European Union Aviation Safety Agency

Explanatory Note to Decision 2019/020/R

Regular update of CS-23

Amendment of the acceptable means of compliance and guidance material to CS-23

RMT.0687

EXECUTIVE SUMMARY

CS-23 (Normal-Category Aeroplanes) has been reorganised by its Amendment 5 into objective specifications. The AMC to this CS-23 complements the CS-23 Amendment 5 objective specifications. This Decision introduces an amendment of the acceptable means of compliance (AMC) and guidance material (GM) (Issue 2) to the reorganised CS-23.

This Issue includes the following safety-related changes:

Spin/Stall and Loss of Control — a new means for showing compliance for stall warning, departure characteristics, and safety-enhancing features to protect against a tendency to hazardously depart from controlled flight is introduced.

Fuel management — following a safety recommendation, the AMC was changed to include a low-level fuel warning for all aeroplanes, instead of only for turbine-powered aeroplanes.

Furthermore, this Issue 2 accepts as a means of compliance to CS-23 Amendment 5 the revisions and introduction of new standards published by ASTM International.

In order to allow simultaneous acceptance of multiple revisions or new standards, ASTM issues on a regular basis Standard F3264 that contains a listing of all relevant standards (including their revision status) and shows how they relate to the rule objectives and are considered as a means to show compliance.

Revision F3264-18b is the basis for this revision to AMC1 to CS-23, and is available for reading on the ASTM website. Where EASA has determined that an ASTM standard needs to be restricted or changed in order to be accepted as an AMC to CS-23, this is specifically indicated in the AMC.

Action area:	Regular updates		
Affected rules:	AMC & GM to Certification Specifications for Normal-Category Aeroplanes (CS-23)		
Affected stakeholders:	Manufacturers and other design organisations dealing with supplemental type certificates (STCs), repairs or changes to these aeroplanes		
Driver:	Efficiency/proportionality	**Rulemaking group:**	No
Impact assessment:	Light	**Rulemaking Procedure:**	Direct publication

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1. About this Decision

The European Aviation Safety Agency (EASA) developed ED Decision 2019/020/R in line with Regulation (EU) 2018/1139[1], ('Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) 2019-2023 under rulemaking task (RMT).0687. The scope and timescales of the task were defined in the related Terms of Reference[3]. RMT.0687 is a standing (open-ended) task that serves to address the introduction of changes to CS-23 and the related AMC and GM. It is anticipated that, in general, most changes to the AMC/GM will be made by accepting new or amendments of referenced consensus standards.

The referenced ASTM International consensus standards stem from ASTM Technical Committee F44 on General Aviation Aircraft[4] and its subcommittees. ASTM F44 applies a process for the development of standards that:

— is documented and publicly available[5];

— is built on collaboration and consensus of those affected. Today, over 350 ASTM F44 members from global industry, users and authorities participate in the development of and changes to consensus standards;

— assures a balance between competing interests by balancing a 50/50 voting right for industry and other members; and

— provides access to the views and objections of other participants, and a fair and impartial process for resolving conflicting views.

Because of the transparency of the ASTM F44 consensus standard development process, as well as the possibility for stakeholders to participate and comment, EASA took the decision to apply Article 15 'Direct publication' of MB Decision No 18-2015 and consulted the draft text of this decision only with the Advisory Bodies (ABs).

The introduction of this second issue of the new AMC/GM after the reorganisation of CS-23 into objective specifications involves the adoption in AMC1 of ASTM International F44 consensus standards that are proposed as AMC by standard F3264-18b, as well as consequential revisions in AMC2 and AMC3.

The final text of this Decision with the AMC and GM to CS-23 has been developed by EASA.

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1 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91 (OJ L 212, 22.8.2018, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1536149403076&uri=CELEX:32018R1139).

2 EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

3 https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0687

4 https://www.astm.org/COMMITTEE/F44.htm

5 https://www.astm.org/ABOUT/faqs.html

The major milestones of this rulemaking activity are presented on the title page.

2. In summary — why and what

2.1. Why we need to change the AMC/GM to CS-23

The principal objective of Article 1 of the Basic Regulation is to establish and maintain a high uniform level of civil aviation safety in Europe. EASA shall, pursuant to Article 76(3) of the Basic Regulation, issue certification specifications (CS) and AMC, as well as GM, for the application of the Basic Regulation and its delegated and implementing acts.

EASA is obliged, pursuant to Article 4(1) of the Basic Regulation, to reflect the state of the art and the best practices in the field of aviation and update its decisions taking into account the worldwide aviation experience and scientific and technical progress in the respective fields.

The existing rulemaking process and resources have shown that keeping up with technological developments is a challenge. In addition, there is uncertainty for applicants and EASA, for instance in cases of projects that contain design specifics that are not appropriately covered by the certification specifications. This slows down both the certification process and innovation.

In order to better serve the certification process with up-to-date information and to promote innovation, it is important that the latest technology and processes should become available for use as means of compliance.

2.2. What we want to achieve — objectives

The overall objectives of the EASA system in the field of civil aviation are defined in Article 1 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined above.

The specific objective of this decision is to provide new and amendment of existing AMC to CS-23 on the basis of consensus standards for state-of-the-art technology and methods.

2.3. How we want to achieve it — overview of the AMC1 to CS-23 amendments

This revision to the AMC introduces changes that are following the changes in the ASTM International technical standards that are used by reference in this AMC. ASTM F3264-18b 'Standard Specification for Normal Category Aeroplanes Certification' contains the listing of the current industry standards which have been determined by consensus in ASTM International, to demonstrate compliance with the requirements for Normal-Category Aeroplanes. This revision of the AMC/GM to CS-23 accepts these changed standards as AMC, as indicated in the tables of this AMC1.

New guidance material (GM1 CS 23.2010) is included to explain how the applicability of the changed AMC relates to the previous issue of this AMC. The previously published AMC1 CS 23.2010 has been reclassified as GM2 CS 23.2010.

Since the first publication of the AMC/GM to CS-23, 11 referenced ASTM standards have been revised, and 1 new standard has been introduced. The revision status of ASTM standards is indicated by the dash number, following the number of the standard. This dash number stands for the year of publication. For example, F3062-18 is the revision of F3062 that was published in 2018. A summary of the changes between the previous accepted revision, and the new revision is provided below for information.

The changes in this AMC include the following safety-related issues:

Spin/Stall and Loss of control (LoC)

The protection against LoC has been strengthened by introducing a new method in AMC1 (see F3180-18 Standard Specification for Low-Speed Flight Characteristics of Aircraft) where in addition to the traditional spin, stall behaviour and warnings, a new method to show protection against a tendency to inadvertently depart from controlled flight is introduced. This does not exist in AMC2 (CS-23, Amdt 4) or AMC3 (CS VLA, Amdt 1), but does not impact the existing methods. Therefore, AMC2 and AMC3 on this subject remain acceptable without any restrictions. No remark is included in these AMC, in contrary to the next fuel management issue.

Fuel management

Following a safety recommendation, the AMC in ASTM F3064 was changed to include a low-level fuel warning for all aeroplanes, instead of only for turbine-powered aeroplanes. This change to the AMC is only incorporated in the revision of ASTM F3064-18. Therefore, the use of the previously published AMC Issue 1, ASTM F3064-15, CS 23.1305 Amendment 4 and VLA.1305 Amendment 1 in AMC2 and AMC3 needs to be complemented. ASTM F3064-18 §6.2.1.6 is an acceptable means for showing compliance.

The introduction of the revised AMC1, referring to ASTM consensus standards, has been based upon the following:

<u>F3062 Standard Specification for Installation for Aircraft Powerplant Installation</u>

<u>Changes from revision -16 to -18:</u>

— Amendment of the standard’s title to a more generic and concise form.

— Addition of References to Specification F3117 for filler markings in 2.1, 8.2.3.1, and 9.3.1.

— Amendment of 2.1 and 11.5.1 to better align with 23.1099.

— Missing language of 23.939 (c) added as 5.3.5 to ensure full coverage of CS-23 Amendment 4.

<u>F3063 Standard Specification for Aircraft Fuel and Energy Storage and Delivery</u>

<u>Changes from revision -16a to -18a</u>

— Amendment of the standard's title to a more generic and concise form.

— Addition of References to Specification F3117 for filler markings in 2.1 and 5.7.1.

— Addition of References to Specification F3179/F3179M for performance in 2.1 and 9.2.2.

— Addition of reference to 5.7.7 in 4.2.2.

— Revised 6.1 to allow the installations to meet the turbine engine requirements of 6.1.2 as a means of compliance.

— Revised 6.2 to add 6.2.2.

— Revised 7.3.1 to clarify requirement.

— Added 8.5.

— In 4.3.2, corrected grammatical and reference errors.

— In 5.8.1, clarified language to allow two options for fuel strainer sizing.

F3064 Standard Specification for Aircraft Powerplant Control, Operation, and Indication

Changes from revision -15 to -18a

— Amendment of the standard's title to a more generic and concise form.

— Updated titles in Section 2.

— Updated 4.1.1 by replacing 14 CFR reference with ASTM reference.

— Updated 4.2.1 to clarify the applicability of the requirement to spark ignition engines per Federal Aviation Administration (FAA) request.

— Removed requirements in 5.1.1.2 that are duplicated in 5.1.1.1.

— Updated paragraph references in 5.9.2.

— Updated paragraph references and minor editorial changes to 6.1 per FAA's request.

— Updated paragraph 6.2.1.6: Based on the safety recommendations (Ref. BEA Incident Report, Reims Aviation F172M 10/15/12), a low-level fuel warning is included for all aeroplanes, instead of only for turbine-powered aeroplanes. In addition, new data from the FAA and the National Transportation Safety Board (NTSB) seems to indicate that the majority of powerplant systems and component failures were incorrectly classified and more than half of those should actually reflect fuel mismanagement accident fatalities making it the third leading cause of general aviation accidents. Data supports that aeroplanes that have voluntarily implemented a low-fuel level annunciation have seen a dramatic reduction in accidents due to fuel mismanagement.

— Removed 6.2.6 that addresses indicators for electric-powered airplanes. This will be reintroduced in a later revision to the standard.

F3065 Standard Specification for Aircraft Propeller System Installation

Changes from revision -15 to -18

— Amendment of the standard's title to a more generic and concise form.

— Combination of 4.5.1.1 and 4.5.1.2 to account for the most adverse combination.

— Revised wording of 7.2.2 to remove reference to part.

F3066 Standard Specification for Aircraft Powerplant Installation Hazard Mitigation

Changes from revision -15 to -18

— Added Specification F3120/F3120M to the standard reference list and changed the text to reference ASTM standard not FAA regulations. Deleted 5.2.3 and combined information into 5.2.2 as the information and conditions for ground icing were conflicting with the standard which is defined in Specification F3120/F3120M.

— Replaced ‘may’ with ‘must’ and added Specifications F3120/F3120M, F3114, F3116/F3116M to the standard reference list and changed the text to reference ASTM standard not FAA regulations.

— Revised wording to include the requirement for level 4 aeroplanes.

— Changed the text to match the intent of 23.1093(a)(5).

F3116 Standard Specification for Design Loads and Conditions

Changes from revision -15 to -18

— Section 2.1: Added F3331 Practice for Aircraft Water Loads, new Standard for Water Loads added to Reference Section

— Section 9.1.2: Revised to change reference from Appendix X7 to Practice F3331.

— Appendix X7 replaced by Practice F3331.

— Removed Appendix X7 Acceptable Means for Calculation of Water Loads.

— Moved Appendix X7 material to Practice F3331.

F3117 Standard Specification for Crew Interface in Aircraft

Changes from revision -15 to -18b

— 5.2.5.2 changed for SI units.

— 5.2.7 changed to clarify applicability of requirements.

— 5.2.8 changed to clarify applicability of requirements.

— 5.2.10 changed to clarify applicability of requirements.

— 5.5.4 and 5.5.5 added to complete the coverage of 23.1357(d).

— 12.1.4 changed for consistency with 12.1.1.

— 13.4.1 changed to make placard required only if indicator is installed.

— 14.13.3 changed to 14.14 to correct paragraph level.

F3173 Standard Specification for Aircraft Handling Characteristics

Changes from revision -15 to -17

— Updated scope with F44 editorial guide.

— Section 4.3.5: Changed ‘establish a zero rate of descent’ to ‘arrest the rate of descent to zero’.

— Section 4.5.6: Replaced specified pedal force limit with a reference to Table 1.

— Section 4.5.7: Replaced specified pedal force limit with a reference to Table 1.

— Section 4.6: ‘Safe entry speeds for these manoeuvres shall be determined’ is replaced by ‘Safe entry speeds for successful completion of these manoeuvres shall be determined’.

— Section 4.7.3.2: Typo corrected.

— Section 4.9: Removed airworthiness level discriminators leaving the rate of roll criteria as solely a function of maximum weight. The changes revert to the 14 CFR Part 23 Amendment 23-63 and CS-23 Amendment 4 requirements. The rate of roll performance requirements have historically been a function of maximum weight.

— Section 4.9.2.4: ‘The aeroplane trimmed at a speed equal to the greater of 1.2 VS1 or 1.1 V_{MC} or as nearly as possible in trim for straight flight.’ is replaced by ‘The aeroplane trimmed, or

trimmed as nearly as possible, in straight flight at a speed equal to the greater of 1.2 V_{S1} or 1.1 V_{MC}.'

— Section 5.1: This change clarifies that flight control system inputs made by an 'always on' function of the flight control system that are transparent to the pilot, as is typical for a closed loop fly-by-wire system, are allowable during trim demonstrations.

— Section 6.4.2.3: Replaced specified pedal force limit with a reference to Table 1.

— Section 6.5.4: Typo corrected.

F3174 Standard Specification for Establishing Operating Limitations and Information for Aeroplanes.

Changes from revision -15 to -18

— Section 1.1 through 1.3: Update to match F44 Standards Editorial Guide 2017-02.

— Section 2.1: New reference for F3082 added. Update of titles.

— Sections 2.2 and 2.3: Removed, since no longer referenced in Section 3 and onwards.

— Section 4.1: Update to match new numbering structure.

— Section 4.2.1: Clarification that V_{NE} shall be established as an operating limitation.

— Section 4.2.1.2(2): Reference changed from section number to title.

— Section 4.2.2: Clarification that V_{NO} shall be established as an operating limitation and reverted to 14 CFR Part 23, Amendment 62 language (non-simplified) for easier acceptance of the first set of consensus standards.

— Section 4.2.3: Applicability to turbine-powered aeroplanes or to aeroplanes for which V_D/M_D is established, reintroduced, reverted to 14 CFR Part 23, Amendment 62 language (non-simplified) for easier acceptance of the first set of consensus standards.

— Section 4.2.3(1): 'may' replaced with 'shall' in accordance with F44 Editorial Guide.

— Section 4.2.3(2): Reference changed from section number to title. The term 'V_{DF}/M_{DF} for jets' reintroduced (non-simplified language) for easier acceptance of the first set of consensus standards.

— Section 4.2.3(3): Reference changed from section number to title. The term 'V_{DF}/M_{DF} for jets' reintroduced (non-simplified language) for easier acceptance of the first set of consensus standards. 'May' replaced with 'shall' in accordance with F44 Editorial Guide.

— Section 4.2.4: Operating Maneuvering Speed (former Section 4.3) moved under Section 4.2 Airspeed Limitations. Title of subsection removed, because of redundant language. Reverted from V_1Vn to match CS 23, Amendment 4 language (non-simplified) for easier acceptance of the first set of consensus standards.

— Section 4.2.5: Flap Extended Speed (former Section 4.4) moved under Section 4.2 Airspeed Limitations. Title of subsection removed, because of redundant language.

— Section 4.2.5.1: Reference changed from section number to title. Was Section 4.4.1.1.

— Section 4.2.5.2: Reference changed from section number to title. Was Section 4.4.1.2.

— Section 4.2.6: Minimum Control Speed (former Section 4.5) moved under Section 4.2 Airspeed Limitations. Reference section number removed since specification number is sufficient.

— Section 4.3: Reference updated from 23.23 to F3082. Was Section 4.6.

— Section numbering updated from former Section 4.6 onwards.

— Section 4.5: Order changed for clarity. Requirements applicable to all aeroplanes moved upwards. Former Section 4.8.2 becomes 4.5.4. Renumbering of former Sections 4.8.3 and 4.8.3.

— Section 4.8.2: Wording order changed, discriminator at the beginning of the sentence for easier understanding.

F3179 Standard Specification for Performance of Aircraft.

Changes from revision -16 to -18

— Section 4. A new hierarchy is developed. Section topics from section 4 are split into new sections 5 to 20.

F3180 Standard Specification for Low-Speed Flight Characteristics of Aircraft.

Changes from revision -16 to -18

The title of the standard has been updated, and in several paragraphs the language has been changed to better align with the objective rules in CS-23 Amendment 5.

The more fundamental change is however that the standard has been reorganised and complemented with new alternative methods to show compliance. The following table summarises this restructuring compared to F3180-16.

F3180-18	Remarks	Corresponding F3180-16 section	Changes from -16 to -18
§ 4.1 Low-Speed Flight Characteristics Score	Introduction of a new scoring system for compliance with standard	N/A	N/A
§ 4.2 Stall characteristics	Conditions for stall characteristics testing. Also, sets up conditions that are re-used for § 4.4.	§ 4.1 Stall	(1) The flight test conditions have been extracted from §4.1.1.6 and §4.1.2.3 and put into §4.2.1 in -18. (2) Allows for reduced set of conditions to be evaluated for level 1 and level 2, low-speed, single-engine aeroplanes.
§ 4.3 Stall warning	Stall warning adapted to incorporate a new scoring system that allows for different combinations of stall warning implementations.	§ 4.4 Stall warning.	Removed prescriptive alternatives for stall warning, and replaced with scoring system that allows for multiple permutations of stall warning technologies to be implemented.

F3180-18	Remarks	Corresponding F3180-16 section	Changes from -16 to -18
§ 4.4 Departure characteristics single-engine	Defines multiple alternatives for determination of departure resistance score for single-engine, non-aerobatic aeroplanes.	§ 4.2 Departure characteristics	(1) Alternative 1 (§4.4.1) updated to refer to flight conditions in §4.2.1. Also, clarifies that these maneuvers need only be tested below 25,000 ft, even for aeroplanes approved for operation at higher altitudes. (2) Alternative 2 (§4.4.2) completely overhauled. Largely uses Alternative 1 maneuvers, but allows an applicant to pass fewer manuevers, if overall 'points' goal established in §4.1 is met. (3) Alternative 3 (§4.4.3) updated to refer to flight conditions in §4.2.1.
§ 4.5 Departure characteristics multi- engine	Defines multiple alternatives for determination of departure resistance score for multi-engine, non-aerobatic aeroplanes.	§ 4.2 Departure characteristics	Complete overhaul of former § 4.2.4 - introduces three alternatives for multi-engine aeroplanes to calculate the departure resistance score required by §4.1.
§ 4.6 Spinning	Defines conditions evaluated for aeroplanes approved for spinning.	§ 4.3 Spinning	Changed former § 4.3.3 (now § 4.6.3) from 'It shall be impossible to obtain unrecoverables spins with any use of the flight or engine power controls either at the entry into or during the spin' to 'The aeroplane must be recoverable with any typical use of the flight or engine power controls either at the entry into or during the spin'
§ 4.7 Safety-Enhancing Features	Introduces scoring system for additional safety-enhancing features that may be used for partial compliance with the score requirements in § 4.1.	N/A	N/A
§ 5 Keywords		§ 5 Keywords	

F3180-18	Remarks	Corresponding F3180-16 section	Changes from -16 to -18
Appendixes			
X1 Example permutations of conditions used to comply with § 4.2 and § 4.4	NEW		
X2 Suggested practice for presentation of information for enhanced indication systems	NEW		
X3 Suggested specification for enhanced envelope awareness systems	NEW		

F3331 New

New Standard Practice for Aircraft Water Loads covering Appendix X7, previously in F3116-15

AMC2&3 CS-23/CS-VLA

The note in the table where AMC to 23.2150 is provided by VLA.221 has been corrected. The initial note was not correctly copied from 23.221.

2.4. What are the stakeholders' views

The consultation of the draft decision with the ABs provided a total of 17 editorial comments from one stakeholder. There were no adverse comments against the proposed AMC.

2.5. What are the benefits and drawbacks

This amendment to the AMC/GM to CS-23 introduces changes in referenced ASTM standards in AMC1, which have been introduced between revision -17 and -18b of F3264 Standard Specification for Normal Category Aeroplanes Certification. Between revision -17 (Published in September 2017) and revision -18b (Published December 2018), 11 standards have been changed, and 1 new standard has been introduced. This shows the ability of the consensus standards process to follow changes and innovation. Where the initial revision of the referenced standards was primarily a transposition of the existing detailed regulatory material into standards, changes and improvements are now being introduced.

Regular and faster updates to consensus standards are creating more up to date means of compliance. This provides a possibility to introduce safety improvements and cover new technology and methods for compliance showing.

On the other side, it is clear that for a user-friendly implementation of the flexible building-block system, additional tools and more detailed information is required to support the process of applying

the AMC and building a certification plan and compliance checklist. Therefore, the relationship information between rule and AMC is being reviewed, and a change is anticipated in a future revision of this AMC/GM to CS-23. For now, the Easy Access Rules for Normal Category Aeroplanes (CS-23) Amendment 5, AMC/GM Issue 1 already provides both the rule and the AMC/GM in one document.

3. How do we monitor and evaluate the rules

The expected success of the migration in CS-23 from prescriptive rules into the new concept, where technical details are captured in this new AMC, will become noticeable in various ways. The high-level effect will show an increase in innovative design applications. In fact, this has already been noticed from the day that CS-23 Amendment 5 was issued.

The second level of effect is expected when a more up-to-date AMC reduces the need of development of project-specific compliance documents. A reduction in special conditions and generic certification review items is expected. This can, however, be negatively affected by more innovation. Therefore, the monitoring of these aspects is not considered from the start.

On the other hand, the agility of the process of developing more up-to-date consensus standards will be monitored through the level of amendments to standards, as well as new standards, in the regular update of the AMC and GM to CS-23.

4. References

4.1. Related decisions

Decision No. 2003/14/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance for normal, utility, aerobatic and commuter category aeroplanes (« CS-23 »)

4.2. Affected decisions

ED Decision 2017/025/R of 20 December 2017 issuing Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Certification Specifications for Normal-Category Aeroplanes (CS-23) 'AMC/GM to CS-23 — Issue 1'

4.3. Other reference documents

n/a

5. Related documents

n/a