AUTOMOTIVE INDUSTRY STANDARD

AUTOMOTIVE VEHICLES – UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES OF CATEGORIES M1, AND N1 WITH REGARD TO BRAKE ASSIST SYSTEM

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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 and HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT and HIGHWAYS)
GOVERNMENT OF INDIA

May 2018

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

Sr. No.	Corrigenda.	Amendment	Revision	Date	Remark	Misc.
General remarks :						

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work 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, has published this standard. For better dissemination of this information ARAI may publish this standard on their web site.

This standard is in line with UN R 139.

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

Automotive Vehicles – Uniform Provisions Concerning the Approval of Vehicles of Categories M1 and N1 with Regard to Brake Assist System

1.0 SCOPE

1.1. This Standard applies to the approval of vehicles of category M_1 fitted with Brake Assist systems (BAS). This standard shall apply to category N1 if fitted with BAS.

1.2. This Standard does not cover:

1.2.1. Vehicles with a design speed not exceeding 25 km/h;

1.2.2. Vehicles fitted for invalid drivers.

2.0 DEFINITIONS

For the purposes of this Standard,

2.1. **"Approval of a vehicle"** means the approval of a vehicle type with regard to brake assist system.

2.2. **"Vehicle type"** means a category of vehicles which do not differ in such essential respects as:

2.2.1. The manufacturer's trade name or mark;

2.2.2. Vehicle features which significantly influence the performances of the Brake Assist System (e.g. design of the braking system);

2.2.3. The design of the Brake Assist System.

2.3. **"Maximum mass"** means the maximum mass stated by the vehicle manufacturer to be technically permissible (this mass may be higher than the "permissible maximum mass" laid down by the national administration).

2.4. **"The distribution of mass among the axles"** means the distribution of the effect of the gravity on the mass of the vehicle and/or its contents among the axles.

2.5. **"Wheel / axle load"** means the vertical static reaction (force) of the road surface in the contact area on the wheel/wheels of the axle.

2.6. **"Brake Assist System (BAS)"** means a function of the braking system that deduces an emergency braking event from a characteristic of the driver's brake demand and, under such conditions:

(a) Assists the driver to deliver the maximum achievable braking rate; or

(b) Is sufficient to cause full cycling of the Anti-lock Braking System.

2.6.1. **"Category A Brake Assist System"** means a system which detects an emergency braking condition based primarily[1] on the brake pedal force applied by the driver;

2.6.2. **"Category B Brake Assist System"** means a system which detects an emergency braking condition based primarily[1] on the brake pedal speed applied by the driver;

3.0 APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to BAS shall be submitted by the vehicle manufacturer or by their duly accredited representative.

3.2. It shall be accompanied by the under-mentioned documents in triplicate and by the following particulars:

3.2.1. description of the vehicle type with regard to the items specified in paragraph 2.2. above. The numbers and/or symbols identifying the vehicle type and the engine type shall be specified;

3.2.2. A list of the components, duly identified, constituting the BAS system;

3.2.3. A diagram of the assembled BAS system and an indication of the position of its components on the vehicle;

3.2.4. Detailed drawings of each component to enable it to be easily located and identified.

3.3. A vehicle, representative of the vehicle type to be approved, shall be submitted to the test agency conducting the approval tests.

4.0 APPROVAL

4.1. If the vehicle type submitted for approval pursuant to this standard meets the requirements of paragraphs 5. and 6. below, approval of that vehicle type shall be granted.

5.0 GENERAL REQUIREMENTS

5.1. Vehicles equipped with a brake assist system shall meet the functional requirements specified in paragraph 6. of this standard. Compliance with these requirements shall be demonstrated by meeting the provisions of paragraphs 8 or 9 of this standard under the test requirements specified in paragraph 7. of this standard. In addition to the requirements of this standard, vehicles equipped with a brake assist system shall also be equipped with ABS in accordance with technical requirements of standard IS 15986 (2015) / AIS 151.

[1] As declared by the vehicle manufacturer.

5.2. The BAS shall be so designed, constructed and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this standard.

5.3. In particular, the BAS shall be so designed, constructed and fitted as to be able to resist the corroding and ageing phenomena to which it is exposed.

5.4. The effectiveness of the BAS shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by fulfilling the technical requirements and respecting the transitional provisions of AIS:004 (Part 3).

5.5. The assessment of the safety aspects of BAS shall be included in the overall safety assessment of the braking system as specified in standard IS 15986 (2015) / AIS 151 requirements associated with complex electronic control systems. This is deemed to be fulfilled on the presentation of AIS IS 15986 (2015) / 151 test report which includes the BAS to be approved.

5.6. Provisions for the periodic technical inspection of electronic brake assist systems

5.6.1. It shall be possible at a periodic technical inspection to confirm the correct operational status by visual observation of the warning signals following a power-on.

5.6.2. At the time of type approval, the means implemented to protect against simple unauthorized modification of the operation of the warning signals shall be confidentially outlined. Alternatively, this protection requirement is fulfilled when a secondary means of checking the correct operational status is available.

6.0 FUNCTIONAL REQUIREMENTS

6.1. General performance characteristics for category "A" BAS systems

When an emergency condition has been sensed by a relative high pedal force, the additional pedal force to cause full cycling of the ABS shall be reduced compared to the pedal force required without the BAS system in operation. Compliance with this requirement is demonstrated if the provisions of paragraphs 8.1. to 8.3. of this standard.are met.

6.2. General performance characteristics for category "B" BAS systems

When an emergency condition has been sensed, at least by a very fast application of the pedal, the BAS system shall raise the pressure to deliver the maximum achievable braking rate or cause full cycling of the ABS.

Compliance with this requirement is demonstrated if the provisions of paragraphs 9.1. to 9.3. of this standard. are met.

7.0 GENERAL TEST REQUIREMENTS

7.1. Variables

While performing the tests described in this Standard, the following variables shall be measured:

7.1.1. Brake pedal force, F_p ;

7.1.2. Vehicle velocity, v_x ;

7.1.3. Vehicle deceleration, a_x ;

7.1.4. Brake temperature, T_d ;

7.1.5. Brake pressure, P, where applicable;

7.1.6 Brake pedal speed, v_p, measured at the centre of the pedal plate or at a position on the pedal mechanism where the displacement is proportional to the displacement at the centre of the pedal plate allowing simple calibration of the measurement.

7.2. Measuring equipment

7.2.1. The variables listed in paragraph 7.1. above shall be measured by means of appropriate transducers. Accuracy, operating ranges, filtering techniques, data processing and other requirements are described in ISO Standard 15037-1: 2006.

7.2.2. Accuracy of pedal force and disc temperature measurements shall be as follows:

Variable range system	Typical operating range of the transducers	Recommended maximum recording errors
Pedal force	0 to 2,000 N	±10 N
Brake temperature	0 – 1,000 °C	±5 °C
Brake pressure*	0 – 20 MPa*	±100 kPa*
* Applicable as specified in paragraph 8.2.5.		

7.2.3. Details on analogue and digital data processing of the BAS test procedures are described in Annex C to this Standard. A sampling rate for data acquisition of at least 500 Hz is required.

7.2.4. Alternative measuring methods to those referred to in paragraph 7.2.3. may be allowed, provided they demonstrate at least an equivalent level of precision.

7.3. Test conditions

7.3.1. Test vehicle loading condition: The vehicle shall be unladen. There may be, in addition to the driver, a second person on the front seat who is responsible for noting the results of the tests.

7.3.2. Braking tests shall be carried out on a dry surface affording good adhesion.

7.4. **Test method**

7.4.1. The tests as described in paragraphs 8. and 9. of this section shall be carried out from a test speed of 100 ± 2 km/h. The vehicle shall be driven at the test speed in a straight line.

7.4.2. The average temperature of the service brakes on the hottest axle of the vehicle, measured inside the brake linings or on the braking path of the disc or drum, shall be between 65 and 100°C prior to any brake application.

7.4.3. For the tests the reference time, t_0, is defined as the moment when the brake pedal force reaches 20 N.

Note: For vehicles equipped with a brake system assisted by an energy source, the applied pedal force necessary depends on the energy level that exists in the energy storage device. Therefore, sufficient energy level shall be ensured at the beginning of the test.

8.0 ASSESSMENT OF THE PRESENCE OF A CATEGORY "A" BAS

A category "A" BAS shall meet the test requirements contained in paragraphs 8.1. and 8.2.

8.1. **Test 1: Reference test to determine F_{ABS} and a_{ABS}.**

8.1.1. The reference values F_{ABS} and a_{ABS} shall be determined in accordance with the procedure described in Annex B to this Standard.

8.2. **Test 2: For activation of BAS**

8.2.1. Once an emergency braking condition has been detected, systems sensitive to pedal force shall show a significant increase in the ratio of:

(a) Brake line pressure to brake pedal force, where permitted by paragraph 8.2.5.; or

(b) Vehicle deceleration to brake pedal force.

8.2.2. The performance requirements for a category "A" BAS are met if a specific brake application characteristic can be defined that exhibits a decrease of between 40 per cent and 80 per cent in required brake pedal force for (F_{ABS} - F_T) compared to ($F_{ABS\ extrapolated}$ - F_T).

8.2.3. F_T and a_T are threshold force and threshold deceleration as shown in Figure 1. The values of F_T and a_T shall be supplied to the Test agency at the time of submission of the type-approval application. The value of a_T shall be between 3.5 m/s² and 5.0 m/s².

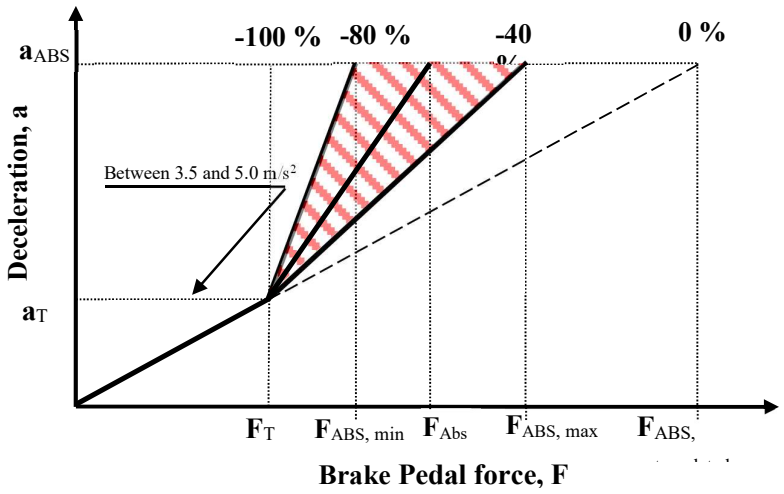

Figure 1a

Pedal force characteristic needed in order to achieve maximum deceleration with category "A" BAS

8.2.4. A straight line is drawn from the origin through the point F_T, a_T (as shown in Figure 1a). The value of brake pedal force "F", at the point of intersection between this line and a horizontal line defined by $a=a_{ABS}$, is defined as $F_{ABS,\ extrapolated}$:

$$F_{ABS,extrapolated} = \frac{F_T \cdot a_{ABS}}{a_T}$$

8.2.5. As an alternative, which can be selected by the manufacturer, in the case of vehicles of category N_1, or M_1 derived from those N_1 vehicles, with a gross vehicle mass GVM > 2,500 kg, the pedal force figures for F_T, $F_{ABS,min}$, $F_{ABS,max}$ and $F_{AB,extrapolated}$ may be derived from the brake line pressure response characteristic instead of the vehicle deceleration characteristic. This shall be measured as the brake pedal force is increasing.

8.2.5.1. The pressure, at which ABS cycling commences, shall be determined by making five tests from 100 ± 2 km/h in which the brake pedal is applied up to the level which produces ABS operation and the five pressures at which this occurs as determined from front wheel pressure records, shall be recorded and the mean value obtained as P_{ABS}.

8.2.5.2. The threshold pressure P_T shall be stated by the manufacturer and correspond to a deceleration in the range of 2.5 - 4.5 m/s^2.

8.2.5.3. Figure 1b shall be constructed in the manner set out in paragraph 8.2.4., but using line pressure measurements to define the parameters set out in paragraph 8.2.5. of this Standard where:

$$F_{ABS,\ extrapolated} = \frac{F_T \cdot P_{ABS}}{P_T}$$

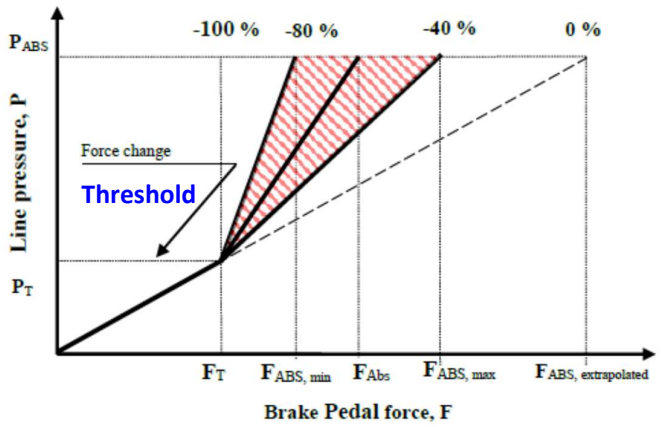

Figure 1b

Pedal force characteristic needed in order to achieve maximum deceleration with category "A" BAS

8.3. Data evaluation

The presence of a category "A" BAS is proven if

$$F_{ABS,min} \leq F_{ABS} \leq F_{ABS,max}$$

where:

$$F_{ABS,max} - F_T \leq \left(F_{ABS,extrapolated} - F_T\right) \cdot 0.6$$

And

$$F_{ABS,min} - F_T \geq \left(F_{ABS,extrapolated} - F_T\right) \cdot 0.2$$

9.0 ASSESSMENT OF THE PRESENCE OF A CATEGORY "B" BAS

A category "B" BAS shall meet the test requirements contained within paragraphs 9.1. and 9.2. of this section.

9.1. **Test 1: Reference test to determine F_{ABS} and a_{ABS}.**

9.1.1. The reference values F_{ABS} and a_{ABS} shall be determined in accordance with the procedure described in Annex B to this Standard.

9.2. **Test 2: For activation of BAS**

The vehicle shall be driven in a straight line at the test speed specified in paragraph 7.4. of this standard. The driver shall apply the brake pedal quickly according to Figure 2, simulating emergency braking so that BAS is activated and ABS is fully cycling.

In order to activate BAS the brake pedal shall be applied as specified by the car manufacturer. The manufacturer shall notify the Test agency of the required brake pedal input at the time of submission of the application for type-approval. It shall be demonstrated to the satisfaction of the Test agency that the BAS activates under the conditions specified by the manufacturer in accordance with paragraph 16.1.1. or 16.1.2. of Annex A.

After $t = t_0 + 0.8$ s and until the vehicle has slowed down to a speed of 15 km/h, the brake pedal force shall be maintained in a corridor between $F_{ABS,\ upper}$ and $F_{ABS,\ lower}$, where $F_{ABS,\ upper}$ is 0.7 F_{ABS} and $F_{ABS,\ lower}$ is 0.5 F_{ABS}.

The requirements are also considered to be met if, after $t = t_0 + 0.8$ s, the pedal force falls below $F_{ABS,\ lower}$ provided the requirement of paragraph 9.3. is fulfilled.

9.3. **Data evaluation**

The presence of BAS 'B' is demonstrated if a mean deceleration (a_{BAS}) of at least $0.85 \cdot a_{ABS}$ is maintained from the time when $t = t_0 + 0.8$ s to the time when the vehicle speed has been reduced to 15 km/h.

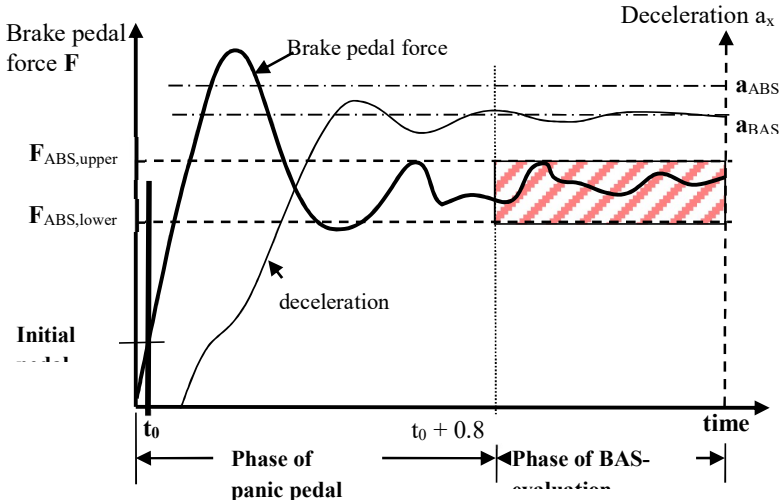

Figure 2

Example of test 2 of a category "B" BAS system

	ANNEX A **Technical Information to be submitted by vehicle manufacturer**		
1.0	Trade name or mark of the vehicle		
2.0	Vehicle type		
3.0	Manufacturer's name and address		
4.0	If applicable, name and address of manufacturer's representative		
5.0	Mass of vehicle		
5.1.	Maximum mass of vehicle		
5.2.	Minimum mass of vehicle		
6.0	Distribution of mass of each axle (maximum value)		
8.0	Engine type		
9.0	Number and ratios of gears		
10.	Final drive ratio(s)		
11.	If applicable, maximum mass of trailer which may be coupled		
11.1.	Unbraked trailer		
12.	Tyre dimension		
13.	Maximum design speed		
14.	Brief description of braking equipment		
15.	Mass of vehicle when tested:		
		Load *(kg)*	
	Axle No. 1		
	Axle No. 2		
	Total		
16.1.	Category of Brake Assist System A / B[2]		
16.1.1.	For category A systems, define the force threshold at which the ratio between pedal force and brake pressure increases[2]		
16.1.2.	For category B systems, define the brake pedal speed which must be achieved in order to activate the Brake Assist System (e.g. pedal stroke speed (mm/s) during a given time interval);[2]		
	[2] Strike out what does not apply.		

17.	(Reserved)	
18.	Vehicle is equipped with ABS in accordance with technical requirements of IS 15986 (2015) / AIS 151 (Yes/No[2])	
19.	Vehicle submitted for approval on	
20.	Test agency responsible for conducting approval	
21.	Date of report issued by that Service	
22.	Number of report issued by that Service	
23.	Approval granted / refused / extended / withdrawn[2]	
24.	Place	
25.	Date	
26.	Signature	
27.	The summary referred to in paragraph 4.3. of this Standard is annexed to this communication	
	[2] Strike out what does not apply.	

ANNEX B

Method for determination of F_{ABS} and a_{ABS}

1.1. The brake pedal force F_{ABS} is the minimum pedal force that has to be applied for a given vehicle in order to achieve maximum deceleration which indicates that ABS is fully cycling. a_{ABS} is the deceleration for a given vehicle during ABS deceleration as defined in paragraph 1.8.

1.2. The brake pedal shall be applied slowly (without activating the BAS in the case of category B systems) providing a constant increase of deceleration until ABS is fully cycling (Figure 3).

1.3. The full deceleration must be reached within the timeframe of 2.0 ± 0.5 s. The deceleration curve, recorded against time, must be within a corridor of ± 0.5 s around the centre line of the deceleration curve corridor. The example in Figure 3 has its origin at the time t_0 crossing the a_{ABS} line 2 seconds. Once full deceleration has been achieved, the brake pedal shall be operated so that the ABS continues fully cycling. The time of full activation of the ABS system is defined as the time when pedal force F_{ABS} is achieved. The measurement shall be within the corridor for variation of increase in deceleration (see Figure 3).

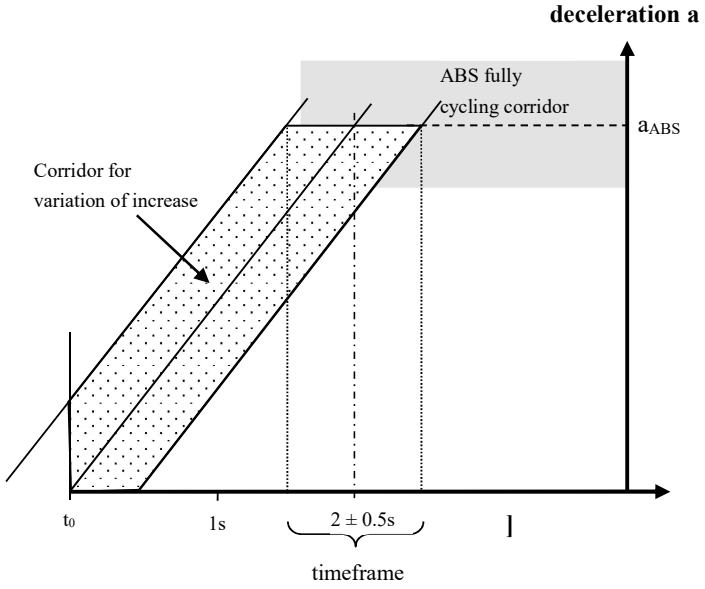

Figure 3

Deceleration corridor for determination of F_{ABS} and a_{ABS}

1.4. Five tests meeting the requirements of paragraph 1.3. shall be carried out. For each of these valid tests the vehicle deceleration shall be plotted as a function of the recorded brake pedal force. Only data recorded at speeds above 15 km/h shall be taken for the calculations described in the following paragraphs.

1.5. For the determination of a_{ABS} and F_{ABS}, a low pass filter of 2 Hz for vehicle deceleration as well as pedal force shall be applied.

1.6. The five individual "deceleration versus brake pedal force" curves are averaged by calculating the mean deceleration of the five individual "deceleration vs. brake pedal force" curves at increments of 1 N pedal force. The result is the mean deceleration versus brake pedal force curve, which will be referred to as the "maF curve" in this annex.

1.7. The maximum value for the vehicle deceleration is determined from the "maF curve" and is named as "a_{max}".

1.8. All values of the "maF curve" that are above 90 per cent of this deceleration value "a_{max}" are averaged. This value of "a" is the deceleration "a_{ABS}" referred to in this Standard.

1.9. The minimum force on the pedal (F_{ABS}) sufficient to achieve the deceleration a_{ABS} is defined as the value of F corresponding to $a = a_{ABS}$ on the maF curve.

ANNEX C
Data processing for the BAS
(see paragraph 7.2.3. of this Standard)

1.0 Analogue data processing

The bandwidth of the entire, combined transducer/recording system shall be no less than 30 Hz.

In order to execute the necessary filtering of signals, low-pass filters with order 4 or higher shall be employed. The width of the pass band (from 0 Hz to frequency f_o at -3 dB) shall not be less than 30 Hz. Amplitude errors shall be less than ±0.5 per cent in the relevant frequency range of 0 Hz to 30 Hz. All analogue signals shall be processed with filters having sufficiently similar phase characteristics to ensure that time delay differences due to filtering lie within the required accuracy for time measurement.

Note: During analogue filtering of signals with different frequency contents, phase shifts can occur. Therefore, a data processing method, as described in paragraph 2. of this appendix, is preferable.

2.0 Digital data processing

2.1. General consideration

Preparation of analogue signals includes consideration of filter amplitude attenuation and sampling rate to avoid aliasing errors, and filter phase lags and time delays. Sampling and digitizing considerations include pre-sampling amplification of signals to minimize digitizing errors; number of bits per sample; number of samples per cycle; sample and hold amplifiers; and time-wise spacing of samples. Considerations for additional phaseless digital filtering include selection of pass bands and stop bands and the attenuation and allowable ripple in each; and correction of filter phase lags. Each of these factors shall be considered in order to achieve a relative overall data acquisition accuracy of ±0.5 per cent.

2.2. Aliasing errors

In order to avoid uncorrectable aliasing errors, the analogue signals shall be appropriately filtered before sampling and digitizing. The order of the filters used and their pass band shall be chosen according to both the required flatness in the relevant frequency range and the sampling rate.

The minimum filter characteristics and sampling rate shall be such that:

(a) Within the relevant frequency range of 0 Hz to f_{max} = 30 Hz the attenuation is less than the resolution of the data acquisition system; and

(b) At one-half the sampling rate (i.e. the Nyquist or "folding" frequency) the magnitudes of all frequency components of signal and noise are reduced to less than the system resolution.

For 0.05 per cent resolution the filter attenuation shall be less than 0.05 per cent in the frequency range between 0 and 30 Hz, and the attenuation shall be greater than 99.95 per cent at all frequencies greater than one-half the sampling frequency.

Note: For a Butterworth filter the attenuation is given by:

$$A^2 = \frac{1}{1+\left(f_{max}/f_0\right)^{2n}} \quad \text{and} \quad A^2 = \frac{1}{1+\left(f_N/f_0\right)^{2n}}$$

where:

n is the order to filter;

f_{max} is the relevant frequency range (30 Hz);

f_o is the filter cut-off frequency;

f_N is the Nyquist or "folding" frequency.

For a fourth order filter

for A = 0.9995: $f_o = 2.37 \cdot f_{max}$

for A = 0.0005: $f_S, = 2 \cdot (6.69 \cdot f_o)$, where f_S, is the sampling frequency = $2 \cdot f_N$.

2.3. Filter phase shifts and time delays for anti-aliasing filtering

Excessive analogue filtering shall be avoided, and all filters shall have sufficiently similar phase characteristics to ensure that time delay differences are within the required accuracy for the time measurement. Phase shifts are especially significant when measured variables are multiplied together to form new variables, because while amplitudes multiply, phase shifts and associated time delays add. Phase shifts and time delays are reduced by increasing f_o. Whenever equations describing the pre-sampling filters are known, it is practical to remove their phase shifts and time delays by simple algorithms performed in the frequency domain.

Note: In the frequency range in which the filter amplitude characteristics remain flat, the phase shift Φ of a Butterworth filter can be approximated by

$\Phi = 81 \cdot (f/f_0)$ degrees for second order

$\Phi = 150 \cdot (f/f_0)$ degrees for fourth order

$\Phi = 294 \cdot (f/f_0)$ degrees for eighth order

The time delay for all filter orders is: $t = (\Phi/360) \cdot (1/f_0)$

2.4. **Data sampling and digitizing**

At 30 Hz the signal amplitude changes by up to 18 per cent per millisecond. To limit dynamic errors caused by changing analogue inputs to 0.1 per cent, sampling or digitizing time shall be less than 32 μs. All pairs or sets of data samples to be compared shall be taken simultaneously or over a sufficiently short time period.

2.5. **System requirements**

The data system shall have a resolution of 12 bits (±0.05 per cent) or more and an accuracy of ±0.1 per cent (2 lbs). Anti-aliasing filters shall be of order 4 or higher and the relevant data range f_{max} shall be 0 Hz to 30 Hz.

For fourth order filters the pass-band frequency f_o (from 0 Hz to frequency f_o) shall be greater than $2.37 \cdot f_{max}$ if phase errors are subsequently adjusted in digital data processing, and greater than $5 \cdot f_{max}$ otherwise. For fourth order filters the data sampling frequency f_s shall be greater than $13.4 \cdot f_o$.

ANNEX D
COMMITTEE COMPOSITION – AISC Panel

Name	Organization
Convener	
Mr. A. A. Badusha	The Automotive Research Association of India (ARAI)
Members	**Representing**
Mr. K. B. Patil	The Automotive Research Association of India (ARAI)
Dr. N. Karuppaiah	NATRiP
Mr. S. Ravishankar / Mr. D. Balakrishnan / Mr. V. Faustino	Ashok Leyland Technical Centre (SIAM)
Mr. S. V. Suderson/ Mr. C. Dinesh Kumar	Daimler India (SIAM)
Mr. Shailesh Kulkarni	Mahindra and Mahindra Ltd. (SIAM)
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Mr. Vikrant Lokhande	Volvo Trucks – VECV (SIAM)
Mr. Vishal P. Jain	Isuzu Motors India
Mr. P. Venugopal / Mr. A. Vijayan	Brakes India Ltd.
Mr. S. Balachandran / Mr. D. Prabhakaran / Mr. Sachin Deshmukh	WABCO
Mr. Arun Bisht	Knorr- Bremse India

ANNEX E
COMMITTEE COMPOSITION – AISC

Chairperson	
Mrs. Rashmi Urdhwareshe	Director The Automotive Research Association of India, Pune
Members	**Representing**
Representative from	Ministry of Road Transport and Highways (Dept. of Road Transport and Highways), New Delhi
Representative from	Ministry of Heavy Industries and Public Enterprises (Department of Heavy Industry), New Delhi
Shri S. M. Ahuja	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi
Shri Shrikant R. Marathe	Former Chairman, AISC
Shri R.R. Singh	Bureau of Indian Standards, New Delhi
Director	Central Institute of Road Transport, Pune
Director	Global Automotive Research Centre, Chennai
Director	International Centre for Automotive Technology, Manesar
Director	Indian Institute of Petroleum, Dehra Dun
Director	Vehicles Research and Development Establishment, Ahmednagar
Director	Indian Rubber Manufacturers Research Association
Representatives from	Society of Indian Automobile Manufacturers
Shri R. P. Vasudevan	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)