



cl1

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Please see seminar presentation by MAN on 25/11/2015 in EPD website:

[首頁 > 空氣 > 問題與解決方案 > 柴油商業車輛技術講座 > 歐盟六期柴油引擎 MAN \(猛獅\)](#)


http://www.epd.gov.hk/epd/tc_chi/environmentinhk/air/prob_solutions/diesel-commercial-vehicles-technical-information.html

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Objective				
<p>After the training, you will be capable to:</p> <ul style="list-style-type: none">• Understand the different EU emission standard requirement.• Understand the design difference among Euro 3, 4, 5 and 6 engine.• Explain the application of emission control on MAN trucks and buses.• Understand by theory the different kinds of engine exhaust after treatment control.				
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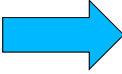
Chapter 1				
<h2>History of European emission standard</h2>				
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Development of Commercial vehicle's Emission control




Euro 0 >1988





Euro 6 >2013




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Development of Commercial vehicle's Emission control




Euro 1 >1.1992
Euro 2 >10.1996



Euro 3 >10.2000



Euro 4 >10.2005
Euro 5 >10.2008



Euro 6 >10.2013



<https://www.youtube.com/watch?v=iRcg8Uct8j0>

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History of European Emission Standard (Truck & Bus)



Stage	Starting date : New type approval *All type approval will be started a year later	Test cycle	CO g/kWh	HC g/kWh	NOx g/kWh	PM g/kWh	Smoke m-1
Euro 0	1988	ECE R-49	12.3	2.6	15.8	-	-
Euro 1	1.1992	ECE R-49	4.5	1.1	8.0	0.36	-
Euro 2	10.1996	ECE R-49	4.0	1.1	7.0	0.15	-
Euro 3	10.1999 <i>EEV only</i>	ESC	1.0	0.25	2.0	0.02	0.15
	10.2000	ESC	2.1	0.7	5.0	0.10	0.8
Euro 4	10.2005	ESC	1.5	0.5	3.5	0.02	0.5
Euro 5	10.2008	ESC	1.5	0.5	2.0	0.02	0.5
Euro 6	12.2013	WHSC	1.5	0.1	0.4	0.01	0.1

Remarks:

EEV – Enhanced Environmentally friendly Vehicle (defined as “clean vehicle in the M2 & M3 category) ECE R-49 – Emission Test Cycle under ECE regulation No.49

ESC – European Stationary Cycle

WHSC – World Harmonized Stationary Cycle

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Overview of Changes on MAN engines Exhaust gas treatment



Euro 3 (10.2000)

- Common Rail Technology - New Diesel Fuel Injection system with EDC 7.
- EGR – Exhaust gas Recirculation (black and white control)

Euro 4 (10.2005)

- CR EDC 7 with EGR (Continuous regulated)
- Exhaust after treatment – PM Kat, and DOC (Diesel Oxidation Catalytic convertor)
- On Board Diagnosis (OBD) –
 - OBD1a (1st registration starting 10/2006) and,
 - OBD1b (1st registration starting 10/2007)

Euro 5 (10.2008)

- Two streams of development:
 - CR EDC 7 with regulated EGR–
 - 2 stage Turbo charger with Low Temperature cooling Concept.
 - With PM Kat for EEV, CRT for City bus, DOC for D08
 - CR EDC 7 AdBlue system with SCR exhaust gas after-treatment
- OBD2 (starting 10/2009)

Euro 6 (12.2013)

- CR EDC 17 with combination of both EGR and AdBlue systems.
- Exhaust gas after-treatment – CRT + SCR
- OBD 2 (starting 10/2014)



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Chapter 2



Euro 3 engine

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Emission improvement Euro 3 (starting from 10.2000)



<u>Toxic content</u>	<u>Unit</u>	<u>Euro 2 From</u>	<u>Euro 3 To</u>	<u>Emission content Improved by</u>
CO (Carbon Monoxide)	g/kwh	4.5	2.1	54%
HC (Un-burnt fuel)	g/kwh	1.1	0.7	36%
Nox (Nitrogen oxides)	g/kwh	8	5	37.5%
PH (particles)	g/kwh	0.36	0.1	72%
Smokes	m-1	--	0.8	Newly controlled content

Engine emission level is achieved by adopting: **EDC 7 CR (Common Rail fuel Injection)**

**EGR (exhaust gas recirculation system) –
Internal EGR for D08 engine (via modified valve timing) or
External EGR for D20/26/28(with water cooled external EGR module)**

Note:

starting from Introduction Euro 3, all engine must use diesel of lower than 50ppm Sulfur content, so called **Ultra-Low-Sulfur Diesel (ULSD)**

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Common Rail Engines with EDC systems



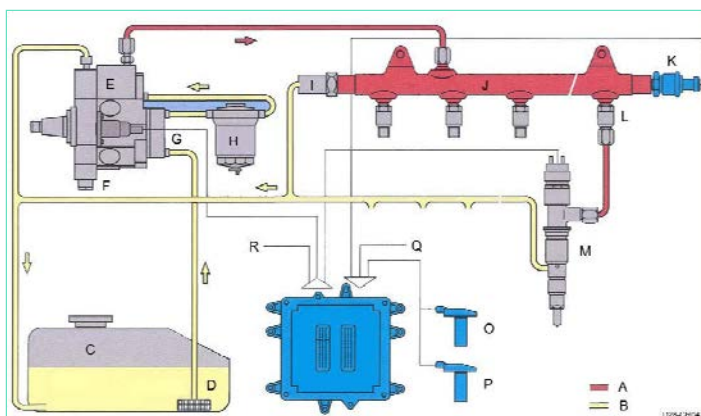
Characteristic:
 •Fuel pressure independent of engine speed.
 •Need intense care when servicing fuel system

Note:
 Dirt particles **greater than 0.2 mm** may cause component failure

Fuel System pressure:
 Euro 3 & 4: max 1600bar
 Euro 5: Max 1800 bar
 Euro 6: Max 2100 bar



Common Rail Engine Concept



- A High-pressure circuit
- B Low-pressure circuit
- C Fuel tank
- D Suction line
- E High-pressure pump
- F Pressure line
- G Pre-supply pump
- H FSC
- I Pressure limiting valve
- J Rail
- K Rail pressure sensor
- L High-pressure line
- M Injector
- O Camshaft sensor P Crankshaft sensor Q Input signals R Output signals

Cleanliness



MAN

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D28 CR Euro 3 engine



MAN

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Exhaust gas recirculation system

In 1999 MAN introduced an external Exhaust Gas Recirculation (EGR) solution for Euro 3 trucks. EGR recycles about 10% percentage of the cooled exhaust gasses back into the engines - to help reduce the Nitrogen Oxide (NOx) emissions.

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Exhaust gas recirculation system

40 °C

160 °C

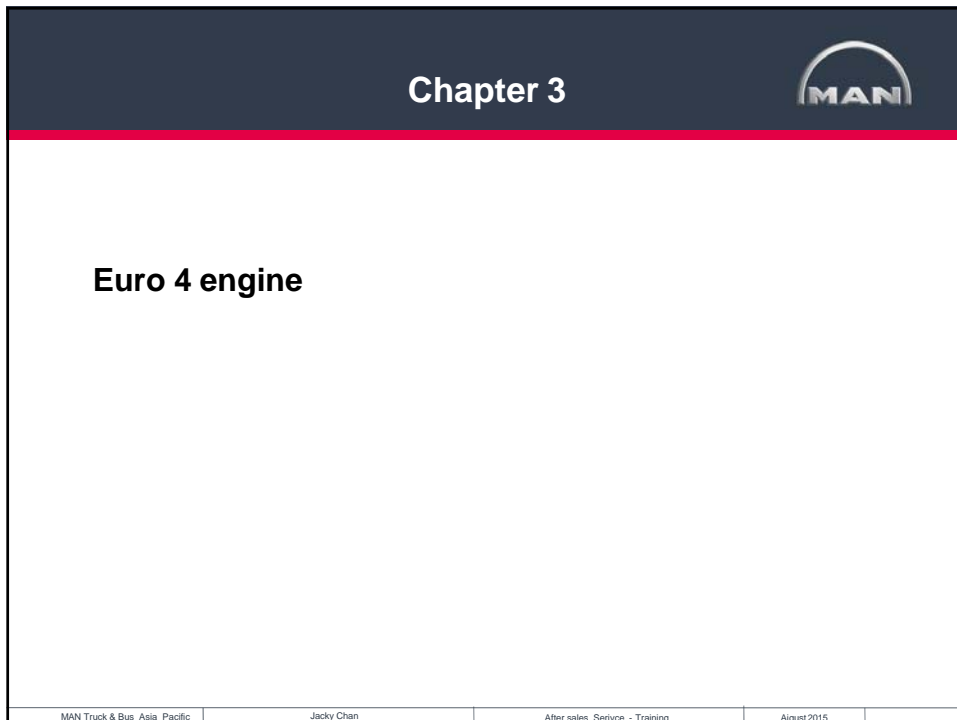
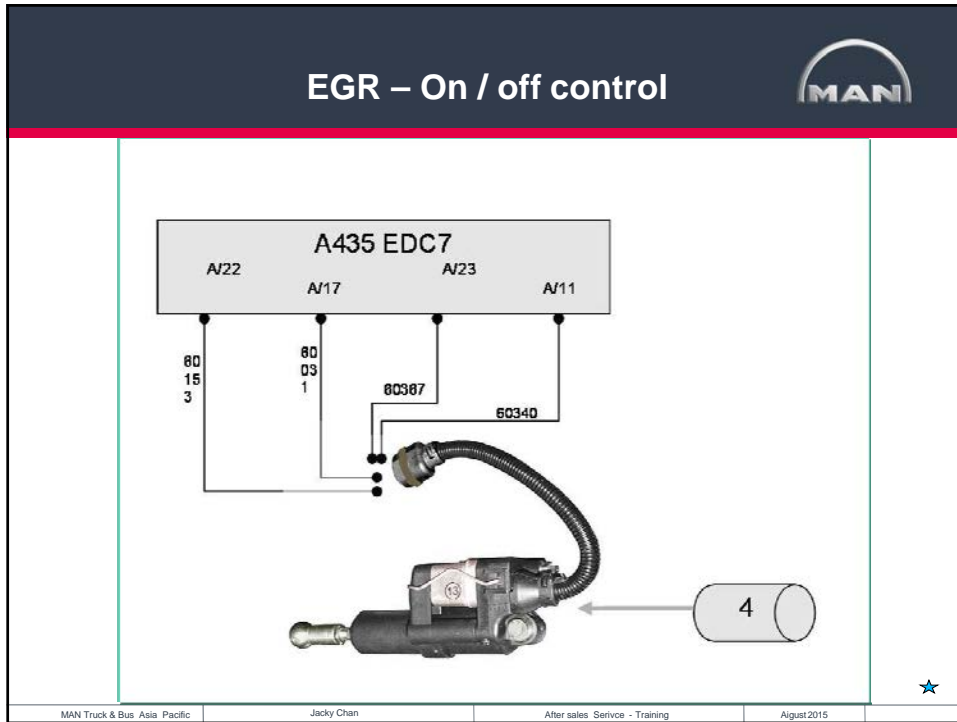
- Lower temperature of cylinder charge
- High recirculation rate

Required NO_x values are achieved


- No further measures are necessary
- Euro 4 potential

- High efficiency
- Low consumption
- Clean oil

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Emission improvement Euro 4 (starting from 10.2005)




<u>Toxic content</u>	<u>Unit</u>	<u>Euro 3 From</u>	<u>Euro 4 To</u>	<u>Decreased by</u>
CO (Carbon Monoxide)	g/kwh	2.1	1.5	28%
HC (Hydrocarbon)	g/kwh	0.7	0.5	28%
Nox (Nitrogen oxides)	g/kwh	5.0	3.5	30%
PH (particles)	g/kwh	0.1	0.02	80%
Smokes	m-1	0.8	0.5	37.5%

General features:

- EDC 7 on Common Rail Engine
- On Board Diagnosis (OBD)
- Controlled EGR
- DOC / PM catalytic convertor

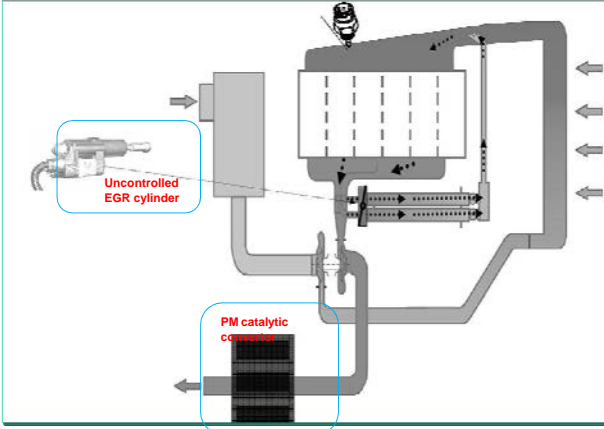
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Early Euro 4 (Up to Oct 2006)




Identifying features:

- EGR rate approx. 20% (black/white regulation)
- With PM catalytic converter




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PM-KAT




After an upstream oxidation catalytic converter, additional soot particles are oxidised to CO₂ in a metal fleece by the present nitrogen dioxide. The open structure prevents the system from becoming clogged.

PM-KAT®



oxidation catalytic converter




$$2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$$

$$2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$$

$$2\text{HC} + 5/2\text{O}_2 \rightarrow 2\text{CO}_2 + \text{H}_2\text{O}$$


Soot particle separator
Metal fleece/fleece layers



$$2\text{NO}_2 + \text{C} \rightarrow 2\text{CO}_2 + 2\text{NO}$$

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MAN PM-KAT®

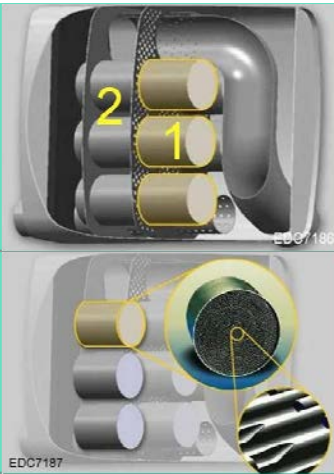


PM = Particulate matter

- 1 Oxidation catalytic converter (PLATINUM CATALYTIC CONVERTER)
- 2 Soot particle separator Metal fleece

- In chamber 1, NO is converted into NO₂ (oxidation process)
- In chamber 2, Soot particles are initially retained by a targeted form of metal fleece pockets.
- The retained soot particles react due to high pressure and an exhaust temperature of 250°C. Degradation of soot particles is achieved by nitrogen dioxide.
- permanent chemical reaction which are then discarded.
- $\text{C} + \text{NO}_2 \rightarrow \text{CO}_2 + \text{N}_2$
- Particle reduction is a continuously operating system with open chambers.

In general speaking, the PM KAT does not need maintenance.


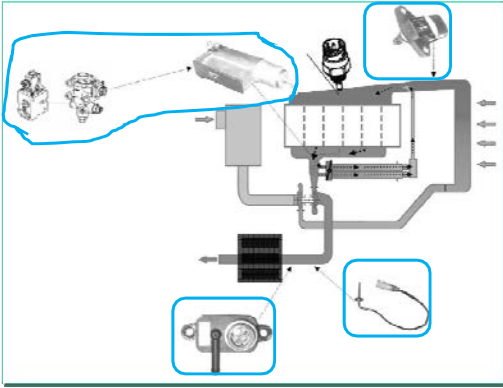


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Euro 4 OBD1a (Up to Oct 2007)

Identifying features:

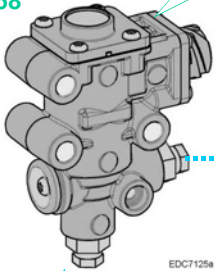
- OBD (On-Board Diagnosis) symbol (MIL=Malfunction Indicator Lamp) in the instruments.
- Charging pressure sensor with integrated temperature sensor
- Position-controlled EGR cylinder with proportional valve
- With PM catalytic converter
- Exhaust-gas relative pressure sensor
- Temperature sensor for exhaust gas before the catalytic converter

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EGR with regulation

Y458



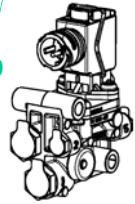
EDC7125a

EDC triggering of exhaust gas recirculation adjusting cylinder as PWM signal




Displacement sensor feedback signal in volts – can be adjusted depending on the software version

Y460

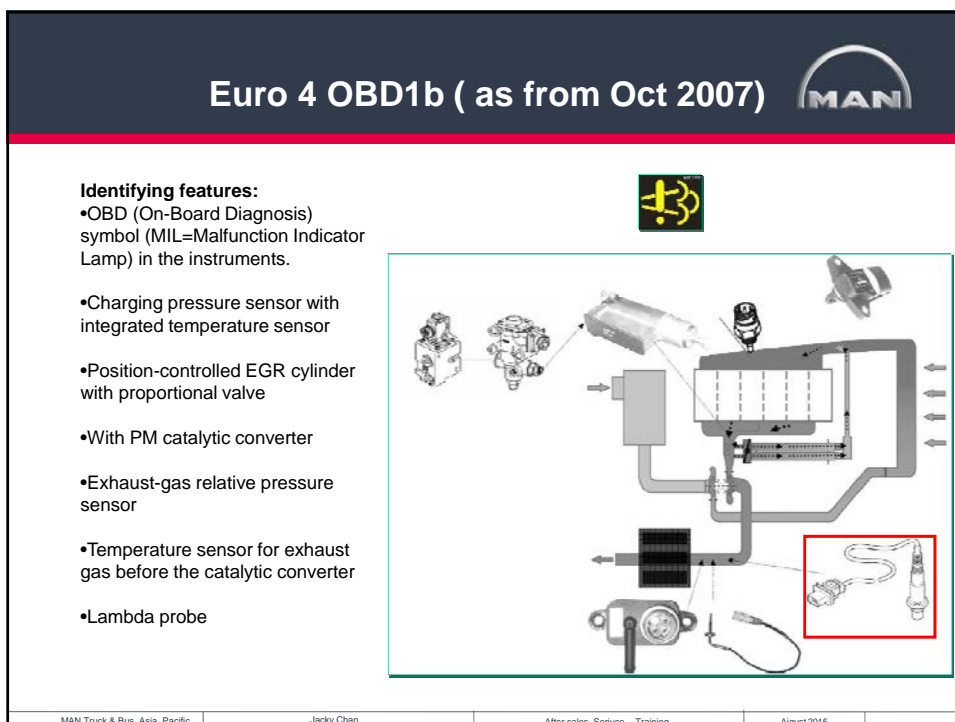
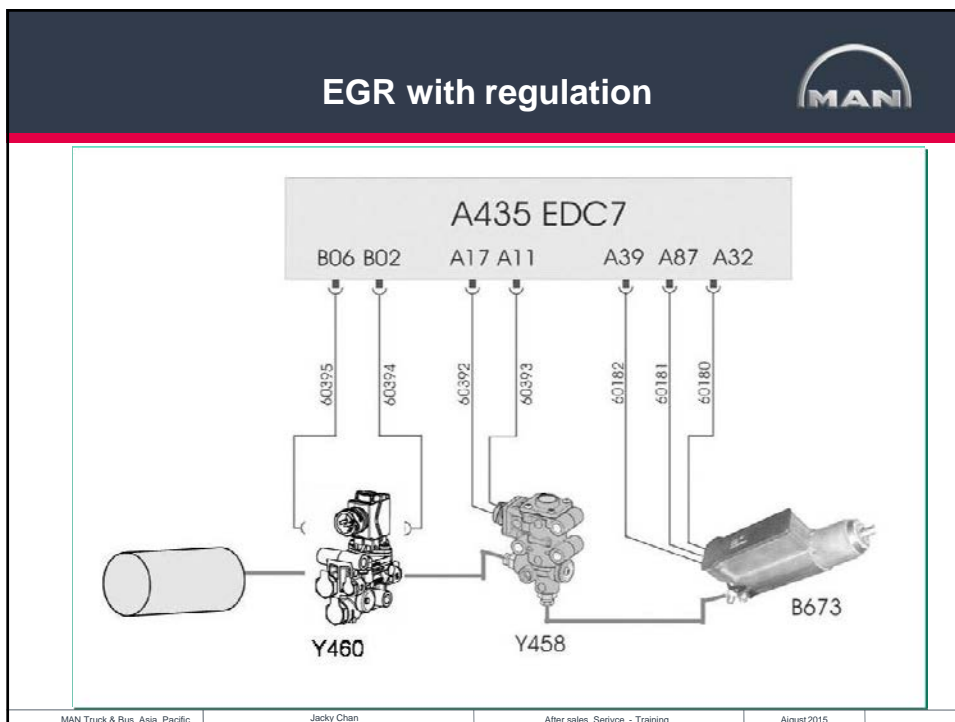


EDC triggering when ignition on



9.3 bar

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Lambda probe (B322)



The lambda probe measures the difference between the oxygen concentration in the ambient air and the exhaust-gas stream. The used lambda probe is a broadband probe, which means that lambda values > 1 (air excess) can also be measured. This broadband probe contains two cells: a pump cell and a sensor cell. The pump stream is the measuring value for the lambda value.

The lambda probe is connected and supplied using the EDC7 engine control unit

There are fault entries 03855 and 03938 in the EDC or long-term fault entry P2BAE in the OBD.

Teaching of Lambda probe



- It is necessary to teach in the lambda probe after a fault has been rectified or it has been replaced.
- If this is not performed the MIL flashes after ignition.
- After rectifying it is necessary to delete the fault memory (EDC and OBD) and test drive the vehicle (coolant temperature $> 70^{\circ}\text{C}$).
- Let the vehicle coast on an ordinary road at 60 km/h for 15 seconds and subsequently accelerate to allow the lambda probe to adapt.
- If you continue in coasting mode for longer than 15 seconds fault 3938-02 appears.
- Then you must repeat the procedure and make sure to keep to the 15-second time frame.

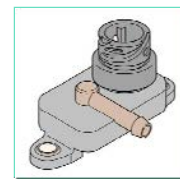
Exhaust-gas relative pressure sensor (B683)

The KAVLIKO exhaust-gas relative pressure sensor (in TGL/TGM) is used in Euro 4 engines. It monitors the differential pressure before and after the particulate filter (PM-KAT). Monitor and warn the operational defect of PM-KAT.

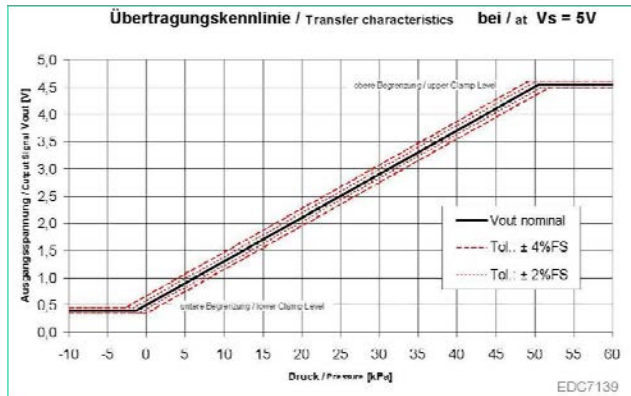
TGL/TGM



TGA/TGS/TGX



Pin 1 Supply voltage 5 volt
 • Pin 2 Earth sensor
 • Pin 3 Output signal



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Fault information for PM-KAT

Possible complaints:


- a) Performance drop
 - Depending on the case, slight, continuous black smoke emission
 - Fault displayed on instruments: 3785 FMI1
- b) Fault displayed on instruments
 - No further noteworthy factors
- c) No fault appears on the display
 - No noticeable performance drop
 - Entry in vehicle fault memory

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Procedure for a) b) c):

- Read out/delete the vehicle fault memory
- Read out/delete the trend data
- Read out with MAN-Cats: exhaust-gas differential pressure in warm operating conditions at breakaway speed
- Hold breakaway speed for approx. 5 s until this condition stabilizes
- Save screen shot
- Maximum value 60 mbar
- At measured value 60 - 150 mbar
- PM-KAT blocked or beginning to block

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Possible remedy

- Test drive for approx. 20 min., load vehicle, high load and temperature (e.g. on uphill gradient) Attention: avoid engine damage.
- Subsequently measure exhaust-gas differential pressure again as described above. Repeat test drive(s) depending on measurement result.
- Burning the residue multiple times may also be performed by the customer (please coordinate) over a relatively long period (e.g. 1-2 weeks).

It is subsequently necessary to perform a check measurement.

- Measured value after residue in catalytic converter has been burnt: > 60 mbar: repeat process of burning residue in catalytic converter. If the value remains > 60 mbar, replace.

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Frequent cause of PM-KAT blocking


- Vehicle is always operated in low load condition, therefore temperatures for regeneration not reached:
 - D08 engines approx. 270°C
 - D20/D26 engines approx. 380°C
- Operation of vehicles with alternative fuel types
 - Formation of chemical ash
 - Eliminating chemical ash is not possible
- Operation of vehicles with diesel fuel with sulphur content > 50 ppm is not permitted.



Chapter 4

Euro 5 engine

Emission improvement Euro 5 (starting from 10.2008)




<u>Toxic content</u>	<u>Unit</u>	<u>Euro 4 From</u>	<u>Euro 5 To</u>	<u>Decreased by</u>
CO (Carbon Monoxide)	g/kwh	1.5	1.5	-
HC (Hydrocarbon)	g/kwh	0.5	0.5	-
Nox (Nitrogen oxides)	g/kwh	3.5	2.0	42%
PH (particles)	g/kwh	0.02	0.02	-
Smokes	m-1	0.5	0.5	-

General features: With the EDC 7 as a base, MAN exhaust treatment has adopted kinds of technology for different applications (Simply saying : Truck & Bus/coach)

1.EGR + Double stage Turbo charger + low temperature cooling system + DOC (Truck D08) ; PM-KAT (D08-EEV) ; CRT (City Bus)

2.AdBlue concept + Selective Catalytic Reduction (SCR). (Truck D20/26/28 E5, EEV)

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The diagram illustrates the transition from Euro 4 (E4) to Euro 5 (E5) emission standards. A horizontal timeline shows the years 2005 through 2013. A vertical line marks the start of E5 in 2009. Below the timeline, three engine configurations are shown, each with its corresponding exhaust treatment technology:

- Engine: -EGR, -2-stage turbocharging** (Yellow box) is associated with **Truck D08** using an **Oxidising catalytic converter**, **EEV D08/D20** using a **PM catalytic convert**, and **City Bus D08/D20/D26** using **CRT**.
- Engine: -no EGR, -1-stage turbocharging** (White box) is associated with **Truck D20/D26/D28** using **SCR**.
- Engine: -EGR, -1-stage turbocharging** (White box) is associated with **Truck & Bus** using a **PM catalytic converter**.

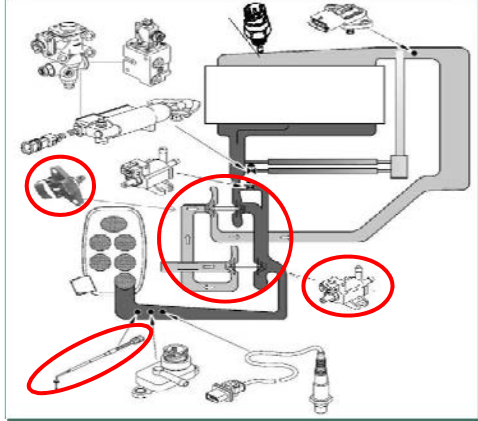
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Euro5 with EGR system




Identifying features:

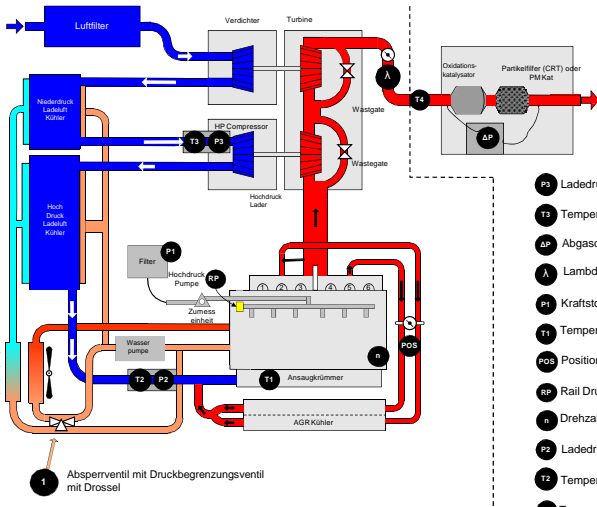
- OBD symbol (MIL) in the instruments
- EGR rate up to approx. 30%
- Up to two charging pressure sensors with integrated temperature sensors
- Position-controlled EGR cylinder with proportional valve and solenoid valve
- Controlled two-step charging with up to two proportional valves
- Exhaust-gas temperature sensor - exhaust-gas relative sensor - lambda probe
- Euro5 with oxidation catalytic converter (D08 engine)
- EEV with PM-Kat, city buses with CRTecR filter (D08, D20 engines)



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Euro5 with EGR system





- P3 Ladedruck Niederdruckladeluftkühler
- T3 Temperatur Niederdruckladeluft
- ΔP Abgasdifferenzdruck
- λ Lambda Sensor
- P1 Kraftstoffdruck vor dem Filter
- T4 Temperatur Ladeluft + Abgas
- POS Position AGR
- RP Rail Drucksensor
- n Drehzahlsensor (KW, NW)
- P2 Ladedruck Hochdruckladeluftkühler
- T2 Temperatur Hochdruckladeluft
- T4 Temperatur Abgas

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Low temperature cooling concept with 2-stages Turbo Charger



MAN PURE DIESEL technology achieves the strict emission limits thanks to lambda controlled exhaust-gas recirculation (EGR) with high recirculation rates (30%).

To achieve this high recirculation rates, it is necessary to keep the charge-air temperature in a low level.

For this reason, a 2-stage turbo charger is adopted so that charged-air are cooled two times by intercoolers in between. The coolant which cool the intercoolers are cooled down by a Low Temperature cooler.

- Water from the coolant circuit is guided to the low-temperature cooler using a solenoid valve.
- Water that has now been cooled twice is then guided through the two intercoolers and then reintroduced to the coolant circuit.
- The two intercoolers (low-pressure and high-pressure intercoolers) are controlled by fast-opening thermostats.

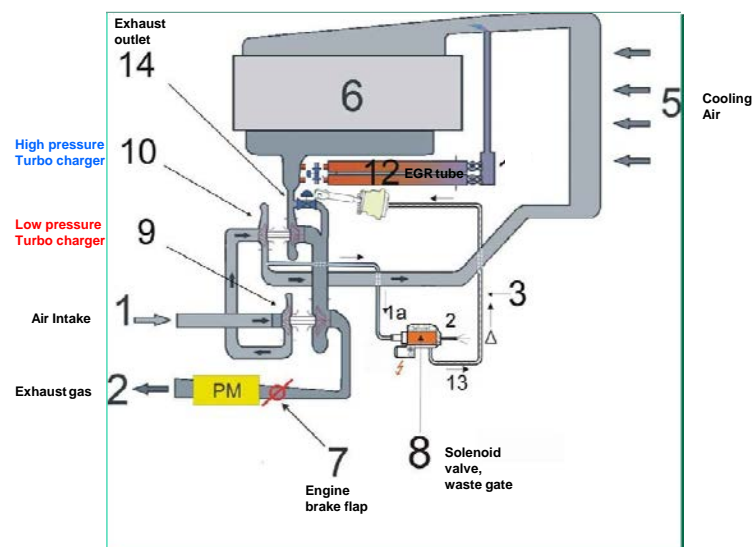
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Principal of 2-stage charging



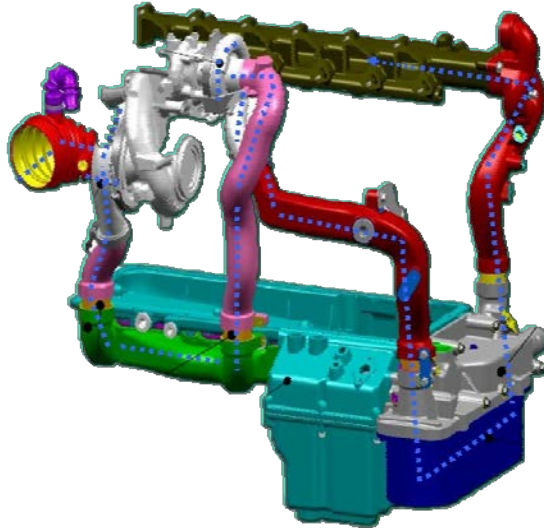
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Intercooling with low-temperature concept in D08 engine



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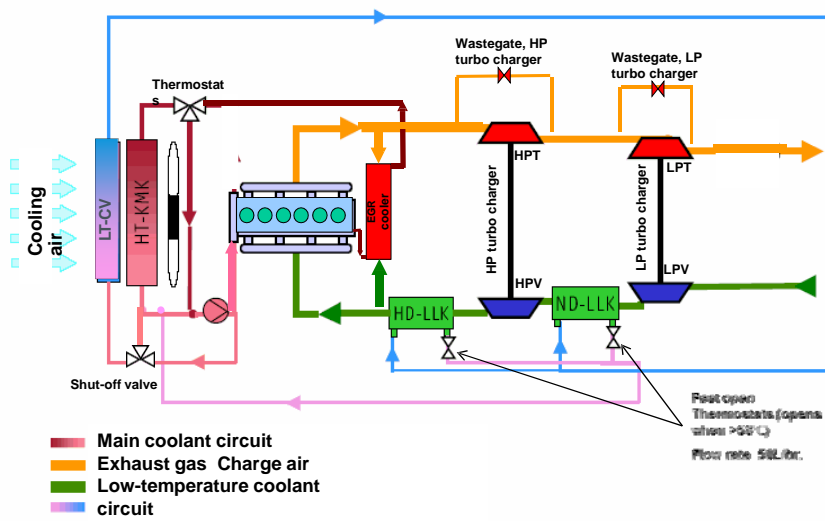
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Cooling circuit

Schematic presentation

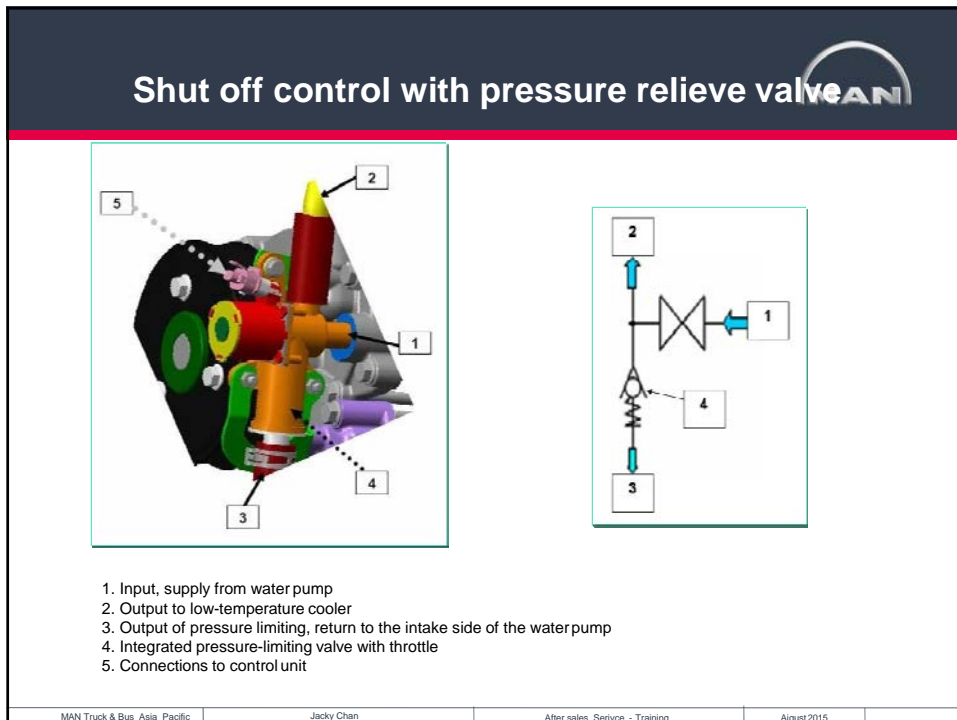
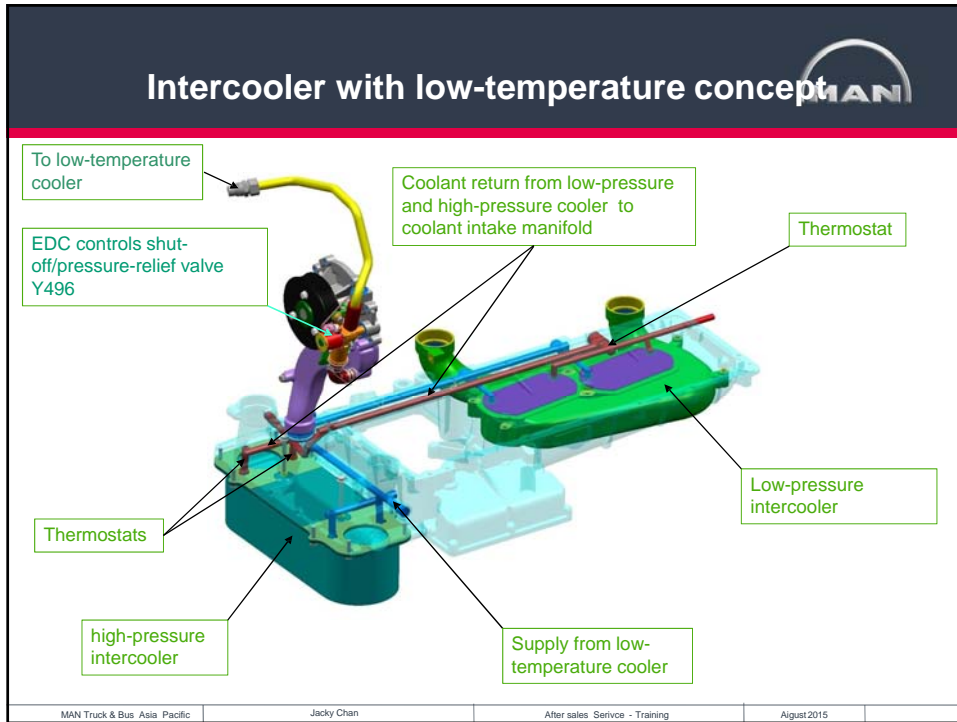


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Shut off control with pressure relief valve

- Controlled and energized by EDC to close. Valve opens when electric off.
- When coolant temperature <80C → valve closed.
- When coolant temperature >85C or charge temp of charge air >50°C, → valve opened.
- Valve also closed when cooling is not necessary. Example: engine braking and when vehicle is coasting at >1600rpm + both thermostat are closed.
- Valve opened again when cooling is needed again.
- Example: engine rev up <1550 or either of the two thermostat opens >60°C.

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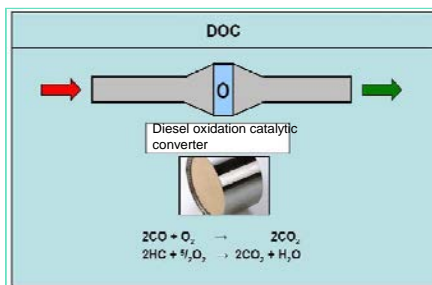
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Diesel Oxidation Catalytic converter

Noble metal trigger a catalytic reaction on a honeycomb-type surface (oxidation= exhaust-gas components are connected to oxygen).




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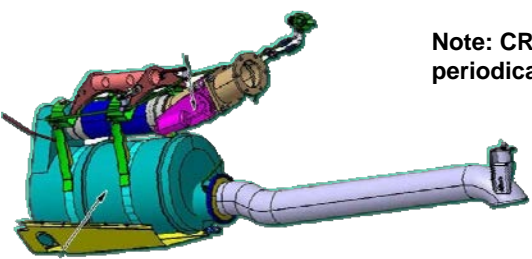
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CRTec – Continuous Regeneration Technology






Note: CRT filter needs to be cleaned periodically.

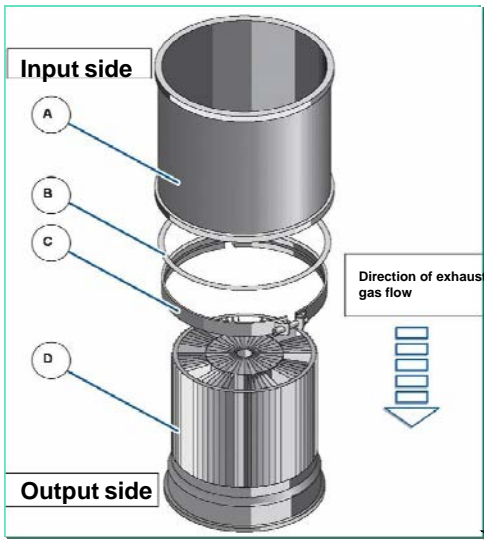
- Apart from combustible soot particles, DES particulate filter systems (diesel exhaust systems) also filter all other solid matter from the engine that cannot be regenerated.
- These are primarily ashes from engine oil combustion.
- These ashes are collected in the filter. This causes the filter to slowly block. This is noticeable from the increasing exhaust-gas back pressure.
- For this reason, the filter must be cleaned depending on the back pressure.
- Cleaning intervals vary from vehicle to vehicle depending on various deployment profiles, engines and power classes.
- You can extend maintenance intervals by using sinterised metal filters and low ash engine oils.
- Compared to ceramic filters the factor is approx. 2.5.



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Cleaning of CRT





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Clean the CRT by water jet




1. clean contrary to the direction of flow
 
2. Clean the filter in the direction of the output side to remove soot and ash from underneath the flange.
 
3. Clean filter from the input side
 
4. Place the filter on the input side and clean contrary to the direction of flow.
 

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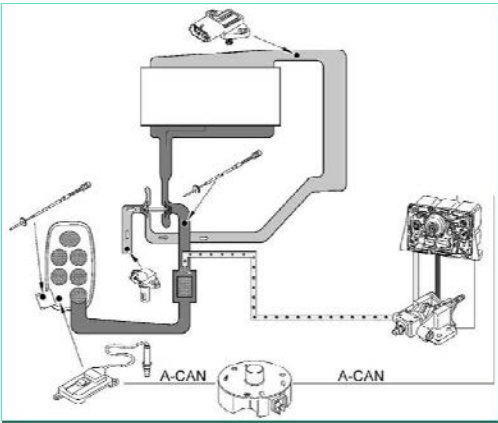
Euro5 with AdBlue system



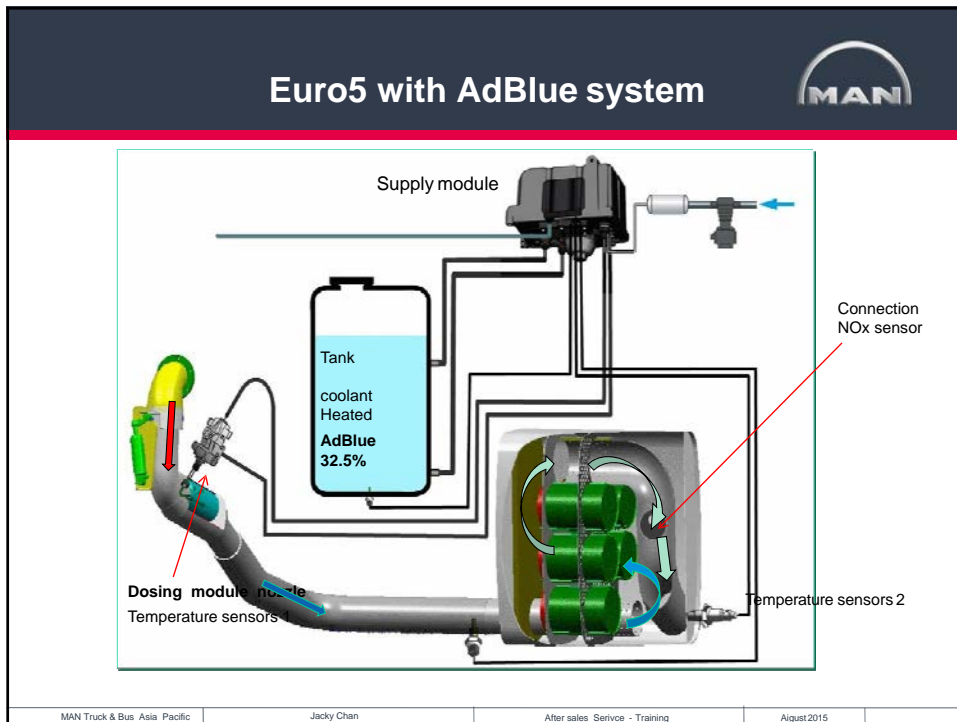
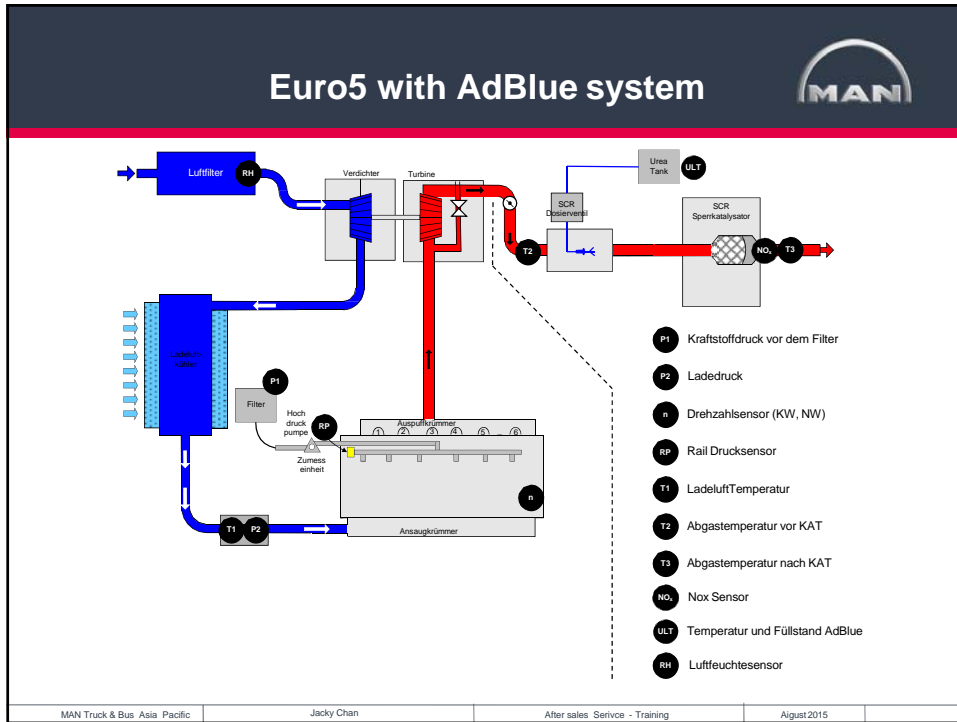


Identifying features:

- Charging pressure sensor with temperature sensor for charge air
- Exhaust-gas temperature sensor before and after the catalytic converter
- Supply module with AdBlueR dosing control unit
- Dosing module
- AdBlueR fluid level and temperature sensor
- Humidity sensor with temperature sensor
- SCR catalytic converter
- NOx sensor


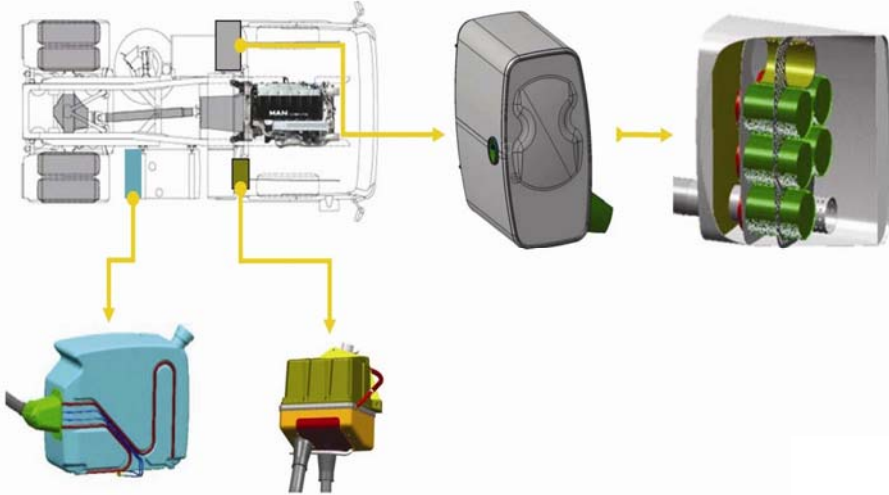


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MAN Technical Training


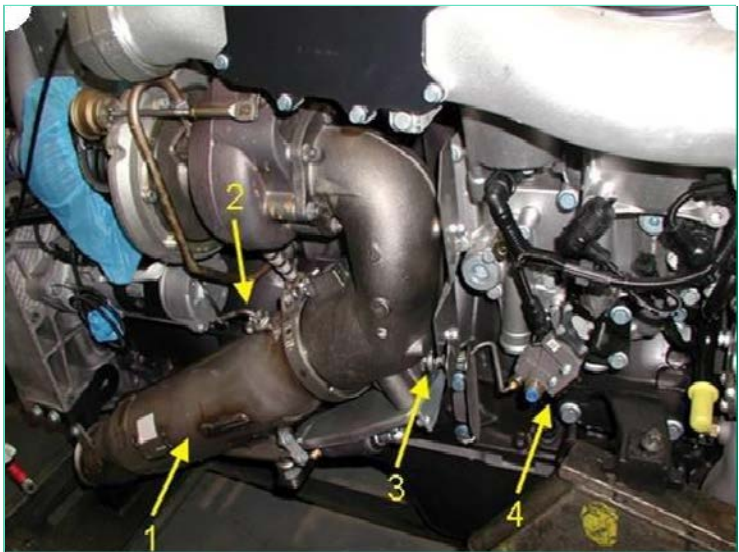
AE-05a Exhaust gas aftertreatment

The diagram illustrates the AE-05a Exhaust gas aftertreatment system. It shows a top-down view of a truck chassis with the engine and exhaust system. Yellow arrows indicate the flow of exhaust gas from the engine through the exhaust manifold, past the AdBlue tank and dosing module, and into the SCR reactor. The reactor is shown in a cutaway view, revealing the internal structure with green catalyst tubes. Below the chassis, the AdBlue tank and dosing module are shown in detail, connected to the exhaust system.

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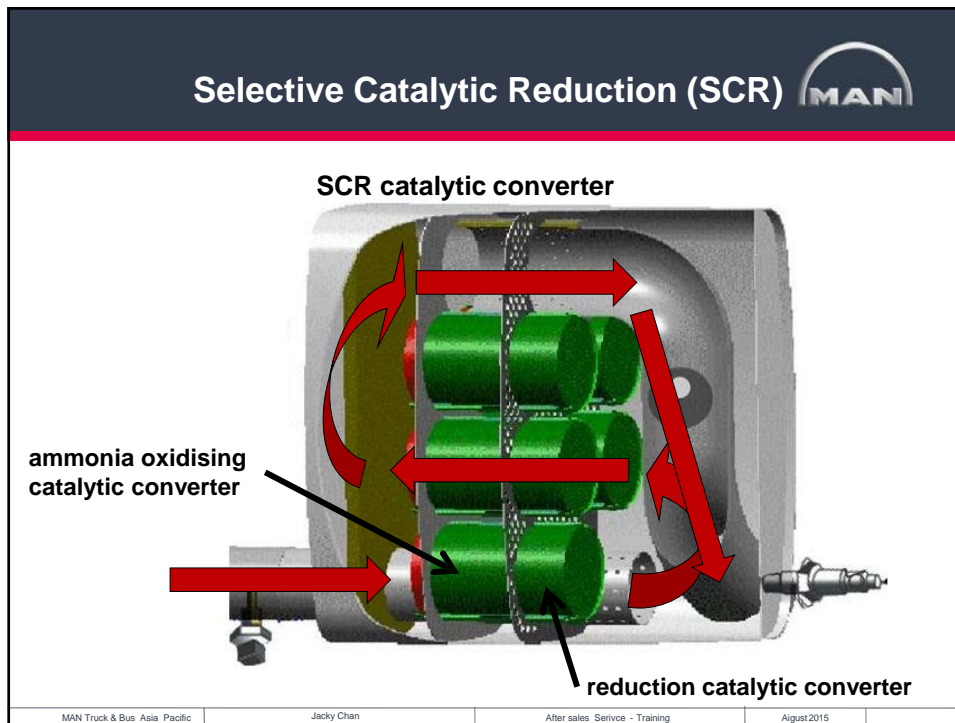
Euro 5 with AdBlue system

1 Mixer
 2 Exhaust-gas temperature sensor 1
 3 AdBlueR injection nozzle
 4 Dosing module

The photograph shows a close-up view of the Euro 5 engine with the AdBlue system components. Yellow arrows point to the following parts: 1. Mixer, 2. Exhaust-gas temperature sensor 1, 3. AdBlueR injection nozzle, and 4. Dosing module.

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Selective Catalytic Reduction (SCR)

- In the selective catalytic reduction nitrogen oxides (NO_x), consisting of NO and NO₂, are reduced in a catalytic converter with ammonia (NH₃) to water (H₂O) and nitrogen (N₂) →(oxygen O is extracted).
- NH₃ is not added to the exhaust gas in pure form, but a 32.5 % urea-water solution, known as AdBlue, is dosed into the exhaust gas, as required. In exhaust-gas temperatures of 350° - 400°C urea is quickly decomposed thermally.

(NH₂)₂CO → NH₃ and HNCO (isocyanic acid)

- The nitrogen oxides (NO_x) are reduced to water (H₂O) and nitrogen (N₂)

No_x + NO + NH₃ → H₂O + N₂ (Upstream Reduction Process)

- Active titanium dioxide layer inside SCR is used as reduction agent.
- To avoid NH₃ slip there is an oxidation catalytic converter layer on the tubes at the output end (blocking catalytic converter).
- In connection with oxygen this causes oxidation of the excess NH₃ to nitrogen and water.

4 NH₃ + 3 O₂ → 2 N₂ + 6 H₂O (downstream oxidation to remove NH₃)

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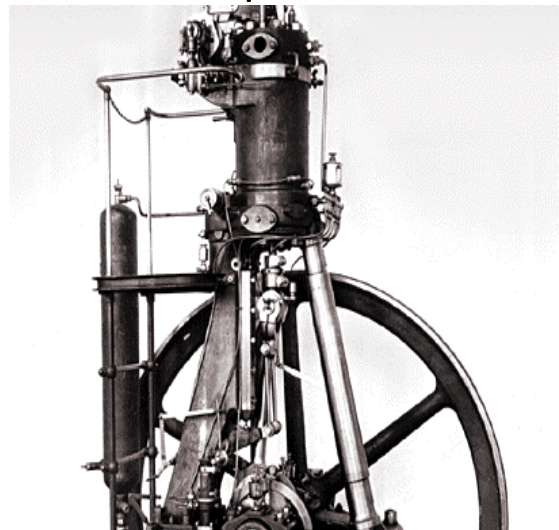
MAN

Stands For

Maschinenfabrik Augsburg-Nürnberg

Highlight:
World 1st Diesel Engine Developed in 1897

- *Single Cylinder 19.6Liters
- *Bore:250mm by Stroke:400mm
- *4-Stroke, Water Cooled
- *20hp @ 172RPM
- *Efficiency 26.2% (Steam Engine < 10%)



Model Introduction



TGX = Model Series Code

26 = Gross Vehicle Weight = 26,000kg

540 = Engine Maximum Horse Power = 540PS

Running Consumables Specification

Engine Oil

Specification:
M3677



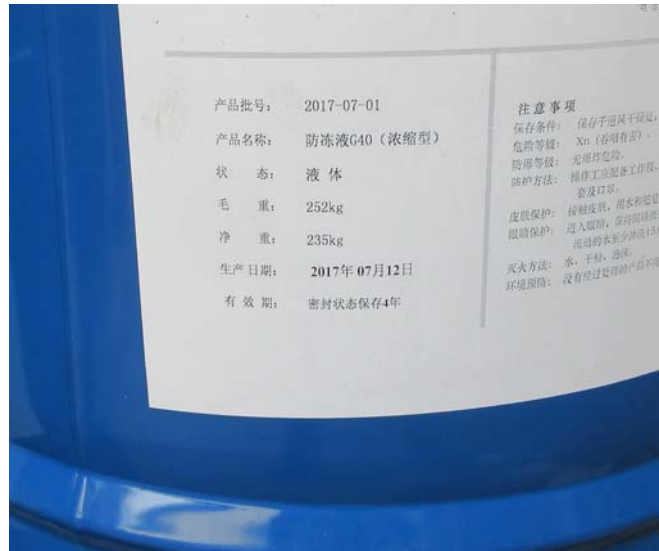
Engine Coolant

Specification: MAN 324 Type

Si-OAT

Proprietary Name: Glystantin G40

Colour: Pink(粉红色)



Exhaust Additive

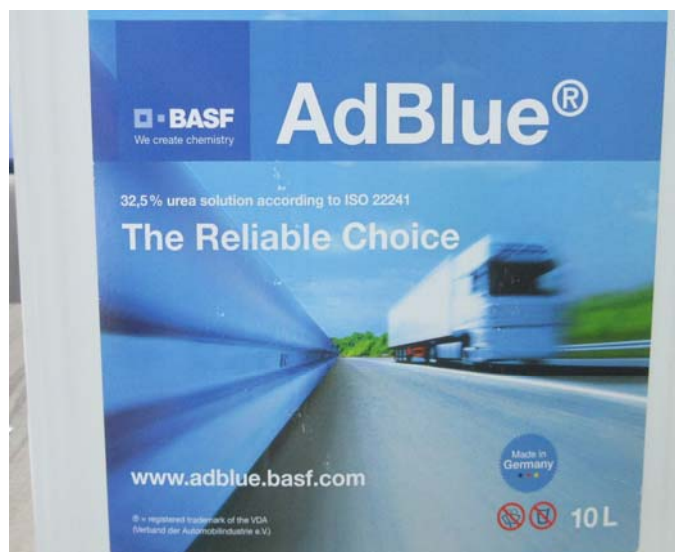
Specification:

AUS32 in ISO

22241

32.5% Urea

Solution



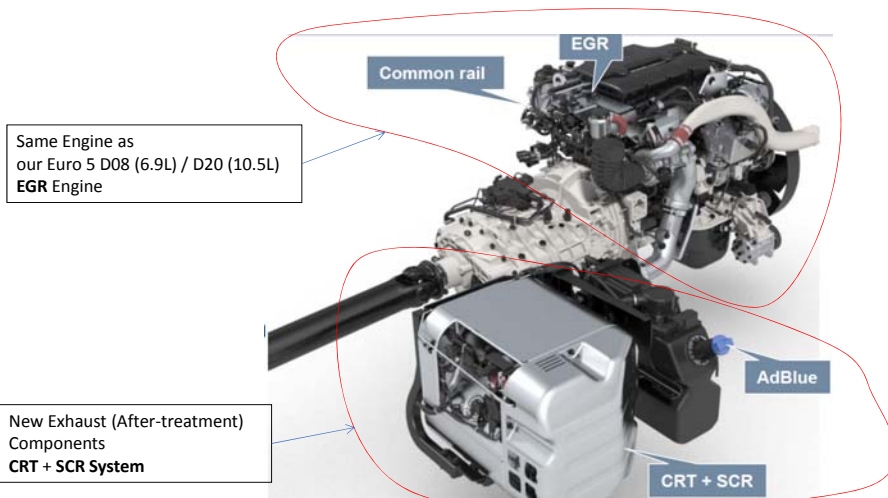


Difference Between Euro V and Euro VI

MAN Euro 6 Trucks

(Difference between MAN E5 & E6 Trucks)

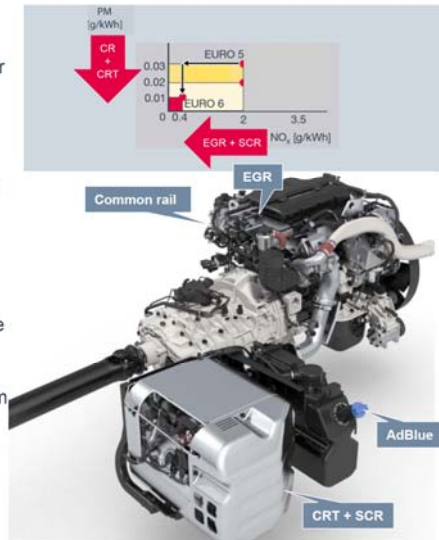
- [Main difference between MAN Euro 5 & Euro 6 Trucks](#)



MAN Euro 6 Trucks (Euro 6 Technology)

Combined technologies

- The combination of cooled external exhaust gas recirculation **AGR** and the **SCR** system for selective catalytic reduction is an essential means of ensuring effective and reliable compliance with the EURO 6 limit value for nitrogen oxides (0.4 g/kWh).
- The low-particle combustion performed by the **common rail** injection system and closed particulate filter system **CRT** ensure the required reduction of particle emission levels (limit value: 0.01 g/kWh)
- The **two-stage turbocharging** and the **low-temperature cooling system** increase engine efficiency and guarantee minimal fuel consumption.
- The function and effect of the individual system components are discussed in the following slides.



MAN Euro 6 Trucks (Euro 6 Technology)

Engine technology similar to EURO 5

- The tried-and-tested technology used in the engine of the EURO 6 driveline is similar to EURO 5.
 - EGR with requirement-based recirculation rate
 - Common rail system with maximum injection pressure of up to 1800 bar
 - Two-stage turbocharging (depending on power rating)
 - Charge air intercooling
 - Intercooling with low-temperature concept



Advantage:
The core elements of our EURO 6 technology, the D08 EGR engines, have proven their worth in series production since 2009.

MAN Euro 6 Trucks (Euro 6 Technology)

Component configuration

- With the EURO 6, the tried-and-tested EGR technology MAN PURE DIESEL® is being enhanced by the addition of the SCR technology MAN AdBlue®.
- The enlarged exhaust silencer (1) on the right side of the vehicle houses the CRT and SCR system.
- The AdBlue tank (2) takes the form of a single tank and is also located on the right side.
- The AdBlue supply module (3) is positioned on the AdBlue tank.
- The free installation space on the right side, e.g. for fuel tanks (4), remains virtually unchanged.
- The battery box (5) is still on the left side of the frame.



MAN Euro 6 Trucks (Euro 6 Technology)

Silencer installation and circulation

- Since the EURO 6 silencer now contains the CRT system and AdBlue mixing section, the overall volume of the silencer housing is greater than its EURO 5 counterpart.
- Cover shields on the front and top of the silencer prevent burns when touching its hot surface.
- The exhaust gas flows into the silencer from the inside.
- The reversing chambers feed the exhaust gas from the lower to the upper silencer components and back down into the open air.

View from outside vehicle with reversing chambers

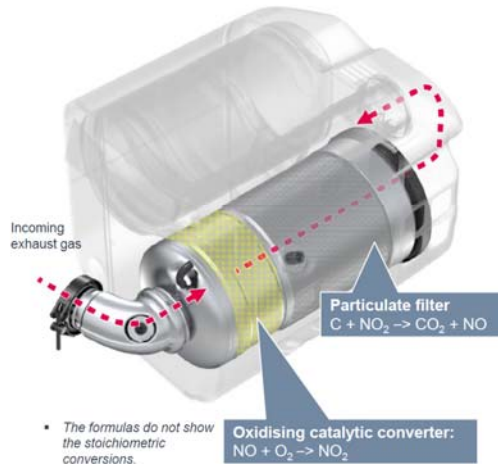


View from inside vehicle



MAN Euro 6 Trucks (Euro 6 Technology)

CRT: continuously regenerating trap



Function

- The CRT filter system (continuously regenerating trap) comprises an oxidising catalytic converter and a closed diesel particulate filter. It reduces the particulate mass downstream of the engine.
- The system is located before the SCR catalytic converter as the nitrogen oxides are required for the soot oxidation process.
- The system is continuously regenerated by the oxidation of the soot particles retained by the filter material into gaseous carbon dioxide (passive regeneration). The particulate filter is therefore very low-maintenance.
- The electronic monitoring of the particulate filter recognises the need for active regeneration on the basis of the rise in pressure.

Advantage:

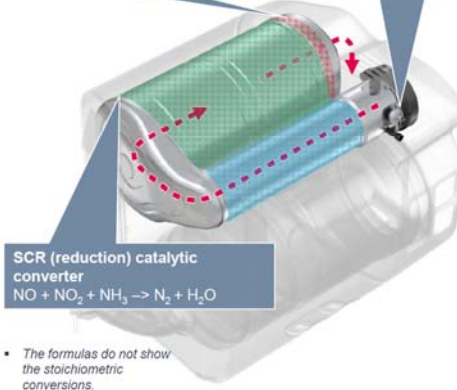
The particulate filter removes up to 99% of all soot particles from the exhaust gas. During normal vehicle operation, the functionality of the filter system is ensured by the passive

MAN Euro 6 Trucks (Euro 6 Technology)

SCR system

Blocking catalytic converter
 $NH_3 + O_2 \rightarrow N_2 + H_2O$

AdBlue injection and hydrolysis section
 NH_3 production from an aqueous urea solution



Function

- After passing through the CRT system, the exhaust gas is fed up to the AdBlue mixer by the reversing chamber.
- The requirement-based AdBlue injection and ammonia conversion is then performed here.
- In the SCR catalytic converter module, the ammonia enables the subsequent chemical conversion of the nitrogen oxides into harmless nitrogen and water.
- The blocking catalytic converter at the end of the process may prevent the escape of excess ammonia – known as ammonia slip.
- A range of sensors monitor the optimum execution of the emission control process.

Advantage:

The SCR system reduces nitrogen oxide emissions below the stipulated EURO 6 thresholds.

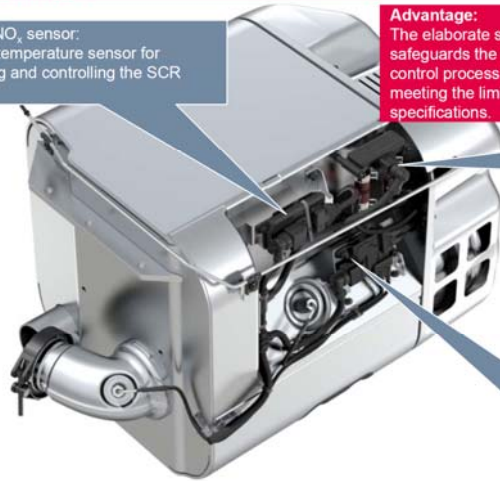
MAN Euro 6 Trucks (Euro 6 Technology)

Silencer sensors

CAN for NO_x sensor:
NO_x and temperature sensor for
monitoring and controlling the SCR
system

Advantage:
The elaborate sensor system of the exhaust silencer
safeguards the functionality of the entire emission
control process and meets all requirements for
meeting the limit values on the basis of OBD
specifications.

Relative and differential
pressure sensor:
Monitors the operability of
the particulate filter



Thermal element with
exhaust gas temperature sensors

MAN Euro 6 Trucks Any External Difference?



What is the difference between MAN Euro 6 & Euro 5 trucks?
What is the new technologies/components??
Any Technical Issues???

MAN Euro 6 Trucks (Filter Regeneration Process)

Regeneration strategy for CRT filter

- The particulate filter regeneration is normally an automated process with no action required by the driver.
- During normal operation, the continuous passive regeneration process ensures that the soot particles retained by the filter material are converted into gas and that the filter is not blocked.
- In cases where the passive regeneration and subsequent active regeneration do not produce the desired results due to special operating conditions while driving (extreme low-load operation), the system automatically triggers additional escalation levels.
- If a given level does not produce a positive result (successful system regeneration), the next higher level takes effect.

6 phases of filter regeneration

Phase	Process	Initiation
1	Passive regeneration while driving	Automatic
2	Active regeneration through increase in exhaust gas temperature (while driving; HCl)	Automatic
3	Warning level 1 (driver informed about necessity of active regeneration while driving)	By means of adapted operation, if possible
4	Warning level 2 (driver informed about necessity of stationary regeneration with increased idling speed)	Manual start via button
5	Warning level 3 (filter replacement required at service workshop)	Go to workshop
6	Activation of engine protection function (performance reduction to avoid damage)	Automatic

Advantage: The regeneration strategy safeguards the functionality of the emission control process while minimising the involvement of the driver and restriction of vehicle operation.

MAN Euro 6 Trucks (Filter Regeneration Process)

• [Simple Version of Driver Instruction on Dashboard – Warning in 3 Phases](#)

重置柴油粒子過濾器指引			
圖案顯示	圖示	警告符號	注意事項
			1) 可以繼續行車
			1) 確保車輛是空檔(N波)並且已經拉手掣。 2) 長按硬破掣3秒，引擎轉數會自動提高。 3) 大約45至60分鐘後，錶板顯示會熄滅，引擎轉數亦會回復至怠速轉數即約600轉。 4) 完成後，車輛可繼續行駛。 
			1) 需要盡快到服務中心檢查

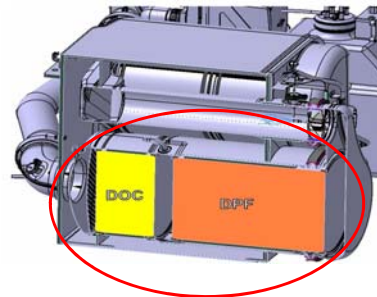


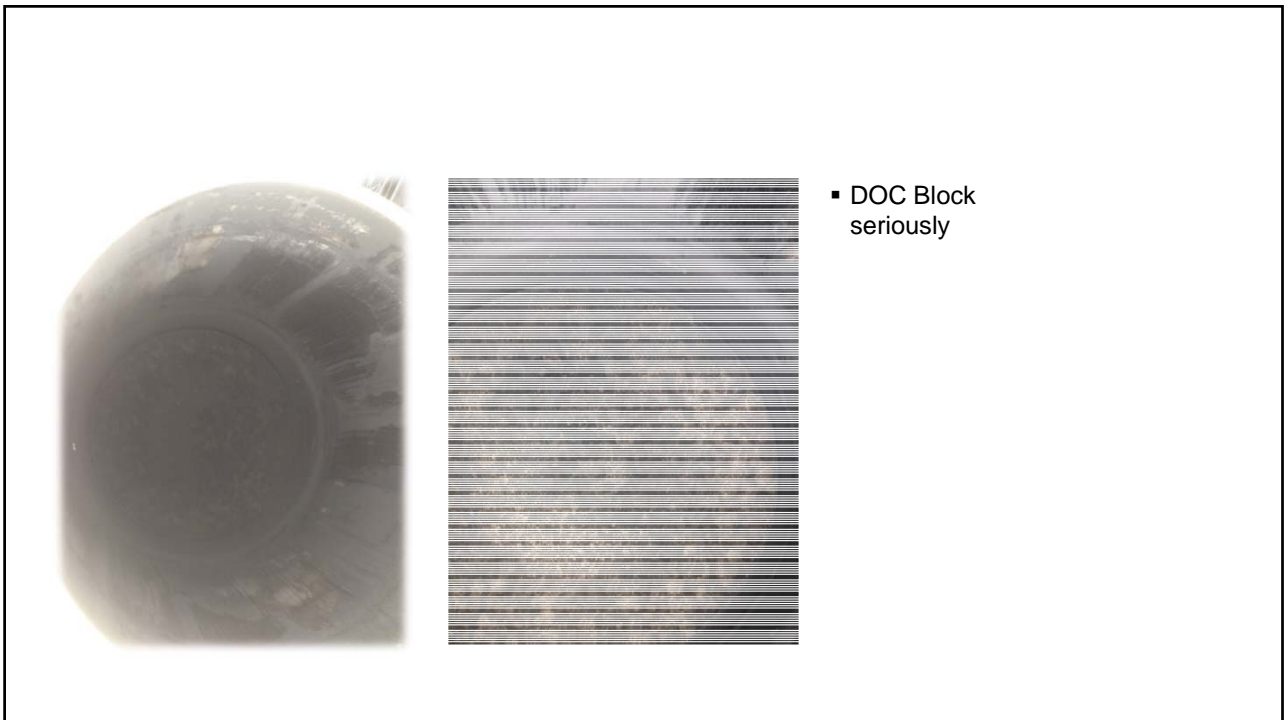
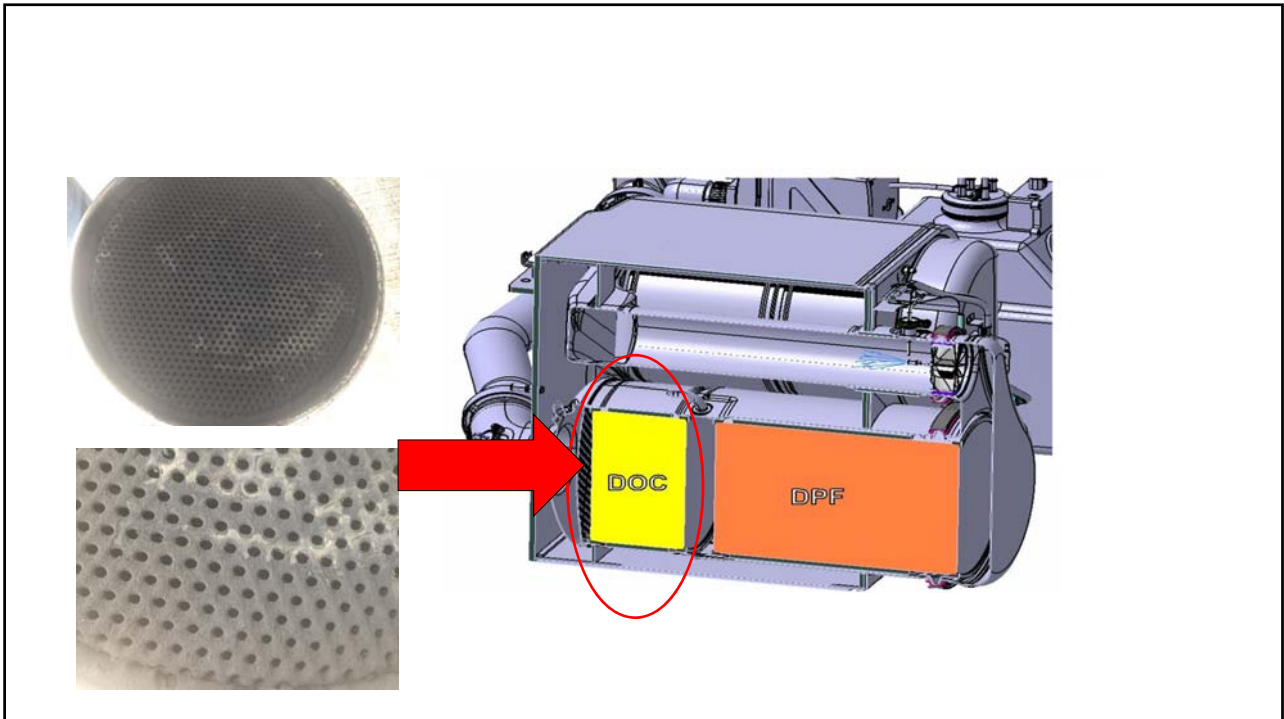
Case Study

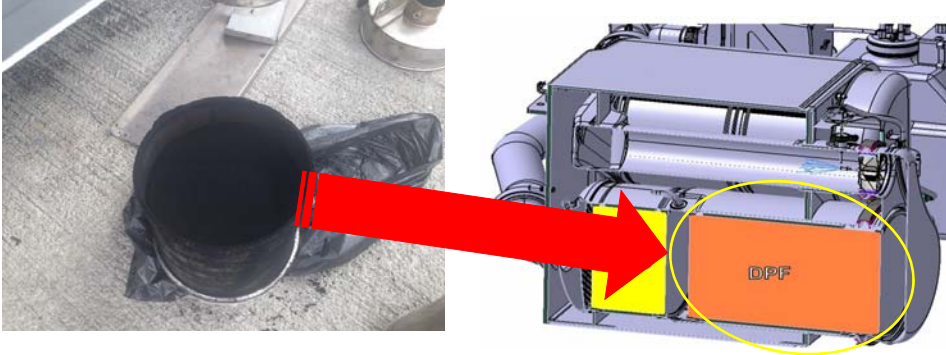
Case Study 1: DPF Block



- The Shell (DOC and DPF) is removed, the DPF is broken.
- **Caution: Please take mask before removing any DPF assemblies.**







- The shell assembly (DOC & DPF) must be replaced in the case.


Major Fault

- (1) Regeneration Indicator has been ignored before
- (2) Prolong Idling Operation
- (3) Fuel System Problem, e.g. Fuel Pump / Injector faulty

Case Study 2: Adblue leakage




- Adblue crystal
- **Caution: It is harmful to human, please take mask and glasses before removing it.**



TGX = Model Series Code
 26 = Gross Vehicle Weight = 26,000kg
 540 = Engine Maximum Horse Power = 540PS

Engine Coolant

Specification: MAN 324 Type
 Si-OAT
 Proprietary Name: Glysantin G40
 Colour: Pink(粉紅色)



Engine Oil

Specification:
M3677



ENERGY SAVING
 ENGINE OIL.


5W-30
 Specifications and Approvals

รถบรรทุกงานหนัก
 ใช้น้ำมัน 5W-30 ประสิทธิภาพสูง

API: CJ-4, CI-4, CH-4, CG-4, CF-4,
 CF, ACEA: E6,E7,E9, CAT ECF-3,
 Cummins CES 20081, Deutz: DQC
 IV-10 LA, Meets the requirements
 of, IVECO TLS E6, JASO: DH-2,
 MACK: EO-O Premium Plus, MAN:
 M3477, MAN: M3677, MB-
 Approval 228.51, MTU Category
 3.1, Renault Trucks: RLD-3, Scania:
 Low Ash, VOLVO: VDS-4

Exhaust Additive

Specification:
 AUS32 in ISO
 22241
 32.5% Urea
 Solution



BASF
 We create chemistry

AdBlue®

32.5% urea solution according to ISO 22241

The Reliable Choice

www.adblue.basf.com

Made in Germany

10L