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Road vehicles — Requirements for inspection and testing of used motor vehicles for roadworthiness



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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established under Cap 327, of the Laws of Uganda. UNBS is mandated to co-ordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
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Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

In reporting the results of a test made in accordance with this Uganda Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with EAS 124:1999, *Rounding off number values*.

Road vehicles — Requirements for inspection and testing of used motor vehicles for road worthiness

1 Scope

This Draft Uganda Standard specifies the safety related performance characteristics of used motor vehicles and their inspection and testing for roadworthiness.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EAS 124, *Rounding off number values*

US 533, *Retro-reflective warning signs for road vehicles — Chevron signs*

US 545, *Seat belt assemblies for motor vehicles — Specification*

US 546, *Anchorage for automobile seat belts — Specification*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

3.1 inspection

activities such as measuring, examining one or more characteristics of a product or service and comparing these with specified requirements to determine conformity

3.2 specification

prescribed requirement with which the product or service has to conform

3.3 defective

non-fulfilment of intended usage requirements

3.4 used motor vehicle

one that has ever been registered in Uganda or elsewhere

3.5 background radiation

ionizing radiation constantly present in the natural environment of the earth, which emitted by natural and artificial sources

3.6 dose

measure of the radiation received or absorbed by a target

3.7

opacity

degree of obstruction of clear visibility by exhaust smoke/fumes

3.8

inspector

person authorized to carry out inspection activities by the relevant government regulatory body

3.9

motor vehicle

any self-propelled vehicle adopted for use on the road except engineering plants and motorcycles

4 Inspection for performance characteristics

4.1 Inspection of wheel alignment

The alignment of the steered wheels shall be inspected with a side slip tester machine or any other suitable apparatus. The reading for skidding shall not exceed 5 mm inward or outward for 1 m of travel (see Annex A). Wheel alignment shall also be inspected visually in accordance with the following:

- a) camber shall not exceed the manufacturer's specified limits;
- b) in the case of a semi-trailer, any axle shall not be out of square to the longitudinal centreline of the vehicle by more than 10.0 mm/m of length of trailer; and
- c) the front wheels (in the straight-ahead position) and rear wheels shall be in the same vertical plane. When relevant, sidecar wheel shall be parallel to or shall not have slight "toe-in" towards the front wheel (in the straight-ahead position).

4.2 Inspection of braking force

4.2.1 General

The braking force of a vehicle under inspection shall be measured with one inspector therein as an occupant with no passenger or luggage, according to the requirements specified in Annex B and the results shall conform to 4.2.2 and 4.2.3.

4.2.2 Braking force of main brake system

4.2.2.1 The total braking force of the main braking system shall not be less than 50 % of the axle weight of the vehicle, and the sum of braking forces on the rear wheels shall not be less than 50 % of the axle weight of the subject axle when unladen.

4.2.2.2 For the main braking system, the difference of braking forces applied to the right and left wheels shall be 8 % or less of the axle weight of the subject axle when unladen.

or

- a) The difference in braking effort between wheels on the same axle should not be more than 30%
- b) On an individual wheel, brake effort shall not fluctuate by more than 30%.

4.2.3 Braking force of parking brake system

The total sum of the braking force of the parking brake system shall not be less than 20 % of the weight of the vehicle as inspected.

4.3 Level of noise produced by automobile

4.3.1 The measurement of the noise level of steady running noise shall not be more than 88 dB(A), when tested in accordance with Annex E.

4.3.3 The noise level in the cabin should not be more than 70 dB(A).

4.4 Exhaust gas from automobile

4.4.1 General

The concentration of or the level of contamination from exhaust gas shall be determined according to Annex C.

4.4.2 Automobiles using gasoline or liquefied petroleum gas as fuel

The concentration of the exhaust gas from an automobile shall be measured when the engine is idling, and inserting the probe of a tester into the exhaust pipe to a depth of approximately 60 cm (if this is not feasible, measures to prevent the ingress of air from outside shall be taken before inserting the probe). The measurements shall not exceed the following reference values:

- a) concentration of carbon monoxide - 4.5 %; and
- b) concentration of hydrocarbon:
 - i) 4-cycle engine - 1 200 ppm;
 - ii) 2-cycle engine - 7 800 ppm; and
 - iii) special engine - 3 300 ppm.

4.4.3 Automobiles using light oil (diesel) as fuel

4.4.3.1 Emissions limits

Table 1 — Carbonmonoxide limits for diesel engines

Effective Date(s)	CO limits (by volume) ≤	Engine RPM
Before 01/10/1986	4.5%	Idling
From 01/10/1986 to 31/12/1993	3.5%	Idling
From 01/01/1994 to 30/06/2002	0.5%	Idling
	0.3%	2500rpm or speed specified by manufacturer
From 01/07/2002	0.3%	Idling
	0.2%	2500rpm or speed specified by manufacturer

Table 2 — Hydro Carbon limits for diesel engines

Effective Date	HC limits(ppm)≤	Engine RPM
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Before 01/10/1986	1 000	Idling
From 01/10/1986 to 31/12/1993	750	Idling
From 01/01/1994	200	2500rpm or speed specified by manufacturer

4.4.3.2 Opacity

The excessive black smoke or fumes emitted from the automobile shall not be allowed.

This test will consist of a snap-idle test also called the snap acceleration test. The exhaust smoke is measured by its ability to allow light to pass through using a special light beam.

0% opacity means the exhaust has no visible smoke to block the light beam while 100% opacity means the exhaust is so dark it completely blocks the light beam. The test will be carried out as described under Annex G.

Reject if, in the case of any type of engine, the exhaust smoke emission is so dense during a test that its opacity measured is higher than the percentages below.

Table 3 — Opacity limits

Year	Opacity Limit
1991 or newer	40 %
1974 - 1991	55 %
1973 or older	70 %

4.5 Brightness of headlamps and orientation of main optical axis

4.5.1 General

The brightness of headlamps and the orientation of their main optical axis shall be measured either manually or using suitable apparatus with the light receiving portion of a tester squarely opposed to the headlamp according to the distance and method of measurement. The manual measurements shall be done in accordance with test methods specified in Annex D and shall agree with the reference values in 4.5.2 and 4.5.3.

4.5.2 Luminous intensity

4.5.2.1 Four-lamp type

For the main headlamp for driving, the intensity shall be 12 000 cd or above and with a sub headlamp added, the intensity shall be 15 000 cd or above.

4.5.2.2 Other types

For the headlamps for driving, the intensity shall be 15 000 cd or above.

4.6 Horn

With the engine of an automobile stopped, the loudness of its alarm unit (that is, the horn) shall meet the requirements below. Measurement shall be conducted in accordance with test method specified in Annex E. A microphone set in a position 1.0 m above the ground and at 2.0 m from the front of the vehicle:

- a) reference value, within the range 90 dB(A) through 115 dB(A); and
- b) the sound of an alarm buzzer shall be continuous and of constant volume.

4.7 Speedometer

The speedometer shall be in good working order. The indicated speed should be within 10% variance of the vehicle's true speed.

5 Inspection of operational systems

5.1 Engine

The engine shall be inspected while observing the following:

- a) the engine shall start with ease, and shall not produce excessive unusual noise or vibration during operation;
- b) no oil leakage or water leakage shall be observed from the main body of the engine; and
- c) no cracking, damage, or deformation shall be observed on the oil sump, and there shall be no leakages from the gaskets.

5.2 Exhaust system

5.2.1 The following components shall be securely installed and free from damage:

- a) exhaust pipe, which, in addition, shall be free from excessive deformation;
- b) catalytic muffler;
- c) silencer;
- d) blow-by gas reducing device; and
- e) emission control device for fuel evaporative gases.

5.2.2 The positioning and routing of exhaust pipe shall be done in acceptable manner and observation of the following shall be made:

- a) no damage or cracking shall be permitted in the intake or exhaust manifold;
- b) no cracking or rubber flaking shall be observed in the exhaust pipe and support bracket; and
- c) the muffler and the gaskets of the exhaust pipe shall be free from damage, exhaust leakage, and abnormal noise.

5.3 Engine cooling

5.3.1 Engine cooling system

The following components shall be securely installed and free from damage:

- a) radiator and radiator cap
- b) over-flow tank
- c) rubber hoses; and
- d) no coolant leakage shall be observed from the radiator, rubber hoses or water pump.

The cooling fans and their drives such as belts shall function normally and shall be free from damage.

The engine temperature indicator shall be in good working condition.

5.4 Fuel system

5.4.1 The fuel tank shall be firmly mounted.

5.4.2 The fuel tank shall have a fuel tank cap that should effectively seal

5.4.3 The fuel system shall have no leakages.

5.5 Transmission system

The transmission shall operate effectively.

5.5.1 Manual transmission

5.5.1.1 There shall be no anomalies in the engagement system of the clutch (for example, slip, incomplete disengagement, judder and unusual noise) and shall operate smoothly.

5.5.1.2 No oil leakage in the clutch system.

5.5.1.3 A clutch pedal shall be provided with a friction pad.

5.5.1.4 The gearbox/transfer box shall be inspected while observing the following:

- a) it shall not produce excessive unusual noise or vibration during operation;
- b) no oil leakage shall be observed from the main body of the gearbox/transfer box; and
- c) no cracking, damage, or deformation shall be observed on the oil sump, and there shall be no oil leaking from the gaskets.

5.5.2 Automatic transmission

5.5.2.1 The transmission shall be capable of being turned to each shift position with ease in the idling state, and there shall be no excessive play in the shift lever in any shift position.

5.5.2.2 The gears or bearings in the transmission shall not produce unusual noise, and no oil leakages from oil seals.

5.5.2.3 The gear shift indicator reading shall match with the actual shift position, and the engine starter shall not operate in any gear selector position other than "P" (Park) or "N" (Neutral).

5.5.3 Axles, drive and propeller shafts

5.5.3.1 The above shall be free from cracking, damage, looseness and abnormal backlash.

5.5.3.2 The above shafts shall not produce run-out or abnormal vibration and noise during driving.

5.5.4 Final drive system

The final drive system shall be free from abnormal backlash, unusual noise, and oil leakage.

5.5.5 Axle housing

No crack (whenever there is cracking), damage, deformation or oil leakage in the axle housing.

5.6 Suspension system

5.6.1 No cracking, damage, off-set or misalignment shall be in the spring and the clip band. Centre bolt or U-bolt shall not be damaged, missing, or loose.

5.6.2 No excessive play at the mounting portions of the shock absorber. No oil or gas leakage shall be present.

5.6.3 The torque rod, radius rod, and their brackets shall be free from deformation and damage, mounting portions and coupling portions shall not be loose or damaged.

5.6.4 The suspension arms shall not be damaged or loosely mounted. The arm support shall be free from cracking, damage, and bends.

6 Inspection of steering system, brake system, wheels and tyres

6.1 Steering system

6.1.1 Steering wheel

6.1.1.1 The steering wheel shall be capable of being easily and reliably operated by a driver sitting in position, and shall be mounted without backlash, lightly operated and with proper play.

6.1.1.2 There shall be no backlash in the direction of the axis of the steering shaft.

6.1.1.3 The effort required to manipulate the steering wheel shall not be excessively different between the clockwise direction and anticlockwise direction.

6.1.2 Steering gear box

6.1.2.1 The gearbox shall be mounted without looseness and be free from oil leakage.

6.1.2.2 The sector shaft shall be free from backlash.

6.1.3 Steering linkage

6.1.3.1 The steering linkage shall be free from deformation and damage such as cracking.

6.1.3.2 No loosely mounted parts, excessive backlash or defective split pin shall be present in any part of the rod arms.

6.1.3.3 There shall be no risk of the wheels coming into contact with the frame, fender, brake hose or any other part during steering.

6.1.4 Power steering

The power steering system shall be free from oil leakage and looseness in its body or connecting portions and shall operate and function properly.

The steering fluid reservoir cover should be tightly secured.

6.2 Brake system

6.2.1 Brake pedal

6.2.1.1 The height, free play and full depression of the brake pedal shall be correct, and the clearance between it and the floorboard shall not be less than 25% of the overall stroke of the pedal. (For an air brake, the play of its pedal shall not exceed 20 mm).

6.2.1.2 The brake pedal shall be free from backlash in the axial direction, and shall not produce any unusual noise when depressed.

6.2.1.3 The brake pedal shall be provided with a mechanism to prevent slipping e.g.a rubber pad.

6.2.1.4 The brake system shall be free from leakages and the ingress of air.

6.2.2 Parking brake

6.2.2.1 The parking brake shall be completely engaged when the brake lever is fully activated.

6.2.2.2 The pulling margin of the brake lever shall not be more than 70 % of its overall stroke.

6.2.2.3 The ratchet shall not be worn or damaged.

6.2.3 Brake rods and cables

Any visible damage shall not be allowed

6.2.4 Brake hose and piping

6.2.4.1 No damaged or loosely installed brake hoses or pipes shall be permitted and there shall be no oil leakage or air leakage from piping or joints.

6.2.4.2 There shall be no risk of a hose or pipe being brought into contact with any other part and no hose or pipe shall show signs of having been in contact with any other part.

6.2.5 Master cylinder and wheel cylinders

The master cylinder and wheel cylinder shall function properly and shall be free from leakage, and no bend or damage shall be present in the push rod.

6.2.6 Backing plate

The backing plate shall be free from deformation and distortion, and shall not be cracked especially in proximity to anchor pin installation areas.

6.2.7 Air brake

The hoses and pipes, release valve, and brake chamber shall be free from damage and air leakage. The brake chamber and rod shall be free from deformation, and no split pins shall be missing.

6.2.8 Braking servo unit

The servo unit shall function properly and there shall be no liquid or air leakage from the unit or pipe joints.

6.3 Wheels and tyres

6.3.1 Wheels

6.3.1.1 No nuts or bolts shall be loose or missing in a wheel

6.3.1.2 The wheel disks, rims and side rings shall be free from cracking and damage due to excessive corrosion or deformation, and the disk shall be free from excessive run-out.

6.3.1.3 Wheel bearing shall be free from excessive backlash and the drag from the brakes and the preload on bearings shall be correct.

6.3.2 Tyres

6.3.2.1 Tyre shall be as per the specifications recommended by the vehicle manufacturer.

6.3.2.2 The tyres shall be inspected visually in accordance with tyre specifications.

The following shall be observed:

- a) the tread pattern shall not be excessively worn or damaged. The sidewall shall be free from cracking and damage and tread shall not show signs of slipping; and
- b) tyres tread shall not be worn beyond 1.6mm or the Tread Wear Indicator.
- c) the tyres should have a shelf life of at least 50% .This applies for tyres on vehicles under importation.
- d) tyres of different Sizes specifications not to be fitted onto the same axle.
- e) tyres designed for winter conditions not allowed.

7 Windshield and windows, wipers and washers, mirrors, lights and reflectors

7.1 Windshield and windows

The Window glass elevating devices shall be functional.

The windshield shall be securely fitted and made of safety glass, and shall be free from any distortion or flaws that may limit visibility.

- a) the windshield shall not be cracked, clouded or otherwise defective that the driver's day view or night view is materially affected or obstructed.
- b) the windshield cracks shall not have sharp edges
- c) the windows shall not restrict the driver's view in the side-mirror.
- d) material other than glass shall not be fitted as; window or transparent partition, except that
 - i) roof windows, and windows and partitions in sidecars, in buses and in passenger semitrailers may be of ultra-high-impact acrylic or polycarbonate plastics materials that are marked with the trade name or trade mark of the manufacturer or with the trade name of the material and with a permanent material identification mark,
 - ii) flexible windows or partitions that fold away may be of plastic material, and
 - iii) windows in trailers and in caravans may be of ordinary acrylic or polycarbonate plastics materials.

7.2 Wipers and washer

The Windshield shall be provided with wipers capable of cleaning the Windshield. The wipers shall function normally and its blades shall be free from damage. Windscreen washers (where fitted) shall be in good working order.

7.3 Rear view and side mirrors

The mirrors shall be effective, firmly installed, and the surfaces shall be free from smudges, distortion and cracking.

The mirrors shall be so structured that their orientation can be easily adjusted and maintained.

7.4 Lighting devices and reflectors

Lighting devices and reflectors shall function normally and shall be free from damage and dirt.

A vehicle shall be fitted with the following lighting devices;

- a) headlamps with main and dipped beams;
- b) front position lamps;
- c) rear lamps;
- d) stop lamps; and
- e) registration plate lamp(s); or

B any lamp listed above shall be securely fitted, free from damage, and in good working order.

7.4.1 Headlamps

The light from headlamps shall be white and the colour of all headlamps shall be identical.

7.4.2 Brake lights

The light from brake lamps shall be red, and the brake lamps shall be automatically turned on when the main brake system is activated.

7.4.3 Number plate lights

The light from license plate lamps shall be white in colour and the licence plates lamps shall be so structured that they are on, when the headlamps and/or parking lights are on.

7.4.4 Parking lights

The light from the rear parking lamps shall be red in colour and the front ones amber or white; parking lamps shall be so structured that they are on whenever the headlamps are on. The colour of left and right parking lamps shall be identical.

7.4.5 Reverse lights

The light from reverse lamps shall be white in colour.

7.4.6 Indicating lights

Indicator lights lamps shall be installed at the front and rear of an automobile, and shall be positioned bilaterally and symmetrically in pairs, respectively. The light from the indicator lamps shall be orange, and the lights shall flash 60 through 120 times per minute.

7.4.7 Chevron reflectors

Reflectors used shall be in accordance with requirements specified in US 533.

7.4.8 Warning lights

Where installed, warning and information lights e.g oil pressure, charging, parking brake, open doors, seat belts etc. shall function effectively.

7.4.9 Hazard warning flashing lights

Hazard warning flashing lights shall be installed bilaterally and symmetrically and shall function properly. The hazard warning flashing lights shall be free from damage and shall be orange or light yellow.

8 Doors, seats and seat belts

8.1 Doors

A door should be properly secured:

- a) hinges, catches or pillars of a door should not be loose to compromise its security;
- b) a door should be able to be opened from both the inside and the outside (except in the case of official security vehicles or where child locks are installed); and
- c) a safety catch should be functioning correctly.

8.2 Seats

All the seats shall be firmly secured as follows:

- a) seat adjustments shall operate effectively;
- b) seat should be of a type or design intended for installation in a motor vehicle;
- c) Any part of any seat assembly, supporting structure, cushion; or
- d) back rest should not be; damaged, worn or designed so as to create a hazard to the occupant of the seat, regardless of seating position.

8.3 Seat belts

The Seat belts shall conform to US 545 and US 546.

9 Frame and vehicle body

9.1 Frame

9.1.1 The frame of an automobile shall be sufficiently rigid to serve purpose.

9.1.2 The frame shall be free from cracks, damage or advanced corrosion, deformation or misalignment.

9.1.3 No loose or missing or insecure rivets, bolts and other fasteners.

9.1.4 No cracked or unsatisfactory weld.

9.1.5 Repairs or modifications not in-line with manufacturer's recommendation are not permitted.

9.2 Vehicle body

9.2.1 The vehicle body shall be reliably secured on the frame, and shall not be loosened by vibration or impact. Any serious damage to an outer panel shall be remedied.

9.2.2 The contour and any other shape of the vehicle body shall not contain any sharp projections, protruded rotating parts or any other elements that may interfere with the safety of traffic.

9.2.3 Any cracking, corrosion or distortion in parts such as pillars and the floorboard, which constitute the fundamentals of a vehicle body and sills, shall be remedied.

9.2.4 Modifications not in-line with manufacturer's recommendation are not permitted.

9.3 Goods-carrying equipment

Goods-carrying equipment e.g. cargo beds, racks etc. shall be capable of carrying goods safely and reliably.

10 Vehicle dimensions

10.1 Overall length

10.1.1 A bus-train shall not exceed 20 m.

10.1.2 A single vehicle, excluding a semi-trailer, including any drawbar or coupling, shall not exceed 12.5 m.

10.1.3 A trailer with one axle or axle unit (other than a semi-trailer), the GVM of which does not exceed 12 000 kg, shall not exceed 8 m, excluding the length of the drawbar or coupling;

10.1.4 An articulated motor vehicle or other combination of motor vehicles consisting of drawing vehicle and a semi trailer, including any draw bar or coupling, shall not exceed 17 m.

10.1.5 A distance between the drawing vehicle and the trailer, shall not exceed 1.8 m, including any drawbar or coupling.

10.1.6 A trailer with one axle or axle unit (other than a semi trailer) the GVM of which exceeds 12 000 kg, shall not exceed 11.3 m, excluding the length of the drawbar or coupling.

10.1.7 A trailer not referred to in **9.1.3**, **9.1.5** and **9.1.6** above (other than a semi trailer), the GVM of which exceeds 12 000 kg, shall not exceed 12.5 m excluding the length of any drawbar or coupling.

10.1.8 Any other combination of vehicles including any drawbar or coupling shall not exceed 22 m.

10.2 Overall overhang-front overhang

Measure the distance between the front axle and the front of the bumper and observe the following:

- a) semi-trailer shall not exceed 1.8 m; or
- b) any vehicle (other than trailer or trailer with axle unit) shall not:
 - i) exceed 60 % of the base ;

- ii) exceed 6.2 m less half of the wheel base, in the case of vehicle in which the front surface of the backrest of the drivers' seat and seat level is within 1.7 m of the front end of the vehicle, when such seat, if adjustable, is in the rear position; or
- iii) exceed 5.8 m less half the wheel base, in the case of any other vehicle.

10.3 Coupling device

10.3.1 The coupling device shall be rigid and so structured that it will provide secure coupling. The coupling device shall not be disconnected due to vibration or impact during driving and shall sufficiently withstand driving.

10.3.2 The coupler of the coupling device shall be installed without looseness and shall function effectively. The pitching shaft, rolling shaft, and bearings shall be free from wear and damage.

10.3.3 The kingpin of the coupling device for trailers shall be installed without looseness.

10.3.4 The pintle hook and lunette eye installed on trucks etc, shall be reliably operatable and free from damage.

11 Odometer and other instruments

11.1 Odometer

The Odometer should not have been tampered with to misrepresent the true mileage

11.2 Other dashboard gauges/indicators

Dash board lighting shall be functional

Dash board instruments such as water temperature gauge, fuel gauge, and tachometer, etc shall function properly.

12 Air conditioning system

Where an air conditioning/refrigeration system is fitted, the refrigerant shall not be chlorofluorocarbons (CFCs).

13 Radiation

When the vehicle is subjected to dose rate test as described in Annex F, the radiation dose rate shall not exceed 0.3 μ Sv/hr.

14 Documentation

The following information shall be made available:

- a) certificate of roadworthiness, attesting conformity to the requirements of this standard, issued by an inspector. The certificate should be properly linked to the particular vehicle using a unique identifier. e.g. Chassis Number, Vehicle Identification number(VIN), registration plate number etc;
- b) appraisal information showing model, year of manufacture, engine capacity and mileage; and
- c) for an imported vehicle, certificate of road worthiness shall be valid for a period of 12 months from the date of issue, and for vehicles already registered in Uganda, the validity shall be as specified in The Traffic And Road Safety (Motor Vehicle Inspection) Regulations.

Annex A (normative)

Wheel alignment testing

A.1 Purpose

This annex sets out the assessment of the wheel slip sideways, to be measured while the vehicle is travelling. The unit of scale employed on measuring the slip is generally (m/km) is the amount of the wheel slip perpendicular to the direction of travel as the vehicle makes a straight drive for 1 km.

A.2 Apparatus

The tester may be either mechanical or electrical depending on the method by which the amount of movement of the board is detected and transmitted to the indicator. The length of the running board is available in either 500 mm, 800 mm, or 1000 mm.

A.3 Procedure

Before performing the test, make sure that there is no dirt on the board and that the boards and the indicator are functioning properly. Then let the vehicle run straight parallel to the centre line of the tester at 4 km/h and read the maximum amount of slip indicated on the scale, before the front wheels completely pass the boards: Make necessary adjustments to the vehicle wheel alignment if the reading is 5 mm or more or even when less than 5 mm or if the figure is different from the value designated from the given vehicle.

Annex B (normative)

Brake testing

B.1 Purpose

This annex sets out the assessment of the braking capacity of the vehicle. The widely used testers are roller driven. The rollers rotate with the wheels placed on top of them. The rollers are motor driven supplied in a set of two, one for each wheel. When brakes are applied, a rotation resistance is applied to the roller that creates torque in the direction opposite to the roller rotation.

B.2 Apparatus

There are various types of testing equipments such as the roller gearbox driven type and roller driven worn shaft type.

B.3 Procedures

Turn on the motor and let the rollers run idle to check that they are smoothly rotating. Make sure the needle indicator is adjusted to zero.

Turn off the motor and move the vehicle to place its wheels on top of and perpendicular to the rollers. Make sure that each of the wheels to be measured are firmly supported by two rollers.

Turn on the motor and let the rollers rotate. Before applying the brakes, check the reading on the indicator and make sure there is no drag of brakes. Then slowly step on the brake pedal. Gradually press down the pedal. The wheels will be eventually locked and the reading on the indicator will become constant.

Read the value indicated immediately prior to the locking of the wheels. This value is usually the maximum braking force.

Measure the braking force of both front and rear wheels.

Annex C (normative)

Exhaust emissions testing

C.1 Purpose

The test is done to measure the volumetric concentrations of CO and HC emissions at idling and not at slightly higher speed and load.

C.2 Apparatus

The apparatus used should be an independent exhaust - gas analyzer unit or part of engine analyzer.

C.3 Procedures

Procedures for calibrating and using exhaust gas analysers vary with the make and model of testers so emphasis shall be put on careful reading of the instructions for the analyzer.

Make necessary connections (electrical supply etc), turn on the analyzer, warm the equipment and calibrate the HC and CO meters for zero reading.

Check the system to be sure it is leak free.

To measure the amount of CO, run the engine at fast idle (say 1 500 rpm to 2 000 rpm for about 30 s), then run the engine at its specified idle speed and read CO on the CO meter.

To measure the HC, run the engine at fast idle (1500 rpm - 2000 rpm for about 30 s), then run the engine at its specified idle speed then read HC on the HC meter.

For diesel engine, vehicle measurement is done under no load and quickly accelerated and the percentage of smoke is read from the smoke meter or inspection done visually.

Annex D (normative)

Head light testing

D.1 Purpose

This annex sets out test for determining the luminosity and direction of irradiation (am) of the headlamp manually. The luminosity is expressed in candela (cd) and the direction of irradiation is generally indicated by the amount (in cm or mm) which the main optical axis oscillates at a 10m distance in the front or as specified by the vehicle manufacturer as to agreed standards.

D.2 Apparatus

There are various types of testers according to the methodology and specifications of measurements. The types of headlight testers are classified into types: screen type, projecting type and automatic tester (Le. automatic optic axis tracking testing) type.

D.3 Procedure

The arrangement shall be done as shown in Figure D.1. The results shown in Figure D.2 and Figure D.3 together with the following general guidelines on handling a headlight tester shall also be observed:

- a) air pressure of all the tyres is of standard/specified value;
- b) there is no inclination of vehicle body due to damaged springs;
- c) the tester and the vehicle are precisely facing each other;
- d) the testing floor is flat;
- e) the distance between the tester and the vehicle headlamp is accurate;
- f) the engine is running and its battery is being charged while testing; and
- g) the vehicle should be unladen with one driver on board.

NOTE Luminosity refers to the brightness of light source and is expressed in candelas (cd) where as illumination refers to the brightness of the irradiated surface and is expressed in luxes (lx).

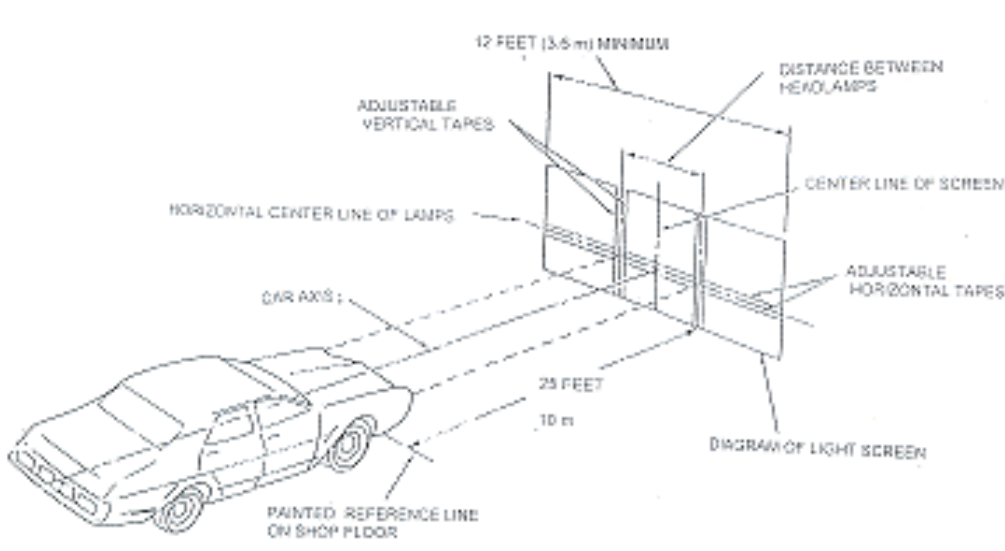


Figure D.1 - Manual headlight aiming screen

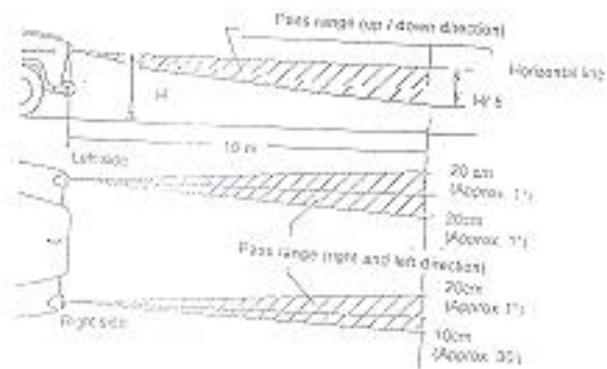


Figure D.2 - Irradiating range of headlights



Figure D.3 - Upper and lower limits to mounting position of headlight

Annex E (normative)

Sound level testing

E.1 Purpose

This annex sets out assessment of the levels of noises produced by the vehicle and the sound of its horn. The gauge simulates human auditory perception. The audit level is indicated in dB (A) units.

Also sound can be expressed in many physical quantities other than dB (A) such as in Pascal (Pa) unit of pressure, sound power (watts), intensity (sound/surface) in watts per square metre (W/m²) or particle speed (m/s).

NOTE 1 Sound level dB = $20 \times \log \frac{P}{P_0}$

where

P_0 is the lowest audible sound of 20 MPa

NOTE 2 1 Pa = 1 N/m²

1 atm = 105 Pa

E.2 Apparatus

Apparatus uses microphone that converts sound captioned in electrical current and its level is indicated on the indicator in dB(A).

E.3 Procedures

Calibrate the indicator before use, follow specific instructions as to the gauge settings and measurements taking. Note the specific settings for measuring of exhaust noises and sound level of the horn, careful noting placement of a gauge to avoid interference of background noises and reflected sounds. Make adjustments for such noises where such noises cannot be avoided.

Annex F (normative)

Radiation Measurement test

F.1 Purpose

The aim of the test is to measure radiation dose on the surface, interior and on the tyres of the Motor vehicles when the vehicle is stationary.

F.2 Apparatus

The apparatus or equipment to be used for the measurement should be a handheld radiation alert detector such as Geiger Muller (GM) tube, Scintillator counter, Ionization chamber, Semi-conductor survey meter etc. calibrated to an accuracy of $\pm 10\%$ of the measure ranging from $0.1 \mu\text{Sv/h}$ and a stop watch.

F.3 Procedures

F.3.1 The Equipment for measuring the dose rate should be placed as close as possible to the surface of the measuring point, though it shall not be in contact with the surface.

F.3.2 The measurement should take place in such a manner that the time of measurement is sufficient for the equipment to stabilize to indicate the dose rate and that both the maximum and minimum for the respective point are recorded.

To fully calculate and understand the amount of dose radiation at the given point, measure five to ten times and take an average.

Annex G (normative)

Measurement of exhaust smoke Opacity

G.1 Purpose

The purpose of the test is to measure the smoke Opacity for a stationary diesel engine vehicle

G.2 Apparatus

The snap-acceleration smoke test requires the use of smoke measurement and data processing by an opacimeter. The operating instructions supplied by the processing unit manufacturer should be consulted for specific equipment set-up procedures.

G.3 Procedure

Choke Wheels.

Prior to preconditioning test, the vehicle should be under load for at least 15min to ensure that the engine is warmed-up. Alternatively, vehicle water and oil temperature gauges may be checked to verify that the engine is within its normal operating temperature range.

All devices installed on the engine or vehicle which alter the normal acceleration characteristics of the engine e.g. air conditioning system, engine brake, etc should be switched off. These have the effect of temporarily lowering the snap-acceleration test results, or preventing the test from being successfully completed.

Place Transmission in neutral.

With the engine warmed-up and at low idle speed:

Insert exhaust probe

The operator shall snap accelerator/hold the throttle in fully open position until the time the engine reaches its maximum governed speed, plus an additional 1 to 4s and opacity reading taken.

Upon completion of the 1 to 4s with the engine at its maximum governed speed, the operator shall release the throttle and allow the engine to return to the low idle speed.

Once the engine reaches its low idle speed, the operator shall allow the engine to remain at idle for a minimum of 5s, but no longer than 45s, before initiating the next snap-acceleration test cycle. The time period at low idle allows the engine's turbocharger (if equipped) to decelerate to its normal speed at engine idle.

The snap acceleration test is repeated a minimum of five times .Average three last readings to determine pass or fail

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