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Volvo Truck Corporation	PM		
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## Emissions from Volvo's trucks

To facilitate emission calculation from transport, Volvo Trucks has summarised emission factors per litre fuel consumed. The summary is applicable primarily for trucks using standard diesel fuel. The stated values are based on certification measurements and can be used for outlined calculations. In an actual traffic situation the values vary due to individual conditions such as vehicle status, driving method, traffic situation etc.

Typical values, based on certification measurements, for the more common Volvo engines, with EU certification diesel fuel							[g/litre fuel]
	Law from	Volvo from	NO <sub>x</sub> g/litre	PM g/litre	HC g/litre	CO g/litre	
Typical	1980		58±5	4±2	6±2	8±3	
Euro 0	1990	1987	41-44	1.5-1.7	1.5-1.8	3-6	
Euro 1	1993	1991	28-32	0.2-0.6	0.5-1.2	2-8	
Euro 2	1996	1993	25-28	0.2-0.5	0.4-1.0	1-7	
Euro 3, D6, 180-220	2001	2000	18	0.35	1.3	2.6	
Euro 3, D6, 250	2001	2000	18	0.25	1.3	2.6	
Euro 3, D7, 250	2001	2000	18	0.25	0.4	2.3	
Euro 3, D7, 290-310	2001	2000	18	0.30	0.4	2.3	
Euro 3, D9, 260	2001	2001	18	0.30	0.8	2.3	
Euro 3, D9, 300	2001	2001	18	0.35	0.8	2.3	
Euro 3, D9, 340-380	2001	2001	19	0.30	0.8	2.4	
Euro 3, D12, 340-420	2001	2000	19	0.25	0.8	2.4	
Euro 3, D12, 460	2001	2001	20	0.35	0.4	2.5	
Euro 3, D12, 500	2001	2001	20	0.30	0.4	2.5	
Euro 3, D16, 550	2001	2003	17	0,25	0,8	2,7	
Euro 3, D16, 610	2001	2003	17	0,25	0,8	3,9	
Euro 4	2006	2005	13	0,10	0,04	1,0	
Euro 5	2009	2005	7	0,10	0,00	1,2	
Euro 6	2013	2013	0,9	0,01	0,06	0,13	

Note: in order to be able to compare the same test cycle (steady state) was used up to Euro 5. For Euro 6 WHTC (transient) was used. Data from different cycles are not directly comparable.



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## Legal requirements

The legal requirements for diesel engines have been tightened several times. Diesel engines are used in various types of vehicles, for various types of traffic, and with varying loads. To be able to measure emissions in a comparable way, they are measured in relation to the work performed by an engine and the units used are grams per kilowatt-hour. For certification, a well defined fuel is used, very similar to standard fuel but with closer tolerances. (figures vary based on test cycle)

Legal requirements and limit values					
	Law from	NOx g/kWh	PM g/kWh	HC g/kWh	CO g/kWh
R49.00	1982	18	-	3.50	14
Euro 0	1990	14.4	-	2.40	11.2
Euro 1	1993	8.0	0.36	1.10	4.5
Euro 2	1996	7.0	0.15	1.10	4.0
Euro 3	2001	5.0	0.10	0.66	2.1
Euro 4	2006	3,5	0,02	0,46	1,5
Euro 5	2009	2,0	0,02	0,46	1,5
Euro 6	2013	0,4	0,01	0,13	1,5

Table 2

## Emission factors

Volvo engines comply with the legal requirements and many engines have even been introduced a couple of years before the legal requirements have come into force.

Certification values are converted in various connections into emissions per vehicle kilometre or per ton-kilometre. They are based on assumptions of a certain type of traffic, driving method, and load utilisation, and are therefore uncertain especially as payload is defined differently in different connections. Transporters and transport buyers need better and better data for their environmental reports and calculations. To facilitate this type of work, Volvo has converted the certification values into emissions per litre of fuel, see table 1.

Using fuel consumption as a base, it is possible to calculate the emissions in a better way compared to earlier and to take into consideration load utilisation, road choice, speed, driving method, etc. The data is based on measurements according to the applicable standard for certification that deviates from a real traffic situation. Emissions from vehicles in traffic may differ from these data. The tables should not be used to make direct comparisons between different vehicles.

### Example:

A truck and trailer are fully loaded with a total weight of 40 tons of which the payload is 26 tons. For a certain type of transport on the motorway (freeway), the fuel consumption is 0.275 litres per km. Of course the consumption can be lower for other types of transport and when the truck is not fully loaded. The 2009 truck has an engine that complies with Euro 5. The emissions per ton-km can be calculated as follows:

Nitrogen oxides, NOx    0.275 l/km \* 7 g/l per 26 tons ≈ 0,074 g/ton-km  
 Particulates, PM        0.275 l/km \* 0,1 g/l per 26 tons ≈ 0,0011 g/ton-km

The emissions of carbon dioxide depend on the fuel consumption. It can be calculated using the fuel data described in the section Fuel Quality below.

Carbon dioxide, CO<sub>2</sub>    0.275 l/km \* 2.6 kg/l per 26 tons ≈ 0.0275 kg/ton-km



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## Fuel consumption

Fuel consumption varies considerably depending on the type of traffic, roads, driving behaviour, etc. It is therefore advisable to base calculations on the actual fuel consumption for a certain transport. When there is no data available for the fuel consumption, the data in the table can be used as a guiding value for vehicles. Please contact your Volvo dealer for information about a specific type of transport.

Typical fuel consumption in litres per 100 km				
	Payload in tons	Total weight in tons	litres / 100 km empty*	litre / 100 km full load*
Truck, distribution traffic	8.5	14	20-25	25-30
Truck, regional traffic	14	24	25-30	30-40
Tractor and semi-trailer, long-haul traffic	26	40	21-26	29-35
Truck with trailer, long-haul traffic	40	60	27-32	43-53

Table 3

## Fuel quality

Carbon dioxide is formed by combustion. The carbon content of the fuel determines the amount. One litre of standard diesel fuel (EN590) creates about 2.6 kg carbon dioxide.

The fuel contains residues of sulphur. The sulphur content must since January 1<sup>st</sup> 2009 not exceed 0.001% (10 ppm) according to EU Directive and the EN590 standard. There could be variations from one country to another. Fuel suppliers can provide more detailed information about the quality of fuel.

## Transporters and carriers have a key role

It is essential to select the correct type of vehicle with the correct powertrain for the respective transport assignment, the right route, and to have a good load utilisation.

Emissions per ton-kilometre can therefore only be calculated with detailed knowledge about the particular transport, load utilisation, route selection, vehicle, etc.

## More information

More information about Volvo Trucks and how we take care of environmental issues can be found at [www.volvotrucks.com](http://www.volvotrucks.com).

An Environmental Footprint Calculator is also available on internet.

\* Add ~4 % AdBlue consumption (volume) for Euro 4 and ~5 % AdBlue consumption (volume) for Euro 5. For Euro 6: Engines D5K, D8K and D16K ~5 % AdBlue consumption (volume) and D11K and D13K ~8 % AdBlue consumption (volume). The main difference for Euro 6 is between cooled and non-cooled EGR.