AUTOMOTIVE INDUSTRY STANDARDS

Electric Power Train Vehicles - CMVR Type Approval for Electric Power Train Vehicles

(Revision 1)

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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

March 2016

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

Sr.	Corrigenda	Amend-ment	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 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 document on their website.

This Standard prescribes the applicability of CMVR rules and corresponding Standards for Electric Power Train Vehicles.

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

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1.0 APPLICABILITY OF THE RULES PRESCRIBED IN CENTRAL MOTOR VEHICLES (AMENDMENT) RULES, 1989 (CMVR)

1.1 The following rules are not applicable for Electric Power Train Vehicles

Rule No.	Subject
112	Exhaust gases
113	Location of Exhaust Pipes.
114	Exhaust pipes of public service vehicles.
115, (A), (B), (C), (D)	Emission of smoke, vapour, etc. from motor vehicles.
116	Test for smoke emission level and carbon monoxide
120(1)	Silencers

1.2 The following rules are applicable, after taking into consideration the amendments listed in Annex A.

Rule No.	Subject
2	Definitions
96(4)	Brakes
101 (1)	Power operated windscreen Wiper
102	Signaling devices, direction indicators and stop lights.
103	Position of the indicator.
104	Fitment of reflectors.
105	Lamps
109	Parking light
110	Lamps on three-wheelers
120 (2)	Noise Standards
122	Embossment of the Chassis number and Engine number in the case of Electric Power Train Vehicles, motor number and month of manufacture
125(1)	Safety-belt, Collapsible steering column, auto-dipper and padded dashboards

1.3 All other rules of CMVR shall be applicable as detailed in each rule.

2.0 APPLICABILITY OF STANDARDS NOTIFIED UNDER RULE 124

2.1 The following standards are not applicable to electric power train vehicles

Standard No.	Subject
IS:12056:1987, AIS-033/2001 and IS 14681: 1999	Fuel Tanks
IS 14283: 1995	The accelerator control system
IS 10791: 1983	Control Cables
IS 13942: 1994	External Projection for two wheeled

2.2 Gradeability test (AIS-003)

This test would be conducted once, for electric powertrain vehicles at 60% state-of-discharge condition of the REESS (Rechargeable Energy Storage System).

The gradeability requirement in case of electric power train vehicles shall be as follows.

Two wheeled electric power train vehicles having net motor power less than or equal to 1000 W: 3.81°

All other electric power train vehicles: 7°

2.2 All other notified standards shall be applicable as per provisions of CMVR 1989.

3.0 STANDARDS REFERRED TO IN VARIOUS RULES OF CMVR

3.1 Brake performance:

The changes needed in the test procedure (IS 14664 and IS 11852 as applicable) for evaluating the prescribed performance requirements of braking systems for Electric Power Train Vehicles, to take into account regenerative braking system, are given in Annex B.

Note: Certain amendments to IS 14464 have been agreed in the AISC for incorporating the requirements of three wheelers with GVW between 1 and 1.5 T. These are given in Annex C, which shall be taken into account for compliance requirements.

3.2 Measurement of pass by noise level:

In IS 3028, the approach speed is specified in terms of the engine rpm in certain cases of vehicles. In case of electric power train vehicle the following are the applicable approach speeds:

3.2.1 50km/h or 75% of the maximum design speed of the vehicle whichever is lower, in the following types of vehicles

a) Two wheelers with maximum design speed exceeding 45km/hr, with manual shift gearbox (Para 8.2.1 of IS 3028:1998.)

b) Three wheelers with manual shift gearbox (Para 8.3 a) of IS 3028:1998).

c) Four wheeled and multi axles vehicles with manual gearbox or an automatic transmission with a manual over ride. (Para 8.4.1 of IS 3028:1998.). Condition given in Para 8.4.2 shall apply.

3.2.2 In all other cases the approach speed shall be same as prescribed in IS 3028:1998.

3.3 **EMC Test**

The EMC test shall be applicable as per AIS-004 (Part 3) as applicable for the category of the electric power train vehicle on the date of application.

4.0 DEFINITIONS

Definitions for electric power train vehicles are enclosed in Annexure-C.

5.0 TECHNICAL SPECIFICATIONS:

The information to be submitted by the manufacturer for type approval shall contain the information given in the revised version of AIS-007 (Rev.5)

Note: The requirements specific to Electric Power Train Vehicles are given in Table 13 of AIS-007 (Rev.5)

6.0 CHANGES IN THE TECHNICAL SPECIFICATIONS ALREADY TYPE APPROVED

6.1 Every modification pertaining to the information declared in accordance with paragraph 5 shall be intimated by the manufacturer to the testing agency.

6.2 If the changes are in parameters not related to the provisions, no further action need be taken.

If the changes are in parameters related to the provisions, the testing agency shall then consider, whether,

a) the model with the changed specifications still complies with provisions;

or,

b) any further verification is required to establish compliance.

For considering whether any further verification is required or not, guidelines given in Annexure D shall be used for the electrical requirements. For other cases, the guide lines given in the individual standard shall be applicable.

6.3 In case of 6.2 b), verification for only those parameters which are affected by the modifications needs to be carried out.

6.4 In case of fulfillment of criterion of para 6.2 a) or after results of further verification as per para of 6.2 b) are successful, the approval of compliance shall be extended for the changes carried out.

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 Type approvals issued for compliance to AIS-049 - 2003 shall be extended to approval of AIS-049 (Rev 1) - 2016 however manufacturer may request a retest.

8.0 VALIDITY OF ANNEXES

It is expected that in due course of time the details given in Annexes A, to D would be incorporated in CMVR and other related documents referred in this chapter. Once such an incorporation takes place, the details given in these annexes would be automatically defunct.

Annex: A
(See para 3.1)

Requirements of Brake and Braking Systems for Electric Power Train Vehicles

A1.0 Definitions:

A1.1 **"Electric regenerative braking system"** means a braking system, which allows the use of the vehicle's drive motor(s) to convert the kinetic energy of the vehicle into electrical energy during deceleration.

A1.2 **"Electric regenerative brake control"** means a device which modulates the action of the electric regenerative braking system

A1.3 **"Electric regenerative braking system of Category A"** means an electric regenerative braking system, which is not part of the service braking system.

A1.4 **"Electric regenerative braking system of Category B"** means an electric regenerative braking system, which is part of the service braking system.

A2.0 General requirements of electric regenerative braking systems:

A electric power train vehicle, if fitted with an electric regenerative braking system, shall comply with the following requirements:

A2.1 Vehicles fitted with Electric regenerative braking system of

Category A:

The electric regenerative braking shall be only activated by accelerator control and/or the gear neutral position.

A2.2 Vehicles fitted with Electric regenerative braking system of

Category B:

A2.2.1 It shall not be possible to disconnect partially or totally one part of the service braking system other than by an automatic device

A2.2.2 The service braking system control shall also actuate the action of the electric regenerative braking system simultaneously.

A2.2.3 The service braking system shall not be adversely affected by the disengagement of the motor(s) or gear ratio used, except during the short duration of operation of gear shifting.

A3.0 Requirements of two wheelers:

A3.1 The requirements covered in IS 14664:1999 shall be complied with.

A3.2 If the brake control (front or rear or both) actuates the electric regenerative brake system (Category B), the prescribed performance requirements shall be complied with the use of the electric regenerative system.

The performance requirements may be verified without the use of the electric regenerative system if so desired by the manufacturer.

A3.3 If the brake control (front or rear or both) does not actuate the electric regenerative brake system (Category A) the prescribed performance requirements shall be obtained without the use of the electric regenerative system.

A4.0 Requirements of three wheelers:

A4.1 The requirements covered in IS 14664:1999 shall be complied with.

A4.2 In the case of three wheelers with GVW not exceeding 1 ton (Category1 & 2 as defined in IS 14664:1999) the conditions of regenerative braking system shall be same as those given in para A3.2 and A3.3

A4.3 For three wheelers with GVW exceeding 1 ton (Category 3 as defined in IS 14664:1999) the conditions of regenerative braking system shall be same as those given in para A5.2. and A5.3.

A4.4 For the purpose of classification only, GVW shall be considered ignoring the weight of the traction batteries. The tests shall be conducted with the full GVW, i.e. including the weight of the traction batteries also.

A5.0 Requirements of vehicles with more than three wheels:

A5.1 The requirements given in the applicable parts of IS:11852 shall be complied with.

A5.2 If the service brake control actuates the electric regenerative brake system (Category B), the prescribed performance requirements shall be obtained with the electric regenerative system.

A5.2.1 The specified secondary brake prescribed performance requirements shall be met with the failure of the regenerative braking simulated without any other failure in the service brake system.

A5.3 If the service brake control does not actuate the electric regenerative brake system (Category A) the prescribed performance requirements shall be obtained without the use of the electric regenerative system.

Annex: B

Proposed Amendments to IS 14464: 1999 for Braking System to incorporate the Features for 3 Wheelers of 1 to 1.5T GVW

B1 Para 1.1 Page 1:

Substitute "of all types of two and three wheeled motor vehicles" for the words "of all types of two wheeled motor vehicles and three wheeled motor vehicles whose maximum gross vehicle weight does not exceed 1500kg"

B2 Para 4.2 Page 2:

a) In para b) add the following words at the end: "and the gross vehicle weight not exceeding 1 tonne."

b) Add the following: "c) Category 3--- Three wheeled motor vehicles with gross vehicle weight exceeding 1.0 T."

B3 Para 7.11, page 3:

Substitute "Every three wheeled vehicle of Category 1 and 2 shall be fitted with a braking system complying with the requirements given in para a) or b) below. Every three wheeled vehicle of category 3 shall be fitted with a braking system complying with the requirements of para b) below." for the words "Every three wheeled vehicle shall be fitted with either:"

B4 Para 7.11. sub-para b) Page 3 :
Add the following at the end of sub-para 5)

"6) In case of three wheelers of category 3, if the requirement given in 7.11(b)(1) above is met by using the same control, the parking brake device shall be so designed that it can be actuated by the driver when the vehicle is in motion with at least one hand on the steering control and shall comply with the requirements for P type dynamic parking brake test given in Table 2. The force exerted on the braking control shall not exceed the values specified in 9.2. Compliance with this requirement shall be deemed to have met if the braking performance has been achieved once."

B5 Para 8.1.1 Page 4:

Add the following at the end: "In case of 3 wheelers of Category 3, the P type dynamic parking brake test as specified in 7.11.b) 6 shall also be carried out."

B6 Para 9.2 Page 4:

Replace the heading on the second and third columns by "3 wheelers of category 1 & 2" and "3 wheelers of category 3", respectively.

B7 Table 2 Page 5:

a) Substitute the words *"For Category 2 & 3"* for the words "For category 2" appearing in the first row.

b) Add the following row after entry no. vi)

"vii	Laden	P type dynamic parking brake test {see7.11.b) 6) for category 3	--	--	--	30	0.1V +V^2/ 40	1.5

B8 Para 12.14 Page 9:

Add the following as a new para: "12.14.3 In the case of P type Dynamic parking brake test {see7.11.b) 6) for category 3, one test is sufficient"

Annex: C
Definitions

C1.0 This Chapter Annexure gives the definitions of the terminology used for Electric Power Train Vehicles.

C1.1 **"Access Probe"** means a test probe simulating in a conventional manner a part of a person or a tool, or the like, held by a person to verify adequate clearance from hazardous part.

C1.2 **"Active driving possible mode"** means the vehicle mode when application of pressure to the accelerator pedal (or activation of an equivalent control) or release of the brake system will cause the electric power train to move the vehicle.

C1.3 **"Approval of a type of Electric power train vehicle"** means the approval of a type of electric power train vehicle regarding construction and functional safety requirements specific to the use of electric energy.

C1.4 **"Auxiliary battery"** means the battery unit whose reserve of energy is used only for the auxiliary network supply.

C1.5 **"Auxiliary network"** means the assembly of auxiliary electric equipment with similar functions to the one used on vehicles equipped with an internal combustion engine.

C1.6 **"Barrier"** means the part providing protection against direct contact to the live parts from any direction of access.

C1.7 **"Cell"** means a single encased electrochemical unit containing one positive and one negative electrode which exhibits a voltage differential across its two terminals.

C1.8 **"Conductive connection"** means the connection using connectors to an external power supply when the rechargeable energy storage system (REESS) is charged.

C1.9 **"Coupling system for charging the Rechargeable Energy Storage System (REESS)"** means the electrical circuit used for charging the REESS from an external electric power supply including the vehicle inlet.

C1.10 **"Coupling system"** means all the parts used to connect the vehicle to an external electric power supply (alternative or direct current supply).

C1.11 **"Chassis connected to the electric circuit"** means AC and DC electric circuits galvanically connected to the electrical chassis."

C1.12 **"Direct contact"** means contact of persons with the live parts.

C1.13 **"Drive direction control unit"** means a specific device physically actuated by the driver in order to select the drive direction (forward or backward), in which the vehicle will travel if the accelerator is actuated.

C1.14 **"Drive Train"** means specific components of power train, such as the traction motors, electronic control of the traction motor, the associated wiring harness and connectors.

C1.15 **"Degree of protection"** means the extent of protection provided by an enclosure against access to hazardous parts against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods.

C1.16 **"Electrical chassis"** means a set made of conductive parts electrically linked together, whose potential is taken as reference.

C1.17 **"Electrical circuit"** means an assembly of connected live parts which is designed to be electrically energized in normal operation.

C1.18 **"Electronic converter"** means a device capable of controlling and/or converting electric power for electric propulsion.

C1.19 **"Electric energy conversion system"** means a system that generates and provides electric energy for electric propulsion.

C1.20 **"Enclosure"** means the part enclosing the internal units and providing protection against direct contact from any direction of access.

C1.21 **"Exposed conductive part"** means the conductive part which can be touched under the provisions of the protection IPXXB, and which becomes electrically energized under isolation failure conditions. This includes parts under a cover that can be removed without using tools.

C1.22 **"Electric power train"** means a system consisting of one or more electric energy storage devices (e.g. a battery, electromechanical flywheel or super capacitor), one or more electric power conditioning devices and one or more electric machines that convert stored electric energy to mechanical energy delivered at the wheels for propulsion of the vehicle;

C1.23 **"External electric power supply"** means an alternating current (AC) or direct current (DC) electric power supply outside of the vehicle.

C1.24 **"High Voltage"** means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms).

C1.25 **"High voltage bus"** means the electrical circuit, including the coupling system for charging the REESS that operates on high voltage.

Where electrical circuits, that are galvanically connected to each other, are galvanically connected to the electrical chassis and the maximum voltage between any live part and the electrical chassis or any exposed conductive part is ≤ 30 V AC and ≤ 60 V DC, only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus."

C1.26 **"Live parts"** means the conductive part(s) intended to be electrically energized in normal use.

C1.27 **"On-board isolation resistance monitoring system"** means the device which monitors the isolation resistance between the high voltage buses and the electrical chassis.

C1.28 **"Open type traction battery"** means a liquid type battery requiring refilling with water and generating hydrogen gas released to the atmosphere.

C1.29 **"Rechargeable Energy Storage System (REESS)"** means the rechargeable energy storage system that provides electric energy for electric propulsion. The REESS may include subsystem(s) together with the necessary ancillary systems for physical support, thermal management, electronic control and enclosures.

C1.30 **"Subsystem"** means any functional assembly of REESS components.

C1.31 **"Type of REESS"** means systems which do not differ significantly in such essential aspects as:

(a) The manufacturer's trade name or mark;

(b) The chemistry, capacity and physical dimensions of its cells;

(c) The number of cells, the mode of connection of the cells and the physical support of the cells;

(d) The construction, materials and physical dimensions of the casing and

(e) The necessary ancillary devices for physical support, thermal management and electronic control.

C1.32 **"Service disconnect"** means the device for deactivation of the electrical circuit when conducting checks and services of the REESS, fuel cell stack, etc.

C1.33 **"State of Charge (SOC)"** means the available electrical charge in a tested-device expressed as a percentage of its rated capacity.

C1.34 **"Solid insulator"** means the insulating coating of wiring harnesses provided in order to cover and protect the live parts against direct contact from any direction of access; covers for insulating the live parts of connectors, and varnish or paint for the purpose of insulation.

C1.35 **"Net power"** means the power obtained on a test bench at the end of the crankshaft or its equivalent at the corresponding motor speed with the auxiliaries listed in Table 1 of AIS-041 (Rev.1) and determined under reference atmospheric condition;

C1.36 **"Maximum 30 minutes power"** means the maximum net power of an electric drive train at DC voltage , which a drive train can deliver over a period of 30 minutes as an average.

C1.37 **"Standard-production equipment"** means equipment provided by the manufacturer for a particular application.

C1.38 **"Electric range"**, for vehicles powered by an electric power train only, means distance that can be driven electrically on one fully charged REESS.

C1.39 **"Hazardous Live Part"** means a live part, which, under certain conditions of external influences can give an electric shock (see IEC 536, at present Document 64 (CO) 196).

C1.40 **"Hazardous Mechanical Part"** means a moving part, other than a smooth rotating shaft, that is hazardous to touch.

C1.41 **"Hazardous part"** means a part that is hazardous to approach or touch.

C1.42 **"Indirect contact"** means contact of persons or livestock with exposed conductive parts.

C1.43 **"IP code"** means a coding system to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water to give additional information in connection with such protection.

C1.44 **"Live parts"** means conductive part(s) intended to be electrically energized in normal use.

C1.45 **"Luggage compartment"** means the space in the vehicle for luggage accommodation, bounded by the roof, hood, floor, side walls, as well as by the barrier and enclosure provided for protecting the power train from direct contact with live parts, being separated from the passenger compartment by the front bulkhead or the rear bulk head.

C1.46 **"Maximum Mass"** means the technically permissible maximum mass declared by the Manufacturer. Also referred as GVW.

C1.47 **"Maximum Thirty Minute Power"** means the maximum net power at wheels of an electric vehicle drive train at appropriate rated voltage, which the vehicle drive train can deliver over a period of 30 minutes as an average.

C1.48 **"Maximum Net Power"** means the power obtained at the wheels of electric vehicle when tested on chassis dynamometer or at Motor shaft when measured at bench dynamometer at corresponding vehicle/motor speed at reference atmospheric conditions and full load on wheels of vehicle/motor.

C1.49 **"Nominal voltage"** means the root –mean – square (r.m.s.) value of the voltage specified by the Manufacturer, for which the electrical circuit is designed and to which its characteristics are referred.

C1.50 **"Object Probe"** means a test probe simulating a solid foreign object to verify the possibility of ingress into an enclosure.

C1.51 **"Off-board charger"** means an energy electronic converter used for charging REESS from an external power supply (mains network) and which is not the integral part of the vehicle.

C1.52 **"On-board charger"** means an energy electronic converter linked by construction to the vehicle and used for charging the traction REESS from an external electric power supply (mains network).

C1.53 **"Opening"** means a gap or aperture in an enclosure, which exists or may be formed by the application of a test probe at the specified force.

C1.54 **"Passenger compartment"** means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, window glass, front bulkhead and rear bulkhead, or rear gate, as well as by the barriers and enclosures provided for protecting the power train from direct contact with live parts.

C1.55 **"Protection degree"** means the protection provided by a barrier/enclosure related to the contact with live parts by a test probe, such as a test finger (IPXXB) or a test wire (IPXXD).

C1.56 **"Power train"** means the system of energy storage device(s), energy converter(s) and transmission(s) that converts stored energy to mechanical energy delivered at the wheels for propulsion of the vehicle;

C1.57 **"Pure electric vehicle"** means vehicle powered by an electric power train only;

C1.58 **"Reference Mass"** means

i) Two wheeled vehicles: unladen mass increased by a figure of 75 kg

ii) Three wheeled vehicles, L7 and M1, M2 (with GVW upto 3500 kg) category vehicles: unladen mass increased by a figure of 150 kg

iii) N category vehicles: unladen mass increased by a figure of 50% of the pay load".

iv) For M2 (with GVW above 3500 kg) and M3 vehicles: unladen mass increased by 75 kg x 50% of Seating Capacity.

C1.59 **"Unladen Mass"** means the mass of the vehicle in running order without driver, crew, passengers or load, but with the fuel tank full (if any), cooling liquid, service and traction batteries, oils, onboard charger, portable charger, tools and spare wheel, whatever is appropriate for the vehicle considered and if provided by the manufacturer of the vehicle.

C1.60 **"Vehicle type"** means Electric Power Train vehicles, which do not differ in such essential aspects as:

dimensions, structure, shape and nature of constituting materials; installation of the power system components , REESS or REESS packs, tyres, unladen mass; nature and type of electric and electronic components.

Also **"Vehicle type"** means vehicles which do not differ in such essential aspects as:

(a) Installation of the electric power train and the galvanically connected high voltage bus;

(b) Nature and type of electric power train and the galvanically connected high voltage components.

C1.61 **"Working voltage"** means the highest value of an electrical circuit voltage root-mean-square (rms), specified by the manufacturer, which may occur between any conductive parts in open circuit conditions or under normal operating condition. If the electrical circuit is divided by galvanic isolation, the working voltage is defined for each divided circuit, respectively.

Annex: D
(See 6.0)
Criteria for Extension

D1.0 In case of following changes, the verification tests which are necessary for establishing compliance are listed below

	Changes of Parameter	Tests to be conducted
D1.1	Type of motor, controller, REESS	Range test, Energy consumption test, Power test, All tests/verifications as per AIS-038 (Rev.1):2015, Gradeability, EMC, and if fitted with regenerative braking of category B, brake test.
D1.2	Layout of REESS, controller, motor	All applicable tests/verifications as per AIS-038 (Rev.1):2015.
D1.3	Working Voltage	All tests
D1.4	Make, model of on-board charger	Energy consumption test as per AIS-039 (Rev.1):2015, Range Test as per AIS-040 (Rev.1):2015
D1.5	Vehicle body construction affecting aerodynamic resistance	Coast-down, range, energy consumption, EMC
D1.6	Wiring harness of Traction REESS	Compliance to 3.1.1.5.3 of AIS-038 (Rev.1):2015

D1.7 In the case of tests affecting range, , energy consumption because of change in reference mass, coast-down parameters etc. the conditions given in MoRTH /CMVR/TAP-115/116 shall be applicable

D1.8 Changes in parameter affecting general performance requirements of CMVR (E.g. brakes, noise etc.) shall be as per details given in the individual standards.

D1.9 For changes other than the above, the provisions given in the AIS-017 (Procedure for Type Approval and Certification of Vehicles for Compliance to Central Motor Vehicles Rules) may be followed.

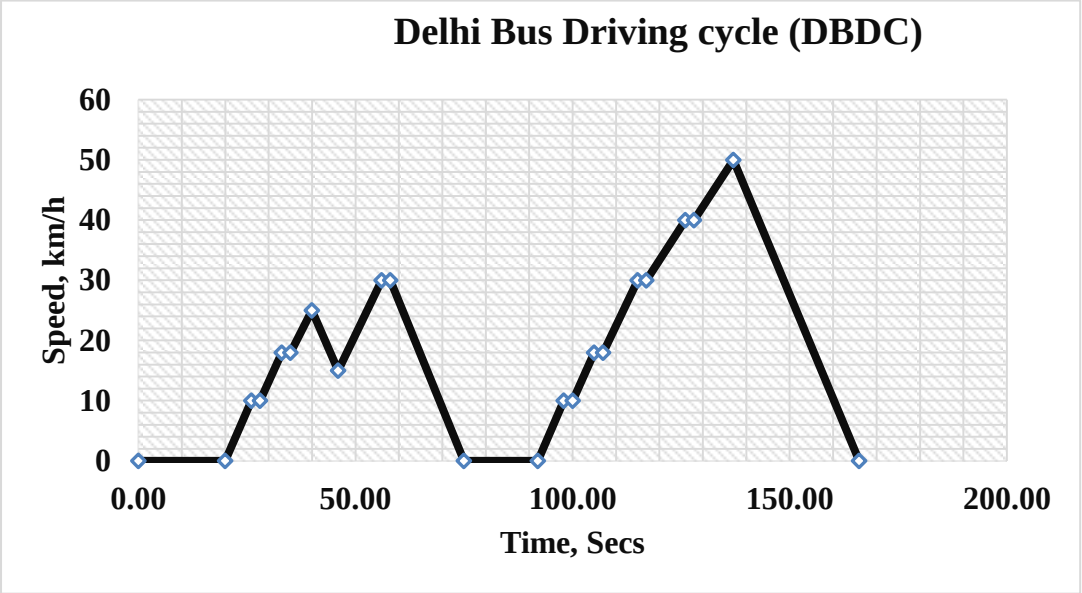
ANNEX E
(See clause 3.4 b of AIS 039 (Rev 1):2015)

DELHI DRIVING CYCLE FOR BUSES

Table 1: Phase wise operation and duration of the Delhi bus Driving cycle (DBDC)

No. of Operation	Operation	Phase	Speed Km/h	Acceleration m/s^2	Duration of Operation, s	Cumulative time, s	Distance, m
1	Idling	1	0	0	20	20	0
2	Acceleration	2	0-10	0.46	6	26	10
3	Cruising	3	10	0	2	28	6
4	Acceleration	4	10-18	0.44	5	33	23
5	Cruising	5	18	0	2	35	10
6	Acceleration	6	18-25	0.39	5	40	31
7	Deceleration	7	25-15	-0.46	6	46	35
8	Acceleration	8	15-30	0.42	10	56	69
9	Cruising	9	30	0	2	58	17
10	Deceleration	10	30-0	-0.49	17	75	79
11	Idling	11	0	0	17	92	0
12	Acceleration	12	0-10	0.46	6	98	10
13	Cruising	13	10	0	2	100	6
14	Acceleration	14	10-18	0.44	5	105	23
15	Cruising	15	18	0	2	107	10
16	Acceleration	16	18-30	0.42	8	115	58
17	Cruising	17	30	0	2	117	17
18	Acceleration	18	30-40	0.31	9	126	71
19	Cruising	19	40	0	2	128	22
20	Acceleration	20	40-50	0.31	9	137	91
21	Deceleration	21	50-0	-0.48	29	166	219
							837

Total Distance = 837 m
Total time = 166 s


Delhi Bus Driving cycle (DBDC)
Speed, km/h
60
50
40
30
20
10
0
0.00
50.00
100.00
150.00
200.00
Time, Secs

ANNEX F

(See introduction)

COMPOSITION OF AISC PANEL ON
Electric Power Train Vehicles - CMVR Type Approval for Electric Power Train Vehicles

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 / Shri Sourabh Rohila	Society of Indian Automobile Manufacturers (SIAM)
Shri. S Ravishankar	Ashok Leyland Ltd. – Technical Center (SIAM)
Mr. T. M. Balaraman/Mr. Adish Agrawal	Hero MotoCorp Ltd.(SIAM)
Mr. Rajendra Khile	General Motors Technical Center India Pvt. Ltd. (SIAM)
Mr. Kiran Mulki	Mahindra & Mahindra Ltd. (SIAM)
Mr. K. Kiran Kumar	Mahindra Reva Electric Vehicles Pvt. Ltd. (SIAM)
Mr. Vijeth R Gatty	Toyota Kirloskar Motor Pvt. Ltd. (SIAM)
Mr. Firoz Khan	Tata Motors Ltd (SIAM)
Mr. Vivekraj S	Renault Nissan Pvt Ltd(SIAM)
Mr. Uday Harite	Automotive Components Manufacturers Association of India (ACMA)

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

Chairman	
Mrs. Rashmi Urdhwareshe	Director The Automotive Research Association of India, Pune
Members	**Representing**
Representative from	Ministry 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
Representative from	National Automotive Testing and R&D Infrastructure Project (NATRiP)
Shri N.K Sharma	Bureau of Indian Standards (BIS), New Delhi
Director	Central Institute of Road Transport(CIRT), Pune
Director	Indian Institute of Petroleum(IIP), Dehra Dun
Director	International Centre for Automotive Technology (ICAT), Manesar, Delhi.
Director	Vehicles Research and Development Establishment (VRDE), Ahmednagar
Shri Shrikant R. Marathe	Former Chairman, Automotive Industry Standards Committee
Representatives from	Society of Indian Automobile Manufacturers (SIAM), New Delhi
Shri T.R.Kesavan	Tractor Manufacturers Association (TMA), New Delhi
Shri Uday Harite	Automotive Components Manufacturers Association of India (ACMA), New Delhi

A. S. Bhale
Member Secretary

The Automotive Research Association of India, Pune

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