AFRICAN STANDARD

DARS 1355-3

First Edition 2020

Vehicle standards — Specification for vehicle roadworthiness — Part 3: Roadworthiness — Supporting information

Reference No. ARS 1355-3:2020(E)
ICS 43.020

Table of contents

Foreword

The African Organization for Standardization (ARSO) is an African intergovernmental organization established by the United Nations Economic Commission for Africa (UNECA) and the Organization of African Unity (AU) in 1977. One of the fundamental mandates of ARSO is to develop and harmonize African Standards (ARS) for the purpose of enhancing Africa's internal trading capacity, increase Africa's product and service competitiveness globally and uplift the welfare of African communities. The work of preparing African Standards is normally carried out through ARSO technical committees. Each Member State interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, Regional Economic Communities (RECs), governmental and non-governmental organizations, in liaison with ARSO, also take part in the work.

ARSO Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare ARSO Standards. Draft ARSO Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an ARSO Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ARSO shall not be held responsible for identifying any or all such patent rights.

This African Standard was prepared by the ARSO Technical (Harmonization) Committee Number 08-4/59 on Automotive Technology and Engineering (ARSO/THC 08-4/ARSO/TC 59).

ARSO Central Secretariat
International House 3rd Floor
P. O. Box 57363 — 00200 City Square
NAIROBI, KENYA

Tel. +254-20-2224561, +254-20-3311641, +254-20-3311608

E-mail: arso@arso-oran.org
Web: www.arso-oran.org

* © 2020 ARSO — All rights of exploitation reserved worldwide for African Member States' NSBs.

ARSO Central Secretariat
International House 3rd Floor
P.O. Box 57363 — 00200 City Square
NAIROBI, KENYA

Tel: +254-20-2224561, +254-20-3311641, +254-20-3311608

E-mail: arso@arso-oran.org
Web: www.arso-oran.org

Introduction

This standard consists of the following parts under the general title “Specification for vehicle roadworthiness”

Part 1: Roadworthiness of vehicles already in service

Part 2: Roadworthiness of vehicles prior to entry into service and thereafter

Part 3: Roadworthiness — Supporting information

Part 4: Roadworthiness — Requirements for vehicle examiners

Part 5: Roadworthiness — Requirements for testing equipment

Part 6: Roadworthiness — Requirements for combinations of vehicles

Vehicle standards — Specification for vehicle roadworthiness — Part 3: Roadworthiness — Supporting information

1 Scope

This Part 3 of the specification contains information intended to support the vehicle examiner and test stations using other Parts of this specification.

The contents of this Part 3 are not mandatory.

NOTE Additions to this part of the specification will be provided at a later date.

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.

ARS 1355-1, *Vehicle Standards — Specification for Vehicle Roadworthiness — Part 1: Roadworthiness of vehicles already in use*

ARS 1355-2, *Vehicle standards — Specification for vehicle roadworthiness — Part 2: Roadworthiness of vehicles prior to entry into service, and thereafter*

3 Terms and definitions

For the purpose of this standard the following definitions apply.

3.1 Definitions

3.1.1
registration plate/ licence plate/ number plate
the plate manufactured and embossed appropriately, which is attached to the front and rear of a motor vehicle or the rear of a trailer and a motorcycle

3.1.2
vehicle category definitions
applied by the UN ECE are included under ARS 1355-2

3.2 Abbreviations

GCM Gross Combination Mass of the vehicle or vehicle combination as specified by the manufacturer of the drawing vehicle on the vehicle plate

GVM Gross Vehicle Mass of the vehicle as specified by the manufacturer of the vehicle on the vehicle plate

UN ECE United Nations Economic Commission for Europe

VIN the vehicle identification number issued, affixed to and recorded on a vehicle appropriately, also referred to as chassis number

WVTA Whole Vehicle Type Approval

4 Assessment of compliance

4.1 Methods of assessment

There are numerous possible approaches to the assessment of compliance to Vehicle Design Safety Standards. The degree of assurance of compliance is directly proportional to the cost and complexity of the method used. The various methods are listed below and their merits and demerits when considered for use in Africa are discussed.

But for the purposes of assessing the likelihood of compliance of imported new or used vehicles to the vehicle safety design requirements in Part 2, Table 5 it is not necessary to delve into the detail of each UN ECE Regulation. This is because one is not actually designing a vehicle or system, one is merely assessing whether the vehicle is likely to have been designed and manufactured to comply with these or similar or equivalent requirements. For example if the vehicle is fitted with a driver and passenger airbag, it is likely to have been approved to comply with a frontal collision test such as UN ECE R 94

4.1.1 Method No 1 – Whole Vehicle Type Approval (WVTA)

The Whole Vehicle Type Approval (WVTA) system applied in Europe requires a test report for each requirement from an acceptable testing authority to be submitted to the Approval Authority and for each manufacturer to have a suitable Quality Management System in force for that product. Other countries operate suitable national approval systems (e.g. China, India, Japan) but would need further study to see if they would be of assistance.

WVTA is an excellent system which relies on the manufacturer to ensure that he continues to produce exactly what was tested successfully. Unfortunately, the Certifications and Test Reports are normally only released by the manufacturer to a subsidiary or authorised distributor of that brand since they constitute proprietary information which competitors must not see. Furthermore, it would be a logistical nightmare for governments to require private entrepreneurs importing second-hand or new vehicles to attempt to obtain and control such test reports for such a huge variety of brands and models often in relatively low volumes. The documentation for each car model covers 20 to 40 extensive requirements covering possibly 600 to 800 test reports (with data files of between 200 and 400MB).

On the other hand, the single WVTA document would be useful as comprehensive evidence of compliance and until recently was only available for light vehicles, but it would not necessarily be released by the manufacturer to private individuals importing new or used vehicles.

So whilst this is probably the most accurate method of proving compliance it will only work if the importers of second hand vehicles are franchised to import specific brands and if they are then given access to the type approval documents and test reports.

4.1.2 Method No 2 – Limit the Sources and the Age

Limit the sourcing of used brands of vehicles to those brands of vehicles previously registered only in countries which have domestic requirements similar or better than those desired by the African recipient country, and which are known to have an effective enforcement regime. Then set an age limit which has been researched to give the desired requirements.

4.1.3 Method No 3 – Limit the Age and mandate visually assessable requirements

This is the preferred approach since limiting the age only may exclude models which are old, but which also embody the desired requirements because they were built to exceed the minimum requirements of the domestic legislation.

This may or may not affect affordability depending on where the age cut-off impacts.

4.1.4 Method No 4 – Limit only the visually assessable requirements

This is better than nothing but is more open to inaccuracies and errors and evasion tactics and to letting undesirable designs through. However, if 2 or 3 visually assessable features appear to indicate

compliance then it increases the probability of the vehicle complying with even more of the UN Regulations.

4.1.5 Method No 5 – Limit only by age

This is the simplest and least administrative burdensome approach but is the least effective in weeding out vehicles with undesirable designs and is open to cheating on the date of first registration, especially where the VIN or chassis number does not tie down the date.

4.1.6 Method No 6 – No limitations

Whilst certainly the least administratively burdensome it must be remembered that it will still lead to general upgrading of standards since it will become less viable to bring in cheaper older vehicles as the years go by. Also avoids setting differing age limits for differing categories of vehicles.

4.2 Degrees of assurance of compliance

In summary can be categorised as follows:

a) Maximum degree of assurance – if test reports from acceptable sources are made available and if test equipment is available locally to re-test in cases of doubt.

b) Lesser degree of assurance – if the vehicles are received only from countries which are known to apply similar standards to their domestic and export production and if the vehicles are not older than 5 years.

c) Minimal degree of assurance – if the vehicles and the owner's manuals are inspected visually for some indications that the vehicle is likely to incorporate some or all of the required design safety standard requirements.

4.3 General considerations

4.3.1 Maintenance and Design

Vehicles can be maintained to a reasonably safe condition for 20 years or more.

So one can argue that setting an age limit does little to provide assurance of receiving a well maintained vehicle. If the objective is to receive vehicles which incorporate later safety technology, then setting an age limit will result in improved occupant safety and improved safety for other road users. Alternatively, simply demand specific vehicle design safety requirements.

4.3.2 Emissions

UN guidelines on “clean mobility” for Africa suggest that after 8 years catalytic converters needed replacement.

Unless one wishes to force expensive replacement of catalytic convertors then a 5 year age limit gives little return in emissions control (only 3 years).

4.4 Annexures

The following annexes are provided to assist vehicle examiners:

Annex A – Information on United Nations Economic Commission for Europe (UN ECE)

Annex B – E-mark symbols allocated to specific countries

Annex C – UN ECE Regulations which this specification proposes may be referenced for compliance are shown below with abbreviated titles

Annex A
(informative)

Information on the United Nations Economic Commission for Europe (UN ECE)

The UN ECE stands for the United Nations Economic Commission for Europe within which the World Forum for the Harmonization of Vehicle Regulations (WP.29) as it is known today was formed to address the road traffic safety concerns and to tackle the problems of diverse state regulations which could disrupt the free flow of commerce across state borders – see

http://www.unece.org/trans/main/welcwp29.html

In existence for more than 50 years and with participants coming from all over the world, especially the main motor vehicle producing countries, the World Forum for Harmonization of Vehicle Regulations (WP.29) offers a unique framework for globally harmonized regulations on vehicles. The benefits of such harmonized regulations are tangible in road safety, environmental protection and trade.

WP.29 is a permanent working party in the institutional framework of the United Nations with a specific mandate and rules of procedure. It works as a global forum allowing open discussions on motor vehicle regulations. Any member country of the United Nations and any regional economic integration organization, set up by country members of the United Nations, may participate fully in the activities of the World Forum and may become a contracting party to the Agreements on vehicles administered by the World Forum. Governmental and non-governmental organizations (NGOs) may also participate in a consultative capacity in WP.29 or in its subsidiary working groups.

An agreement, commonly known as the 1958 UN ECE Agreement, was entered into amongst several European countries, the effect of which meant that signatories would accept vehicles from any member country provided the vehicles and systems were type approved to the relevant UN EC Regulations. Original version entered into force on 20 June 1959, followed by Revision 1 on 10 November 1967, Revision 2 on 16 October 1995 and Revision 3 on 14 September 2017.

Excellent summary of the UN ECE Agreements and activities is given in the so-called “Blue Book” available for downloading at: - www.unece.org/trans/main/wp29/publications/other_vehicles.html

Many countries outside of Europe have become signatories to the 1958 Agreement and have adopted many of the UN EC Regulations, thus facilitating world trade and safer vehicle transportation systems. The workings of the UN ECE WP.29 are now fully global. The countries that are contracting parties to the 1958 Agreement are listed in Annex 2. Signatories of the 1958 Agreement from Africa include Egypt, Nigeria, South Africa and Tunisia.

Note that whilst the UN ECE has been assigned specialisation duties on Road Transportation, the UN ECA (United Nations Economic Commission for Africa) has been assigned specialisation duties on agricultural matters within the worldwide UN Community.

At this stage there are now 145 UN EC Regulations applicable to road vehicle safety design, emissions and some other road traffic safety matters with some 54 countries having acceded to the 1958 Agreement. A list is attached below which also shows the “E numeral” which each country is authorised to apply to vehicles and components which for which its government has authorised the type approval.

Annex B
(informative)

E-mark symbol allocated to specific countries

ECE symbols	Contracting Parties	Date of adhesion
E 1	Germany	28.01.1966
E 2	France	20.06.1959
E 3	Italy	26.04.1963
E 4	Netherlands	29.08.1960
E 5	Sweden	20.06.1959
E 6	Belgium	05.09.1959
E 7	Hungary	02.07.1960
E 8	Czech Republic	01.01.1993
E 9	Spain	10.10.1961
E 10	Serbia	12.03.2001
E 11	United Kingdom	16.03.1963
E 12	Austria	11.05.1971
E 13	Luxembourg	12.12.1971
E 14	Switzerland	28.08.1973
E 16	Norway	04.04.1975
E 17	Finland	17.09.1976
E 18	Denmark	20.12.1976
E 19	Romania	21.02.1977
E 20	Poland	13.03.1979
E 21	Portugal	28.03.1980
E 22	Russian Federation	17.02.1987
E 23	Greece	05.12.1992
E 24	Ireland	24.03.1998
E 25	Croatia	08.10.1991
E 26	Slovenia	25.06.1991
E 27	Slovakia	01.01.1993
E 28	Belarus	02.07.1995
E 29	Estonia	01.05.1995
E 30	Republic of Moldova	20.11.2016
E 31	Bosnia and Herzegovina	06.03.1992
E 32	Latvia	18.01.1999
E 34	Bulgaria	21.01.2000
E 35	Kazakhstan	08.01.2011

ECE symbols	Contracting Parties	Date of adhesion
E 36	Lithuania	29.03.2002
E 37	Turkey	27.02.1996
E 39	Azerbaijan	14.06.2002
E 40	The Former Yugoslav Republic of Macedonia	17.11.1991
E 42	European Union	24.03.1998
E 43	Japan	24.11.1998
E 45	Australia	25.04.2000
E 46	Ukraine	30.06.2000
E 47	South Africa	17.06.2001
E 48	New Zealand	26.01.2002
E 49	Cyprus	01.05.2004
E 50	Malta	01.05.2004
E 51	Republic of Korea	31.12.2004
E 52	Malaysia	04.04.2006
E 53	Thailand	01.05.2006
E 54	Albania	05.11.2011
E 56	Montenegro	03.06.2006
E 57	San Marino	26.01.2016
E 58	Tunisia	01.01.2008
E 60	Georgia	25.05.2015
E 62	Egypt	03.02.2013
E 63	Nigeria	17.12.2018

Annex C
(informative)

UN ECE regulations which this standard proposes may be referenced

Subject	UN ECE Regulation or other Standard
Braking	ECE R13H
	ECE R13
Lighting	ECE R48
Contour tape	ECE R104
Chevrons	ARS 1355-1, Annex B or SANS 1329-4
Safety glass	ECE R43
Rear view	ECE R46
Tyres – passenger	ECE R30
Tyres – commercial	ECE R54
Emissions – Light vehicles	Euro 2
Emissions – Heavy vehicles	Euro II
Safety belts	ECE R16
Rear underrun	ECE R58
Speedometer	ECE R39
Audible warning	ECE R28
Warning triangle	ECE R27
Frontal collision	ECE R94
Side impact	ECE R95
Tilt angle	ECE R107 – 28 Degrees
Superstructure	ECE R66

Thus a warning triangle which has been Type Approved by the government of Estonia would bear the markings with a serial No XXXXXX "E29 – R27 – XXXXXXXXXXX"

A passenger car tyre Type Approved by the government of Tunisia would show "E58 – R30 – YYYYYYYY"

Glass Type Approved by the government of Germany would show "E1 – R43 – ZZZZZZZZZZ"

Annex D
(informative)

How to obtain copies of UN ECE Regulations free of charge

Access to all the UN ECE Regulations and to the activities and discussions of various Groups of Experts, now referred to as Working Groups is via the website below:
https://www.unece.org/trans/main/welcwp29.html

The latest UN ECE Regulations may be downloaded free-of-charge from the above website by clicking on “Vehicle Regulations” then “Agreements and Regulations” then “UN Regulations (1958 Agreement)”, then “Regulations (Addenda to the 1958 Agreement)” then select the Regulation number required – eg for UN ECE Reg 43 Glass, select “Regs 41-60” then “43” on the top line, and click on the level required to be downloaded.

French and Portuguese translations of the UN ECE Regulations are available at:
https://ec.europa.eu › attachments › translations › renditions › native

There are commonly many revisions, amendments, supplements and corrigenda to each Regulation and the different levels of amendments will normally have been adopted or given force at different dates in the past.

For the purposes of this roadworthiness specification, the levels of the regulations selected for this specification date back a few years so as to ensure that the level which is being specified for compliance would have been achieved, or achievable, on vehicles which are older than 5 years.

All such selected levels of regulations are obtainable free-of-charge from the TTTFP website at http://tttfp.org

NOTE Vehicles and components which meet the selected levels in 6.3 of ARS 1355-2, or which meet any later levels of UN ECE Regulations are acceptable.

Annex E
(informative)

Vehicle category definitions used by UNECE, EU and several other countries

Passenger vehicles – Category M

Category M1 motor vehicle, hereinafter referred to as a vehicle is a motor vehicle that is used for the carriage of passengers, that has at least four wheels, and that has seating accommodation for not more than eight passengers in addition to the driver of the vehicle.

Category M2 motor vehicle, hereinafter referred to as a vehicle is a motor vehicle that is used for the carriage of passengers, that has at least four wheels, and that has seating accommodation for more than eight passengers in addition to the driver of the vehicle, and that has a maximum mass not exceeding 5 000kg.

Category M3 motor vehicle, hereinafter referred to as a vehicle is a motor vehicle that is used for the carriage of passengers, that has at least four wheels, that has seating accommodation for more than eight passengers in addition to the driver of the vehicle, and that has a maximum mass exceeding 5 000kg.

Goods vehicles – Category N

Category N motor vehicle is a goods vehicle that has at least four wheels, or that has three wheels and a maximum mass exceeding 1 000kg.

Category N1 motor vehicle, hereinafter referred to as a vehicle is a motor vehicle that has a maximum mass not exceeding 3 500kg, that has at least four wheels (or, provided that the maximum mass exceeds 1 000kg, at least three wheels), and that is used for the carriage of goods.

Category N2 motor vehicle, hereinafter referred to as a vehicle is a category N vehicle that is used for the carriage of goods and that has a maximum mass of more than 3 500kg but not more than 12 000kg.
Category N3 motor vehicle, hereinafter referred to as a vehicle is a category N vehicle that is used for the carriage of goods and that has a maximum mass exceeding 12 000kg.

Trailers – Category O

Category O1 is a single axle trailer, other than a semi-trailer, with a maximum mass not exceeding 750kg.

Category O2 is a trailer, other than a category O1 trailer, with a maximum mass not exceeding 3 500kg.

Category O3 is a trailer with a maximum mass exceeding 3 500kg but not exceeding 10 000kg.

Category O4 is a trailer with a maximum mass exceeding 10 000kg.

Mopeds, motorcycles, tricycles, quadricycles – Category L

These are mopeds and motorcycles, as well as all-terrain vehicles (quadricycles) and other small vehicles with 3 or 4 wheels.

Within category L, motorcycles are further subdivided into 2 groups (with and without sidecars). There is also a subdivision for mopeds with 3 wheels, which have smaller engines and lower top speeds than motor tricycles.

Annex F
(informative)

Vehicle data plate: Explanation of information plates (data plates) which show both the manufacturers limits and the legal limits

Many vehicle manufacturers, especially those in Japan, India and China find the following requirements for a vehicle data plate on goods vehicles and on buses to be incomprehensible and unnecessary.

However, member states are requested to consider the system and its benefits to road traffic law enforcers, especially with regard to vehicle overloading and to ensure that manufacturers rated capacities are not exceeded, especially in the case of front tyres.

The essential elements of the labelling system are:

1) To detail the vehicle manufacturer's limits in the left-hand column and to detail the applicable legislated permissible limits in the right-hand column.

2) The applicable maximum permissible legislated limits in the right-hand column are the lower of what the national or regional legislation states, and what the manufacturer has stated in the left-hand column.

The minimum requirement of maximum load information on a data plate is the left-hand column which shows the manufacturers maximum limiting values, sometimes called the "gross" values but internationally called the "technically permissible maximum" values. This allows for the law enforcement authorities to work out the maximum permissible values applicable in their country according to their domestic legislation relating to the maximum capacity of the road (also referred to as pavement) and other limitations.

Consider an example of where the legislated limit for the rear axle is 10 000kg and for the front steering axle is 8 000kg. Both the tyre manufacturer and the legislation states that the tyre capacities must not be exceeded. In this case the tyre capacity is 3 875kg per tyre.
Based on this information construct the table below – which will become the data plate information.

Line	Manufacturers Limits in LH Column	Matter to be considered affecting RH column	RH Column must therefore show limiting values of
1	Front axle design capacity – 8 000kg	Maximum permissible limit of 8 000kg on all steering axles with 2 wheels. Tyre capacity is 3 875kg	7 750kg
2	Rear axle design capacity - 11 000kg	Maximum permissible on rear axle with 4 wheels is 10 000kg and the dual tyres can carry 14 600kg	10 000kg
3	Vehicle design capacity – GVM - 18 500kg	The least of the sum of the front and rear axle of 17 750kg or the GVM of 18 500kg	17 750kg
4	Vehicle in combination with a trailer – 24 000kg	It may be limited by its power mass ratio or by the minimum mass on the driving axle or by bridge formula or by the limit of 56 000kg or by parking brake performance.	24 000kg

Explanation for Line 1) – Although the front axle is designed to be able to carry 8 000kg it has tyres which are limited to a carrying capacity of 7 750kg.

Explanation for Line 2) – The rear axle is designed to carry 11 000kg and its tyres can carry 14 600kg, but the legislation limits the maximum rear axle load to 10 000kg and so its legally permissible axle load is the lowest of the three, being 10 000kg.

Explanation for Line 3) – The vehicle has a design capacity of 18 500kg (GVM) and has a brake test report to UN Reg 13 to support this capacity. But legally we have shown it may only carry 7 750kg on the front axle and 10 000kg on the rear axle and so its legally permissible maximum for the vehicle may not exceed 10 000kg + 7 750kg = 17 750kg.

Explanation for Line 4) – The manufacturer's GCM rating of 24 000kg implies it could tow a trailer of actual maximum mass (24 000kg minus 17 750 kg) = 6 250kg in a case where the drawing vehicle is laden to its maximum load i.e. to its GVM of 17 750kg. However in cases where the drawing vehicle is not fully laden to its maximum load then the trailer GVM can be increased provided the total mass of both vehicles does not exceed 24 000kg.

Explanation for tyre capacities – The tyres the Load Index of 155 / 153 on the sidewall (see Annex 8). The 155 refers to their use as "singles" with a load capacity of 3 875kg per tyre and the 153 refers to their use a "duals" with a load capacity of 3 650kg per tyre.

Definition of GCM is "the maximum mass of any combination of vehicles……" Note that it is not defined as the sum of the GVM's of the drawing vehicle and trailer and it is affected by regulations governing the minimum load on the steering axle, the maximum load on the driving axle and the minimum load on the driving axle(s).

So the data plate for the above vehicle would be as follows:

Manufactured by	
Made in	Model No
VIN	
Tare: abcd kg	Power: 180 kW
GVM: 18 500	V: 17 750
GCM: 24 000	D/T: 24 000
GA Fr: 8 000	A Fr: 7 750
GA Rr:11 000	A Rr: 10 000

In the event that the front tyres had a load index of 151 then the maximum tyre load would be 3 450kg and the data plate would show the following information:

Manufactured by	
Made in	Made in
VIN	
Tare: abcd kg	Power: 180 kW
GVM: 18 500	V: 16 900
GCM: 24 000	D/T: 24 000
GA Fr: 8 000	A Fr: 6 900
GA Rr:11 000	A Rr: 10 000

Notes on layout of information on the above data plate or data label for a heavy vehicle:

a) The left hand column is what the manufacturer states as technically permissible.

b) The right hand column are the values which are the lowest of the technically permissible in the left hand column and of the legally permissible in that country.

c) For passenger cars and light goods vehicle (pick-ups) only the right hand column need be shown on the data plate or data label and the tare need not be shown.

d) Under the SI system, it is protocol to use capital letters only where the name of the inventor is used e.g.: - Nm for Newton metres. kW for kilowatts. mA for milliAmpere and so on. All other abbreviations are in lower case.

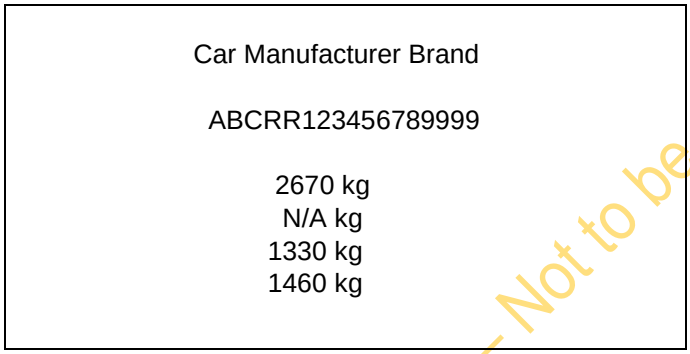
e) If the vehicle is not authorised by the manufacturer to draw a trailer then the GCM value may be shown as a blank, or as “N/A”, or sometimes shown as being the same value as the GVM.

In the case of passenger cars and light goods vehicles, if the sequence of GVM, then GCM, then Front axle, then Rear axle is used there is no need for any other data.

For example the following details are all that is required for a passenger car or light goods vehicle where only the name of the manufacturer, the 17 character VIN and the GVM, GCM, Front axle rating, Rear axle rating are needed to be shown.

In this example below the VIN is ABCRR123456789999; the GVM is 2 670kg; the GCM is not applicable in that the vehicle manufacturer does not approve the vehicle for towing any trailer; the front axle capacity is 1 330kg and the rear axle capacity is 1 460kg.

So long as the sequence of information is GVM, GCM, Front axle, Rear axle then no other abbreviations or descriptions are required.



Annex G
(informative)

Vehicle data plate: Bridge formula

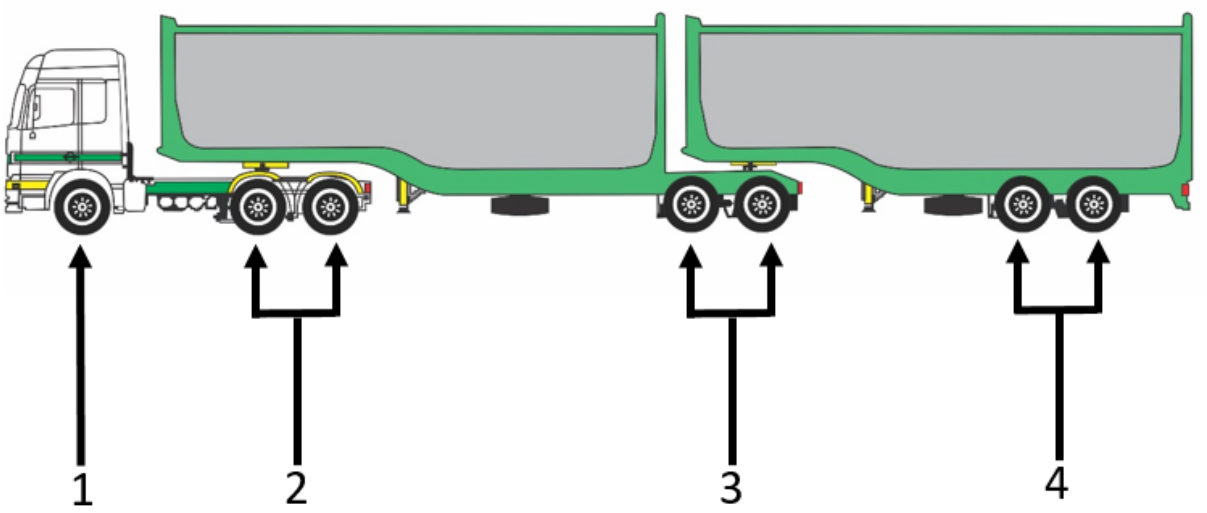
Carrying Capacity (Bridge Formula) Test

A Carrying Capacity (Bridge Formula) Test is performed to determine if the total axle mass loads do not exceed the maximum carrying capacity calculated from the bridge formula.

Capture Bridge Formula Information

An Axle Group of a heavy vehicle is the combination of any two axle units of the vehicle. In order to perform the Carrying Capacity (Bridge Formula) Test, the axle dimensions of all Axle Groups of a vehicle need to be captured.

The Axle Group is represented by sequential indicators of the axle units of the vehicle. For example, a vehicle with axle configuration 1222, as seen below, will have axle unit identifiers 1, 2, 3 and 4, as the vehicle has four axle units. The following Axle Group indicators will exist: 1-2, 1-3, 1-4, 2-3, 2-4 and 3-4. An Axle Dimension must be provided for at least the Axle Group containing the first and last axle unit.



Perform Carrying Capacity (Bridge Formula) Test

The Carrying Capacity (Bridge Formula) Test is performed at a weigh station for all Axle Group Dimensions captured as mentioned above. For a vehicle's first weigh, the appropriate tolerance percentage is applied to the permissible mass.

The Carrying Capacity (Bridge Formula) Test permissible mass is the product of an Axle Group's axle dimensions and Bridge Formula Variable 1 and adding the Bridge Formula Variable 2. Both variables are defined in the appropriate legislations.

The Total Axle Mass Load of an Axle Group is determined as the sum of the masses of all axle units within the Axle Group being tested. For example, if Axle Group 1-4 of a vehicle with four axle units is being tested, the Total Axle Mass Load used is the sum of the masses of all four axle units. If Axle Group 2-4 of a vehicle with four axle units is being tested, the Total Axle Mass Load used is the sum of the permissible masses of axle unit 2, 3, and 4.

A vehicle will pass the Carrying Capacity (Bridge Formula) Test if the Total Axle Mass Load is equal or less than the Carrying Capacity (Bridge Formula) Test permissible mass. A vehicle will fail the Carrying

Capacity (Bridge Formula) Test if the Total Axle Mass Load is greater than the Carrying Capacity (Bridge Formula) Test permissible mass.

Pass Result:

M ≤(D ×Bridge Formula Variable 1)+Bridge Formula Variable 2

Fail Result:

M >(D ×Bridge Formula Variable 1)+Bridge Formula Variable 2

M = Total Axle Mass Load of the applicable axle group.

D = Axle Dimensions (metres) between the axle units of an axle group.

Bridge Formula Variable 1 = 2 100

Bridge Formula Variable 2 = 18 000

Annex H
(informative)

Considerations of front reflectors according to UN ECE Regulation 48

In the 1950s and 1960s several countries continued to require front retroreflectors on vehicles but this requirement has gradually been deleted on the grounds that:

a) The reflectivity needed at the front of a vehicle was considered to be almost unnecessary, whereas that for the rear was considered to be a vital safety measure.

b) The reflectivity provided by the headlight reflectors was considered to be sufficient for the relatively fewer conditions where it might be advantageous.

c) Under UN ECE Regulation 48 front reflectors (Reg 48 Item 6.16) are now mandatory only on trailers and on vehicles having all concealable forward facing lamps with reflectors concealable.

d) Even parking lamps (Reg 48 Item 6.12) are optional on vehicles less than 6m long and 2m wide and are prohibited on all other vehicles.

f) Front position lamps (Reg 48 Item 6.9) are still mandatory on all vehicles except trailers less than 1 600mm wide.)

Annex J
(informative)

Tyre load index markings

L.I. is the load index number marked on the tyre and the maximum load is shown in kg.

L.I.	kg	L.I.	kg	L.I.	kg	L.I.	kg	L.I.	kg	L.I.	kg	L.I.	kg
0	45	40	140	80	450	120	1400	160	4500	200	14000	240	45000
1	46.2	41	145	81	462	121	1450	161	4625	201	14500	241	46250
2	47.5	42	150	82	475	122	1500	162	4750	202	15000	242	47500
3	48.3	43	155	83	487	123	1550	163	4875	203	15500	243	48750
4	50	44	160	84	500	124	1600	164	5000	204	16000	244	50000
5	51.5	45	165	85	515	125	1650	165	5150	205	16500	245	51500
6	53	46	170	86	530	126	1700	166	5300	206	17000	246	53000
7	54.5	47	175	87	545	127	1750	167	5450	207	17500	247	54500
8	56	48	180	88	560	128	1800	168	5600	208	18000	248	56000
9	58	49	185	89	580	129	1850	169	5800	209	18500	249	58000
10	60	50	190	90	600	130	1900	173	6000	210	19000	250	60000
11	61.5	51	195	91	615	131	1950	171	6150	211	19500	251	61500
12	63	52	200	92	630	132	200	172	6300	212	20000	252	63000
13	65	53	206	93	650	133	2060	173	6500	213	20600	253	65000
14	67	54	212	94	670	134	2120	174	6700	214	21200	254	67000
15	69	55	218	95	690	135	2180	175	6900	215	21800	255	69000
16	71	56	224	96	710	136	2240	176	7100	216	22400	256	71000
17	73	57	230	97	730	137	2300	177	7300	217	23000	257	73000
18	75	58	236	98	750	138	2360	178	7500	218	23600	258	75000
19	77.5	59	243	99	775	139	2430	179	7750	219	24300	259	77500
20	80	60	250	100	800	140	2500	180	8000	220	25000	260	80000
21	82.5	61	257	101	825	141	2575	181	8250	221	25750	261	82500
22	85	62	265	102	850	142	2650	182	8500	222	26500	262	85000
23	87.5	63	272	103	875	143	5725	183	8750	223	27250	263	87500
24	90	64	280	104	900	144	2800	184	9000	224	28000	264	90000
25	92.5	65	290	105	925	145	2900	185	9250	225	29000	265	92500
26	95	66	300	106	950	146	3000	186	9500	226	30000	266	95000
27	97.5	67	307	107	975	147	3075	187	9750	227	30750	267	97500
28	100	68	315	108	1000	148	3150	188	10000	228	31500	268	100000
29	103	69	325	109	1030	149	3250	189	10300	229	32500	269	103000
30	106	70	335	110	1060	150	3350	190	10600	230	33500	270	106000
31	109	71	345	111	1090	151	3450	191	10900	231	34500	271	109000
32	112	72	355	112	1120	152	3550	192	11200	232	35500	272	112000
33	115	73	365	113	1150	153	3650	193	11500	233	36500	273	115000
34	118	74	375	114	1180	154	3750	194	11800	234	37500	274	118000
35	121	75	387	115	1215	155	3875	195	12150	235	38750	275	121000
36	125	76	400	116	1250	156	4000	196	12500	236	40000	276	125000
37	128	77	412	117	1285	157	4125	197	12850	237	41250	277	128500
38	132	78	425	118	1320	158	4250	198	13200	238	42500	278	132000
39	136	79	437	119	1360	159	4375	199	13600	239	43750	279	136000

Explanation of Load Index Markings.

A tyre which is marked "11 R 22.5" has an 11 inch section, is of R = radial construction, and has a Rim Diameter of 22.5 inches.

The markings after this size are normally 148 M, i.e. 11 R 22.5 148 M. The 148 in the Table above means its maximum load is 3150kg.

A tyre which is marked "295/80 R 22.5 154M has a 295 section, is of a low profile design (section height = 80% of section width), is of R=Radial construction, and has a rim diameter of 22.5 inches and a maximum load of 3750kg. In cases where two numbers are shown such as "295/80 R 22,5 154/150M" this means when used as singles the maximum load is 3750kg but when used as duals the maximum

load is reduced to 3350kg. Speed ratings in both cases are designated by the "M" which means maximum safe speed of 130km/h.

A passenger car tyre marked "205/55 R16 91H" has a 205mm section is of low profile design (section height = 55% of section width), is of radial construction, and has a rim diameter of 16 inches and a maximum load of 615kg and a speed rating of H = 210km/h.

Annex K
(informative)

Tyre speed index ratings

The various letter designations for maximum safe speeds are given below

Speed Symbol	Speed Category (km/h)	Speed Symbol	Speed Category (km/h)
A1	5	J or JR	100
A2	10	K or KR	110
A3	15	L or LR	120
A4	20	M or MR	130
A5	25	N or NR	140
A6	30	P or PR	150
A7	35	Q or QR	160
A8	40	R or RR	170
B	50	S or SR	185
C or CR	60	T or TR	190
D	65	U or UR	200
E or ER	70	H or HR	210
F	80	V	240
G or GR	90	VR	Over 210
		ZR	Over 240
		W	Over 270

EXAMPLE A tyre with sidewall markings “205/55 R16 91H” means this tyre has a 205mm section, is of low profile design (section height is 55% of section width), is of radial construction, has a rime diameter of 16 inches and a maximum load of 615kg. The last letter “H” signifies a maximum safe speed of 210km/h.

Annex L
(informative)

Field of vision at ground level from the rear-view mirrors

For simplicity and practicability purposes the roadworthiness compliance checks in ARS 1355-1 are prescribed only for Class II and Class III exterior mirrors and are detailed in Annex C, ARS 1355-1, requiring the driver to be able to see on each side of the vehicle marks on the ground positioned 4m behind the driver and 1m away from the side of the vehicle, and 20m behind the driver and 3,5m away from the side of the vehicle.

For information and for compliance to UN ECE Regulation 36 purposes the following mandatory rules apply, but differ from one country to another.

Passenger cars (M1) and light goods vehicles (N1) may have Class II or Class III exterior mirrors.

Bus categories M2 and M3 must have Class II exterior mirrors and Class IV, V and VI are optional.

Goods vehicles N2 < 7,5t, N2 > 7,5t have slightly differing requirements.

Goods vehicles N3 must have Class II, IV, V and VI

The following diagrams show the field of vision which the various types of mirrors must provide in terms of UN ECE Regulation 36. But it is vital to note that assessment to the requirements below is done in a very precise manner requiring a mannequin with lights for its eyes at a specified position, with the mannequin placed on the driver's seat according to a specified procedure, the vehicle loaded as specified and the image captured on a screen positioned behind the vehicle. The mannequin's eyes (ocular points), head and body may not be moved during the test.

The diagrams below are shown with the ocular points positioned for LHD vehicles but can be transposed for RHD vehicles without any change to the dimensions.

Class I Mirror – Interior mirror if not obscured by body or load

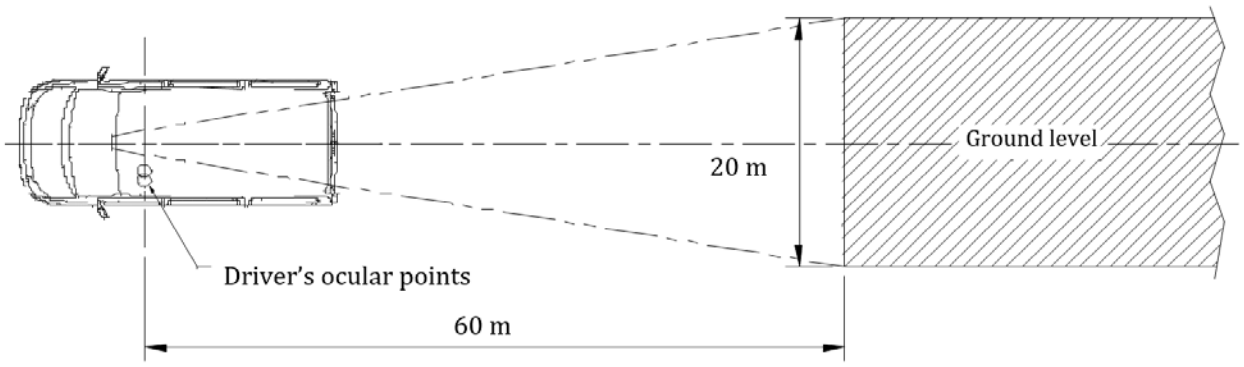


Figure L.1 — LHD Class I Mirror

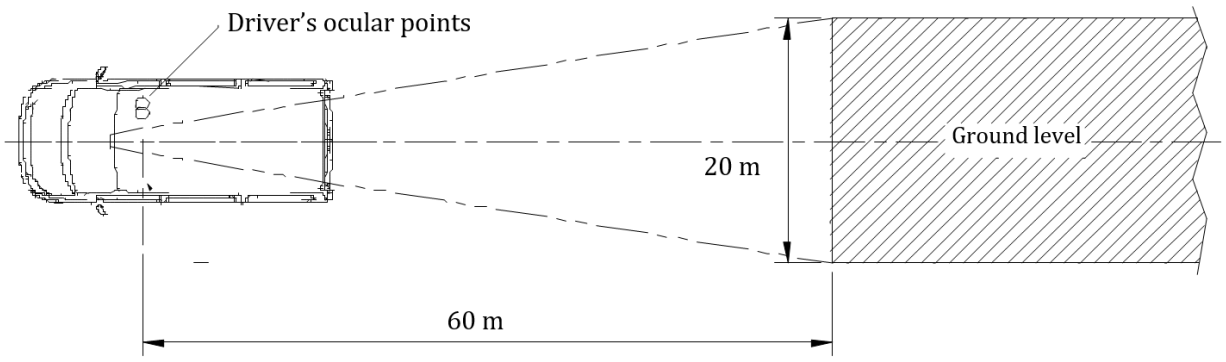


Figure L.2 — RHD Class I Mirror

Class II Exterior mirrors

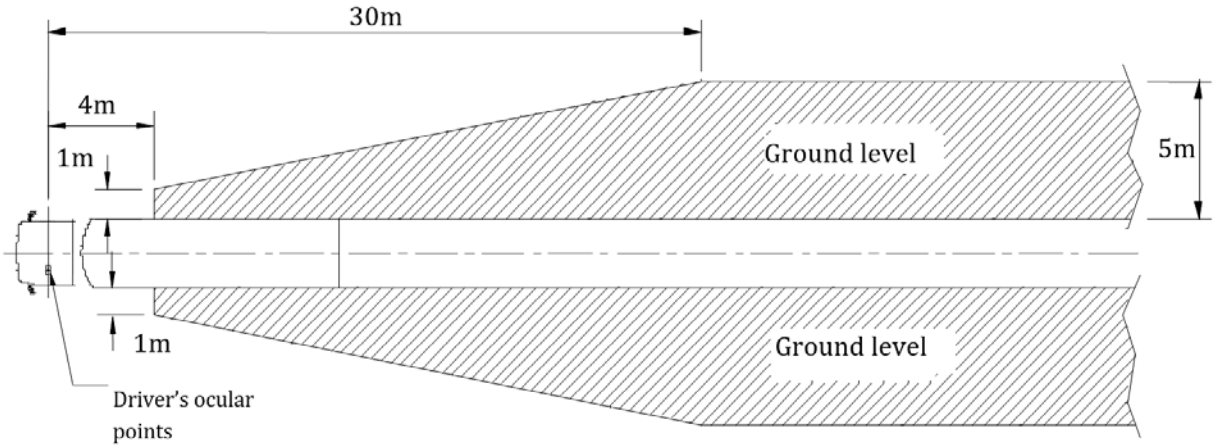


Figure L.3 — LHD Class II Exterior Mirrors

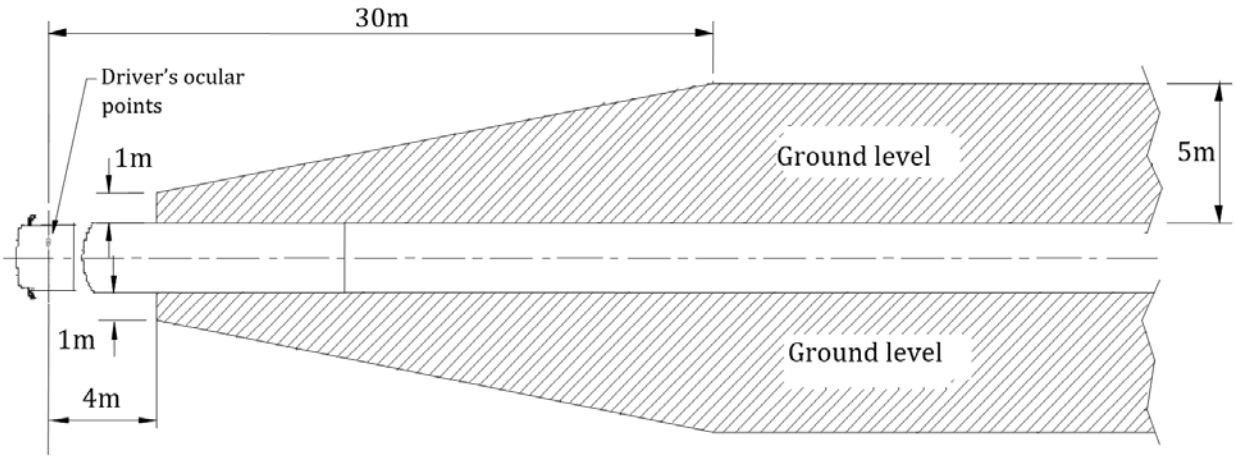


Figure L.4 — RHD Class II Exterior Mirrors

Class III Mirrors

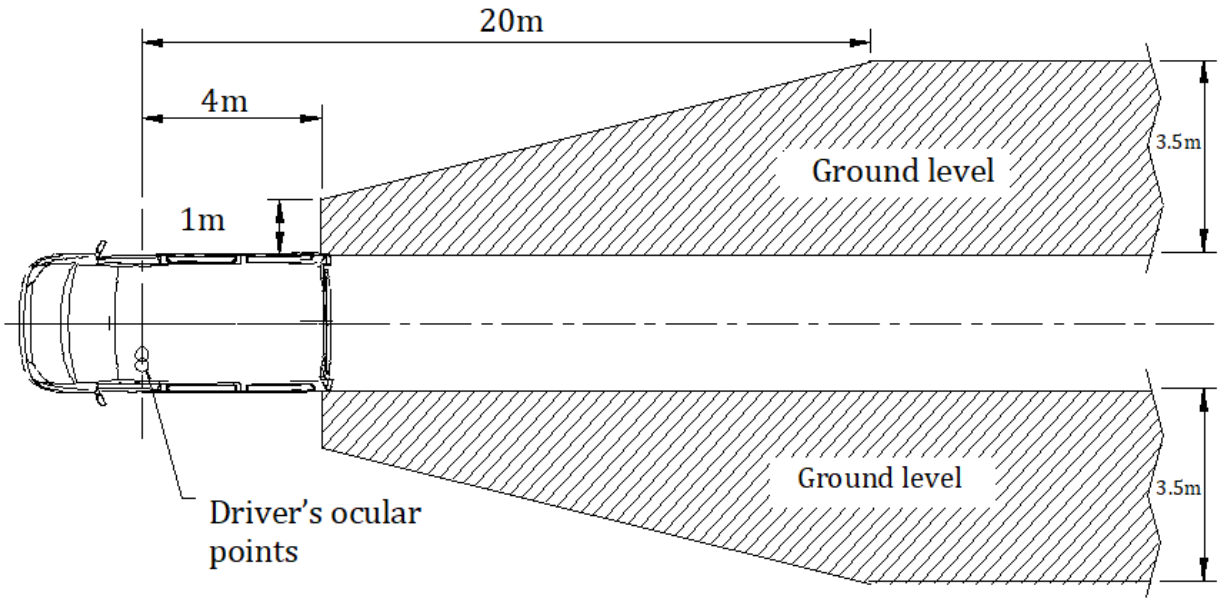


Figure L.5 — LHD Class III Mirrors

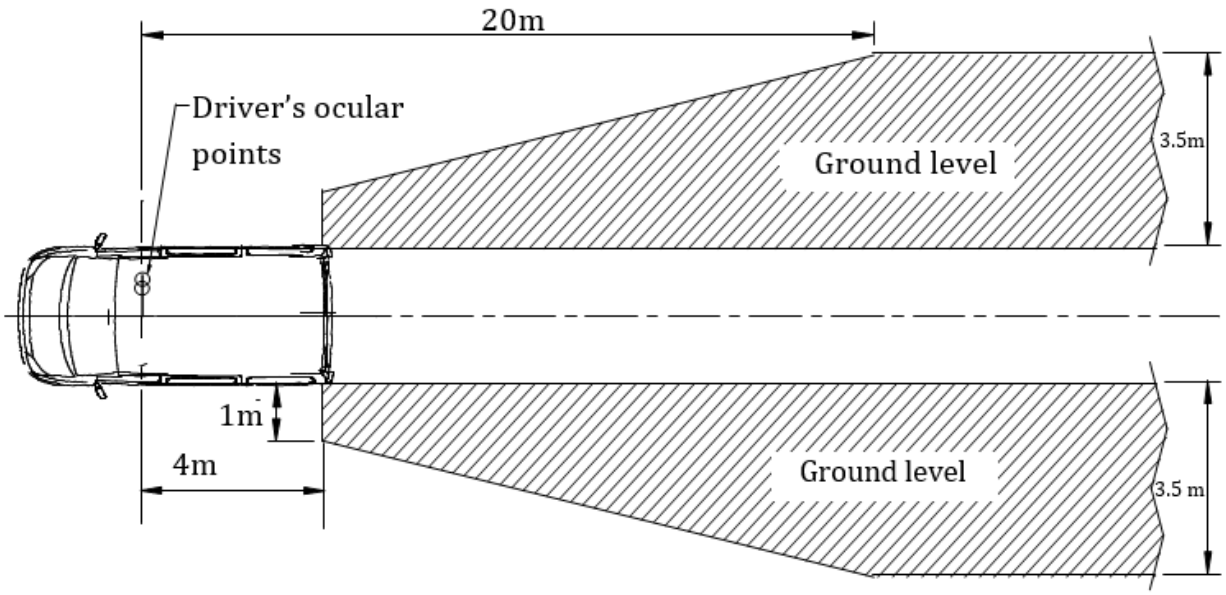


Figure L.6 — RHD Class III Mirrors

Class IV Mirrors – Wide angle mirrors

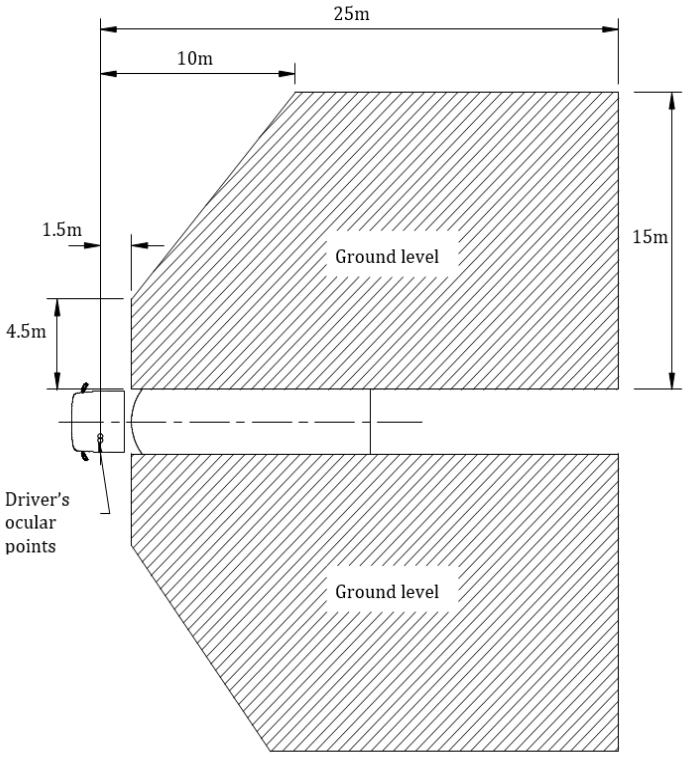


Figure L.7 — LHD Class IV Mirrors

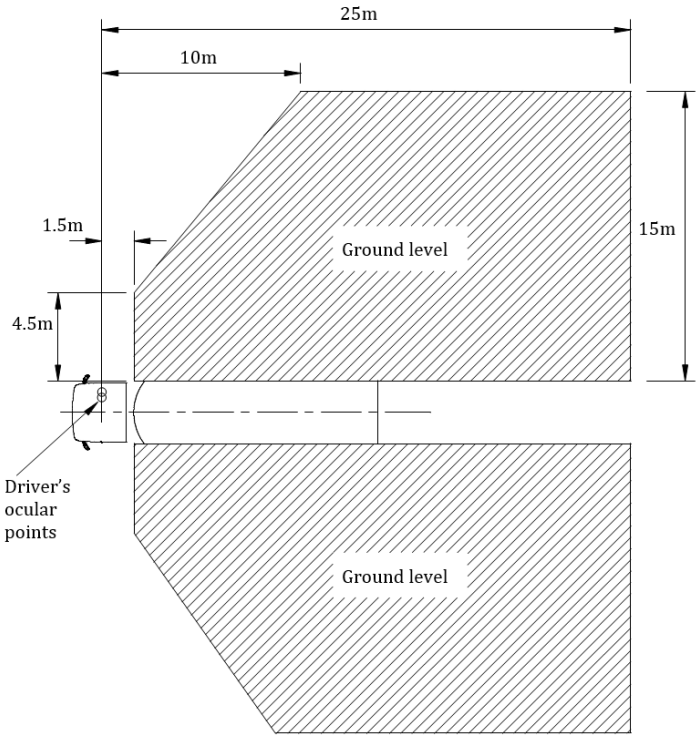


Figure L.8 — RHD Class IV Mirrors

Class V Mirrors – Close proximity mirrors - image 1

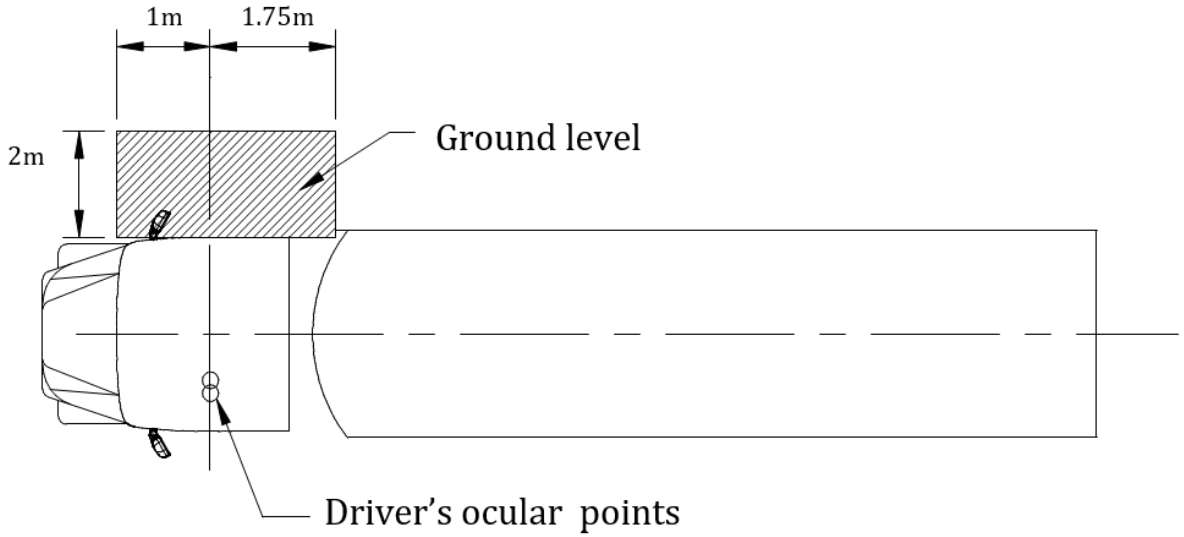


Figure L.9 — LHD Class V Mirrors

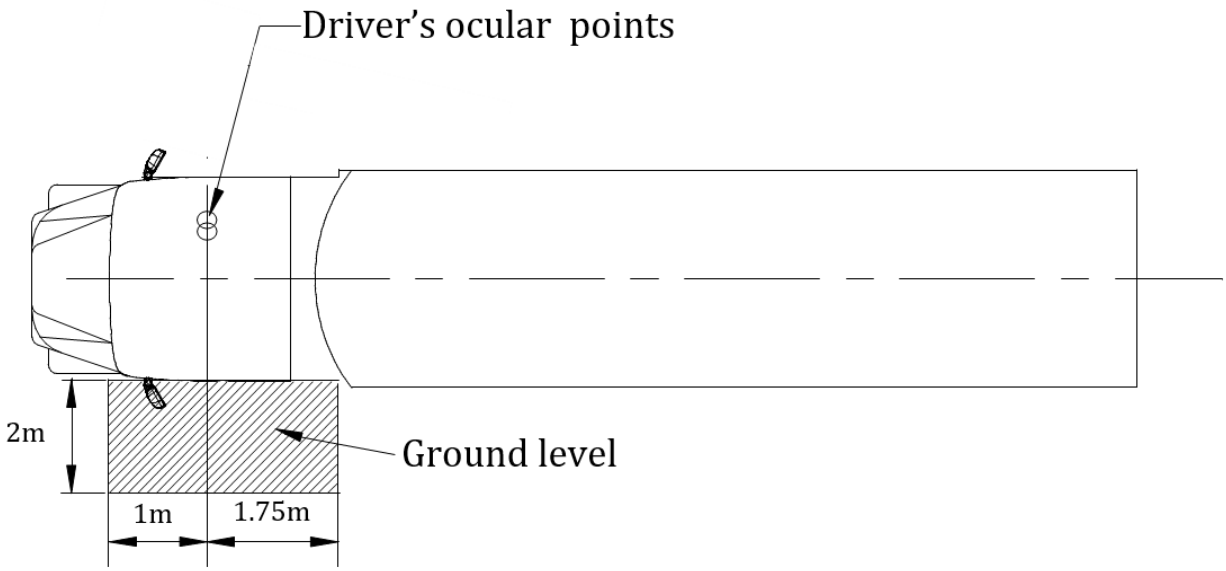


Figure L.10 — RHD Class V Mirrors

Class V Mirrors – Close proximity mirrors - image 2

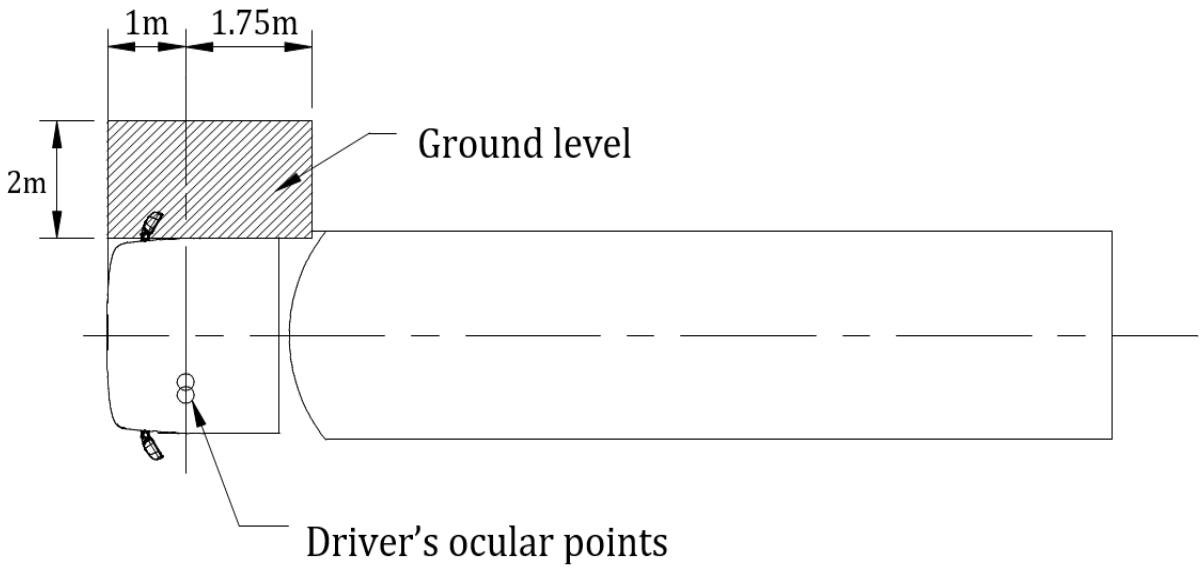


Figure L.11 — LHD Class V Mirrors

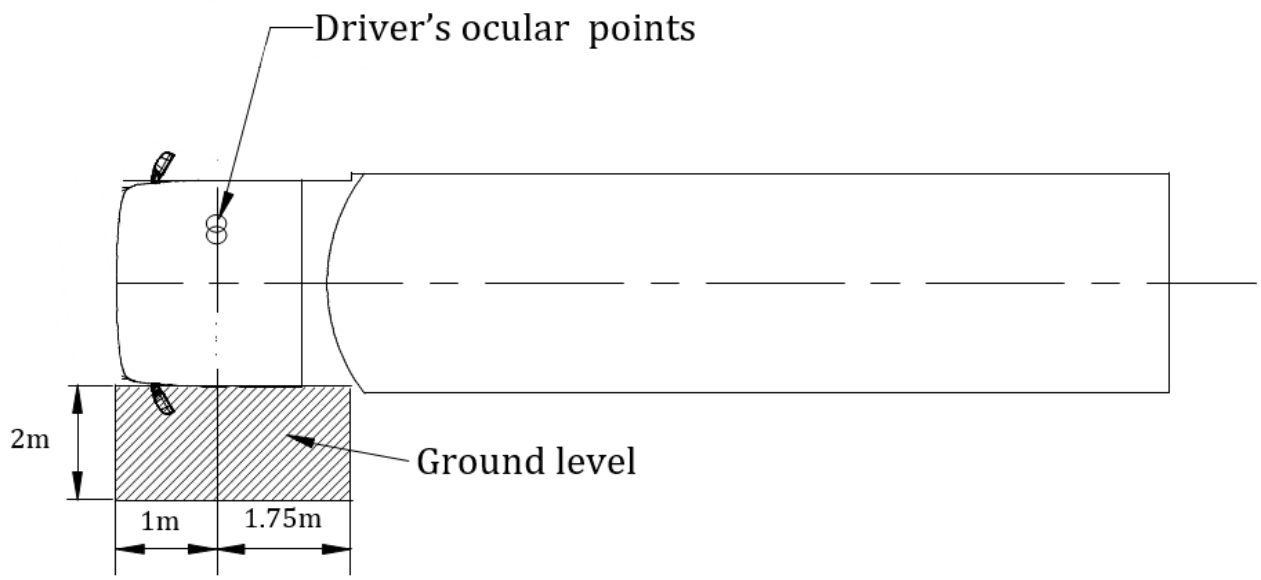


Figure L.12 — RHD Class V Mirrors

Class VI Mirrors – Front mirrors

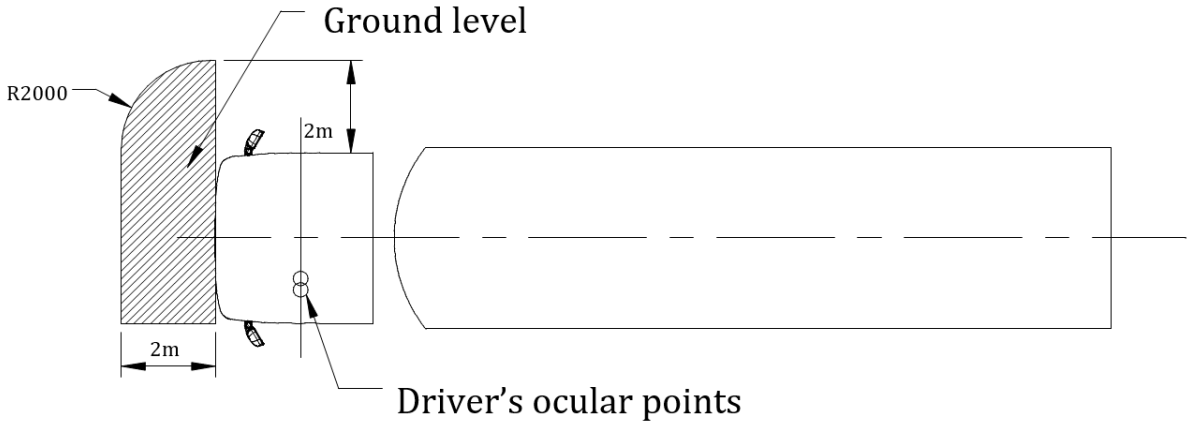


Figure L.13 — LHD Class VI Mirrors

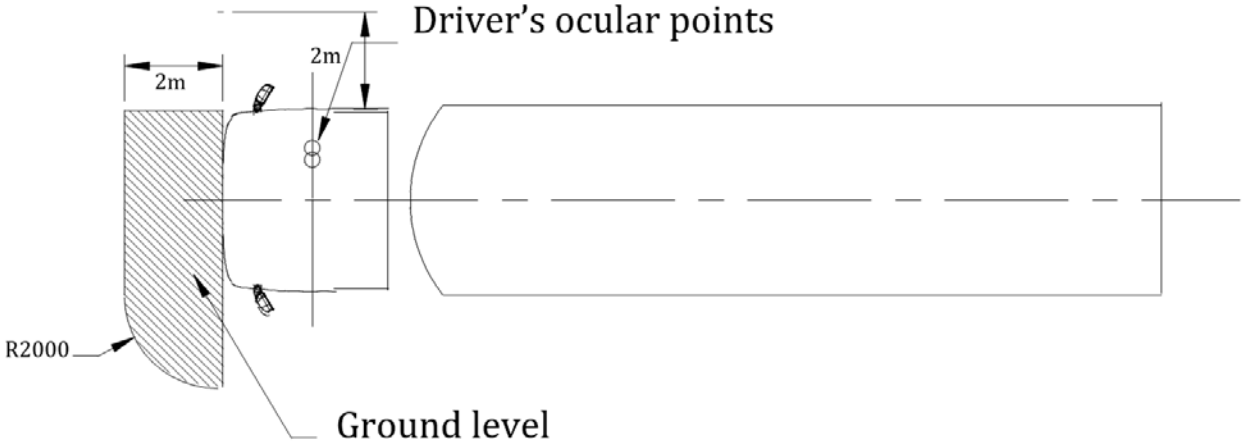


Figure L.14 — RHD Class VI Mirrors

Annex M
(informative)

Access to the UK MoT testing guide for test stations

This guide is accessible via https://www.gov.uk/government/publications/mot-testing-guide and provides a wealth of information on a multitude of aspects of setting up and operating a light vehicle testing station.

This guide sets out the rules you have to follow to run an MOT test station. It includes what you need to know about:

- how to become an MOT authorised examiner (a sole trader, partnership or limited company authorised to run an MOT test station)
- the facilities, equipment and security you need
- eligibility to be an MOT tester, qualifications, and training and assessments
- appeals and complaints from vehicle owners
- documents, including forms, certificates and manuals
- disciplinary action that can be taken against you if you do not meet the standards
- clearing prohibitions from unsafe vehicles
- accounts and fees
- MOT testing service rules and user roles
- the process to follow when the MOT testing service is unavailable

Annex N
(informative)

Approval of testing equipment

Further extremely useful UK website is https://www.gov.uk/become-an-mot-station/approved-testing-equipment which enables interested parties to establish which makes and types of testing equipment have been approved by the UK Authorities. For example the 15 approved makes of brake roller testers valid as at 01 June 2018 can be viewed at https://www.gea.co.uk/document-category/dvsa-acceptable-equipment/ then click on "List-ATF-Roller Brake Tester" and download the .pdf file.

NOTE ATF means acceptable for use in HGV/PSV Authorised Testing Facilities, whereas MoT test information generally relates to light vehicles.

Equipment and premises
You need to make sure that your equipment and premises are suitable for the vehicle classes you plan to test.

Equipment
- computer, laptop or tablet with internet connection
- printer

Approved testing equipment
Different classes of vehicle need different specialist test equipment. You must make sure you have at least the minimum level for each vehicle class you're approved to test. All equipment must be kept in good working order and calibrated properly. You'll need to use approved equipment for:
- brake pedal application devices
- decelerometers
- diesel smoke meters
- exhaust gas analysers (catalyst vehicles)
- exhaust gas analysers (non-catalyst vehicles)
- headlamp aim testers
- plate brake testers
- roller brake testers
- tow bar socket testers
- tyre tread depth gauges
- wheel play detectors

There are 3 categories of decelerometers:
- category A are approved for all classes of vehicle
- category B are approved for class 3, 4, 5 and 7 vehicles
- category C are approved for class 1 and 2 vehicles

Premises
You need to make sure your premises are suitable and testing bay sizes are correct for the vehicle classes you'll be testing. You can find the minimum standards in the MOT testing guide.

Approval in principle
Your premises will be given an approval in principle when you apply for authorised examiner (AE) status. This will help you avoid committing to expensive work or alterations before your premises are approved.

If you've already got AE status and want to make changes to the test facilities, write to the Driver and Vehicle Standards Agency (DVSA) before you make any changes. Include supporting drawings, to show that the changes will not affect the testing station's approval.

Annex P
(informative)

Screen method for assessment of dipped beam

In cases where headlamp beam testing equipment is not available the following method may be of assistance until such time as the compulsory automatic recording type of the beam tester results machine becomes available for Certificate of Fitness testing.

The criteria is that the dipped beam must slant downwards. If the dipped beam is level or slanting upwards it will dazzle oncoming traffic. If the dipped beam is slanting downwards too much then the driver will see very little of the road ahead when he dips his headlamps.

The downwards slant on some vehicles is adjusted automatically to compensate for whether it is loaded or not. On some vehicles this can be adjusted by the driver using a control inside the vehicle. On older vehicles the adjustment is possible only by opening the bonnet and adjusting the dipped beam headlight. The desired slant depends upon the height of the cars lights above the ground and is recommended by the vehicle manufacturer.

The above variations can mean that the beam may be slanting downwards anything from 1% to 4% when properly and acceptably set up and presented for test.

So the important issue is that the dipped beam must slant slightly downwards and never upwards.

A slant of 2 to 4% is generally acceptable. This means that for every 1m distance from the light surface on the vehicle the light should appear to drop to be 20 to 40 mm lower.

So over a distance of 5m the “drop” should be 100 to 200mm lower.

1) Select a reasonably flat piece of ground which will enable a vehicle to be positioned facing a flat vertical screen or a suitable wall.

2) Position the vehicle to be tested so that the lenses of its dipped beam lights are 5m from the vertical white screen or suitable wall.

3) Note the height of the centre of the dipped beam headlight on the vehicle.

4) Note the height where the “cut-off” of the dipped beam headlight strikes the white screen or the wall.

5) The “drop” should be approximately 100 to 200mm.

Annex Q
(informative)

Cross references to the UK DVSA: Heavy goods vehicle inspection manual

The clauses in ARS 1355-1 of the Vehicle Roadworthiness Standard are the norms to be applied but further extensive information is available in overseas publications such as the UK DVSA and the UK MoT publications and no doubt similar helpful information will be available in other languages from other countries.

The detail in the UK DVSA Heavy Goods Inspection Manual[1] is extensive and is directly related to legislation applicable to vehicles in the UK. It may not be applicable to roadworthiness requirements for vehicles operating in Africa but is cross referenced below since it may be of some general assistance to vehicle examiners.

	Clause in ARS 1355-1 of Vehicle Roadworthiness Standard	Section in UK DVSA Heavy Goods Vehicle Inspection Manual*
Brake pedal	6.3.1	37
Brake lever	6.3.2	36
Hand control valves	6.3.3	39
Vacuum assisted	6.3.4	38
Air or vacuum pumped	6.3.5	34
Trailer brakes	6.3.7	12
ABS, EBS, ESC	6.3.8	38
Braking components	6.3.9	59
Braking performance	6.4	71, 72, 73
Lighting, signalling, reflectives	6.5	62, 63, 66, 67
Driver's view, glass, mirrors	6.6	22, 23, 25
Steering & driving controls	6.8	28, 30, 54
Tyres – Size and type	6.9	7
Tyres - Condition	6.10	8
Road wheels	6.11	6
Suspension	6.12	48
Condition of chassis	6.14	41
Bodywork & equipment	6.15	15,16,17,19,20
Couplings	6.17	11
Safety belts	6.18	03
Speedometer	6.21	26
Hooter	6.22	27
Liquid leakage	6.23	44 ,45
Electrical wiring	6.24	42

[1] Can be downloaded from https://www.gov.uk/government/publications/mot-testing-guide

Annex R
(informative)

Examples of typical compliance to regulations and standards

R.1 Typical braking equipment complying with UN ECE Regulation 13

A very fundamental requirement of ECE R13 is to have two brake circuits. So a good place to start is at the footbrake valve where for an air brake system there must be two separate circuits which means there must be two inlet ports and two outlet ports on the footbrake valve as can be seen on the photograph below.

To check for ABS on a heavy truck one may be able to see the sensors at the wheels which signal whether the wheels are locking up or not. If not the wiring to the sensors may be visible and if all else fails, there must be warning lights on the dashboard when the truck is started.

The specialist valves for ABS may be more difficult to see if there is a body on the truck.

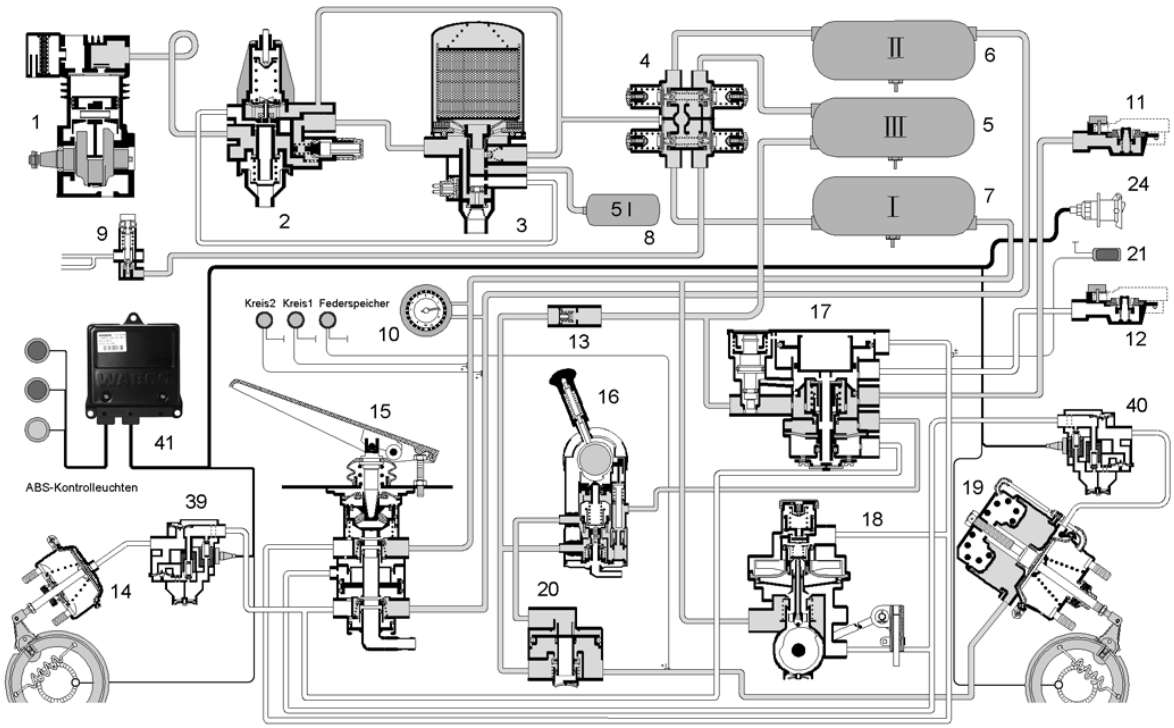
Checking for the presence of ABS on a light vehicle to UN ECE R13H such as a passenger car is much easier since one can usually see the gallery of brake pipes when one opens the bonnet.

The schematic below shows a typical layout of an air brake system fitted to a truck with couplings to tow a trailer or semitrailer.

It may vary from different makes or models, but the basic principle remains. Note that not all trucks are equipped with a load sensing valve (18) and instead regulate the brake force distribution solely by electronic means through the ABS or EBS or other advanced electronics (41).

One may also find additional reservoirs if the truck is equipped with air suspension or other air consuming equipment.

What does ABS do? Many believe that it reduces stopping distance but in fact its main function is to ensure directional stability during heavy braking. It controls the road wheels to ensure optimum slip and so prevents the wheels from locking and thus ensures effective steer ability at all times.



Visual inspection

A visual check does by not by any means replace a full inspection, but it can give a good idea whether all essential components required for a full compliance with the UN ECE R13 Regulation are present.

In the Cab

Foot brake valve (15)

It can be in many different shapes and sizes, but the importance is that the valve is of dual circuit, i.e. two inlet ports and two outlet ports to individually brake the circuits. Brake valves for EBS also have an additional control module fitted to the body of the valve.

It may have electric connections for the integrated control of a retarder, if such is fitted.

Parking brake valve (16)

Fitted in dashboard or near driver's seat.

It can also have many different shapes and configurations.

If the vehicle is equipped with couplings to tow a trailer then check whether the valve has a "test" feature when in the park position, which allows the lever to lift over a barrier to release momentarily the trailer brakes. This is to check if the vehicle combination can be held stationary with the truck parking brakes only.

Trailer Brake (Stretch brake)

Fitted against steering column or near driver's seat

This type of trailer brake operation is illegal in some countries and may not be fitted to the truck. The reason is that the driver can "over-use" the trailer brakes instead of using all the brakes on the combination.

Warnings and Gauges (10)

Air pressure gauge(s) and optical/audible warning for supply pressure and parking brake.

On the chassis

Air reservoirs (5, 6, 7)

Normally fitted on the left-hand side of chassis near or below the battery box.

At least one reservoir for each service circuit and parking brake.

More reservoirs may be fitted if vehicle has air suspension.

Drain valves

Fitted to the bottom of each air reservoir.

Drain valves on every reservoir for manual or automatic drainage of water or oil.

Multi-circuit protection valve (4)

Fitted near the air reservoirs on the outside of the chassis.

A minimum of 3 circuits must be protected, both service circuits and the spring parking brake. Most common is 4-circuit protection, but modern trucks may also have 6-circuit protection.

Trailer brake control valve

Fitted near the reservoirs on the inside of the chassis

The exact configuration with number of connections may vary between ABS and EBS controlled vehicles.

On the axles or below the chassis

Brake chambers

Most common on front axle brakes, situated outside the chassis and rigidly mounted to the wheel carrier.

Identical sizes on both left and right side of the axle.

Spring brake chambers

On all rear wheel brakes. Commonly mounted on top of the axle housing within the truck chassis.

Sizes must be identical on both left and right hand side of the chassis.

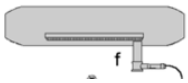
Sizes may differ between 1st and 2nd rear axle if the vehicle does not have a “balanced” suspension.

Slack adjusters

Slack adjusters fitted to the end of the shaft rotating the S-cam in the drum brakes. Must be of the automatic type.

Slack adjusters must be freely operable by hand if all the brakes of the vehicle are released.

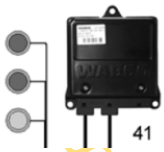
Wheel sensors



Wheel sensors to detect the speed of each wheel must be provided on each wheel of the front axle and at least on each wheel on one of the rear axles.

ABS specific modules

ABS Control module (41)



Normally fitted against firewall behind radiator grille or in the footwell on the passenger side.

Modulating brake pressure signals from brake pedal and wheel sensors.

Automatic load sensing valve

Fitted within the chassis above the rear axle(s).

On steel suspensions the valve is connected with a flexible lever system to the axle body, or to a connecting bar linking both axles.

On air suspensions the valve is pneumatically connected to the air bellows of the axle suspension.

ABS Relay valve

Fitted within the chassis above the rear axle(s).

This relay valve may be in place of the automatic load sensing valve on vehicles which do not have the automatic load sensing valve installed.

ABS Relay solenoid valve

Fitted to the outer chassis above the front axle.

Modulating the brake pressure to the front axle brake chambers.

EBS specific modules

EBS Control module

Normally fitted against firewall behind radiator grille or in the footwell on the passenger side.

Modulating brake pressure signals from brake pedal and wheel sensors

EBS Control Valve

Fitted above rear axle(s) in chassis

Electrically controlling modulated brake pressure to rear axle(s).

Proportional Relay Valve

Fitted above front axle in chassis.

Electrically controlling modulated brake pressure to front axle.

Axle modulator

Fitted on each side of the chassis frame near the rear axle.

Modulating the brake pressure to each side of the rear axle(s).

Note that the UN recently separated out the ESC and the BAS requirements from R13H and re-introduced them into ECE R139 (BAS) and ECE R140 (ESC).

BAS is the “brake assist system” which senses the driver is trying to apply the brakes quickly and assists in doing this quickly.

ESC is “electronic stability control” which senses the direction the driver wishes to direct the vehicle during perhaps a skidding manoeuvre and assists in achieving this direction by applying a single wheel brake to counter oversteer or understeer[2]. It is also called ESP, electronic stability program.

R.2 Typical lighting equipment complying with UN ECE Regulation 48

The latest lighting equipment includes LEDs, adaptive front lighting systems, cornering lamps, gas discharge lights and so on with all these being optional equipment. Note that for a period Japan were not supportive of daytime running lamps to be used in Japan, but we believe that they now support their fitment and use.

Mandatory lighting equipment and its switching, position and number is listed clearly in UN ECE R48. There are minor differences between these details and the designs of other countries but most are converging onto the requirements of the UN Regulation. Vehicles from the USA may still have significant differences.

Note a new development which is to allow brake lights to flash at a frequency which increases according to the pressure being applied to the brake pedal.

R.3 Contour marking retro-reflective tape to UN ECE Regulation 104 and Chevrons to UN ECE Regulation 69 or 70

This tape is also used simply to show up the sides and rear of vehicles. The term retro-reflective means that the reflected light will come back almost directly to the driver whose lights lit up the retro-reflective tape. This is unlike many reflective materials which do not necessarily direct the light back to where it came from. The yellow tape which complies with Regulation 104 is E-marked and marked with the letter “C” as is the case of 2 samples shown below.

It is believed that the use of this material and of retro-reflective chevrons is particularly beneficial in countries where operators may use vehicles at night with defective lights.

[2] Videos explaining ESC
https://www.youtube.com/watch?v=k8h3Kv7fU1A
https://www.bosch-mobility-solutions.com/en/products-and-services/passenger-cars-and-light-commercial-vehicles/driving-safety-systems/electronic-stability-program/
https://m.drive.com.au/news/safety-explained-what-is-abs-and-esc--120919

R.4 Safety glass to UN ECE Regulation 43

Note that 2 types of glass are covered by Regulation 43 being:

a) high penetration resistant (HPR) laminated safety glass for windscreens, and

b) toughened/ tempered glass for side windows.

Apart from offering the driver protection against the windscreen shattering into sharp shards of glass, the HPR laminated windscreen serves an additional function of retaining the driver and front seat passenger within the vehicle in the case of a substantial accident.

It is important therefore that the windscreen shows the two parallel lines signifying laminated glass.

R.5 Tyres to UN ECE Regulations 30 and 54

Regulation 30 applies to passenger tyres – generally speaking to passenger cars whereas Regulation 54 applies to commercial tyres – designed for trucks and buses.

Minibuses with 10 to 16 seats are at the “crossover point” between these two regulations and this caused many safety problems because the passenger car tyres which fitted the Minibuses were much cheaper than the commercial tyres which were tougher and which were intended to be fitted to the Minibuses because of the loads, especially at the rear axle, which Minibuses carry. This was compounded by the fact that whitewall tyres looked more attractive but were originally available only for passenger car rated capacities.

Repairs to sidewalls are not recommended and sidewall failure can have catastrophic results. All the tyres on this vehicle were considered unroadworthy.

R.6 Safety belts to UN ECE Regulation 16

The current requirements is for all outboard seats to be of the inertia type. On passenger cars and pick-ups this means that the centre seatbelt is likely to be of the static type.

It is important to know that the dynamic test to which safety belt designs are subjected to is severe. It involves a 70kg dummy being strapped into a safety belt on a seat on a sled and the sled is accelerated to 50km/h and then impacted against a buffering mechanism such that the sled is stopped in a distance of approximately 350mm.

This stopping distance of 350mm and the deceleration involved amounts to a “cushioned” gradual survivable stop compared with a stopping distance of say 100mm.

The buffer mechanism that stops the sled is designed to give a deceleration trace that must lie between the lines A, B, C, D, E, F and G, H, I as shown below for the test to be accepted.

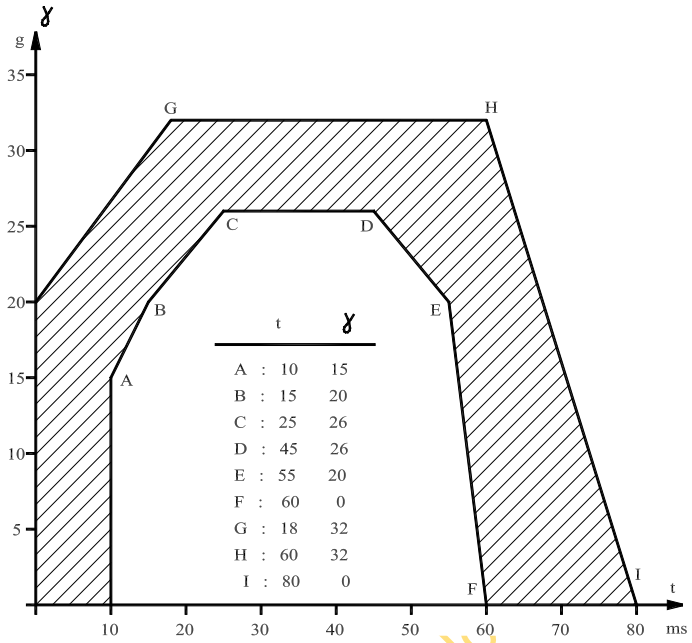
This corresponds to an average deceleration of approximately 25g or 25 x 10m/s^2 or 250m/s^2

The duration is approximately 2/10th of a second (0.2 seconds) being the time interval between trying to clap one’s hand as quickly as possible.

The 350mm corresponds roughly to the amount by which the front end of a car will “crush” if the car hits a solid concrete wall at 50 km/h.

The load on the safety belt for the 0,2 seconds is very approximately 25 times the mass of the dummy is 25 x 70kg = 1,75 tons which explains why many occupants of safety belts suffer severe bruising or even fracture of their ribs.

It is important for an examiner to develop a feel for the forces involved in crashes such that the examiner develops an awareness of the need for components and vehicle structures to be of adequate strength. This case for safety belts is significant and can be carried through to seatbelt anchorage strength, to seat strength, to rear underrun strength and so on.



R.7 Rear Underrun to UN ECE Regulation 58

The object of having a “rear underrun” is exactly to prevent a car or pick-up running under the rear end of a truck in an accident and for the rear underrun “bumper” to act as the “solid concrete wall” in the above example so that the “crush zone” of the impacting car is utilised in slowing down the car and enabling the occupants to survive.

The alternative in most cases without the rear underrun would be for the car to ride under the rear end of the truck and to shear the roof off the car and to decapitate the occupants.

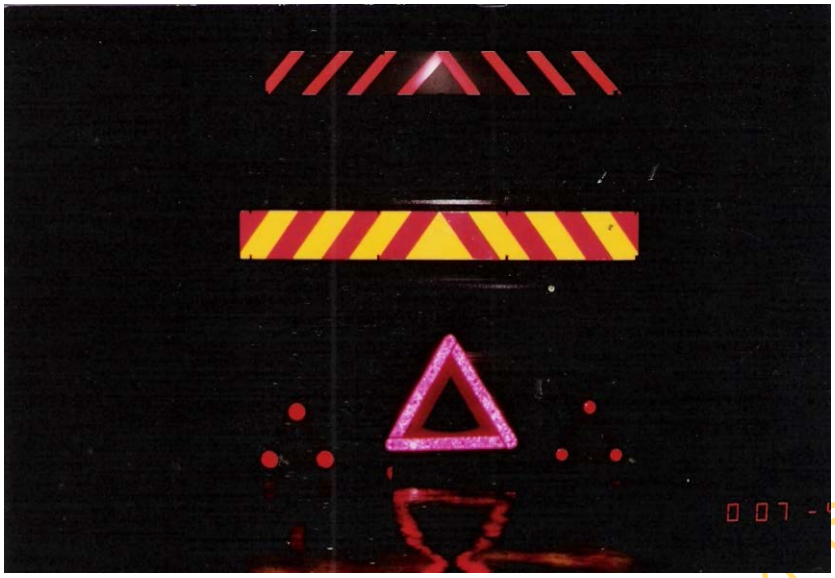
It is important for an examiner to develop a feel for the forces involved in crashes such that the examiner develops an awareness of the need for components and vehicle structures to be of adequate strength.

R.8 Warning Triangle to UN ECE Regulation 27

Note that the correct title is “Advance Warning Triangle” and it is designed to be placed approximately 45 meters behind the vehicle to provide advance warning of its presence. It does not achieve much advance warning if it is placed only a few metres behind the broken-down vehicle.

It is also important that at night the owners of the broken down vehicle should spend as little time as possible behind the vehicle, taking items out of the boot or whatever, because they block out the lights and the vehicle reflectors whilst they are standing behind the car or retrieving items from the boot.

Note also that the retro-reflective performance of the triangle complying with Regulation 27 is vastly improved compared with that of the older double-sided triangle with 3 bicycle reflectors on each side as below and it is more readily recognizable.



R.9 Frontal Collision to UN ECE Regulation 94

Applies only to category M1 vehicles of total permissible mass not exceeding 2 500kg although other vehicles may be approved at the request of the manufacturer.

The test speed is 56km/h using dummies to assess the injuries and the vehicle under test is directed into a deformable “honeycomb” barrier fixed to a concrete block.

R.10 Side Impact (Lateral Collision) to UN ECE Regulation 95

Applies to both category M1 and N1 where the “R” point of the lowest seat is not more than 700mm from ground level. (Roughly speaking the “R” point is close to where the upper leg joins the torso.)

A mobile deformable barrier is impacted into the vehicle under test at a speed of 50km/h using side-impact-dummies.

R.11 Tilt Angle to UN ECE Regulation 107

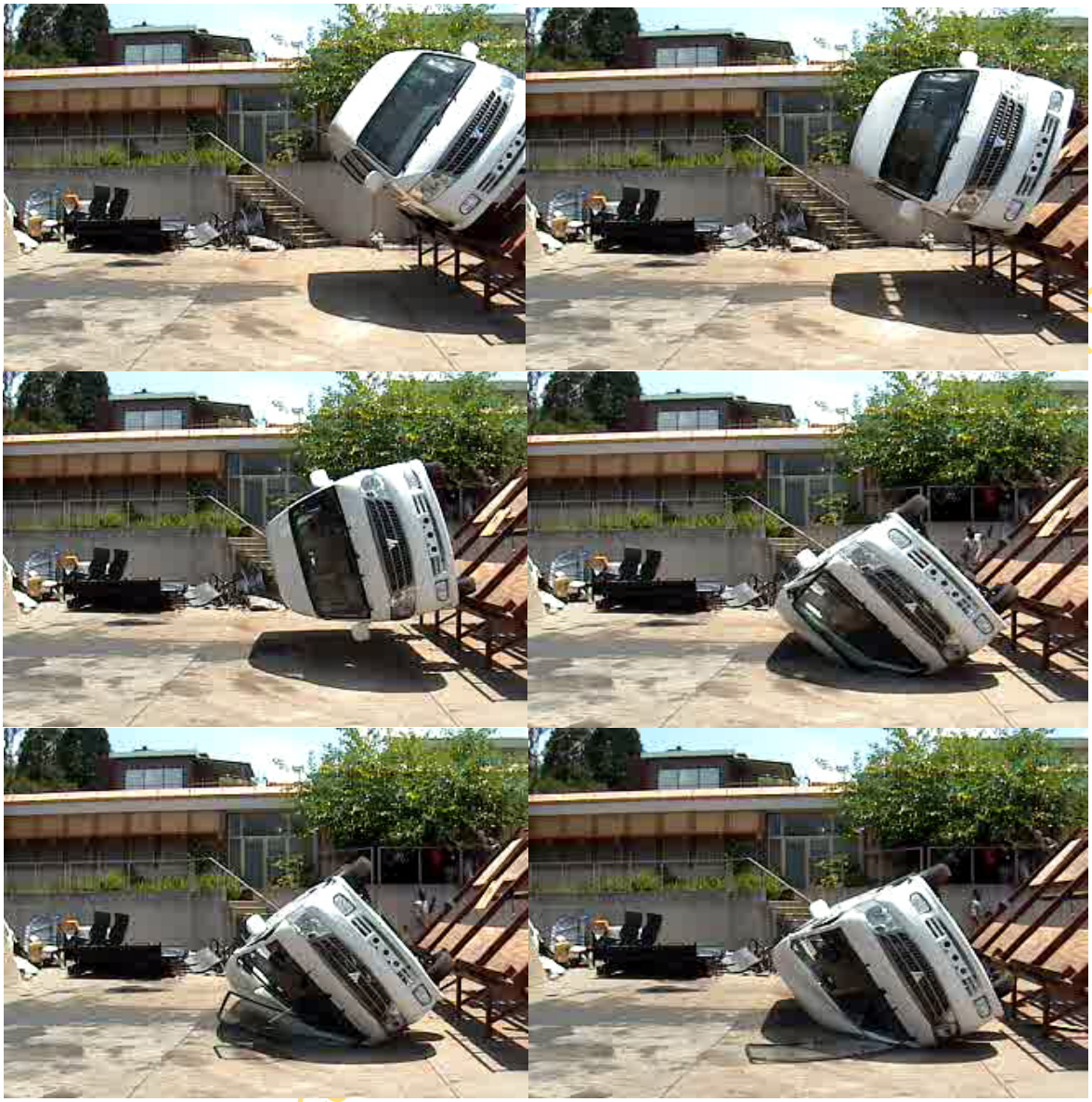
Applies to both category M2 and M3 vehicles (Buses). It is referred to as a stability test. The bus is loaded with 68 < 75kg per seating position, also whether standees are accounted for at 50% of the normal passenger load - depending on the edition of the R107. In the case of double deck buses the loading is done only on the upper deck. The bus is placed on a platform which is tilted to an angle of 28 degrees. As one can see from the picture below this is not a new idea nor a new requirement.

R.12 Strength of Superstructure – Rollover protection- UN ECE Regulation 66

Applies to both category M2 and M3 vehicles (Buses). The bus is not loaded and is fitted with internal polystyrene “gauges” which if damaged will show whether the occupant zones are intruded by any deformation of the bus body or structure as it is tipped over to fall and simulate an accident.

Before designing to R66 the superstructure of a bus was almost an “add-on” and could collapse in an accident.

After R66 the structure involved “hoops” at front and rear and at other parts along the bus body and this strengthened the whole structure and protected the occupants to some extent.



Bibliography

SADC HT 105-3:2019, *SADC Harmonized Text — Vehicle Standards — Specification for Vehicle Roadworthiness — Part 3: Supporting Information*

CIE 54: *Retroreflection: Definition and measurement*

FMVSS 115: *Federal VIN Requirements (Title 49, Chapter V, Part 565)*

ISO 3779, *Road vehicles — Vehicle identification number (VIN) — Content and structure*

ISO 3780: *Road vehicles – World manufacturer identifier (WMI) code*

ISO 4030, *Road vehicles — Vehicle identification number (VIN) — Location and attachment*

ISO/IEC 17025: *General requirements for the competence of testing and calibration laboratories*

SANS 1329-4: *Retro-reflective and fluorescent warning signs for road vehicles. Part 4: Retro-reflective chevron signs*

UK MoT Heavy Goods Vehicle Inspection Manual, Consolidated Edition, DVSA 2013, https://www.gov.uk/government/publications/mot-testing-guide

UK MoT Testing Guide (6th Edition), DVSA February 2018, www.gov.uk/topic/mot/manuals

UK MoT Testing Guide for Test Stations, DVSA 18 June 2018, MOT testing guide

UK MoT Vehicle Inspection Manual, DVSA, www.gov.uk/topic/mot/manuals

UK MoT Set up a test station, DVSA, www.gov.uk/topic/mot/manuals

