



AEROSPACE STANDARD	AS8018™	REV. A
	Issued 1978-10 Revised 1996-09 Reaffirmed 2023-06 Superseding AS8018	
Minimum Performance Standard for Mach Meters		

RATIONALE

AS8018A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE:

This AS covers subsonic and supersonic Mach meter instruments which, when connected to sources of static (Ps), and total (Pt), or impact (Pt-Ps), pressure provide indication of Mach number. These instruments are known as Type A. This AS also covers servo-operated repeater or digital display instruments which indicate Mach number when connected to the appropriate electrical output of a Mach transducer or Air Data Computer. These instruments are known as Type B.

1.1 Purpose:

This Aerospace Standard (AS) specifies the minimum safe performance standards for Mach Meter instruments primarily intended for use in aircraft under standard and environmental conditions.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2023 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE AS8018A

For more information on this standard, visit
<https://www.sae.org/standards/content/AS8018A/>

Documents
Document Sharing Hub

2.1 FAR Publications:

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

Federal Aviation Regulation 25.1359

2.2 RTCA Publications:

Available from RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, DC 20036.

RTCA Document No. DO 160 Environmental Conditions and Test Procedures for Airborne Electronic/Electrical Equipment and Instruments

2.3 NASA Publications:

NASA Technical Note D-822

2.4 Other Publications:

U.S. Standard Atmosphere 1962

3. GENERAL STANDARDS:

3.1 Operation of Controls:

The design of the instrument must be such that any controls intended for use during flight cannot be operated in any possible position, combinations or sequences that would result in a condition detrimental to the continued performance of the instrument.

3.2 Accessibility of Controls:

Controls which are not normally adjusted in flight must not be readily accessible to flight personnel.

3.3 Malfunction Indication:

Means must be provided to indicate failures and/or the existence of the following conditions:

3.3.1 Loss of such electrical power as is necessary for the functioning of the instrument.

3.3.2 If the equipment is a remote indicator, means must be incorporated to detect internal malfunction or loss of “information valid” signal from remote Mach number computing source, in addition to the requirement in 3.3.1. Failure warning signals and flag alarms must not degrade the accuracy of associated equipment. The indicating means shall indicate the failure or malfunction in a positive and conspicuous manner, that is effective for any operational lighting condition likely, when a malfunction may occur.

3.4 Self-Test Capability:

If the equipment contains integral arrangements to permit pre-flight and/or in-flight self-test checks on the operation of the equipment in combination with other aircraft subsystems, a means shall be provided to deactivate any subsystem which might be adversely affected during the self-test cycle. In flight, self-test activating controls must provide a means to warn the pilot of this mode of operation.

3.5 Compatibility of Components:

If components are individually acceptable but require matching for proper operation, they shall be identified on the equipment nameplate in a manner that will ensure proper matching.

3.6 Interchangeability:

Mach Meters and their components identified with a manufacturer’s part and/or model number must be directly and completely interchangeable with all Mach Meters and their components identified with that part and/or model number.

With reference to type “B” instruments which have a separate sensor and indicator, replacing either device will not degrade the system tolerances beyond those specified in Figures 1 and 2.

3.7 Input Connections - Type A Instruments Only:

The input connections shall be such that it will not be possible to interchange the pitot and static pressure lines to the instrument. The connections must be marked as follows:

“P” - Pitot pressure connection

“S” - Static pressure connection

3.8 Presentation:

The presentation shall be such that it will not associate more than one Mach number with any indication.

3.9 Limitation of Indicator Movement:

Indications beyond the normal range of the instrument shall not be displayed in a manner interpretable as an on-scale reading, or as an off-scale reading in the wrong direction.

3.10 Indicating Means:

The Mach number must be indicated by means of one or more pointers, dials, tapes, drums, digital displays or other devices. Relative motion of the index with respect to the scale, when moving elements are employed, (either the index or the scale may be moving element) shall be clockwise, down or to the right for increasing Mach number.

The indicating means shall be effective for any operational lighting condition that may occur.

3.11 Dial Markings:

- 3.11.1 Indicating Graduations: Indicators comprising a dial must be provided with Mach number graduations at intervals not to exceed 0.01 with major graduations every 0.05 and with numerical markings at intervals not greater than 0.1. When digital indication is employed, the resolution shall be better than or equal to 0.01 Mach.

When the display is of the instantaneous change-over type, such as light emitting diodes, a resolution equal to 0.001 Mach shall be provided.

- 3.11.2 Visibility: Mach number indications must be visible from any point within the frustrum of a cone the side of which makes an angle of at least 30° with the perpendicular to the dial and the small diameter of which is the viewing aperture of the indicator.
- 3.11.3 Integral Lighting: When integral lighting is provided, it must, under normal cockpit lighting conditions, make all indicia within the required visibility of 3.11.2 easily readable. No direct light shall radiate from the instrument within an angle of 45° either side of the vertical center line of the instrument face in the horizontal plane and above 30° to the longitudinal axis in the vertical plane.
- 3.11.4 Reflectance Cover Glass: The total reflectance of the instrument cover glass including the integral lighting wedge, if applicable, shall not exceed 10% of the incident light. This reflectance applies over the visible light spectrum from 450 nanometers to 600 nanometers, and over an incident solid angle of 60° perpendicular to the viewing plane.

3.12 Fire Resistance:

Except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire, or produce a significant amount of toxic fumes, all materials used must be self-extinguishing when tested in accordance with the requirements of Federal Aviation Regulation 25.1359 (d) and appendix F, thereto, with the exception that materials tested may be configured in accordance with para. (b) of appendix F or may be configured as used.

4. MINIMUM PERFORMANCE STANDARDS UNDER STANDARD CONDITIONS:

4.1 The test conditions applicable to a determination of the performance of Mach meters are set forth in Appendix A of this AS. All instruments shall be tested in accordance with the manufacturer's recommendations. The manufacturer shall conduct sufficient tests to prove compliance with this AS.

4.2 Scale Error:

Scale error is defined as the difference between the correct Mach number corresponding to given values of impact or total and static pressure and the value displayed by the Mach meters. With reference to Type "B" Mach meters, the scale error permitted between the nominal values applied to the input and the display, shall not exceed 0.002 Mach. The scale error of the combination of transducer/or Mach computer and the indicating instrument shall not exceed the values in Figures 1 or 2 as appropriate.

4.3 Friction:

The difference between two readings taken under constant pressure conditions, one with the instrument, or transducer and instrument not subjected to any vibration, and the other with tapping applied to remove all friction, shall not exceed .01 Mach.

4.4 Balance Error:

The difference between the readings obtained in the normal operating position, and in any other position shall not exceed 0.01 Mach for Type A instruments and 0.001 Mach for Type B instruments.

4.5 Case Leak (Type A Instruments only):

With the pitot and static lines connected together and the common line connected to a vacuum system, evacuate the system to a level of 400 mbar abs (11.8 inches Hg abs). With the system evacuated to this level and sealed, the rise in pressure, after allowing 1 minute for stabilization shall not exceed 1 mb/minute (0.03 inch Hg/minute). The total volume of the sealed system, including the instrument, shall not exceed 1 liter (61 inches³).

4.6 Dynamic Pressure Capsule Leak (Type A Instruments only):

When differential pressure equal to the maximum dynamic pressure for which the instrument is rated is applied to the dynamic pressure input and then shut off at the instrument connections, the Mach indication shall not decrease at a rate exceeding 0.001 Mach per minute.