Annex B:

China Green Car Assessment Program (C-GCAP) - Trial Version

Test & Assessment Rules for Energy Efficiency

China Automotive Technology and Research Center Co. Ltd.

Contents

1. Scoring Method

1.1 Indicator System

The energy efficiency indicators are shown in Table 1-1.

Table 1-1 Energy Efficiency Indicator System

Primary Indicator	Secondary Indicator	Tertiary Indicator
Energy efficiency	Fuel consumption under Chinese operating conditions	Average fuel consumption
		Urban fuel consumption
	Range	Power consumption under Chinese operating conditions
		Low-temperature driving range
		High-speed driving range
	Charging	Charging time
		Charging compatibility
		Charging protection

1.2 Weight Assignment of Indicators

1.2.1 Weight Assignment of Secondary Indicators

There are three secondary energy efficiency indicators: fuel consumption under Chinese operating conditions, range and charging. Among them, fuel consumption under Chinese operating conditions is applicable to gasoline vehicles and PHVs (including EREVs), while range and charging are applicable to PEVs. The weight of each indicator is shown in Table 1-2.

Table 1-2 Weights of Secondary Energy Efficiency Indicators

Primary Indicator	Secondary Indicator			
	Applicable Model	No.	Test Item	Weight
Energy efficiency	Gasoline vehicles PHVs (including EREVs)	1	Fuel consumption under Chinese operating conditions	100%
	PEVs	1	Range	60%
		2	Charging	40%

1.2.2 Weight Assignment of Tertiary Indicators

There are two tertiary indicators under the secondary indicator of fuel consumption under Chinese operating conditions, and their weights are shown in Table 1-3.

Table 1-3 Weights of Tertiary Indicators under Fuel Consumption under Chinese Operating Conditions

Secondary Indicator	Tertiary Indicator		
	Applicable Model	Test Item	Weight
Fuel consumption under Chinese operating conditions	Gasoline vehicles PHVs (including EREVs)	Average fuel consumption	50%
		Urban fuel consumption	50%

There are three tertiary indicators under the secondary indicator of range, and their weights are shown in Table 1-4.

Table 1-4 Weights of Tertiary Indicators under Range

Secondary Indicator	Tertiary Indicator		
	Applicable Model	Test Item	Weight
Range	PEVs	Power consumption under Chinese operating conditions	40%
		Low-temperature driving range	40%
		High-speed driving range	20%

There are three tertiary indicators under the secondary indicator of charging, and their weights are shown in Table 1-5.

Table 1-5 Weights of Tertiary Indicators under Charging

Secondary Indicator	Tertiary Indicator		
	Applicable Model	Test Item	Weight
Charging	PEVs	Charging time	40%
		Charging compatibility	30%
		Charging protection	30%

1.2.3 Weight Assignment of Quaternary Indicators

There are two quaternary indicators under each of the tertiary indicators of average fuel consumption and urban fuel consumption: oil consumption under normal temperature and oil consumption of air conditioning under high temperature, and their weights are shown in Table 1-5.

Table 1-5 Weights of Quaternary Indicators under Average Fuel Consumption and Urban Fuel Consumption

Tertiary Indicator	Quaternary Indicator			
	Applicable Model	No.	Test Item	Weight
Average fuel consumption	Gasoline vehicles PHVs (including EREVs)	1	Oil consumption under normal temperature	66.7%
		2	Oil consumption of air conditioning under high temperature	33.3%
Urban fuel consumption	Gasoline vehicles PHVs (including EREVs)	1	Oil consumption under normal temperature	66.7%
		2	Oil consumption of air conditioning under high temperature	33.3%

There is one quaternary indicator under the tertiary indicator of power consumption under Chinese operating conditions, and its weight is shown in Table 1-6.

Table 1-6 Weight of Quaternary Indicator under Power Consumption under Chinese Operating Conditions

Tertiary Indicator	Quaternary Indicator			
	Applicable Model	No.	Test Item	Weight
Power consumption under Chinese operating conditions	PEVs	1	Power consumption under Chinese operating conditions	100%

There are two quaternary indicators under the tertiary indicator of low-temperature driving range: the reduction rate of low-temperature driving range and the accuracy of low-temperature driving range estimate, and their weights are shown in Table 1-7.

Table 1-7 Weights of Quaternary Indicators under Low-temperature Driving Range

Tertiary Indicator	Quaternary Indicator			
	Applicable Model	No.	Test Item	Weight
Low-temperature driving range	PEVs	1	Reduction rate of low-temperature driving range	80%
		2	Accuracy of low-temperature driving range estimate	20%

There are two quaternary indicators under the tertiary indicator of high-speed driving range: the reduction rate of high-speed driving range and the accuracy of high-speed driving range estimate, and their weights are shown in Table 1-8.

Table 1-8 Weights of Quaternary Indicators under High-speed Driving Range

Tertiary Indicator	**Quaternary Indicator**			
	Applicable Model	**No.**	**Test Item**	**Weight**
High-speed driving range	PEVs	1	Reduction rate of high-speed driving range	80%
		2	Accuracy of high-speed driving range estimate	20%

There are two quaternary indicators under the tertiary indicator of charging time: DC charging time under normal temperature and DC charging time under low temperature, and their weights are shown in Table 1-9.

Table 1-9 Weights of Quaternary Indicators under Charging Time

Tertiary Indicator	**Quaternary Indicators**			
	Applicable Model	**No.**	**Test Item**	**Weight**
Charging time	PEVs	1	DC charging time under normal temperature	50%
		2	DC charging time under low temperature	50%

There is one quaternary indicator under the tertiary indicator of charging compatibility: DC charging compatibility, and its weight is shown in Table 1-10.

Table 1-10 Weight of Quaternary Indicator under Charging Compatibility

Tertiary Indicator	**Quaternary Indicator**		
	Applicable Model	**Test Item**	**Weight**
Charging compatibility	PEVs	DC charging compatibility	100%

There are three quaternary indicators under the tertiary indicator of charging protection: protection against electric shock, thermal safety of charging, and functional safety of charging, and their weights are shown in Table 1-11.

Table 1-11 Weights of Quaternary Indicators under Charging Protection

Tertiary Indicator	Quaternary Indicator		
	Applicable Model	Test Item	Weight
Charging protection	PEVs	Protection against electric shock	30%
	PEVs	Thermal safety of charging	50%
	PEVs	Functional safety of charging	20%

1.3 Score Calculation Methods

1.3.1 Score Calculation Method of Primary Indicator

According to the C-GCAP, the total score of energy efficiency is based on the scores and weights of the secondary indicators, rounded to one decimal place. The calculation method is shown in Formula (1-1).

$$S = \sum_{i=1}^{n} S_i \times a_i \tag{1-1}$$

In which: S is the total score of energy efficiency; i is the number of secondary indicator; S_i and a_i are the score and weight of the secondary indicator numbered i, respectively. The numbers and weights are shown in Table 1-2.

1.3.2 Score Calculation Method of Secondary Indicators

The scores of the secondary indicators are based on the scores and weights of the tertiary indicators, rounded to two decimal places. The calculation method is shown in Formula (1-2).

$$S_i = \sum_{j=1}^{n_i} S_{ij} \times b_{ij} \tag{1-2}$$

In which: j is the number of a tertiary indicator under a secondary indicator; n_i is the number of tertiary indicators under the secondary indicator numbered i. S_{ij} and b_{ij} are the score and weight of the tertiary indicator numbered j under the secondary indicator numbered i, respectively.

1.4 Notes to Scores of Test Items

1.4.1 Note to Test Score of Average Fuel Consumption

The score is based on the ratios of average fuel consumption (basic oil consumption × 2/3 + oil consumption of air conditioning under high temperature × 1/3) to the limits of different mass segments corresponding to the limits of average fuel consumption. The limit of average fuel consumption is FC_L= 0.0035 × (CM−1580) + 8.02. If the curb mass (CM) is more than 2,510kg, FC_L=11.28L/100km. If the full score is 100, the calculated score shall be rounded to two decimal places. The scoring method is shown in Table 1-12.

Table 1-12 Score of Average Fuel Consumption

Average Fuel Consumption/Fuel Consumption Limit	**Score**
≥1.76	0
1.20	60
≤0.90	100
Notes: 1) When the average fuel consumption/fuel consumption limit is ≤1.20 and ≥0.90, the score will be 60-100, subject to linear interpolation within the interval; 2) When the average fuel consumption/fuel consumption limit is ≤1.76 and ≥1.20, the score will be 0-60, subject to linear interpolation within the interval; 3) Deduction for air conditioning performance: When the interior temperature of the vehicle first reaches the target temperature for more than 15min, 2 points will be deducted for each additional minute, up to 10 points.	

1.4.2 Note to Test Score of Urban Fuel Consumption

The score is based on the ratios of urban fuel consumption (basic oil consumption × 2/3 + oil consumption of air conditioning under high temperature × 1/3) to the limits of different mass segments corresponding to the limits of urban fuel consumption. The limit of urban fuel consumption is FC_L= 0.0035 × (CM−1580) + 8.02. If the curb mass (CM) is more than 2,510kg, FC_L=11.28L/100km. If the full score is 100, the calculated score shall be rounded to two decimal places. The scoring method is shown in Table 1-13.

Table 1-13 Score of Urban Fuel Consumption

Urban Fuel Consumption/Fuel Consumption Limit	**Score**
≥1.90	0
1.50	60

Urban Fuel Consumption/Fuel Consumption Limit	Score
≤1.10	100
Notes: 1) When the urban fuel consumption/fuel consumption limit is ≤1.50 and ≥1.10, the score will be 60-100, subject to linear interpolation within the interval; 2) When the urban fuel consumption/fuel consumption limit is ≤1.90 and ≥1.50, the score will be 0-60, subject to linear interpolation within the interval.	

1.4.3 Note to Test Score of Range

1.4.3.1 Note to Score of Power Consumption under Chinese Operating Conditions

The normal-temperature power consumption under Chinese operating conditions shall be tested with the method specified in 2.2 herein and shall be calculated to provide the scoring basis. The power consumption of pure electric passenger cars shall be calculated according to the combination formula of Y=0.006M+8, and the score shall be rounded to one decimal place. The scoring method is shown in Table 1-14:

Table 1-14 Score of Normal-Temperature Power Consumption under Chinese Operating Conditions

Indicator Name	Measurement (kWh/100km)	Score
Power consumption under Chinese operating conditions	≥1Y	0
	=0.85Y	60
	≤0.6Y	100
Notes: 1) When the power consumption of the vehicle is ≤1.0Y and ≥0.85Y, the score will be 0-60, subject to linear interpolation within the interval; 2) When the power consumption of the vehicle is <0.85Y and ≥0.6Y, the score will be 60-100, subject to linear interpolation within the interval; 3) M is the curb mass of the vehicle under test, kg.		

1.4.3.2 Note to the Score of Reduction Rate of Low-Temperature Driving Range

The test shall be conducted with the method specified in 2.3 herein, and the score is based on the reduction rate of low-temperature driving range compared with the reduction rate of normal-temperature driving range, rounded to one decimal place. The scoring method is shown in Table 1-15:

Table 1-15 Score of Reduction Rate of Low-Temperature Driving Range

Indicator Name	Post-measurement Calculated Value	Score
Reduction rate of low-temperature driving range	≥60%	0
	=40%	80
	≤30%	100

Notes:

1) When the reduction rate is ≤60% and ≥40%, the score will be 0-80, subject to linear interpolation within the interval;

2) When the reduction rate is ≤40% and ≥30%, the score will be 80-100, subject to linear interpolation within the interval;

3) There are two deductions for air conditioning performance:

a) When the interior temperature of the vehicle first reaches the target temperature for more than 15min, 2 points will be deducted for each additional minute, up to 10 points;

b) After 15min and until the end of the test, when the interior temperature of the vehicle fails to reach the temperature interval for more than 1.5 hours, 10 points will be deducted.

1.4.3.3 Note to Score of Accuracy of Low-Temperature Driving Range Estimate

The test shall be conducted with the method specified in 2.3 herein, and the score is based on the accuracy of low-temperature driving range estimate, rounded to one decimal place. The scoring method is shown in Table 1-16:

Table 1-16 Score of Accuracy of Low-Temperature Driving Range Estimate

Indicator Name	Coefficient of Determination	Score
Accuracy of low-temperature driving range estimate	＜0.40	0
	=0.99	100

Note: When the accuracy of driving range estimate is ≥0.40 and ≤0.99, the score will be 0-100, subject to linear interpolation within the interval.

1.4.3.4 Note to Score of Reduction Rate of High-speed Driving Range

The test shall be conducted with the method specified in 2.3 herein, and the score is based on the reduction rate of high-speed driving range, rounded to one decimal place. The scoring method is shown in Table 1-17:

Table 1-17 Score of Reduction Rate of High-speed Driving Range

Indicator Name	Post-measurement Calculated Value	Score
Reduction rate of high-speed driving range	≥60%	0
	=40%	80
	≤30%	100
Notes: 1) When the reduction rate is ≤60% and ≥40%, the score will be 0-80, subject to linear interpolation within the interval; 2) When the reduction rate is ≤40% and ≥30%, the score will be 80-100, subject to linear interpolation within the interval.		

1.4.3.5 Note to Score of Accuracy of High-speed Driving Range Estimate

The test shall be conducted with the method specified in 2.3 herein, and the score is based on the accuracy of high-speed driving range estimate, rounded to one decimal place. The scoring method is shown in Table 1-18:

Table 1-18 Score of Accuracy of High-speed Driving Range Estimate

Indicator Name	Coefficient of Determination	Score
Accuracy of high-speed driving range estimate	＜0.40	0
	=0.99	100
Note: When the accuracy of driving range estimate is ≥0.40 and ≤0.99, the score will be 0-100, subject to linear interpolation within the interval.		

1.4.4 Note to Score of DC Charging Time under Normal Temperature

1.4.4.1 Note to Score of DC Charging Time under Normal Temperature

The DC charging time under normal temperature shall be tested with the method specified in 2.6.1 herein to provide the scoring basis, and the score shall be rounded to one decimal place. The scoring method is shown in Table 1-19:

Table 1-19 Score of DC Charging Time under Normal Temperature

Indicator Name	Calculated Value (h)	Score
DC charging time under normal temperature	≥1	0
	≤0.5	100
Note: When the charging time is ≤1h and ≥0.5h, the score will be 0-100, subject to linear		

interpolation within the interval; If charging stops abnormally during the test due to non-operational reasons at the vehicle end, 5 points will be deducted for the charging compatibility of the vehicle with the charging pile; if charging stops abnormally twice during the test, the test is ended and no score will be given for the test item.

1.4.4.2 Note to Score of DC Charging Time under Low Temperature

The charging time under low temperature shall be tested with the method specified in 2.6.1, and the score is based on DC charging time under low temperature, rounded to one decimal place. The scoring method is shown in Table 1-20.

Table 1-20 Score of DC Charging Time under Low Temperature

Indicator Name	Calculated Value (h)	Score
DC charging time under low temperature	≥1.6	0
	≤1	100
Note: When the charging time is ≤1.6h and ≥1h, the score will be 0-100, subject to linear interpolation within the interval; If charging stops abnormally during the test due to non-operational reasons at the vehicle end, 5 points will be deducted for the charging compatibility of the vehicle with the charging pile; if charging stops abnormally twice during the test, the test is ended and no score will be given for the test item.		

1.4.4.3 Note to Score of DC Charging Compatibility

The test shall be conducted with 10 DC charging piles, each of which has a full score of 10 and the total score is 100. The test shall be conducted with the test method of charging compatibility specified in 2.6.2 herein, and the scoring method for each charging pile is shown in Table 1-21:

Table 1-21 Score of DC Charging Compatibility

Indicator Name	Pass/Fail	Score
DC charging compatibility	Fail the test specified in 2.6.2.2.4	0
	Pass the test specified in 2.6.2.2.4 Fail the tests specified in 2.6.2.2.5-2.6.2.2.7	5
	Pass all the tests specified in 2.6.2.2.4-2.6.2.2.7	10

1.4.4.4 Note to Score of Charging Protection

The charging protection shall be tested with the method specified in 2.6.3, and the score shall be rounded to one decimal place. The scoring method is shown in Table 1-22.

Table 1-22 Score of Protection against Electric Shock

Indicator Name	Pass/Fail	Score
Protection against electric shock	Fail some of the tests specified in 2.6.3.1-2.6.3.3	0
	Pass all the tests specified in 2.6.3.1-2.6.3.3	100

1.4.4.5 Score Calculation Method of Thermal Safety of Charging

The charging protection shall be tested with the method specified in 2.6.3, and the score shall be rounded to one decimal place. The scoring method is shown in Table 1-23.

Table 1-23 Score of Thermal Safety of Charging

Indicator Name	Pass/Fail	Score
Thermal safety of charging	Fail the test specified in 2.6.3.4	0
	Pass the test specified in 2.6.3.4	100

1.4.4.6 Score Calculation Method of Functional Safety of Charging

The charging protection shall be tested with the method specified in 2.6.3, and the score shall be rounded to one decimal place. The scoring method is shown in Table 1-24.

Table 1-24 Score of Protection against Electric Shock

Indicator Name	Pass/Fail	Score
Functional safety of charging	Fail some of the tests specified in 2.6.3.5-2.6.3.6	0
	Pass all the tests specified in 2.6.3.5-2.6.3.6	100

2. Test Methods

2.1 Test Method of Fuel Consumption under Chinese Operating Conditions

2.1.1 Scope

This method is the specified test method of fuel consumption under Chinese operating conditions in the C-GCAP evaluation.

This Program applies to the test of fuel consumption under Chinese operating conditions for all the models selected for C-GCAP evaluation.

2.1.2 Normative References

The following documents contain provisions which, through reference by this Program, constitute provisions of these rules.

GB/T 1884 Petroleum and Liquid Petroleum Products - Determination of Density - Hydrometer Method

GB 18352.6-2016 Limits and Measurement Methods for Emissions from Light-duty Vehicles (China 6)

GB/T 19233-2020 Measurement Methods of Fuel Consumption for Light-duty Vehicles

GB/T 19753-2021 Test Methods for Energy Consumption of Light-duty Hybrid Electric Vehicles

GB 19578-2021 Fuel Consumption Limits for Passenger Cars

GB/T 38146.1-2019 China Automotive Test Cycle - Part 1: Light-duty Vehicles

2.1.3 Terms and Definitions

Terms and definitions in GB 18352.6-2016 shall apply to this document.

2.1.4 General Requirements

1) The fuel consumption test shall be conducted with the test cycle under Chinese operating conditions to measure CO_2, CO and HC emissions.

2) The test results of CO_2, CO and HC emissions shall be expressed in grams per kilometer (g/km), with the measurement of CO_2 emissions rounded off (rounded) to an integer.

3) The measurements of CO_2, CO and HC emissions shall be used to calculate fuel consumption with the method specified in 2.1.5.5.6 based on the carbon balance method. The calculated result shall be rounded off (rounded) to two decimal places.

2.1.5 Test Conditions

2.1.5.1 Vehicle under Test

1) The vehicle shall be properly used and maintained, without modifications. The vehicle's pollutant emission control device shall function normally, without being affected by any alarm or failure, such as: fire on the engine cylinder and sensor damage.

2) Before the test, care shall be taken regarding the technical condition and adjustment of the assembly to keep it in good condition, and the deviation of tire pressure from standard value shall not exceed ±10kPa.

3) In the laboratory, the sealing of the air intake system can be checked to avoid additional air intake that may affect atomization. In the laboratory, the vehicle can be checked for

performance that meets the manufacturer's regulations, for the ability to run under normal driving conditions, and for normal cold and hot start.

4) Before the test, the vehicle shall be placed indoor under the temperature maintained at 293K-299K (20℃-26℃) until the lubricating oil and coolant of the engine fall within the temperature range of 23±2℃. The vehicle shall be placed under the specified temperature for 6-36 hours.

5) During the test, only the functional equipment of the vehicle shall be in use. Normally, the auxiliary equipment required for the normal operation of the vehicle must be in working condition.

6) If a temperature-controlled radiator fan is used, it shall function properly as it does on the vehicle. The air conditioning system in the passenger compartment shall function properly.

2.1.5.2 Vehicle Load

1) The basic load of the vehicle shall include the driver, the tester (if applicable) and the test equipment, including equipment such as the mounting bracket and power supply.

2) The load setting of the vehicle shall comply with GB 18352.6-2016 *Limits and Measurement Methods for Emissions from Light-duty Vehicles (China 6)*.

2.1.5.3 Lubricating Oil and Fuel Oil

The equivalent fuel specified in Annex K of GB 18352.6-2016 shall be used and shall not contain any oxygen-containing compounds. The fuel parameters used for fuel consumption calculation are as follows:

1) Density: The density of the test fuel shall be measured with the method specified in GB/T 1884: the density of octane-92 gasoline is 0.735-0.755g/cm^3 (15℃) and the density of octane-95 gasoline is 0.745-0.760g/cm^3(15℃).

2) Hydrogen-carbon ratio: A fixed number, 1.85 for gasoline and 1.86 for diesel.

2.1.5.4 Test of Basic Oil Consumption

2.1.5.4.1 Test Cycle

1) The test cycle adopted shall be comply with China Light-duty Vehicle Test Cycle for Passenger Cars (CLTC-P).

2) If the vehicle cannot reach the acceleration and maximum speed required for the test cycle, the accelerator pedal shall be fully depressed until it returns to the required operation curve. Any deviation from the test cycle shall be documented in the test report.

3) The vehicle under test shall be tested in the master mode or, if there is no master mode, an economic mode that can follow the test cycle shall be selected.

2.1.5.4.2 Dynamometer Settings

The load and inertia of the dynamometer shall be set according to Annex C of GB 18352.6-2016, and the driving resistance shall be determined with the coastdown method.

2.1.5.4.3 Test Protocols

1) Traditional gasoline vehicles and non-PHVs shall be tested through the test procedures specified in Chapter 6 of GB/T 19233-2020.

2) For PHVs (including plug-in and extended-range vehicles), before the pre-treatment test, the Rechargeable Electrical Energy Storage System (REESS) shall be charged to at least 50% of the state of charge (SOC) according to Appendix C.2.3 of GB/T 19753-2021; before the formal test, the vehicle shall be pre-treated under the following operating conditions and shall be tested through the test procedures specified in Chapter 6 of GB/T 19233-2020.

The speed of the vehicle shall be stabilized at 50±2km/h until the engine starts on its own and stops in 10s later, followed by 3 consecutive CLTC-P cycles. If the vehicle cannot keep the speed constant at 50km/h±2km/h without starting the engine, the speed may be reduced to an extent appropriate for the vehicle to drive stably for the test.

2.1.5.5 Test of Oil Consumption of Air Conditioning under High Temperature

2.1.5.5.1 Laboratory and Test Equipment

The laboratory and the technical specifications of the test equipment shall comply with the provisions of Annex 2.

2.1.5.5.2 Environmental Conditions

1) The ambient temperature shall be 30±2℃.

2) The ambient relative humidity shall be 50%±5%.

3) During the fuel consumption test, with the air conditioning turned on, the solar radiation intensity that the vehicle is exposed to shall be 850±45W/m^2, and there shall be no solar radiation intensity in the other tests. The benchmark solar radiation intensity shall be the one on the highest point of the roof in the plane position.

2.1.5.5.3 Vehicle Preparations

1) The vehicle shall be prepared according to the requirements in Chapter 5 of GB/T 19233-2020.

2) Temperature measurement points in the passenger compartment shall be arranged in the front seats with the method specified in Appendix 1.

2.1.5.5.4 Air Conditioning Settings

1) For automatically controlled air conditioning, the air conditioning shall be set to the “Auto” mode and the minimum temperature, and the air circulation switch shall be placed at the

internal circulation (unless switch between internal/external circulation is disabled under the "Auto" mode) and the air on the face only positions (unless switch to the air on the face only is disabled under the "Auto" mode). After the temperature inside the vehicle reaches 23℃, the temperature knob shall be adjusted to keep the average temperature of the test points inside the vehicle within the range of 20℃-23℃ when possible.

2) For manually controlled air conditioning, the temperature condition switch shall be placed in the maximum cooling mode position; the air flow adjustment switch shall be placed in the maximum position; the air circulation switch shall be placed in the internal circulation and the air on the face only positions. After the temperature inside the vehicle reaches 23℃, the air flow adjustment switch shall be placed in the medium position and the temperature knob shall be adjusted to keep the average temperature of the test points inside the vehicle within the range of 20℃- 23℃ when possible.

3) For vehicles with middle and rear air vents, the middle and rear air vents and the control switch (if any) shall be turned off, and the front air vent shall be adjusted to the maximum opening.

2.1.5.5.5 Test Protocol

1) Test Preparations

a) The ambient temperature and humidity shall be set as required in 1) and 2) of 2.1.5.5.2.

b) The vehicle shall be put in place, and the test equipment such as the exhaust sampling system shall be connected. Care shall be taken to ensure that the fuel piping is free from leakage and fully vented.

c) The chassis dynamometer shall be set as required in 2.1.5.4.2.

2) Measurement of Vehicle's Fuel Consumption with Air Conditioning Turned on (FC_{ON})

a) All the windows shall be opened; the air circulation switch of air conditioning shall be placed in the external circulation position; the air flow adjustment switch shall be placed in the medium position (rounded off to a higher position). At this point, the compressor shall always be in the off state.

b) The vehicle shall drive at a constant speed of 90±2km/h and then undergo the pre-treatment test as specified in 2.1.5.4.3.

c) The engine and all the windows shall be turned off. After the solar radiation intensity is set as required in 3) of 2.1.5.5.2, the vehicle shall be left to stand for 30min.

d) The air conditioning of the vehicle shall be opened and set as required in 2.1.5.5.4.

e) The vehicle shall be tested once in the CLTC-P cycle as required in 1) of 2.1.4, and the test result shall be calculated with the method specified in 2) of 2.1.5.5.6.

f) During the test, temperature changes in the test points shall be recorded continuously in real time with an acquisition frequency of not less than 1Hz as required in 2) of 2.1.5.5.2). The average temperature of all the test points shall be calculated and monitored, and the time it takes for this average temperature to first reach 23°C shall be recorded. Until the end of the test, this average temperature shall be kept within the range of 20-℃23℃ for every 1 minute.

2.1.5.5.6 Calculation of Fuel Consumption

1) The calculated HC, CO and CO_2 emissions shall be used to calculate the urban, suburban and average fuel consumption.

2) The fuel consumption shall be calculated with the formula below and measured in liters per 100km (L/100km):

a) For vehicles equipped with gasoline engines:

$$FC=\frac{0.1155}{D}[(0.866\times HC)+(0.429\times CO)+(0.273\times CO_2)] \quad (1\text{-}3)$$

b) For vehicles equipped with diesel engines:

$$FC=\frac{0.1156}{D}[(0.865\times HC)+(0.429\times CO)+(0.273\times CO_2)] \quad (1\text{-}4)$$

In which: FC - fuel consumption, measured in liters per 100 kilometers (L/100km); HC - the measured hydrocarbon emissions, measured in grams per kilometer (g/km); CO - the measured carbon monoxide emissions, measured in grams per kilometer (g/km); CO_2 - the measured carbon dioxide emissions, measured in grams per kilometer (g/km); D - the density of the test fuel at 288K (15 °C), measured in kilograms per liter (kg/L).

3) The average fuel consumption is the average fuel economy, and the urban fuel consumption is the urban fuel economy.

2.2 Test Method of Normal-Temperature Power Consumption under Chinese Operating Conditions

The test shall be conducted with the method used for the test of driving range under Chinese operating conditions as specified in 2.3, and the power consumption shall be estimated with the calculation method of energy consumption as specified in 2.3.8.

2.3 Test Method of Driving Range

2.3.1 General Provisions

This section describes the test methods of driving range and energy consumption.

2.3.2 Test Conditions

2.3.2.1 Vehicle Conditions

The tire pressure of the vehicle under test shall be adjusted according to the manufacturer's specifications and shall not deviate from the standard value by more than ±10kPa.

The lighting and signaling devices and the auxiliary equipment on the vehicle shall be turned off, unless otherwise required by the test and operation of the vehicle in the daytime;

Except for driving purposes, all the energy storage systems shall be charged to the maximum value (electrical, hydraulic, pneumatic, etc.) specified by the manufacturer.

The test driver shall follow the operating procedures recommended by the manufacturer of the vehicle to keep the power battery working at the normal operating temperature.

Before the test, the vehicle under test shall drive for a running-in mileage of at least 3,000km on the on-board power battery (See Annex 2 for the running-in test conditions and method).

2.3.2.2 Ambient Temperature Condition

The indoor test shall be conducted under normal temperature, low temperature and high speed:

The normal-temperature and high-speed driving range tests shall be conducted under the normal temperature of (23±3)℃;

The low-temperature driving range test shall be conducted under the temperature of (-7±3)℃, with air conditioning turned on for heating.

2.3.3 Test Procedures

2.3.3.1 General Provisions

The test of driving range shall be conducted under three conditions: normal temperature, low temperature, and high speed. The test of energy consumption is conducted under normal temperature only.

During the test, the most economical driving mode shall be selected for the driving range and energy consumption tests, provided that the speed of the vehicle under this mode keeps up with

the CLTC-P operating curve. Otherwise, an alternative mode under which the speed can keep up with the curve shall be adopted.

2.3.3.2 Test Cycle

2.3.3.2.1 The test cycle shall be the CLTC-P specified in Annex A of GB/T 38146.1-2019, including three speed intervals, namely low speed (Part 1), medium speed (Part 2), and high speed (Part 3).

2.3.3.2.2 If the maximum speed of the vehicle is less than the maximum speed specified for CLTC-P, the test cycle shall be corrected according to Annex CA.5 of GB 18352.6-2016 when the target speed is more than the maximum speed of the vehicle.

2.3.3.3 Speed Curve Tolerance

The allowable tolerance between the actual speed of the vehicle and the speed specified for the test cycle is as follows:

The upper limit of tolerance: +2.0km/h, within less than ±1.0s;

The lower limit of tolerance: -2.0km/h, within less than ±1.0s, as shown in Figure 1-1.

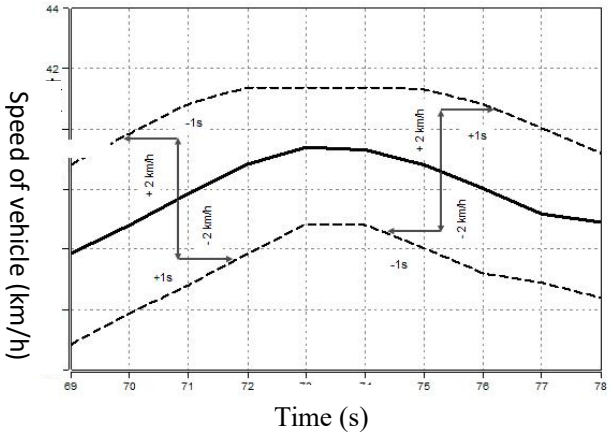

Figure 1-1 Speed Curve Tolerance

In each driving cycle, the allowable cumulative out-of-tolerance time shall not exceed 4s, and the total out-of-tolerance time shall be indicated in the test report.

2.3.3.4 Criteria for Ending the Test Cycle

2.3.3.4.1 During the test of low-temperature driving range:

a) If the maximum speed of the vehicle is not less than the maximum speed specified for CLTC-P and the tolerance requirements in 2.3.3.3 is not met, the test shall be stopped;

b) If the maximum speed of the vehicle is less than the maximum speed specified for CLTC-P, the test cycle shall be corrected according to Annex CA.5 of GB 18352.6-2016 where the maximum speed of the vehicle is exceeded, and the driver now is required to fully depress the accelerator pedal. The actual speed of the vehicle is allowed to exceed the upper limit of tolerance specified in 2.3.3.3, but the test shall be stopped when the actual speed of the vehicle cannot meet

the lower limit of tolerance specified in 2.3.3.3; when the target speed is less than the maximum speed of the vehicle and the tolerance requirements specified in 2.3.3.3 are not met, the test shall be stopped;

2.3.3.4.2 During the test of normal-temperature driving range, if the vehicle fails to meet the lower limit of tolerance specified in 2.3.3.3 for 4s continuously in the constant speed segment CSSE, the test shall be stopped.

2.3.3.4.3 During the test of high-speed driving range, if the driving speed of the vehicle fails to meet the lower limit of tolerance specified in 2.3.3.3 for 4s continuously, the test shall be stopped.

2.3.3.4.4 When the conditions for ending the test are met, with the gear unchanged, the vehicle shall be coasted to the minimum constant speed or 5km/h and then stopped with the brake pedal depressed.

2.3.4 Initial Charging of Power Battery

2.3.4.1 General Provisions

Unless otherwise specified by the manufacturer of the vehicle or the manufacturer of the power battery, the initial charging of the power battery shall be performed as specified in 2.3.4.2 and 2.3.4.3. If several required tests or measurements are conducted continuously, the first charging may be considered as the initial charging.

2.3.4.2 Discharging of Power Battery

First, when the vehicle under test is driving at a constant speed equal to 70%±5% of the maximum speed for 30min, the power battery of the vehicle shall be discharged. The discharge ends when the speed of the vehicle fails to keep up with 65% of the maximum speed for 30min. REESS discharge may also be conducted with the procedure specified by the manufacturer of the vehicle, provided that the REESS is discharged to the minimum SOC.

2.3.4.3 Charging of Power Battery

2.3.4.3.1 Conventional Charging

The recommended conventional charging is AC charging, and the charging power shall not be more than 42kW. When a number of AC charging methods (such as conductive charging and induction charging) are available, the conduction charging method shall be used. If a number of power levels are available for conduction charging, the maximum charging power shall be used. A lower charging power may be selected if it is recommended by the manufacturer of the vehicle. When only DC charging is available for the vehicle, the DC charging is acceptable. Charging shall be continuous, and if a power failure occurs during charging, the test fails and a complete test

shall be restarted. The charging mode shall be selected according to the recommendation of the manufacturer of the vehicle.

REESS shall be charged by one of the following devices under the ambient temperature specified in 2.3.2.2:

a) Car charger (if any);

b) Standard external charger.

The charging procedures mentioned above do not include any special charging procedures that are automatically or manually activated, such as equalizing charge or maintenance. Charging strategies of vehicles sold on the market that do not require additional operations are not considered as special charging procedures.

2.3.4.3.2 Criteria for Ending Charging

Charging is deemed as being completed when the vehicle or external instrumentation indicates that REESS is fully charged. If the vehicle or external instrumentation gives a clear signal that the REESS is not fully charged, the maximum charging time in this case is: 3 x the REESS energy (kWh)/power supply (kW) specified by the manufacturer of the vehicle.

2.3.5 Vehicle Exposure for Pre-treatment

2.3.5.1 Before the normal-temperature test, the vehicle shall be exposed to the ambient temperature of (23±3)℃ for 12-15 hours.

2.3.5.2 Before the low-temperature test, the vehicle shall be exposed to a low temperature of (-7±3)℃ for 12-15 hours. During this period, the hourly average ambient temperature shall be maintained at (-7±3)℃; the instantaneous temperature shall be kept within the temperature range of -13℃ to -1℃ and shall not be lower than -10℃ or more than -4℃ for 3 consecutive minutes.

2.3.5.3 Before the high-speed test, the vehicle shall be exposed to the ambient temperature for 12-15 hours.

2.3.6 Test of Driving Range

2.3.6.1 Setting of Road Load for the Vehicle

a) The driving resistance for the tests of normal-temperature and high-speed driving range shall be set according to Annex C of GB 18352.6-2016.

b) Driving resistance for the test of low-temperature driving range: The resistance of chassis dynamometer for the test of low-temperature driving range shall be the resistance of chassis dynamometer, A, B and C, for the test of normal-temperature driving range multiplied by 1.1.

2.3.6.2 Air Conditioning Settings for the Low-Temperature Test

When the test cycle starts, the air conditioning shall be set to the external circulation and the air on the legs only modes. The air conditioning settings may respect the temperature and air flow settings specified by the manufacturer of the vehicle, so that the average temperature of the test points in the car will reach more than 20℃ as soon as possible. Until the end of the test, it shall be kept within the temperature range of 20℃-22℃ when possible. If the manufacturer of the vehicle does not submit clear operational requirements, the setting steps are as follows:

a) For automatically controlled air conditioning, the air conditioner shall be set to the "Auto" mode and the maximum temperature, and the air circulation switch is placed in the external circulation and the air on the legs only modes. The air conditioning setting shall meet four requirements only; if there are different requirements other than these four requirements in the "Auto" mode, it can be switched to manual mode for control. After the temperature inside the vehicle reaches 20℃, the temperature knob shall be adjusted to keep the average temperature of the test points inside the vehicle within the range of 20℃-22℃ when possible.

b) For manually controlled air conditioning, the temperature condition switch shall be placed in the maximum heating mode position; the air flow adjustment switch shall be placed in the maximum position; the air circulation switch shall be placed in the external circulation and the air on the legs only positions. After the temperature inside the vehicle reaches 20℃, the air flow adjustment switch shall be placed in the medium position and the temperature knob shall be adjusted to keep the average temperature of the test points inside the vehicle within the range of 20℃-22℃ when possible.

c) For vehicles with middle and rear air vents, the middle and rear air vents shall be turned off or closed; if the switches cannot be closed through settings or control, they shall be closed manually. The front air vent shall be adjusted to the maximum opening and the medium direction.

During the test, temperature changes (see Annex 1 for the distribution of temperature test points) in the test points inside the passenger compartment shall be recorded continuously in real time with an acquisition frequency of not less than 1Hz. The average temperature of all the test points shall be calculated and monitored, and the time t_L takes for this average temperature to first reach 20°C shall be recorded. Until the end of the test, this average temperature shall be kept within the range of 20℃-24℃ for every 10min and within the range of 17℃-25℃ for every 1 minute.

2.3.6.3 Test Conditions and Processes

2.3.6.3.1 Test Conditions of Normal-Temperature Driving Range

The test conditions of the normal-temperature driving range are based on the combined conditions under CLTC-P. The speed segment consists of two test cycle segments and two constant speed segments, as shown in Figure 1-2, where DS_1 and DS_2 are the test cycle segments, while CSS_M and CSS_E are constant speed segments, which are composed of higher constant speeds to discharge as soon as possible, reduce the test time, and stop the test in time when the conditions for ending the test are triggered.

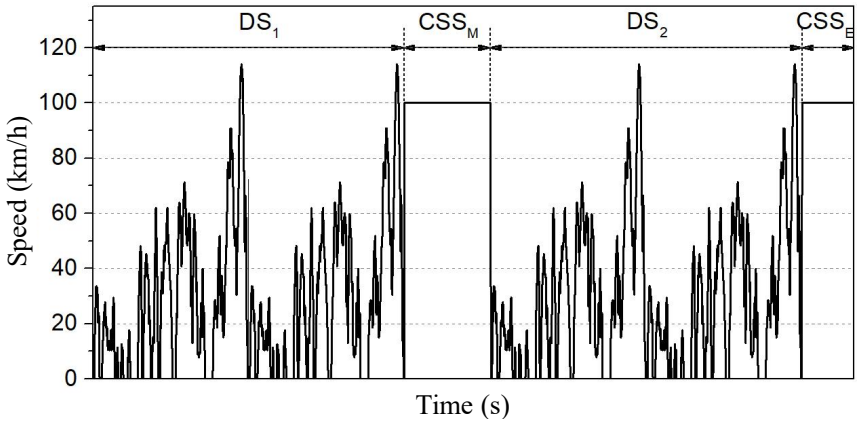

Figure 1-2 Target Speed of M_1 Vehicles

2.3.6.3.1.1 Test Cycle Segments

The test cycle segments are composed of the test cycles specified in 2.3.6.3.1, and each test cycle segment includes two CLTC-P cycles.

2.3.6.3.1.2 Constant Speed Segments

2.3.6.3.1.2.1 Speed Requirement

The recommended speed for the constant speed segments is 100km/h; the maximum speed of the vehicle for 30min is less than the recommended speed, the recommended speed for the constant speed segments shall be set as the maximum speed of the vehicle for 30min.

After the end of the test cycle segments, the vehicle shall be accelerated to the constant speed segments steadily and within 1min. After the end of the constant speed segments, the vehicle shall be parked as specified in 2.3.3.4.4.

2.3.6.3.1.2.2 Distance Requirement

The distance for the constant speed segment CSS_E shall be based on the percentage of $E_{REESS,STP}$ specified in 2.3.8.3. After the end of the test cycle segment DS_2, the remaining energy of REESS shall not be more than 10% of $E_{REESS,STP}$. If this requirement is not met, the test shall be restarted.

The distance for the constant speed segment CSS_M shall be calculated according to the following formula (1-5):

$$d_{CSS_M} = BER_{est} - d_{DS_1} - d_{CSS_E} - d_{DS_2} \quad (1\text{-}5)$$

In which:

d_{CSS_M} - Distance for the constant speed segment CSS_M, km;

BER_{est} - Estimated driving distance of the vehicle on the chassis dynamometer, tested with the shortening method, km;

d_{DS_1} - Distance for the test cycle segment DS_1, km;

d_{CSS_E} - Distance for the constant speed segment CSS_E, km;

d_{DS_2} - Distance for the test cycle segment DS_2, km.

2.3.6.3.2 Test Conditions of Low-Temperature Driving Range

The test of low-temperature driving range shall repeat the CLTC-P conditions.

2.3.6.3.3 Test Conditions of High-speed Driving Range

A test with the constant speed of (120±2)km/h shall be conducted, and the vehicle is allowed to stop twice during the test, each time for less than 2min. The test shall be stopped in time when the conditions for ending the test are triggered as specified in 2.3.3.4.3.

The number and duration of vehicle stops during the test shall be recorded. When the test cycle ends and the vehicle stops, the distance BER_S that the vehicle under test has travelled, measured in kilometers (km), shall be recorded and rounded to an integer. This distance is the driving range measured with the constant high-speed method. At the same time, the duration shall be recorded, measured in hours (h).

2.3.6.3.4 Test of Normal-Temperature Driving Range

a) The initial charging of the power battery shall be conducted as specified in 2.3.4;

b) The vehicle shall be exposed for pre-treatment within 12 hours after the power battery is charged as specified in 2.3.5;

c) After the vehicle has been exposed as required in the preceding paragraph, the test of driving range shall be conducted under the test conditions specified in 2.3.6.3.1 until the test cycle ends (See 2.3.3.4.2). During the test, the current and voltage of REESS shall be recorded in real time as specified in 2.3.7.1.

d) After the test, REESS shall be recharged as specified in 2.3.4.3, and the external charge input shall be measured.

e) The normal-temperature driving range BER_N of the vehicle shall be calculated;

f) If the vehicle needs to be moved between every two steps, the on-board power shall not be used to move the vehicle to the next test location and the regenerative braking system shall not be applied.

2.3.6.3.5 Test of Low-Temperature Driving Range

a) The initial charging of the power battery shall be conducted as specified in 2.3.4;

b) The vehicle shall be exposed for pre-treatment within 12 hours after the power battery is charged as specified in 2.3.5;

c) After the vehicle has been exposed as required in the preceding paragraph, the test of driving range under the CLTC-P conditions shall be conducted until the end of the test cycle (See

2.3.3.4.1). The air conditioning shall be set as required (See 2.3.6.2), and the driving range BER_L of the vehicle under test shall be calculated;

d) If the vehicle needs to be moved between every two steps, the on-board power shall not be used to move the vehicle to the next test location and the regenerative braking system shall not be applied.

2.3.6.3.6 Test of High-speed Driving Range

a) The initial charging of the power battery shall be conducted as specified in 2.3.4;

b) The vehicle shall be exposed for pre-treatment within 12 hours after the power battery is charged as specified in 2.3.5;

c) After the vehicle has been exposed as required in the preceding paragraph, the test of high-speed driving range shall be conducted until the end of the test cycle (See 2.3.3.4.3). The air conditioning shall be set as required (See 2.3.6.2), and the driving range BER_s of the vehicle under test shall be calculated;

d) If the vehicle needs to be moved between every two steps, the on-board power shall not be used to move the vehicle to the next test location and the regenerative braking system shall not be applied.

2.3.7 Determination of the Currents and Voltages of REESS in the Test of Normal-Temperature Driving Range

From the beginning to the end of the test as specified in 2.3.3.4, all the currents and voltages of REESS shall be measured during the test as specified, and no REESS current and voltage test instruments shall be turned off during the exposure of the vehicle. If timed integrating instruments are used, they shall be maintained in the operating condition during the test.

2.3.7.1 Measurements of Currents and Voltages of REESS

2.3.7.1.1 The currents of REESS shall be measured with a clamped or closed current sensor during the test.

2.3.7.1.2 The current sensor shall be connected to the REESS cable to measure the currents of REESS. The measured currents shall be the total currents of REESS. The minimum sampling frequency of current sensor and recording frequency of current data are 20Hz.

2.3.7.1.3 When the voltages of REESS are measured with external measuring equipment, the measurement shall be made at a suitable, safe and convenient connection point on the vehicle. The minimum recording frequency of voltage data is 20Hz.

2.3.7.2 Charging and Charge Input Measurement of REESS

After the test, the vehicle shall be charged within 2h as specified in 2.3.4.3.1 and with the

method as used before the test. When an AC charging method is used, the charge input measuring equipment shall be installed between the plug and the power supply equipment of the vehicle; if a DC charging method is used, the charge input measuring equipment shall be installed between the power supply equipment and the power grid. When the requirements of 2.3.4.3.2 are met, the charging of REESS is completed.

The external charging input E_{AC} and the charging time shall be measured as specified in 2.3.4.3.1. When the requirements of 2.3.4.3.2 are met, the charge input measurement is completed.

2.3.8 Calculation of Normal-Temperature Energy Consumption and Driving Range

2.3.8.1 Formulas for Calculating Energy Consumption and Driving Range

The formulas for calculating the energy consumption and driving range of the vehicle are as follows:

$$EC_{DC,j} = \frac{\Delta E_{REESS,j}}{d_j} \tag{1-6}$$

In which:

$EC_{DC,j}$ - The energy consumption in the speed interval j based on the electrical energy changes of REESS, Wh/km;

j - The number of speed interval: for a complete test cycle, j is c;

d_j - The driving range of the vehicle in the speed interval j, km;

$\Delta E_{REESS,j}$ - The electrical energy changes of all the REESS in the speed interval j, Wh; and calculated with the formula (1-7):

$$\Delta E_{REESS,j} = \sum_{g=1}^{m} \Delta E_{REESS,g,j} \tag{1-7}$$

In which:

g - The number of REESS;

m - The total number of REESS;

$\Delta E_{REESS,g,j}$ - The electrical energy change of REESS numbered g within the time range of the speed interval j, Wh; and calculated with the formula (1-8):

$$\Delta E_{REESS,g,j} = \frac{1}{3600} \times \int_{t_0}^{t_{end}} U(t)_{REESS,g,j} \times I(t)_{g,j} dt \tag{1-8}$$

In which:

t_0 - The start time of the speed interval j, s;

t_{end} - The end time of the speed interval j, s;

$U(t)_{REESS,g,j}$ - The voltage of REESS numbered g within the time range of the speed interval j at t, V;

$I(t)_{g,j}$ - The current of REESS numbered g within the time range of the speed interval j at t, A.

2.3.8.2 Energy Consumption

The energy consumption shall be calculated with the formula (1-9):

$$EC = \frac{E_{AC}}{BER} \tag{1-9}$$

In which:

EC - The energy consumption sourced externally, Wh/km;

E_{AC} - The charge input from an external source measured as specified in 2.3.7.2, Wh;

BER - The driving range calculated as specified in 2.3.8.3, km.

2.3.8.3 Normal-Temperature Driving Range

The driving range based on the shortening method shall be calculated with the formula (1-10):

$$BER = \frac{E_{REESS,STP}}{EC_{DC}} \tag{1-10}$$

In which:

BER - The driving range, km;

$E_{REESS,STP}$ - The charge input change of REESS before and after the test with the shortening method, Wh;

EC_{DC} - The energy consumption based on the charge input change of REESS, Wh/km.

In which, $E_{REESS,STP}$ and EC_{DC} shall be calculated with the formula (1-11) and Formula (1-12):

$$E_{REESS,STP} = \Delta E_{REESS,DS_1} + \Delta E_{REESS,CSS_M} + \Delta E_{REESS,DS_2} + \Delta E_{REESS,CSS_E} \tag{1-11}$$

In which:

$\Delta E_{REESS,DS_1}$ - The charge input changes of all the REESS in the test cycle segment DS_1 calculated as specified in 2.3.8.1, Wh;

$\Delta E_{REESS,CSS_M}$ - The charge input changes of all the REESS in the constant speed segment CSS_M calculated as specified in 2.3.8.1, Wh;

$\Delta E_{REESS,DS_2}$ - The charge input changes of all the REESS in the test cycle segment DS_2 calculated as specified in 2.3.8.1, Wh;

$\Delta E_{REESS,CSS_E}$ - The charge input changes of all the REESS in the constant speed segment CSS_E calculated as specified in 2.3.8.1, Wh.

$$EC_{DC} = \sum_{c=1}^{4} \left(EC_{DC,c} \times K_c \right) \tag{1-12}$$

In which:

c - The number of test cycles: There are four test cycles in the two test cycle segments, DS_1 and DS_2;

$EC_{DC,c}$ - The energy consumption based on the charge input change of REESS in the test cycle c, Wh/km;

K_c - The weight coefficient of the test cycle c, calculated with the formula (1-13):

$$K_c = \begin{cases} \dfrac{\Delta E_{REESS,c}}{E_{REESS,STP}}, (c \le 2) \\ \dfrac{1 - K_1 - K_2}{2}, (c > 2) \end{cases} \quad (1\text{-}13)$$

In which:

$\Delta E_{REESS,c}$ - The charge input changes of all the REESS in the test cycle c calculates as specified in 2.3.8.1, Wh.

2.3.8.4 Low-temperature Driving Range

The low-temperature driving range shall be calculated with Formula (1-14):

$$BER_L = \frac{E_{REESS.CCP}}{EC_{DC}} \quad \text{.....(1-14)}$$

In which:

BER_L - The low-temperature driving range, km;

$E_{REESS,CCP}$ - The charge input change of REESS before and after the test of low-temperature driving range, Wh;

EC_{DC} - The energy consumption based on the charge input change of REESS, Wh/km.

In which, $E_{REESS,CCP}$ and EC_{DC} shall be calculated with Formula (1-15) and Formula (1-16), respectively:

$$E_{REESS,CCP} = \sum_{j=1}^{k} \Delta E_{REESS,j} \quad \text{.....(1-15)}$$

In which:

k - The number of speed intervals traveled by the vehicle after the end of the low-temperature driving range test, including the speed intervals uncompleted when the criteria for ending the test specified in 4.2.3.3.4.1 are met;

$\Delta E_{REESS,j}$ - The charge input changes of all the REESS in the speed interval j calculated as specified in 2.3.8.1, Wh.

$$EC_{\mathrm{DC}}=\sum_{c=1}^{n}\left(EC_{\mathrm{DC},c}\times K_c\right) \quad \text{……(1-16)}$$

In which:

c - The number of test cycles;

n - The number of complete test cycles traveled by the vehicle after the end of the test, excluding the test cycles uncompleted when the criteria for ending the test specified in 2.3.3.4.1 are met;

$EC_{\mathrm{DC},c}$ - The energy consumption based on the charge input change of REESS in the test cycle c, Wh/km;

K_c - The weight coefficient of the test cycle c, calculated with Formula (1-17):

$$K_c=\begin{cases}\dfrac{\Delta E_{\mathrm{REESS},c}}{E_{\mathrm{REESS,CCP}}},(c\le 2)\\ \dfrac{1-K_1-K_2}{n-2},(c>2)\end{cases} \quad \text{……(1-17)}$$

In which:

$\Delta E_{\mathrm{REESS},c}$ - The charge input changes of all the REESS in the test cycle c calculated as specified in 2.3.8.1, Wh.

2.3.9 Calculation of the Reduction Rate of Driving Range

The reduction rate of low-temperature driving range: $(BER_N\text{-}BER_L)/BER_N\times 100\%$, accurate to one decimal place;

The reduction rate of high-speed driving range: $(BER_N\text{-}BER_S)/BER_N\times 100\%$, accurate to one decimal place;

BER_N - Normal-temperature driving range, km;

BER_L - Low-temperature driving range, km;

BER_S - High-speed driving range, km;

2.4 Test Method of the Accuracy of Driving Range Estimate

The test of the accuracy of driving range estimate shall be conducted concurrently with the test of driving range under the CLTC-P conditions. In order to calculate the accuracy of driving range estimate, the remaining driving ranges indicated on the instrument and the actual driving

range shall be collected and characterized. If the instrument of the vehicle under test does not indicate the remaining driving range, the test shall not be conducted and scored. The remaining driving range indicated on the instrument is expressed by y_i as the observed value, and the actual driving range is expressed by $\hat{y}_i$ in a regression line. The deviation shall be evaluated with the goodness-of-fit algorithm, namely the coefficient of determination.

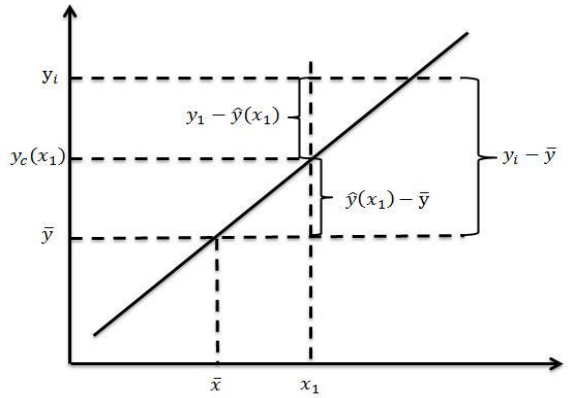

Figure 1-3 Mathematical Model of Driving Range Estimate

The accuracy of driving range estimate includes the low-temperature driving range and the high-speed driving range and shall be calculated with the formula below:

$$R^2 = 1 - \frac{\sum(\hat{y}_i - y_i)^2}{\sum(\bar{y} - y_i)^2} \quad (1\text{-}18)$$

In which:

R^2 - The coefficient of determination for the accuracy of driving range, accurate to four decimal places;

y_i - The remaining driving range indicated on the instrument: the remaining driving range indicated on the instrument when every test cycle ends during the test. (During the test of high-speed driving range, a sample is collected for every 15km.) When the charge is too low to be indicated on the instrument, the remaining driving range shall be "0", measured in kilometers (km) and rounded to an integer;

$\hat{y}_i$ - The actual driving range: the driving range travelled by the vehicle, recorded as corresponding to the remaining driving range indicated on the instrument (y_i) and calculated by the driving range completed by the vehicle minus the driving range travelled during the sampling, measured in kilometers (km) and rounded to an integer;

$\bar{y}$ - The average of the remaining driving ranges indicated on the instrument recorded in all the sampling points, measured in kilometers (km) and rounded to an integer.

2.5 Relevant Parameters and Precision of Test

The relevant parameters and precision of the test results shall comply with the requirements shown in Table 1-20. During the specified calculation, the process data shall not be rounded, unless otherwise specified.

Table 1-20 Relevant Parameters and Precision of Test Results

Parameter	Unit	Precision of Test Result
Energy consumption (EC)	Wh/km	Rounded to an integer
Charge input (E_{AC})	Wh	Rounded to an integer
Driving range (BER)	km	Rounded to an integer

2.6 Charging Test Methods

2.6.1 Test Method of Charging Time

2.6.1.1 Test Conditions

Specification of DC charging equipment: a DC charging system with maximum output voltage and maximum output current that can meet the maximum demand values of the vehicle;

The charging interface of the DC charging system shall comply with GB/T 20234.1-2015 and GB/T 20234.3-2015. The communication protocol shall comply with GB/T 27930, or the test shall be conducted under the communication protocol provided by the manufacturer of the vehicle that has been modified according to GB/T 27930.

2.6.1.2 Pre-treatment of the Vehicle

The vehicle shall be discharged to below 20% of SOC and then charged to 30% of SOC with the DC charging test system with a charging power of no more than 30kW. The SOC of the vehicle is based on the charging message.

2.6.1.3 Test Procedures of Charging Time

2.6.1.3.1 The vehicle shall be exposed to the target temperature for 14-16 hours before being charged and shall be tested under the target temperature.

2.6.1.3.2 For the DC charging test, the charge input between the charging pile and the electric vehicle shall be recorded continuously in real time with a frequency of not less than 1Hz during charging, and the time t takes for the vehicle to be charged to 90% of the SOC (measured in h, accurate to two decimal places) as well as the corresponding charging input E shall be recorded.

Note: The SOC of the vehicle is based on the charging message.

2.6.1.3.3 Calculation Method of Charging Power

DC charging power: the ratio of E to t (kWh/h, accurate to two decimal places).

(Measured in h, accurate to two decimal places).

Note: If charging stops abnormally for the first time during the test, the vehicle should be pre-treated again and re-tested; if charging stops abnormally for the second time during the test, the test shall be stopped.

2.6.1.4 Target Temperature of Charging

2.6.1.4.1 Normal charging temperature: 25±5℃;

2.6.1.4.2 Low charging temperature: -10±2℃;

2.6.2 Test Method of Charging Compatibility

2.6.2.1 General Provisions

The vehicle-pile compatibility test refers to the DC charging compatibility test.

The charging compatibility test shall be conducted with DC charging piles that meet the requirements of GB/T 34657.1-2017, GB/T 34658-2017, GB/T 20234.1-2015 and GB/T 20234.3-2015.

During the test, the type of the charging piles used and the detailed test results shall be recorded.

2.6.2.2 Test Conditions

2.6.2.2.1 The test shall be conducted under the ambient temperature.

2.6.2.2.2 The deliverable test samples shall include the necessary operating documentation and interface components (such as connectors and charging plugs) required for connection with the test equipment. The supplier of test samples shall provide the safe working limits of the samples to ensure the safety of the entire test process.

2.6.2.2.3 Alternative Charging Pile Depot

Please visit the official website of C-NCAP.

2.6.2.2.4 Test of Normal Charging Start

When the vehicle is cut off power supply, the vehicle shall be fully plugged with the socket and the DC charging pile shall be operated to start charging within 3min. The vehicle shall start charging normally and shall be charged continuously for 5min or reach the target SOC. After the conditions for ending charging are met, the vehicle shall stop charging normally.

2.6.2.2.5 Test of Normal Charging Start under the Air Conditioner Heating Mode

When the vehicle is connected to power supply, the air conditioner is turned on for heating, and both the target temperature and the air flow speed are set to the maximum, the vehicle shall be fully plugged with the socket and the DC charging pile shall be operated to start charging within 3min. The vehicle shall start charging normally and shall be charged continuously for 5min or reach the target SOC. After the conditions for ending charging are met, the vehicle shall stop charging normally.

2.6.2.2.6 Test of Normal Charging Start under the Air Conditioner Cooling Mode

When the vehicle is connected to power supply, the air conditioner is turned on for cooling, the target temperature is set to the minimum and the air flow speed is set to the maximum, the vehicle shall be fully plugged with the socket and the DC charging pile shall be operated to start

charging within 3min. The vehicle shall start charging normally and shall be charged continuously for 5min or reach the target SOC. After the conditions for ending charging are met, the vehicle shall stop charging normally.

2.6.2.2.7 Checking of Non-working Charging interface with Power Supply Connected

During the DC charging process, the AC/DC voltages of the AC socket terminals of the vehicle (between any two of L, N and PE) shall be measured and meet at least one of the following conditions:

(1) The voltages shall be less than 60 V DC and 30V AC;

(2) The steady-state pick-up current shall be less than 0.5mA AC and 2mA DC.

2.6.3 Test Method of Charging Protection

2.6.3.1. Protective Conductor

The power supply plug or the vehicle socket shall have a conductor terminal for connecting the electrical platform of the vehicle with an external protective conductor of power supply. The connecting resistance of the protective conductor between its terminal and the electrical platform of the vehicle and between all exposed conductive parts of the power supply circuit of the vehicle shall be less than 0.1Ω and shall apply to all the conductive paths that protect the connections of the protective conductor.

2.6.3.2. Pick-up Current

When the vehicle is connected to an external power supply, the effective value of the AC pick-up current of the vehicle under the single point of failure shall not be more than 3.5mA the DC pick-up current shall not be more than 10mA, and the pick-up current under normal operating conditions shall not be more than 0.5mA AC or 2mA DC.

2.6.3.3. Y Capacitance

The total Y capacitance of the on-board power supply circuit of the vehicle shall not exceed 4μF.

2.6.3.4. Over-temperature Protection of Charging Interface

The temperature of the DC power terminal of the vehicle socket shall not exceed the temperature limit specified by the manufacturer. It shall not exceed 90°C when the ambient temperature does not exceed 40°C during charging. If it exceeds 90°C due to external heating, protective measures shall be triggered for the vehicle (see ISO 17409 for the test method).

2.6.3.5. Over-current Protection

When the supply voltage of the external power supply exceeds the over-voltage and under-voltage protection values of the vehicle, the vehicle shall stop charging. When the charging current output from an off-board charger is 1.2 times more than the demand current of the vehicle or the over-current protection value specified by the manufacturer, the vehicle shall give a response to stop charging.

2.6.3.6. Recharging after Full Charging

When the vehicle is fully charged, the plug of the vehicle shall be unplugged within 5min and reinserted. K5 and K6 shall not be closed, and the vehicle shall not start charging.

Note: The start of recharging due to normal battery power reduction caused by the use of electrical equipment or DCDC on the vehicle shall not be considered as non-compliance.

Annex 1: Temperature Measurement Positions

1. Temperature measurement points shall be arranged in each passenger seat in the front row. Longitudinally adjustable seats shall be locked rearward right in or closest to the middle of the travel. Individually height adjustable seats shall be adjusted to the manufacturer's design position or the lowest position. Seat backrests shall be adjusted to the manufacturer's design angle or tilting 25° backward from the vertical plane.

2. The positions of the temperature measurement points are shown in Figure A.1.

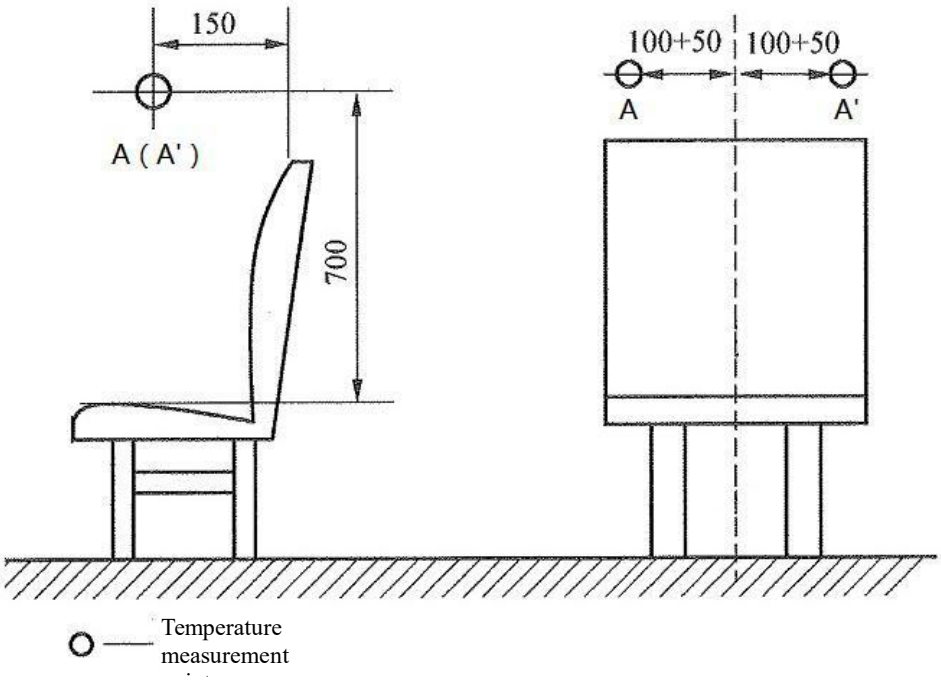

Figure A.1 Positions of Temperature Measurement Points

Annex 2: Test Specification Requirements

1. Test Conditions

1.1 Road Conditions

The test road can be a general highway, a high-speed ring road, and a paved social road in the test site, and the road surface shall not be obviously slippery.

1.2 Environmental Conditions

The test shall not be conducted in rainy, snowy, foggy or windy weather that may affect safety.

1.3 Vehicle Conditions

The tire pressure and four-wheel alignment parameters of the vehicle shall be the specified values provided by the manufacturer.

The vehicle shall not carry anyone or anything not related to the test and shall not contain anything that may splash easily, and any load on the vehicle shall be well fixed.

The tire tread depth of the vehicle shall not be less than 90% of the tread depth of a new tire.

1.4 Running-in Milage

The vehicle under test shall drive for a running-in mileage of 3,000km.

2. Test Method

2.1 Speed and Mileage Corrections

The speed indicator and the odometer of the sample vehicle shall be corrected according to GB/T 12548.

2.2 Running-in Requirements

No.	Test Mile	Load Status	Acceleration Operation	Speed Requirement	Deceleration Operation
1	0-1000km	Light load (with one driver only)	Depress the accelerator pedal slightly	≤120km/h	Normal braking
2	1001-2000km	Half load	Depress the accelerator pedal moderately to heavily	≤80%V_{max}	Normal braking
3	2001-3000	Full load	Depress the accelerator pedal	Accelerate from standstill to 80% of V_{max} (not more than 120km/h), decelerate to 60km/h	Retarding brake with a deceleration

No.	Test Mile	Load Status	Acceleration Operation	Speed Requirement	Deceleration Operation
			moderately to heavily	with the specified deceleration, then accelerate to 80% of V_{max} (not more than 120km/h), decelerate to 60km/h with the specified deceleration, and repeat this process for cumulatively 200 times; then the vehicle shall travel the remaining running-in mileage at a speed not more than 80% of V_{max} (with normal braking for deceleration) until it meets the specified mileage requirement.	of $3m/s^2$