high mileage): a leakage volume of <100ml/min is permissible, as this does not lead to a fault being entered.

Checking the pressure-limiting valve for leaks
Regardless of whether the engine is running or is only turned over by the starter: the pressure-limiting valve must not leak. When the engine is running, only a few drops of fuel are allowed to emerge. A return volume is only permissible when there is a fault if the pressure-limiting valve is open (~850bar) (e.g. rail pressure control fault), otherwise the pressure-limiting valve must be deemed defective.

In order to enable better assessment of the pressure-limiting valve leakage, we recommend performing the high-pressure test. The test can be started using MAN-cats® and works from EDC7 software version V34.1 onwards.

Procedure: Remove the return line on the pressure-limiting valve and plug it on the vehicle side. From the CR test kit, take a hose with collecting container and connect it to the pressure-limiting valve. Then start the high-pressure test and check that there are no pressure-limiting valve leaks during the test.

Individual measurement of leakage volume – D20/26, D08 and D2868 V8
If an increased leakage volume is recorded when measuring the total leakage volume and the pressure-limiting valve is not leaking (a few drops of fuel are permissible), it is more than likely that the fault will be found in one or sometimes two of the injectors. By closing off individual injectors, it is possible to find out which cylinder has a leak in the area of the injector.

The procedure described below is for a D20 engine. The procedure for D08, D26 and D2868 V8 engines is essentially the same. If high-pressure lines are removed from a D08 engine, these lines and the pipe clamps must be replaced with new ones.

Procedure:
– The injector wiring harness remains connected to the EDC7 control unit
– The connection plug of the MProp on the high-pressure pump remains connected
– Remove the high-pressure line of the first cylinder
– Seal the connection of the first cylinder to the rail
– Use protective sleeve 81.96002-0512 to seal the rail connection against the risk of contamination
– Start the engine
– Engine running at idling speed
– Measure the leakage oil volume
Repeat the procedure accordingly on every single cylinder until the leakage oil volume drops significantly or becomes normal, i.e. until the return volume at 600 rpm is at the normal level for the engine model concerned (see evaluation of total leakage volume measurement)

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The cylinder at which the leakage oil volume has normalised is also the one with the leak. If the volume reduces at several cylinders, these are also responsible for the leak.

Carefully clean the connection nipple afterwards! Do not use any other connection pieces such as balls with union nuts or the like!

Individual measurement of leakage volume – D28 in-line engine
If an increased leakage volume is recorded when measuring the total leakage volume and the pressure-limiting valve is not leaking, it is more than likely that the fault will be found in one or sometimes two of the injectors. As the leakage oil is routed out separately at each cylinder in the case of the D28 engine, the leakage for the rail and the injector of each individual cylinder may have to be tested separately. To do this, successively replace the leakage oil hollow screw of each individual cylinder with a hose connection and direct the emerging leakage volume into a collecting container.

Suitable connecting pieces can be found in the CR test kit.

When the engine is running, this method can be used to find out which cylinder has a leak in the area of the injector. The cylinder for which the total leakage volume has become normal, i.e. falls below 70 ml, is also the cylinder that is leaking. If the volume reduces at several cylinders, these are also responsible for the leak. Repeat the procedure accordingly on every single cylinder until the leakage oil volume drops significantly or becomes normal, i.e. until the return volume is below 70 ml per minute at 600 rpm.

Delivery rate measurement of the high-pressure pump
In this measurement method, the delivery of the high-pressure pump is checked at a rail pressure of 800 to 900 bar.

Preparations
The measurement setup is identical to that used for measuring the total leakage volume. The only difference is that the fuel metering unit is disconnected. With the D08 engine, the lines of the injector return and of the PLV must be extended for the test and routed into the measuring glass. Do not start the measurement until constant leakage volumes are emerging from both measuring lines. Make sure the measuring lines do not project into the fuel otherwise the measuring result will be falsified.

Make ready a sufficiently large measuring glass (min. 1000 ml, 10 ml gradations). Caution: The fuel line and measuring glass become hot.

Measuring principle
The high-pressure pump goes to maximum delivery when the MProp is disconnected. This means the rail pressure quickly rises to 1800 bar and the PLV is opened. The engine then runs with a rail pressure regulated by the PLV of 800 to 900 bar. The surplus volume pumped by the high-pressure pump flows through the PLV into the measuring beaker. In addition, about 60 ml/min of fuel comes from the injectors.

Procedure
– Disconnect the connection plug of the MProp at the high-pressure pump
– Start the engine
– Measure the total leakage oil volume from the PLV and injectors at idling speed

Evaluation of measuring results

Engine type	High-pressure pump	Minimum delivery rate of the HP pump at idling speed
D20 / D26	CP3.4+ / CP3.4H+	1100 ml/min
D20 / D28	CP3.4	950 ml/min
D2868 (V8)	CP3.4	950 ml/min
D0836	CP3.3 / CP3.3NH	650 ml/min
D0836	CP3.4	750 ml/min
D0834	CP3.3 / CP3.3NH	880 ml/min***)**

***)** In D0834 engines, the high-pressure pump delivery rate is higher because the idling speed is 800 rpm.

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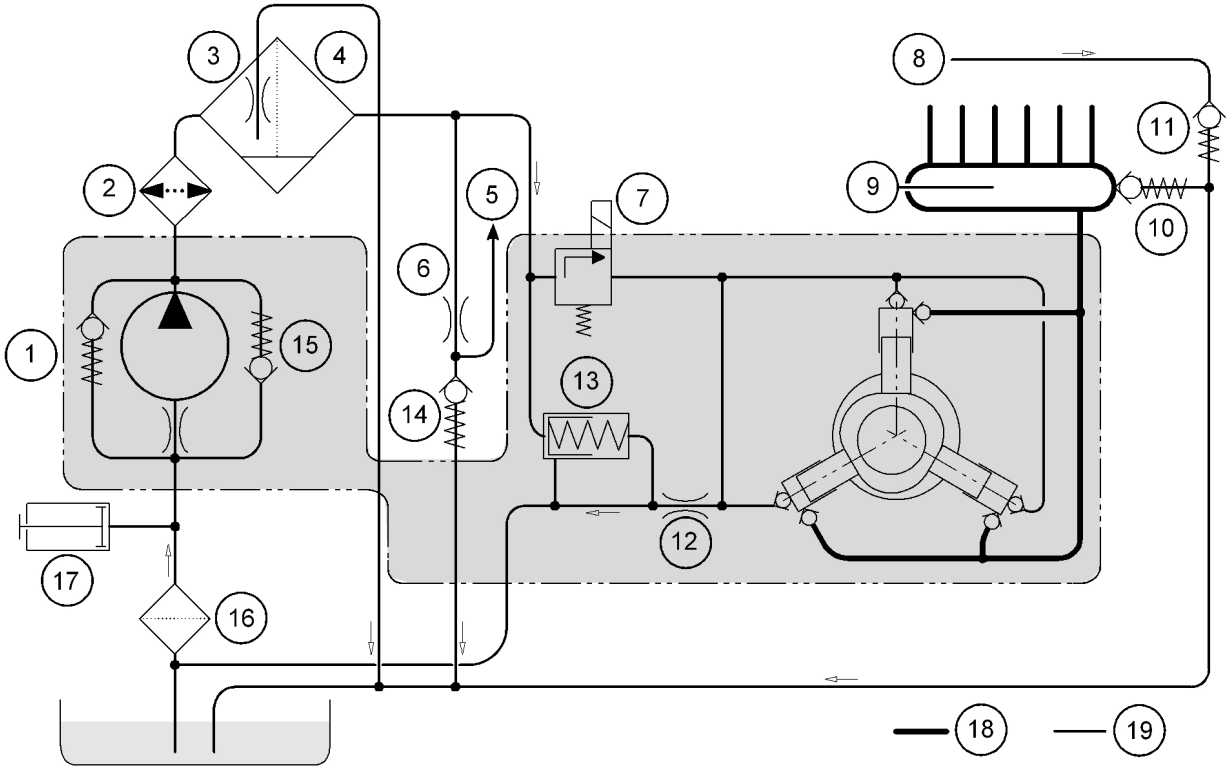
High-pressure pumps that deliver more than the specified minimum delivery can be classed as OK.

If the measured volume is significantly lower, fit a new MProp and repeat the measurement. Only fit a new high-pressure pump if this is not successful.

Pumps that are removed after a previous measurement of the minimum delivery rate must be sent in together with the measuring results in the event of a warranty claim.

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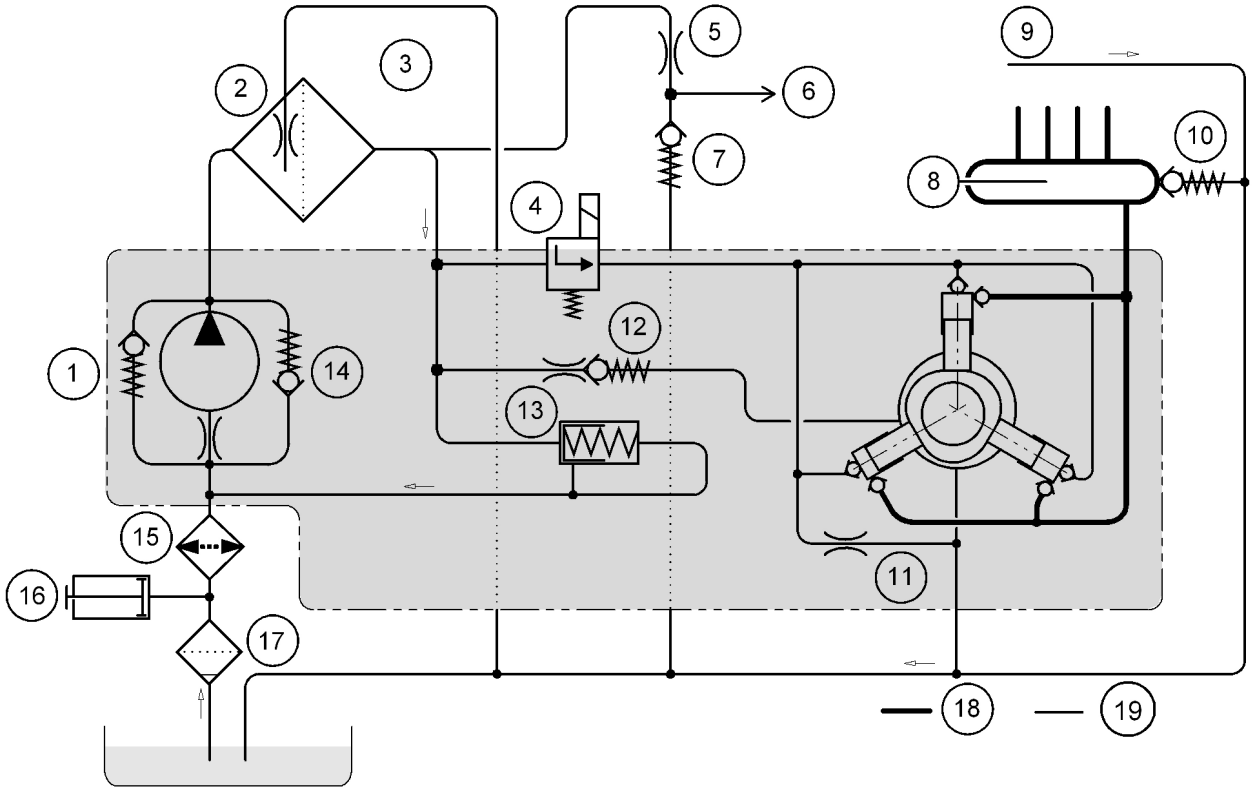
Fuel diagram, general
Oil-lubricated high-pressure pump CP3.4



1 Overflow valve gear pump (Δp = 10.4 – 13 bar)
2 Heat sink (optional)
3 Continuous ventilation in the fuel service centre
4 Filter with water separator (burst pressure > 15 bar)
5 Connection, flame start system
6 Flame start system throttle hole
7 Metering unit (fuel proportional valve, MProp)
8 Injector return line (leakage oil line)
9 High-pressure accumulator (rail) with injector connection
10 Two-stage pressure limiting valve
11 Pressure retaining valve, injector return line (Δp = 1.2....1.4 bar) **measuring point 2** (for Euro 3 engines only)
12 Zero delivery throttle
13 Overflow valve (Δp = 5.5 bar)
14 Flame start system pressure retaining valve **measuring point 1**
15 Bypass valve (Δp = 0.15 bar)
16 Primary filter
17 Hand pump
18 High-pressure line
19 Low-pressure line

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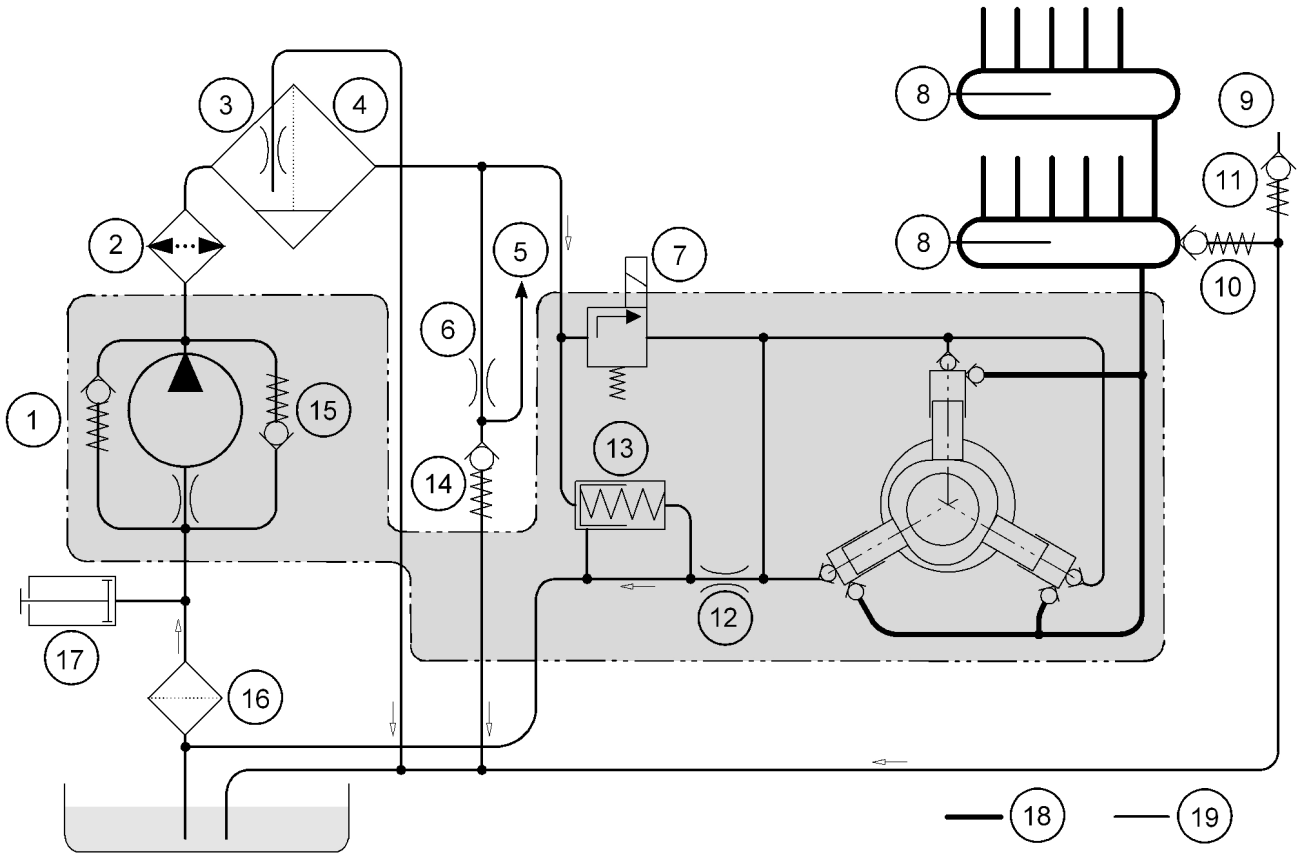
Fuel diagram, general
Fuel-lubricated high-pressure pump CP3.4+



1 Overflow valve gear pump (Δp = 10.4 – 13 bar)
2 Continuous ventilation in the fuel service centre
3 Filter with water separator (burst pressure > 16 bar)
4 Metering unit (fuel proportional valve, MProp)
5 Flame start system throttle hole
6 Connection, flame start system
7 Flame start system pressure retaining valve
8 High-pressure accumulator (rail) with injector connection
9 Injector return line (leakage oil line)
10 Two-stage pressure limiting valve
11 Zero delivery throttle
12 Throttle-type non-return valve 2.8 bar, high-pressure pump lubrication
13 Overflow valve (Δp = 5.5 bar)
14 Bypass valve (Δp = 0.15 bar)
15 Heat sink (optional)
16 Hand pump
17 Primary filter
18 High-pressure line
19 Low-pressure line

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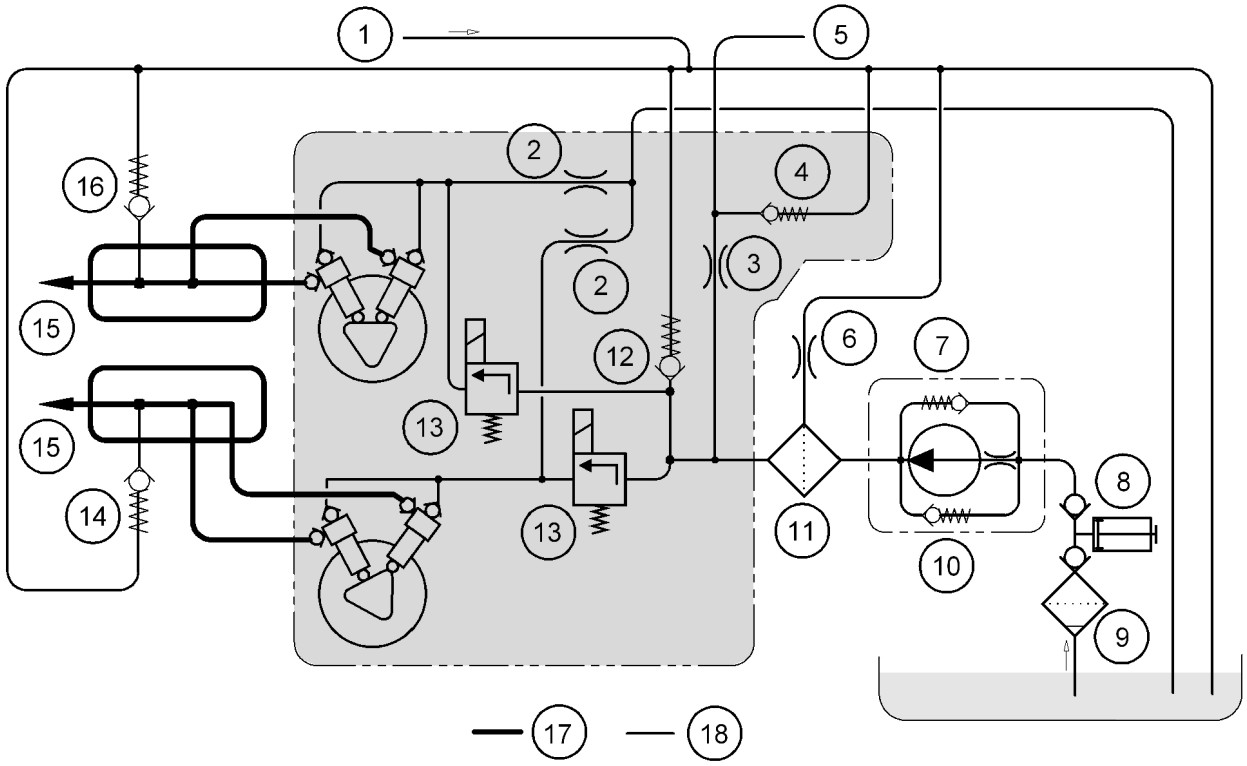
Fuel diagram, general
Oil-lubricated high-pressure pump CP3.4 D2868



1 Overflow valve gear pump (Δp = 10.4 – 13 bar)
2 Heat sink (optional)
3 Continuous ventilation in the fuel service centre
4 Filter with water separator (burst pressure > 15 bar)
5 Connection, flame start system
6 Throttle bore, flame start system
7 Metering unit (fuel proportional valve, MProp)
8 High-pressure accumulator (rail) with injector connection
9 Injector return line (leakage oil line)
10 Two-stage pressure limiting valve
11 Omitted
12 Zero delivery throttle
13 Overflow valve (Δp = 5.5 bar)
14 Pressure retaining valve, flame start system
15 Bypass valve (Δp = 0.15 bar)
16 Pre-filter
17 Hand pump
18 High-pressure line
19 Low-pressure line

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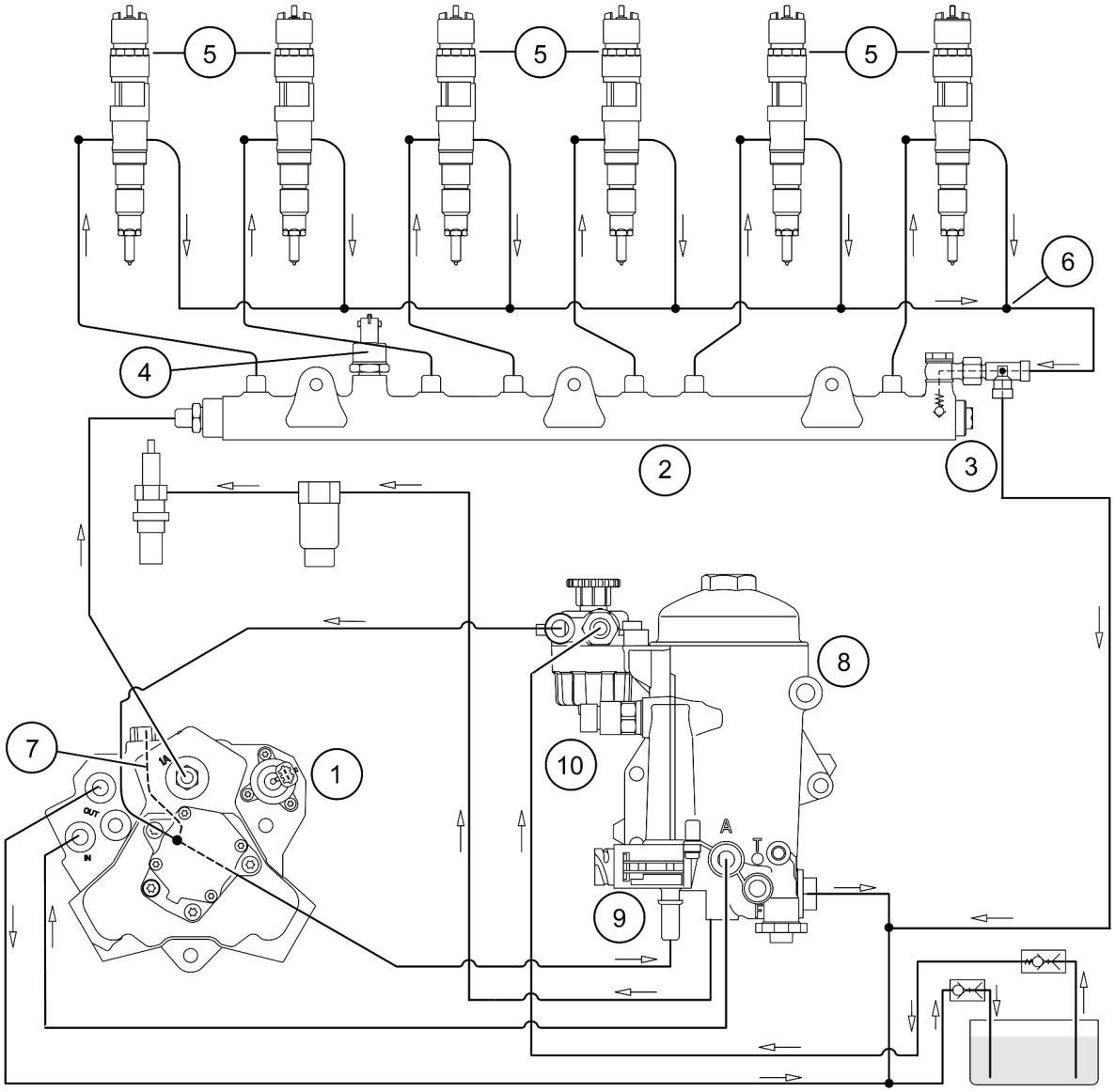
Fuel diagram, general
Oil-lubricated high-pressure pump CP9V4 D2840/42/48



1 Injector return line (leakage oil line)
2 Zero delivery throttle
3 Throttle bore, flame start system
4 Pressure retaining valve, flame start system
5 Connection, flame start system
6 Continuous ventilation in the fuel service centre
7 Overflow valve gear pump (Δp = 10.4 – 13 bar)
8 Hand pump
9 Pre-filter
10 Gear pump with bypass valve (Δp = 0.15 bar)
11 Filter with water separator (burst pressure > 16 bar)
12 Overflow valve (Δp = 5.5 bar)
13 Metering unit (fuel proportional valve, MProp)
14 Two-stage pressure limiting valve
15 High-pressure accumulator (rail) with injector connection
16 Two-stage pressure limiting valve
17 High-pressure line
18 Low-pressure line

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Fuel diagram, D20/D26 engine Euro 4/5



1 Quantity-controlled high-pressure pump CP 3.4+ (fuel-lubricated)

2 High-pressure accumulator (rail)

3 Pressure limiting valve (PLV 4) integrated in the rail

4 Rail-pressure sensor

5 Injectors

6 Injector return line (leakage oil line)

7 Internal hot/cold circuit

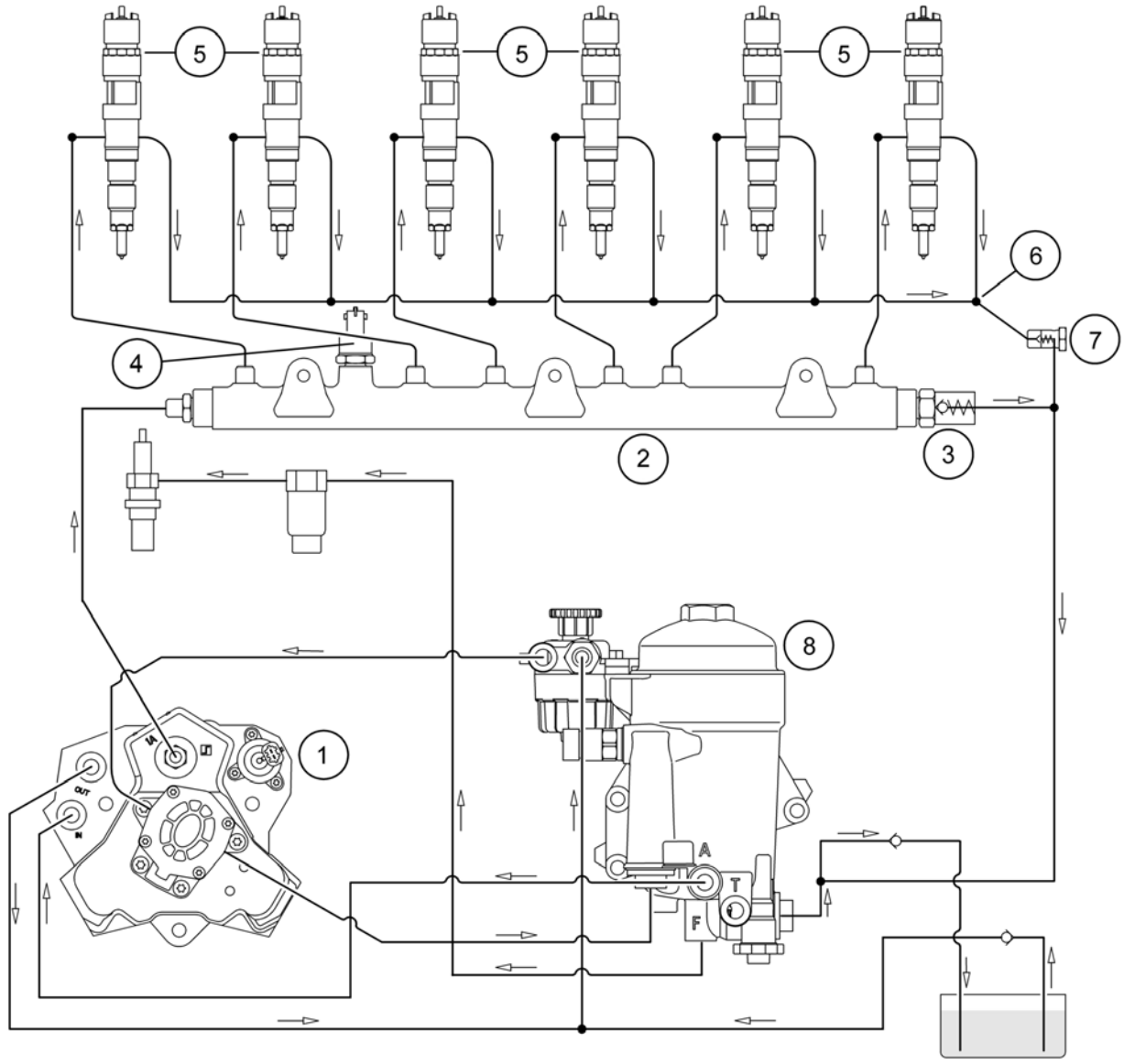
8 Fuel service centre

9 Filter heater

10 Fuel low pressure sensor

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Fuel diagram, D2066 Euro 3 engine



1 Quantity-controlled high-pressure pump CP 3.4 (oil-lubricated)

2 High-pressure accumulator (rail)

3 Pressure limiting valve

4 Rail-pressure sensor

5 Injectors

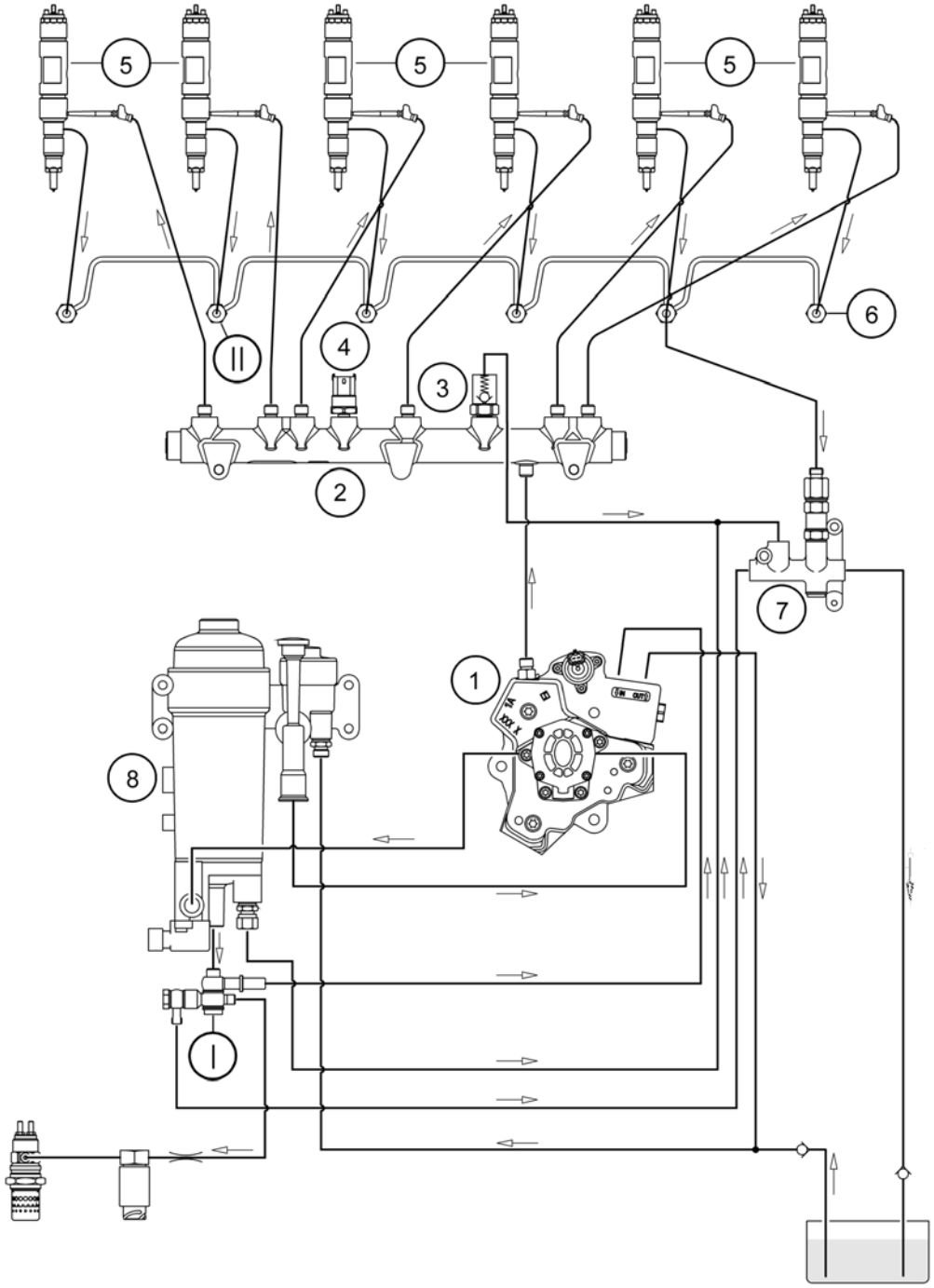
6 Injector return line (leakage oil line)

7 Overflow valve 1.2...1.3 bar

8 Fuel service centre

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Fuel diagram, D2876 LF Euro 3 engine



1 Quantity-controlled high-pressure pump CP 3.4

2 High-pressure accumulator (rail)

3 Pressure limiting valve

4 Rail-pressure sensor

5 Injectors

6 Injector return line (leakage oil line)

7 Collector, return line with pressure retaining valve p = 1.2 ... 1.4 bar

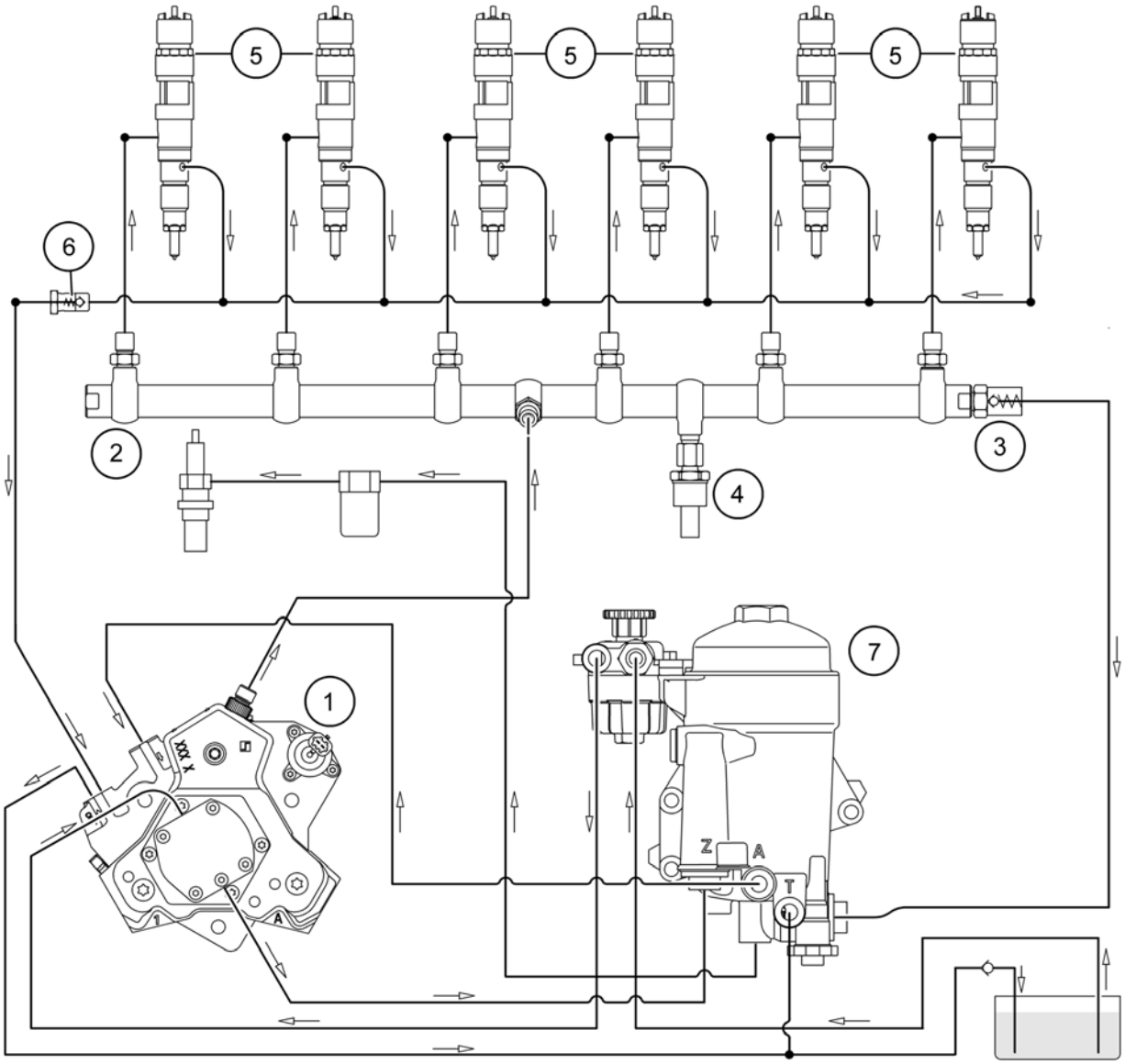
8 Fuel service centre

I **Measuring point 1:** Connection, flame start system, sealed off from return line

II **Measuring point 2:** Injector return line at cylinder 2

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Fuel diagram, D0836 LF Euro 3 engine



1 Quantity-controlled high-pressure pump CP 3.4

2 High-pressure accumulator (rail)

3 Pressure limiting valve

4 Rail-pressure sensor

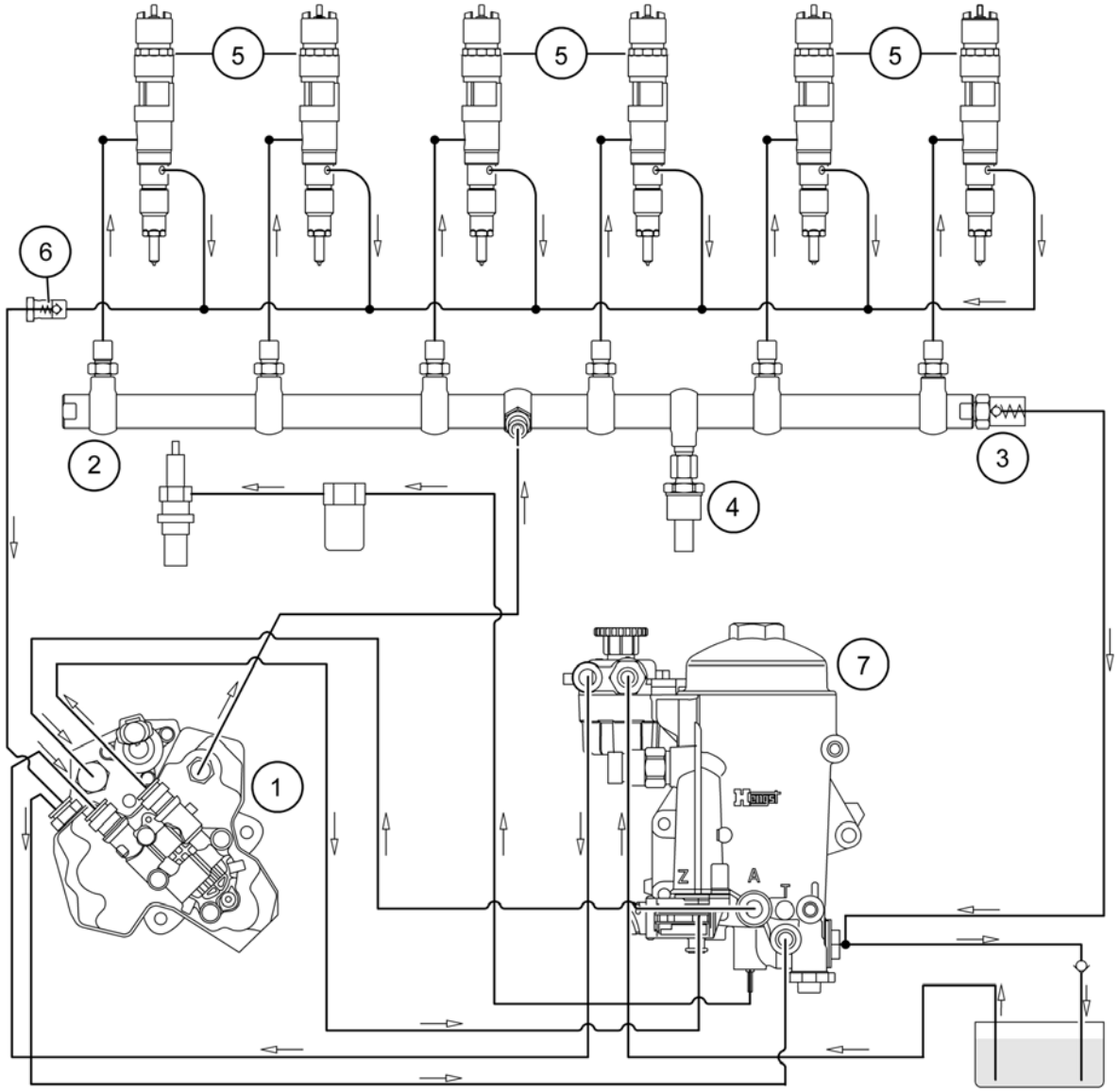
5 Injectors

6 Overflow valve 1.2...1.4 bar

7 Fuel service centre

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Fuel diagram, D0836 LFL Euro 3/4 engine



1 Quantity-controlled high-pressure pump CP 3.3

2 High-pressure accumulator (rail)

3 Pressure limiting valve

4 Rail-pressure sensor

5 Injectors

6 Overflow valve 1.2...1.3 bar

7 Fuel service centre

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Troubleshooting with MAN-cats®

Compression test
The compression test ascertains the compression deviations of the individual cylinders. To do this, the engine is cranked by the starter. The control unit suppresses injection (engine does not start) and, for each cylinder, measures how severely the starter was braked during the compression cycle.

The starter must be actuated via the ignition lock until the control unit has measured the speeds at bottom dead centre and shortly before top dead centre for all cylinders. The engine revs reach minimum briefly at top dead centre of each cylinder. This is the point of maximum compression. This means that heavy braking, i.e. a low engine speed before top dead centre, indicates relatively good compression.

Procedure and requirements:
– Battery 100% charged
– Engine at operating temperature >75 °C
– Warm up the vehicle by driving, do not let it warm up whilst stationary
– Follow the MAN-cats® instructions quickly (otherwise there will be no evaluation)
– Make sure you turn off the ignition after completion of the compression test!

Results when the engine is intact

Cylinder	Lower speed (rpm)	Upper speed (rpm)	Difference (rpm)
1	209	243	34
5	208	243	34
3	208	241	33
6	208	242	34
2	207	242	35
4	209	241	32

As a result, the operator receives two speeds for all cylinders:

Lower speed: This is the lower of the two speeds that were measured in the compression cycle (approx. 8° before to 8° after TDC).

Upper speed: This is the higher of the two speeds that were measured a long way before TDC (approx. 70° before TDC).

Difference: The maximum difference between the individual cylinders should be ± 5 rpm.

Evaluation assessment:
– Unclear to ± 5 rpm (adjust valves)
– Defect detected if difference greater than 5 (valve damage, piston ring damage etc.).
In the event of cylinder damage, the values for the other cylinders can also be more widely spread

Measuring accuracy:
– The deviation between the compression test with MAN-cats® and a compression pressure plotter is up to 5 bar

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High-pressure test
The high-pressure test is a quick way of detecting leakage faults SPN 3775, 3776, 3777, 3778, 3779, 3780 and indicates whether the fault is on the pressurisation side (high-pressure pump or metering unit) or on the consumer side (injector, rail connection, pressure-limiting valve). The test works for EDC7 software version V34.1 onwards.

In the test, the rail pressure is increased to 1600 bar and reduced to 600 bar four times (once at 800 rpm and three times at 700 rpm). During this process, the time for pressurisation or depressurisation is measured and a result is output.

Procedure and requirements:
– Engine at operating temperature >75 °C
– Warm up the vehicle by driving, do not let it warm up whilst stationary
– Parking brake applied
– Shift the gearbox to neutral
– Start the engine and make sure it idles at 600 rpm
Note: The high-pressure test can only be performed if the sensors for the engine speed, coolant temperature and rail pressure are in perfect working order. If the speed increases to 800/1200/1400/1800 rpm during the test, the test result is invalid. Reason: The fitted control unit has old programming, meaning that no valid statements are possible!

Result evaluation, 1600-bar system

Speed	Pressurisation	Depressurisation
800 rpm	600 ms	1070 ms
700 rpm	400 ms	1190 ms
700 rpm	400 ms	1180 ms
700 rpm	430 ms	1170 ms

There are no reference values for pressurisation, as this time is not meaningful for troubleshooting.

For intact systems, the depressurisation time is between 1100 and 1600 ms.

Minimum depressurisation time limit:
– 4-cylinder in-line engine: 1300 ms
– 6-cylinder in-line engine: 1000 ms
– V8 engine (one high-pressure pump): 850 ms
– V8 engine (two high-pressure pumps): 1600 ms
– V12 engine: 1100 ms

If the values are below these values, this indicates a leakage on the consumer side (injector, rail connection, pressure-limiting valve).

To localise the fault(s), we recommend performing the test again with an open line at the pressure-limiting valve (PLV). The PLV must not leak during the test! If the PLV does not leak, this indicates a fault in the injector area.

Experience shows that, in engines with low mileage, an increased leakage volume is relatively simple to remedy: Loosen all rail and injector attachments and then retighten them in accordance with the regulations. If this work does not bring the desired success, perform individual measurement of the leakage volume to determine the defective injector(s).

Note. Detection of one or more leaking rail connections depends a lot on the engine temperature.

Maximum depressurisation time limit:
– All engines: 2000 ms

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If the value is below these values, this indicates a leakage on the consumer side (jamming M-Prop (metering unit), blocked high-pressure pump zero-delivery throttle)

Note: Before the HP pump is removed, always perform the high-pressure test again with a new M-Prop. If the depressurisation time is again over 2000 ms, re-install the original metering unit and check the return line to the fuel tank (crushed, kinked or possibly blocked).

Simple test method: Direct the fuel from the high-pressure pump "OUT" connection into a collecting container using a hose. If the high-pressure test values are then normal, the fault is due to insufficient through-flow in the return line to the tank (backup effect).

Note: If a leakage is detected in a vehicle/engine (SPN 3775, 3776, 3777, 3778, 3779, 3780) but the depressurisation times are OK, look for fault(s) in the high-pressure pump or the metering unit using a process of elimination: **Check the high-pressure pump delivery.**

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DLS coil tester
The DLS coil tester is used for detecting internal leakage on the injector when the engine is running. DLS is a German abbreviation for **D**etection of **L**eakage by means of coil resistance measurement.

Troubleshooting in the event of leakage fault messages on the CR injection system is problematic as, in the event of leakage fault messages, any component in the high-pressure system can be the cause of the fault (high-pressure pump, rail-pressure sensor, pressure limiting valve, injector, rail connection). What's more, troubleshooting requires special tools, profound system knowledge and a great deal of time.

The DLS coil tester makes troubleshooting much easier:
– It is possible without dirt ingress, as the high-pressure system does not need to be opened
– There is no need for inconvenient individual leakage volume measurements
– The pressure-limiting valve can be tested without the need for a time-consuming test drive
– The test result can be documented using MAN-cats®. The damaged part can be accompanied by documentation of the fault cause
– Can be used for all CR systems in the field (C3, C32) and is prepared for EDC17
The test sequence is defined within the MAN-cats® programming, and the DLS tester is activated via the K-line.

Two tests are possible using the DLS coil tester:
– Injector leakage test
– PLV Open Test, a leakage test for the pressure limiting valve

Measuring principle for leakage detection on the injector:
– High-pressure leakage leads to increased fuel temperature
– Hot fuel heats the injector internally and, therefore, also the solenoid coil
– The coil temperature increase can be measured by the change in the coil resistance

DLS coil test sequence
Important: It is only advisable to perform the DLS test if the injectors' total leakage volume is too high.

Therefore, always measure the total leakage volume before the DLS test.

Exception: If the vehicle offers the option of a high-pressure test (THPC), there is no need to measure the total leakage volume. The THPC can be used to determine whether the problem is on the consumer side (injectors, rail connection, pressure-limiting valve) or on the pressurisation side (metering unit, high-pressure pump).

The engine temperature is an important variable during the DLS test. As the test lasts around 8 minutes, engine (coolant) temperature changes during the test have an effect on the result.

To ensure correct evaluation of the measuring results, the coolant temperature may only change by max. 2°C. The engine temperature at the start/end of the measurement is therefore documented in the result report.

This gives rise to the following procedure:
– Warm up the engine to the test temperature (approx. 70°C), preferably by running the engine
– Connect the DLS tester
– The engine must be run at a certain speed, depending on the engine model: D20 and D26 engines at idling speed, D08 and D28 engines at 800 rpm
– Open the test with MAN-cats® under menu item "Workshop routines", then select and start the DLS test:
  – MAN-cats® query from EDC: Which engine model? Current rail pressure?
  – MAN-cats®: Start command for measurement on DLS tester (with holding times, adjustment factor for rail pressure jump)
  – DLS tester performs coil resistance measurement at existing rail pressure
  – DLS-Tester performs RDS signal manipulation (ramp, holding time), engine running with 400 bar increased rail pressure
  – DLS tester performs coil resistance measurement at increased rail pressure
  – Measured values transferred from DLS tester to MAN-cats®
  – Cancellation of rail pressure manipulation
  – MAN-cats®: Output of result report

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The DLS tester allows temperature measurement in stages of 0.8°C (this corresponds to a resistance change of 1 mΩ). Excessive leakage on the injector leads to temperature increases up to 15°C. However, normal leakage leads to max. 3°C temperature increase. According to previous results, injectors at the leakage limit can already be detected.

Evaluation of the test results
The following is an example using the result report:

Relative injector resistance increase (in mOhm)

Evaluation	Cylinder 1	Cylinder 3	Cylinder 2	X	Cylinder 5	Cylinder 6	Cylinder 4	X
Delta	-1	14	2	0	-1	4	-1	0

The injector is defective as of a relative internal resistance increase of > 5 mΩ. This means that, according to the above table, the cylinder 3 injector is defective and the cylinder 6 injector is at the limit.

In this test procedure, a leak between the injector and the rail connection leads to no temperature change or a less pronounced temperature change (i.e. resistance change) than a leakage in the injector. Therefore, the DLS tester can be used to establish beyond doubt if the injectors are leaking or not. Leaking rail connections can be detected by implication: the pressure-limiting valve is not leaking, the injectors are not leaking, therefore the rail connection must be leaking.

Important information regarding incorrect measurement
If an engine “hunts” relatively severely during the test sequence, the result can be invalid.

The following is an example based on a D28 engine:

Relative injector resistance increase (in mOhm)

Evaluation	Cylinder 1	Cylinder 3	Cylinder 2	X	Cylinder 5	Cylinder 6	Cylinder 4	X
Delta	973	979	974	0	-1	4	-1	0

Incomprehensible results are shown for cylinders 1, 2 and 3. The reason for this: Due to the rail pressure increase, the engine speed control can only maintain the idling speed of 600 rpm with difficulty, the engine “hunts”. Due to this “hunting” injection at cylinders 1, 2 and 3 is very irregular, making it impossible for the DLS tester to obtain a usable resistance measurement.

Remedy: Repeat the test at 800 rpm to 1000 rpm, as a higher idling speed has no effect on the test result. The only disadvantage here is that the coolant temperature increases.

Incorrect measurement due to changed coolant temperature
As already mentioned, every temperature change has an effect on the test result. If the coolant temperature rises by 4 K during the test sequence, for example, the test result is unusable as the resistance value of most of the injectors also increases. Reliable diagnosis is therefore extremely difficult.

In simple terms: if the coolant temperature changes by 1°C, the injector coil resistance also changes by around. 1 mΩ.

Incorrect measurement due to too many successive test sequences
If five or more tests are performed within a few minutes, the higher rail pressure heats up all injectors relatively quickly, and the differences between the individual injectors become increasingly smaller. Consequently, reliable diagnosis is more difficult. Therefore, allow the engine to cool down at idling speed after two or max. three test sequences.

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PLV Open Test
The PLV Open Test, a leakage test for the pressure limiting valve. This test is the only way of raising an engine's rail pressure to just below the PLV opening pressure.

Note: The procedure and test steps depend on the software version used for the EDC control unit: A DBV Open Test with DLS tester can be performed on all EDC7 control units. Control units with software version V43 and later have the test integrated in the control unit. This means that a DLS coil tester is not required here.

Procedure and test sequence with DLS tester
– Connect the DLS tester
– Engine running at idling speed
– Open the test with MAN-cats® under menu item “Workshop routines”, then select and start PLV Open Test (German: DBV Open Test):
  – MAN-cats® query from EDC: Which engine model? Current rail pressure?
  – MAN-cats®: Start command for measurement on PLV Open Tester (with holding times, adjustment factor for rail pressure jump)
  – DLS-Tester performs RDS signal manipulation (ramp, holding time), engine running with increased rail pressure (depending on engine model, mostly 1650-1700 bar)
  – Cancellation of rail pressure manipulation
  – MAN-cats®: 10 s waiting time for reduction in rail pressure
  – MAN-cats®: Measurement of the rail pressure at test end
  – MAN-cats®: Output of result report

Procedure and test sequence without DLS tester
– Engine running at idling speed
– In MAN-cats®, select the "PLV Open Test" option from the "Diagnosis EDC 7C32 Bosch" menu
After the end of the test, the last pressure at which the pressure-limiting valve was still closed and the valve status are shown. The following status messages may be shown:

MAN-cats® display	State of pressure-limiting valve	Procedure
No fault	Valve OK	—
PLV open	Valve was blasted open	Fit new valve
Leakage	Valve leaking but not blasted open	Fit new rail

Summary
– If the pressure-limiting valve (PLV) is OK:
  – Perform an injector test
– If the pressure-limiting valve (PLV) has been blasted open:
  – Fit a new pressure-limiting valve (PLV)
– If the pressure-limiting valve (DBV) leaks despite having been retightened to 100 Nm:
  – Fit new rail

Evaluation of the test results
The following is an example using the result report:

PLV Open Test completed

Actual rail pressure before PLV test	493 bar
Actual rail pressure after PLV test	495 bar
Maximum rail pressure achieved	1771 bar

– If the rail pressure after the PLV test is below 800 bar, the PLV has not opened
– If the rail pressure after the PLV test is between 800 bar and 900 bar, the PLV has opened
From this, it cannot be determined whether the PLV is actually leaking with 100% certainty. This test result merely shows that the PLV was not forced open. If the DLS test and/or the measurement of the injector and rail connection leakage volume was OK, the PLV Open Test must be repeated and the PLV must be monitored for leaks visually and/or by measuring the leakage volume.

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The main advantage of the PLV Open Test is that the rail pressure can be increased to just below the PLV opening pressure whilst the vehicle is stationary.

Important information regarding incorrect measurement
If an engine “hunts” relatively severely during the test sequence, the result can be invalid.

Example:

Actual rail pressure before PLV test	508 bar
Actual rail pressure after PLV test	504 bar
Maximum rail pressure achieved	970 bar

The reason for this: Due to the rail pressure increase, the engine speed control can only maintain the idling speed of 600 rpm with difficulty, the engine “hunts”.

Remedy: Repeat the test at 700 rpm to 800 rpm.

The test result on the same engine at 700 rpm:

Actual rail pressure before PLV test	623 bar
Actual rail pressure after PLV test	616 bar
Maximum rail pressure achieved	1780 bar

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Rev-up test
The rev-up test makes it possible to check whether the cylinders are functioning evenly. To do this, switch off the cylinders and accelerate the engine from idling speed. The acceleration in engine revs is calculated in this case. A large discrepancy for the switched-off cylinder indicates incorrect injection or a defective cylinder.

To determine whether all cylinders deliver the same performance, the engine speed which can be reached with a defined injection quantity in a certain time is measured during the rev-up test. A sequence of seven consecutive rev-ups is performed during the rev-up test: In the first rev-up, all injectors are activated and the speed reached is determined. From the second rev-up onwards, the engine is accelerated again, although the injectors are shut off one after the other in the firing order. If the engine then reaches almost the same speed as during the first rev-up, despite the shut-off injector, this cylinder is not working well during engine operation and delivers poorer performance.

Procedure and requirements:
– Engine at operating temperature >75 °C
– Warm up the vehicle by driving, do not let it warm up whilst stationary
– Always perform the rev-up test at least twice. Important: do not allow any further consumers - such as the compressor or fan - to be activated if these are likely to be deactivated in the second test, since this will falsify the result
– At the end of the rev-up test, always switch off the ignition, otherwise the smooth-running control will not be activated

The following table shows a sample test result. In this case, there is an irregularity at cylinder 3:

Cylinder	Speed acceleration in rpm/s	Difference, no cylinder shut-off
0	704	0
1	550	154
5	540	164
3	630	74
6	566	138
2	535	169
4	542	164

If the engine reaches almost the same speed as during the first rev-up, despite the shut-off injector, this cylinder is not working well during engine operation. This does not mean that an injector at this cylinder is defective, however! It merely means that the cylinder in question has a lower performance. This means the engine mechanical system has to be checked: valve clearance, compression etc. The rev-up test can therefore only be evaluated in conjunction with the compression test. The rev-up test only compares the cylinders with each other. The result must also match the correction quantities.

Note: If there is a line discontinuity in a current path, only the defective injector is switched off, i. e. the rev-up test can be performed and shows the affected current path. If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i. e. a 6-cylinder in-line engine then only runs on three cylinders. The rev-up test is aborted with a fault message because the engine is then only running on two cylinders

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Cylinder shut-off test
The cylinder shut-off test makes it possible to switch off a particular cylinder prior to injection at idling speed. This permits acoustic diagnosis of the engine in case of abnormal noises (mechanical system/combustion).

If the cylinder affected is shut off before combustion, the noise should no longer be perceivable.

If the noise is still audible, the cause must be sought elsewhere (front end, gear train, air compressor, etc.).

Procedure and requirements:
– Engine at operating temperature >75 °C
– Warm up the vehicle by driving, do not let it warm up whilst stationary
– Parking brake applied
– Shift the gearbox to neutral
– Start the engine and make sure it idles at 600 rpm
Note: The test can also be performed when the coolant temperature is 0 °C or more if damage is already apparent.

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Smooth running control
Smooth running control is designed to ensure smooth engine running, especially when idling. If a six-cylinder engine is fitted, each cylinder accelerates the engine for 120° in its combustion stroke. The control unit evaluates the engine running for 120° in each case and activates the injectors of the “slow” cylinders for longer and the injectors of the “fast” cylinders for a shorter time.

These activation differences are displayed graphically by MAN-cats ® using different bar lengths.

The fuel correction quantity represents the deviation from the desired quantity. Note the firing sequence: **1-5-3-6-2-4** in the evaluation.

The smooth running control correction quantities are shown in cylinder monitoring.

In order to enable better assessment of the engine state, the speed and the injector status should also be selected to compare the cylinders in the freely definable monitoring.

Sample evaluation
If cylinder 2 power is poor, the correction quantity at injector 2 is increased. If the engine still does not run smoothly after this, the quantity for injector 4 is also increased. However, the volume for cylinders 1 and 5 is reduced afterwards so that the engine does not rev too quickly. There is also a clear group in which two injectors have an excess quantity **(+)** and one (sometimes also two) reduced quantity **(–)**. In this **+ + - -** group, the first cylinder is the one with poor power output.

This does not mean that the injector of the second cylinder is defective, however! It only means that the second cylinder in this example is the one with the poorer power output. Additional checks are necessary in order to establish what the fault is, because poor power may be also be caused by lack of fuel or poor compression pressure. Therefore, also perform the compression and run-up test!

The injection quantity is calculated based on the injection **period** and the rail **pressure**. If an injector does not open, the calculated and displayed quantity is greater than the actual quantity.

In order to enable better assessment of the engine state, the speed and the injector status should also be selected to compare the cylinders in the freely definable monitoring.

Summary of the events in case of a fault

Display	Possible cause	Possible remedy
Injection quantity is reduced	Cylinder before has too much output	Check the injector of the cylinder before, carry out run-up test using MAN-cats
	Injection too long due to poorly closing injector	Electrically disconnect injector and repeat test, perform run-up test with MAN-cats, exchange injector when damage is determined
	Injector does not close or closes poorly between pre-injection and main injection	Electrically disconnect injector and repeat test, exchange injector when damage is determined

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Display	Possible cause	Possible remedy
Injection quantity is increased	Cylinder before does not have enough output	Check the injector of the cylinder before, perform run-up test with MAN-cats, check electrical activation, exchange injector when damage is determined
	Injector does not open	Check the injector, perform run-up test with MAN-cats, check electrical activation, exchange injector when damage is determined
	Injector is not activated, possible cable discontinuity	Check wiring for discontinuity and poor crimping, perform run-up test with MAN-cats
	Cylinder has insufficient output due to poor compression	Check compression, carry out compression test with MAN-cats

Important note when exchanging injectors: When exchanging, ensure that injectors with the same Bosch number are installed again. There are currently two types of injectors. **It is not possible to replace “old” injectors with “new” injectors! Do not mix!** If it is necessary to change over to the latest type of injectors, the rail must be replaced and the control unit reprogrammed.

See Service Information 132400!

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Troubleshooting chart

1. Starter does not engage	2. Starter disengages again after one second	3. Starter turns, engine does not start	4. Engine difficult to start	5. Engine stops, dies	6. Engine cannot be accelerated beyond idling speed	7. Unusual combustion noises when starting	8. Unusual combustion noises	Possible cause of fault	SPN
x				o				EDC 7 without voltage supply	
x								Terminal 50 not on vehicle management computer	
x					x			Engine CAN interrupted between vehicle management computer and EDC	2039/3064
x								EDC7 wiring to starter interrupted (voltage supply to starter, IMR relay)	3751/3045
	x			o				Engine speed acquisition: crankshaft and camshaft speed sensors not connected	190/3082
		o	x					Crankshaft speed sensor not connected, polarity reversal, spurious signals, camshaft pulse-generating wheel damaged	190/3752
		o	x				o	Camshaft speed sensor polarity reversal	190/3752
	o	o	x					Crankshaft speed sensor not connected, polarity reversal, spurious signals, flywheel damaged	190/3753
		o	x				o	Crankshaft speed sensor polarity reversal	190/3753
		x						Incorrect EDC/vehicle management computer pairing (re-parameterise using vehicle data file)	3076/3077
		o						Control unit has been programmed with data record containing incorrect part number	
		x	x	x				Air in the system, rail fuel pressure does not build up. Return stop in supply line defective. Ball valve in fuel service centre sticking	94/3755/3776
		o	x	x				Excessive vacuum upstream of fuel supply pump (tank line plugged), rail pressure does not build up	94/3755/3780
		o	o				o	Injector open, rail pressure does not build up	3775/3778/3779
		o	o			o	o	Injector damage	
		x	x					Delivery connection to injectors leaking, rail pressure does not build up	3775/3778/3779
		o	o	o		o	o	Metering unit (MProp) blocked, pressure limiting valve open	3775/3776 /3777/3780
		o	x	x				Fuel supply pump (gear pump) defective	94/3775/3776 /3780
		o	x	x				High-pressure pump defective, rail pressure does not build up	3775/3776/3780
		x	o			x		Return pressure at high-pressure pump too high, consequently excessive rail pressure (especially when idling and on the overrun/trailing throttle)	3775/3777/3781

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1. Starter does not engage 2. Starter disengages again after one second 3. Starter turns, engine does not start 4. Engine difficult to start 5. Engine stops, dies 6. Engine cannot be accelerated beyond idling speed 7. Unusual combustion noises when starting 8. Unusual combustion noises								
							Possible cause of fault	**SPN**
		o	x	x			Fuel filter blocked, clogged	94
		o	o			x	Wiring to rail-pressure sensor or sensor defective	3099
		o	o				Pressure limiting valve on rail is open/blocked/leaking	3687/3775/3781
		o	o	o		o	Wiring to injectors	651 to 656
		o	o				Air cleaner dirty, clogged, engine not receiving any air	
x			x	o			Battery voltage too low (less than 9 V)	168/3780
x							Wiring from battery to starter interrupted, starter defective	3045
						x	Wiring to metering unit (MProp) interrupted	3748/3781
					x		Engine brake switch actuated	
x							Incorrect immobiliser ID in the vehicle management computer, key teach-in not performed, reading coil defective	

9. Rated speed significantly reduced 10. Reduced power in all areas 11. Irregular engine running 12. Engine idling speed unstable, engine “hunting” 13. Lots of smoke produced when accelerating 14. Heavy smoking: White/blue smoke 15. High smoke output at full power								
							Possible cause of fault	**SPN**
		o	o		o		Camshaft speed sensor polarity reversal	190/3752
		o	o		o		Crankshaft speed sensor polarity reversal	190/3753
	o		o	o			Control unit has been programmed with data record containing incorrect part number	
	x		x				Air in the system, rail fuel pressure does not build up	94/3755/3776
	x	x	o				Injector open, rail pressure does not build up	3775/3778/3779
	o	o	o	o	o		Injector damage	
	x	x					Delivery connection to injectors leaking, rail pressure does not build up	3775/3778/3779
	x	o	x	o			Metering unit (MProp) blocked, pressure limiting valve open	3775/3776/3777 /3780

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9. Rated speed significantly reduced								
	10. Reduced power in all areas							
		11. Irregular engine running						
			12. Engine idling speed unstable, engine “hunts”					
				13. Lots of smoke produced when accelerating				
					14. Heavy smoking: white/blue smoke			
						15. High smoke output at full power		
							Possible cause of fault	**SPN**
		o	**o**	**o**			High-pressure pump defective, rail pressure does not build up	3775/3776/3780
	o						Fuel filter blocked, clogged	94
	x			**o**		**o**	Wiring to rail-pressure sensor or sensor defective	3099
x	**o**	**o**	**o**				Pressure limiting valve (PLV) on rail is open/blocked/leaking	36873775//3781
	x	**x**	**o**				Wiring to injectors	651 to 656
	o		**o**	**x**		**x**	Air cleaner dirty, clogged, engine not receiving any air	
	x			**o**		**o**	Charge air cooler excessive pressure loss (drain condensation, frozen	102
x	**x**			**o**		**o**	Exhaust gas recirculation permanent system deviation, exhaust gas recirculation flap stiff, wiring to compressed air cylinder or to proportional valve E-EGR	3004/3746
	x						Wiring to metering unit (MProp) interrupted	3748/3781
	x			**o**			Wiring, charge-pressure sensor	1080/3088
	x						Wiring, coolant temperature sensor	3091
					x		Flame start system leaking/continuously energised	
	x			**x**	**x**		Leaks in the charge air system (intercooler, charge air hose)	3671
		x					Oil in the control unit plug due to leaking injector wiring harness	651 to 656

x likely

o possible

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Troubleshooting program

General information
The following troubleshooting program contains the faults that can be detected by the diagnostic memory.

The sequence of tests corresponds to the numerical succession of fault codes (SPNs), irrespective of the evaluation of the fault.

This troubleshooting program does not currently fully match the previous SPN list. The missing fault codes will be added successively.

During initial vehicle testing, the entire diagnostic memory must always be read out and all the stored faults documented. This is important because troubleshooting involves disconnecting lines and components in the system, which leads to corresponding fault messages being set and stored. Consequently, the diagnostic memory should always be deleted after intermediate inspections. If parts have been exchanged, send a printout from MAN-cats verifying the fault together with the returned part in order to claim back the costs.

Other procedures are only permitted subject to consultation with the relevant MAN department!

Similarly, control units are only allowed to be exchanged under warranty subject to consultation with the relevant MAN department.

If a control unit has been exchanged unnecessarily, this action can only be cancelled within 14 calendar days by means of ex-factory parameterisation (subject to a charge). The procedure and processing are described in Service Information 265502.

Repeat the test and delete the diagnostic memory after correcting the error and checking the repair.

Always delete the diagnostic memory and observe the fault before replacing any component or control unit. If several faults are entered, always start with the test instructions which do not require components or control units to be replaced. Make sure the ignition is switched off before commencing repairs and replacing components or control units. If the ignition is not switched off, there will be entries in the corresponding control units.

Always test the lines in the following order:
– Discontinuity or contact resistance (e. g. receptacles bent open, connectors or receptacles pushed back or corroded plug and socket connections)
– Short circuit to negative
– Short circuit to positive
– Short circuit to adjacent lines
– Loose contacts
– Reverse polarity
– Water or moisture in the cable harness
Cable harnesses may be damaged or defective even if the corrugated hose appears undamaged on the outside!

Break the connection to the control unit before **measuring resistance values**.

Refer to the wiring diagrams for the vehicle in question!

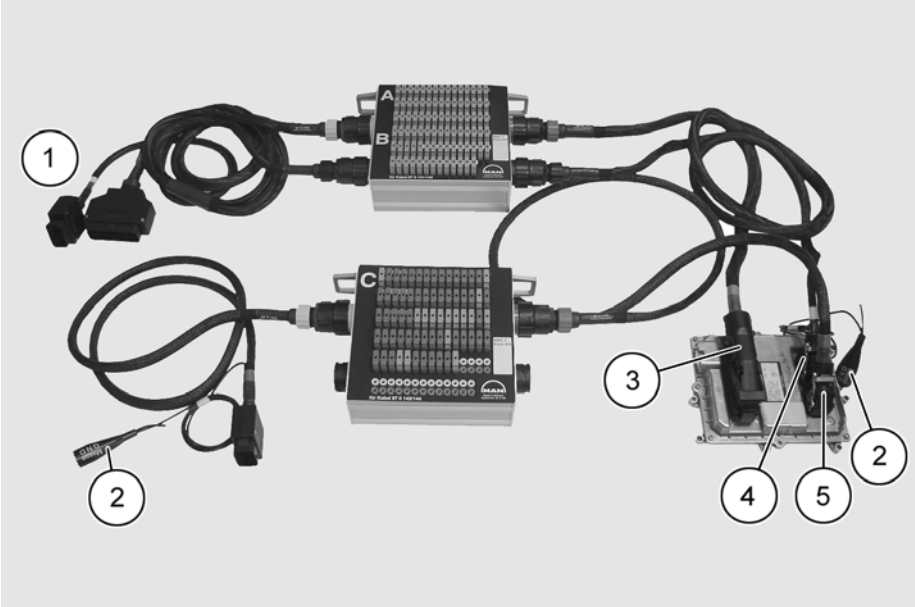
Please refer to the System Descriptions T 100 (HD-OBD) and T 110 (MAN AdBlue® System).

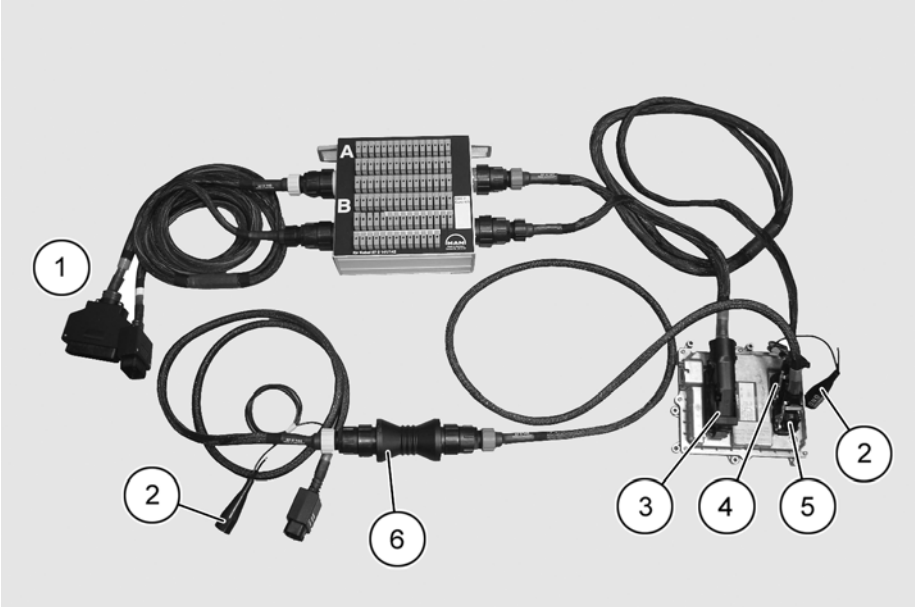
Use a test box (contact box) and an adapter wiring harness when performing tests relating to the control unit connector. The pin assignment on the control unit connector is identical to measuring sockets on the test box.

The test box and the accompanying test cables can be obtained from the Logistics Center. Test box item number: 80.99641-6027, item number for test cables incl. templates: 80.99641-6025.

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Test box with test cable





1 Connection, vehicle wiring harness
2 Ground terminals
3 Engine connector A
4 Vehicle connector B
5 Injector connector C
6 Adapter (alternative)

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SPN 81 EXHAUST GAS DIFFERENTIAL PRESSURE OR EXHAUST GAS RELATIVE PRESSURE physical

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1000, MIL on As of software version P362V42: PB2AE
Monitoring strategy:	Monitoring for loose contact or plausibility of the rate of change of exhaust pressure, excessive or insufficient exhaust pressure.
Effect of fault:	Output of a default value
Fault description:	FMI 1: Pressure too high FMI 2: Pressure too low FMI 11: Loose contact on the signal line Sensor defective
Note:	Please refer to Service Information 223302a

Refer to the wiring diagrams for the vehicle in question

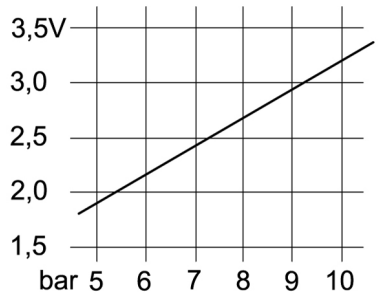
Test	Measurement	Remedy
Voltage supply	Voltage measurement between pin A41 and pin A59 **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new sensor – Fit a new control unit if no faults can be detected
Signal voltage	Voltage measurement between pin A78 and pin A59 **Desired value:** 0.40 - 0.70 V	

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SPN 94 FUEL SUPPLY PRESSURE

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring whether fuel supply pressure is in the normal range
Effect of fault:	Engine may stop, possibly lack of power
Fault description:	FMI 1: Fuel supply pressure **too high** because, e.g.: – Fuel filter clogged – Fuel pressure sensor defective – Overflow valve in the high-pressure pump does not deactivate FMI 2: Fuel supply pressure **too low** because, e.g.: – Tank breather blocked – Pre-filter blocked – Loose contact on the signal line – Air in the system – Fuel pressure at high-pressure pump feed too low due to defective pre-supply pump – Fuel system ran dry due to leakage when engine stationary – Pressure-relief valve defective FMI 3: Signal implausible FMI 11: Loose contact
Consequential fault:	Possibly SPN 3775-2. 3776, 3779
Note:	Please refer to Service Information 180911b

Refer to the wiring diagrams for the vehicle in question

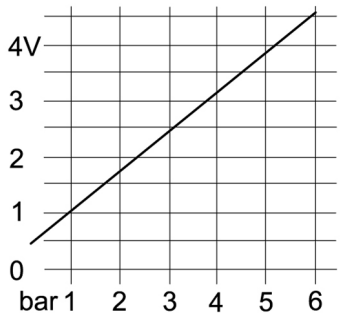
Test	Measurement	Remedy
Fuel system	Check according to hydraulic test step list	– Remedy fault in low-pressure circuit in accordance with hydraulic test step list
Fuel pressure sensor, voltage supply	Voltage measurement between pin A40 (+) and pin A37 (-) **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new fuel pressure sensor
Fuel pressure sensor, signal voltage	Voltage measurement between pin A20 (+) and pin A37 (-) **Nominal value:** 2.33 - 3.43 V 	

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SPN 100 OIL PRESSURE physical

Fault indication:	Central fault lamp **flashes continuously red** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring for insufficient oil pressure, loose contact or plausibility of rate of change of the oil pressure.
Effect of fault:	Danger of engine damage!
Fault description:	FMI 2: Pressure too low FMI 3: Signal implausible FMI 11: Loose contact on the signal line Sensor defective

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oil pressure	**Desired value:** 1.5 - 5.4 bar	– Check the oil level – Check the oil supply – Check for oil dilution
Oil pressure sensor, supply voltage	Voltage measurement between pin A24 (+) and pin A38 (-) **Desired value:** 4.75 - 5.25 V	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new oil pressure sensor
Oil pressure sensor, signal voltage	Voltage measurement between pin A21 (+) and pin A38 (-) **Desired value:** 1.96 - 4.81 V 	

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SPN 102 CHARGE PRESSURE DOWNSTREAM OF COOLER (in charge-air pipe), physical

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P0069, MIL off

Monitoring strategy: Monitoring for loose contact or plausibility of rate of change of charge pressure. Change compared to simulated charge pressure at temperature less than the specified threshold. Comparison with atmospheric pressure signal.

Effect of fault: Output of a simulated charge pressure as default value

Fault description: FMI 3: Signal implausible
FMI 8: Signal defective
FMI 11: Loose contact on the signal line
Charge-pressure sensor stuck (frozen), sensor defective
Intercooler blocked, charge air piping leak

Fault entries in other control units: Yes, vehicle management computer: SPN 3117 (CAN charge-pressure sensor not available)

Note: A simulated charge air pressure value is generally used instead. The driver receives the fault message; however, no restrictions are noticed unless the entire cooler is frozen, for example. Furthermore, SPN 102 does not have priority 2 in the case of all FMI (red fault lamp). A physical defect classification that reacts to an iced-up sensor (or even intercooler) is assigned priority 4 (i. e. no indication).

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Charge pressure	Pressure sensor pressurised using ALDA tester or Mitywac Duo hand pump (absolute pressure gauge) Measurement using MAN-cats with the engine stopped and the ignition switched on **Desired value:** 0 mbar	– Check that the sensor and intercooler are not iced up – Check the air cleaner – Check the charge pressure connection for leaks
Charge-pressure sensor, supply voltage	Voltage measurement between pin A25 (+) and pin A62 (-) **Desired value:** 4.75 - 5.25 V	– Check the signal for plausibility at idle speed using MAN-cats Monitoring and atmospheric pressure sensor – Check lines – Check plug connections – Fit new charge-pressure sensor
Charge-pressure sensor, signal voltage	Voltage measurement between pin A81 (+) and pin A62 (-) **Desired values:** 0.94 - 1.20 V at 0 bar 1.10 - 1.40 V at 0.2 bar	

Table of comparative values

Pressure in bar	- 0.5	0	0.5	1	1.5	2	2.5	3
Voltage in volts	0.50	1.07	1.64	2.21	2.78	3.35	3.93	4.50

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SPN 105 CHARGE AIR TEMPERATURE UPSTREAM OF CYLINDER INLET (downstream of EGR), physical

Fault indication:	None (priority 4) OBD fault P1004, MIL on
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of charge air temperature.
Effect of fault:	Output of a default value
Fault description:	Sensor defective FMI 1: Temperature too high FMI 2: Temperature too low FMI 11: Loose contact on the signal line

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin A76 and pin A57 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new charge air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin A76 and pin A57 **Desired value:** 4.2 - 2.2 V at 0 - 60 °C	
EGR flap	—	– EGR flap open (SPN 3004)

Table of desired values (tolerance ± 3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 108 ATMOSPHERIC PRESSURE physical

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of atmospheric pressure.
Effect of fault:	Output of a default value
Fault description:	Pressure compensation element on control unit damaged or blocked (painted over?) FMI 3: Signal implausible (rate of change), FMI 11: Loose contact

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Check the signal for plausibility at idle speed using MAN-cats Monitoring and charge-pressure sensor	– Fit a new control unit if no faults can be detected

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SPN 110 COOLANT TEMPERATURE physical

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P2BAC and possibly also P2BAE, depending on engine data record, MIL on
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of coolant temperature. Excessive or insufficient temperature.
Effect of fault:	Torque reduction if temperature too high EGR inactive
Fault description:	Sensor defective FMI 1: Temperature too high FMI 2: Temperature too low FMI 3: Temperature implausible FMI 11: Loose contact on the signal line (rate of change of temperature too high)

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, coolant, sensor resistance	Resistance measurement between pin A77 and pin A58 **Desired value:** 2.05 kΩ ±3% at 25 °C	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new temperature sensor
Temperature sensor, coolant, sensor voltage	Voltage measurement between pin A77 and pin A58 **Desired value:** 3.46 - 1.22 V at 30 - 90 °C	
Coolant circuit	—	– See engine repair manual

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 168 BATTERY VOLTAGE

Fault indication: Central fault lamp shows **steady yellow light** when stationary (priority 3)

Monitoring strategy: Monitoring of the voltage limits

Effect of fault: If the battery voltage drops below 8 V, the EDC control unit is deactivated.

Fault description: FMI 1: Battery voltage too high (> 32 V)
FMI 2: Battery voltage too low (< 16 V)

Fault entries in other control units: Yes, vehicle management computer and central on-board computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Voltage supply, EDC control unit	Voltage measurement between pins A01, A07, A12 and A13 (+) and pins A03, A09, A14 and A15 (-) **Desired value:** 20 - 28 V	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new control unit if no faults can be detected
Alternator	Voltage, output as per data sheet	– If defect classification, repair or fit new alternator
Battery	Charge level as per data sheet	– If defect classification, fit new battery

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SPN 171 AMBIENT AIR TEMPERATURE, physical

Fault indication: None (priority 4)

Monitoring strategy: Monitoring for loose contact or plausibility of rate of change of ambient air temperature. Excessive or insufficient temperature.

Effect of fault: If an electrical or physical defect is detected, the function provides a default value for the signal output value.

Fault description: Sensor defective
FMI 1: Temperature too high
FMI 2: Temperature too low
FMI 3: Signal implausible
FMI 11: Loose contact on the signal line

Note: The signal is provided by the vehicle management computer via the M-CAN.

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor	See System Description T 65, test step list for vehicle management computer	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Check the sensor for polarity reversal – Fit new sensor

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SPN 173 EXHAUST GAS TEMPERATURE UPSTREAM OF EXHAUST GAS AFTERTREATMENT, physical

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE and P1010, MIL on
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of exhaust gas temperature Excessive or insufficient temperature.
Fault description:	Sensor defective FMI 1: Temperature too high FMI 2: Temperature too low FMI 3: Signal implausible FMI 11: Loose contact on the signal line (rate of change of temperature too high)

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin B33 and pin B26 **Desired value:** 200 - 700 Ω	– Use MAN-cats Monitoring “Exhaust gas aftertreatment” to check the exhaust gas temperature – Check lines – Check plug connections – Check the sensor for polarity reversal – Fit new sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin B26 and pin A03 **Desired value:** >10 MΩ	
Exhaust gas temperature sensor, sensor voltage	Voltage measurement between pin B33 and pin B26 **Desired value:** 1.08 - 2.30 V at 20 - 700 °C	

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SPN 190 ENGINE SPEED

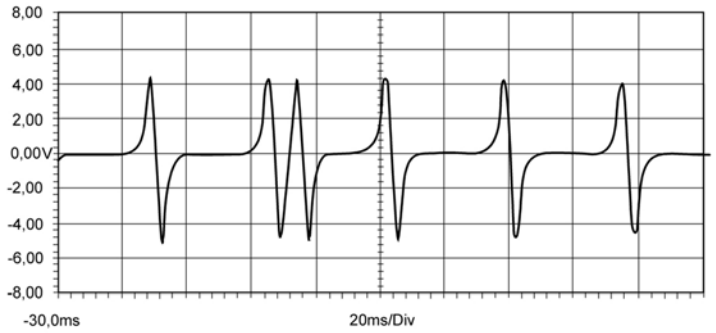
Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1500, MIL off
Monitoring strategy:	Monitoring of the camshaft and crankshaft speed path
Effect of fault:	Engine may not start or remain stationary
Fault description:	FMI 1: Signal too high FMI 3: Signal implausible (see note) FMI 4: No signal present FMI 8: Signal defective FMI 9: Device fault
Note:	If the engine is switched off and the ignition switched back on immediately or the ignition key is released before the engine catches, the coasting movement of the engine is incorrectly interpreted as turning in reverse and fault 190 is stored. This fault with FMI 3 and the environmental condition “Synchronisation status 12” and “Engine speed evaluation without function” can be ignored. There is no need to fit a new speed sensor.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Speed sensor, crankshaft	Resistance measurement between pin A73 and pin A55 **Desired value:** 750 - 1100 Ω	– Check the signal for plausibility using MAN-cats Monitoring and check the state of engine speed acquisition – Check lines – Check plug connections – Check the sensor for polarity reversal – Fit new engine speed sensor
Speed sensor, camshaft	Resistance measurement between pin A72 and pin A54 **Desired value:** 750 - 1100 Ω	
Speed signal	Signal test with oscilloscope **Desired value:** see oscilloscope curves	
Distance between speed sensor and flywheel	**Desired value:** 0.5 - 1.5 mm	– Correct the distance

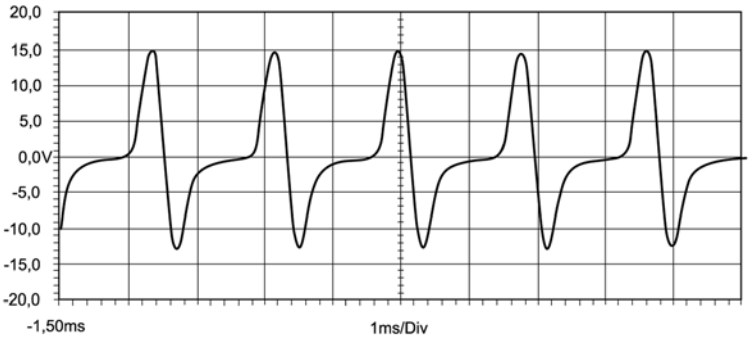
Oscilloscope curves

Camshaft speed sensor signal measured at 600 rpm between pin A72 and A54



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Crankshaft speed sensor signal measured at 600 rpm between pin A73 and A55



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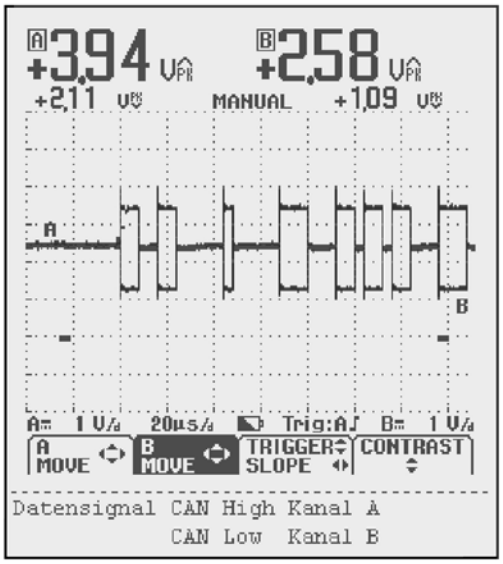
SPN 609 CAN MODULE 1

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring for busoff state, CAN module 1
Effect of fault:	EDC control unit goes into “Stand-alone mode” (i.e. engine cannot be accelerated beyond idling speed).
Fault description:	FMI 4: No signal present → Busoff state FMI 8: Signal defective → Error passive state FMI 9: Device error → DPRAM error during initialisation
Note:	In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
M-CAN databus	**Desired value:** see oscilloscope curve	



CAN High: Channel A
CAN Low: Channel B

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SPN 651 BANK 1 INJECTOR 1 (4-cylinder engine: Cylinder 1; 6-cylinder engine: Cylinder 1; 8-cylinder engine Master: Cylinder 1, Slave: Cylinder 5; 10-cylinder engine Master: Cylinder 1, Slave: Cylinder 6; 12-cylinder engine Master: Cylinder 1, Slave: cylinder 12)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1300, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short circuit can also be caused by oil in the injector wiring harness or control unit plug (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Run-up test TRUP	Start from MAN-cats and follow the instructions	– If there is a cable discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 652 BANK 2 INJECTOR 1 (4-cylinder engine: Cylinder 3; 6-cylinder engine: Cylinder 5; 8-cylinder engine Master: Cylinder 2, Slave: Cylinder 7; 10-cylinder engine Master: Cylinder 5, Slave: Cylinder 10; 12-cylinder engine Master: Cylinder 5, Slave: cylinder 8)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1301, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short-circuit can also be caused by oil in the injector wiring harness or control unit connector (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 653 BANK 1 INJECTOR 2 (4-cylinder engine: Cylinder 4; 6-cylinder engine: Cylinder 3; 8-cylinder engine Master: Cylinder 3, Slave: Cylinder 6; 10-cylinder engine Master: Cylinder 2, Slave: Cylinder 7; 12-cylinder engine Master: Cylinder 3, Slave: cylinder 10)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1302, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short-circuit can also be caused by oil in the injector wiring harness or control unit connector (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 654 BANK 2 INJECTOR 2 (4-cylinder engine: Cylinder 2; 6-cylinder engine: Cylinder 6; 8-cylinder engine Master: Cylinder 4, Slave: Cylinder 8; 10-cylinder engine Master: Cylinder 3, Slave: Cylinder 8; 12-cylinder engine Master: Cylinder 6, Slave: cylinder 7)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1303, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short-circuit can also be caused by oil in the injector wiring harness or control unit connector (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 655 BANK 1 INJECTOR 3 (6-cylinder engine: Cylinder 2; 10-cylinder engine Master: Cylinder 4, Slave: Cylinder 9; 12-cylinder engine Master: Cylinder 2, Slave: cylinder 11)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1304, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short-circuit can also be caused by oil in the injector wiring harness or control unit connector (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 656 BANK 2 INJECTOR 3 (6-cylinder engine: Cylinder 4; 12-cylinder engine Master: Cylinder 4, Slave: cylinder 9)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1305, MIL on
Monitoring strategy:	Check the current path between the control unit and the injector wiring harness for discontinuity, short-circuit or other electrical faults
Effect of fault:	Power loss, no fuel is injected into the cylinder concerned
Fault description:	FMI 1: Too high = Solenoid valve output stage short-circuit or other electrical fault A short-circuit can also be caused by oil in the injector wiring harness or control unit connector (especially in vehicles with high mileage) FMI 4: No signal present = Discontinuity (injector wiring harness), coil in injector defective
Note:	Although only one SPN is entered in the fault memory of the control unit, there may also be other cylinders in this cylinder bank that are affected. The system reacts to faults in different ways, depending on the version of the EDC control unit. These reactions are explained in more detail in the “SPN list” section.

Refer to the diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is discontinuity in a current path, only the defective injector is switched off, i.e. the run-up test (TRUP) can be performed and shows the affected current path – If there is a short circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 959 TIME/DATE: SECONDS INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No fault date and fault time information available

Fault description: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer and tachograph

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 960 TIME/DATE: MINUTES INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No date and time information available about the faults

Fault entries in other control units: Yes, vehicle management computer and tachograph

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 961 TIME/DATE: HOURS INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No date and time information available about the faults

Fault entries in other control units: Yes, vehicle management computer and tachograph (MTCO)

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 962 TIME/DATE: DAYS INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No date and time information available about the faults

Fault entries in other control units: Yes, vehicle management computer and tachograph

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 963 TIME/DATE: MONTHS INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No date and time information available about the faults

Fault entries in other control units: Yes, vehicle management computer and tachograph (MTCO)

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 964 TIME/DATE: YEARS INVALID

Fault indication: None (priority 4)

Monitoring strategy: Monitoring to check whether the vehicle management computer (FFR) sends a valid numerical value

Effect of fault: No date and time information available about the faults

Fault entries in other control units: Yes, vehicle management computer and tachograph

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Instrumentation	Check whether the time and mileage are indicated	– Troubleshooting in I-CAN and tachograph
Tachograph	Check for correct functioning	– Fit new tachograph if no faults can be detected
Vehicle management computer	Check parameterisation	– Fit new vehicle management computer if no faults can be detected

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SPN 1079 SUPPLY, RAIL PRESSURE SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1013, MIL on
Monitoring strategy:	Checking for short-circuit to ground or $+U_{bat}$ and discontinuity
Effect of fault:	Sensor may supply no values or incorrect values. Pressure limiting valve opens, engine keeps running with 800 bar rail pressure. Limiting: D08: 100 mg/stroke, D20: 150 mg/stroke, D26 and D28: 180 mg/stroke.
Fault description:	Sensor defective FMI 4: Supply line discontinuity FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Supply voltage, rail-pressure sensor	Voltage measurement between pin A43 and pin A61 **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new rail-pressure sensor – Fit a new control unit if no faults can be detected

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SPN 1080 SUPPLY, FUEL LOW PRESSURE, CHARGE PRESSURE, OIL PRESSURE AND EXHAUST GAS RELATIVE PRESSURE SENSOR

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1014, MIL off

Monitoring strategy: Checking for short-circuit to ground or $+U_{bat}$ and discontinuity

Effect of fault: Sensors supply incorrect values or no values

Fault description: Sensor defective
FMI 4: Supply line discontinuity
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$

Fault entries in other control units: Yes, vehicle management computer and central on-board computer

Note: If the supply voltage is too low (approx. 2.6 V), a short-circuit in the oxygen sensor could also be a possible fault cause.
Furthermore, the plug connection for the exhaust gas relative pressure sensor must be checked (even if no sensor is installed).

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Voltage supply, fuel pressure sensor	Voltage measurement between pin A40 and pin A37 **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new sensor – Fit a new control unit if no faults can be detected
Voltage supply, charge-pressure sensor	Voltage measurement between pin A25 and pin A62 **Desired value:** 4.75 - 5.25 V	
Voltage supply, oil pressure sensor	Voltage measurement between pin A24 and pin A38 **Desired value:** 4.75 - 5.25 V	
Voltage supply, exhaust gas relative pressure sensor	Voltage measurement between pin A41 and pin A59 **Desired value:** 4.75 - 5.25 V	

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SPN 1131 CHARGE AIR TEMPERATURE DOWNSTREAM OF COOLER (in charge-air pipe), physical

Fault indication:	None (priority 4)
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of charge air temperature
Effect of fault:	Output of a default value
Fault description:	Sensor defective FMI 1: Temperature too high FMI 2: Temperature too low FMI 3: Signal implausible (rate of change) FMI 11: Loose contact on the signal line

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin A70 and pin A62 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new charge air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin A70 and pin A62 **Desired value:** 4.2 - 2.2 V at 0 - 60 °C	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 2039 FFR 1: TIMEOUT

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring for receipt of vehicle management computer 1 (FFR1) message
Effect of fault:	EDC control unit goes into “Stand-alone mode” (i.e. engine cannot be accelerated beyond idling speed)
Fault description:	FMI 3: Signal implausible FMI 4: Timeout state, no receipt of FFR 1 message
Note:	In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω (see note)	

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SPN 3004 EGR CONTROLLER STEADY-STATE DEVIATION

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring for steady-state deviation
Effect of fault:	No EGR function
Fault description:	Desired flap position does not match the actual position. Compressed-air cylinder for the shut-off valve/flap defective or incorrectly set. FMI 1: EGR flap open FMI 2: EGR flap closed
Note:	Please refer to Service Information 169000 and 276700a

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EGR feedback (only if uncontrolled EGR is fitted)	Resistance measurement between pin A23 and A22 **Desired value:** < 2 Ω	– Perform actuator test with MAN-cats (does positioning cylinder extend?) – Check lines – Check plug connections – Fit new EGR controller – Fit a new control unit if no faults can be detected
EGR feedback in case of controlled EGR	Voltage measurement between pin A32 and A39 **Desired value:** 4.75 - 5.25 V (idling) Voltage measurement between pin A87 and A39 **Desired value:** 0.50 - 0.90 V (idling)	
EGR activation	Resistance measurement between pin A17 and A11 Desired value: 25 - 110 Ω	
EGR flap	Flap actuation ease of movement	– Repair or fit new EGR flap
Compressed air feed	—	– Check compressed air supply

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SPN 3007 DM4-REQUEST INVALID

Fault indication:	None (priority 4)
Monitoring strategy:	Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN
Effect of fault:	Fault memory cannot be read out on display via menu
Fault description:	Invalid vehicle management computer request to send a DM4 message (fault memory) FMI 8: Signal defective
Note:	In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L

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SPN 3009 ENGINE OVERREVVING

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Check to determine whether limit speed has been exceeded
Effect of fault:	Danger of engine damage! Injection is blocked until the speed has dropped below the specified threshold. Limiting: D20 and D26: 2800 rpm
Fault description:	Incorrect operation, driving error (e. g. incorrect gear selected) FMI 1: Speed too high

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle management computer	Read out trend data	– No further measures required

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SPN 3014 MAIN RELAY BLOCKED

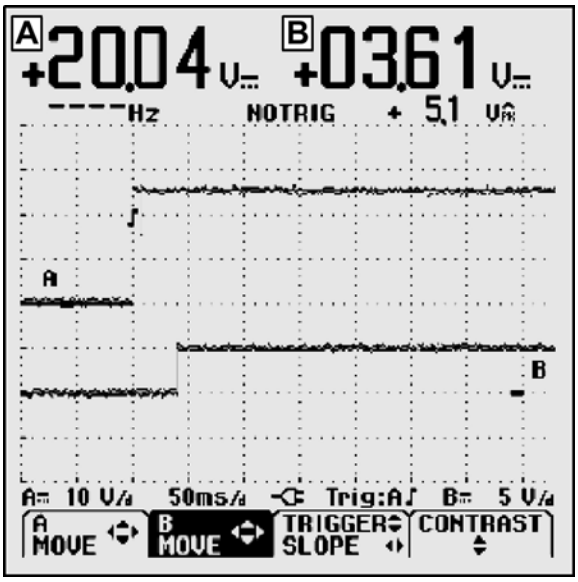
Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Fault if the control unit is still energised after a certain time following deactivation of terminal 15
Effect of fault:	Battery can discharge if vehicle left at standstill for a prolonged period of time
Fault description:	Main relay integrated in control unit defective FMI 2: Signal too low FMI 3: Signal implausible FMI 4: No signal present

Refer to the wiring diagrams for the vehicle in question

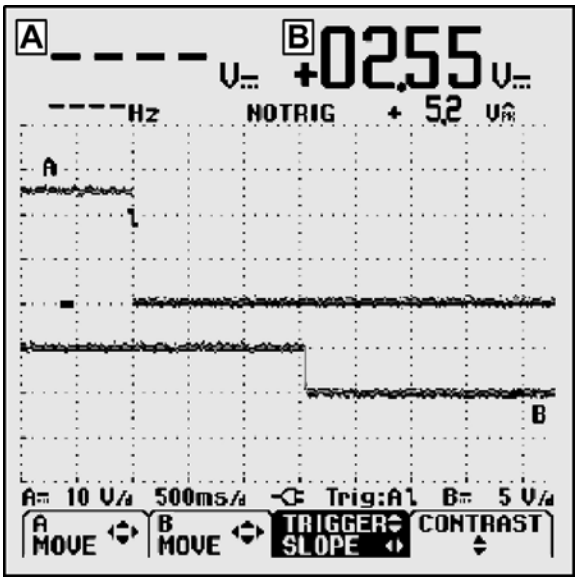
Test	Measurement	Remedy
Main relay in EDC control unit	Voltage measurement with ignition ON between pin B36 and A03 Ignition on **Desired value:** U_{bat} Ignition off **Desired value:** 0 V Voltage measurement, main relay, between pin A40 and A03 Ignition on **Desired value:** 4.74 - 5.25 V Ignition off **Desired value:** 0 V	– Check lines – Fit a new control unit if no faults can be detected

Note: When engine is stationary, pin A40 must switch to 0 V with a delay of 0.5 to 5 seconds after the ignition has been switched off

Ignition **ON**



Ignition **OFF**



Channel A: Ignition pin B36
Channel B: Main relay pin A40

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SPN 3016 FFR1: BIT ERROR ZERO QUANTITY DUE TO ENGINE BRAKE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: No engine brake function

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3017 FFR1: BIT ERROR DESIRED TORQUE

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Engine starts idling

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3018 FFR1: BIT ERROR MAXIMUM SPEED GOVERNOR PARAMETER ID

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Control parameter set “0” activated, possibly poor engine running characteristics at current governor settings

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3020 FFR1: BIT ERROR EDR DESIRED VALUE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Maximum speed reduction (EDR) is cancelled, engine can speed up slowly

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3022 FFR1: ZDR DESIRED VALUE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Engine does not go into ZDR mode (= intermediate speed governing)

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3023 FFR1: BIT ERROR REQUEST MEOS

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Request for MEOS (Momentary Engine Overspeed) is cancelled

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3024 FFR1: BIT ERROR REQUEST RAMPS OFF

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Ramps are reactivated

Fault description: FMI 1: Vehicle management computer sends invalid numerical value, gearbox control unit sends invalid value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3025 FFR1: CHECKING OF CHECK BITS (Reserved Bits and Bytes)

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN
Effect of fault:	None
Fault description:	FMI 1: Vehicle management computer sends no “1” in the check bits

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3029 FFR2: BIT ERROR IDLING DESIRED VALUE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Engine goes to EDC-internal idling speed

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3030 FFR2: BIT ERROR IDLING CONTROL PARAMETER ID

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Idling speed governor parameter set “0” is activated

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3031 FFR2: REQUESTED IDLING DESIRED VALUE TOO GREAT

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: Maximum possible idling speed (800 rpm) is achieved

Fault description: FMI 1: Vehicle management computer requests idling speed greater than 800 rpm

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3032 FFR2: BIT ERROR REQUEST STAND ALONE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: EDC goes into Stand-alone mode (= idling)

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3033 FFR2: BIT ERROR START REQUEST

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: No starter control

Fault description: FMI 1: Vehicle management computer sends invalid numerical value
Customer-specified module (via vehicle management computer) sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3034 FFR2: BIT ERROR REQUEST ENGINE STOP

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN
Effect of fault:	Engine is not stopped by vehicle management computer
Fault description:	FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3035 FFR2: CHECKING OF CHECK BITS (Reserved Bits and Bytes)

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: None

Fault description: FMI 1: Vehicle management computer sends no “1” in the check bits

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3038 FFR3: BIT ERROR VEHICLE STANDSTILL DETECTION

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: “Moving vehicle” is detected despite the fact that the vehicle is stationary
Control unit can only be programmed when CAN is interrupted
Run-up test and compression test not available

Fault description: FMI 1: Vehicle management computer sends invalid numerical value

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer (FFR)	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	
Parking brake	—	– Apply the parking brake
Instrumentation	MAN-cats diagnosis indication road speed	– Check tachograph and Kitas sensor

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SPN 3039 FFR3: CHECKING OF CHECK BITS (Reserved Bits and Bytes)

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Effect of fault: None

Fault description: Vehicle management computer sends no “1” in the check bits

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Vehicle data file	–	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	

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SPN 3045 ERROR, STARTER CONTROL

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of starter activation
Effect of fault:	Fault in starter path, it may not be possible to start the engine
Fault description:	FMI 3: Voltage drop in the battery too low during start

Fault entries in other control units:

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
IMR relay	Resistance measurement between pin A16 and pin A19 **Desired value:** 15 - 30 Ω	– Check lines – Check plug connections – Fit new IMR relay – Fit new starter – Fit a new control unit if no faults can be detected

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SPN 3046 ATMOSPHERIC PRESSURE SENSOR

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2226, MIL on
Monitoring strategy:	Monitoring of the atmospheric pressure sensor signal for voltage limits and AP blocking
Effect of fault:	If charge-pressure sensor is defective: Default value 1000 mbar, otherwise the same as the charge pressure at idling
Fault description:	FMI 4: No signal, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$
Note:	Also see SPN 108

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Control unit	Check the signal for plausibility at idle speed using MAN-cats Monitoring and charge-pressure sensor	– Fit a new control unit if no faults can be detected

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SPN 3063 AFTER-RUN NOT COMPLETE

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1504, MIL on
Monitoring strategy:	Monitoring to check whether the last two run-on operations were completed correctly
Effect of fault:	No faults can be stored in EDC
Fault description:	FMI 1: The last two run-on operations were not completed correctly
Consequential fault:	If the voltage supply connection is defective, this fault can also cause faults 3082, 3087 and 3751.
Note:	This fault also occurs if the vehicle is stopped too often using the electrical battery emergency off switch (fitted in vehicles for hazardous goods transport).

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Control unit voltage supply	Voltage measurement between pins A01, A07, A12 and A13 (+) and pins A03, A09, A14 and A15 (-) **Desired value:** 20 - 28 V	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new control unit if no faults can be detected

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SPN 3064 EDC STAND-ALONE MODE

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: Monitoring of the idling speed request from the vehicle management computer by central monitoring logic

Effect of fault: EDC control unit goes into “Stand-alone mode” (i.e. engine cannot be accelerated beyond idling speed)

Fault description: FMI 1: Communication with the vehicle management computer is not possible or the vehicle management computer is requesting stand-alone operation

Note: In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new vehicle management computer if no faults can be detected

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SPN 3076 IMMOBILISER ENABLE

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of pairing recognition between EDC and vehicle management computer
Effect of fault:	Starter turns, engine does not start
Fault description:	FMI 9: Immobiliser ID in vehicle management computer and EDC control unit do not match
Note:	This fault can also be caused by a faulty key transponder signal. Check fuse at slot 18 of the central electrical system (F376 or F628).

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle management computer/EDC pairing	MAN-cats diagnosis	– Correct pairing
Vehicle data file	MAN-cats parameterisation	– Check control unit parameterisation
Read coil	See vehicle management computer measurement	– Check lines – Check plug connections – Check fuse at slot 18 of the central electrical system – Fit new read coil – Try using another key – Fit a new vehicle management computer if no faults can be detected
Vehicle management computer (FFR)	Voltage measurement between pin X1/17 and X13 **Desired value:** > 8 V	

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SPN 3077 IMMOBILISER ENABLE

Fault indication:	Central fault lamp shows **steady read light** whilst driving and when stationary (priority 2) up to software version V43, priority 5 from V 44 onwards
Monitoring strategy:	Monitoring of pairing recognition between EDC and vehicle management computer
Effect of fault:	Starter turning, engine does not start
Fault description:	FMI 3: No quantity due to timeout when sending the vehicle management computer ID, i. e. the vehicle management computer does not detect a vehicle management computer ID within a defined time period

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle management computer/EDC pairing	MAN-cats diagnosis	– Check pairing and correct if necessary
Vehicle data file	MAN-cats parameterisation	– Check control unit parameterisation

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SPN 3081 BOOST PRESSURE GOVERNOR SHUT-OFF

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1018, MIL on
Monitoring strategy:	Monitoring for steady-state deviation of the charge pressure control
Effect of fault:	Speed reduced to 1800 rpm and torque reduction
Fault description:	FMI 3: Desired charge pressure cannot be set. Signal implausible
Note:	Please refer to Service Information 342200

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Turbocharger proportional valve	Resistance measurement between pin A02 and pin A04 **Desired value:** 80 - 100 Ω	– Check lines – Check plug connections (pin 1 and pin 2 on pulse valve must not be interchanged) – Check pulse valve (actuator test) and, if necessary, fit a new one
Compressed air feed Charge air lines	Check compressed air supply	– Check line from charge-air pipe to pulse valve for dirt and leaks
Turbocharger /wastegate	Functional check	– Pressurise control receptacle (wastegate) with approx. 2 bar and check for leaks – Check control rack for correct functioning at the same time – Fit new turbocharger/wastegate as necessary (see engine repair manual)

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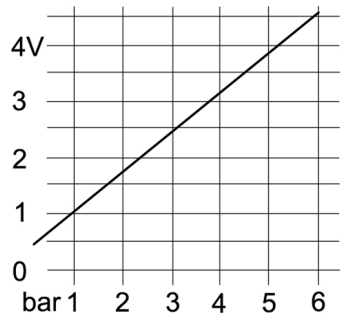
SPN 3082 PLAUSIBILITY, OIL PRESSURE SENSOR

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: When the engine is stationary, the oil pressure is checked to see if it is below a specified threshold or is falling.
When the engine is running and at operating temperature, a check is performed to determine whether two different engine speeds also produce two different oil pressure values.

Fault description: FMI 1: Engine stationary and oil pressure > 0.5 bar
FMI 3: Engine running at different speeds and oil pressure does not change

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oil pressure when the engine is running	**Desired value:** 1.5 - 5.4 bar The oil pressure must change when the engine speed changes	– Check the oil level – Check the oil circuit for leaks downstream of the oil pump – Check suction pipe at the oil pump – Check the oil cooler for blockage
Oil pressure when stationary	**Desired value:** > 0.5 bar	– Check the oil pressure sensor and renew as necessary
Oil pressure sensor, supply voltage	Voltage measurement between pin A24 (+) and pin A38 (-) **Desired value:** 4.75 - 5.25 V	– Check the signal for plausibility using MAN-cats Monitoring – Check lines (including ground lead in MP box) – Check plug connections – Fit a new oil pressure sensor
Oil pressure sensor, signal voltage	Voltage measurement between pin A21 (+) and pin A38 (-) **Desired value:** 1.96 - 4.81 V 	

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SPN 3083 PLAUSIBILITY, RAIL PRESSURE SENSOR

Fault indication: Central fault lamp shows **steady yellow light** when stationary (priority 3)
OBD fault P1020, MIL off

Monitoring strategy: Monitoring to check whether rail pressure falls to atmospheric pressure level when engine is stationary

Fault description: FMI 1: Sensor voltage too high when engine stationary
FMI 2: Sensor voltage too low when engine stationary

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Rail-pressure sensor supply voltage	Voltage measurement between pin A43 and pin A61 **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new rail-pressure sensor
Rail-pressure sensor signal voltage	Voltage measurement between pin A80 and pin A61 **Desired value:** 1.01 - 1.60 V	

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SPN 3086 EGR ADJUSTER POSITION, LIMIT POSITION

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3)
Monitoring strategy:	Monitoring of the voltage limits (supply voltage and sensor voltage) and AP blocking
Possible faults:	Exhaust gas recirculation flap defective or incorrectly set FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$
Fault description:	Please refer to Service Information 169000 and 276700a

Refer to the wiring diagrams for the vehicle in question

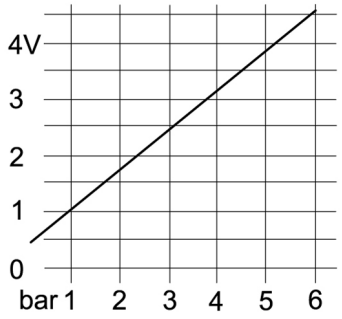
Test	Measurement	Remedy
EGR feedback (only if uncontrolled EGR is fitted)	Resistance measurement between pin A23 and A22 **Desired value:** < 2 Ω	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Check as per Service Information 169000 – Fit new EGR controller
EGR activation	Resistance measurement between pin A17 and A11 Desired value: 25 - 110 Ω	

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SPN 3087 OIL PRESSURE SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage) and AP blocking
Effect of fault:	Output default value 1 bar
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oil pressure sensor, supply voltage	Voltage measurement between pin A24 (+) and pin A38 (-) **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new oil pressure sensor – Also see SPN 1080
Oil pressure sensor, signal voltage	Voltage measurement between pin A21 (+) and pin A38 (-) **Desired value:** 1.96 - 4.81 V 	

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SPN 3088 CHARGE PRESSURE SENSOR DOWNSTREAM OF COOLER (in charge-air pipe)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1022, MIL off
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage) and AP blocking
Effect of fault:	Output of a simulated charge pressure as default value
Fault description:	Sensor defective FMI 3: Signal implausible FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground (see note) FMI 6: Short-circuit to $+U_{bat}$
Note:	If there is a turbo defect and the turbo no longer builds up charge pressure, this fault is indicated wrongly as FMI 5 (short-circuit to ground) and not as FMI 2 (charge pressure too low). This is misleading as, in this case, the fault is wrongly sought on the electrical side.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Charge-pressure sensor, supply voltage	Voltage measurement between pin A25 (+) and pin A62 (-) **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit a new charge-pressure sensor – Check the turbocharger (see note above and SPN 3081)
Charge-pressure sensor, signal voltage	Voltage measurement between pin A81 (+) and pin A62 (-) **Desired values:** 0.94 - 1.20 V at 0 bar 1.10 - 1.40 V at 0.2 bar	

Table of comparative values

Pressure in bar	- 0.5	0	0.5	1	1.5	2	2.5	3
Voltage in volts	0.50	1.07	1.64	2.21	2.78	3.35	3.93	4.50

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SPN 3089 CHARGE AIR TEMPERATURE SENSOR UPSTREAM OF CYLINDER INLET (downstream of EGR)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1023, MIL on
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage) and AP blocking
Effect of fault:	Output, default value
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, sensor resistance	Resistance measurement between pin A76 and pin A57 **Desired value:** see table	– Check lines – Check plug connections – Fit a new temperature sensor
Temperature sensor, sensor voltage	Voltage measurement between pin A76 and pin A57 **Desired value:** 4.2 - 2.2 V at 0 - 60 °C	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3091 COOLANT TEMPERATURE SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P2BAC, P2BAE and P0115, MIL on
Monitoring strategy:	Monitoring of the voltage limits (sensor voltage) and AP blocking
Effect of fault:	Output default value 100 °C Torque reduction 10% EGR inactive
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground between pin A77 and pin A03 FMI 6: Short-circuit to $+U_{bat}$ between pin A77 and pin A01 FMI 10: Sensor line discontinuity

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, sensor voltage	Voltage measurement between pin A77 and pin A58 **Desired value:** 3.46 - 1.22 V at 30 - 90 °C	– Check the coolant temperature using MAN-cats® Monitoring “Temperatures” – Check lines – Check plug connections – Fit a new temperature sensor

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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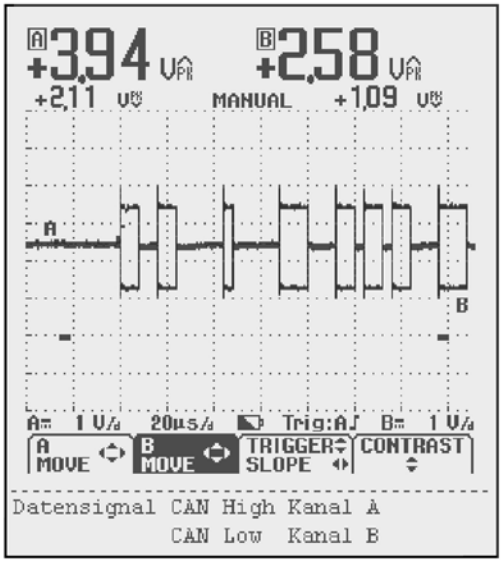
SPN 3092 TIME/DATE: TIMEOUT

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring for timeout of date information (day/month/year etc.)
Effect of fault:	No fault date and fault time information available. Variables are frozen to value before timeout
Fault description:	FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Fault entries in other control units: Yes, vehicle management computer and tachograph (MTCO)

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle data file	—	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer (FFR)	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	
Tachograph	Check for correct functioning	
M-CAN databus T-CAN databus I-CAN databus	**Desired value:** see oscilloscope curve	



CAN High: Channel A
CAN Low: Channel B

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SPN 3093 CHECKING OF CHECK BITS (TIME/DATE MESSAGE)

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

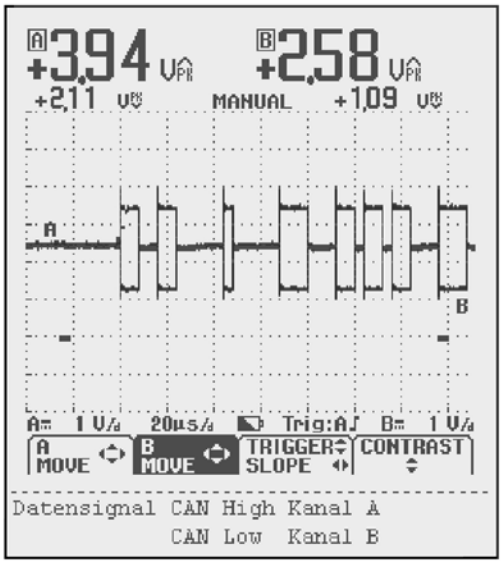
Monitoring strategy: Monitoring of messages that are sent in a defined time grid or on request on the vehicle management computer CAN

Fault description: FMI 1: Time/date message does not send a “1” to the reserved message locations

Fault entries in other control units: Yes, vehicle management computer

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Vehicle data file	—	– Check control unit parameterisation
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
Vehicle management computer (FFR)	Resistance measurement between pin X1/12 (CAN-L) and X1/10 (CAN-H) **Desired value:** ~60 Ω	
M-CAN databus T-CAN databus I-CAN databus	**Desired value:** see oscilloscope curve	



CAN High: Channel A
CAN Low: Channel B

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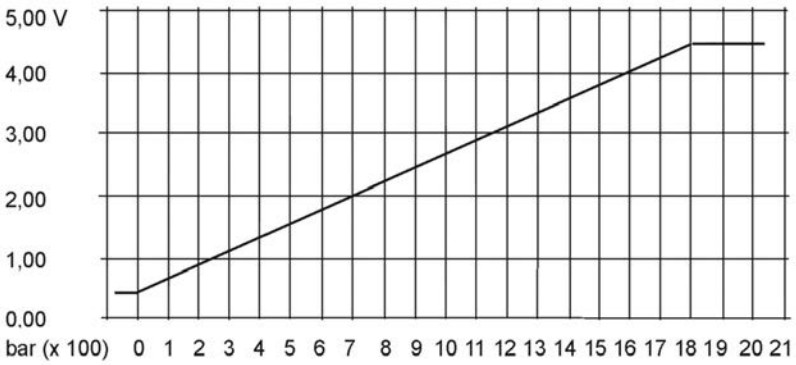
SPN 3099 RAIL PRESSURE SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P0190, MIL on
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage) and AP blocking
Effect of fault:	Pressure limiting valve opens, engine keeps running with 800 bar rail pressure. Limiting: D08: 2000 rpm; 100 mg/stroke, D20: 130-150 mg/stroke, D26: 180 mg/stroke
Fault description:	Sensor defective FMI 1: Rail pressure too high FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Rail-pressure sensor supply voltage	Voltage measurement between pin A43 and pin A61 **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new rail-pressure sensor – If no fault can be detected, determine the reason for the opening of the pressure limiting valve as per the hydraulic test step list
Rail-pressure sensor signal voltage	Voltage measurement between pin A80 and pin A61 **Desired value:** 1.01 - 1.60 V	

Sensor curve

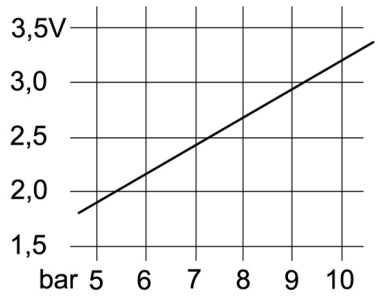


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SPN 3100 FUEL PRESSURE SENSOR (LOW-PRESSURE)

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3)
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage) and AP blocking
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Fuel pressure sensor, voltage supply	Voltage measurement between pin A40 (+) and pin A37 (-) **Desired value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new fuel pressure sensor
Fuel pressure sensor, signal voltage	Voltage measurement between pin A20 (+) and pin A37 (-) **Desired value:** 2.33 - 3.43 V 	

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SPN 3671 ERROR DURING EEPROM READING

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3) OBD fault P1501, MIL on
Monitoring strategy:	Monitoring of the storage procedure in running-on
Effect of fault:	Fault memory and learned data of EDC cannot be stored during control unit run-on
Fault description:	FMI 9: EEPROM checksum check defective because EEPROM defective or saving (fault memory etc.) was interrupted during last after-run.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Check run-on	—	– See test for main relay (SPN 3014)
EDC control unit	—	– Fit new control unit (only after consultation with the department responsible)

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SPN 3673 CAN MODULE 2 (OBD-CAN or Master-Slave CAN)

Fault indication:	**OBD-CAN:** Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) **Master-Slave CAN:** Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1510, MIL on
Monitoring strategy:	Monitoring of CAN module 2 (OBD-CAN for in-line engine or Master-Slave CAN for V engine)
Effect of fault:	**OBD-CAN:** No communication with OBD socket **Master-Slave CAN:** Slave control unit blocks injection quantity, engine keeps running with one bank of cylinders (output halved)
Fault description:	CAN module 2 Busoff state FMI 4: No signal present FMI 8: Signal defective FMI 9: Device fault
Note:	In in-line engines, the OBD-CAN is on pin B25 and pin B32. In V engines with MAN AdBlue® system, the OBD-CAN is on pin B25 and pin B32 of the **Slave** control unit. The A-CAN (exhaust gas aftertreatment CAN) is on pin B25 and Pin B32 of the **Master** control unit. In in-line engines with MAN AdBlue® system, the A-CAN is on pin B27 and pin B45.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
CAN connection to OBD socket	Resistance measurement between pin B25 (OBD-CAN-H) and pin B32 (OBD-CAN-L) **Desired value:** 115 - 125 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L
Master-Slave CAN	Resistance measurement between pin B27 of the Master control unit and pin B27 of the Slave control unit (CAN2-H) and between pin B45 of the Master control unit and pin B45 of the Slave control unit (CAN2-L) **Desired value:** < 2 Ω	
MAN-cats® Interface T200	See Service Bulletin 1383SM, Supplement 8	– See Service Bulletin 1383SM, Supplement 8

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SPN 3676 DEFECTIVE REDUNDANT SHUT-OFF DEVICE (TEST DURING AFTER-RUN)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1511, MIL on
Monitoring strategy:	Checking of output stage shut-off to the injectors in run-on
Effect of fault:	The engine stops
Fault description:	FMI 9: Overvoltage protection defective

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– Fit new control unit (only after consultation with the department responsible)

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SPN 3678 BOOSTER VOLTAGE CAPACITOR BANK 1

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
OBD fault P1306, MIL on

Monitoring strategy: Monitoring of the booster voltage of the bank 1 injectors for voltage limits, short-circuit and plausibility

Effect of fault: No injection in the cylinder concerned

Fault description: Bank 1 injectors not working, electrical discontinuity
FMI 1: Signal too high
FMI 2: Signal too low
FMI 3: Signal implausible
FMI 4: No signal present
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$
FMI 8: Signal defective

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is a line discontinuity in a current path, only the defective injector is switched off, i.e. the rev-up test (TRUP) can be performed and shows the affected current path – If there is a short-circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 3679 BOOSTER VOLTAGE CAPACITOR BANK 2

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
OBD fault P1307, MIL on

Monitoring strategy: Monitoring of the booster voltage of the bank 2 injectors for voltage limits, short-circuit and plausibility

Effect of fault: No injection in the cylinder concerned

Fault description: Bank 2 injectors not working, electrical discontinuity
FMI 1: Signal too high
FMI 2: Signal too low
FMI 3: Signal implausible
FMI 4: No signal present
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$
FMI 8: Signal defective

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Activation, injector	Check signal shape using clamp-on probe (idling)	– Check injector plausibility with MAN-cats Monitoring “Status of injectors” – Check cylinder assignment – Check lines (including under valve cover) – Check plug/screw connections (including under valve cover) – Fit a new control unit if no faults can be detected
Injector coil resistance	Resistance measurement in accordance with test step list **Desired value:** < 2 Ω	– Fit new injector
Rev-up test TRUP	Start from MAN-cats and follow the instructions	– If there is a line discontinuity in a current path, only the defective injector is switched off, i.e. the rev-up test (TRUP) can be performed and shows the affected current path – If there is a short-circuit in a current path to an injector, all injectors in the affected bank are switched off, i.e. a 6-cylinder in-line engine then only runs on three cylinders. TRUP is aborted with a fault message because the engine is then only running on two cylinders

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SPN 3687 PRESSURE LIMITING VALVE DOES NOT OPEN

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P1028, MIL on
Monitoring strategy:	Monitoring to check whether pressure limiting valve opens
Effect of fault:	The engine stops
Fault description:	FMI 9: Pressure limiting valve is mechanically blocked
Consequential fault:	This fault can occur in conjunction with SPN 3099.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Pressure limiting valve	—	– Check that the return line is clear – Fit a new pressure limiting valve

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SPN 3693 BOOSTER VOLTAGE

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of output stages
Effect of fault:	Possible problems with pre-injection, main injection or post-injection (engine noise, performance) As fault detection mostly occurs when the engine is started (see speed for the boundary conditions in the fault memory), this fault is not critical
Fault description:	Insufficient voltage for injector activation FMI 1: Signal too high FMI 2: Signal too low FMI 3: Signal implausible FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 8: Signal defective
Consequential fault:	This fault can also be a consequential fault of SPN 651, 652, 653, 654, 655 and 656. Remedy these faults first.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Voltage supply, EDC control unit	—	– See test for battery voltage (SPN 168) – Fit a new control unit if no faults can be detected

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SPN 3732 DEFECT CLASSIFICATION FOR INITIALISATION

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3) OBD fault P1512, MIL on
Monitoring strategy:	Monitoring of the test device for the overvoltage test
Fault description:	FMI 1: Internal test device for overvoltage test in EDC control unit defective

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
EDC control unit	—	– Fit new control unit (only after consultation with the department responsible)

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SPN 3735 EDC-INTERNAL TEMPERATURE

Fault indication:	None (priority 4)
Monitoring strategy:	Monitoring of EDC internal temperature (voltage limits and AP blocking)
Effect of fault:	Output default value 60 °C
Fault description:	FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– No measures necessary

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SPN 3736 OUTPUT STAGE SHUT-OFF BY EDC HARDWARE

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1514, MIL on

Monitoring strategy: Monitoring of the output stages for faults in watchdog communication

Effect of fault: The engine stops

Fault description: FMI 1: Overvoltage
FMI 8: Signal defective
FMI 9: Device fault

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– Fit new control unit (only after consultation with the department responsible)

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SPN 3737 INITIALISATION IN MASTER/SLAVE MODE

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of Master and Slave control unit when ignition on
Effect of fault:	Engine may not start
Fault description:	FMI 3: Signal implausible
Note:	This fault is generally due to incorrect operation by the driver. Faults occur if there is an insufficient time span between ignition “off” and “on” and if the Master and the Slave control units are not yet finished with the mutual reset. The data record for newer control units has already been optimised in this respect (also see SPN 3773)

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SPN 3745 HIGHSIDE OUTPUT STAGE, BOOST PRESSURE CONTROL

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1036, MIL off
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
Effect of fault:	Speed reduced to 1800 rpm and torque reduction
Fault description:	Proportional valve (pulse valve) defective FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 10: Discontinuity
Consequential fault:	Possible consequential fault of SPN 3081

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Turbocharger proportional valve	Resistance measurement between pin A02 and pin A04 **Desired value:** 80 - 100 Ω	– Check lines – Check plug connections – Check the proportional valve and renew as necessary – Fit a new control unit if no faults can be detected

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SPN 3746 HIGHSIDE OUTPUT STAGE, EXHAUST GAS RECIRCULATION

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1037 and P2BAC, MIL on
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
Effect of fault:	Shut-off of output stage (reversible), pressure limiting valve opens, engine keeps running at 800 bar rail pressure. Limiting: D20: 150 mg/stroke, D26: 180 mg /stroke No EGR function
Fault description:	EGR positioning cylinder (Euro 3) or E-EGR proportional valve (Euro 4) defective FMI 4: No signal present FMI 5: Short-circuit to ground between pin A17 and pin A03 FMI 6: Short-circuit to $+U_{bat}$ between pin A17 and pin A01 FMI 10: Discontinuity

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EGR positioning cylinder	Resistance measurement between pin A17 and A11 **Desired value:** 80 - 110 Ω	– Perform actuator test with MAN-cats (does positioning cylinder extend?) – Check lines – Check plug connections – Fit new EGR controller – Fit a new control unit if no faults can be detected
Proportional valve E-EGR	Resistance measurement between pin A17 and A11 **Desired value:** 25 - 110 Ω	– Check lines – Check plug connections – Check the proportional valve and renew as necessary – Fit a new control unit if no faults can be detected

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SPN 3748 HIGHSIDE, OUTPUT STAGE, METERING UNIT

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P1038, MIL on
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
Effect of fault:	Shut-off of output stage (reversible), pressure limiting valve opens, engine keeps running at 800 bar rail pressure. Limiting: D20: 150 mg/stroke, D26: 180 mg /stroke
Fault description:	FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 10: Discontinuity
Note:	After the fault has been remedied, the engine must be running correctly before the fault can be classified as passive and deleted.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Metering unit (MProp)	Resistance measurement between pin A08 and A10 **Desired value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections – Fit new MProp – Fit a new control unit if no faults can be detected

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SPN 3751 HIGHSIDE, OUTPUT STAGE, STARTER RELAY (IMR)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
Effect of fault:	Possibly no engine start
Fault description:	FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
IMR relay	Resistance measurement between pin A16 and pin A19 Desired value: 15 - 30 Ω	– Check lines – Check plug connections – Fit new IMR relay – Fit new starter – Fit a new control unit if no faults can be detected

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SPN 3752 CAMSHAFT SPEED SENSOR (SEGMENT SENSOR)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1517, MIL off
Monitoring strategy:	Monitoring of the speed signals
Effect of fault:	Poor engine starting
Fault description:	FMI 1: Signal too high FMI 3: Signal implausible (incorrect pulse sequence (interference) FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 8: Signal defective
Note:	Also see SPN 190

Refer to the wiring diagrams for the vehicle in question

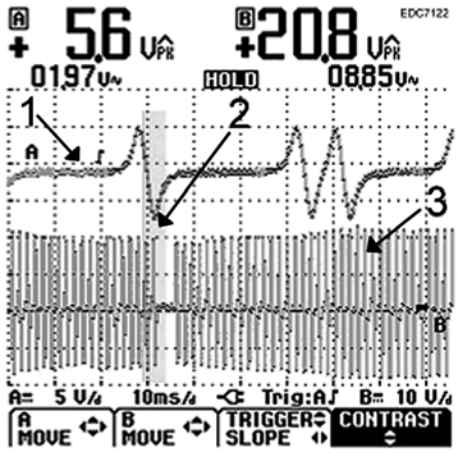
Test	Measurement	Remedy
Speed sensor, camshaft	Resistance measurement between pin A72 and pin A54 **Desired value:** 750 - 1100 Ω	– Check the signal for plausibility using MAN-cats Monitoring and check the state of engine speed acquisition – Check lines – Check plug connections – Check the sensor for polarity reversal – Fit new engine speed sensor – Check the camshaft gear (pins for speed detection are in the wrong position, loose or missing) – Fit a new control unit if no faults can be detected
Speed signal	Signal test with oscilloscope **Desired value:** see oscilloscope curves	
Distance between engine speed sensor and pulse-generating wheel	**Desired value:** 0.5 - 1.5 mm	– Correct the distance

Camshaft speed sensor signal measured at 600 rpm between pin A72 and A54

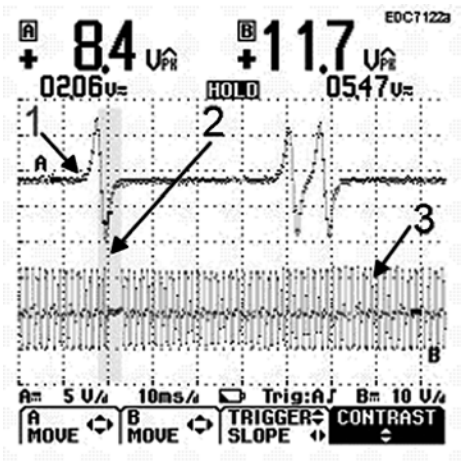
The following pictures show superimposed speed signals, in which case the correct phase offset can be seen.

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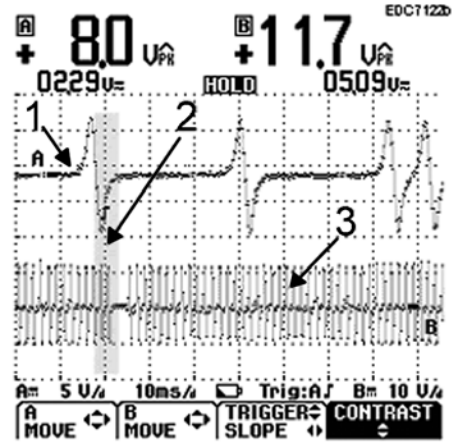
Signal, speed sensor, camshaft and crankshaft, D28/D20/D26



Signal, speed sensor, camshaft and crankshaft, D08 4-cylinder



Signal, speed sensor, camshaft and crankshaft, D08 6-cylinder



1 Speed sensor, camshaft
2 Synchronisation
3 Speed sensor, crankshaft

Note: Attention must be paid to the synchronisation between the camshaft speed sensor and the crankshaft speed sensor. Incorrect setting of the of the sensor gear of the camshaft to the crankshaft can be detected by these mismatched signals.

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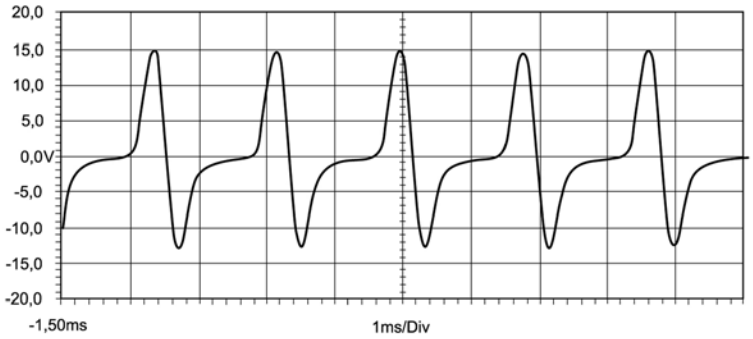
SPN 3753 CRANKSHAFT SPEED SENSOR (INCREMENT SENSOR)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1518, MIL off
Monitoring strategy:	Monitoring of the speed signals
Effect of fault:	None
Fault description:	FMI 1: Signal too high FMI 3: Signal implausible (incorrect pulse sequence (interference) FMI 4: No signal present FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$ FMI 8: Signal defective
Note:	Also see SPN 190

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Speed sensor, crankshaft	Resistance measurement between pin A73 and pin A55 **Desired value:** 750 - 1100 Ω	– Check the signal for plausibility using MAN-cats Monitoring and check the state of engine speed acquisition – Check lines – Check plug connections – Check the sensor for polarity reversal – Check flywheel for damage and correct hole pattern – Fit new engine speed sensor – Fit a new control unit if no faults can be detected
Speed signal	Signal test with oscilloscope **Desired value:** see oscilloscope curves	
Distance between speed sensor and flywheel	**Desired value:** 0.5 - 1.5 mm	– Correct the distance

Crankshaft speed sensor signal at 600 rpm measured between pin A73 and A55



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SPN 3754 WATCHDOG FAULT SYSTEM START

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P1519, MIL off
Monitoring strategy:	Monitoring of the injector output stages
Effect of fault:	Engine stops / engine start not possible
Fault description:	FMI 9: Watchdog test failed. At least one injector output stage cannot be shut off by the monitoring routine

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
EDC control unit	—	– Fit new control unit (only after consultation with the department responsible)

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SPN 3755 PLAUSIBILITY CHECK, FUEL LOW-PRESSURE

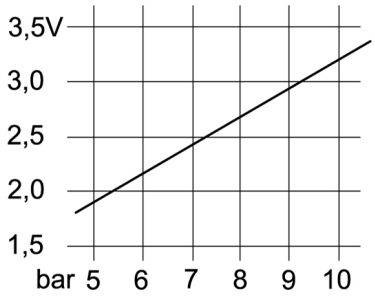
Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: Monitoring for sticking sensor
When the engine is stopped, the fuel supply pressure is checked to see if it is below a threshold or, if not, if the pressure is falling. When the engine is running at operating temperature, a check is performed to see whether two different engine speeds also produce two different pressure values

Fault description: FMI 1: Signal too high
FMI 3: Signal implausible

Note: Fault mostly occurs during starting after system has emptied (see speed in fault memory boundary conditions)

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– Remedy fault in low-pressure circuit in accordance with hydraulic test step list
Fuel pressure sensor, voltage supply	Voltage measurement between pin A40 (+) and pin A37 (-) **Nominal value:** 4.75 - 5.25 V	– Check lines – Check plug connections – Fit new fuel pressure sensor
Fuel pressure sensor, signal voltage	Voltage measurement between pin A20 (+) and pin A37 (-) **Nominal value:** 2.33 - 3.43 V 	

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SPN 3756 SUPPLY VOLTAGE, EGR FEEDBACK

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3)
Monitoring strategy:	Monitoring of the sensor supply voltages for short-circuit to ground or U_{bat} and discontinuity
Effect of fault:	Sensor supplies no values or incorrect values
Fault description:	FMI 4: No signal present (discontinuity) FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EGR feedback in case of controlled EGR	Voltage measurement between pin A32 and pin A39 **Desired value:** 4.75 - 5.25 V (idling speed) Voltage measurement between pin A87 and pin A39 **Desired value:** 0.50 - 0.90 V (idling speed)	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new EGR controller

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SPN 3773 MASTER/SLAVE OPERATING MODE CHANGE ERROR

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3)
Monitoring strategy:	Checking of operating mode between Master and Slave control unit
Effect of fault:	Engine may not start
Fault description:	FMI 3: Signal implausible
Note:	This fault is generally due to incorrect operation by the driver. Faults occur if there is an insufficient time span between ignition “off” and “on” and if the Master and the Slave control units are not yet finished with the mutual reset. The data record for newer control units has already been optimised in this respect (also see SPN 3737)

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SPN 3775 RAIL PRESSURE MONITORING

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P0087, MIL on
Monitoring strategy:	Monitoring for excessive or insufficient rail pressure
Effect of fault:	Rail pressure too high: Pressure limiting valve forced open Rail pressure too low: Engine can stop due to missing rail pressure Limiting D08: 2000 rpm, 100 mg/stroke, Limiting D20: 130-150 mg/stroke Limiting D26: 180 mg/stroke
Fault description:	FMI 1: Rail pressure too high FMI 2: Rail pressure too low
Note:	Check vehicle electrical system voltage: voltage peaks or voltage drops can cause impermissible rail pressure fluctuations.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Desired value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections – Fit new metering unit
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 252400	– Flash the control unit

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SPN 3776 POSITIVE RAIL PRESSURE SYSTEM DEVIATION

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P0087, MIL on
Monitoring strategy:	Monitoring of the rail pressure, insufficient rail pressure cannot be corrected
Effect of fault:	Problems in the fuel supply. Engine can stop Limiting D08: 100 mg/stroke Limiting D20: 130 - 150 mg/stroke Limiting D26: 180 mg/stroke
Fault description:	FMI 1: Rail pressure too high

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 334700	– Flash the control unit

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SPN 3777 NEGATIVE RAIL PRESSURE SYSTEM DEVIATION

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P1044, MIL on
Monitoring strategy:	Monitoring of the rail pressure, excessive rail pressure cannot be corrected
Effect of fault:	Problems in the fuel return. Pressure limiting valve can open
Fault description:	FMI 1: Rail pressure too high
Note:	Check vehicle electrical system voltage: voltage peaks or voltage drops can cause impermissible rail pressure fluctuations. In the case of systems with fuel-lubricated high-pressure pumps, all faults in which the pressure limiting valve is forced open can also be caused by a blocked return line (e.g. kinked line etc.) to the fuel tank.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Desired value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections – Fit new metering unit
EDC control unit	Test as per Service Information 334700	– Flash the control unit

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SPN 3778 RAIL PRESSURE: LEAKAGE UNDER OVERRUN/TRAILING THROTTLE CONDITIONS

Fault indication: Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1)

Monitoring strategy: Monitoring for leakage in the high-pressure hydraulic system under overrun /trailing throttle conditions

Effect of fault: Pressure limiting valve can open
Limiting D08: 100 mg/stroke
Limiting D20: 130 - 150 mg/stroke
Limiting D26: 180 mg/stroke

Fault description: FMI 1: Rail pressure too high
FMI 10: Discontinuity

Note: In the case of systems with fuel-lubricated high-pressure pumps, all faults in which the pressure limiting valve is forced open can also be caused by a blocked return line (e.g. kinked line etc.) to the fuel tank.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Desired value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections – Fit new metering unit
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 334700	– Flash the control unit

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SPN 3779 RAIL PRESSURE: LEAKAGE DUE TO QUANTITY COMPENSATION

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1)
Monitoring strategy:	Monitoring for leakage in high-pressure hydraulic system
Effect of fault:	High-pressure side leaking, engine can stop, lack of power, risk of fire Limiting D08: 100 mg/stroke Limiting D20: 130 - 150 mg/stroke Limiting D26: 180 mg/stroke
Fault description:	FMI 1: Rail pressure too high FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Desired value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections – Fit new metering unit
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 334700	– Flash the control unit

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SPN 3780 RAIL PRESSURE: HIGH CONTROLLER OUTPUT IDLING

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1)
Monitoring strategy:	Monitoring for rail pressure controller idling
Fault description:	Engine can stop
Possible faults:	FMI 1: Controller output too high

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Nominal value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 334700	– Flash the control unit

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SPN 3781 PRESSURE LIMITING VALVE OPEN

Fault indication:	Central fault lamp **flashes red** whilst driving and when stationary, stop indication on display (priority 1) OBD fault P1048, MIL on
Monitoring strategy:	Monitoring for open pressure limiting valve
Effect of fault:	Rail pressure limited to 700 - 900 bar Limiting D08: 100 mg/stroke Limiting D20: 150 mg/stroke Limiting D26: 180 mg/stroke
Fault description:	FMI 1: Rail pressure too high
Note:	In the case of systems with fuel-lubricated high-pressure pumps, all faults in which the pressure limiting valve is forced open can also be caused by a blocked return line (e.g. kinked line etc.) to the fuel tank.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Fuel system	Check according to hydraulic test step list	– See hydraulic test step list
Metering unit (MProp)	Resistance measurement between pin A08 and pin A10 **Nominal value:** 2.5 - 4.5 Ω	– Check lines – Check plug connections
Rail-pressure sensor	Check the plug connection on the sensor for loose contact	– Repair or fit a new connector – Fit new rail-pressure sensor
EDC control unit	Test as per Service Information 298100 and 334700	– Flash the control unit

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SPN 3782 FUEL SUPPLY PRESSURE DYNAMIC

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3)
Monitoring strategy:	Monitoring for fluctuating supply pressure
Effect of fault:	Possible lack of power
Fault description:	Possibly air in the system FMI 1: Signal too high

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Fuel pressure	Check according to hydraulic test step list	– See hydraulic test step list – Compare sensor fuel pressure with external pressure measuring point – If pressure measuring point shows no fluctuations compared to the sensor: Fit new sensor – If both measuring points show fluctuations: Check pre-supply pump
Fuel filter	Check filter	– Fit new filter
Fuel pressure sensor, voltage supply	Voltage measurement between pin A40 (+) and pin A37 (-) **Desired value:** 4.75 - 5.25 V	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new fuel pressure sensor – Fit a new control unit if no faults can be detected
Fuel pressure sensor, signal voltage	Voltage measurement between pin A20 (+) and pin A37 (-) **Desired value:** 2.33 - 3.43 V	
High-pressure pump	Check overflow valve in the high-pressure pump	– See hydraulic test step list

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SPN 3785 MONITORING OF PARTICULATE FILTER/PM CATALYTIC CONVERTER

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1522, P2BAE, MIL on
Monitoring strategy:	Monitoring for exhaust gas differential pressure too high or too low
Fault description:	Pressure measuring hoses at exhaust gas differential pressure sensor interchanged (CRT filter) FMI 1: Too high: CRT filter /PM cat. blocked FMI 2: Too low: CRT filter/PM cat. not fitted or burned
Note:	This fault also occurs with FMI 1 if the cable capacity is too high, e.g. due to lengthening of the cable due to vehicle conversions. Please refer to Service Information 223302a, 225100, 241800, 246100, 327500a, 333200 and the notes on current topics 3306AT and 3308AT.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
PM catalytic converter	Check for presence or blocking	– Clear and check the PM cat. as per notes on current topics 3306AT – Fit new PM catalytic converter
CRT filter	Check for presence or blocking	– Clean or fit a new CRT filter as per Service Information 46000a and 225100
Exhaust gas differential pressure sensor (CRT filter)	Check whether pressure measuring hoses are interchanged	– Correct them if they are interchanged
Exhaust gas differential pressure sensor / exhaust gas relative pressure sensor, voltage supply	Voltage measurement between pins A41 and A59 **Desired value:** 4.75 - 5.25 V (idling speed)	– Check lines – Check plug connections – Fit new sensor
Exhaust gas differential pressure sensor / exhaust gas relative pressure sensor, signal voltage	Voltage measurement between pins A78 and A59 **Desired value:** 0.40 - 0.70 V (idling speed)	
EDC control unit	Check as per Service Information 225100, 241800a, 246100, 327500a, 333200 and notes on current topics 3308AT	– Flash the control unit – Load FUP as per Service Information 333200

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SPN 3789 EXHAUST GAS DIFFERENTIAL OR EXHAUST GAS RELATIVE PRESSURE SENSOR

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1049, MIL on, PB2AE from software version P362 V42 onwards
Monitoring strategy:	Monitoring of voltage limits and AP blocking
Effect of fault:	Output of a default value
Fault description:	Sensor defective, wiring defective FMI 1: “Differential pressure when engine stationary” signal too high FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$
Note:	Please refer to Service Information 223302a

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Pressure sensor, voltage supply	Voltage measurement between pins A41 and A59 **Desired value:** 4.75 - 5.25 V (idling speed)	– Check lines – Check plug connections – Fit new sensor
Pressure sensor, signal voltage	Voltage measurement between pins A78 and A59 **Desired value:** 0.40 - 0.70 V (idling speed)	

Table of measurements

Pressure in kPa	0.0	5.0	10	15	20	30	40	50	65
Voltage in volts	0.50	0.90	1.30	1.70	2.10	2.90	3.70	4.50	4.50

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SPN 3790 EXHAUST GAS DIFFERENTIAL OR EXHAUST GAS RELATIVE PRESSURE PLAUSIBILITY

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1050, MIL on
Monitoring strategy:	When the engine is stationary, the pressure is checked to see if it is below a specified threshold. With the engine running at operating pressure, a check is performed to see if two different corrected charge pressure values also produce two different exhaust gas pressure values
Effect of fault:	Defect detected if status is not plausible
Fault description:	Sensor defective FMI 1: Signal too high FMI 3: Signal implausible
Note:	Please refer to Service Information 223302a

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Correcting the fault
Pressure sensor, voltage supply	Voltage measurement between pins A41 and A59 **Desired value:** 4.75 - 5.25 V (idling speed)	– Check lines – Check plug connections – Fit new sensor
Pressure sensor, signal voltage	Voltage measurement between pins A78 and A59 **Nominal value:** 0.40 - 0.70 V (idling speed)	

Table of measurements

Pressure in kPa	0.0	5.0	10	15	20	30	40	50	65
Voltage in volts	0.50	0.90	1.30	1.70	2.10	2.90	3.70	4.50	4.50

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SPN 3792 EXHAUST GAS TEMPERATURE SENSOR UPSTREAM OF EXHAUST GAS AFTERTREATMENT

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1051 and P2BAE, MIL on
Monitoring strategy:	Monitoring of voltage limits and AP blocking
Effect of fault:	Output of a default value
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground between pin B33 and pin A03 FMI 10: Sensor line discontinuity

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin B33 and pin B26 **Desired value:** 200 - 700 Ω	– Check lines – Check plug connections – Fit new temperature sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin B26 and pin A03 **Desired value:** > 10 MΩ	
Exhaust gas temperature sensor, sensor voltage	Voltage measurement between pin B33 and pin B26 **Desired value:** 1.08 - 2.30 V at 20 - 700°C	

Table of measurements

Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

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SPN 3793 EXHAUST GAS TEMPERATURE SENSOR DOWNSTREAM OF EXHAUST GAS AFTERTREATMENT, physical

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
OBD fault P2BAE, MIL on

Monitoring strategy: Monitoring for loose contact or plausibility of rate of change of exhaust gas temperature Excessive or insufficient temperature

Fault description: Sensor defective
FMI 1: Temperature too high
FMI 2: Temperature too low
FMI 3: Temperature implausible
FMI 11: Loose contact (rate of change of temperature too high)

Note: The exhaust gas temperature sensor downstream of exhaust gas aftertreatment is not connected at the EDC control unit but at the AdBlue® dosing control unit DCU 15. The exhaust gas temperature value is sent from DCU 15 to the EDC control unit via CAN with information about the validity. In the event of a fault, SPN 5002 is sent by the DCU.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin B34 and pin B27 or between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 200 - 700 Ω	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Check the sensor for polarity reversal – Fit new sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin B27 and pin A03 or between pin 22 and pin 3 of the **AdBlue control unit** **Desired value:** > 10 MΩ	
Exhaust gas temperature sensor, sensor voltage	Voltage measurement between pin B34 and pin B27 or between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 1.08 - 2.30 V at 20 - 700°C	

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SPN 3794 EXHAUST GAS TEMPERATURE SENSOR DOWNSTREAM OF EXHAUST GAS AFTERTREATMENT

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2031 and P2BAE, MIL on
Monitoring strategy:	Monitoring of voltage limits and AP blocking
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked FMI 5: Short-circuit to ground FMI 10: Sensor line discontinuity
Note:	The exhaust gas temperature sensor downstream of exhaust gas aftertreatment is not connected at the EDC control unit but at the AdBlue® dosing control unit DCU 15. The exhaust gas temperature value is sent from DCU 15 to the EDC control unit via CAN with information about the validity. SPN 3794 is masked out. In the event of a fault, SPN 5002 is sent by the DCU with FMI 5 or FMI 12.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 200 - 700 Ω	– Check lines – Check plug connections – Fit new temperature sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin 22 and pin 3 of the **AdBlue control unit** **Desired value:** > 10 MΩ	
Temperature sensor, sensor voltage	Voltage measurement between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 1.08 - 2.30 V at 20 - 700°C	

Table of measurements

Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

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SPN 3797 HIGHSIDE, OUTPUT STAGE, OXYGEN SENSOR

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1525 and P2BAE, MIL on
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or $+U_{bat}$ and discontinuity
Fault description:	Oxygen sensor heating defective FMI 5: Short-circuit to ground between pin B08 and pin A03 or B05 FMI 6: Short-circuit to $+U_{bat}$ between pin B08 and pin A01 FMI 10: Discontinuity (no load), line discontinuity pin B05 or pin B08 or pin B08 and pin B23 interchanged or consequential fault of FMI 6

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

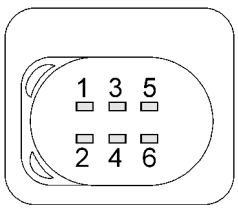
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check lines – Check plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating ($+U_{bat}$)	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3798 OUTPUT STAGE, OBD FAULT LAMP (MIL)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of the output stage
Fault description:	FMI 4: No signal present (line discontinuity, ground offset) FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$
Note:	This fault occurs mostly in the case of buses and coaches. In most cases, the cause of the fault is a poor ground connection on the engine, turntable, main switchboard or instrumentation. The MIL is activated by the EDC output stage or by the DM1 message (vehicle management computer, central on-board computer, instrumentation), depending on the instrumentation. The Stoneridge instrumentation evaluates the MIL request in the DM1 message. Wiring to the EDC MIL output stage is provided for Continental (Siemens-VDO) instrumentation (line no. 90132 high active). The signal is always output at the CAN and the EDC output stage simultaneously.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Activation, MIL	Measurement between pin A51 and the instrumentation for continuity	– Check lines – Check plug connections – Check instrumentation
Ground connections	Check the ground pin on the engine and turntable and the ground connection on the main switchboard and instrumentation	– Check the lines – Test and remedy as per Service Information 257402 and 340102

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SPN 3800 HIGHSIDE OUTPUT STAGE, WASTEGATE, ON LOW-PRESSURE TURBOCHARGER

Fault indication: None (priority 4)
OBD fault P1106, MIL on

Monitoring strategy: Monitoring of the output stage for short-circuit to ground or U_{bat} and discontinuity

Effect of fault: Wastegate on low-pressure turbocharger not working

Fault description: Turbocharger 2 proportional valve (pulse valve) defective
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$
FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Turbocharger 2 proportional valve (pulse valve)	Resistance measurement between pin B04 and pin B13 **Desired value:** 80 - 100 Ω	– Check the lines – Check the plug connections – Check the proportional valve and, if necessary, fit a new one – Fit a new control unit if no faults can be detected

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SPN 3801 HIGHSIDE OUTPUT STAGE, SHUT-OFF VALVE FOR LT CIRCUIT

Fault indication: None (priority 4)
OBD fault P1107, MIL on

Monitoring strategy: Monitoring of the output stage for short-circuit to ground or U_{bat} and discontinuity

Effect of fault: LT cooler shut-off/pressure-reducing valve not working

Fault description: LT cooler shut-off/pressure-reducing valve defective
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$
FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
LT cooler shut-off /pressure-reducing valve	Resistance measurement between pin A06 and pin A05 **Desired value:** 40 - 110 Ω	– Check the lines – Check the plug connections – Check the shut-off/pressure-reducing valve and, if necessary, fit a new one – Fit a new control unit if no faults can be detected

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SPN 3802 HIGHSIDE, OUTPUT STAGE, COMPRESSED-AIR SHUT-OFF VALVE

Fault indication:	None (priority 4) OBD fault P1103 and P2BAC, MIL on
Monitoring strategy:	Monitoring of the output stage for short-circuit to ground or U_{bat} and discontinuity
Effect of fault:	No EGR function
Fault description:	Compressed-air shut-off valve defective FMI 4: No signal present FMI 5: Short-circuit to ground between pin B06 and pin A03 FMI 6: Short-circuit to $+U_{bat}$ between pin B06 and pin A01 FMI 10: Discontinuity

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Compressed air shut-off valve	Resistance measurement between pin B06 and pin B02 **Desired value:** 25 - 260 Ω	– Check lines – Check plug connections – Fit new compressed-air shut-off valve

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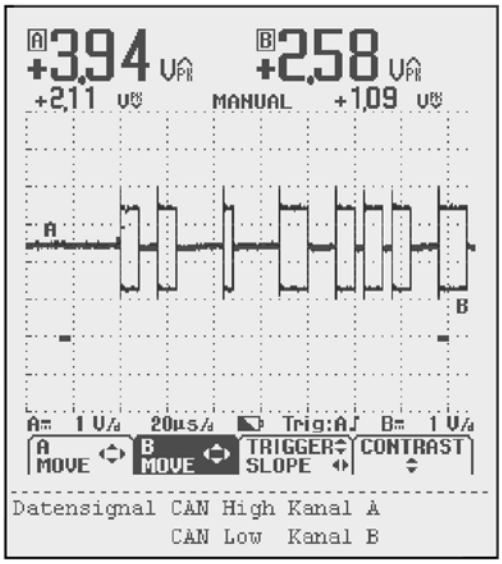
SPN 3804 TIMEOUT ERROR CAN 1 (VEHICLE MANAGEMENT COMPUTER/EDC-CAN)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of CAN module 1 (FFR1, FFR2, FFR3 or Time/Date from vehicle management computer) for timeout
Effect of fault:	Receipt of one of the messages FFR1, FFR2, FFR3 or Time/Date from vehicle management computer not possible
Fault description:	FMI 4: No signal present
Note:	In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit a new control unit if no faults can be detected
M-CAN databus	**Desired value:** see oscilloscope curve	



CAN High: Channel A
CAN Low: Channel B

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SPN 3806 TIMEOUT ERROR CAN 2 (OBD-CAN or Master-Slave CAN)

Fault indication:	**OBD-CAN:** Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) **Master-Slave CAN:** Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of CAN 2 (OBD-CAN for in-line engine, Master-Slave CAN for V engine) for timeout
Effect of fault:	**OBD-CAN:** Fault in communication with OBD socket **Master-Slave CAN:** Fault in Master-Slave communication, receive fault, CAN Master/Slave Decoder Slave control unit blocks injection quantity until communication OK again; engine keeps running with Master control unit, i.e. one bank of cylinders (output halved)
Fault description:	FMI 1: Signal too high FMI 3: Signal implausible FMI 4: No signal present
Note:	In in-line engines, the OBD-CAN is on pin B25 and pin B32. In V engines with MAN AdBlue® system, the OBD-CAN is on pin B25 and pin B32 of the **Slave** control unit. The A-CAN (exhaust gas aftertreatment CAN) is on pin B25 and Pin B32 of the **Master** control unit. In in-line engines with MAN AdBlue® system, the A-CAN is on pin B27 and pin B45. The Master-Slave CAN (connection between Master control unit and Slave control unit) is on pins A27 and A45. In the case of in-line engines with MAN AdBlue® system, the A-CAN (exhaust gas aftertreatment CAN) is on these pins (pin A27 →line 191 and Pin 45 →line 192).

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
CAN connection to OBD socket	Resistance measurement between pin B25 (OBD-CAN-H) and pin B32 (OBD-CAN-L) **Desired value:** 115 - 125 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit a new control unit if no faults can be detected
Master-Slave CAN	Resistance measurement between pin B27 of the Master control unit and pin B27 of the Slave control unit (CAN2-H) and between pin B45 of the Master control unit and pin B45 of the Slave control unit (CAN2-L) **Desired value:** < 2 Ω	– Check lines – Check plug connections

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SPN 3811 VERIFICATION, EXHAUST GAS TEMPERATURE UPSTREAM OF EXHAUST GAS AFTERTREATMENT

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
OBD fault P1056, MIL on

Monitoring strategy: Monitoring for sensor drift when ignition on, i. e. whether exhaust gas temperature has dropped to ambient temperature with the engine stopped. Monitoring in operation to check whether sensor is installed, i. e. the temperature is too high at low load and too low at high load.

Fault description: Sensor defective or not fitted
FMI 1: Temperature too high (exhaust gas temperature has not fallen to ambient temperature when stationary)
FMI 2: Temperature too low (exhaust gas temperature has fallen below ambient temperature when stationary)
FMI 3: Temperature implausible (exhaust temperature is too high at low load)
FMI 8: Signal defective (exhaust gas temperature is too low at high load)

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin B33 and pin B26 **Desired value:** 200 - 700 Ω	– Check lines – Check plug connections – Fit new temperature sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin B26 and pin A03 **Desired value:** >10 MΩ	
Temperature sensor, sensor voltage	Voltage measurement between pin B33 and pin B26 **Desired value:** 1.08 - 2.30 V at 20 - 700°C	
EDC control unit	Test as per Service Information 256700 and 273000	– Flash the control unit

Table of measurements

Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

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SPN 3812 VERIFICATION, EXHAUST GAS TEMPERATURE DOWNSTREAM OF EXHAUST GAS AFTERTREATMENT

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)

Monitoring strategy: Monitoring for sensor drift when ignition on, i. e. whether exhaust gas temperature has dropped to ambient temperature with the engine stopped. Monitoring in operation to check whether sensor is installed, i. e. the temperature is too high at low load and too low at high load.

Fault description: Sensor defective or not fitted
FMI 1: Temperature too high (exhaust gas temperature has not fallen to ambient temperature when stationary)
FMI 2: Temperature too low (exhaust gas temperature has fallen below ambient temperature when stationary)
FMI 3: Temperature implausible (exhaust temperature is too high at low load)
FMI 8: Signal defective (exhaust gas temperature is too low at high load)

Note: The exhaust gas temperature sensor downstream of exhaust gas aftertreatment is not connected at the EDC control unit but at the AdBlue® dosing control unit DCU 15. The exhaust gas temperature value is sent from DCU 15 to the EDC control unit via CAN with information about the validity. In the event of a fault, SPN 5002 is sent by the DCU.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Exhaust gas temperature sensor, sensor resistance	Resistance measurement between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 200 - 700 Ω	– Check lines – Check plug connections – Fit new temperature sensor
Exhaust gas temperature sensor, earthing	Resistance measurement between pin 22 and pin 3 of the **AdBlue control unit** **Desired value:** >10 MΩ	
Temperature sensor, sensor voltage	Voltage measurement between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** 1.08 - 2.30 V at 20 - 700°C	

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SPN 3813 STARTER MONITORING (starter protection)

Fault indication:	Central fault lamp shows **steady red light** when stationary (priority 2)
Monitoring strategy:	Monitoring of starting duration
Effect of fault:	None
Fault description:	FMI 1: Starting duration too long
Note:	The warming of the starter is evaluated in the control unit, depending on the starter actuation time. If the starter is actuated for longer than 30 seconds without interruption and the engine does not start, the fault message SPN 3813 appears on the display. This fault message remains active until it can be assumed that the starter has cooled down enough. The message is active for 10 minutes per 30-second actuation. This fault has no other effects and the fault message disappears automatically after the specified time has elapsed. There may also be a second fault in the system, since there must be a reason for the long starting procedure (air in the system, sensor fault, fuel supply or immobiliser).

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC system	—	– Determine the reason for the long starting duration

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SPN 3814 ACQUISITION, CONTROL UNIT SWITCH-OFF DURATION

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring of the switch-on and switch-off point and the switch-off duration of the control unit. Unable to determine switch-off duration
Effect of fault:	This fault occurs when a new start attempt takes place in the after-run time during the engine stopping phase. Otherwise this fault has no effects.
Fault description:	FMI 3: Signal implausible

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Test as per Service Information 241800a and 246100	– Flash the control unit

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SPN 3819 CAN MODULE 3 (exhaust gas aftertreatment CAN)

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault U1009, MIL on
Monitoring strategy:	Monitoring of CAN module 3 (exhaust gas aftertreatment CAN = A-CAN) for Busoff (exhaust gas temperature, AdBlue level and AdBlue temperature)
Fault description:	CAN module 3 Busoff state FMI 4: No signal present FMI 8: Signal defective FMI 9: Device fault
Note:	In the case of EDC7 C32 Stand Alone with MAN AdBlue® system, the A-CAN is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, the A-CAN is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN)	Resistance measurement between pin A27 (A-CAN-H) and pin A45 (A-CAN-L) **Desired value:** 115 - 125 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit a new control unit if no faults can be detected
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN) in V8 engine	Resistance measurement between pin B25 (A-CAN-H) and pin B32 (A-CAN-L) of the **Master** control unit. **Desired value:** 115 - 125 Ω	

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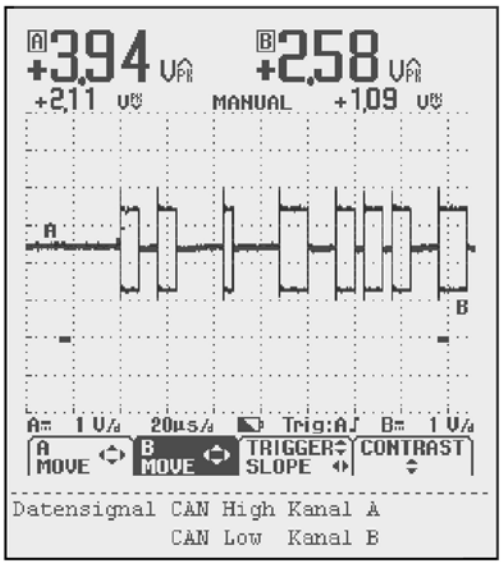
SPN 3820 BYTE MONITORING CAN 1

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring of CAN module 3 (oil and ambient air temperature) for bit error
Fault description:	FMI 3. Signal implausible (oil and ambient air temperature) At least one of these CAN messages is not plausible
Note:	In the new generation of EDC7 control units (EDC7 C32), the engine CAN can no longer be tested in the familiar way using the 120-ohm terminating resistor. The terminating resistor has been replaced internally in the EDC control unit by RC wiring (dynamic resistor). In other words, the engine CAN can no longer be measured directly at the vehicle management computer as before when control units are connected as, in this case, 120 ohms are measured instead of the expected 60 ohms, leading to the false assumption that the wiring is defective. Measurements can therefore only be performed when the EDC control unit is disconnected, the ignition is switched off and the contact box (test box) is connected or using the oscilloscope!

Fault entries in other control units: Yes, vehicle management computer

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Resistance measurement between pin B21 (CAN-L) and B22 (CAN-H) **Desired value:** ~120 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit new control unit or vehicle management computer if no faults can be detected
M-CAN databus	**Desired value:** see oscilloscope curve	



CAN High: Channel A
CAN Low: Channel B

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SPN 3821 BYTE MONITORING CAN 3 (exhaust gas aftertreatment CAN)

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault U1011, MIL on
Monitoring strategy:	Monitoring of CAN module 3 (exhaust gas aftertreatment CAN = A-CAN) for bit error (exhaust gas temperature, AdBlue level and AdBlue temperature)
Fault description:	FMI 3: Signal implausible (exhaust gas temperature, AdBlue level and AdBlue temperature) At least one of these CAN messages is not plausible
Note:	In the case of EDC7 C32 Stand Alone with MAN AdBlue® system, the A-CAN is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, the A-CAN is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN)	Resistance measurement between pin A27 (A-CAN-H) and pin A45 (A-CAN-L) **Desired value:** 115 - 125 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit a new control unit if no faults can be detected
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN) in V8 engine	Resistance measurement between pin B25 (A-CAN-H) and pin B32 (A-CAN-L) of the **Master** control unit. **Desired value:** 115 - 125 Ω	

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SPN 3822 TIMEOUT MONITORING CAN 3 (exhaust gas aftertreatment CAN)

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault U1012, MIL on
Monitoring strategy:	Monitoring of CAN module 3 (exhaust gas aftertreatment CAN = A-CAN) for Timeout (exhaust gas temperature, AdBlue level and AdBlue temperature)
Fault description:	At least one of these CAN messages cannot be received FMI 4: No signal present (exhaust gas temperature, AdBlue level and AdBlue temperature)
Note:	In the case of EDC7 C32 Stand Alone with MAN AdBlue® system, the A-CAN is on pin A27 (line 191) and pin 45 (line 192). In the case of EDC7 C32 Master/Slave with MAN AdBlue® system, the A-CAN is on pin 25 (line 191) and pin 32 (line 192) of the **Master** control unit.

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN)	Resistance measurement between pin A27 (A-CAN-H) and pin A45 (A-CAN-L) **Desired value:** 115 - 125 Ω	– Check voltage supply – Check lines – Check plug connections – At approx. 0 Ω, short-circuit from CAN-H to CAN-L – Fit a new AdBlue fill level/temperature sensor if no faults can be detected
CAN connection to DCU15, NOx sensor and AdBlue fill level sensor (A-CAN) in V8 engine	Resistance measurement between pin B25 (A-CAN-H) and pin B32 (A-CAN-L) of the **Master** control unit. **Desired value:** 115 - 125 Ω	

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SPN 3836 ACQUISITION LAMBDA VALUE, physical

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring for loose contact or plausibility of rate of change of the signal
Fault description:	FMI 3: lambda value not plausible FMI 11: Rate of change of lambda value too high (loose contact)

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

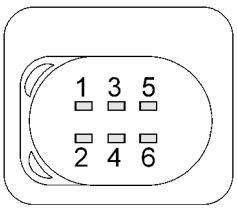
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3837 ACQUISITION OXYGEN SENSOR

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring of the lambda value for voltage limits and AP blocking
Fault description:	FMI 4: No signal present due to blocked AP channel, control unit fault FMI 5: Short-circuit to ground between pin B31 and pin A03 and/or pin B31 and pin B08, short-circuit of lines against each other FMI 6: Short-circuit to $+U_{bat}$ or line discontinuity at pin B31 or consequential fault of SPN 3797 FMI 6
Note:	If the fault with FMI 5 (short-circuit to ground) only occurs sporadically, please refer to Service Information 295400a.

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

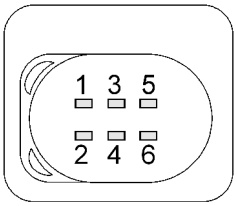
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor – Fit a new control unit if no faults can be detected
EDC control unit	Test as per Service Information 295400a	– Flash the control unit

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating ($+U_{bat}$)	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3838 INTERNAL RESISTANCE, OXYGEN SENSOR, physical

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring of the oxygen sensor internal resistance for loose contact or plausibility of the rate of change of internal resistance
Fault description:	FMI 3: Internal resistance not plausible FMI 11: Rate of change of internal resistance too high (loose contact)

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

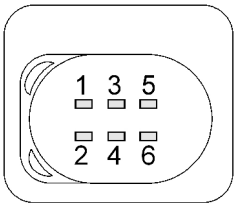
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3839 INTERNAL RESISTANCE, OXYGEN SENSOR

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring for voltage limits and AP blocking
Fault description:	FMI 4: No signal present due to blocked AP channel, control unit fault FMI 5: Short-circuit to ground FMI 6: Short-circuit to $+U_{bat}$

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

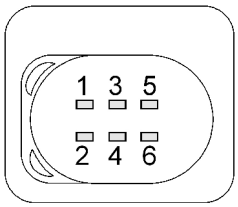
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor – Fit a new control unit if no faults can be detected

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating ($+U_{bat}$)	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3844 VERIFICATIN, CHARGE AIR TEMPERATURE UPSTREAM OF CYLINDER INLET (downstream of EGR)

Fault indication: Central fault lamp shows **steady yellow light** when stationary (priority 3)

Monitoring strategy: Monitoring for sensor drift with the ignition on, i. e. whether the temperature upstream of cylinder inlet has dropped to the coolant temperature with the engine stopped. Monitoring during operation for whether the sensor is fitted (temperature is not allowed to deviate excessively from the charge air temperature upstream of engine)

Fault description: Sensor defective or not fitted
FMI 1: Temperature too high (temperature upstream of cylinder inlet has not fallen to coolant temperature when stationary)
FMI 2: Temperature too low (temperature upstream of cylinder inlet has fallen below coolant temperature when stationary)
FMI 3: Temperature implausible (temperature upstream of cylinder inlet deviates too much from charge air temperature upstream of engine)

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, sensor resistance	Resistance measurement between pin A76 and pin A57 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new charge air temperature sensor
Temperature sensor, sensor voltage	Voltage measurement between pin A76 and pin A57 **Desired value:** 4.2 - 2.2 V at 0 - 60°C	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3847 CHARGE AIR TEMPERATURE DOWNSTREAM OF COOLER (in charge-air pipe)

Fault indication:	None (priority 4) OBD fault P1066, MIL on
Monitoring strategy:	Monitoring for voltage limits and AP blocking
Effect of fault:	Output of a default value
Fault description:	Sensor defective FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 10: Discontinuity

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin A70 and pin A62 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new charge air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin A70 and pin A62 **Desired value:** 4.2 - 2.2 V at 0 - 60°C	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3849 SCR CATALYTIC CONVERTER NOT FITTED (verification, exhaust gas filter temperature)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1535, MIL on
Monitoring strategy:	Monitoring during operation to check whether sensor is fitted in exhaust
Effect of fault:	Not fitted if an insufficient temperature is measured at high load
Fault description:	FMI 9: Device fault, catalytic converter not fitted

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor after exhaust gas aftertreatment, sensor resistance	Resistance measurement between pin 22 and pin 23 of the **AdBlue control unit** **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new temperature sensor

Table of desired values

Temperature in °C	0	25	200	400	600	800
Resistance in ohms	200	220	352	494	627	751

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SPN 3850 POSITION DEVIATION, CLOSED EGR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1068, MIL on
Monitoring strategy:	Monitoring of the EGR flap position for valid zero-point adaptation
Fault description:	FMI 1: Zero-point adaptation invalid
Note:	The setting instructions apply to all compressed-air cylinders, except 51.08150-0042 and 51.08150-0046. Please refer to Service Information 169000 and 276700a

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Positioning cylinder, E-EGR	–	**Setting the positioning cylinder:** – Screw the piston rod all the way in – From this positioning cylinder “zero position”, unscrew the piston rod by one turn (equivalent to 1.25 mm) – Keep repeating this step until no further fault messages appear
EGR feedback in case of controlled EGR	Voltage measurement between pin A32 and A39 **Desired value:** 4.75 - 5.25 V (idling) Voltage measurement between pin A87 and A39 **Desired value:** 0.50 - 0.80 V (idling)	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new EGR controller

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SPN 3851 EGR POSITION SENSOR (E-EGR)

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3) OBD fault P1069 and P2BAC, MIL on
Monitoring strategy:	Monitoring for voltage limits and AP blocking
Effect of fault:	EGR inactive
Fault description:	Sensor defective FMI 4: No signal present due to blocked AP channel, control unit fault FMI 5: Short-circuit to ground between pin A87 and pin A03 FMI 6: Short-circuit to $+U_{bat}$ between pin A87 and pin A01 FMI 10: Sensor line discontinuity
Note:	Please refer to Service Information 169000 and 276700a

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EGR feedback in case of controlled EGR	Voltage measurement between pin A32 and A39 **Desired value:** 4.75 - 5.25 V (idling speed) Voltage measurement between pin A87 and A39 **Desired value:** 0.50 - 0.80 V (idling)	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit a new EGR controller

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SPN 3852 VERIFICATION OF THE EGR BY TEMPERATURE

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
OBD fault P1070, MIL on

Monitoring strategy: Monitoring during operation to check whether the temperature upstream of the cylinder inlet is around the temperature upstream of the engine, within certain limits, i. e., whether the temperature upstream of the cylinder inlet deviates too much from the temperature downstream of the cooler.

Fault description: FMI 3: Temperature implausible. Temperature upstream of cylinder inlet deviates too much from temperature downstream of cooler

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Charge air temperature sensor downstream of cooler, sensor resistance	Resistance measurement between pin A70 and pin A62 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new temperature sensor
Charge air temperature sensor downstream of cooler, sensor voltage	Voltage measurement between pin A70 and pin A62 **Desired value:** 4.2 - 2.2 V at 0 - 60°C	
Charge air temperature sensor upstream of cylinder inlet, sensor voltage	Voltage measurement between pin A76 and pin A57 **Desired value:** 4.2 - 2.2 V at 0 - 60°C	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3853 STEADY-STATE DEVIATION E-EGR

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3) OBD fault P1071 and P2BAC, MIL on
Monitoring strategy:	Monitoring of the EGR flap position for permanent control deviation
Effect of fault:	Output of a default value for the signal output value EGR inactive
Fault description:	FMI 1: The control deviation amount is too large, deviation between actual position and desired position
Consequential fault:	Possible consequential fault of SPN 3850
Note:	Please refer to Service Information 169000 and 276700a

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Proportional valve E-EGR	Resistance measurement between pin A17 and A11 **Desired value:** 25 - 110 Ω	– Check lines – Check plug connections – Fit new proportional valve E-EGR
EDC control unit	Test as per Service Information 241800a, 246100 and 334700	Flash the control unit

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SPN 3855 OXYGEN SENSOR SYSTEM

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring of the oxygen sensor lines for short-circuit and discontinuity
Fault description:	FMI 7/FMI 9: Short-circuit between pins B23, B24, B30, B31 and pin B05/B08 (sensor heating) Short-circuit between pins B23, B24, B30, B31 and pin A03 (ground)/pin A01 ($+U_{bat}$). Mixing up of pin B05 B24 or pin B08/B08 and B23/B30. Discontinuity of Nernst voltage line (black) at pin B30 or discontinuity of virtual ground line (yellow) at pin B23.
Note:	In isolated cases, incorrect connection of connector “B” on the control unit has caused control unit pin B30 to become so bent that it lies on pin 31.

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

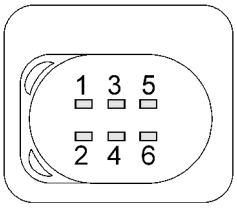
Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor
Control unit	Check plug connection “B” for damage or bent pins	– Fit new control unit (after consultation with the department responsible)

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Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating ($+U_{bat}$)	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3856 OXYGEN SENSOR CALIBRATION

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring for excessive or insufficient oxygen sensor calibration value
Fault description:	FMI 1: Calibration value too high FMI 2: Calibration value too low

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

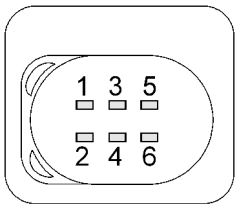
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω Check the oxygen sensor correction factor using MAN-cats Monitoring “NOx verification measurement” **Desired value:** 890 - 1140	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3857 OXYGEN SENSOR, SPI COMMUNICATION

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring for SPI communication plausibility
Fault description:	FMI 3: SPI communication fault (control unit fault)
Note:	The oxygen sensor evaluation module communicates with the main computer via SPI (Serial Peripheral Interface). The module controls the reading-out and setting of the oxygen sensor evaluation module's internal index following a request by the software.

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– Fit a new control unit (after consultation with the department responsible)

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SPN 3858 OXYGEN SENSOR TEMPERATURE

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring for excessive or insufficient oxygen sensor temperature
Fault description:	FMI 1: Temperature too high (> 800 ℃) Short-circuit between pins B23, B24 and B30 FMI 2: Temperature too low (< 635 °C) Short-circuit between pin B05 and B08 or consequential fault of SPN 3797 FMI 4/5 or pin B08/B05 and B31 interchanged

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

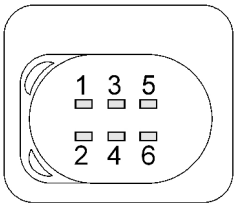
Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω Use MAN-cats Monitoring “Lambda values” to check the sensor temperature. **Desired value:** 780 °C ± 2 °C Check the clock-pulse ratio for activating the heater stage **Desired value:** ≤ 60 %	– Check the lines – Check the plug connections as per Service Information 264202 – Fit a new oxygen sensor

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Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating ($+U_{bat}$)	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3859 OXYGEN SENSOR TEMPERATURE CALIBRATION

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring for excessive or insufficient oxygen sensor temperature correction value
Fault description:	FMI 1: Excessive temperature correction value FMI 2: Insufficient temperature correction value Trimming resistor line (green) at pin B31 and Nernst voltage line (black) at pin B30 interchanged
Note:	In isolated cases, incorrect connection of connector “B” on the control unit has caused control unit pin B30 to become so bent that it lies on pin 31.

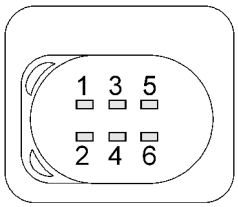
Clear the fault memory after remedying the fault (EDC and OBD).

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω Use MAN-cats Monitoring “Lambda values” to check the sensor temperature. **Desired value:** 780 °C ± 2 °C Check the clock-pulse ratio for activating the heater stage **Desired value:** ≤ 60 %	– Check the lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3863 TRAILING THROTTLE MONITORING

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary, stop indication on display (priority 1)

Monitoring strategy: Monitoring of the injector stage activation duration in trailing-throttle condition. The purpose of trailing throttle monitoring is to check the plausibility of the current activation duration for the injector output stages under certain operation conditions according to the maximum permitted activation duration for the current revs.

Effect of fault: In case of a fault, it is assumed that a control unit is not operating correctly, a recovery (control unit reset) is triggered and SPN 3873 is set as a consequential fault.

Fault description: FMI 1: The injector stage activation duration is too great in trailing-throttle condition

Note: Fault occurs mainly in vehicles which are exposed to severe load reversals in intermediate speed governing mode (e.g. concrete pumps, wood chippers, grain mills etc.).
Remedy: Parameterise intermediate speed governing FUP 81.25890-7343 for concrete pump and, if necessary, FUP for severe load reversals 81.25890-1309. Then wire intermediate speed governor 1 (ZDR 1).

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– See note above – If no fault can be detected (reset unsuccessful), fit a new control unit (only after consultation with the specialist department responsible)

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SPN 3868 VERIFICATION, CHARGE-AIR TEMPERATURE DOWNSTREAM OF COOLER (in charge-air pipe)

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1079, MIL off
Monitoring strategy:	Monitoring for sensor drift with the ignition on, i. e. whether the charge air temperature has dropped to the coolant temperature with the engine stopped. Monitoring during operation for whether the sensor is fitted (two different charge pressures must produce two different temperatures)
Fault description:	Sensor defective or not fitted FMI 1: Temperature too high (charge-air temperature upstream of engine has not fallen to coolant temperature when stationary) FMI 2: Temperature too low (charge-air temperature upstream of engine has fallen below coolant temperature when stationary) FMI 3: Temperature implausible (two different charge pressures must produce two different temperatures)

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin A70 and pin A62 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check lines – Check plug connections – Fit new charge air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin A70 and pin A62 **Desired value:** 4.2 – 2.2 V at 0 - 60°C	
EDC control unit	Test as per Service Information 310,200a	– Flash the control unit

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3871 PLAUSIBILITY CHECK, EDC INTERNAL TEMPERATURE

Fault indication: None (priority 4)

Monitoring strategy: Monitoring for sensor drift with the ignition on, i.e. whether the control unit internal temperature has dropped to the coolant temperature with the engine stopped

Fault description: FMI 1: Temperature too high
FMI 2: Temperature too low

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Test as per Service Information 310,200a	– Flash the control unit

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SPN 3872 PLAUSIBILITY CHECK, COOLING BRACKET TEMPERATURE

Fault indication: None (priority 4)

Monitoring strategy: Monitoring for sensor drift with the ignition on, i.e. whether the heat sink bracket temperature has dropped to the coolant temperature with the engine stopped

Fault description: FMI 1: Temperature too high
FMI 2: Temperature too low

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	Test as per Service Information 310,200a	– Flash the control unit

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SPN 3873 RECOVERY MONITORING

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: Monitoring to check whether the control unit was reset and restored (Recovery). The control unit was in an undefined state.

Fault description: FMI 1: Signal too high
FMI 9: Device fault

Note: Fault occurs mainly in vehicles which are exposed to severe load reversals in intermediate speed governing mode (e. g. concrete pumps, wood chippers, grain mills etc.) and is a consequential fault of SPN 3863
Remedy: Parameterise intermediate speed governing FUP 81.25890-7343 for concrete pump and, if necessary, FUP for severe load reversals 81.25890-1309. Then wire intermediate speed governor 1 (ZDR 1).

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EDC control unit	—	– See note above – If no fault can be detected (reset unsuccessful), fit a new control unit (only after consultation with the specialist department responsible)

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SPN 3919 FAULT STATUS, HEATING, NOx SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of the NOx sensor heating for short-circuit, discontinuity and plausibility
Fault description:	Sensor defective FMI 3: Signal implausible FMI 7: Short-circuit to ground or $+U_{bat}$, short-circuit of the lines against each other, FMI 10: Line discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
NOx sensor supply voltage	Voltage measurement between pin 1 (line 195) and pin 2 (line 196) of the NOx sensor **Desired value:** $+U_{bat}$ Further measurements cannot be performed at this time as the data link is via the exhaust gas aftertreatment CAN (A-CAN)	– Check lines – Check plug connections – Fit new sensor

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SPN 3920 FAULT STATUS, NOx CONCENTRATION

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
Monitoring strategy:	Monitoring of the NOx sensor for short-circuit, discontinuity and plausibility
Fault description:	Sensor defective FMI 3: Signal implausible FMI 7: Short-circuit to ground or $+U_{bat}$, short-circuit of the lines against each other, FMI 10: Line discontinuity

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
NOx sensor supply voltage	Voltage measurement between pin 1 (line 195) and pin 2 (line 196) of the NOx sensor **Desired value:** $+U_{bat}$ Further measurements cannot be performed at this time as the data link is via the exhaust gas aftertreatment CAN (A-CAN)	– Check lines – Check plug connections – Fit new sensor

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SPN 3921 FAULT STATUS, O_2 CONCENTRATION

Fault indication:	Central fault lamp shows **steady yellow light** when stationary (priority 3) OBD fault P0130, MIL on
Monitoring strategy:	Monitoring of the NOx sensor for short-circuit, discontinuity and plausibility
Fault description:	Sensor defective FMI 3: Signal implausible FMI 7: Short-circuit to ground or $+U_{bat}$, short-circuit of the lines against each other, FMI 10: Line discontinuity

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
NOx sensor supply voltage	Voltage measurement between pin 1 (line 195) and pin 2 (line 196) of the NOx sensor **Desired value:** +Ubat Further measurements cannot be performed at this time as the data link is via the exhaust gas aftertreatment CAN (A-CAN)	– Check lines – Check plug connections – Fit new sensor

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SPN 3926 GRADIENT MONITORING, RAIL PRESSURE SENSOR

Fault indication: None (priority 4)

Monitoring strategy: Monitoring of the rail-pressure sensor signal for loose contact

Fault description: FMI 11: Loose contact

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Supply voltage, rail-pressure sensor	Voltage measurement between pin A43 and pin A61 **Desired value:** 4.75 - 5.25 V	– Check the lines – Check the plug connections – Fit a new rail-pressure sensor

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SPN 3927 OXYGEN SENSOR NOT FITTED IN EXHAUST PIPE

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAE, MIL on
Monitoring strategy:	Monitoring of the lambda values
Fault description:	FMI 9: Oxygen sensor not installed in exhaust pipe

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

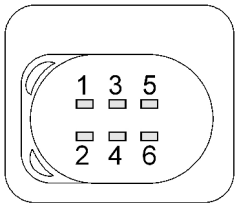
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit a new oxygen sensor or re-install the existing one

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3929 MONITORING OF EGR WITH LAMBDA (MIL fault)

Fault indication:	None (priority 4) In the case of field test vehicles: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAD, MIL on
Monitoring strategy:	Monitoring of the NOx verification system by means of oxygen sensor
Effect of fault:	If oxygen sensor monitoring reveals that the EGR rate is too low and, therefore, that the NOx concentration is too high, there is a MIL request
Fault description:	FMI 1: MIL request without EGR blocking FMI 2: MIL request with blocked EGR FMI 8: MIL request directly from blocked EGR FMI 9: MIL request directly from defective EGR
Note:	NOx-related faults here are above all faults which cause defective or inactive exhaust gas recirculation. Depending on limit values and the EGR status, it is decided whether only the MIL lamp should be activated or whether the output should be reduced in addition to this.

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EGR	See remedy	– See SPN 3004, 3756, 3802, 3837, 3850, 3851, 3852, 3853
EDC control unit	Test as per current topics 3308AT	– Remove and reload function parameters (FUP)
	Test as per Service Information 343500	– Flash the control unit

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SPN 3930 MONITORING OF EGR WITH LAMBDA (PR fault)

Fault indication:	None (priority 4) In the case of field test vehicles: Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P2BAD, MIL on
Monitoring strategy:	Monitoring of the NOx verification system by means of oxygen sensor
Effect of fault:	If oxygen sensor monitoring reveals that the EGR rate is too low and, therefore, that the NOx concentration is too high, the torque is reduced (= PR request)
Fault description:	FMI 1: PR request without EGR blocking FMI 2: PR request with blocked EGR FMI 8: PR request directly from blocked EGR FMI 9: PR request directly from defective EGR
Note:	NOx-related faults here are above all faults which cause defective or inactive exhaust gas recirculation. Depending on limit values and the EGR status, it is decided whether only the MIL lamp should be activated or whether the output should be reduced in addition to this. (PR = Power Reduction = engine output reduction).

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output state, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the diagrams for the vehicle in question

Test	Measurement	Remedy
EGR	See remedy	– See SPN 3004, 3756, 3802, 3837, 3850, 3851, 3852, 3853
EDC control unit	Test as per current topics 3308AT	– Remove and reload function parameters (FUP)

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SPN 3938 OXYGEN SENSOR NOT ADAPTABLE

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring for excessive or insufficient correction factor.
Fault description:	FMI 1: Correction factor too great Nernst voltage line (black) at pin B30 and virtual ground line (yellow) at pin B23 interchanged or Nernst voltage line (black) at pin B30 and trimming resistor line (green) at pin B31 interchanged or discontinuity in pump current line (red) at pin B24 FMI 2: Correction factor too small Nernst voltage line (black) at pin B30 and virtual ground line (yellow) at pin B23 interchanged FMI 3: Oxygen sensor signal implausible (O_2 signal too large) FMI 8: Signal defective (O_2 signal to small in trailing-throttle mode Short-circuit between pin B23/B24/B30/B31 and B05/B08 or pin B05 and B25 or B05/B08 and B23/B30 interchanged

Clear the fault memory after remedying the fault (EDC and OBD). Start the engine and check the oxygen sensor correction factor in MAN-cats Monitoring. If the value is between 890 and 1140, no further actions are necessary. If the correction factor is approx. 8000 or -8000, oxygen sensor teach-in is necessary.

Oxygen sensor teach-in: Test drive the vehicle (coolant temperature > 70 °C). Let the vehicle run in overrun/trailing throttle mode at 60 km/h for 15 seconds and then accelerate again (the oxygen sensor calibrates itself in trailing-throttle mode). If you stay in overrun/trailing throttle mode for longer than 15 seconds, fault 3938-02 appears. In this case, repeat the process and make sure overrun mode does not last longer than 15 seconds.

Stop the engine, switch off the ignition and then switch on again. Start the engine and check the oxygen sensor correction factor again in MAN-cats Monitoring. The value should be between 890 and 1140. Repeat the process if it is not.

As of EDC 7-SW version from V34.1 onwards, there is a point for initialising the oxygen sensor correction factor (factor is set to one). This means that teach-in by means of test drive is not required. This point is available from MAN-cats version 08.01 onwards.

Procedure: Stop the engine, switch off the ignition and then switch on again. In the Diagnosis EDC 7 C32 BOSCH menu, select “Initialisation of the lambda correction factor”. The oxygen sensor correction factor is initialised. Switch the ignition off and on again.

Refer to the diagrams for the vehicle in question

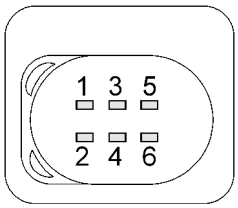
Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check lines – Check the plug connections as per Service Information 264202 – Fit new oxygen sensor

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05

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Pin	Line number / line colour	Function	EDC control unit, pin
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3942 CHARGE PRESSURE DOWNSTREAM OF LOW-PRESSURE INTERCOOLER

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)

Monitoring strategy: Monitoring for loose contact or plausibility of charge pressure rate of change downstream of low-pressure intercooler.

Fault description: FMI 3: Signal implausible
FMI 11: Loose contact on the signal line
Intercooler blocked, charge air piping leak

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Compressed-air feed Charge-air lines	Check the compressed-air supply	– Check the line from the charge-air pipe to the pulse valve for dirt and leaks
Turbocharger /wastegate	Functional check	– Pressurise control receptacle (wastegate) with approx. 2 bar and check for leaks – Check control rack for correct functioning at the same time – Fit new turbocharger/wastegate as necessary (see engine repair manual)
Charge-pressure sensor, voltage supply	Voltage measurement between pin B28 (+) and pin B20 (–) **Desired value:** 4.75 - 5.25 V	– Check the lines – Check the plug connections – Fit a new charge-pressure sensor
Charge-pressure sensor, signal voltage	Voltage measurement between pin B18 (+) and pin B20 (–) **Desired values:** 1.05 - 1.11 V (idling) 1.05 - 1.62 V (high idle)	

Table of comparative values

Pressure in bar	- 0.5	0	0.5	1	1.5	2	2.5	3
Voltage in volts	0.50	1.07	1.64	2.21	2.78	3.35	3.93	4.50

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SPN 3943 CHARGE-PRESSURE SENSOR DOWNSTREAM OF LOW-PRESSURE INTERCOOLER

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1092

Monitoring strategy: Monitoring of the voltage limits (supply voltage, sensor voltage AP blocking and plausibility)

Fault description: Sensor defective
FMI 3: Signal implausible
FMI 4: No signal present, AP channel blocked, control unit fault
FMI 5: Short-circuit to ground
FMI 6: Short-circuit to $+U_{bat}$

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Charge-pressure sensor, voltage supply	Voltage measurement between pin B28 (+) and pin B20 (–) **Desired value:** 4.75 - 5.25 V	– Check the lines – Check the plug connections – Fit a new charge-pressure sensor
Charge-pressure sensor, signal voltage	Voltage measurement between pin B18 (+) and pin B20 (–) **Desired values:** 1.05 - 1.11 V (idling) 1.05 - 1.62 V (high idle)	

Table of comparative values

Pressure in bar	- 0.5	0	0.5	1	1.5	2	2.5	3
Voltage in volts	0.50	1.07	1.64	2.21	2.78	3.35	3.93	4.50

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SPN 3944 CHARGE-AIR TEMPERATURE DOWNSTREAM OF LOW-PRESSURE INTERCOOLER

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1093

Monitoring strategy: Monitoring for loose contact or plausibility of rate of change of charge air temperature

Fault description: Sensor defective
FMI 1: Temperature too high
FMI 2: Temperature too low
FMI 3: Signal implausible (rate of change)
FMI 11: Loose contact on the signal line

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin B10 and pin B20 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check the lines – Check the plug connections – Fit a new charge-air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin B10 and pin B20 **Desired value:** 4.2 - 2.2 V at 0 - 60℃	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3945 CHARGE-AIR TEMPERATURE SENSOR DOWNSTREAM OF LOW-PRESSURE INTERCOOLER

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1094
Monitoring strategy:	Monitoring of the voltage limits (supply voltage, sensor voltage AP blocking and plausibility)
Fault description:	Sensor defective FMI 3: Signal implausible FMI 4: No signal present, AP channel blocked, control unit fault FMI 5: Short-circuit to ground FMI 10: Discontinuity

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Temperature sensor, charge air, sensor resistance	Resistance measurement between pin B10 and pin B20 **Desired value:** see table	– Check the signal for plausibility using MAN-cats Monitoring – Check the lines – Check the plug connections – Fit a new charge-air temperature sensor
Temperature sensor, charge air, sensor voltage	Voltage measurement between pin B10 and pin B20 **Desired value:** 4.2 - 2.2 V at 0 - 60℃	

Table of desired values (tolerance ±3%)

Temperature in °C	0	20	40	60	80
Resistance in ohms	5896	2500	1175	595	322
Voltage in volts	4.30	3.74	2.98	2.17	1.48

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SPN 3946 HIGH-PRESSURE INTERCOOLER

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1095
Monitoring strategy:	Monitoring of the thermostat(s) in the high-pressure intercooler and the shut-off /pressure-reducing valve for correct functioning
Effect of fault:	Limiting to 100 mg/stroke in the case of D08 engines
Fault description:	Thermostat defective Shut-off/pressure-reducing valve defective FMI 3: Signal implausible

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Thermostat in HP intercooler	See engine repair manual	– Check the thermostat – Fit a new thermostat – Fit a new intercooler
Shut-off /pressure-reducing valve	Resistance measurement between pin A06 and pin A05 **Desired value:** ~~40 - 110 Ω~~ 20 - 28 Ω	– Check the signal for plausibility using MAN-cats Monitoring – Check the lines – Check the plug connections – Fit a new shut-off/pressure-reducing valve

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SPN 3947 LOW-PRESSURE INTERCOOLER

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1096

Monitoring strategy: Monitoring of the thermostat in the low-pressure intercooler and the shut-off /pressure-reducing valve for correct functioning

Fault description: Thermostat defective
Shut-off/pressure-reducing valve defective
FMI 3: Signal implausible

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Thermostat in LP intercooler	See engine repair manual	– Check the thermostat – Fit a new thermostat – Fit a new intercooler
Shut-off /pressure-reducing valve	Resistance measurement between pin A06 and pin A05 **Desired value:** ~~40 - 110 Ω~~ 20 - 28 Ω	– Check the signal for plausibility using MAN-cats Monitoring – Check the lines – Check the plug connections – Fit a new shut-off/pressure-reducing valve

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SPN 3972 MONITORING FOR INSUFFICIENT NOx VALUE

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5) OBD fault P1557
Monitoring strategy:	Monitoring for insufficient NOx value
Fault description:	FMI 1: Insufficient lambda value FMI 2: Insufficient lambda value and EGR inactive
Note:	NOx-related faults here are above all faults which cause defective or inactive exhaust gas recirculation. Depending on limit values and the EGR status, it is decided whether only the MIL lamp should be activated or whether the output should be reduced in addition to this.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
EGR	See remedy	– See SPN 3004, 3756, 3802, 3837, 3850, 3851, 3852, 3853
EDC control unit	Test as per current topics 3308AT	– Remove and reload function parameters (FUP)
	Test as per Service Information 343500	– Flash the control unit

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SPN 3973 CHARGE PRESSURE IN HIGH-PRESSURE CIRCUIT

Fault indication: Central fault lamp shows **steady yellow light** whilst driving and when stationary in the case of FMI 2 (priority 5)
Central fault lamp shows **steady red light** whilst driving and when stationary in the case of FMI 1 (priority 2)
OBD fault P1104

Monitoring strategy: Monitoring of the charge pressure in the high-pressure circuit. Wastegate defects can thus be detected.

Fault description: FMI 1: Charge pressure too high
FMI 2: Charge pressure too low

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Turbocharger proportional valve	Resistance measurement between pin A02 and pin A04 **Desired value:** 80 - 100 Ω	– Check the lines – Check plug connections (pin 1 and pin 2 on pulse valve must not be interchanged) – Check pulse valve (actuator test) and, if necessary, fit a new one
Compressed-air feed Charge-air lines	Check the compressed-air supply	– Check the line from the charge-air pipe to the pulse valve for dirt and leaks
Turbocharger /wastegate	Functional check	– Pressurise control receptacle (wastegate) with approx. 2 bar and check for leaks – Check control rack for correct functioning at the same time – Fit new turbocharger/wastegate as necessary (see engine repair manual)

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SPN 3974 CHARGE PRESSURE IN LOW-PRESSURE CIRCUIT

Fault indication: None (priority 4)
OBD fault P1105

Monitoring strategy: Monitoring of the charge pressure in the low-pressure circuit. Wastegate defects can thus be detected.

Fault description: FMI 1: Charge pressure too high
FMI 2: Charge pressure too low

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Turbocharger proportional valve	Resistance measurement between pin B13 and pin B04 **Desired value:** 80 - 100 Ω	– Check the lines – Check the plug connections (pin 1 and pin 2 on pulse valve must not be interchanged) – Check the pulse valve (actuator test) and, if necessary, fit a new one
Compressed-air feed Charge-air lines	Check the compressed-air supply	– Check the line from the charge-air pipe to the pulse valve for dirt and leaks
Turbocharger /wastegate	Functional check	– Pressurise the control receptacle (wastegate) with approx. 2 bar and check for leaks – Check the control rack for correct functioning at the same time – Fit a new turbocharger/wastegate as necessary (see engine repair manual)

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SPN 3975 MONITORING OF THE OXYGEN SENSOR LINES FOR OPEN LINE

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1558
Monitoring strategy:	Monitoring of the oxygen sensor lines for open line (discontinuity)
Fault description:	FMI 3: Discontinuity, pin B24 (IP line = pump current) FMI 7: Discontinuity, pin B23 (virtual ground) FMI 8: Discontinuity, pin B30 (Nernst line) or line B24 and B08 interchanged
Note:	This fault can also be entered in the case of active lambda control and an initiated rev-up test.

Clear the EDC fault memory after remedying the fault. Use MAN-cats® to call up the "Reset flashing MIL and torque reduction" function. Then switch off the ignition. After EDC after-run (max. duration 5 sec.), the control unit can be switched on again. The flashing MIL and the torque reduction are now reset. The corresponding “normal” OBD fault entry is also deleted, while the long-term fault memory is not deleted. The fault memory entry is retained for a further 400 days or 9600 operating hours and is then deleted automatically if the fault is no longer present.

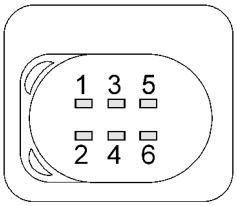
Exception: The long-term fault P2BAE, caused by a CAN communication error between the EDC and AdBlue system or by an electrical defect in the oxygen sensor/output stage, disappears from the long-term fault memory immediately if the fault is no longer present!

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit a new oxygen sensor or re-install the existing one

Connector pin assignment, oxygen sensor

Pin	Line number / line colour	Function	EDC control unit, pin
1	60183/red	Pump current	B24
2	60185/yellow	Virtual ground	B23
3	60396/white	Activation, heater cycle, sensor heating (–)	B08
4	60397/grey	Supply, sensor heating (+U_{bat})	B05
5	60184/green	Trimming resistor (trim current)	B31
6	60186/black	Nernst voltage	B30



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SPN 3976 DEFECT STATUS OXYGEN SENSOR DYNAMIC CHECK

Fault indication: Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2)
OBD fault P1559

Monitoring strategy: Dynamic monitoring of the oxygen concentration (O_2 signal)

Fault description: FMI 3: The O_2 signal changes during the load-no load mode transition. If the oxygen sensor is intact, a defined time must not be exceeded.
If the time is exceeded, this indicates excessive soot deposits and that the oxygen sensor needs to be exchanged.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	–	**–** Fit a new oxygen sensor

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SPN 3978 OXYGEN SENSOR ELECTRICAL DEFECT

Fault indication:	None (priority 4) OBD fault P1560
Monitoring strategy:	Monitoring of the recording module and the oxygen sensor output stage for electrical faults
Fault description:	FMI 8: Signal defective
Consequential fault:	This fault can occur as a consequential fault in the case of all oxygen sensor electrical problems
Note:	This fault can also be entered in the case of active lambda control and an initiated rev-up test.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω	– Check the lines – Check the plug connections as per Service Information 264202 – Fit a new oxygen sensor – Try fitting a new control unit if no faults can be detected

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SPN 3979 DEACTIVATED/REMOVED OXYGEN SENSOR

Fault indication:	Central fault lamp shows **steady red light** whilst driving and when stationary (priority 2) OBD fault P1561)
Monitoring strategy:	Monitoring for deactivated or removed oxygen sensor
Fault description:	FMI 8: Signal defective Oxygen sensor temperature too low, dew point not reached Oxygen sensor not installed in exhaust pipe

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
Oxygen sensor	Resistance measurement between pin B24 and B31 **Desired value:** 30 - 300 Ω Resistance measurement between pin B08 and B05 **Desired value:** 2 - 4 Ω Use MAN-cats Monitoring “Lambda values” to check the sensor temperature. **Desired value:** 780 °C ± 2 °C	– Check the lines – Check the plug connections as per Service Information 264202 – Fit a new oxygen sensor

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SPN 3981 EXHAUST GAS BACKPRESSURE TOO HIGH

Fault indication:	Central fault lamp shows **steady yellow light** whilst driving and when stationary (priority 5)
Monitoring strategy:	Monitoring for excessive exhaust gas backpressure
Fault description:	FMI 1: Too high: CRT filter / PM cat. blocked.
Note:	Please refer to Service Information 223302a, 241800, 246100, 225100, 333200, the notes on current topics 3306AT and 3308AT, and the notes in the Operator's Manual.

Refer to the wiring diagrams for the vehicle in question

Test	Measurement	Remedy
PM cat. converter	Check for blockage	– Clear and check the PM cat. as per notes on current topics 3306AT – Fit a new PM catalytic converter – See notes in the Operator's Manual
CRT filter	Check for blockage	– Clean or fit a new CRT filter as per Service Information 46000a and 225100 – See notes in the Operator's Manual
EDC control unit	Test as per Service Information 241800a, 246100, 225100, 333200 and 3308AT	– Flash the control unit – Load FUP as per Service Information 333200

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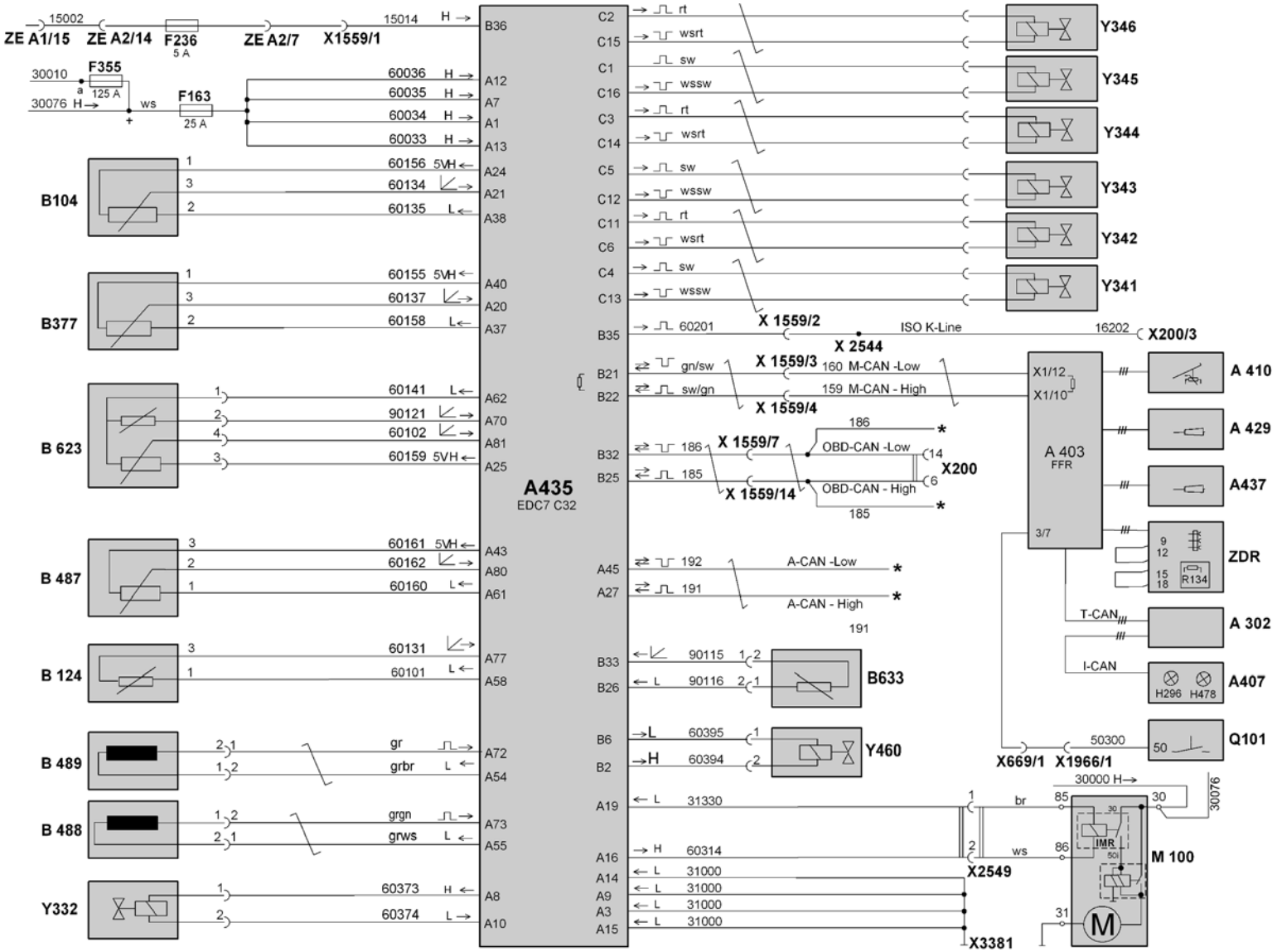
OVERVIEW, EDC7 C32 EURO 5 OBD 1 WITH NOX MONITORING

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC
A437 Sustained-action brake lever
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B623 Charge-pressure sensor/temperature sensor
B633 Exhaust gas temperature sensor 1 (upstream of AdBlue® mixer)
F163 Fuse, engine control (terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
H296 Check lamp, EDC
H478 Check lamp, OBD fault MIL
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
R283 Terminating resistor, HD OBD-CAN
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X2544 Potential distributor, 21-pin, K-line
X2549 Plug connection, IMR (starter)
X3381 Threaded pin M5 (motor power box)
Y332 Metering unit (fuel proportional valve, MProp)
Y341 Injector, 1st cylinder
Y342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y460 Compressed air shut-off valve
ZDR Intermediate speed interface
***** See overview of AdBlue® dosing control unit DCU15

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OVERVIEW, EDC7 C32 EURO 5 OBD 1 WITH NOX MONITORING



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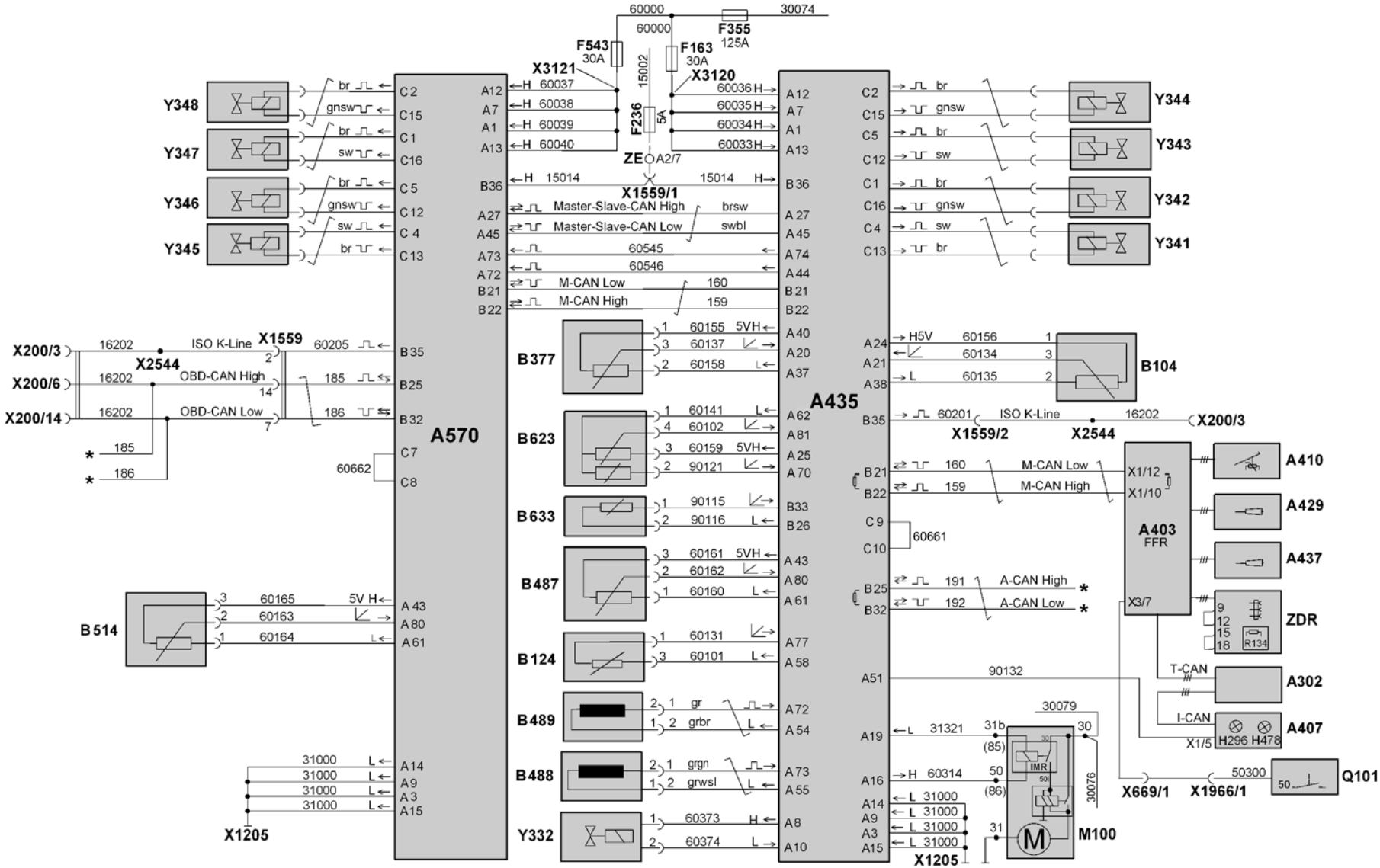
OVERVIEW, EDC7 C32 EURO 5 MASTER/SLAVE OBD 1 WITH NOX MONITORING

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC (Master)
A437 Sustained-action brake lever
A570 Control unit, EDC II (Slave)
B104 Oil pressure sensor
B124 Temperature sensor, coolant
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B514 Rail-pressure sensor
B623 Charge-pressure sensor/temperature sensor
B633 Exhaust gas temperature sensor 1 (upstream of AdBlue® mixer)
F163 Fuse, engine control (Master, terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
F543 Fuse, engine control II (Slave, terminal 30)
H296 Check lamp, EDC
H478 Check lamp, OBD fault MIL
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1205 Distributor, line 31000
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X2544 Potential distributor, 21-pin, K-line
X3120 Threaded pin M6, distributor, term. 30 (equipment compartment)
X3121 Threaded pin M6, distributor, term. 30 (equipment compartment)
Y332 Metering unit (fuel proportional valve, MProp)
Y341 Injector, 1st cylinder
X342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y347 Injector, 7th cylinder
Y348 Injector, 8th cylinder
ZDR Intermediate speed interface
***** See overview of AdBlue® dosing control unit DCU15 Master/Slave

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OVERVIEW, EDC7 C32 EURO 5 MASTER/SLAVE OBD 1 WITH NOX MONITORING



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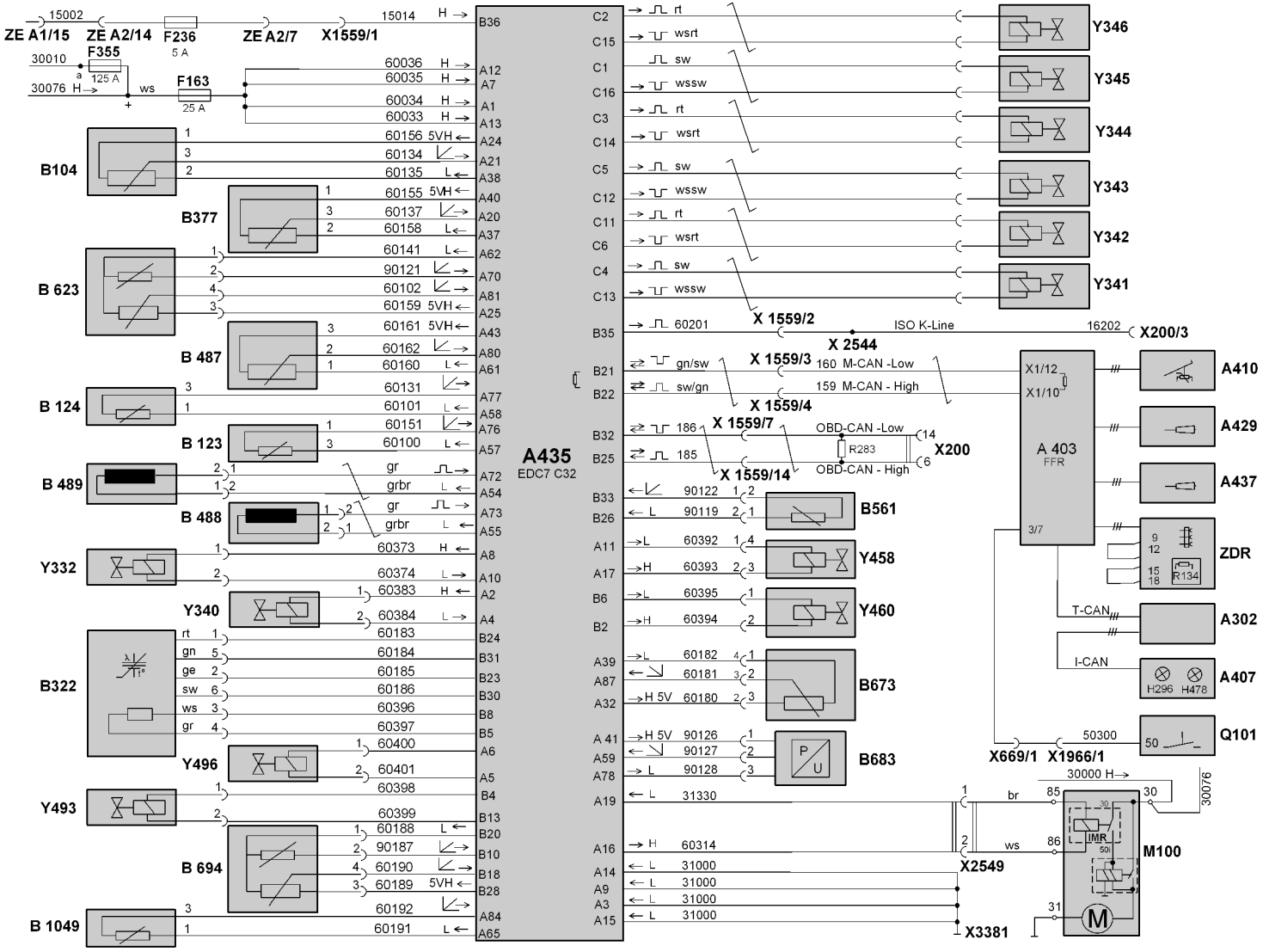
OVERVIEW, EDC7 C32 EURO 5 EGR OBD 2

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC
A437 Sustained-action brake lever
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B322 Oxygen sensor
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B561 Exhaust gas temperature sensor 1 (upstream of filter)
B623 Charge-pressure sensor/temperature sensor
B673 Position sensor, E-EGR controller
B683 Exhaust gas relative pressure sensor
B694 Charge-pressure sensor/temperature sensor, LT cooler
B1049 Temperature sensor, coolant, LT cooler
F163 Fuse, engine control (term. 30)
F236 Fuse, engine control (term. 15)
F355 Main fuse 30-2
H296 Check lamp, EDC
H478 Check lamp, OBD fault MIL
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
R283 Terminating resistor, HD OBD-CAN
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X2544 Potential distributor, 21-pin, K-line
X2549 Plug connection, IMR (starter)
X3381 Threaded pin M5 (motor power box)
Y332 Metering unit (fuel proportional valve, MProp)
Y340 Proportional valve, turbocharger 1 (pulse valve)
Y341 Injector, 1st cylinder
Y342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y458 Proportional valve E-EGR
Y460 Compressed-air shut-off valve
Y493 Proportional valve, turbocharger 2 (pulse valve)
Y496 Shut-off/pressure-reducing valve, LT cooler
ZDR Intermediate speed interface

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OVERVIEW, EDC7 C32 EURO 5 EGR OBD 2



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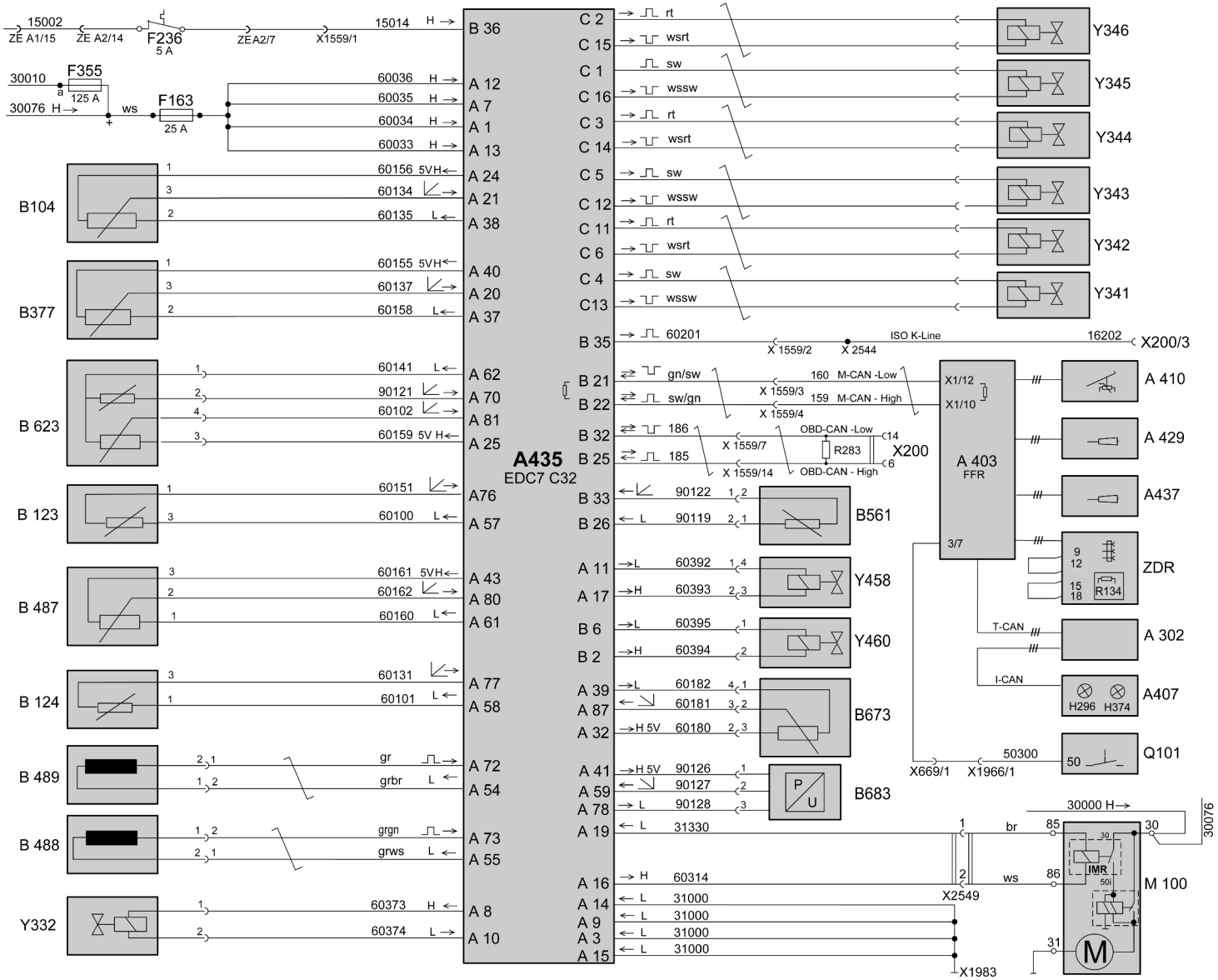
OVERVIEW, EDC7 C32 EURO 4 OBD 1

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC
A437 Auxiliary brake lever
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B561 Exhaust gas temperature sensor 1 upstream of filter (omitted in the case of D08 engines with OBD1 without NOx monitoring)
B623 Charge-pressure sensor/temperature sensor
B673 Position sensor, E-EGR controller
B683 Exhaust gas relative pressure sensor
F163 Fuse, engine control (terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
H296 Check lamp, EDC
H374 Check lamp, air cleaner dirty
M100 Starter
Q101 Ignition switch
R134 Resistor bank
R283 Terminating resistor, HD OBD-CAN
X200 Diagnostic socket
X669 Plug connection, starter interlock
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X1983 Threaded pin M6 (motor power box)
X2544 Potential distributor, 21-pin, K-line
X2549 Plug connection, IMR (starter)
Y332 Metering unit (fuel proportional valve, MProp)
Y341 Injector, 1st cylinder
Y342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y458 Proportional valve, E-EGR
Y460 Compressed air shut-off valve
ZDR Intermediate speed interface

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OVERVIEW, EDC7 C32 EURO 4 OBD 1



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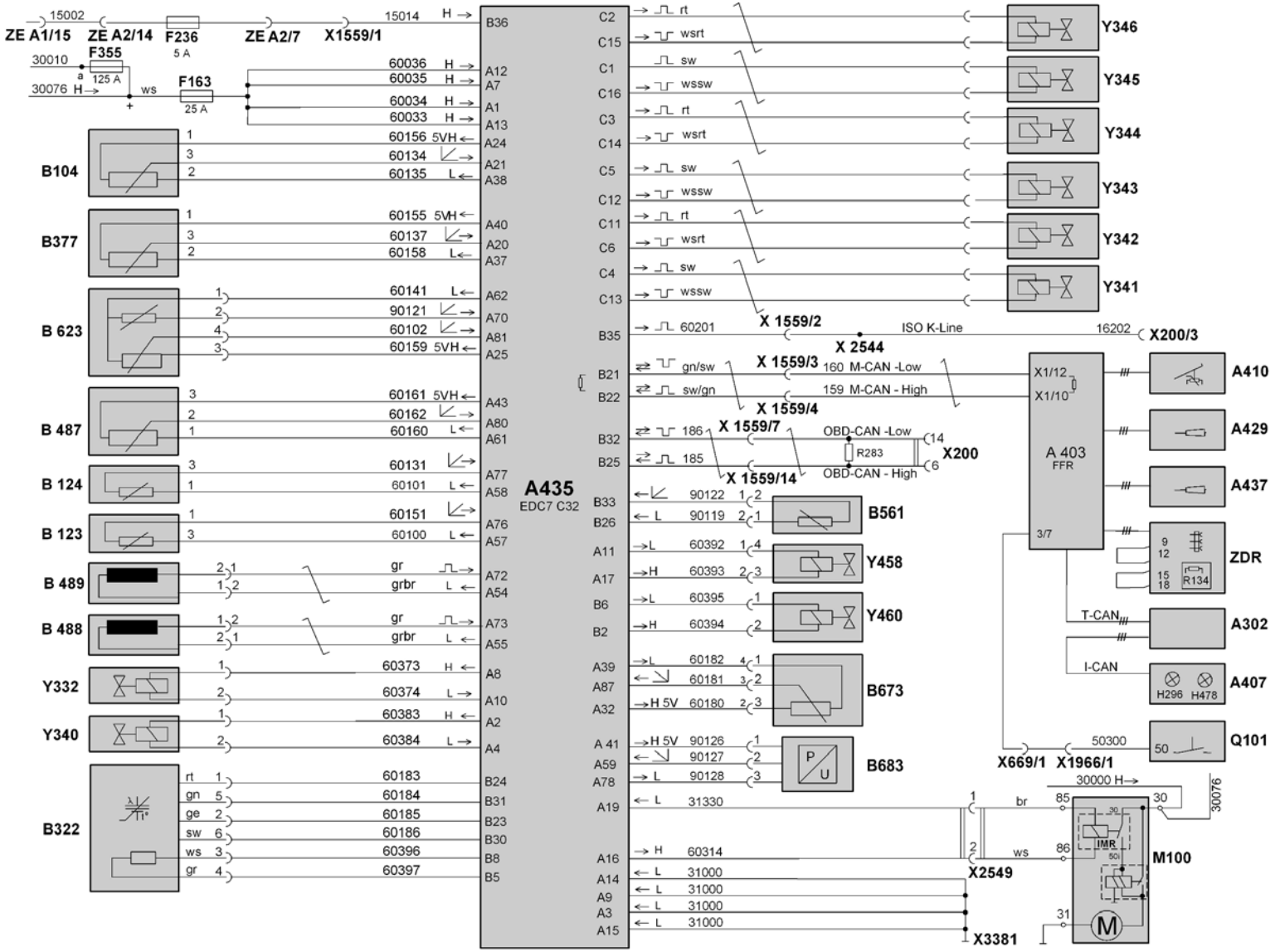
OVERVIEW, EDC7 C32 EURO 4 OBD 1 WITH NOX MONITORING

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC
A437 Sustained-action brake lever
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B322 Oxygen sensor
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B561 Exhaust gas temperature sensor 1 (upstream of filter)
B623 Charge-pressure sensor/temperature sensor
B673 Position sensor, E-EGR controller
B683 Exhaust gas relative pressure sensor
F163 Fuse, engine control (terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
H296 Check lamp, EDC
H478 Check lamp, OBD fault MIL
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
R283 Terminating resistor, HD OBD-CAN
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X2544 Potential distributor, 21-pin, K-line
X2549 Plug connection, IMR (starter)
X3381 Threaded pin M5 (motor power box)
Y332 Metering unit (fuel proportional valve, MProp)
Y340 Proportional valve, turbocharger (only in case of D08 engines)
Y341 Injector, 1st cylinder
Y342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y458 Proportional valve E-EGR
Y460 Compressed air shut-off valve
ZDR Intermediate speed interface

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OVERVIEW, EDC7 C32 EURO 4 OBD 1 WITH NOX MONITORING



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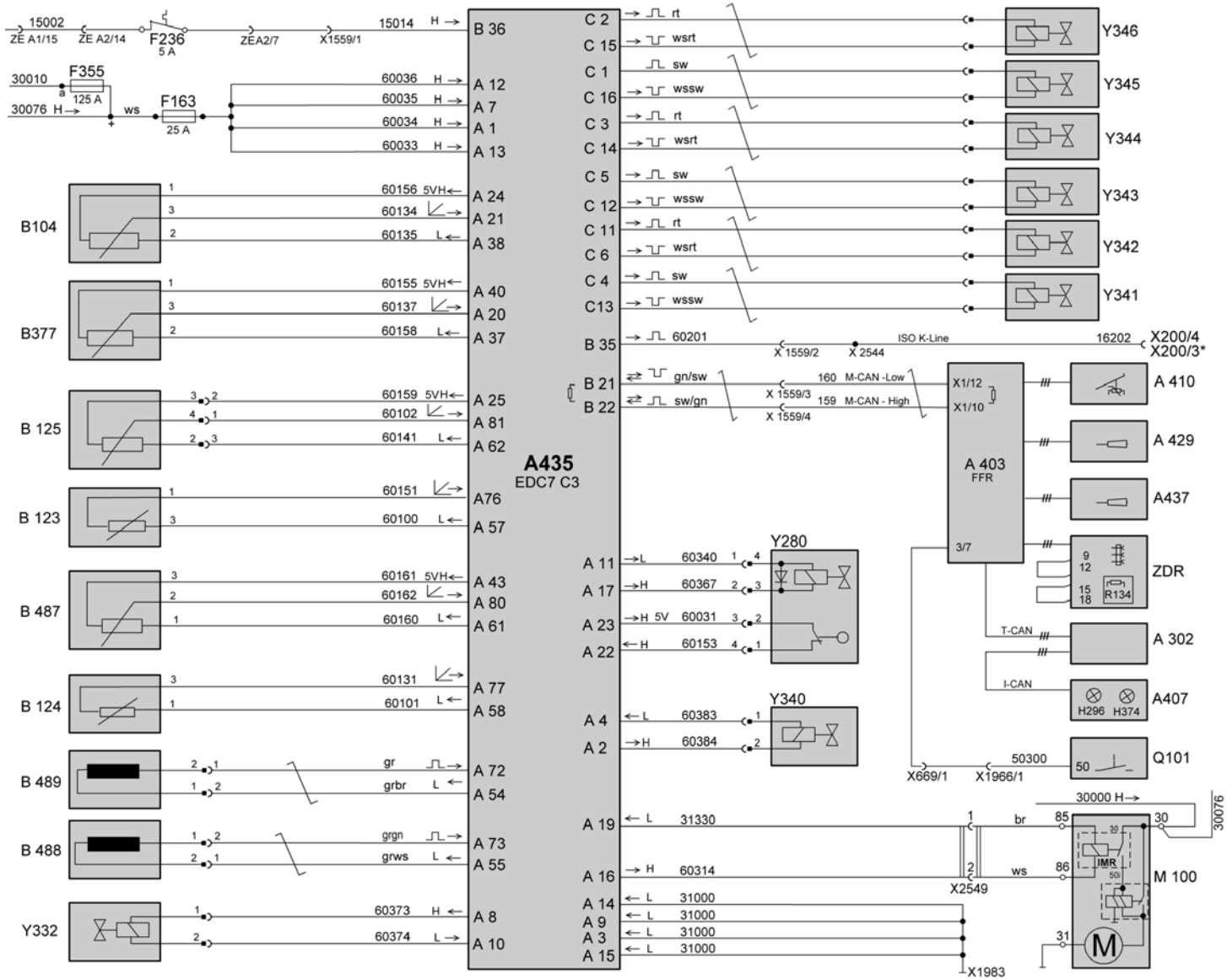
OVERVIEW, EDC7 C3 EURO 3

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC
A437 Auxiliary brake lever
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B125 Charge-pressure sensor
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
F163 Fuse, engine control (terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
H296 Check lamp, EDC
H374 Check lamp, air cleaner dirty
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X1983 Threaded pin M6 (motor power box)
X2544 Potential distributor, 21-pin, K-line
X2549 Plug connection, IMR (starter)
Y280 Exhaust gas recirculation cylinder EGR
Y332 Metering unit (fuel proportional valve, MProp)
Y340 Proportional valve, turbocharger, 2-stage supercharging (only for D 08 engines)
Y341 Injector, 1st cylinder
Y342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
ZDR Intermediate speed interface
***** If HD-OBD diagnosis socket, K-line is on pin 3

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OVERVIEW, EDC7 C3 EURO 3



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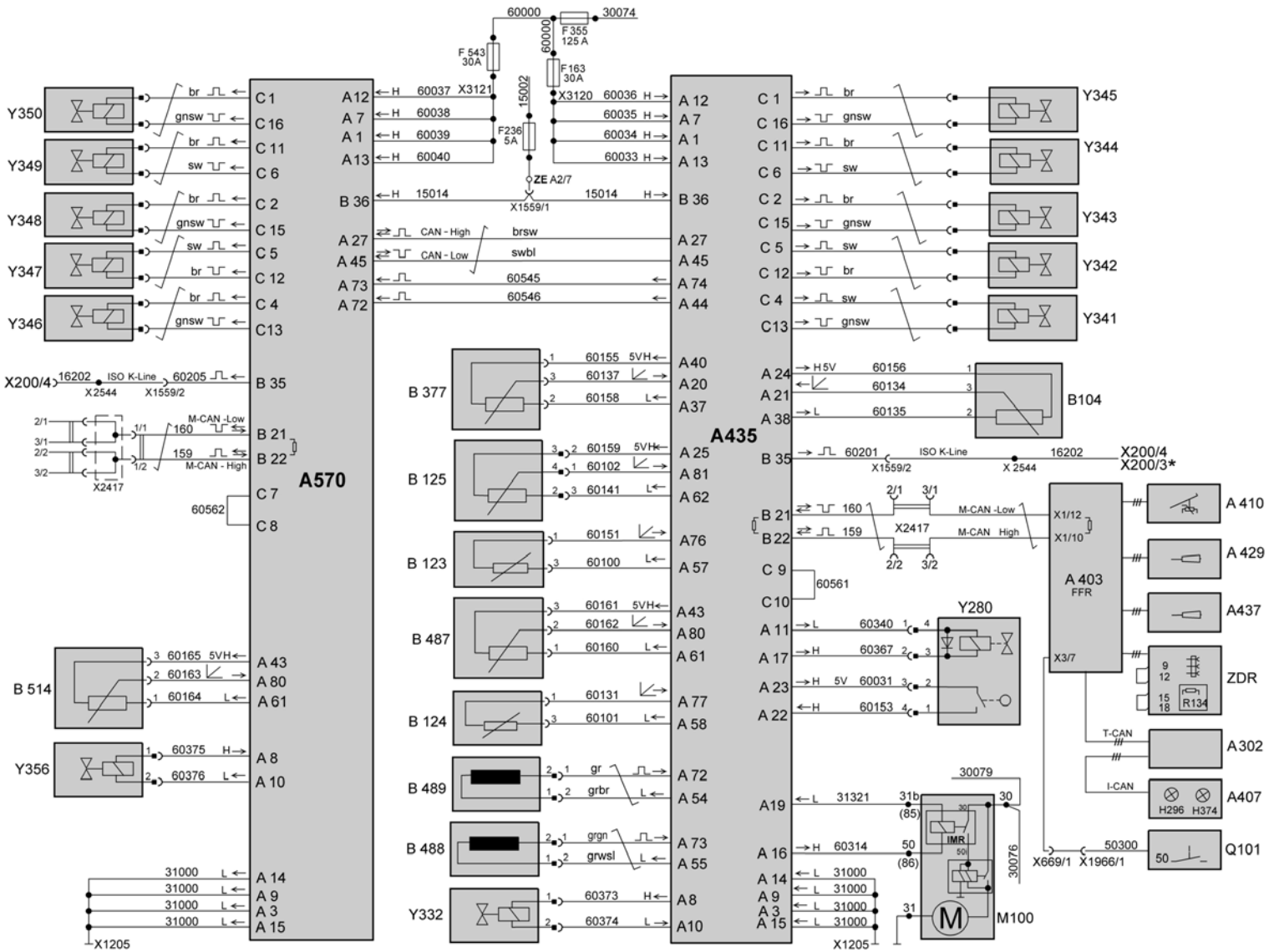
OVERVIEW, EDC7 C3 EURO 3 MASTER/SLAVE

Legend

A302 Central on-board computer
A403 Vehicle management computer
A407 Instrumentation
A410 Accelerator pedal
A429 Cruise control switch
A435 Control unit, EDC (Master)
A437 Auxiliary brake lever
A570 Control unit, EDC II (Slave)
B104 Oil pressure sensor
B123 Temperature sensor, charge air
B124 Temperature sensor, coolant
B125 Charge-pressure sensor
B377 Fuel pressure sensor
B487 Rail-pressure sensor
B488 Speed sensor, crankshaft (speed increment sensor)
B489 Speed sensor, camshaft (speed segment sensor)
B514 Rail-pressure sensor II
F163 Fuse, engine control (Master, terminal 30)
F236 Fuse, engine control (terminal 15)
F355 Main fuse 30-2
F543 Fuse, engine control II (Slave, terminal 30)
H296 Check lamp, EDC
M100 Starter
Q101 Ignition/starter switch
R134 Resistor bank
X200 Diagnosis socket
X669 Plug connection, starter interlock
X1205 Distributor, line 31000
X1559 Plug connection, engine/EDC/gearbox IV
X1966 Plug connection, ignition lock
X2417 Plug connection, engine CAN 3x
X2544 Potential distributor, 21-pin, K-line
X3120 Threaded pin M6, distributor, term. 30 (equipment compartment)
X3121 Threaded pin M6, distributor, term. 30 (equipment compartment)
Y280 Exhaust gas recirculation cylinder, EGR
Y332 Metering unit (fuel proportional valve, MProp)
Y341 Injector, 1st cylinder
X342 Injector, 2nd cylinder
Y343 Injector, 3rd cylinder
Y344 Injector, 4th cylinder
Y345 Injector, 5th cylinder
Y346 Injector, 6th cylinder
Y347 Injector, 7th cylinder
Y348 Injector, 8th cylinder
Y349 Injector, 9th cylinder
Y350 Injector, 10th cylinder
Y356 Metering unit II (fuel proportional valve, MProp)
ZDR Intermediate speed interface
***** If HD-OBD diagnosis socket, K-line is on pin 3

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OVERVIEW, EDC7 C3 EURO 3 MASTER/SLAVE



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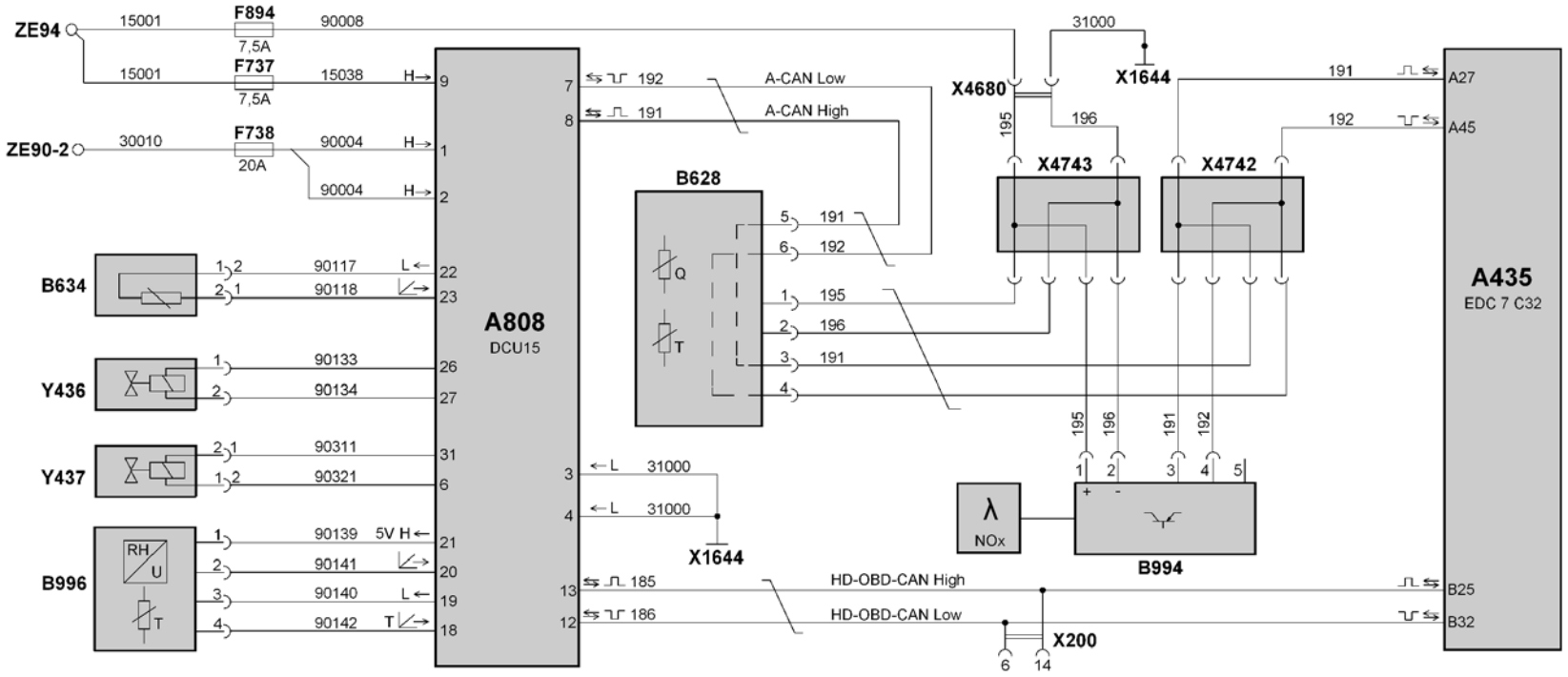
OVERVIEW, ADBLUE® DOSING CONTROL UNIT DCU15

Legend

A435 Control unit, EDC
A808 AdBlue® dosing control unit DCU15
B628 AdBlue® fill level/temperature sensor
B634 Exhaust gas temperature sensor 2 (downstream of catalytic converter)
B994 NOx sensor
B996 Air humidity sensor with temperature sensor
F737 Fuse, voltage supply, terminal 15
F738 Fuse, voltage supply, terminal 30
F894 Fuse, sensors
X200 Diagnosis socket
X1644 Earthing point, cab (next to central electrical system)
X4680 Plug connection, cab/dosing control unit
X4742 Potential distributor, exhaust gas CAN/NOx sensor
X4743 Potential distributor, voltage supply, NOx sensor
Y436 Dosing module
Y437 Coolant valve, AdBlue®

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OVERVIEW, ADBLUE® DOSING CONTROL UNIT DCU15



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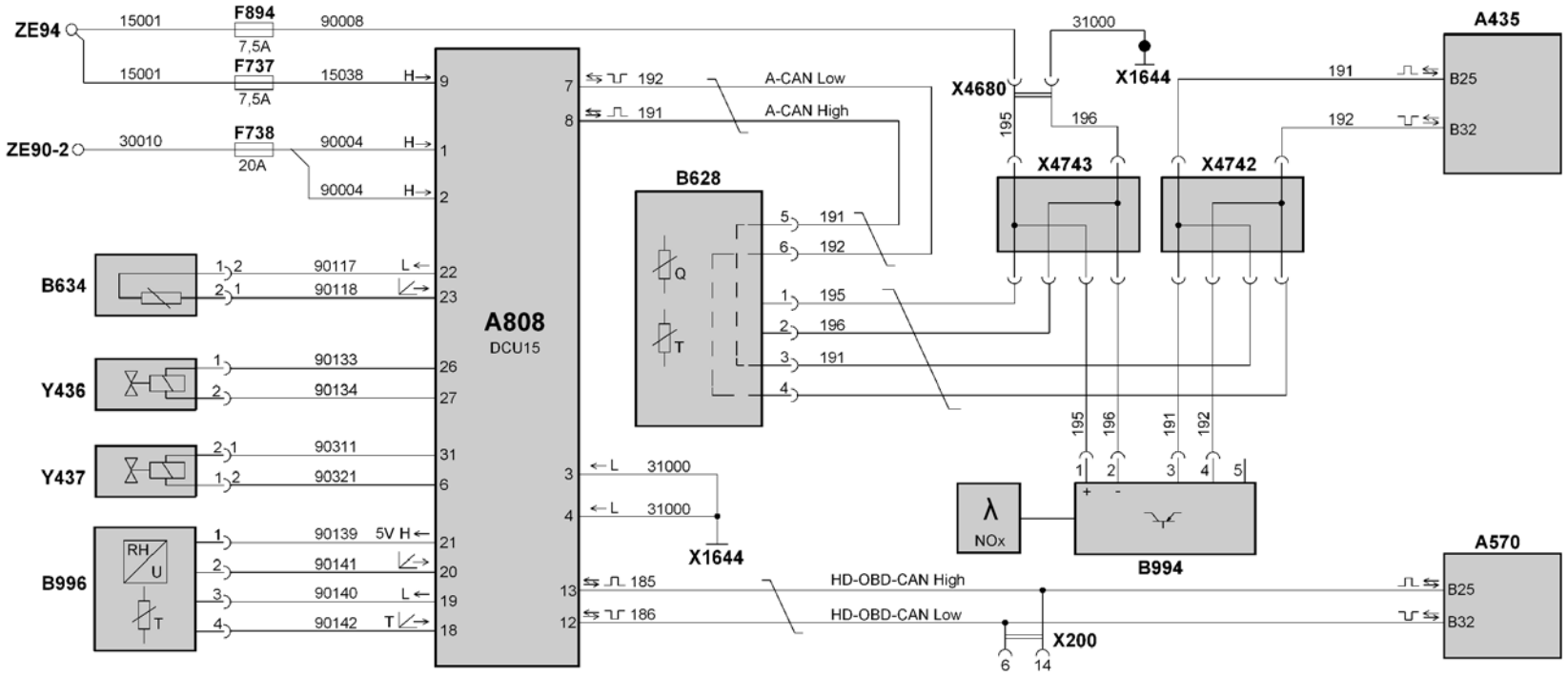
OVERVIEW, ADBLUE® DOSING CONTROL UNIT DCU15 MASTER/SLAVE

Legend

A435 Control unit, EDC (Master)
A570 Control unit, EDC (Slave)
A808 AdBlue® dosing control unit DCU15
B628 AdBlue® fill level/temperature sensor
B634 Exhaust gas temperature sensor 2 (downstream of catalytic converter)
B994 NOx sensor
B996 Air humidity sensor with temperature sensor
F737 Fuse, voltage supply, terminal 15
F738 Fuse, voltage supply, terminal 30
F894 Fuse, sensors
X200 Diagnosis socket
X1644 Earthing point, cab (next to central electrical system)
X4680 Plug connection, cab/dosing control unit
X4742 Potential distributor, exhaust gas CAN/NOx sensor
X4743 Potential distributor, voltage supply, NOx sensor
Y436 Dosing module
Y437 Coolant valve, AdBlue®

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OVERVIEW, ADBLUE® DOSING CONTROL UNIT DCU15 MASTER/SLAVE



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