

AUTOMOTIVE INDUSTRY STANDARD

**Requirements of Truck Cabin
Ventilation System for Category
N2 & N3 Vehicles**

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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

May 2017

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

| Sr. No. | Corrigendum | Amendment | Revision | Date | Remark | Misc. |
|------------|-------------|-----------|----------|------|--------|-------|
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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 on the preparation of the 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 Standards 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, will publish this standard.

The original guideline standard AIS-056: 2009 was created based on road tests and design survey conducted from 2003 onwards. Now in 2017, Ministry of Road Transport has taken further initiative to mandate certain levels of climate comfort within N2 and N3 category truck cabins.

This standard is being revised for providing technical requirements for type approval.

The compositions of the AISC Panel, Automotive Industry Standards Committee (AISC) for Vehicles with GVW of more than 3.5 tonnes and Permanent Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annexure-6, 7 & 8 respectively.

Requirements of Truck Cabin Ventilation System for Category N2 & N3 Vehicles

1. SCOPE

- 1.1 This Standard shall apply to vehicles of N2 & N3 category, irrespective of whether they leave the factory premises as fully built or incomplete vehicle.
- 1.2 Vehicles referred in Clause No. 1.1 above depending on whether they are equipped with Air Conditioning (AC) / Heating, Ventilation and Air Conditioning (HVAC) systems or Ventilation Systems shall comply with respective requirements given in this standard.

2. REFERENCES

- 2.1 AIS-053 Automotive Vehicles - Types - Terminology

3. DEFINITIONS:

The definitions pertaining to the requirements are specified at respective Annexures to this standard.

4. APPLICATION FOR TYPE APPROVAL

- 4.1 The application for type approval of a vehicle type shall be submitted by the vehicle manufacturer along with at least the details given in **Annexure 1**.

Note: If the details are covered in application for complete vehicle type approval, it is not necessary to submit them separately.

5. TECHNICAL REQUIREMENTS:

The vehicle submitted for type approval shall meet the requirements given in **Annexure 2** of this standard.

6. PERFORMANCE REQUIREMENTS / TEST PROCEDURE:

The performance requirements & test procedure are given in **Annexure 3** of this standard.

7. GUIDELINES FOR CRITERIA FOR EXTENSION OF APPROVAL (CEA)

: CEA is given in Annexure 4 of this standard.

ANNEXURE 1

(See 4.1)

**TECHNICAL INFORMATION TO BE SUBMITTED BY VEHICLE
MANUFACTURER FOR TYPE APPROVAL**

| | | |
|----------|--|--|
| A | General information | |
| 1. | Name and address of vehicle manufacturer | |
| 2 | Vehicle model and its variant(s) | |
| 3 | Vehicle overall dimensions, (length, width and height), mm | |
| B | Information for Ventilation system | |
| 1.1 | Total area (cm ²) of the unblocked openings and their locations excluding the area of Side Door Windows (Drawing to be provided) | |
| 1.2 | Cabin volume (m ³) | |
| 2 | Name of manufacturer of the installed blower(s) | |
| 3 | Total flow rate (m ³ /hr) of all the blowers installed | |
| 4 | No. of speeds offered in blower (s) | |
| 5 | Whether air vents have been provided for direction control, If yes, their locations | |

ANNEXURE 2

(See 5.0)

TECHNICAL REQUIREMENTS

A 2.1 Definitions

A 2.1.1 **Forced ventilation:** Ventilation arrangement in which air is forced through ducts or vents using a blower into the truck cabin.

A 2.1.2 **Natural ventilation:** Ventilation arrangement in which air is supplied to and / or removed from the truck cabin using pressure differences arising from natural forces and without using mechanical aids.

A 2.1.3 **Openings:** Passages or cutouts provided in the truck cabin for connecting the air inside the cabin to the ambient air for natural ventilation. They may be provided with louvers, doors or hatches for blocking and unblocking by the occupant.

A 2.1.4 **Unblocked area of the openings:** Clear cross sectional area of the openings in fully open condition.

A 2.1.5 **Cabin volume:** Interior spatial capacity of the enclosed space of the truck cabin wherein volume of seats & dashboard shall be excluded.

A.2.1.6 **Air Conditioning (AC) System:** An Air Conditioning system is a system intended for cooling and dehumidifying the warm air in the occupant area. The system may optionally replenish the air in the occupant area with ambient air from outside.

A 2.1.7 **Heating, Ventilation and Air Conditioning (HVAC) System:** A Heating, Ventilation and Air Conditioning (HVAC) System is an AC system with additional capability to warm up the air in the occupant area.

A 2.1.8 **Type Approved Kit:** Type Approved Kit, for the purpose of this standard means forced ventilation kit type approved by any of the testing agencies notified under CMV Rule 126 and complying the requirements of this standard. The Type Approved Kit shall consist of the following:

1. Blower along with its accessories including ducts and controls for flow rates.
2. Drawings – Duct and Openings

A 2.2 Requirements

A 2.2.1 Differentiated requirements for vehicles equipped with HVAC / AC or Ventilation System

A 2.2.1.1 All vehicles covered in the scope of this standard which are equipped with ventilation system shall meet the requirements of natural ventilation (Clause No. A 2.2.2) and of forced ventilation (Clause No. A 2.2.3).

A 2.2.1.2 All vehicles covered in the scope of this standard which are equipped with HVAC/AC system shall meet the forced ventilation requirements (Clause No. A 2.2.3). Such vehicles shall be exempt from complying with requirements of natural ventilation requirements (Clause No. A 2.2.2).

A 2.2.2 Natural ventilation

A 2.2.2.1 Every truck cabin shall be provided with openings such that the total combined unblocked area of all the openings shall not be less than $120 \text{ cm}^2/\text{m}^3$ of cabin volume.

A 2.2.2.2 Typical examples of such openings are front quarter windows, rear quarter windows, roof hatch, rear window, air extractors, kick vents, front panel vents or any other feature provided by the manufacturer. Refer Figure in Annexure 5. The open area in the main windows of the side doors shall not be included in the calculation of unblocked area.

A 2.2.2.3 For incomplete vehicles without full cabin enclosures, the vehicle manufacturer shall provide body building guidelines on the openings required in the Cabin to facilitate their inclusion during body building. These guidelines shall also be submitted to the test agency with the application in Annexure 1 in such case responsibility for type approval of natural ventilation system against A 2.2.2.1 shall lie with body builder.

A 2.2.3 Forced ventilation

A 2.2.3.1 Every truck cabin shall be installed with a forced ventilation system that provides a minimum combined value of the airflow from all the blower outlets of $275 \text{ m}^3 / \text{hr}$ of air flow rate at voltage specified by manufacturer.

A 2.2.3.2 The manufacturer may install the blower and its accessories at any appropriate locations inside the cabin such as the dashboard, roof and rear wall to suit the cabin design and layout.

A 2.2.3.3 The blower shall have a control that provides at least 2 flow rates such that the minimum flow rate specified in A 2.2.3.1 is achieved on at least one position.

A 2.2.3.4 The outlets of the forced ventilation system shall be provided with louvers or alternate arrangement for directing the flow of air in desired direction.

A 2.2.3.5 The specified forced ventilation system shall be installed on incomplete vehicles also.
Where the cabin build level of the incomplete vehicles prevents the fitment of the forced ventilation system, the vehicle manufacturer shall provide these items as a type approved kit along with the vehicle and accompanied with suitable guidelines to facilitate the body builder in installing the items.

A 2.3 Guidelines on desirable features

A 2.3.1 The previous version of AIS-056: 2009 was a guideline standard which recommended several non-mandatory desirable features in the Truck cabins for improving the thermal comfort of occupants. The panel decided that the recommendation with regard to body thermal insulation to improve cabin occupant comfort should be carried forward as desirable non-mandatory feature recommendation to provide guidance to designers. For this, Clause No. 3.1 of previous version is being reproduced here as Clause No. A 2.3.2.

A 2.3.2 **Provision of Heat Insulation Material** : It is desirable that the following areas are provided with heat insulating materials to reduce the transfer of heat into the cabin:

A 2.3.2.1 Engine Compartment



A 2.3.2.2 Cabin Flooring



Examples of suitable materials, recommended locations and suitable fixing methods are tabulated herewith for ready reference:

Floor and Engine Hood Insulation

| Description | Location | Recommended Specifications | | Recommended method of fixing |
|---------------------------------------|--|----------------------------|-----------------------------|--|
| | | Thickness (mm) | Density (g/m ²) | |
| Felt | Inside Cabin : Floor Engine Hood | 15-20 | 1000-1200 | Kept loose on floor or mechanical fixing |
| EVA (Ethylene Vinyl Acetate) Sheet | | 2-5 | 3000-4000 | Using suitable Adhesive |
| Rubber mat /melt pad | | 5-10 | ----- | Kept loose on floor or mechanical fixing |
| Dimpled PU foam* | Outside Cabin / | 20-50 | 2000-5000 | Using suitable adhesive |
| Glass wool or Polyester sheet Or felt | Engine Compartment | 2-5 | 1000-1200 | Mechanical fitment |

***Caution Note:** Thickness should not exceed 50mm to mitigate the risk of engine overheating

A 2.3.2.3 Cabin Roof



A 2.3.2.4 Cabin Bulkhead (Firewall), Side and Rear Walls



A 2.3.2.5 Door Panels



It is recommended that the heat insulating material so provided could be fire retardant. Examples of suitable materials, recommended locations and suitable fixing methods are tabulated herewith for ready reference:

Cabin Roof, Door Pads and Side Wall Insulation

| Description | Location | Recommended Specifications | | Recommended method of fixing |
|---|-----------|----------------------------|-------------------------|---|
| | | Thickness (mm) | Density | |
| Poly Urethane (PU) foam Sandwich | Roof / | 10-25 | 28-32 kg/m ³ | Using suitable adhesive / Velcro |
| Molded roof lining / Polypropylene (PP) trims | Sidewalls | 1.5 - 8 | ----- | Mechanical Fixing (eg. Plastic plugs) |
| Polyester wadding | Door Pads | 3-10 | 100 - 150 gsm | Mechanical fixing (eg. Plastic plug, Screw) |

A 2.3.3 It is also recommended to fit an air exhauster to the truck cabin for removing stale air as desirable non-mandatory feature.

ANNEXURE 3

(See 6.0)

TEST PROCEDURE

A 3.1 Air flow rate test

A 3.1.1 The blower of the forced ventilation system shall be bench tested for conformance to flow rate requirements. At the request of the manufacturer, optionally this test may be conducted on the vehicle. When the test is conducted on the vehicle, the combined value of the airflow from all the outlets into the cabin shall meet the requirements of clause no **A 2.2.3.1**.

A 3.1.2 An air velocity meter (for e.g. vane type anemometer) with a measurement accuracy of $\pm 2\%$ shall be used for this test.

A 3.1.3 The inlet of the air velocity meter shall be placed directly at the outlet of the blower. In case the test is conducted on the vehicle at the manufacturer's request, the velocity meter shall be placed directly at the outlet of the vent(s). Formula for deriving Air flow rate from measured air velocity shall be as follows:

$$\begin{aligned} \text{Air flow rate (m}^3\text{/hr)} \\ = \text{Air velocity (m/s) X Air outlet exit area in contact with Anemometer(m}^2\text{) X 3600} \end{aligned}$$

A 3.2 Verification of unblocked area of openings

A 3.2.1 The manufacturer shall provide necessary drawings and calculation in evidence of conformance to the unblocked area requirements.

A 3.2.2 Where necessary the test agency may audit the submission with actual measurements in the case of vehicle manufacturer built cabins.

A 3.2.3 In the case of a body built by a body builder, the test agency may decide on the comprehensiveness of the audit in A 3.2.2 based on whether or not submissions as in A 3.2.1 are received.

A 3.3 Electro Magnetic Compatibility: The components of the forced ventilation system shall comply with EMC requirements of AIS-004 (Part 3) where applicable.

ANNEXURE 4

(See 7.0)

GUIDELINES FOR CRITERIA FOR EXTENSION OF APPROVAL (CEA)

In case of following changes, the verification shall be carried out for establishing compliance of the changed parameters to the requirements specified in this standard.

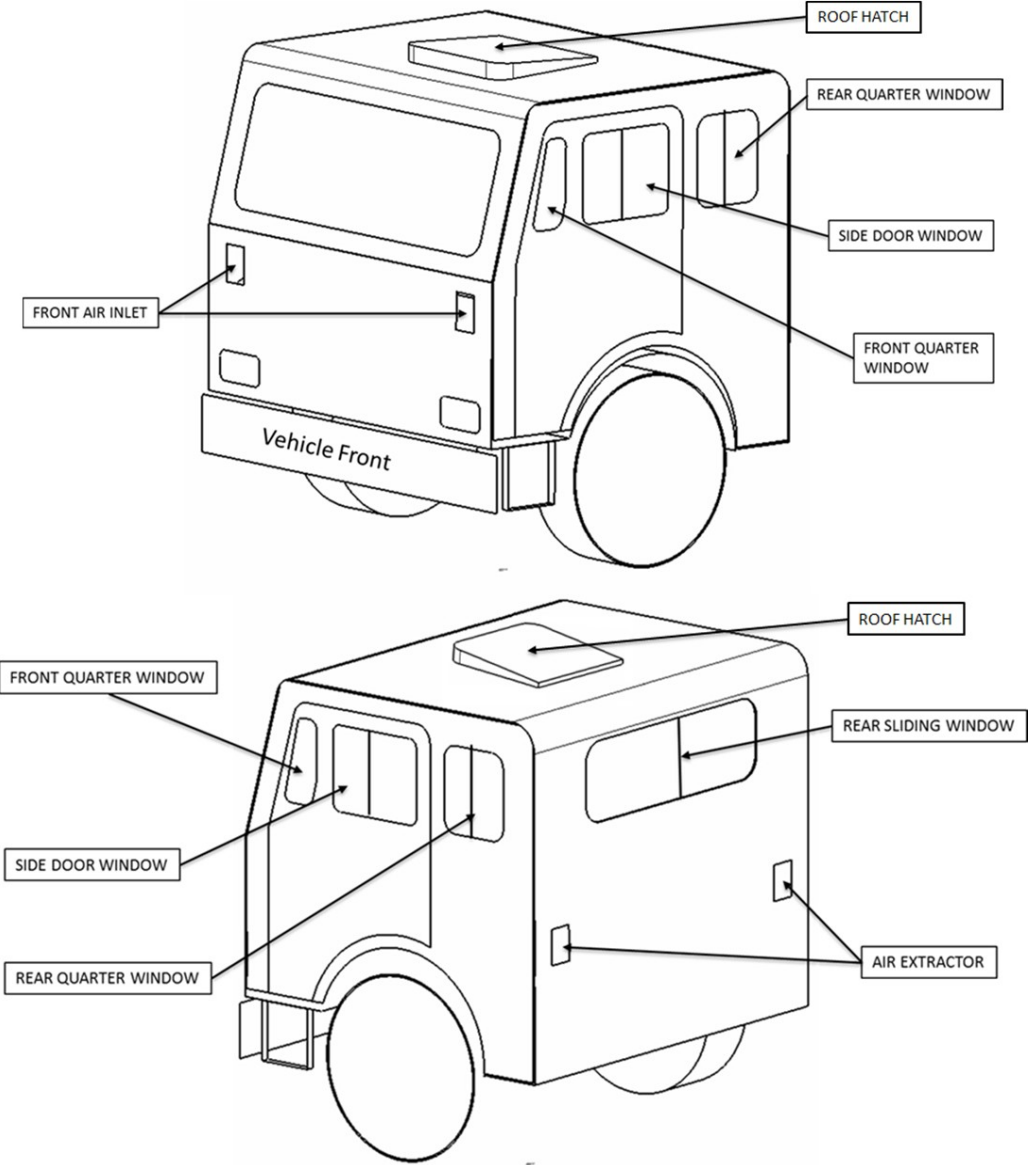
| | | |
|-------|----------------------------------|--|
| A 4.1 | Blower | If change in make, check for air flow rate and EMC |
| A 4.2 | Unblocked area Openings | Reduction in area with respect to already approved |
| A 4.3 | Blower speed control arrangement | If change in make, check for air flow rate |

Changes other than the above are considered as not affecting compliance and do not call for any verifications.

ANNEXURE 5

(See Clause A 2.2.2.2 of Annexure 2)

TYPICAL LAYOUT FOR UNBLOCKED OPENING AREAS IN N2 /N3 VEHICLE CABINS



Note: This figure is indicative. While providing openings in cabin are mandatory, locations shown here are for reference only.

ANNEXURE 6
(See Introduction)
PANEL COMPOSITION*

| | |
|--|---|
| Convener | |
| Dr. Venkat Srinivas | Mahindra & Mahindra Ltd.(Truck & Bus Division) |
| Members | Representing |
| Shri Samir Sattigeri /Shri S. N. Dhole | Central Institute of Road Transport (CIRT) |
| Shri V. P. Rawal | Automotive Research Association of India (ARAI) |
| Director | International Centre for Automotive Technology (ICAT) |
| Director/Shri SAM Shaikh | Vehicle Research & Development Establishment (VRDE) |
| Director/Site Head | Global Automotive Research Centre (GARC) |
| Executive Director | Association of State Road Transport Undertakings (ASRTU) |
| Shri Vishnu Mathur/ Shri K. K. Gandhi/ Shri P.K.Banerjee | Society of Indian Automobile Manufacturers (SIAM) |
| Shri S. Ravishankar /Shri D. Balkrishnan/ Shri V.Faustino | SIAM (Ashok Leyland Ltd.) |
| Shri P. Gowrishankar/Shri Dwijendra Mane/Shri Sharad Bhole/Shri D. S. Patil/ Shri Sambhaji Jaybhay | SIAM (Tata Motors Ltd.,) |
| Shri A. S. Ravikumar | SIAM (Daimler India) |
| Shri Shyam Bute | SIAM (VE Commercial Vehicles Ltd.) |
| Shri K. Nagaraju/ Shri V.G. Kulkarni/ Shri Tejun Saif | SIAM (Mahindra & Mahindra Ltd. TBD) |
| Shri Hirdesh Thakur/ Shri Girish S. Kodolikor | SIAM (Force Motors Ltd.) |
| Shri Uday Harite | Automotive Component Manufacturers Association of India (ACMA) |
| Shri Uddhav Kate/Shri S. B. Kolhe | Maharashtra State Road Transport Corporation (MSRTC) |
| Dr. Sudarshan Kamal | CCOE, Petroleum & Explosives Safety Organization |
| Shri Bhim Wadhwa/ Shri Bal Malkit Singh/ Shri Amit Lal Madan | All India Motor Transport Congress (AIMTC), |
| Shri B. Channa Reddy | All India Confederation of Goods Vehicle Owners' Associations (AICOGOA) |
| Chief Engineer Transport (Operation)/ Shri S. R. Deshpande | The BEST Undertaking |

| | |
|------------------------------|--|
| Managing Director | Metropolitan Transport Corporation (MTC) |
| Chief Engineer | Delhi Transport Corporation (DTC) |
| Shri B. R. Jagadeesh Chandra | Bangalore Metropolitan Transport Corporation (BMTC) |
| President/Shri Ashok Kumar | Collaborative Advance Research for Transportation (CART) |

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

ANNEXURE 7
(See Introduction)

Composition of AISC for Vehicles with GVW of more than 3.5 Tonnes *

| | |
|---|------------------|
| Director, Central Institute of Road Transport (CIRT) | Chairman |
| Representative from Automotive Research Association of India (ARAI) | Member |
| Representative from the Dept. of Heavy Industry, Ministry of Heavy Industry & Public Enterprises (DHI, MoHI & PE) | Member |
| Representative from Ministry of Road Transport & Highways (MoRTH) | Member |
| Representative from Ministry of Petroleum & Natural Gas (MoPNG) | Member |
| Representative from Ministry of Environment, Forest & Climate Change & (MoEF & CC) | Member |
| Representative from Bureau of Indian Standards (BIS) | Member |
| Representative from National Automotive Testing, Research and Infrastructure project (NATRiP) | Member |
| Representative from Vehicle Research & Development Establishment (VRDE) | Member |
| Representative from International Centre of Automotive Technology (ICAT) | Member |
| Representative from Indian Institute of Petroleum (IIP) | Member |
| 3 Representatives from Society of Indian Automobile Manufacturers (SIAM) | Members |
| 2 Representatives Automotive Component Manufacturers Association (ACMA) | Members |
| 2 Representatives from State Transport Department on rotation on bi annual basis | Members |
| Representative from Association of State Road Transport Undertakings (ASRTU) | Member |
| Representative from Indian Construction Equipment Manufacturers Association (ICEMA) | Member |
| Representative from Tractors Manufacturers Association (TMA) | Member |
| 3 Representatives from Association/Organisations of Bus Body Builders, Truck Body Builders and Trailer Builders | Members |
| 2 Representatives from Associations/ Organisations of Fleet Operators of Buses and Trucks, respectively | Members |
| Representative from Central Institute of Road Transport (CIRT) | Member Secretary |

ANNEXURE 8

(See Introduction)

AISC COMPOSITION*

Automotive Industry Standards Committee

| | |
|--------------------------|--|
| Chairperson | |
| Mrs. Rashmi Urdhwareshe | Director The Automotive Research Association of India, Pune |
| Members | Representing |
| Shri Priyank Bharti | 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 R.R. Singh | Bureau of Indian Standards, New Delhi |
| Director | Central Institute of Road Transport, Pune |
| Director | Global Automotive Research Centre |
| Director | International Centre for Automotive Technology, Manesar |
| Director | Indian Institute of Petroleum, Dehra Dun |
| Director | Indian Rubber Manufacturers Research Association |
| Director | Vehicles Research and Development Establishment, Ahmednagar |
| Representatives from | Society of Indian Automobile Manufacturers |
| Shri T. R. Kesavan | Tractor Manufacturers Association, New Delhi |
| Shri Uday Harite | Automotive Components Manufacturers Association of India, New Delhi |

Member Secretary

Shri Vikram Tandon

Dy. General Manager

The Automotive Research Association of India, Pune

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