

AUTOMOTIVE INDUSTRY STANDARD

**Automotive Vehicles –
Recording Equipment in
Road Vehicles (Tachograph)**

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ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

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

GOVERNMENT OF INDIA

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

Sr. No.	Corr- igenda.	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 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 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 web site.

Automatic recording of vehicle's journey details such as speed and distance traveled will contribute significantly to road safety and will encourage sensible driving of the vehicle. The tachograph is precisely the recording equipment fitted in road vehicles capable of recording vehicle journey details for each driver. In order to finalise construction and functional requirements for tachograph for the purpose of type approval, a panel was constituted by AISC with ARAI as secretariat. The panel after deliberations finalised this AI standard in the present form.

While preparing this standard, considerable assistance has been taken from EEC Directive 3821/85 (Issue2, Dec. 2003) (as amended by 3314/90, 3572/90, 3688/92, 2479/95, 1056/97, 2135/98 and 1360/2002 and regulation EC No.1882/2002) on Recording equipment in road transport.

The Automotive Industry Standards Committee responsible for preparation of this standard is given in Annexure-V.

Automotive Vehicles – Recording Equipment in Road Vehicles (Tachograph)

1.0 SCOPE

This standard specifies the requirements and methods of tests of the recording equipment in road vehicles (Tachograph).

2.0 REFERENCES

- 2.1 IS: 10250-1982 " Specifications for Severities for Environmental Tests for Automotive Electrical Equipment"
- 2.2 IS: 9000 (Part V/Sec. 1 and 2) - 1981 "Basic Environmental Testing Procedures for Electronic and Electrical Items "
- 2.3 AIS-004/1999 : Electromagnetic Radiation from Automotive Vehicles – Permissible Levels and Method of Tests.

3.0 APPLICATION FOR TYPE APPROVAL

Applications for approval of a type of tachograph with a model record sheet/ memory card shall be submitted, accompanied by the appropriate specifications, by the manufacturer or his agent to the test agency.

Any modifications or additions to an approved model must receive additional type approval from the test agency which granted the original type approval.

The requirements for extension of type approval because of modification(s) in approved model are given in Annexure IV.

4.0 REQUIREMENT OF CONSTRUCTION, TESTING AND INSTALLATION

Tachograph shall satisfy the construction and installation requirement as given in Annexure I (Chart Type Tachograph) or Annexure II (Digital Tachograph), as applicable.

Note: Recording equipment in the standard has been referred as tachograph.

5.0 TESTS ON TACHOGRAPH

- 5.1 The tachograph may be approved when it meets the requirements of para 5.3, 5.4 , 5.5, 5.6 and 5.8 below.
- 5.2 Five samples of tachograph shall be submitted - four samples for the performance and endurance test described in para 5.3 and 5.4 below and one sample for EMI/EMC test. In the case of on-board system built in the vehicle, the involved system and its components shall be submitted separately for the performance and endurance tests.

5.3 Performance Tests

5.3.1 All the five samples shall be tested for performance as given below.

5.3.2 Visual Examination

The tachograph shall be visually examined for workmanship, finish, marking and general requirements as mentioned in Annexure I or Annexure II, as applicable.

5.3.3 Functional Test

The tachograph shall be connected to the rated voltage. The tachograph shall be coupled to a suitable test rig and tested for its functions as mentioned in Annexure I or Annexure II, as applicable. It shall meet the maximum tolerance requirements as given in cl. 4.0 of Annexure I and cl. 5.0 of Annexure II as applicable.

5.3.4 Operating Voltage Range

The tachograph shall operate satisfactorily over the following voltage range

Rated Voltage of Tachograph, V	Test Voltage Range, V	
	Maximum	Minimum
24	32	18
12	16	9

5.3.5 Protection Against Reverse Polarity

The tachograph shall be able to withstand polarity inversion for a minimum duration of 1 min without electrical damages apart from fuses (broken fuses may be changed). After the test, the tachograph shall work satisfactorily for its intended operations.

5.4 Endurance Test at Ambient Temperature

The tachograph should be mounted on a test bench simulating the vehicle conditions. The component should be tested for 500 h at an ambient temperature of $30^{\circ}\text{C} \pm 5^{\circ}\text{C}$ as follows

3 sec ON at min 80% of the full-scale speed range of the tachograph and 3 sec OFF. After the endurance test, the tachograph shall meet the maximum tolerance requirements as given in cl. 4.0 of Annexure I and cl. 5.0 of Annexure II as applicable.

5.5 Conditioning Tests

5.5.1 The device shall be subjected to the following conditions and meet the performance requirements as given in the cl. 5.3.3 after the conditioning.

5.5.2 Dry Heat Test

The component shall be subjected for 16 h in a chamber whose temperature is maintained at $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ as per cl. 4.2 of IS:10250-1982.

5.5.3 Cold Test

The component shall be subjected for 16 h in a chamber whose temperature is maintained at $-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$ as per cl. 4.4 of IS:10250-1982.

5.5.4 Damp Heat (Cycling) Test

The component shall be subjected for 6 damp heat cycles in a chamber, whose environment is varied according to Damp Heat Cycle Test as per 1A Test Cycle of Variant 1 with upper temperature of 55°C of IS: 9000 (Part V/Sec. 2)-1981 (Fig.2).

5.5.5 Rapid Change of Temperature Test

The component shall be subjected for 5 cycles in a chamber whose temperature is varied between -10°C and 70°C described in Group 2 ,cl. 4.5 of IS: 10250-1982.

5.5.6 Vibration Test

The component shall be mounted on a table as per cl. 4.1 of IS: 10250-1982, and subjected to the following conditions of vibrations

- For Engine mounted components: In the frequency range of 10 Hz to 250 Hz with constant displacement of 0.75 mm up to a frequency of 57/62 Hz and a constant acceleration of 10 g above that frequency for 1 h in each axis for all the three axes.
- For Cabin mounted components: In the frequency range of 10-55 Hz, with constant displacement of 0.35 mm for 1 h in each axis for all the three axes.

5.5.7 Salt Spray Test

The components, exposed to the ambient road environment, shall be kept in a salt spray chamber with 5% concentration of sodium chloride and internal temperature of $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 50 h as per cl. 4.8 of IS: 10250-1982.

5.5.8 Dust Test

The unit should be conditioned as per cl. 4.6 of IS: 10250-1982.

5.5.9 Water Spray Test

The unit should be conditioned as per cl. 4.13 of IS: 10250-1982.

5.5.10 Bump Test

The complete device should be subjected to bump test as per cl. 4.11 of IS: 10250-1982.

5.6 EMI/EMC TEST

The tachograph shall meet the requirements of electro magnetic radiation levels as per AIS-004/1999. The tachograph shall be protected against battery power supply transient and shall comply with the requirements of ISO:7637-2. The tachograph shall be protected against electrostatic discharges and shall comply with the requirements of IEC: 61000 – 4 - 2, ± 2 kV (Level 1).

5.7 The distribution of the samples for the various tests is given below

Sr. No.	Test	Sample No.				
		1	2	3	4	5
1.	Endurance Tests	*				
2.	Conditioning Tests					
2.1	High Temperature		*			
2.2	Low Temperature		*			
2.3	Damp Heat Cycles		*			
2.4	Rapid Change of Temperature		*			
2.5	Vibration				*	
2.6	Salt Spray			*		
2.7	Dust			*		
2.8	Water Spray			*		
2.0	Bump				*	
3	EMI/EMC Tests					*

5.8 Performance Tests on the Device as Fitted on the Vehicle

5.8.1 The tachograph as installed on 3 vehicles shall comply with the following additional requirements

5.8.1.1 Tachograph Installation on Vehicle

The tachograph shall be provided with an installation plaque. The plaque shall bear at least the following details

- a) Name and Address of tachograph Manufacturer
- b) Tachograph Sl. No.
- c) Characteristic Coefficient of the Vehicle in the form $W = \dots$ Impulses/km
- d) Constant of the tachograph in the form $K = \dots$ impulses/km
- e) Effective Circumference of the Wheel Tyres in the form $L = \dots$ mm

The tachograph shall be mounted in the test vehicle and it shall be activated with appropriate entry of characteristic coefficient of the vehicle and tachograph constant.

5.8.1.2 Vehicle Preparation

The test vehicle shall be unladen in normal running order. The tyre pressure shall be as per the vehicle manufacturer's recommendation. The tyre wear shall be within the limits.

5.8.2 Characteristics of Test Track

The test shall be carried out on a roadway, smooth, dry and covered with asphalt or a similar material in a straight line. The roadway shall be capable of allowing the maximum speed to be maintained over a measuring strip minimum of 200m, established to the nearest one meter.

The measuring stretch of track shall have adequate length on either ends for the purpose of achieving the test speed and stopping the vehicle at the end of the trial.

Alternatively, suitable roller chassis dynamometer can be used for vehicle tests with necessary road load simulation.

5.8.3 Test Method

The test vehicles shall be driven at test speeds as given below

Maximum Speed of Test Vehicle as Declared by Vehicle Manufacturer (km/h)	Test Speed (km/h)
Up to 100 km/h	40 km/h and 80% of the maximum speed (rounded off to the nearest value divisible by 5)
More than 100 km/h	40km/h, 80km/h and 80% of maximum speed or 120 km/h whichever is lower.

The test instrumentation for measuring the true vehicle speed shall be accurate within $\pm 0.5\%$.

The test vehicle shall be driven till a steady speed of 50 ± 2 km/h is achieved and at this speed the vehicle shall be driven for at least 10 km.

5.8.4 Acceptance Criteria for Test

The tachograph when tested as per the above test method shall comply with the maximum tolerance requirement as per cl. 4.0 of Annexure I and 5.0 of Annexure II as applicable.

ANNEXURE I

(See 4.0)

**REQUIREMENT FOR CONSTRUCTION, TESTING, INSTALLATION,
AND INSPECTION OF CHART TYPE TACHOGRAPH****1.0 DEFINITIONS****In this Annexure****1.1 Recording Equipment (Tachograph) means**

Equipment intended for installation in road vehicles to show and record automatically or semi-automatically details of the movement of those vehicles and of the certain working periods of their drivers;

1.2 Record Sheet means

A sheet designed to accept and retain recorded data, to be placed in the tachograph and on which the marking devices of the latter inscribe a continuous record of the information to be recorded;

1.3 The Constant of the Tachograph means

The numerical characteristic giving the value of the input signal required to show and record a distance traveled of one kilometer; this constant must be expressed either in revolutions per kilometer ($k = \dots \text{ rev/km}$), or in impulses per kilometer ($k = \dots \text{ imp/km}$);

1.4 Characteristic Coefficient of the Vehicle means

The numerical characteristic giving the value of the output signal emitted by the part of the vehicle linking it with the tachograph (gearbox output shaft or axle) while the vehicle travels a distance of one measured kilometer under normal test conditions. The characteristic coefficient is expressed either in revolutions per kilometer ($w = \dots \text{ rev/km}$) or in impulses per kilometer ($w = \dots \text{ imp/km}$);

1.5 Effective Circumference of Wheel Tyres means

The average of the distances traveled by the several wheels moving the vehicle (driving wheels) in the course of one complete rotation. The measurement of these distances must be made under normal test conditions and is expressed in the form: $L = \dots \text{ mm}$.

**2.0 GENERAL CHARACTERISTICS AND FUNCTIONS OF
TACHOGRAPH**

The equipment must be able to record the following

- i) Distance traveled by the vehicle;
- ii) Speed of the vehicle;
- iii) Driving time;
- iv) Other periods of work or of availability;
- v) Breaks from work and daily rest periods;

vi) Opening of the case containing the record sheet. The equipment must have the facility to retrieve the record onboard and must be able to record distinctly in case of multi-driver operation the details of the periods listed under iii, iv and v.

vii) Driver's Identity

The equipment must be capable of recording on sheets details of the periods listed under iii, iv and v for at least one driver and for two drivers as option.

viii) For electronic recording equipment (tachograph), which is equipment operating by electrical signals transmitted from the distance and speed sensor, any interruption exceeding 100 milli second, in the power supply of the recording equipment (except lighting), in the power supply of the distance and speed sensor and any interruption in the signal lead to the distance and speed sensor.

3.0 CONSTRUCTION REQUIREMENTS FOR TACHOGRAPH

3.1 Tachograph shall include the following

3.1.1 Visual instruments showing

- a) Distance traveled (Odometer),
- b) Speed (speedometer),
- c) Time (clock).

3.1.2 Recording instruments comprising

- a) A recorder of the distance traveled,
- b) A speed recorder,
- c) One or more time recorders
- d) Driver's Identity

3.1.3 A means of marking showing on the record sheet individually

- a) Each opening of the case containing that sheet
- b) For electronic recording equipment, any interruption exceeding 100 ms in the power supply of the recording equipment (except lighting), not latter than at switching on the power supply again,
- c) For electronic equipment any interruption exceeding 100 ms in the power supply of the distance and speed sensor and any interruption in the signal lead to the distance and speed sensor.

3.1.4 Any inclusion in the equipment of the devices additional to those listed above must not interfere with the proper operation of the mandatory devices or with the reading of them.

The equipment must be submitted for approval complete with any such additional devices.

3.2. Materials

- 3.2.1 All the constituent parts of the tachograph must be made of materials with sufficient stability and mechanical strength and stable electrical and magnetic characteristics.
- 3.2.2. Any modification in a constituent part of the equipment or in the nature of the materials used for its manufacture must, before being applied in manufacture, be submitted for approval to the authority, which granted type-approval for the equipment.

3.3 Measurement of distance traveled

The distances traveled may be measured and recorded either

- So as to include forward and reverse movement or forward only.

Any recording of reversing movements must on no account affect the clarity and accuracy of the other recordings.

3.4 Measurement of speed

- 3.4.1 The range of speed measurement shall be as stated in the type approval certificate.
- 3.4.2 The natural frequency and the damping of the measuring device must be such that the instruments showing and recording the speed can, within the range of measurement, follow acceleration changes of up to 2 m/s^2 and deceleration changes up to 5 m/s^2 within the limits of accepted tolerances.

3.5 Measurement of time (clock)

- 3.5.1 The control of the mechanism for resetting the clock must be located inside a case containing the record sheet; each opening of that case must be automatically recorded on the record sheet. Any resetting of the clock must be automatically recorded
- 3.5.2 If the forward movement mechanism of the record sheet is controlled by the clock, the period during which the latter will run correctly after being fully wound must be greater by at least 10 % than the recording period corresponding to the maximum sheet-load of the equipment.

3.6 Lighting and Protection

- 3.6.1 The visual instruments of the equipment must be provided with adequate non-dazzling lighting.
- 3.6.2 For normal conditions of use, all the internal parts of the equipment must be protected against damp and dust. In addition they must be made proof against tampering by means of casings capable of being sealed.

3.7 Visual instruments

- i) Distance traveled indicator (distance recorder)
- ii) The value of the smallest grading on the instrument showing distance traveled must be 0.1 kilometers. Figures showing hectometers must be clearly distinguishable from those showing whole kilometers.
- iii) The figures on the distance recorder must be clearly legible and must have an apparent height of at least 4 mm.
- iv) The distance recorder must be capable of reading up to at least 99 999.9 kilometers.

3.8 Speed indicators (speedometer)

- i) Within the range of measurement, the speed scale must be uniformly graduated by 1, 2, 5 or 10 kilometers per hour. The value of a speed graduation (space between two successive marks) must not exceed 10 % of the maximum speed shown on the scale.
- ii) The length of each space on the scale representing a speed difference of 10 kilometers per hour must not be less than 10 millimeters.
- iii) On an indicator with a needle, the distance between the needle and the instrument face must not exceed three millimeters.

3.9 Time indicator (clock)

The time indicator must be visible from outside the equipment and give a plain and unambiguous reading.

3.10 Recording instrument

3.10.1 **General Points:** All equipment, whatever the form of the record sheet (strip or disc) must be provided with a mark enabling the record sheet to be inserted correctly, in such a way as to ensure that the time shown by the clock and the time-marking on the sheet correspond.

3.10.2 The mechanism moving the record sheet must be such as to ensure that the latter moves without play and can be freely inserted and removed.

3.10.3 For record sheets in disc form, the forward movement device must be controlled by the clock mechanism. In this case, the rotating movement of the sheet must be continuous and uniform, with a minimum speed of seven millimeters per hour measured at the inner border of the ring marking the edge of the speed recording area.

In equipment of the strip type, where the forward movement device of the sheets is controlled by the clock mechanism the speed of rectilinear forward movement must be at least 10 millimeters per hour.

3.10.4 Recording of the distance traveled, of the speed of the vehicle and of any opening of the case containing the record sheet or sheets must be automatic.

3.10.5 Recording distance traveled

3.10.5.1 Every kilometer of distance traveled must be represented on the record by a variation of at least one millimeter on the corresponding coordinate.

3.10.5.2 Even at speeds reaching the upper limit of the range of measurement, the record of distances must still be clearly legible.

3.10.6 Recording speed

3.10.6.1 Whatever the form of the record sheet, the speed recording stylus must normally move in a straight line and at right angles to the direction of travel of the record sheet.

However, the movement of the stylus may be curvilinear, provided the following conditions are satisfied

a) The trace drawn by the stylus must be perpendicular to the average circumference (in the case of sheets in disc form) or to the axis (in the case of sheets in strip form) of the area reserved for speed recording,

b) The ratio between the radius of curvature of the trace drawn by the stylus and the width of the area reserved for speed recording must be not less than 2.4 to 1 whatever the form of the record sheet,

c) The markings on the time-scale must cross the recording area in a curve of the same radius as the trace drawn by the stylus. The spaces between the markings on the timescale must represent a period not exceeding one hour.

3.10.6.2 Each variation in speed of 10 kilometers per hour must be represented on the record by a variation of at least 1.5 millimeters on the corresponding coordinate.

3.10.7 Recording time

3.10.7.1 Tachograph must be so constructed that the period of the driving time is always recorded automatically and that it is possible, through the operation where necessary of a switch device to record separately the other periods of time.

3.10.7.2 It must be possible, from the characteristics of the traces, their relative positions to distinguish clearly between the various periods of time.

The various periods of time should be differentiated from one another on the record by differences in the thickness of the relevant traces, or by any other system of at least equal effectiveness from the point of view of legibility and ease of interpretation of the record.

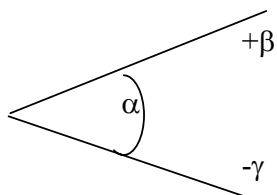
3.10.7.3 In the case of vehicles with a crew consisting of more than one driver, the recordings provided for cl. 3.10.7.1 must be made on two separate sheets, each sheet being allocated to one driver. In this case, the forward movement of the separate sheets must be effected either by a single mechanism or by separate synchronized mechanisms.

3.10.8 Closing device

- i) The case containing the record sheet or sheets and the control of the mechanism for resetting the clock must be provided with a lock.
- ii) Each opening of the case containing the record sheet or sheets and the control of the mechanism for resetting the clock must be automatically recorded on the sheet or sheets.

3.10.9 Markings

- i) The following markings must appear on the instrument face of the equipment
 - close to the figure shown by the distance recorder, the unit of measurement of distance, indicated by the abbreviation 'km',
 - Near the speed scale, the marking 'km/h',
 - The measurement range of the speedometer in the form 'V min . . . km/h, V max . . . km/h', This marking is not necessary if it is shown on the descriptive plaque of the equipment.
- ii) The descriptive plaque must be built into the equipment and must show the following markings, which must be visible on the equipment when installed
 - Name and address of the manufacturer of the equipment,
 - Manufacturer's serial number and year of construction, Equipment type/ model name
 - The constant of the equipment in the form 'k = . . . rev/km' or 'k = . . . imp/km',
 - Optionally, the range of speed measurement, in the form indicated in point 1,
 - Should the sensitivity of the instrument to the angle of inclination be capable of affecting the readings given by the equipment beyond the permitted tolerances, the permissible angle expressed as



Where α is the angle measured from the horizontal position of the front face (fitted the right way up) of the equipment for which the instrument is calibrated, while β and γ represent respectively the maximum permissible upward and downward deviations from the angle of calibration α .

4.0 Maximum Tolerances (visual and recording instruments)

4.1 On the test bench before installation

- (a) Distance traveled:
1 % more or less than the real distance, where that distance is at least one kilometer;
- (b) speed:
3 km/h more or less than the real speed;
- (c) Time:
± two minutes per day with a maximum of 10 minutes per seven days in cases where the running period of the clock after rewinding is not less than that period.

4.2 On installation

- (a) Distance traveled:
2 % more or less than the real distance, where that distance is at least one kilometer;
- (b) Speed:
4 km/h more or less than the real speed;
- (c) Time:
± two minutes per day, or
± 10 minutes per seven days.

- 4.3 The above tolerances apply for the lab testing as a component and type testing in as installation condition.
- 4.4. The maximum tolerances set out in cl. 4.1 and 4.2 are valid for temperatures between 0° and 40°C, temperatures being taken in close proximity to the equipment.
- 4.5. Measurement of the maximum tolerances set out in cl. 4.2 shall take place under the conditions laid.

5.0 RECORD SHEETS

- 5.1 The record sheets must be such that they do not impede the normal functioning of the instrument and that the records, which they contain, are indelible and easily legible and identifiable. The record sheets must retain their dimensions and any records made on them under normal conditions of humidity and temperature.

In addition it must be possible to write on the sheets, without damaging them and without affecting the legibility of the recordings.

Under normal conditions of storage, the recordings must remain clearly legible for at least one year.

- 5.2 The minimum recording capacity of the sheets, whatever their form, must be 24 hours.

If several discs are linked together to increase the continuous recording capacity which can be achieved without intervention by staff, the links between the various discs must be made in such a way that there are no breaks in or overlapping of recordings at the point of transfer from one disc to another.

5.2 Recording areas and their graduation

- 5.2.1 The record sheets shall include the following recording areas

- An area exclusively reserved for data relating to speed,
- An area exclusively reserved for data relating to distance traveled,
- One or more areas for data relating to driving time, to other periods of work and availability to breaks from work and to rest periods for drivers.

The area for recording speed must be scaled off in divisions of 20 kilometers per hour or less. The speed corresponding to each marking on the scale must be shown in figures against that marking. The symbol 'km/h' must be shown at least once within the area. The last marking on the scale must coincide with the upper limit of the range of measurement.

- 5.2.2 The area for recording distance traveled must be set out in such a way that the number of kilometers traveled may be read without difficulty.

The area or areas reserved for recording the periods referred to in point 1 must be so marked that it is possible to distinguish clearly between the various periods of time.

5.3 Information to be printed on the record sheets

Each sheet must bear, in printed form, the following information

- a) Name and address or trade name of the manufacturer,
- b) Approval mark for the model of the sheet,
- c) Approval mark for the type or types of equipment in which the sheet may be used,
- d) Upper limit of the speed measurement range, printed in kilometers per hour.

By way of minimal additional requirements, each sheet must bear, in printed form a time-scale graduated in such a way that the time may be read directly at intervals of fifteen minutes while each five minute interval may be determined without difficulty.

5.4 Free space for hand written insertions

A free space must be provided on the sheets such that drivers may as a minimum write in the following details

- Surname and first name of the driver,
- Date and place where use of the sheet begins and date and place where such use ends,
- The registration number or numbers of the vehicle or vehicles to which the driver is assigned during the use of the sheet,
- Odometer readings from the vehicle or vehicles to which the driver is assigned during the use of the sheet,
- The time at which any change of vehicle takes place.

6.0 INSTALLATION OF TACHOGRAPH

- 6.1. Tachograph must be positioned in the vehicle in such a way that the driver has a clear view from his seat of speedometer, distance recorder and clock while at the same time all parts of those instruments, including driving parts, are protected against accidental damage.
- 6.2. It must be possible to adapt the constant of the tachograph to the characteristic coefficient of the vehicle by means of a suitable device, to be known as an adaptor.
Vehicles with two or more rear axle ratios must be fitted with a switch device whereby these various ratios may be automatically brought into line with the ratio for which the equipment has been adapted to the vehicle.
- 6.3. After the equipment has been checked on installation, an installation plaque shall be affixed to the vehicle beside the equipment or in the equipment itself and in such a way as to be clearly visible.
- 6.4. The equipment shall, furthermore, be so designed that it is possible, without opening the case, to verify that recordings are being made.
- 6.5. In order to ensure that tachograph functions reliable and correctly, it is advisable that the competent authorities lay down uniform requirements for the periodic checks and inspections and sealing to which the equipment is to be subjected after installation. It is also advisable that the competent authorities define the responsibilities of drivers and fleet owners.

ANNEXURE II

(See 4.0)

REQUIREMENT FOR CONSTRUCTION, TESTING, INSTALLATION, AND
INSPECTION OF ELECTRONIC DIGITAL TACHOGRAPH**1.0 DEFINITIONS****In this Annexure****1.1 “Activation” means**

phase where the tachograph become fully operational and implants all functions, including security functions;

1.2 “Authentication” means

a function intended to establish and verify a claimed identity;

1.3 “Authenticity” means

the property that an information is coming from a party whose identity can be verified;

1.4 “Built-in-test (BIT)” means

tests run at request, triggered by the operator or by an external equipment;

1.5 “Calendar day” means

a day ranging from 00.00 hours to 24.00 hours. All calendar days relate to IST time

1.6 “Calibration” means

updating or confirming vehicle parameters to be held in the data memory. Vehicle parameters include vehicle identification and vehicle characteristics (w. k, l, tyre size, speed limiting device setting (if applicable), current IST time, current odometer value);

1.7 “Card number” means

a 16 alpha-numerical character number that uniquely identifies a tachograph card

1.8 “Card consecutive index” means

the 14th alpha-numerical character of a card number that is used to differentiate the different cards issued to a company or a body entitled to be issued several tachograph cards. The company or the body is uniquely identified by the 13 first characters of the card number;

- 1.9 **“Card renewal index” means**
the 16th alpha-numerical character of a card number, which is incremented each time a tachograph card is renewed;
- 1.10 **“Card replacement index” means**
the 15th alpha-numerical character of a card number which is incremented each time a tachograph card replaced.
- 1.11 **“Characteristics coefficient of the vehicle” means**
the numerical characteristic giving the value of the output signal emitted by the part of the vehicle linking it with the tachograph (gearbox output shaft or axle) while the vehicle travels a distance of one kilometer under standard test conditions.
The characteristic coefficient is expressed in impulses per kilometer ($w = \dots \text{ Imp/km}$);
- 1.12 **“Company card” means**
a tachograph card issued by the authorities to the owner or holder of vehicles fitted with tachograph;
the company card identifies the company and allows for displaying, downloading and printing of the data stored in the tachograph which has been locked by this company;
- 1.13 **“Constant of the Tachograph” means**
the numerical characteristics giving the value of the input signal required to show and record a distance traveled of one kilometer; this constant shall be expressed in impulses per kilometer ($k = \dots \text{ Imp/km}$);
- 1.14 **“Data memory” means**
an electronic data storage device built into the tachograph;
- 1.15 **“Downloading” means**
copying together with digital signature of a part or of a complete set of data stored in the data memory of the vehicle or in the memory of a tachograph card; downloading may not alter or delete any stored data;
- 1.16 **“Driver card” means**
a tachograph card issued by the authorities to a particular driver;
the driver card identifies the driver and allows for storage of driver activity data;

- 1.17 **“Effective circumference of the wheel tyres” means**
the average of the distances traveled by each of the wheels moving the vehicle (driving wheels) in the course of one complete rotation. The measurement of these distances shall be made under standard test conditions and is expressed in the form “I = ... mm”. Vehicle manufacturers may replace the measurement of these distances by a theoretical calculation which takes into account the distribution of the weight on the axles, vehicle unladen in normal running order. The methods for such theoretical calculation will be approved by a competent authority.
- 1.18 **“Event” means**
abnormal operation detected by the tachograph, which may come from a fraud attempt;
- 1.19 **“Fault” means**
abnormal operation detected by the tachograph, which may come from an equipment malfunction or failure;
- 1.20 **“Installation” means**
mounting of the tachograph in a vehicle;
- 1.21 **“Speed sensor” means**
part of the tachograph, providing a signal representative of vehicle speed and/or distance traveled;
- 1.22 **“Non valid card” means**
a card detected as faulty, or which initial authentication failed, or which start of validity date is not yet reached, or which date has passed;
- 1.23 **“Over speeding” means**
exceeding the authorized speed of the vehicle, defined as any period of more than 60 seconds during which the vehicle’s measured speed exceeds the limit for setting the speed limitation device on the installation and use of speed limitation devices for certain categories of motor vehicles.
- 1.24 **“Printer” means;**
component of the tachograph which provides printouts of stored data;
- 1.25 **“Tachograph” means;**
the total equipment intended for installation in road vehicles to show, record and store automatically or semi-automatically details of the movement of such vehicle and of certain work periods their drivers;

- 1.26 **“Self test” means;**
tests run cyclically and automatically by the tachograph to detect faults;
- 1.27 **“Tachograph card ” means;**
smart card intended for use with the tachograph. Tachograph cards allow for identification by the tachograph of the identify (or identify group) of the cardholder and allow for data transfer and storage. A tachograph card may be of the following types;
- driver card
 - company card
- 1.28 **“Type approval” means;**
process to certify, that the tachograph (or component) or the tachograph card under investigation fulfils the requirements of this standard;
- 1.29 **“Tyre size” means;**
the designation of the dimensions of the tyres .
- 1.30 **“Vehicle identification” means**
number identifying the vehicle: vehicle registration number (VRN) with indication of the registering authority and vehicle identification number (VIN).
- 1.31 **“Vehicle unit (VU)”means**
the tachograph excluding the motion sensor and the cables connecting the motion sensor. The vehicle unit may either be a single unit or be several units distributed in the vehicle, as long as it complies with the security requirements of this regulation;
- 2.0 GENERAL CHARACTERISTICS AND FUNCTIONS OF THE TACHOGRAPH**
- Any vehicle fitted with the tachograph complying with the provisions of this Annexure must include a speed display and an odometer. These functions may be included within the tachograph.
- 2.1 General Characteristics**
- 2.1.1 The purpose of the tachograph is to record, store, display and output data related to driver activities.
- 2.1.2 The tachograph includes cables, a speed sensor, a vehicle unit and tachograph cards

- 2.1.3 The vehicle unit includes a processing unit, a data memory, a real time clock, smart card interface device, a printer (optional), a display, a visual warning, a downloading connector and facility for entry of user's inputs.

The tachograph may be connected to other devices through additional connectors.

- 2.1.4 Any inclusion in or connection to the tachograph of any function, devices, or devices, approved or otherwise, shall not interface with, or be capable of interfacing with, the proper and secure operation of the tachograph and the provisions of the standard.

- 2.1.5 Tachograph users identify themselves to the equipment via tachograph cards. The tachograph shall be provided with driver card(s) and a company card. The construction and functional requirements for tachograph cards are as per Annexure III.

- 2.1.6 The tachograph provides selective access rights to data and functions according to user's type and/or identity.

The tachograph records and stores data in its data memory and in tachograph cards.

2.2 Functions

The tachograph shall ensure the following functions;

- a) monitoring cards insertions and withdrawals,
- b) speed and distance measurement
- c) time measurement;
- d) monitoring driver activities,
- e) monitoring driving status,
- f) detection of events and/or faults,
- g) built-in self tests,
- h) reading from data memory,
- i) recording and storing in data memory,
- j) reading from tachograph cards,
- k) recording and storing in tachograph cards,
- l) displaying,
- m) printing (optional),
- n) warning,
- o) data downloading to external media,
- p) output data to additional external devices,
- q) time adjustment.

3.0 Modes of Operation

The tachograph shall operate in the following modes of operation;

- a) operational mode,
- b) company mode,

The tachograph shall ignore non-valid cards inserted, except displaying, printing or downloading data held on an expired card, which shall be possible.

4.0 Security

The system security aims at protecting the data memory in such a way as to prevent unauthorized access to and manipulation of the data and detecting any such attempts, protecting the integrity and authenticity of data exchanged between the speed sensor and the vehicle unit, protecting the integrity and authenticity of data exchanged between the tachograph and the tachograph cards, and verifying the integrity and authenticity of data download.

5.0 CONSTRUCTION AND FUNCTIONAL REQUIREMENTS FOR TACHOGRAPH

5.1 Monitoring Cards Insertion and Withdrawal

The tachograph shall monitor the card interface devices to detect card insertions and withdrawals.

Upon card insertion the tachograph shall detect whether the card inserted is a valid tachograph card and in such a case identify the card type.

The tachograph shall be so designed that the tachograph cards are locked in position on their proper insertion into the card interface devices.

The release of tachograph cards may function only when the vehicle is stopped and after the relevant data has been stored on the cards. The release of the card shall require positive action by the user.

5.2 Speed and Distance Measurement

This function shall continuously measure and be able to provide the odometer value corresponding to the total distance traveled by the vehicle.

This function shall continuously measure and be able to provide the speed of the vehicle.

The speed measurement function shall also provide the information whether the vehicle is moving or stopped. The vehicle shall be considered as moving as soon as the function detects more than 1 imp/sec for at least five seconds from the speed sensor, otherwise the vehicle shall be considered as stopped.

Devices displaying speed (speedometer) and total distance traveled (odometer) installed in any vehicle fitted with a tachograph complying with the provisions of this Standard, shall comply with the requirements of maximum tolerances specified in cl. 5.3 and 5.4 below

5.3 Measurement of Distance Traveled

The distance traveled shall be measured so as to cumulate both forward and reverse movements.

The tachograph shall measure distance from 0 to 9,99,999.9 km

Distance measured for a test distance of min 10 km, shall be within the tolerances as given below

- a) $\pm 1\%$ on test bench
- b) $\pm 2\%$ on installation in vehicle

Distance measured shall have a resolution better than or equal to 0.1 km.

5.4 Measurement of Speed

The tachograph shall measure speed from 0 to 150 km/h.

Speed Measurement shall be within the tolerances as given below

- a) ± 1 km/h on test bench (at constant speed)
- b) ± 2 km/h on installation in vehicle

The speed shall be measured correctly within the normal tolerances within 2 seconds of the end of a change when the speed has changed at a rate up to 2 m/s^2 .

Speed measurement shall have a resolution better than or equal to 1 km/h.

5.5 Time Measurement

The time measurement function shall measure permanently and digitally provide IST date and time.

IST date and time shall be used for dating throughout the tachograph (recordings, printouts, data exchange, display...).

In order to visualize the local time, it shall be possible to change the offset of the time displayed, in half hour steps.

Time drift shall be within ± 2 seconds per day in type approval conditions.

Time measured shall have a resolution better than or equal to 1 second.

Time measured shall have the date format DD:MM:YYYY and time format HH:MM:SS.

Time measurement shall not be affected by an external power supply cut-off of less than 12 months in type approval conditions.

5.6 Monitoring Driver Activities

This function shall permanently monitor the activities of driver.

When the vehicle is moving, DRIVING shall be selected automatically for the driver.

When vehicle stops, STOP shall be selected automatically for the driver.

This function shall output activity changes to the recording functions at a resolution of one minute.

This function shall also permanently monitor the continuous driving time and the cumulative break time of the driver.

5.7 Detection of Events and / or Faults

This function shall detect the following events and / or faults

a) Insertion of a Non-valid Card Event

This event shall be triggered at the insertion of any non-valid card and / or when an inserted valid card expires.

b) "Time Overlap" Event

This event shall be triggered when the date / time of last withdrawal of a driver card, as read from the card; is later than the current date / time of the tachograph in which the card is inserted.

c) "Card Insertion while Driving" Event.

This event shall be triggered when a tachograph card is inserted in the slot, while driver activity is DRIVING,

d) "Over Speeding" Event

This event shall be triggered for each over speeding.

e) **“Power Supply Interruption” Event**

This event shall be triggered in case of any interruption exceeding 200 milliseconds of the power supply of the speed sensor and/or of the vehicle unit. The manufacturer shall define the interruption threshold. The drop in power supply due to the starting of the engine of the vehicle shall not trigger this event.

f) **“Speed Sensor Error” Event**

This event shall be triggered in case of interruption of the normal signal flow between the speed sensor and the vehicle unit and/or in case of data integrity or data authentication error during data exchange between the speed sensor and vehicle unit.

g) **“Security Breach Attempt” Event**

This event shall be triggered for any other event affecting the security of the speed sensor and/or of the vehicle unit as specified within the generic security targets of these components.

h) **“Card” Fault**

This fault shall be triggered when a tachograph card failure occurs during operation.

i) **“Tachograph” fault**

This fault shall be triggered for any of these failures

- VU internal fault,
- Printer fault,
- Display fault,
- Downloading fault,
- Sensor fault.

5.8 Built-in and Self Tests

The tachograph shall self-detect faults through self tests and built-in-tests, according to the manufacturer’s specifications.

5.9 Reading from Data Memory

The tachograph shall be able to read data stored in its data memory.

5.10 Recording and Storing in the Data Memory

For the purpose of this paragraph,

- a) times are recorded with a resolution of one minute,
- b) odometer values are recorded with a resolution of one kilometer,
- c) speeds are recorded with a resolution of 1 km/h.

Data stored into the data memory shall not be affected by an external power supply cut-off of less than twelve months in type approval conditions.

The tachograph shall be able to record and store implicitly or explicitly in its data memory the following

Equipment Identification Data

Vehicle Unit Identification Data

The tachograph shall be able to store in its data memory the following vehicle unit identification data

- a) name of the manufacturer,
- b) address of the manufacturer,
- c) part number,
- d) serial number,
- e) software version number,
- f) software version installation date,
- g) year of equipment manufacture,

Vehicle unit identification data are recorded and stored once and for all by the vehicle unit manufacturer, except the software-related data and the approval number which may be changed in case of software upgrade.

Speed Sensor Identification Data

The speed sensor shall be able to store in its memory the following identification data

- a) name of the manufacturer,
- b) part number,

Speed sensor identification data are recorded and stored once and for all in the tachograph, by the manufacturer.

Driver Card Insertion and Withdrawal Data

For each insertion and withdrawal cycle of a driver card in the equipment, the tachograph shall record and store in its data memory

- a) the card number and expiry date as stored in the card,
- b) the insertion date and time,
- c) the vehicle odometer value at card insertion,
- d) the withdrawal date and time,
- e) the vehicle odometer value at card withdrawal,

The data memory shall be able to hold these data for at least 365 days.

When storage capacity is exhausted, new data shall replace oldest data.

Driver Activity Data

The tachograph shall record and store in its data memory whenever there is a change of activity for the driver and/or whenever there is an insertion or withdrawal of a driver card

- a) the card status in the relevant slot (INSERTED, NOT INSERTED) (see Note),
- b) the activity (DRIVING, STOP)
- c) the date and time of the change.

Note: INSERTED means that a valid driver card is inserted in the slot. NOT INSERTED means the opposite, i.e. no valid driver card is inserted in the slot (e.g. a company card is inserted or no card is inserted).

The data memory shall be able to hold driver activity data for at least 365 days.

When storage capacity is exhausted, new data shall replace oldest data

Odometer Data

The tachograph shall store in its data memory odometer values at minimum 1 minute interval for at least 365 calendar days.

Speed Data.

The tachograph shall store in its data memory speed values at minimum 1 minute interval for at least 365 calendar days.

The tachograph shall record and store in its data memory the instantaneous speed of the vehicle and the corresponding date and time every second for at least the last 24 hours that the vehicle has been moving.

Event Data

The tachograph shall record and store in its data memory the following data for each event detected to the following storage rules

Event	Storage rules	Data to be recorded per event
Card insertion while driving.	- the last event for each of the 10 last days of occurrence	- date and time of the event, - card number, - number of similar events that day.
Over Speeding	- the most serious for each of the 10 last days of occurrence (i.e. the one with the highest average speed). - The five most serious events over the last 365 days.	- date and time of beginning of event, - date and time of end of event, - maximum speed measured during the event, - arithmetic average speed measured during the event, - card number, - number of similar events that day.
Power Supply interruption	- the longest event for each of the 10 last days of occurrence, - The five most events over the last 365 days.	- date and time of beginning of event, - date and time of end of event, - card number, - number of similar events that day.
Speed Sensor error	- the longest event for each of the 10 last days of occurrence, - The five most events over the last 365 days.	- date and time of beginning of event, - date and time of end of event, - card number, - number of similar events that day.
Security breach attempt	- the most recent events per type of event.	- date and time of beginning of event, - date and time of end of event, - card number, - type of event.

Faults Data

The tachograph shall attempt to record and store in its data memory the data for each fault detected according to the following storage rules

Fault	Storage rules	Data to be recorded per event
Card fault	- the 10 most recent driver card faults	- date and time of beginning of fault, - date and time of end of fault, - card number.
Tachograph faults	- the 10 most recent faults for each type of faults	- date and time of beginning of fault, - date and time of end of fault, - type of fault, - card number.

5.11 Displaying

The Display shall include at least 20 characters.

The display shall be provided with adequate non-dazzling lighting.

The display shall always be ON when the vehicle is moving.

The tachograph may include a manual or automatic feature to turn the display OFF when the vehicle is not moving.

Warning Display

The tachograph shall display warning information using suitable means.

5.12 Warnings

The tachograph shall warn the driver when detecting any event and / or fault.

Warning of a power supply interruption event may be delayed until the power supply is reconnected.

Warning shall be visual. Audible warnings may also be provided in addition to visual warnings.

Visual warnings shall be clearly recognizable by the user, shall be suited in the driver's field of vision and shall be clearly legible both by day and by night.

Visual warnings may be built into the tachograph and / or from the tachograph.

Warnings shall have duration of at least 30 seconds, unless acknowledged by the user by hitting any key of the tachograph. This first acknowledgement shall not erase warning causes display.

5.13 Data Downloading to External Media

The tachograph shall be able to download on request data from its data memory or from a driver card to external storage media via the downloading connector. The tachograph shall update data stored on the relevant card before starting downloading.

Downloading shall not alter or delete any stored data.

5.14 Time Adjustment

The time adjustment function of the tachograph shall allow for adjusting the current time in amounts of one minute maximum at intervals of not less than seven days.

5.15 Performance Characteristics.

The vehicle until shall be fully operational in the temperature range -20°C to 70°C , and the speed sensor in the temperature range -40°C to 135°C . Data memory content shall be preserved at temperature down to -40°C .

The tachograph shall be fully operational in the humidity range of 10% to 90%.

ANNEXURE :III
(See 2.1.5 of Annexure II)

**CONSTRUCTION AND FUNCTIONAL REQUIREMENTS FOR
TACHOGRAPH CARDS**

1.0 Visible Data

The front page of the card shall be printed with the large-type words “Driver Card” or “Company Card”.

The front page of the card shall have provision for printing information specific to the card such as

- i) Driver Card: Name & Address of Driver, Photograph of Driver, Signature of Driver, Driving License No. of Driver, Card No., Card Validity/Expiry Date
- ii) Company Card: Name & Address of Company, Card No., Card Validity/Expiry Date

2.0 Security

The system security aims at protecting integrity and authenticity of data exchanged between the cards and tachograph, protecting the integrity and authenticity of data down-loaded from the cards, allowing certain write operations on to the cards to tachograph only, ruling out any possibility of falsification of data stored in the card, preventing tampering and detecting any attempt of that kind.

The tachograph cards shall broadly achieve the above system security requirements.

3.0 Environmental and Electrical Requirements

The tachograph cards shall be capable of satisfactory operation in all the climatic conditions normally encountered in the temperate range – 25°C to + 70°C.

The tachograph cards shall be capable of satisfactory operation in the humidity range 10% to 90%.

During operation, the tachograph cards shall comply with the requirements of AIS-004/1999 related to electromagnetic compatibility and shall be protected against electrostatic discharge, when tested as per IEC: 61000 – 4 - 2, ± 2 kV (Level 1).

4.0 Data Storage

4.1 For the purpose of this requirement

- a) times are recorded with resolution of one minute
- b) odometer values recorded with resolution of one km
- c) speeds are recorded with resolution of one km/h

4.2 Driver Card

The driver card shall be able to store the following

- a) Card identification
- b) Card holder identification
- c) Driving license information
- d) Vehicle usage data
- e) Driver activity data: The driver card memory shall be able to hold driver activity data for at least 28 days
- f) Events data
- g) Faults data

4.3 Company Card

The company card shall be able to store the following

- a) Card identification
- b) Card holder identification
- c) Company activity data

ANNEXURE IV

(See 3.0)

REQUIREMENTS FOR EXTENSION OF TYPE APPROVAL

1. Any modification in software or hardware of the tachograph or in the nature of materials used for its manufacture shall, before being used, be notified to the test agency which granted type approval for the equipment. The test agency shall confirm to the manufacturer the extension of type approval based on relevant functional checks/tests.
2. Procedure to upgrade the software of the tachograph field units shall be approved by the test agency which granted type approval of the equipment. Software upgrade must not alter nor delete any driver activity data stored in the tachograph. Software may be upgraded only under the responsibility of the equipment manufacturer.

ANNEXURE V
(See Introduction)
COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

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Shri B. Bhanot	Director The Automotive Research Association of India, Pune
Members	Representing
Shri Alok Rawat	Ministry of Shipping, Road Transport & Highways, New Delhi
Shri Sushil Kumar	Department of Heavy Industry, Ministry of Heavy Industries & Public Enterprises, New Delhi
Shri Chandan Saha	Office of the Development Commissioner, Small Scale Industries, Ministry of Small Scale Industries, New Delhi
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The Automotive Research Association of India, Pune

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