



Terms of Reference

for a rulemaking task

Rotorcraft gearbox loss of lubrication

RMT.0608 — ISSUE 2 — 17.5.2016

Applicability		Process map	
Affected regulations and decisions:	CS-27 and CS-29	Concept Paper:	No
Affected stakeholders:	Manufacturers of large rotorcraft; foreign authorities	Rulemaking group:	Yes
Driver/origin:	Safety	RIA type:	Full
Reference:	SR No: TSB A11-01, A11-02; JCT Report — TCCA RDIMS 7399502	Technical consultation during NPA drafting:	No
		Publication date of the NPA:	2016/Q2
		Duration of NPA consultation:	3 months
		Review group:	TBD
		Focused consultation:	TBD
		Publication date of the Decision:	2016/Q3



1. Issue and reasoning for regulatory change

CS 29.927(c) currently requires a test to be performed to demonstrate that any failure that results in a loss of oil pressure to any normal use lubrication system will not impair the capability of the rotorcraft to operate under autorotative conditions for 15 minutes (Category B), or for continued safe flight for at least 30 minutes (Category A), unless such failures are extremely remote.

Recent experience has shown that the use of the 'extremely remote' clause can be challenging due to unforeseen variables and complexity associated with predicting potential failure modes and their associated criticality and frequency of occurrence.

It has also been recognised that there is a discrepancy between the test objective of CS 29.927(c) and the pilots' perception of a rotorcraft's endurance following loss of Main Gearbox (MGB) oil. This has been promulgated through Type Certification Holder (TCH) documentation and can lead to unrealistic expectations.

One of the underlying root causes contributing to loss of lubrication is related to the lubrication system currently falling outside the rotor drive system design assessment of CS 29.917(b). The lubrication system is an integral part of the rotor drive system and is necessary to achieve continued safe operation of the rotor drive system.

In response to a fatal accident (Ref. 1), Transport Canada (TCCA), the Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) created a Joint Cooperation Team (JCT) to conduct a review of the current design standard and Guidance Material relating to the certification of helicopter MGBs, specifically with respect to loss of lubrication, including CS 29.927(c). The JCT has examined the adequacy of these regulations, including the provision of the 'extremely remote' criteria in the standard, and provided in its final report (Ref. 2) recommendations for revising CS-29 and related AMC. EASA concurs with the JCT's recommendations which should be considered by the rulemaking group during this rulemaking exercise.

As an interim position, changes to FAA AC to clarify the intent of 29.927(c) were issued by the FAA in July 2012 (Ref. 3), and a similar EASA Certification Memo (CM), EASA CM — RTS — 001 Issue: 01, was published on 11 November 2013 (Ref. 4).

2. Objectives

The specific objective of this rulemaking task is to implement the recommendations of the JCT and to strengthen the existing CS-29 provisions pertaining to rotor drive system lubrication.

This task proposes a harmonised action to address gaps identified in the existing requirements, clarify the intent of the rule and redefine test requirements to meet the intended safety standards. This will both reduce the potential for lubrication system failures from occurring and mitigate the consequences of any failure, if this should happen.

Test results, obtained from testing a gearbox's capability to operate with depleted oil, should be taken into consideration when developing the emergency procedures for loss of lubrication in the rotorcraft flight manual. Specifying an endurance capability of the rotorcraft following failure of the rotor drive lubrication system will increase the landing opportunities that are available to the flight crew.



When this task is complete, all CS-29 Category A rotorcraft undergoing a new type-certification, or a significant change under Part 21.101, should comply with a loss of oil test and 'extremely remote' should be removed from the requirement.

The scope of this regulatory change is primarily to address this safety issue with respect to large CS-29 rotorcraft. For small CS-27 Category A rotorcraft, the safety implications of gearbox loss of lubrication are considered to be less significant due to both design and operational differences. Nevertheless, it may be considered that some provisions will also become applicable to CS-27 Category A rotorcraft, especially where specific CS-29 and CS-27 provisions are interrelated.

3. Activities

3.1 Propose a new amendment to CS 29.927(c) as a test requirement

- 3.1.1. The rule could be similar in format to that of 29.923 and 29.927(b).
- 3.1.2. The rule should clarify the applicability of the rule and distinguish between requirements for pressurised lubrication systems and those for splash lubrication systems.
- 3.1.3. Consideration should be given to removal of the term 'extremely remote' and rewriting the requirement to become a prescriptive 'oil out' durability test of the rotor drive system gearboxes used on Category A rotorcraft.
- 3.1.4. The test should prescribe the torque(s) and rotational speed(s) that must be applied to the rotor drive system. As a minimum, the torque and rotational speed should not be less than that required to maintain continued level flight and to perform a safe landing at maximum take-off gross weight (applicants may elect to consider some adjustment to gross weight as a result of fuel burn).
- 3.1.5. The method for draining oil from the gearbox should be stated. This should be identified as simulating the worst-case oil leak.
- 3.1.6. Determine the duration of the 'oil out' test, taking into account operational need.
- 3.1.7. The test duration should be of sufficient length to justify with confidence that a minimum of 30 minutes of continued flight would be available in operation. This would be consistent with the intention of 29.927(c) Amendment 26.
- 3.1.8. On completion of the test, the test results and the duration of the test should be taken into consideration when developing the appropriate emergency procedures for loss of lubrication in the rotorcraft flight manual.

3.2 Develop Guidance Material for AMC 29.927

- 3.2.1. The Guidance Material should provide Acceptable Means of Compliance to the rule.
- 3.2.2. One acceptable means of achieving the test duration may be through the use of an independent auxiliary lubrication system, subject to satisfactory substantiation of the independence of the auxiliary lubrication system from the primary lubrication system.



3.3 Elaborate AMC 29.917 to include the lubrication system as part of the rotor drive system

3.3.1. Lubrication system failures should be included as part of the rotor drive system design assessment under 29.917(b). A failure analysis would be required to identify all lubrication failures that will prevent continued safe flight or safe landing.

3.3.2. The AC should be extended to provide specific advice and means of compliance for the assessment of lubrication system reliability in addition to minimising the likelihood of individual lubrication system failure modes.

3.4 Revise CS-27 Appendix C to reflect the changes in CS-29

3.4.1. Any changes to the composition and contents of CS-29 should be appropriately reflected in CS-27 Appendix C to ensure consistency as well as to maintain the applicability of these provisions to CS-27 Category A rotorcraft.

4. Deliverables

The final delivery from the rulemaking group will be a draft proposal to amend 14 CFR Part 29/CS-29/AWM 529, and in particular paragraphs 29.917(b), 29.927(c) and associated Guidance Material. Subpart G on rotorcraft flight manual operating limitations and procedures may also be impacted.

5. Profile and contribution of the rulemaking group

Profile of potential rulemaking group and its members:

Specific expertise required

- Specialists in design, safety assessment, and testing of rotor drive systems.

Composition of the group (stakeholders' balance)

- Authority representatives from EASA, FAA and TCCA;
- Large helicopter manufacturers;
- Helicopter pilot/Operator.



6. Annex I: Reference documents

6.1. Affected regulations

EASA: CS-27 and CS-29

FAA: 14 CFR Part 29

TCCA: AWM 529

6.2. Affected decisions

N/a

6.3. Reference documents

1. TSB Aviation Investigation Report A09A0016
Main Gearbox Malfunction/Collision With Water
Cougar Helicopters Inc.
Sikorsky S-92A, C-GZCH
St. John's, Newfoundland and Labrador, 35 nm E
12 March 2009
2. Report of the Joint Cooperation Team (JCT) on the Review of Helicopter Main Gearbox Certification Requirements for TCCA/FAA/EASA
TCCA RDIMS 7399502, September 28, 2012
3. FAA AC 29-2C Update 2012-07.06
([http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/47f05fca88b954c686257515006ae03e/\\$FILE/AC_29-2C_Update_2012-07-06.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/47f05fca88b954c686257515006ae03e/$FILE/AC_29-2C_Update_2012-07-06.pdf))
4. EASA Certification Memorandum — Large Helicopter Main Gearbox Certification Requirements
EASA CM — RTS — 001 Issue: 01, 11.11.2013

