



AEROSPACE STANDARD	AS8055	REV. A
	Issued	1999-03
	Revised	2015-07
Superseding AS8055		
(R) Minimum Performance Standard for Airborne Head Up Display (HUD)		

RATIONALE

This SAE Aerospace Standard provides the Minimum Performance Standard for Airborne Head-Up Display (HUD) for use by the aerospace industry and may also be used by the FAA and other regulatory agencies in a technical standard order. The original version focused on CRT-HUD technology and Revision A updates the CRT requirements and extends the requirements to cover digital HUDs. This document was developed by the SAE A-4 HUD subcommittee and supersedes AS8055.

TABLE OF CONTENTS

1.	SCOPE	5
2.	REFERENCES	5
2.1	Applicable Documents	5
2.1.1	SAE Publications	5
2.1.2	Regulatory Publications	5
2.1.3	RTCA/EUROCAE Publications	6
2.1.4	CIE (Commission Internationale de l'Eclairage) Publications	6
2.1.5	Electronic Industry Association (EIA) Publications	6
2.2	Related Publications	6
2.2.1	SAE Publications	6
2.2.2	Regulatory Publications	7
2.2.3	RTCA/EUROCAE Publications	8
2.2.4	CIE (Commission Internationale de l'Eclairage) Publications	8
2.2.5	U.S. Government Publications	9
2.2.6	Other Publications	9
2.3	Definitions	9
3.	GENERAL REQUIREMENTS	9
3.1	Material	9
3.2	Workmanship	9
3.3	Components Compatibility	9
3.4	Interchangeability	9
3.5	Accessibility of Adjustments and Controls	9
3.6	Self-Test Capability	10
3.7	Effect of Tests	10
3.8	Malfunction & Failure Indications	10
3.8.1	Malfunction Indication	10

SAE Technical Standards Board 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 © 2015 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 AS8055A

SAE values your input. To provide feedback on this Technical Report, please visit <http://www.sae.org/technical/standards/AS8055A>



3.8.2	Power Failure Indication	10
3.8.3	Fail Safe Provision	10
3.9	Multiple Mode or Function Indications	10
3.10	Identification	10
3.11	Display	11
3.11.1	Discernibility	11
3.11.2	Critical Information	11
3.11.3	Information Limit Indication	11
3.11.4	Scale Indications	11
3.11.5	Ambiguity	11
3.12	Resistance to Dust and Moisture	11
3.13	Mechanical Hazard System Protection	11
3.14	Fire Resistance	11
3.15	Supplemental Heating/Cooling	11
3.16	Lighting	12
3.17	Flight Guidance Performance	12
3.18	Visual Obstructions	12
4.	MINIMUM PERFORMANCE STANDARDS UNDER STANDARD CONDITIONS	12
4.1	Equipment Functions and Mechanical Operation	12
4.1.1	Start-Up	12
4.1.2	Power Transient Recovery	12
4.1.3	Lag Time	12
4.1.4	Data Update	12
4.2	Display Characteristics	12
4.2.1	HUD Display Viewing Angles	13
4.2.2	HUD Eyebox	13
4.2.3	Symbol Positioning Accuracy (External)	14
4.2.4	Symbol Positioning Alignment	14
4.2.5	Display Drift	14
4.2.6	Line Width	14
4.2.7	Display Jitter	15
4.2.8	Display Flicker	15
4.2.9	Symbol Quality	15
4.2.10	Display Binocular Parallax Errors	15
4.2.11	Symbol Motion	16
4.2.12	Image Retention	16
4.2.13	Response Time	17
4.3	HUD Photometric Characteristics	17
4.3.1	HUD Luminance	17
4.3.2	Luminance Uniformity	17
4.3.3	Display Contrast Ratio	17
4.3.4	HUD Combiner Transmissivity	18
4.3.5	HUD Combiner Real World Color Shift	18
4.3.6	Manual and Automatic Luminance Control	18
4.3.7	Combiner Performance	18
4.3.8	Color	19
4.3.9	Color Registration	19
4.3.10	Discrimination	19
4.4	HUD Physical Assembly	20
4.4.1	Combiner Stowage	20
4.4.2	Combiner Head Injury Criteria	20
4.4.3	Combiner Position Alignment	20
4.4.4	Head Clearance Measurement	20
4.5	Video Display Performance (Imaging Display)	20
4.5.1	HUD Symbolology and Video Display Compatibility	20
4.5.2	Video Resolution	20
4.5.3	Video Luminance	21
4.5.4	Video Contrast Variation	21
4.5.5	Video Low Level Luminance	21

4.5.6	Video Luminance Uniformity	22
4.5.7	Video Distortion and Linearity	22
4.5.8	Video Display and Outside View Compatibility	22
5.	MINIMUM PERFORMANCE STANDARDS UNDER ENVIRONMENTAL CONDITIONS	22
5.1	Requirements	22
5.1.1	Display Characteristics	23
5.1.2	Luminance	23
5.1.3	Color	23
5.1.4	Color Registration	23
5.1.5	Display Response Time	23
5.1.6	Mechanical Operation	23
5.2	Definition of Terms	23
5.3	Conditions of Tests	23
5.4	Temperature and Altitude Tests (Section 4.0, DO-160G/ED-14G)	23
5.4.1	Low-Temperature Test	23
5.4.2	High Temperature Test	24
5.4.3	In-Flight Loss of Cooling Test	24
5.4.4	Altitude, Decompression and Overpressure Tests (When Required) (Section 4.6 DO-160G/ED-14G).....	24
5.5	Temperature Variation Test (Section 5.0, DO-160G/ED-14G)	24
5.6	Humidity Test (Section 6.0, DO-160G/ED-14G)	24
5.7	Operational Shocks and Crash Safety Tests (Section 7.0, DO-160G/ED-14G)	24
5.8	Vibration Tests (Section 8.0, DO-160G/ED-14G)	25
5.9	Explosive Atmosphere Test (When Required) (Section 9.0, DO-160G/ED-14G)	25
5.10	Waterproofness Test (When Required) (Section 10.0, DO-160G/ED-14G)	25
5.11	Fluids Susceptibility Test (When Required) (Section 11.0, DO-160G/ED-14G)	25
5.12	Sand and Dust Test (When Required) (Section 12.0, DO-160G/ED-14G)	25
5.13	Fungus Resistance Tests (When Required) (Section 13.0, DO-160G/ED-14G)	25
5.14	Salt Fog Test (When Required) (Section 14.0, DO-160G/ED-14G)	25
5.15	Magnetic Effect Test (Section 15.0, DO-160G/ED-14G)	25
5.16	Power Input Test (Section 16.0, DO-160G/ED-14G)	25
5.16.1	Normal Operating Conditions	25
5.16.2	Abnormal Operating Conditions	25
5.17	Voltage Spike Test (Section 17.0, DO-160G/ED-14G)	26
5.17.1	Category A Test (When Required)	26
5.17.2	Category B Test (When Required)	26
5.18	Audio Frequency Conducted Susceptibility – Power Inputs (Section 18.0, DO-160G/ED-	26
5.19	Induced Signal Susceptibility Test (Section 19.0, DO-160G/ED-14G)	26
5.20	Radio Frequency Susceptibility Test (Radiated and Conducted) (Section 20.0, DO-160G/ED-14G)	26
5.21	Emission of Radio Frequency Energy Test (Section 21.0, DO-160G/ED-14G)	26
5.22	Lightning Induced Transient Susceptibility (Section 22.0, DO-160G/ED-14G)	26
5.23	Lightning Direct Effects (When Required) (Section 23.0, DO-160G/ED-14G)	27
5.24	Icing (When Required) (Section 24.0, DO-160G/ED-14G)	27
5.25	Electrostatic Discharge (ESD) (Section 25, DO-160G/ED-14G)	27
5.26	X-Ray Radiation	27
5.27	UV Radiation	27
5.28	Fogging (Hermetically Sealed or Desiccated Display Units Only)	27
5.29	Thermal Shock (When Required)	27
5.30	Dielectric Test	27
6.	TEST PROCEDURES	28
6.1	Test Conditions	28
6.2	Ambient Room Conditions	28
6.3	Power Conditions	28
7.	GLOSSARY OF TERMS	28
7.1	Ambient Background	28
7.2	Ambiguous or Erroneous Information	28
7.3	Combiner	28
7.4	Conformal	28
7.5	Contrast Ratio	28

7.6	Design Eye Position	28
7.7	Display Element	28
7.8	Failed-Off	29
7.9	Failed-On	29
7.10	Field of View (FOV)	29
7.10.1	Total FOV	29
7.10.2	Instantaneous FOV (IFOV)	29
7.10.3	Binocular Overlapping FOV	29
7.10.4	Monocular FOV	29
7.11	Flicker	29
7.12	Flight Deck	29
7.13	Generated Background	29
7.14	HUD Computer, HUD Symbol Generator, or HUD Processor Unit	29
7.15	HUD Control Panel (HCP)	30
7.16	HUD Eye Reference Point	30
7.17	HUD Eyebox	30
7.18	HUD System	30
7.19	Industry Standards	31
7.20	Jitter	31
7.21	Line Width	31
7.22	Luminance	31
7.23	Minimum Performance Standard	31
7.24	Nonconformal	31
7.25	Operating Modes	31
7.26	Optical Infinity	31
7.27	Parallax Errors	31
7.27.1	Convergence	31
7.27.2	Divergence	31
7.27.3	Dipvergence	32
7.28	Photopic	32
7.29	Primary Flight Display	32
7.30	Ratcheting	32
7.31	Video Resolution	32
7.32	Redundancy	32
7.33	Reflective or Holographic HUD	32
7.34	Refractive HUD	32
7.35	Shall Function	32
7.36	Shall Not Be Adversely Affected	32
7.37	Transmittance of Combiner	32
8.	NOTES	33
APPENDIX A	HEAD UP DISPLAYS	34
Figure 1	Minimum HUD eyebox	13
Figure 2	Dimensions for a 95 percentile male head (all units are in inches)	21
Figure 3	HUD field of view (at optical infinity)	30

1. SCOPE

This SAE Aerospace Standard (AS) specifies minimum performance standards for airborne binocular Head-Up Displays (HUDs) in fixed wing (14 CFR part 23, 25) aircraft; while this document is also applicable to rotorcraft (14 CFR part 27, 29) additional performance standards may be required for rotorcraft. This aerospace standard covers basic display standards, but does not include specific application requirements. Specific applications can include flight instrumentation, navigation, engine and system status, alerting, surveillance, communication, terrain awareness, weather, enhanced vision, synthetic vision and other displays.

This document covers criteria for conformal and non-conformal HUD systems that are intended for use in the flight deck by the pilot or copilot. Display minimum performance characteristics are specified for standard and other environmental conditions for the purpose of product qualification.

This document does not address sensor imaging systems, displays worn by the pilot (goggles, helmet mounted displays) or specific symbology to be displayed.

This document is intended to be used in combination with other guidance material contained in current system specific, Technical Standard Orders (TSOs), Advisory Circulars (ACs), and other Federal Aviation Administration (FAA)-approved guidance material. This SAE Aerospace Standard can be applicable to HUDs used across multiple aircraft types.

2. REFERENCES

The documents listed in 2.1 are regulations, requirements, or recommended practices and not necessarily minimum standards or requirements. These documents are invoked by this document only to the extent specified herein. The documents listed in 2.2 are provided for information purposes only and do not form a part of the requirements of this document.

2.1 Applicable Documents

The following publications form a part of this document only to the extent specified within the requirements of this Aerospace Standard. The latest issue of all SAE publications shall apply except in cases where referring documents call out specific versions. 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.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP5583A Guide to Certification of Aircraft in a High-Intensity Radiated Field (HIRF) Environment

2.1.2 Regulatory Publications

FAA AC-() documents are available from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, or www.faa.gov

"14 CFR" documents may be purchased from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, www.faa.gov

"TSO" documents are available from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, or www.faa.gov

"JAR" documents may be purchased from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Koeln, Germany, Tel: +49-221-8999-000, www.easa.europa.eu/home/rq_certspeccs.html

Advisory Circular 20-136B Aircraft Electrical and Electronic System Lightning Protection

Advisory Circular 20-158 Certification of Aircraft Electrical and Electronic Systems for Operations in the High-Intensity Radiated Fields (HIRF) Environment

Advisory Circular 25-11A Transport Category Airplane Electronic Display Systems

Advisory Circular 23.1309-1D System Safety Analysis and Assessments for Part 23 Airplanes

Advisory Circular 25.1309-1A System Design Analysis

14 CFR 2X.562 Emergency Landing Dynamic Conditions
23.562(b) (5); 25.562(c) (5); 27.562(c) (5); 29.562(c) (5)

14 CFR 2X.853 Compartment Interior

14 CFR 25.869 Fire Protection: System

14 CFR 2X.1309 Equipment, Systems, and Installation
23.1309; 25.1309; 27.1309; 29.1309

2.1.3 RTCA/EUROCAE Publications

RTCA publications available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

EUROCAE publications available from EUROCAE Secretariat, 102 rue Etienne Dolet, 92240 Malakoff, France, Tel: +33 1 40 92 79 30, www.eurocae.net.

RTCA DO-160G/EUROCAE ED-14G Environmental Conditions and Test Procedures for Airborne Equipment

2.1.4 CIE (Commission Internationale de l'Eclairage) Publications

Available outside of the U.S. from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at and inside the U.S. from United States National Committee of the Commission Internationale De L'Eclairage, Radiometric Physics Division, National Bureau of Standards, Washington, DC 20234.

2.1.5 Electronic Industry Association (EIA) Publications

Available from Available from Electronic Component Association (ECA), 2500 Wilson Boulevard, Arlington, VA 22201-3834, Tel: 703-907-7500, www.eia.org.

EIA-503-A Recommended Practice for the Measurement of X-Radiation from Direct-View Television Tubes

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Aerospace Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP1161 Crew Station Lighting – Commercial Aircraft

ARP1782 Photometric and Colorimetric Measurement Procedures for Airborne Direct View CRT Displays

ARP1874	Design Objectives for CRT Displays for Part 25 (Transport) Aircraft
ARP4032	Human Engineering Considerations in the Application of Color to Electronic Aircraft Displays
ARP4101	Flight Deck Layout and Facili
ARP4102	Flight Deck Panels, Controls, and Displays
ARP4102/7	Electronic Displays
ARP4102/8	Flight Deck Head-Up Displays
ARP4103	Flight Deck Lighting for Commercial Transport Aircraft
ARP4105	Abbreviations, Acronyms, and Terms for Use on the Flight Deck
ARP4155	Human Interface Design Methodology for Integrated Display Symbolology
ARP4256	Design Objectives for Liquid Crystal Displays for Part 25 (Transport) Aircraft
ARP4260	Photometric and Colorimetric Measurement Procedures for Airborne Electronic Flat Panel Displays
AIR4742	Display Characteristics of FDI Head-Up-Guidance System As Approved for the B-727 Airplane
ARP5287	Optical Measurement Procedures for Airborne Head Up Display (HUD)
AS8034	Minimum Performance Standard for Airborne Multipurpose Electronic Displays

2.2.2 Regulatory Publications

FAA AC-() documents are available from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, or www.faa.gov

"14 CFR" documents may be purchased from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, www.faa.gov

"TSO" documents are available from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, Tel: 301-322-4961, or www.faa.gov

"JAR" documents may be purchased from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Koeln, Germany, Tel: +49-221-8999-000, www.easa.eu.iny/home/rg_certspeccs.html

FAA Advisory Circular 23.1309-1D

System Safety Analysis and Assessments for Part 23 airplanes

FAA Advisory Circular 23.1311-1B Installation of Electronic Display Instrument Systems in Part 23 Airplanes

FAA Advisory Circular 25.773.1 Pilot Compartment Design Considerations

FAA Advisory Circular 29.773-1 Pilot Compartment View

FAA Advisory Circular 120-28D Criteria for Approval of Category III Weather Minima for Takeoff, Landing and Rollout

FAA Advisory Circular 120-29A Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operations

14 CFR Part 23 Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

14 CFR Part 25/JAR Part 25 Airworthiness Standards: Transport Category Airplanes

14 CFR Part 27 Airworthiness Standards: Normal Category Rotorcraft

14 CFR Part 29 Airworthiness Standards: Transport Category Rotorcraft

14 CFR 25.581 Lightning Protection

14 CFR 2X.773 Pilot Compartment View
23.773; 25.773; 27.773; 29.773

14 CFR 2X.1301 Function and Installation
23.1301; 25.1301; 27.1301; 29.1301

14 CFR 2X.1303 Flight and Navigation Instruments
23.1303; 25.1303; 27.1303; 29.1303

14 CFR 23.1311 Electronic Display Instrument Systems

14 CFR 25.1316 System Lightning Protection

14 CFR 2X.1321 Arrangement and Visibility
23.1321; 25.1321; 27.1321; 29.1321

14 CFR 2X.13xx High-intensity Radiated Fields (HIRF) Protection
23.1308; 25.1317; 27.1317; 29.1317

JAR-HUDS-901 Category 3 Operations with a Head Up Display

JAR-HUDS-902 Category 2 Operations with a Head Up Display

JAR-HUDS-903 Head Up Displays

TSO-C113 Airborne Multipurpose Electronic Displays

2.2.3 RTCA/EUROCAE Publications

RTCA publications available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

EUROCAE publications available from EUROCAE Secretariat, 102 rue Etienne Dolet, 92240 Malakoff, France, Tel: +33 1 40 92 79 30, www.eurocae.net.

RTCA DO-178B/EUROCAE ED-12B Software Considerations in Airborne systems and equipment Certification

2.2.4 CIE (Commission Internationale de l'Eclairage) Publications

Available outside of the U.S. from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at and inside the U.S. from United States National Committee of the Commission Internationale De L'Eclairage, Radiometric Physics Division, National Bureau of Standards, Washington, DC 20234.

Supplement No. 2 to CIE Publication No. 15 Recommendations on Uniform Color Spaces Color Difference Equations - Psychometric Color Terms

2.2.5 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

MIL-HDBK-87213	Military Handbook: Electrically/Optically Generated Airborne Displays
MIL-STD-1787B	Military Standard: Aircraft Display Symbolology
MIL-STD-1295A	Military Standard: Human Factors Engineering Design Criteria for Helicopter Cockpit Electro-Optical Display Symbolology (Cancelled)
MIL-STD-810	Military Standard: Environmental Test Methods and Engineering Guidelines

2.2.6 Other Publications

Human Factors Issues in Head-Up Display Design: "The Book of HUD"; SOAR CSERIAC 92-2 May 1992

2.3 Definitions

Definitions used in this document shall be as noted in the Glossary of Terms defined in Section 7.

The word "shall" is used to express an essential requirement where compliance is mandatory.

The word "should" is used to express a recommendation. Deviation from the specified recommendation shall require justification.

The word "must" is used to express an essential (mandatory) requirement that is required by a specific regulation.

3. GENERAL REQUIREMENTS

3.1 Material

Material shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.2 Workmanship

Workmanship shall be consistent with high quality aircraft electromechanical and electronic instrument manufacturing practices.

3.3 Components Compatibility

If a display system component is individually acceptable but requires calibration adjustments or matching to other components in the aircraft for proper operation, the component shall be identified in a manner that will ensure performance to the requirements of this document.

3.4 Interchangeability

Display system components which are identified with the same manufacturer part or model number shall be completely interchangeable.

3.5 Accessibility of Adjustments and Controls

Calibration adjustments which are not normally made in flight shall not be readily accessible to flight personnel when the equipment is installed in accordance with the equipment manufacturer's instructions.

The arrangement of the HUD operational controls shall ensure that they are visible to, identifiable and usable by the pilot from his normal seated position. The arrangement and/or type of the controls should preclude inadvertent operation.

3.6 Self-Test Capability

If the equipment contains integral arrangements to permit preflight and/or in-flight self-test checks on the operation of the equipment in combination with other aircraft subsystems, such tests shall not adversely affect any associated subsystem.

In-flight, self-test activation features which are interruptive to the system shall include a means to inform the pilot or appropriate flight crew member of this mode of operation.

3.7 Effect of Tests

The application of all prescribed in-service testing shall not produce a subsequent condition which would be detrimental to the continued performance of the equipment.

3.8 Malfunction and Failure Indications

3.8.1 Malfunction Indication

Means shall be provided to indicate HUD system malfunctions or failures to the appropriate crew member. A blank display or an "X" across a blank display are examples of acceptable means of indicating failure.

3.8.2 Power Failure Indication

Means shall be provided to indicate when electrical power (voltage and/ or current of all required phases) is not sufficient for proper operation of the equipment. A blank display is an example of acceptable means of indicating failure.

3.8.3 Fail Safe Provision

No single failure or malfunction of the HUD system shall introduce unsafe conditions to associated interconnected equipment.

- Unsafe conditions include the probability of failure of the article that could lead to an unsafe condition, based upon the design assurance level.
- A System Safety Assessment (SSA) shall be performed on the equipment being submitted for TSO authorization. The SSA shall include any probable failure conditions of the article. Depending on the hazard classification for both Hardware and Software, the results of the SSA may require that a Failure Modes and Effects Analysis (FMEA) be performed to identify, isolate, and mitigate individual failures.
- ARP4761 Table 1 shows a means of evaluating the failure condition severity as related to Probability Objectives and Assurance Levels for components and systems in aircraft.

3.9 Multiple Mode or Function Indications

When a HUD has more than one operational display mode, each mode shall be indicated by the HUD.

3.10 Identification

The following information shall be legible and permanently marked on the equipment or nameplate attached thereto:

- a. Name of equipment
- b. Manufacturer's part number
- c. Manufacturer's serial number or date of manufacture
- d. AS8055A or equivalent approval identification

- e. Manufacturer's name or trademark
- f. Weight to the nearest 0.05 kg (tenth of a pound)
- g. Environmental categories per DO-160G/ED-14G

3.11 Display

The information being displayed should functionally conform to the applicable SAE Aerospace Recommended Practice or other standards as appropriate.

3.11.1 Discernibility

Means shall be incorporated to prevent obscuration or confusion of task essential information. Task essential information shall be identified and defined by the applicant (e.g., typically by the manufacturer or OEM).

3.11.2 Critical Information

Means shall be provided to inform the pilot if critical data normally displayed on the HUD is invalid. For display function criticality and the criticality of hazardous misleading primary flight data, refer to AC 25-11A.

3.11.3 Information Limit Indication

A means shall be provided to identify when critical information exceeds the display format functional limits.

3.11.4 Scale Indications

The display scaling, graduations, and numeration shall be appropriate for the level of reading accuracy and dynamic range required (e.g., familiar units of measure are not as significant as the values and may be a smaller font, but still must be discernible).

3.11.5 Ambiguity

Means shall be provided to prevent ambiguous indications within the operating range of the equipment.

3.12 Resistance to Dust and Moisture

Optics shall be designed to prevent contamination of internal surfaces by dust or moisture under all operating and test conditions including the low temperature and fogging tests of this document.

3.13 Mechanical Hazard System Protection

Within the environmental constraints of this document, the HUD system shall be designed such that no hazard will result from implosion, or other mechanical failures. When the HUD combiner is stowed, the combiner shall be designed such that it cannot be inadvertently deployed.

3.14 Fire Resistance

Except for small parts (e.g., fasteners, grommets, knobs, seals, small electrical parts) that would not contribute significantly to the propagation of a fire, all materials used must be self-extinguishing when tested in accordance with the requirements of 14 CFR 2X.853 and 25.869 Appendix F thereto, with the exception that materials tested may be configured in accordance with paragraph (b) of Appendix F or may be configured as used.

3.15 Supplemental Heating/Cooling

Where supplemental heating or cooling is required by the equipment to ensure conformance with this standard, it shall be the responsibility of the manufacturer to specify such requirements. If the loss of supplemental heating or cooling during normal system operation could lead to hazardous misleading information, the heating or cooling sources shall be monitored and the flight crew alerted to the failure.