



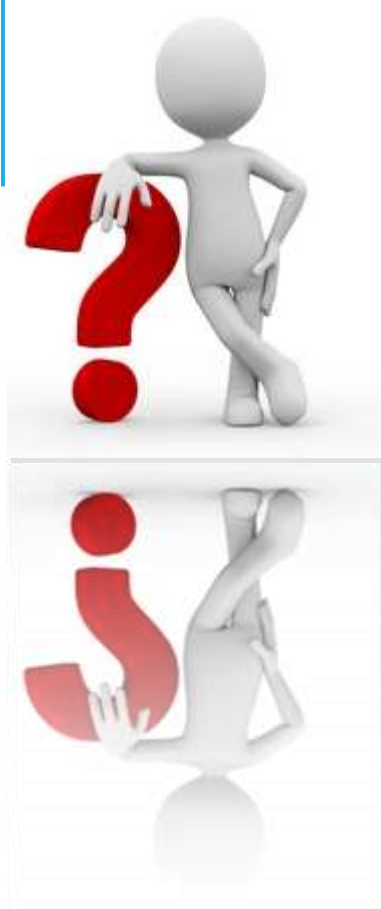
19MO611-AUTOTRONICS

UNIT 1 – INTRODUCTION EMISSION LAW

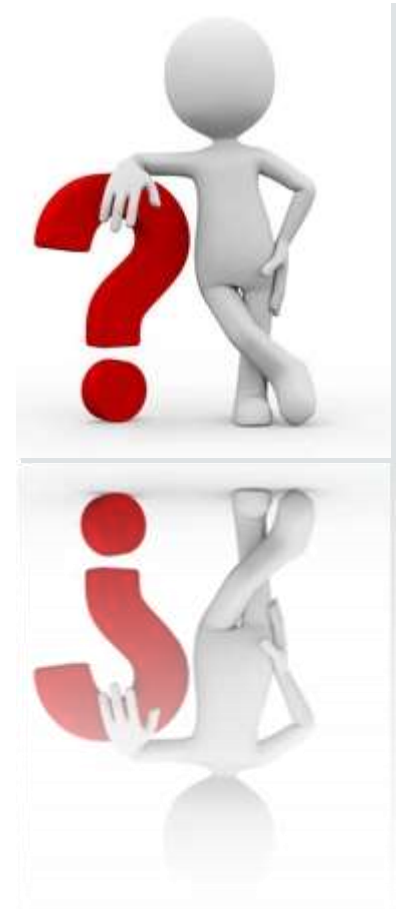
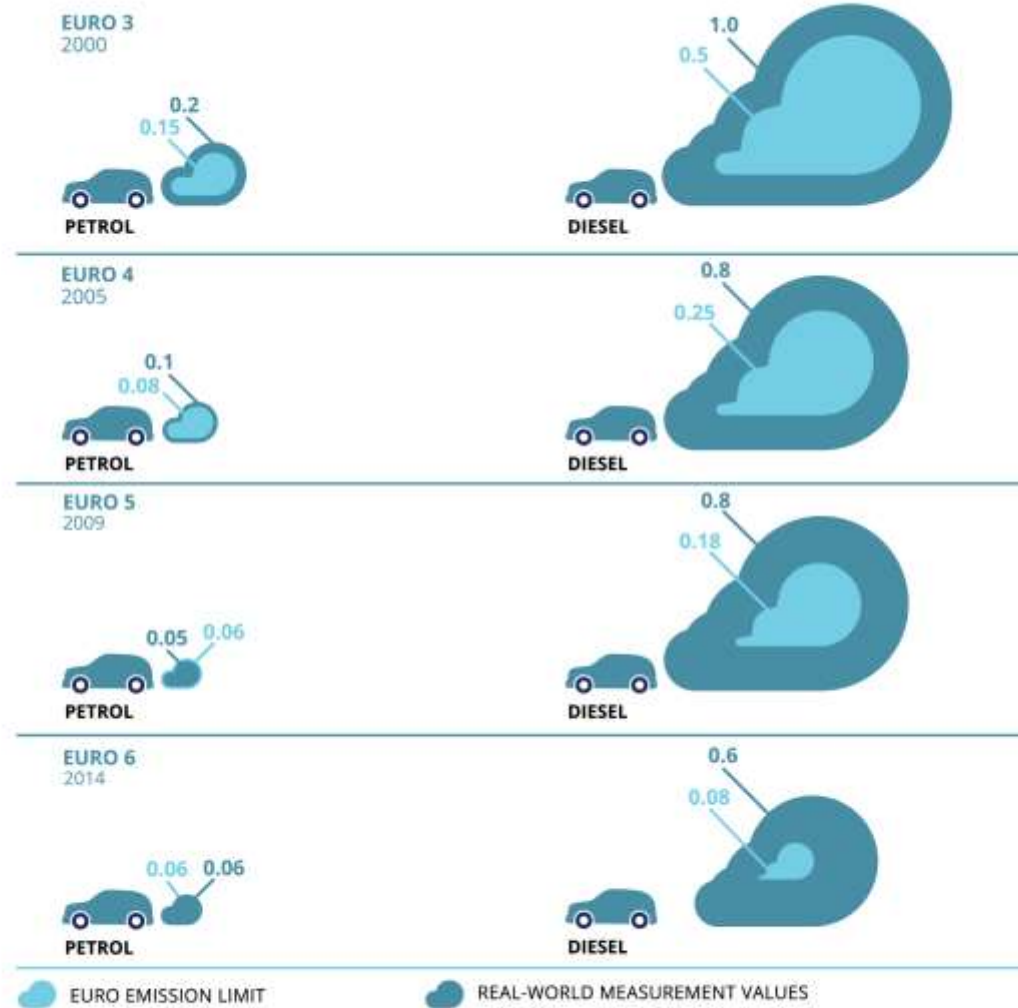


AUTOTRONICS

The Autotronics is referred as the modern automotive technology and also commonly known as Automotive Mechatronics. Autotronics is the combination of automobile and electronics. Also, the use of electronics science in automobile vehicles is called autotronics. The use of electronics in the automobile field makes the system safe, improved and efficient. In a vehicle almost all significant parts are featured with electronic items



Comparison of NO_x emission standards for different Euro classes





EMISSION LAW

Legally enforceable limit on the physical, chemical or biological characteristics of a point source of emission to water or air, normally expressed as a maximum permissible concentration of a specified substance. The first emission norms were introduced in India in 1991 for petroleum distillate, and 1992 for diesel vehicles. These were followed by making the Catalytic converter mandatory for petrol vehicles and the introduction of unleaded petrol in the market.



The first Indian emission regulations were idle emission limits which became effective in 1989. These idle emission regulations were soon replaced by mass emission limits for both gasoline (1991) and diesel (1992) vehicles, which were gradually tightened during the 1990s. Since the year 2000, India started adopting European emission and fuel regulations for four-wheeled light-duty and for heavy-duty vehicles. India's own emission regulations still apply to two- and three-wheeled vehicles.

The foundation for automotive emission standards in India since the early 2000s is contained in two reports from the Indian Planning Commission. The *National Auto Fuel Policy*, announced on October 6, 2003, envisioned a phased program for introducing Euro 2-4 emission and fuel regulations by 2010. In order to establish limits beyond Bharat Stage IV, the Indian Planning Commission established an Expert Committee in 2013 to draft an updated Auto Fuel Policy, *Auto Fuel Vision and Policy 2025*, that was published in May 2014. While legislators are not required to adhere strictly to the recommendations contained in these reports, they serve as a starting point for subsequent legislative action to establish the implementation schedule and other details of automotive emission standards. The implementation schedule of EU emission standards in India is summarized in Table 1.



Table 1 Indian emission standards (4-wheel vehicles)			
Standard	Reference	Date	Region
India 2000	Euro 1	2000	Nationwide
Bharat Stage II	Euro 2	2001	NCR*, Mumbai, Kolkata, Chennai
		2003.04	NCR*, 11 cities†
		2005.04	Nationwide
Bharat Stage III	Euro 3	2005.04	NCR*, 11 cities†
		2010.04	Nationwide
Bharat Stage IV	Euro 4	2010.04	NCR*, 13 cities‡
		2015.07	Above plus 29 cities mainly in the states of Haryana, Uttar Pradesh, Rajasthan and Maharashtra [3231]
		2015.10	North India plus bordering districts of Rajasthan (9 States) [3232]
		2016.04	Western India plus parts of South and East India (10 States and Territories) [3232]
		2017.04	Nationwide [3232]
Bharat Stage V	Euro 5	n/a ^a	
Bharat Stage VI	Euro 6	2020.04	Nationwide [3827]

* National Capital Region (Delhi)
† Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra
‡ Above cities plus Solapur and Lucknow. The program was later expanded with the aim of including 50 additional cities by March 2015
^a Initially proposed in 2015.11 [3297][3298] but removed from a 2016.02 proposal [3349] and final BS VI regulation [3827]



Biodiesel Testing. In April 2016, a notification was published that requires all newly produced vehicles compatible with diesel or a mixture of diesel and biodiesel up to B100 (flex-fuel biodiesel vehicle) to meet emission standards with both diesel and B100 reference fuels. Proposed requirements are listed in Table 2. Diesel vehicles compatible with blends up to B20 would only need to certify with diesel fuel.

Table 2 Test requirements for type approval for flex-fuel biodiesel vehicles

Test	4 wheeled vehicles with GVW ≤ 3,500 kg	3 wheeled vehicles	4 wheeled vehicles with GVW > 3,500 kg
Gaseous pollutants	Both diesel and B100	Both diesel and B100	Both diesel and B100
Free acceleration smoke	Both diesel and B100	Both diesel and B100	Both diesel and B100
Durability, if opted for instead of fixed Deterioration Factor	Diesel fuel only	Diesel fuel only	Diesel fuel only
OBD	Both diesel and B100	Not applicable	Both diesel and B100



FUEL ECONOMY REGULATION

Fuel economy standards for motor vehicles that are sold in India are developed by the Bureau of Energy Efficiency (BEE)—an agency within the India Ministry of Power. Fuel economy standards (norms) have been adopted for passenger cars and for heavy-duty vehicles.

Passenger Cars. Attempts to set fuel economy standards started in 2007, but it were delayed due to inter-ministerial conflicts and pressure from the auto industry. In January 2014, the BEE notified minimum fuel efficiency norms for passenger vehicles. Two sets of Average Fuel Consumption Standards were announced: one set for fiscal years 2016-17 to 2020-21 and another for fiscal year 2021-22 onwards [3037]. The Road Transport Ministry objected by claiming the new emission levels were being mandated a year ahead of an earlier agreed to deadline. A new notification was issued in April 2015, which moved the compliance schedule by one year (i.e., from FY 2017-18 to 2021-22, and FY 2022-23 onwards) [3825].

Heavy-Duty Vehicles. In August 2017, the BEE published final fuel efficiency standards for commercial heavy-duty vehicles category M3 (buses) and N3 (trucks) with a gross vehicle weight (GVW) of 12 tonnes or greater [3826][3828]. Two sets of standards have been published: Phase 1 standards effective from 1 April 2018, and Phase 2 standards effective beginning 1 April 2021.

The standards are expressed by an equation based on GVW and axle configuration, providing normalized values of fuel consumption in L/100 km. The published equations are applicable to BS-IV vehicles; a correction factor is to be published that will be applicable to BS-VI vehicles. Fuel consumption performance is tested over the constant speed fuel consumption



TARGET LEVELS

Target levels

Targets (2020-2024)

For the period 2020-2024, Regulation (EU) 2019/631 confirms the EU fleet-wide CO₂ emission targets set under Regulations (EC) No 443/2009 and (EU) No 510/2011.

- Cars: 95 g CO₂/km
- Vans: 147 g CO₂/km

These target levels refer to the NEDC emission test procedure. From 2021 onwards, the emission targets for manufacturers will be based on the new WLTP emission test procedure.

Specific emission targets are set annually for each manufacturer. Those targets are based on the EU fleet-wide targets and take into account the average mass of the manufacturer's new vehicles registered in a given year, using a limit value curve. This means that manufacturers of heavier cars are allowed higher average emissions than manufacturers of lighter cars. The curve is set in such a way that the targets for the EU fleet-wide average emissions are achieved.

For manufacturers of passenger cars 2020 is a phase-in year: the specific emission targets will apply only to the 95% least emitting new cars in their fleet.



Incentive mechanism for zero- and low-emission vehicles (ZLEV)

In the years from 2020 to 2022, a **super-credits system** applies for passenger cars with emissions of less than 50 g CO₂/km (NEDC). These vehicles are counted multiple times for the calculation of the average specific emissions of a manufacturer:

- as 2 vehicles in 2020
- as 1.67 vehicles in 2021
- as 1.33 vehicles in 2022.

A cap on the super-credits is set at 7.5 g/km per car manufacturer over the three years. No super-credits system is in place for vans.

From 2025, a different ZLEV **crediting system** is introduced both for car and van manufacturers. It allows for the relaxation of a manufacturer's specific emission target, if its share of new ZLEVs (vehicles with emissions between 0 and 50 g CO₂/km (WLTP)) registered in a given year exceeds the following **benchmarks**:

- Cars: 15% ZLEV from 2025 on and 35% ZLEV from 2030 on
- Vans: 15% ZLEV from 2025 on and 30% ZLEV from 2030 on

A one percentage point exceedance of the ZLEV benchmark will increase the manufacturer's CO₂ target (in g CO₂/km) by one percent. The target relaxation is capped at maximum 5% to safeguard the environmental integrity of the Regulation.

For calculating the ZLEV share in a manufacturer's fleet, an accounting rule applies. This gives a greater weight to ZLEV with lower CO₂ emissions.



Penalties for excess emissions

If the average CO₂ emissions of a manufacturer's fleet exceed its specific emission target in a given year, the manufacturer has to pay – for each of its vehicles newly registered in that year – an **excess emissions premium** of €95 per g/km of target exceedance.

Pooling

Manufacturers can group together and act jointly to meet their emissions target. In forming such a pool, manufacturers must respect the rules of competition law. Pooling between car and van manufacturers is not possible.

Exemptions

Manufacturers responsible for fewer than 1 000 cars or fewer than 1 000 vans newly registered in the EU per year are exempted from meeting a specific emissions target, unless they voluntarily apply for a derogation target.

Derogations

Manufacturers may apply for a derogation from their specific emission target at the following conditions:

- A small-volume manufacturer (responsible for less than 10 000 cars or less than 22 000 vans newly registered per year) can propose its own derogation target, based on the criteria set in the Regulation.
- A niche car manufacturer (responsible for between 10 000 and 300 000 cars newly registered per year) can apply for a derogation for the years until 2028 included. Between 2020 and 2024, the derogation target must correspond to a 45% reduction from its average emissions in 2007. In the years 2025 to 2028, the derogation target will be 15% below the 2021 derogation target.



Eco-innovations

To encourage eco-innovation, manufacturers may obtain emission credits for vehicles equipped with innovative technologies for which it is not possible to demonstrate the full CO₂ savings during their type approval.

The manufacturer must demonstrate these savings on the basis of independently verified data. The maximum emission credits for these eco-innovations per manufacturer are 7 g CO₂/km per year.

As of 2025, also the efficiency improvements for air conditioning systems will become eligible as eco-innovation technologies.

More information can be found [here](#).

In-service verification

Manufacturers are required to ensure correspondence between the CO₂ emissions recorded in the certificates of conformity of their vehicles and the CO₂ emissions of vehicles in-service.

Type-approval authorities will verify this correspondence in selected vehicles, as well as the presence of any strategies artificially improving the vehicle's performance in the type-approval tests.

On the basis of their findings, type-approval authorities will ensure the correction of the certificates of conformity and may take additional measures, set out in the [Type Approval Framework Regulation EN●●●](#).

Type-approval authorities will report any deviations to the Commission, who will take them into account for the purpose of calculating the average specific emissions of a manufacturer.

The detailed rules implementing this measure are under preparation.



Noxious emissions

Noxious emissions from vehicle exhausts, such as carbon monoxide, hydrocarbons, oxides of nitrogen and particulates can cause smog, heart and lung disease and cancer. To minimise these impacts, Australia has had noxious emission standards since the early 1970s. These standards set maximum limits for noxious emissions from vehicle exhausts for new road vehicles supplied to Australia, and have been progressively tightened over the past 40 years.

An increasing proportion of vehicles meeting tighter noxious emission standards has played a major part in improving and maintaining good air quality in Australia. Our commitment to harmonise with international vehicle standards developed by the [United Nations](#), wherever possible and ensure we are focused on improving health outcomes for all Australians is reflected in the current noxious emission standards.

The current minimum noxious emission standard for new light vehicles in Australia is [ADR 79/04](#), which is based on an international standard known as Euro 5. The current minimum noxious emission standard for new heavy vehicles is [ADR 80/03](#), which is based on an international standard known as Euro V, with vehicles meeting equivalent US or Japanese standards also accepted.

On 13 October 2022, the Minister for Infrastructure, Transport, Regional Development and Local Government, the Hon Catherine King MP, announced a new ADR 80/04 based on the Euro VI (Stage C) requirements will be phased in for newly approved heavy vehicle models supplied from 1 November 2024 and existing heavy vehicle models still being supplied to the Australian market on or after 1 November 2025. The text of ADR 80/04 is being settled in consultation with stakeholders most directly affected by the change. As with ADR 80/03, vehicles meeting equivalent US or Japanese standards will also be accepted.



During previous consultation, stakeholders informed the Government that improved fuel quality standards are needed before Euro 6 standards can be implemented for light vehicles, as fuel quality can affect the operability of advanced petrol and diesel engines. To support the introduction of Euro 6, the Government recently implemented amendments to reduce the maximum sulfur levels permitted in petrol sold in Australia. The Department of Infrastructure, Transport Regional Development, Communications and the Arts is working closely with the Department of Climate Change, Energy, Environment and Water, which regulates fuel quality standards to consider whether further improvements to aromatics in petrol are needed to enable the introduction of Euro 6 for light vehicles.

The tables listed below summarise the noxious emission limits that apply to light and heavy vehicles in the Australian Design Rules (ADRs), depending on when the vehicle was manufactured. The ADRs are performance standards that specify the maximum levels of noxious emissions permitted under a specified test. If and when new noxious emission standards are adopted, these will be adopted as new ADRs and these tables will be updated to reflect this.



Fuel efficiency standards

Australia does not currently have fuel efficiency standards, which regulate average carbon dioxide (CO₂) emission levels from new vehicles supplied annually by a manufacturer, to reduce greenhouse gas emissions. The Australian Government has recently announced it will consult on the possible introduction of fuel efficiency standards to increase the supply of more affordable, electric, hybrid and other fuel efficient vehicles that are already available in other markets, as part of the development of Australia's first National Electric Vehicle Strategy.

Over 80 per cent of all vehicles sold in the world are already covered by a fuel efficiency standard, including the European Union, United States, United Kingdom, China, Japan, Brazil, India, Canada, South Korea, Mexico and Saudi Arabia.

In other countries with fuel efficiency standards, the target for each manufacturer is tied to the average weight of the vehicles they sell. This means that manufacturers that sell larger or heavier vehicles have a target that is proportional to their vehicle range. Fuel efficiency standards only apply to new vehicles, they do not affect the vehicles already on the roads.



In-Service Emissions

The regulation of emissions from vehicles once they are on the road (in-service) is the responsibility of the state and territory governments. However, the Australian Government undertaken a number of studies to improve the understanding of emissions performance of the in-service passenger car fleet.

The [National In-Service Emission Study](#) (NISE1), published in 1996, is the most comprehensive study of emissions from cars ever undertaken in Australia. It tested over 600 vehicles manufactured between 1980 and 1993 and demonstrated that considerable exhaust emissions benefits could be obtained from regular tuning and maintenance. An update and expansion of this study, [NISE 2](#), covering later model vehicles, was completed in March 2009.

The NISE 1 study also indicated that evaporative emissions from vehicles were, on average, well above the limits mandated in the then applicable standard, Australian Design Rule 37(ADR37). The subsequent Petrol Volatility Project (1997) examined this in more detail and concluded that reducing the volatility of commercial petrol was the most cost-effective means to address this problem. States have since set limits on the volatility of summertime petrol supplies.

