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Electric road vehicles — Road operating characteristics

Véhicules routiers électriques — Caractéristiques routières

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International 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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8715 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 21, *Electric road vehicles*.

Annex A forms a normative part of this International Standard.

Electric road vehicles — Road operating characteristics

1 Scope

This International Standard specifies the procedures for measuring the road performance of purely electrically propelled passenger cars and commercial vehicles of a maximum authorized total mass of 3 500 kg[1].

The road performance comprises road operating characteristics such as speed, acceleration and hill climbing ability.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes*

ISO 8714:—[2], *Electric road vehicles — Reference energy consumption and range — Test procedures for passenger cars and light commercial vehicles*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
complete vehicle kerb mass
mass of the vehicle including batteries, without occupants but with fuel, cooling liquid, window washer fluid, lubricating oil, tools and spare wheel, on-board charger, portable charger or part of it, if provided as standard equipment by the vehicle manufacturer

Code: ISO-M06 (see ISO 1176)

3.2
maximum design total mass
maximum vehicle mass as specified by the vehicle manufacturer

Code: ISO-M07 (see ISO 1176)

1) These vehicles comply with the vehicle categories M1 and N1 according to the Consolidated Resolution on the Construction of Vehicles (R.E.3) of UN/ECE, and according to 70/156/ EEC, and with three and four wheel motor vehicles as defined in the Directives 92/53/EEC and 92/62/EEC.

2) To be published.

3.3
test mass
sum of the complete vehicle kerb mass plus

— the maximum authorized pay mass (including driver) if it is equal or less than 180 kg;

— 180 kg, if the maximum authorized pay mass exceeds 180 kg but is less than or equal to 360 kg;

— half of the maximum authorized pay mass if this pay mass exceeds 360 kg

3.4
dynamic loaded radius (tyre)
effective radius of a tyre when it is deformed by the mass of the vehicle loaded to its test mass

3.5
maximum speed
highest average speed which the vehicle can maintain twice over a distance of 1 km

NOTE For the relevant test procedure, see 9.3.

3.6
maximum thirty minutes speed
v_{30}
highest average speed which the vehicle can maintain over 30 min

NOTE For the relevant test procedure, see 9.1.

3.7
acceleration ability (v_1 to v_2)
shortest time required to accelerate the vehicle from speed v_1 to speed v_2

NOTE For the relevant test procedures, see 9.5 and 9.6.

3.8
speed uphill
highest average speed which the vehicle can maintain on a given slope over a distance of 1 km

NOTE For the relevant test procedure, see 9.7.

3.9
hill starting ability
maximum slope on which the vehicle can start moving over a minimum distance of 10 m

NOTE For the relevant test procedure, see 9.8.

4 Principle

All road operating characteristics (3.5 to 3.9) shall be tested in the test sequence according to clause 8 with the charged states of the battery for each test resulting from the previous procedure.

However, if any test is conducted individually, start the test procedure for maximum speeds (9.1 and 9.3) with a battery state between 100 % and 90 % of fully charged. For acceleration (9.5 and 9.6), speed uphill (9.7) and hill starting ability (9.8), the test procedure shall be started with a battery state between 60 % and 50 % of fully charged.

5 Parameters, units and accuracy of measurements

Table 1 specifies parameters and their units, accuracy and resolution.

Table 1 — Parameters, units and accuracy of measurements

Parameter	Unit	Accuracy	Resolution
Time	s	± 0,1 s	0,1 s
Length (off-board measurements)	m	± 0,1 %	1 m
Temperature	°C	± 1 °C	1 °C
Air pressure	kPa	± 1 kPa	1 kPa
Speed, constant	km/h	± 1 % or ± 0,1 km/h, whichever is greater	0,2 km/h
Mass	kg	± 0,5 %	1 kg

6 Test conditions

6.1 Vehicle conditions

The vehicle shall be loaded according to the specification for each test.

The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer when the tyres are at ambient temperature.

The viscosity of oils for the mechanical moving parts shall conform to the specification of the vehicle manufacturer.

The lighting, signalling and auxiliary devices shall be off, except those required for testing and usual day-time operation of the vehicle.

All energy storage systems available for other than traction purposes (electric, hydraulic, pneumatic, etc.) shall be charged up to their maximum level specified by the vehicle manufacturer.

The vehicle shall be clean, and the windows and air entries, not needed for the correct operation of the vehicle and the drive system, shall be closed by the normal operating controls.

If batteries are to be operated at temperatures above ambient temperature, the driver shall follow the procedure recommended by the vehicle manufacturer to keep the battery temperature within its operating range.

The vehicle shall be driven over at least 300 km seven days before the test(s) with those batteries that are installed in the test vehicle.

The traction battery shall be in the state of charge required for the test to be performed.

6.2 Atmospheric conditions

Outdoor test steps shall be performed at an ambient temperature between 5 °C and 32 °C. Indoor test steps shall be performed at a room temperature between 20 °C and 30 °C. The atmospheric pressure shall be between 91 kPa and 104 kPa. The average wind speed measured 0,7 m above the ground shall be less than 3 m/s, and the maximum speed of gusts shall be less than 5 m/s. The relative humidity shall be less than 95 %. The tests shall be performed in the absence of rain and fog.

6.3 Track conditions

6.3.1 General conditions

The measurements shall be taken on a dry track, which may be either a straight track (see 6.3.2) or a loop track (see 6.3.3). The surface of the track shall be hard, smooth, clean and give good adhesion.

6.3.2 Straight track

The length of the measuring zone shall be at least 1 000 m.

The length of the launching track shall be long enough to achieve a stable speed 200 m ahead of the measuring zone. The longitudinal slope on the measuring zone and on the last 200 m of the launching track shall not exceed 0,5 %. The longitudinal slope on the launching tracks shall not exceed 4 %.

The transverse slope in the measuring zone shall not exceed 3 %.

In order to reduce the influence of factors such as road slope and wind direction/speed, the acceleration and the speed tests shall be executed in both directions of the test track in direct sequence, taking care to use the same stretch of the track.

When conditions preclude performing the test in both directions, a single direction test shall be carried out as in 6.3.4.

6.3.3 Loop track

The length of the loop track shall be not less than 1 000 m. For calculating the speeds, the length of run shall be the distance actually covered by the vehicle while it is being timed.

The loop track may vary from a perfect circle to straight sections linked by approximately circular sections. The radius of the curves shall be not less than 200 m.

The longitudinal slope in the measuring zone shall not exceed 0,5 %. The effects of centrifugal forces may be compensated by the transverse profile of the curves in such a way that the vehicle holds a normal line without any action on the steering wheel.

6.3.4 Single direction test

Testing in one direction only shall be permitted if, because of the characteristics of the test track layout, it is not possible for the vehicle to reach its maximum speed in both directions.

The following conditions shall be fulfilled:

— the track shall conform to the requirements of 6.3.2;

— the variation in altitude shall not exceed 1 m between any two points;

— the run shall be repeated twice in immediate succession;

— the components of wind speed parallel to the track shall not exceed 2 m/s.

7 Preconditioning of the vehicle

7.1 Battery charge

The battery shall be charged according to the following procedure.

7.1.1 Normal overnight charging procedure

The charging of the battery shall be carried out at an ambient temperature between 20 °C and 30 °C using the on-board charger, if fitted, or an external charger as recommended by the vehicle manufacturer.

The electrical connection with the public network shall be made with a plug as used for domestic appliances and as recommended by the vehicle manufacturer.

The procedure excludes all types of special charging, for example battery refreshing or service charging.

The vehicle manufacturer shall be in the position to attest that during the test no special charging has been performed.

7.1.2 End-of-charge criteria

The end of charge criteria correspond to a charging time of 12 h except if a clear indication is given to the driver by the standard instrumentation that the battery is not yet fully charged. In this case, the maximum charging time shall be 3 × manufacturer's specified battery capacity in kilowatt hours (kW·h) / mains power supply in kilowatts(kW).

7.1.3 Fully charged battery

A battery is fully charged when charged according to the overnight charging procedure and the end of charge criteria.

7.2 Trip meter setting

The on-board trip meter shall be set to zero, or the reading of the odometer shall be recorded.

7.3 Warm-up

The vehicle shall be driven over a distance of about 5 000 m at 80 % of the manufacturer's estimated maximum thirty minutes speed in order to warm up the motor and transmission gears.

8 Test sequence

The test sequence is arranged such that all road performances can be performed within two days. It shall be performed according to the following sequences.

— First day:

1) preconditioning (see clause 7);

2) test: maximum thirty minutes speed (see 9.1);

3) complete battery discharge (see 9.2).

— Second day:

1) preconditioning (see clause 7);

2) test: maximum speed (see 9.3);

3) 40 % battery discharge (see 9.4);

4) test: acceleration 0 km/h to 50 km/h (see 9.5);

5) test: acceleration 50 km/h to 80 km/h (see 9.6);

6) test: speed uphill at slopes of 4 % and 12 % (see 9.7);

7) test: hill starting ability (see 9.8).

9 Test procedures

9.1 Maximum thirty minutes speed

The test of the maximum thirty minutes speed shall be performed either on a loop track or on a chassis dynamometer calibrated according to annex A, as follows.

a) Load the vehicle to the test mass (see 3.3).

b) Precondition the vehicle in accordance with clause 7.

c) Determine the maximum thirty minutes speed, v_{30}, by driving the vehicle at the manufacturer's best estimate of such a speed ± 5 % for 30 min. (Speed variations during the test can be compensated for by pressing the accelerator pedal to match the ± 5 % range.)

d) Measure the distance covered, d, in metres, and calculate the average thirty minutes speed, v_{30}, in kilometres per hour (km/h) using the following equation:

$$v_{30} = \frac{d}{500} \text{ km/h} \tag{1}$$

e) If the speed has dropped below the – 5 % level during the test, the test may be repeated at the manufacturer's discretion with either the same or a revised manufacturer's estimated maximum thirty minutes speed.

9.2 Complete battery discharge

After performing the maximum thirty minutes speed test, the vehicle shall rest for 30 min. Driving shall then be resumed at 70 % of v_{30} until the speed has decreased with fully pressed accelerator pedal to 50 % of $v_{30} \pm 10$ km/h, or until an indication is given to the driver to stop driving by the standard on-board instrumentation.

The total distance, S_{tot}, covered during the preconditioning plus the maximum thirty minutes speed test plus the complete discharge shall be recorded.

9.3 Maximum speed

9.3.1 Standard test procedure

Perform the following test procedure.

a) Load the vehicle to the test mass (see 3.3).

b) Precondition the vehicle in accordance with clause 7.

c) Accelerate the vehicle to its maximum speed on the straight or loop track and maintain it over a distance of 1 km.

d) Immediately perform the same test in the opposite track direction.

The maximum speed value in kilometres per hour (km/h), is the arithmetical average between the two measured values.

9.3.2 Single direction test procedure

When a single direction test is carried out using a test track as in 6.3.4, the results of the two runs shall be calculated as follows, where the maximum speed v is the arithmetical average of the two values of v_i.

The maximum speed shall be corrected according to the following formula which considers the wind speed:

$$v_i = v_r \pm v_v \times f \tag{2}$$

where

the + sign is used if the axial wind component is in the opposite direction to the vehicle driving direction;

the – sign is used if the axial wind component is in the same direction as the driving direction;

v_r is the maximum speed measured for each run, where = 3,6 L/t, in kilometres per hour (km/h), and where

t is the time in seconds (s) and taken over

L is the measured length in metres (m);

v_v is the axial wind component in metres per second (m/s);

f is the correction factor = 0,6.

9.4 40 % battery discharge

The battery shall then be discharged by running the vehicle over the test track or on a dynamometer roll at a constant speed of 70 % of v_{30} ± 5 km/h until a distance of 40 % of S_{tot} (9.2) has been achieved.

9.5 Acceleration ability 0 km/h to 50 km/h

Perform the following test procedure.

a) Load the vehicle to the test mass (see 3.3).

b) Stop the vehicle on the test track in the start position.

c) Accelerate the vehicle by fully depressing the accelerator pedal and, if fitted, by using the clutch and gear lever.

d) Record the time elapsed from depressing the accelerator pedal to achieving the speed of (50 ± 1) km/h.

e) Immediately perform the same test in the opposite direction.

The 0 km/h to 50 km/h acceleration in seconds (s) is the arithmetical average of the two measured time periods.

9.6 Acceleration ability 50 km/h to 80 km/h

Perform the following test procedure.

a) Load the vehicle to the test mass.

b) Stop the vehicle on the test track in the start position.

c) Accelerate the vehicle to the speed of (50 ± 1) km/h and maintain it over a distance of 0,5 km.

d) Accelerate the vehicle by fully depressing the accelerator pedal and, if fitted, by using the clutch and gear lever.

e) Record the time elapsed from fully depressing the accelerator pedal to achieving the speed of (80 ± 1) km/h or 90 % of the maximum speed, if it is lower than 89 km/h. In this case the final speed shall be noted in the report.

f) Immediately perform the same test in the opposite direction.

The 50 km/h to 80 km/h acceleration in seconds (s) is the arithmetical average of the two measured time periods.

9.7 Speed uphill

Perform the following test procedure.

a) Load the vehicle to its maximum design total mass.

b) Position the vehicle on the dynamometer and make any necessary adjustments to suit the ISO-M07 mass value.

NOTE The test can also be done using a dynamometer trailer.

c) Set up the bench with an additional load corresponding to a 4 % slope.

d) Accelerate by fully depressing the accelerator pedal.

e) Determine the maximum stabilized speed value that the vehicle can reach and run at over a distance of 1 km.

f) Repeat the test starting with the bench set up with an additional load corresponding to a 12 % slope.

9.8 Hill starting ability

9.8.1 Principle

The measurement of hill starting ability shall be performed by starting on a slope featuring an angle, α_1, as near as possible to the vehicle manufacturer's claimed hill starting ability, α_0.

The difference between the real angle α_1 and the claimed α_0 shall be compensated for by an additional or a reduced mass Δm.

In the case where the angle α_0 is unknown, it can be evaluated using the formulae in 9.8.3.

9.8.2 Procedure

Perform the following test procedure.

a) Load the vehicle to its maximum design total mass.

b) Arrange the vehicle on test gradient slope α_1 selected as near as possible to α_0, facing up the slope.

c) Add the mass Δm or reduce the pay mass by Δm, calculated using the following formula:

$$\Delta m = m \times \frac{\sin\alpha_0 - \sin\alpha_1}{\sin\alpha_1 + R} \tag{3}$$

where

m is the mass ISO-M07 of the vehicle under test, in kilograms (kg);

R is the rolling resistance, conventionally equal to 0,01.

The mass Δm shall be uniformly distributed in passenger and load compartments.

d) Run the vehicle over a distance of at least 10 m.

9.8.3 Evaluation of α_0

With known peak motor shaft torque, calculate the wheel torque:

$$C_r = C_a \times T \times \eta_\tau \tag{4}$$

and with known tyre rolling radius the balance of forces:

$$F_t = C_r / r = m \times g \times (\sin\ \alpha_0 + R) \tag{5}$$

where

C_r is the wheel torque;

C_a is the maximum peak motor shaft torque;

T is the total gear ratio;

η_τ is the gear efficiency;

F_t is the total traction force necessary to balance the load, in newton metres (N · m);

r is the tyre dynamic loaded radius, in metres (m);

g is the acceleration of gravity, in metres per second squared (m/s^2).

From Equation 4 and 5, α_0 and the hill starting ability, equal to

$$\tan\alpha_0 \times 100 \qquad (6)$$

can be calculated.

Annexe A
(normative)

Determination of the total road load power of a vehicle and calibration of the chassis dynamometers

A.1 Introduction

The purpose of this annex is to define the method of measuring the total road load power of a vehicle with a statistical accuracy of ± 2 % at constant speed and to reproduce this measured road load power on a dynamometer with an accuracy of ± 5 %.

NOTE This annex is derived from the procedure for the measurement of consumption and range of electric vehicles according to UN/ECE draft Trans/WP29/484.

A.2 Characteristics of the track

The test road layout shall be level, straight and free of obstacles or wind barriers which adversely affect the variability of road load measurement.

The test road longitudinal slope shall not exceed ± 2 %. This slope is defined as the ratio of the difference in elevation between both ends of the test road and its overall length. In addition, the local inclination between any two points 3 m apart shall not deviate by more than ± 0,5 % from this longitudinal slope.

The maximum cross-sectional camber of the test road shall be 1,5 %.

A.3 Atmospheric conditions

A.3.1 Wind

Testing shall be performed at wind speeds averaging less than 3 m/s with peak speeds less than 5 m/s. In addition, the vector component of the wind speed across the test track shall be less than 2 m/s. Wind velocity shall be measured at 0,7 m above the track surface.

A.3.2 Humidity

The track shall be dry.

A.3.3 Reference conditions

Reference conditions are

— air pressure H_0 = 100 kPa,

— environmental temperature T_0 = 293 K (20 °C), and

— air density ρ_0 = 1,189 kg/m^3.

A.3.3.1 Air density

A.3.3.1.1 The air density, when the vehicle is tested, calculated as in 3.3.1.2, shall not differ by more than 7,5 % from the density under the reference conditions.

A.3.3.1.2 The air density shall be calculated by the formula:

$$\rho_T = \rho_0 \times \frac{H_T}{H_0} \times \frac{T_0}{T_T} \quad \text{(A.1)}$$

where

ρ_T is the air density at test condition, in kilograms per cubic metre (kg/m^3);

ρ_0 is the air density at reference condition, kilograms per cubic metre (kg/m^3);

H_T is the air pressure at test condition, in kilopascals (kPa);

H_0 is the air pressure at reference condition, in kilopascals (kPa);

T_T is the absolute temperature during test, in kelvins (K);

T_0 is the temperature at reference condition, in kelvins (K).

A.3.3.2 Ambient conditions

A.3.3.2.1 The ambient temperature shall be between 5 °C (278 K) and 35 °C (308 K), and the atmospheric pressure between 91 kPa and 104 kPa. The relative humidity shall be less than 95 %.

A.3.3.2.2 However, with the manufacturer’s agreement, the tests may be made at lower ambient temperatures down to 1 °C. In this case the correction factor calculated for 5 °C should be used.

A.4 Preparation of the vehicle

A.4.1 Running-in

The vehicle shall be in normal running order and adjustment after having been run-in for at least 300 km. The tyres shall be run-in at the same time as the vehicle, or shall have a tread depth within 90 % and 50 % of the initial tread depth.

A.4.2 Checks

The following checks shall be made in accordance with the manufacturer’s specifications for the intended use: wheels, wheel trim, tyres (make, type, pressure), front axle geometry, brake adjustment (elimination of parasitic drag), lubrication of front and rear axles, adjustment of the suspension and vehicle attitude, etc. Check that during freewheeling there is no electrical braking.

A.4.3 Preparation for the test

A.4.3.1 The vehicle shall be loaded to its test mass including driver and measurement equipment, spread in a uniform way in loading areas.

A.4.3.2 In the case of a test track, the windows of the vehicle shall be closed. Any covers for air conditioning systems, headlight, etc. shall be closed.

A.4.3.3 The vehicle shall be clean.

A.4.3.4 Immediately before the test, the vehicle shall be brought to normal running temperature in an appropriate manner.

A.5 Specified speed, v

The specified speed is required for obtaining the running resistance at the reference speed from the running resistance curve. To determine the running resistance as a function of vehicle speed in the vicinity of reference speed v_0, running resistances shall be measured at the specified speed v. At least four to five points indicating the specified speeds, along with the reference speeds, are desired to be measured.

Table A.1 shows the specified speeds according to the vehicle category.

Table A.1 — Specified speeds

Vehicle category v_{max}	Specified speed v km/h					
$v_{max} > 130$	120 [a]	100	80 [b]	60	40	20
$130 \geqslant v_{max} > 100$	90	80 [b]	60	40	20	—
$100 \geqslant v_{max} > 70$	60	50 [b]	40	30	20	—
$v_{max} \leqslant 70$	50 [a]	40 [b]	30	20	—	—

[a] If possible with the vehicle.

[b] Reference speed.

A.6 Energy variation during coast-down

A.6.1 Total road load power determination

A.6.1.1 Measurement equipment and accuracy

The margin of measurement error shall be less than 0,1 s for time, and smaller than ± 0,5 km/h for speed.

A.6.1.2 Test procedure

A.6.1.2.1 Accelerate the vehicle to a speed of 5 km/h greater than the speed at which test measurement begins.

A.6.1.2.2 Put the gearbox in neutral, or disconnect the power supply.

A.6.1.2.3 Measure the time t_1, taken, for the vehicle to decelerate from $v_2 = v + \Delta v$ to $v_1 = v - \Delta v$, in kilometres per hour (km/h), where

$\Delta v \leqslant 5$ km/h for nominal speed $\leqslant 50$ km/h;

$\Delta v < 10$ km/h for nominal speed > 50 km/h.

A.6.1.2.4 Carry out the same test in opposite direction, and measure the time of t_2.

A.6.1.2.5 Take the average T_1 of the two times t_1 and t_2.

A.6.1.2.6 Repeat these tests until the statistic accuracy (p) of the average of time

$$T = \frac{1}{n}\sum_{i=1}^{n} T_i \tag{A.2}$$

is equal to or less than 2 % ($p \leqslant 2$ %).

The statistical accuracy (p) is defined by

$$p = \frac{t \times s}{\sqrt{n}} \times \frac{100}{T} \tag{A.3}$$

where

t is the coefficient given by Table A.2;

s is the standard deviation:

$$s = \sqrt{\sum_{i=1}^{n} \frac{\left(T_i - T\right)^2}{n-1}} \tag{A.4}$$

n is the number of tests.

Table A.2 — Coefficient t

n	4	5	6	7	8	9	10
t	3,2	2,8	2,6	2,5	2,4	2,3	2,3
$t / \sqrt{n}$	1,6	1,25	1,06	0,94	0,85	0,77	0,73

A.6.1.2.7 The running resistance F, in newtons (N), at the specified speed v is calculated as follows:

$$F = \left(m + m_r\right) \times \frac{2\,\Delta v}{\Delta T} \times \frac{1}{3{,}6} \tag{A.5}$$

where

m is the test mass;

m_r is the equivalent inertia mass of all wheels and vehicle portions rotating with the wheels during coast down on the road, in kilograms; m_r shall be measured or calculated by an appropriate manner.

A.6.1.2.8 The running resistance determined on the track shall be corrected to the reference conditions in clause A.3 as follows.

$$F_{corrected} = k \times F_{measured}$$

$$k = \frac{R_R}{R_T}\left[1 + K_R\left(t - t_0\right)\right] + \frac{R_{AERO}}{R_T} \times \frac{\rho_0}{\rho_t} \tag{A.6}$$

where

R_R is the rolling resistance at specified speed v;

R_{AERO} is the dynamic drag at speed v;

R_T is the total road load = $R_R + R_{AERO}$;

K_R is the temperature correction factor of rolling resistance, taken to be equal to $3{,}6 \times 10^{-3}/t$ (°C);

t is the road test ambient temperature, in degrees Celsius (°C);

t_0 is the reference temperature (20 °C);

ρ_t is the air density at the test condition;

ρ_0 is the air density at the reference condition (20 °C, 100 kPa).

The ratios R_R/R_T and R_{AERO}/R_T shall be specified by the vehicle manufacturer on the basis of the data normally available to the company. If these values are not available, subject to the agreement of the manufacturer and the technical service concerned, the figures for the rolling/total resistance ratio given by the following formula may be used.

$$\frac{R_R}{R_T} = a \times m + b \qquad \text{(A.7)}$$

where

m is the test mass, in kilograms;

a and b are coefficients, values of which are given for each speed in Table A.3.

Table A.3 — Coefficients *a* and *b*

v km/h	a	b
20	$7{,}24 \times 10^{-5}$	0,82
30	$1{,}25 \times 10^{-4}$	0,67
40	$1{,}59 \times 10^{-4}$	0,54
50	$1{,}86 \times 10^{-4}$	0,42
90	$1{,}71 \times 10^{-4}$	0,21
120	$1{,}57 \times 10^{-4}$	0,14

A.6.2 Setting of the dynamometer

NOTE The purpose of this procedure is to simulate the total road load power at a given speed on the dynamometer.

A.6.2.1 Measuring equipment and accuracy

The measuring equipment shall be similar to that used on the track.

A.6.2.2 Test procedure

A.6.2.2.1 Install the vehicle on the dynamometer.

A.6.2.2.2 Adjust the tyre pressure (cold) of the driving wheels as required for the chassis dynamometer.

A.6.2.2.3 Adjust the equivalent inertia mass of the chassis dynamometer according to Table A.4.

A.6.2.2.4 Bring the vehicle and the chassis dynamometer to stabilized operating temperature, in order to reproduce road conditions.

A.6.2.2.5 Carry out the operations specified in A.6.1.2 with the exception of A.6.1.2.4 and A.6.1.2.5, replacing m by I and m_{r} by m_{rm} in equation A.5.

A.6.2.2.6 Adjust the brake to reproduce the corrected running resistance half payload (see A.6.1.2.8) and to take into account the differences between the vehicle mass on the track and the equivalent inertia test mass (I) to be used. This can be done by calculating the mean corrected road coast down time from v_2 to v_1 and reproducing the same time on the chassis dynamometer with the following relationship:

$$T_{\mathrm{corrected}} = \left(I + m_{\mathrm{rm}}\right) \frac{2\,\Delta v}{F_{\mathrm{corrected}}} \times \frac{1}{3,6} \qquad \text{(A.8)}$$

where

I is the flywheel equivalent inertia mass of chassis dynamometer in kilograms (kg);

m_{rm} is the equivalent inertia mass of the powered wheels and vehicle portions rotating with the wheels during coast down, in kilograms (kg);

I and m_{rm} shall be measured or calculated by an appropriate method.

A.6.2.2.7 The power P_{a} to be absorbed by the chassis dynamometer shall be determined in order to enable the same total road load power to be reproduced for the same vehicle on different days or on different bench units of the same type.

Table A.4 — Equivalent inertia mass of chassis dynamometer

Test mass m kg	**Equivalent inertia** I kg
$m \leqslant 480$	455
$480 < m \leqslant 540$	510
$540 < m \leqslant 595$	570
$595 < m \leqslant 650$	625
$650 < m \leqslant 710$	680
$710 < m \leqslant 765$	740
$765 < m \leqslant 850$	800
$850 < m \leqslant 965$	910
$965 < m \leqslant 1\ 080$	1 020
$1\ 080 < m \leqslant 1\ 190$	1 130
$1\ 190 < m \leqslant 1\ 305$	1 250
$1\ 305 < m \leqslant 1\ 420$	1 360
$1\ 420 < m \leqslant 1\ 530$	1 470
$1\ 530 < m \leqslant 1\ 640$	1 590
$1\ 640 < m \leqslant 1\ 760$	1 700
$1\ 760 < m \leqslant 1\ 870$	1 810
$1\ 870 < m \leqslant 1\ 980$	1 930
$1\ 980 < m \leqslant 2\ 100$	2 040
$2\ 100 < m \leqslant 2\ 210$	2 150
$2\ 210 < m \leqslant 2\ 380$	2 270
$2\ 380 < m \leqslant 2\ 610$	2 270
$2\ 610 < m$	2 270

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Price based on 17 pages