



# Explanatory Note to Decision 2016/024/R

## CS-27 AMENDMENT 4

RELATED NPAs/CRDs: NPA/CRD 2013-21 (RMT.0119 (27&29.003)); NPA/CRD 2013-04 (RMT.0134 (27&29.029)); NPA/CRD 2014-16 (RMT.0223 (MDM.024)) & NPA/CRD 2011-17 (RMT.0364 (MDM.089)) — 30.11.2016

### EXECUTIVE SUMMARY

This Decision addresses a number of safety and regulatory harmonisation issues that are currently not or are only partially addressed in the current CS-27.

The specific objective is to update the certification specifications for small rotorcraft in order to maintain a high level of safety and to provide cost-efficient rules harmonised with those of international partners.

This Decision proposes the following main changes:

- To amend AMC 27.351 to reflect certification experience and ensure a consistent and safe approach to establishing structural substantiation.
- To adopt AC 27-1B — Change 4, published by FAA in May 2014. Most changes adopted in this Advisory Circular were previously developed jointly by FAA and EASA however some minor differences remain.
- To create new Certification Specifications on HIRF (CS 27.1317) and lightning (CS 27.1316). This will better reflect existing certification practice and will replace reliance on ageing JAA interim policies. AMC material associated with these new rules has previously been published by EASA in AMC-20.
- To create a new rule related to volcanic ash (CS 27.1593). This will ensure that design organisations undertake an assessment of their product’s susceptibility to volcanic cloud hazards as part of type certification, and establish limitations and/or provide information for their safe operation.

The proposed changes are expected to increase safety and cost-effectiveness, reduce regulatory burden and constitute an improvement in terms of harmonisation with other certification authorities.

<b>Affected rules</b>	CS-27				
<b>Affected stakeholders</b>	Manufacturers of small rotorcraft				
<b>Driver</b>	Safety	<b>Reference</b>	N/A		
<b>Rulemaking group</b>	Yes (flight subgroup only)	<b>Impact assessment</b>	Light	<b>Procedure</b>	Standard

### EASA rulemaking process



RMT.0119 (Iss.2): 21.10.08	NPA 2013-04: 14.3.13	N/A	N/A	DD.MM.20XX
RMT.0134: 20.10.10	NPA 2013-21: 4.11.13			
RMT.0223: 10.2.12	NPA 2014-16: 25.6.14			
RMT.0364: No ToR	NPA 2011-17: 23.9.11			



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## 1. Procedural information

### 1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed this ED Decision 2016/024/R in line with Regulation (EC) No 216/2008<sup>1</sup> (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure<sup>2</sup>.

The rulemaking activities are included in the Agency's [5-year Rulemaking Programme](#) under RMT.0119 (27&29.003), RMT.0134 (27&29.029), RMT.0223 (MDM.024) and RMT.0364 (MDM.089). The scope and timescale of the tasks were defined in the related Terms of Reference (ToR) (see 'process map' on the title page).

The draft text of this Decision has been developed by the Agency. In the case of RMT.0119 this was supported by a rulemaking group, and for RMT.0134 by a rulemaking subgroup specifically addressing flight issues. All interested parties were consulted through NPA 2013-21, NPA 2013-04, NPA 2014-16 and NPA 2011-17<sup>3</sup>.

The Agency has reviewed the comments received on all of the NPAs. The comments received and the Agency's responses are presented in the associated Comment-Response Documents (CRDs)<sup>4</sup>.

The final text of this Decision with the Certification Specifications (CS) and Acceptable Means of Compliance (AMC) has been developed by the Agency.

The process map on the title page summarises the major milestones of this regulatory activity.

### 1.2. Structure of the related documents

Chapter 1 contains the procedural information related to this task. Chapter 2 explains the core technical content. Chapter 2.4 summarises the findings from the Regulatory Impact Assessment (RIA). The text of the CS/AMC is annexed to the ED Decision.

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<sup>1</sup> Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

<sup>2</sup> The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See Management Board Decision N° 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications, acceptable means of compliance and guidance material ('Rulemaking Procedure')

<sup>3</sup> In accordance with Article 52 of the Basic Regulation and Articles 6(3) and 7 of the Rulemaking Procedure.

<sup>4</sup> <https://www.easa.europa.eu/document-library/comment-response-documents>



## 2. Explanatory Note

### 2.1. Overview of the issues to be addressed

This Decision includes the outcome of four individual rulemaking tasks as described below.

### 2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in this Chapter. Therefore, the specific objectives of this proposal are to:

- (a) Review the rationale and acceptability of CS 27&29.351 and associated AMC. In the past, different interpretations have been used for showing compliance with the yaw manoeuvre structural design requirements prescribed under CS 27&29.351. Certification experience has shown that variations in interpretation and application can have important repercussions on the strength level required for new designs.
- (b) Develop and maintain AMC that has been found during certification activities to be incomplete, misleading, outdated or that do not reflect the current accepted certification practice.
- (c) Enhance High-Intensity Radiated Fields (HIRF) and lightning standards to counter the growing threat due to the increased use of critical and essential electrical/electronic systems on rotorcraft, coupled with the development and use of non-metallic structural materials that are more 'transparent' to electromagnetic radiation and have low electrical conductivity. An update of CS-27 to reflect recent developments will ensure that the state of the art and best practices are duly recognised and harmonised with the Federal Aviation Authority (FAA) rules.
- (d) Strengthen the Certification Specifications and AMC to ensure that design organisations undertake an assessment of their product's susceptibility to volcanic cloud hazards as part of type certification, and establish limitations and/or provide information for their safe operation, following recent experiences with volcanic activity.

### 2.3. Outcome of the consultation

The Agency received public comments on each of the four NPAs forming part of this amendment. For a full list of comments and the Agency's response thereto, please refer to the associated CRD. The most significant comments are published here for information:

- (a) CRD 2013-21 — Yawing Conditions: none.
- (b) CRD 2013-04 — Rotorcraft AMC Revision.

As adoption of FAA Advisory Circular (AC) 27-1B — Change 4 will automatically adopt Change 3, which was not previously part of a joint FAA/EASA development process, stakeholders were specifically requested to provide comments on the acceptability of this material for direct adoption.

- (c) CRD 2014-16 — High-Intensity Radiated Fields (HIRF) and lightning: no comments specifically related to CS-27.
- (d) CRD 2011-17 — Volcanic Ash: no significant comments specifically related to CS-27.



## 2.4. Summary of the Regulatory Impact Assessment (RIA)

Safety: the proposed changes will provide clear and unambiguous rules and means of compliance to further enhance rotorcraft safety, as well as a consistent approach to certification.

Environment: none.

Social: the strengthening of rules governing flight in volcanic ash will minimise the impact in the case of airspace contaminated by volcanic ash.

Economic: these changes should result in economic benefits as they will enable applicants to predetermine the Agency's expectations and thus avoid unnecessary cost and time delays during a certification project. In many cases, the changes are aligned with those of FAA further reducing the need for scrutiny during validation activities. For some manufacturers, these proposals may require additional effort and/or a change in compliance methodology and associated tools and procedures. However, the cost of such changes is likely to be low.

Proportionality issues: in yawing conditions, the option to substantiate structural strength using 'the line' has been retained in recognition of the limited capabilities of the small rotorcraft industry. Furthermore, the rules governing volcanic ash are only applicable to turbine-engined rotorcraft and some flexibility has been introduced into the rules on whether flight in airspace contaminated by volcanic ash is not required.

Impact on regulatory harmonisation: these proposals will increase harmonisation with the FAA rules. In the case of yawing conditions, the fact that the rulemaking group was unable to reach full consensus within the timescale available has resulted in some differences being retained. For volcanic ash, there is no equivalent FAA rule.

## 2.5. Overview of the amendments

The main changes introduced in this CS-27 Amendment 4 are summarised as follows:

- A new Certification Specification (CS 27.1316) on electrical and electronic systems lightning protection is created. The existing CS provisions only require the applicant to 'consider' lightning. While the focus on protection of electrical and electronic systems that perform critical or essential functions is fundamental to the wording of earlier airworthiness standards regarding systems, this proposal focusses on the effects that failure conditions would have on rotorcraft safety. The Agency proposes that lightning protection design required for each rotorcraft is determined by the type of electrical and electronic systems installed on the rotorcraft and by how critical the system or function is to either continued safe flight and landing or rotorcraft capability and flight crew's ability to respond to adverse operating conditions. Related AMC material is contained in AMC 20-136.
- A new Certification Specification (CS 27.1317 plus Appendix D) on High-Intensity Radiated Fields (HIRF) is created. Currently, CS 27.1309 provides general certification requirements applicable to the installation of all aircraft systems and equipment, which, however, do not include specific certification requirements for protection against HIRF. This has led to the development of 'special conditions' to address HIRF protection, which have then been systematically imposed on all applicants seeking issuance of a Type Certificate (TC) or change to a TC. The new Certification



Specification will replace these 'special conditions'. Related AMC material is contained in AMC 20-158.

- A new rule (CS 27.1593) together with AMC on exposure to volcanic ash is created. The specific objective is to mitigate the risks to rotorcraft from operating in areas contaminated by volcanic clouds. For this purpose, it is proposed that manufacturers support operators by providing all relevant airworthiness information, including technical data and information regarding the susceptibility of the rotorcraft to volcanic-cloud-related effects, the nature of these effects and the related pre-flight, in-flight and post-flight precautions to be observed.
- Adoption of FAA AC 27-1B — Change 4 to be included into CS-27 Book 2. To ensure that AMC remain relevant to the certification of modern rotorcraft, there is a need to maintain and update AMC on a regular basis so that they reflect the latest technological developments and accepted certification practice. A list of changes introduced is detailed in the following table. Additionally, changes introduced by FAA at Change 3 will be automatically adopted.

<b>Section</b>	<b>Title of section</b>	<b>Description</b>
<b>27.29</b>	Empty weight and corresponding centre of gravity	Clarification of empty weight.
<b>27.45</b>	General (performance)	AC has been added in response to frequent comments and cases of improper application of one-engine-inoperative (OEI) power. It clarifies that 30 sec of OEI power should be limited to 3 scenarios: (a) recovery from engine failure, (b) missed approach, (c) final approach and landing. OEI power ratings should not be part of normal operations, including all-engines-operative (AEO) hover performance.  The allowable wind speed for HV testing is increased from 0–3 kts to 0–5 kts. When the velocity of the wind is very low, the direction and speed are very often variable. Past experience has shown that even a slight tailwind during HV trials can lead to a hard landing. With an increase in wind speed, the direction is more established and a change of direction is less likely. The change will, therefore, improve safety without modifying the relevance of the test.
<b>27.79</b>	Limiting height — speed envelope	Included guidance material on extrapolation of HV data. Applying a penalty of 3 % per 1 000 ft on the W/sigma curve beyond 2 000 ft has previously been used by authorities. Providing explicit guidance will standardise this approach for all applicants who may wish to use this methodology.
<b>27.141</b>	General (flight characteristics)	Revised guidance material to address pilot control forces as a result of hydraulic-boost system failure, as well as the testing required to address controllability and pilot fatigue



		concerns.
<b>27.143</b>	Controllability and manoeuvrability	Revised guidance material to include procedures for yaw controllability flight testing.
<b>27.151</b>	Flight controls	Revised guidance material to include qualitative methods for evaluating flight control characteristics.
<b>27.561</b>	General (emergency landing conditions)	Included rearward load factor note for doors and emergency exit design.
<b>27.610</b>	Lightning and static protection	Included reference to Society of Automotive Engineers (SAE) Aerospace documents associated with lightning protection.
<b>27.903B</b>	Engines	Revised explanation in guidance material on demonstration of engine restart capability.
<b>27.939</b>	Turbine engine operating characteristics	Revised guidance material to include flight test procedures for evaluating installed engine operating characteristics for Full Authority Digital Engine Controls (FADEC)-equipped engines. At present, the AC is not precise enough in its description to cover all different techniques and manoeuvres to be performed in order to 'determine that no adverse characteristics (such as stall, surge or flameout) are present'.
<b>27.1093</b>	Induction system icing protection	Included guidance material for inadvertent operation in falling and blowing snow conditions with 1 mile or less visibility.
<b>27.1309</b>	Equipment, systems, and installations	Included a reference in AC to the new AC 27.1316/29.1316 to promote guidance material for lightning protection of electrical and electronic equipment. Revised AC to remove obsolete software guidance material reference to DO-178A. Revised AC to move HIRF guidance material to the new AC 27.1317/29.1317.
<b>27.1316</b>	Aircraft electrical and electronic systems lightning protection	New AC 27.1316.
<b>27.1317</b>	High-Intensity Radiated Fields (HIRF) protection	New AC 27.1317.
<b>27.1329</b>	Automatic pilot system	Revised guidance material to address evaluation of autopilot malfunction. The AC adequately addresses limit loads, but flight path deviations are considered only for Instrument Approach Procedures (IAP), which constitute a small section of the overall operation of a helicopter. The introduction of subparagraph (iv) will allow operators to



		define a minimum use height or minimum engagement height for hands-off flight.
<b>27.1337</b>	Power plant instruments	Revised AC to include guidance material associated with fuel quantity indication for fuel tanks that are interconnected and use gravity for fuel transfer between tanks.
<b>27.1357</b>	Circuit-protective devices	Revised AC material to clarify the use of a circuit breaker.
<b>27.1543</b>	Instrument markings (general)	Editorial corrections.
<b>MG 5</b>	Agricultural Dispensing Equipment Installation	Revised Miscellaneous Guidance for the installation of agricultural dispensing equipment within the FAA Restricted category.
<b>MG 6</b>	Emergency Medical Service (EMS) Systems	Revised Miscellaneous Guidance for the installation of equipment and systems for Emergency Medical Services.  Note: the Agency has introduced a minor revision to this MG in CS-27 Book 2 due to the differences in the minimum equipment required for Emergency Medical Services.
<b>MG 22</b>	Rotorcraft OEI training	New GM to provide explicit guidance on the use of a dedicated OEI training mode that simulates an OEI condition by reducing power on both engines. This will enhance safety compared to today's training practice of selecting flight idle to simulate a failed engine, as recovery following a real engine failure in the training mode will provide a shorter response time to enable the operating engine to accelerate quickly. This issue has been highlighted by a recent training accident in which the engine operating within the 30-second rating failed and the engine at idle could not accelerate quickly enough to recover.





- A new AMC No 1 to CS 27.351 on yawing conditions is introduced. This represents the harmonised output arising from RMT.0119. However, although this AMC does not form part of the FAA AC revision at Change 4.
- Revision to AMC No 2 to CS 27.351. This AMC identifies compliance issues which the Agency wishes to retain (i.e. consensus was not reached during RMT.0119). It has undergone minor amendments to align with the introduction of AMC No 1 to CS 27.351. It will remain in CS-27 Book 2 once AMC No 1 to CS 27.351 is removed. The specific issues where a difference remains are:
  - Aerodynamic Loads: Compliance with FAA AC 27-1B and the limited yawing envelope may be inadequate for the design of rotorcraft structural components that are principally subjected in flight to significant aerodynamic loads (e.g. vertical empennage, fins, cowlings and doors). Through RMT.0119 a gap in the regulations regarding aerodynamic design loads was identified and the development of a new rule was recommended. However, until the aerodynamics rule is in place, the Agency will ensure that all structural loads are fully accounted for.
  - Interaction of systems and structure (use of yaw limiters): The Agency takes the view that if a device is necessary to show compliance to the rule, then compensating features must be employed if the device fails, and the flight time spent in a failed condition must also be taken into account. Without such an approach, it is conceivable that the ultimate loads generated when a yaw limiting device is fitted and operating may be less than the limit loads generated when the device is in a failed condition.



### 3. References

#### 3.1. Related regulations

- Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).
- Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations (OJ L 224, 21.8.2012, p.1).

#### 3.2. Affected decisions

Decision No. 2003/15/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications for small rotorcraft ('CS-27').

#### 3.3. Reference documents

- [Federal Aviation Administration \(FAA\) Advisory Circular \(AC\) 27-1B — Change 4 'Certification of normal category rotorcraft', 1 May 2014.](#)
- JAA INT/POL/27&29/1 — Protection from the Effects of HIRF for Small and Large Rotorcraft.
- AMC 20-136 — Aircraft Electrical and Electronic System Lightning Protection.
- AMC 20-158 — Aircraft Electrical and Electronic System High-Intensity Radiated Fields (HIRF) Protection.

