

AUTOMOTIVE INDUSTRY STANDARDS

**Electric Power Train Vehicles -
Method of Measuring the Range**

(Revision 1)

PRINTED BY
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P.B. NO. 832, PUNE 411 004

ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

February 2015

Status chart of the Standard to be used by the Purchaser for updating the record.

Sr. No.	Corrigenda	Amendment	Revision	Date	Remark	Misc.

General Remarks :

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of Standards and development of test facilities in parallel when the work of preparation of Standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the Standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standard Committee (AISC) vide order no. RT-11028/11/97-MVL dated September 15, 1997. The Standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC) after approval, The Automotive Research Association of India, (ARAI), Pune, being the secretariat of the AIS Committee, has published this Standard. For better dissemination of this information, ARAI may publish this standard on their website.

This standard prescribes the requirements for the measurement of range of battery operated vehicle.

Considerable assistance has been taken from UN R101 Rev 3(Supplement 1 to the 01 series of amendments - Date of entry into force: 27 January 2013): Uniform Provisions concerning the approval of Passenger Cars powered by an Internal Combustion Engine only, or powered by a Hybrid Electric Power Train with regard to the measurement of the Emission of Carbon Dioxide and Fuel Consumption and/or the measurement of Electric Energy Consumption and Electric Range, and of categories M1 and N1 vehicles powered by an Electric Power Train only with regard to the measurement of Electric Energy Consumption and Electric Range.

The AISC panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annex A and Annex B respectively.

Electric Power Train Vehicles - Method of Measuring the Range

Contents

Para. No.	Items	Page No.
1	Scope	1/6
2	Definitions	1/6
3	Vehicle Preparation	1/6
4	Climate Condition	1/6
5	Test Procedure	1/6
6	Technical Specification	4/6
7	Transitional Provisions	4/6
List of Annexes		
Annex A	Composition of AISC Panel	5/6
Annex B	Composition of AISC	6/6

Electric Power Train Vehicles - Method of Measuring the Range

1.0 SCOPE

This standard specifies the method for measurement of range expressed in km for L, M and N categories of Electric Power Train Vehicles as defined in Rule 2 (u) of CMVR.

2.0 DEFINITIONS

Refer AIS-049:2003 as amended and revised from time to time, for the definitions.

3.0 VEHICLE PREPARATION

Vehicle preparation shall be as per details given in para 3 of AIS-039 (Rev. 1).

4.0 CLIMATE CONDITION

Climate conditions shall be as per details given in para 3.4 of AIS-039 (Rev.1).

5.0 TEST PROCEDURE

5.1 Test Sequence

5.1.1 The driving cycle shall be the Indian Driving Cycle (IDC) as given in Annexure-II of CMVR for all L category vehicles.

5.1.2 The driving cycle shall be Part-I of the modified Indian driving cycle as given in Annexure-IV B of CMVR for M1, M2 (with GVW upto 3500 kg) and N category of vehicles.

The driving cycle shall be Delhi Driving Cycle as given in AIS-049:2003 as amended and revised from time to time (Rev 1) for M2 (with GVW above 3500 kg) and M3 category of vehicles.

5.1.3 In cases where the vehicle does not reach the required acceleration during driving, the accelerator/speed control shall remain fully activated until the reference curve has been reached again

5.2 Power setting of the chassis dynamometer

The procedure prescribed in the document MoRTH/TAP/CMVR-115/116 as amended from time to time shall be adopted. Reference mass shall be taken as defined in AIS-049:2003 as amended and revised from time to time.

5.3 Test Method

5.3.1 Principle

The test method described hereafter permits to measure the range of the Electric Power Train Vehicles expressed in km.

5.3.2

Parameters, Units and Accuracy of Measurements Parameter	Unit	Accuracy	Resolution
Time	s	+/- 0.1 s	0.1 s
Distance	m	+/-0.1 per cent	1m
Temperature degrees	C	+/- 1 degree C	1 degree C
Speed	km/h	+/- 1 per cent	0.2 km/h
Mass	kg	+/-0.5 per cent	1 kg
Electricity balance	Ah	+/-0.5 per cent	0.3 per cent
Where accuracy is specified in %, it is the % of the measured value			

5.4 Operation Modes

The test method includes the following steps:

- a) Initial charge of the Rechargeable Energy Storage System (REESS)
- b) Application of the cycle and measurement of the range.

Between the steps, if the vehicle has to be moved, it is pushed to the following test area (without regenerative recharging).

5.4.1 Initial charge of the Rechargeable Energy Storage System (REESS)

Charging the REESS consists of the following procedures:

Note: "Initial charge of the REESS" applies to the first charge of the REESS, at the reception of the vehicle. In case of several combined tests or measurements, carried out consecutively, the First charge carried out shall be an "initial charge of the REESS" and the following may be done in accordance with the "normal overnight charge" procedure.

5.4.1.1 Discharge of the Rechargeable Energy Storage System (REESS)

- 5.4.1.1.1 The procedure starts with the discharge of the REESS of the vehicle while driving (on the test track, on a chassis dynamometer, etc.) at a steady speed of 70 per cent +/-5 percent from the maximum thirty minutes speed of the vehicle.

5.4.1.1.2 Stopping the discharge occurs:

- (a) When the vehicle is not able to run at 65 per cent of the maximum thirty minutes speed;
- (b) Or when an indication to stop the vehicle is given to the driver by the standard onboard instrumentation; or
- (c) After covering the distance of 100 km.

5.4.1.2 Application of a normal overnight charge

The Rechargeable Energy Storage System (REESS) shall be charged according to the following procedure.

5.4.1.2.1 Normal overnight charge procedure

The charging is carried out:

- (a) With the on board charger if fitted; or
- (b) With an external charger recommended by the manufacturer using the charging pattern prescribed for normal charging;
- (c) In an ambient temperature comprised between 20 °C and 30 °C.

Note: If the ambient condition cannot be met at the time of the test, then based on mutual agreement between test agency and vehicle manufacturer, requirement of ambient temperature condition can be waived.

This procedure excludes all types of special charges that could be automatically or manually initiated like, for instance, the equalisation charges or the servicing charges. The manufacturer shall declare that during the test, a special charge procedure has not occurred.

5.4.1.2.2 End of charge criteria

The end of charge criteria corresponds to a charging time not exceeding twelve hours, except if a clear indication is given to the driver by the standard instrumentation that the REESS is not yet fully charged.

In this case,

$$\text{the maximum time is } = \frac{3 \times \text{claimed battery capacity (Wh)}}{\text{mains power supply (W)}}$$

5.5 Application of the Cycle and Measurement of the Range

The test sequence shall be followed as per 5.1 above.

The end of test criteria shall be when the vehicle is not able to meet the target curve up to 50 km/h , (or 85% of the maximum speed of the driving cycle or 85% of the maximum speed of the vehicle for L1 category of vehicles only) or when an indicator from the standard on-board instrumentation is given to the driver to stop the vehicle. Then the vehicle shall be slowed down to 5 km/h by deactivating the accelerator control , without touching the brake control and then stopped by braking.

When the vehicle does not reach the required acceleration or speed of the test cycle, the accelerator control shall remain fully activated until the reference curve has been reached again.

To respect human needs, up to three interruptions shall be permitted between test sequences of not more than 15 minutes in total.

At the end, measure D of the covered distance in km is the electric range of the electric vehicle. It shall be rounded to nearest whole number.

6.0 TECHNICAL SPECIFICATIONS

The details of technical specification, approvals of changes in specification shall be as per para 5.0 of AIS-049:2003 as amended and revised from time to time.

7.0 TRANSITIONAL PROVISIONS

- 7.1 General guidelines for transitional provisions for this standard shall be as per AIS-000, as amended from time to time, as applicable with the following requirement.
- 7.2 For L category vehicles type approvals issued for compliance to AIS-040-2003 shall be extended for approval to of AIS-040 (Rev1)-2015. A retest may be performed at the request of manufacturer.
- 7.3 For M and N category vehicles re-testing shall be carried out for compliance to AIS 040 (Rev 1): 2015 from the date of notification. Manufacturers may request testing as per this standard from the date of adoption of this standard in CMVR-TSC.

(See Introduction)

**COMPOSITION OF AISC PANEL ON
ELECTRIC POWER TRAIN VEHICLES- CONSTRUCTION
AND FUNCTIONAL SAFETY REQUIREMENTS***

Convener	
Mr. A.A. Deshpande	The Automotive Research Association of India (ARAI)
Members	Representing
Mr. M.M.Desai	The Automotive Research Association of India (ARAI)
Mr. D. P. Saste/ Mr. Karthikeyan K (Alternate)	Central Institute of Road Transport (CIRT)
Representative from	International Centre for Automotive Technology (ICAT)
Mr. Vinod Kumar	Vehicle Research & Dev. Estt. (VRDE)
Dr. N. Karuppaiah	National Automotive Testing and R&D Infrastructure Project (NATRIP)
Mr. K. K. Gandhi	Society of Indian Automobile Manufacturers (SIAM)
Mr. T. M. Balaraman	Society of Indian Automobile Manufacturers (SIAM) (Hero MotoCorp Ltd.)
Mr. Adish Agrawal	Society of Indian Automobile Manufacturers (SIAM) (Hero MotoCorp Ltd.)
Mr. Rajendra Khile	Society of Indian Automobile Manufacturers (SIAM) (General Motors)
Mr. Kiran Mulki	Society of Indian Automobile Manufacturers (SIAM) (Mahindra and Mahindra)
Mr. K. Kiran Kumar	Society of Indian Automobile Manufacturers (SIAM) (Mahindra Reva)
Mr. Vijeth R Gatty	Society of Indian Automobile Manufacturers (SIAM) (Toyota Kirloskar Motors Ltd.)
Mr. Firoz Khan	Society of Indian Automobile Manufacturers (SIAM) (Tata Motors Ltd.)
Mr. Vivekraj S	Society of Indian Automobile Manufacturers (SIAM) (Renault Nissan)
Mr. P. C. Joshi	Bureau of Indian Standards (BIS)

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEX B
(See Introduction)
COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

Chairperson	
Mrs. Rashmi Urdhwareshe	Director The Automotive Research Association of India, Pune
Members	Representing
Representative from	Ministry of Road Transport and Highways (Dept. of Road Transport and Highways), New Delhi
Representative from	Ministry of Heavy Industries and Public Enterprises (Department of Heavy Industry), New Delhi
Shri S. M. Ahuja	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi
Shri Shrikant R. Marathe	Former Chairman, AISC
Shri N. K. Sharma	Bureau of Indian Standards, New Delhi
Director/ Shri D. P. Saste (Alternate)	Central Institute of Road Transport, Pune
Director	Indian Institute of Petroleum, Dehra Dun
Director	Vehicles Research and Development Establishment, Ahmednagar
Representatives from	Society of Indian Automobile Manufacturers
Shri T. C. Gopalan	Tractor Manufacturers Association, Chennai
Shri Uday Harite	Automotive Components Manufacturers Association of India, New Delhi

Member Secretary
Mr. A. S. Bhale
General Manager
The Automotive Research Association of India, Pune

* At the time of approval of this Automotive Industry Standard (AIS)