

CHAPTER 9 : TYPE II TEST ON SI ENGINES (VERIFYING CARBON MONOXIDE EMISSION AT IDLING)

1 Scope :

This Chapter describes the procedure for the Type II test for verifying carbon monoxide emission at idling of spark ignition engines, as defined in para 5.2.3 of Chapter 1 of this Part.

2 Test Instrument

2.1 The instrument used for the measurement of CO should meet the requirements given in Para 5.0.

2.2 The instrument should be prepared, used and maintained following the directions given in the instrument manufacturer's operation manual, and it should be serviced at such intervals as to ensure accuracy.

2.3 Within a period of 4 hours before the instrument is first used, and each time the instrument is moved or transferred to a new environment, a "span and zero" calibration should be carried out using calibration gas. The calibration shall be performed well away from the exhaust of motor vehicles whose engines are running.

2.4 If the sample handling system is not integral with the analyser, the effectiveness of the condensate traps and all connections of the gas sampling system should be checked. It should be checked that filters are clean, that filter holders are fitted with their gaskets and that these are in good conditions.

2.5 If the instrument is not self-compensated for non-standard conditions of altitude and ambient temperature or not equipped with manually controlled system of compensation, the scale calibration should be performed with calibration gas.

2.6 It should be ensured that the sample handling line and probe are free from contaminants and condensates.

3 Vehicle and Fuel :

3.1 This test should be carried out immediately after the sixth operating cycle of the Type I test, or at after the Part II of the modified IDC, as applicable, with the engine at idling speed, the cold start device not being used. Immediately before each measurement of the carbon monoxide content, a TYPE I test operating cycle as described in Chapter 3 of this Part or Chapter 3 of Part IX as applicable shall be carried out.

- 3.1.1 In case the Type II test is carried out without Type I test, the following steps are to be taken for vehicle preparation :It should be checked that the road vehicle/engine in all its parts, components and systems conform to the declared particulars in the application for type approval.
- 3.1.2 It should be checked that the road vehicle exhaust system is leakproof and that the manual choke control has been returned to the rest position.
- 3.1.3 It should be checked that the gas sampling probe can be inserted into the exhaust pipe to a depth of at least 300 mm. If this proves impossible owing to the exhaust pipe configuration, a suitable extension to the exhaust pipe(s), making sure that the connection is leakproof, should be provided.
Alternatively, the sample may be taken from a fixed connection of the sample collecting system for the Type I test.
- 3.1.4 The vehicle shall have attained normal thermal conditions as defined in 2.3 of chapter 1 of this part immediately prior to the measurement, by running the vehicle on chassis dynamometer with specified number of warming up cycles declared by the manufacturer and six driving cycles.
- 3.1.5 The vehicle idling speed should be checked and set as per Para 2.2 Chapter 1 with all the accessories switched off.

3.2 Fuel :

The fuel shall be the reference fuel whose specifications are given in the relevant notification If the engine is lubricated by mixture, the oil added to the reference fuel shall comply with the manufacturer's recommendations.

4.0 Measurement :

- 4.1 Immediately preceding the measurement, the engine is to be accelerated to a moderate speed with no load, maintained for at least 15 seconds, then returned to idle speed.
- 4.2 While the engine idles, the sampling probe should be inserted into the exhaust pipe to a depth not less than 300 mm, if the probe prescribed in para 5.3.2.1 below is used.
- 4.3 After the engine speed stabilises the reading should be taken. In the case of 2 & 3 wheeled vehicles fitted with air cooled engines, this stabilised speed may be outside the range specified by the manufacturer.
- 4.4 The value of CO concentration reading should be recorded.

- 4.5 In cases where gadgets or devices are incorporated in the exhaust system, for dilution of the exhaust, both CO and CO₂ should be measured using an instrument having facility to measure both CO and CO₂. If the total of the measured values of CO and CO₂ (T CO and T CO₂) concentrations exceed 15% for four stroke engines and 10% for two stroke engines, the measured value of CO should be taken as carbon mono-oxide emissions from the vehicle. If it does not, the corrected value (T corrected) should be taken, as given below :-

$$T \text{ corrected} = \frac{TCO_x * 15}{(TCO + TCO_2)} \quad \text{for 4 stroke engines.}$$

$$= \frac{TCO_x * 10}{(TCO + TCO_2)} \quad \text{for 2 stroke engines.}$$

- 4.6 Multiple exhaust outlets should be connected to a manifold arrangement terminating in a single outlet. If a suitable adapter is not available, the arithmetic average of the concentrations from the multiple pipes may be used.
- 4.7 If the measurement is to be repeated, the entire procedure of para 4 shall be repeated.
- 5 Technical Specifications of Carbon Monoxide Analyser/Equipment for Road Vehicles
- 5.1 The analyser shall be compatible with all types of motor vehicle operating environments and shall meet under the conditions and performance requirements as per Part I and Part VIII.
- 5.2 Instruments with facility for carbon-dioxide measurement, also for applications mentioned in 4.5 shall meet all the above performance criteria mentioned for CO, except that the instrument read-out shall have a range of 0 to 20% CO₂ or less (clause 5.3.3.1) above.