JAR VLR NPA 1

Comment Response Document

1. General

Comment

Given that JAR-VLA uses a value of 750kg, is there a need for some consensus regarding the meaning of "Very Light"?

Response

Agreed. The maximum weight limit will be increased to 750 kg to bring JAR VLR into line with JAR VLA. However a separate NPA will be produced. See also comments 102 and part of 110.

2. General

Comment

The numbering system of Appendix B does not have the flexibility for extra requirements to be added at a later date. All requirements should have a '0' added, for example, 'JAR VLR B.1' should become 'JAR VLR B.10' etc.

Response

Agreed and adopted in principle. However Appendix B will follow the same convention as the main body of the document, i.e use odd numbers only.

3. General

Comment

In view of the consequences of an engine failure on an aircraft of this type, e.g. the difficulty of transition to autorotation, it is essential that the engine be of the highest reliability possible for the application. Therefore the standard should be for JAR-E certification. JAR-VLR.903 should be amended accordingly to allow only type certificated engines.

Response

Not accepted. It should be noticed that JAR-VLR 903 b(1) is a more stringent requirement than JAR-VLA 903 b(1) as it requires :

" Each component of the powerplant and its installation must be constructed, arranged and installed to ensure its continued safe operation between normal inspections or overhauls"

The scope of this requirement is to oblige the Applicant to go through a reliability program in order to demonstrate that the product can ensure safe operation between the proposed normal inspections or overhauls. The methodology used to accomplish the above task might be the following or a combination of the following:

- Test (endurance, fatigue).
- Safety Assessment and Enhanced design review.
- In service monitoring.

It is the WG's opinion that the above reliability demonstration is a means to further demonstrate the airworthiness of engines certified to the requirements of the Appendix B of JAR-VLR.

ACJ material has been added for VLR.901(b)(1), VLR B.15 which relates to the determination of engine reliability.

Finally we do not agree that VLR helicopters would show difficulty of transition to autorotation when compared to JAR 27 helicopters. Actually both the data available and the minimum design criteria indicated under ACJ VLR 143 (d) would suggest a much better behavior in autorotation both in terms of lower descent speed and main rotor rotational speed decay after engine failure.

4. General

Comment

There is no technical reason why engines incorporating turbochargers and/or superchargers should not be acceptable, as long as the engine is properly qualified. Indeed, for a diesel engine it is likely to be essential. An additional paragraph should be included along the lines developed for BCAR-VLH.

Response

Agreed in principal, however the WG does not understand what has led the commentator to make his observations or to which parts of BCAR VLH she/he is referring to. Nevertheless, the WG advises the commentator that as there is no specific exclusion for turbo-charging / supercharging, then by default it is included as part of the permissible design and agrees that on diesel engines it is likely to be essential.

5. General

Comment

The requirements related to engine mount etc. appear to have been missed. Therefore the requirements of ’22.1823 Engine mounting attachments and structure’ should be added.

Response

Accepted. Engine structural substantiation will be required under the provisions of JAR-VLR 361 and JAR-VLR 549 .

If the engine is to be approved under Appendix B of JAR VLR then it is not a stand alone component for which a type certificate is issued. It is now regarded as a part of the helicopter just like a main rotor blade.

Title of JAR-VLR 549 changed to: Fuselage, Landing Gear, rotor pylon and engine structures. ACJ material added to cross refer to VLR.361 for the engine structure when the engine is approved under Appendix B of JAR VLR.

6. VLR.1

Comment

The question and response section indicates that the JAR-VLR WG does not address the gyroplane case. It might therefore be better to amend JAR-VLR-1 Applicability to state that the requirements apply only to helicopters. If and when amendments are made to include requirements for gyroplanes, the same amendments can amend the paragraph on applicability. It really isn't sufficient to include a major restriction to the applicability in an ACJ.

Response

Agreed we believe all references and inferences to Gyroplanes have been deleted. Also ACJ VLR 1 now includes a statement that specifically excludes gyroplanes. Paragraph VLR.73(b) deleted.

7. VLR.1(a)3

Comment

For clarification of meaning, should the wording not be "turbine and/or rocket engines"?

Response

Agreed. Text changed.

8. VLR.1(a)4

Comment

This refers to "VFR day operation". It would be more correct to refer to "operation by day in accordance with the Visual Flight Rules." In any case, do the WG members realise that, if the VLR is on the UK register and is flying at or below 3000ft ASL, this can mean the flight visibility can be virtually zero or at least very low indeed e.g. 100m (see Rule of the Air 26 (2)(b)(iii)). Will the stability and control characteristics of these VLRs be suitable to allow flight in such conditions? Should there not be a minimum in-flight visibility requirement, e.g. 1km, so that 4 would then read "is restricted to flight in accordance with the Visual Flight Rules, save the minimum in-flight visibility shall be not less than 1 km".

Response

Not accepted. Apparently the commentator seems to make some confusion between airworthiness and operational requirements. JAR-VLR is an airworthiness code and has nothing to do with operational requirements.

The fact that applicability is limited to VFR day operation only, is simply reflecting that in JAR-VLR there are no requirements for instruments and landing lights and no special stability requirements for IFR fights as those requested in Appendix B of JAR 27. The responsibility of authorizing flight operations under specific visual rule is a task of the relevant Operational Authority that will base its decision on the design features of the helicopter and on the type of instrumentation installed onboard.

9. VLR.65

Comment

There is some confusion regarding the presentation of comment responses. CAA's request to have JAR27.65(b)(2) included was rejected on cost grounds although DGAC comment on the same issue and referring back to the CAA comment, was accepted. The relevant paragraph now seems to have been included as we would wish. Can we have confirmation that this the final standard?

Response

Agreed, this is the final standard.

10. VLR.73

Comment

We accept the point that a hover WAT adequately addresses CAA concerns, but this is not included in 1583.

Response

Not accepted. As this is performance information, the WAT chart is rightly requested under the provisions of JAR-VLR 1587. We don't understand the need to move it under JAR-VLR 1583.

Comment 11: VLR.79

Comment

The WG, in response to our previous comment on 73(2), are offering the limited power available argument as a reason for not conducting H-V at 7000ft. VLR.51(b) seems to allow the generation of a WAT chart for take off. VLR.73(a)(2) requires that the HIGE ceiling must be achievable at max gross weight up to 3000ft, but weight can be cut back above this altitude. VLR.79(a)(2) allows that H-V be conducted at a weight which must not be less than HOGE, which should, in turn, be less than HIGE.

Irrespective, therefore, of which altitude the testing is conducted, the weight should be less than the maximum weight at which take off is permitted. Power available should not be an issue.

Response

Agreed. The original reduction of altitude to 6000 ft in JAR-VLR 79 for H-V determination was taken consistently with the reduction of altitude to 3000 ft for compliance with JAR-VLR 73, this one effectively dictated by engine power limitations.

On the other hand we are still of the opinion that for this class of helicopter it would be very unlikely to take off and landing at altitude above 6000 ft (irrespective of the all-up weight) and we don't see any safety related issue to increase this value to 7000 ft.

On the other hand the argument raised by the UK CAA is fully understood and the 7000 ft has been re-introduced under JAR-VLR 79.

In addition we don't believe that this change may increase the economic burden of the certification considering the small difference in altitude and the large number of airfields available for testing activity at altitudes of 7000 ft and higher.

7000 feet has been re-instated.

12. VLR.143(d).

Comment

CAA are not immediately familiar with the disc rotor coefficient formula in ACJ VLR 143(d) and support DGAC concerns. In particular, It is not apparent how $\tau > 1.3$ sec relates to pilot intervention time.

Response

Noted. We understand the doubts from the commentator; as he correctly pointed out this parameter does not relate in any respect to reaction time. In fact it does, but not in an obvious manner and direct manner.

Actually the original intention of the WG proposal was to raise the applicant's awareness on this parameter before starting the flight tests required by JAR VLR-143(d) as it provides an extremely useful theoretical indication on the helicopter's behavior in case of engine failure.

The AUTOROTATIONAL BELL CRITERIA is a simplified form of the equation governing the main rotor rotational decay occurring in case of a sudden engine failure. This criteria provides an easy way to appreciate the helicopter entry in autorotation. The higher is this parameter (expressed in seconds) the higher will be the time available after an engine failure for the pilot to lower the collective lever and enter autorotational flight.

Considering that a t/k value of 1 is the minimum the US Army will accept for any helicopter proposed for its fleet, a t/k value of 1.3 is seen as the minimum acceptable in order to guarantee a satisfactory and safe pilot intervention strategy. Experience has shown that any helicopter with a value of 1.3 or greater will inherently have characteristics that allow the minimum acceptable pilot intervention times to safely recover and control the helicopter after a sudden engine stoppage.

See also Attachments 1 and 2 at the end of this comment response document.

13. VLR.303

Comment

This paragraph adopts the wording found in both JAR/FAR 27 and 29. The second sentence reads;

"This factor applies to external and inertia loads unless its application to the resulting internal stresses is more conservative"

Although present in both existing rotorcraft codes, this sentence does not appear in the fixed wing codes. It is possible that this requirement is intended to address a case where internal load is not proportional to an applied external load such as a pre-loaded joint or assembly. However, the circumstances where this is appropriate, practical or beneficial are not clear.

The sentence has already caused confusion on several projects and should either be amended and/or supported by interpretative material with clear examples. It is understood that this comment applies to part 27/29 as much as VLR and action must be taken to effect a change to all three codes as necessary.

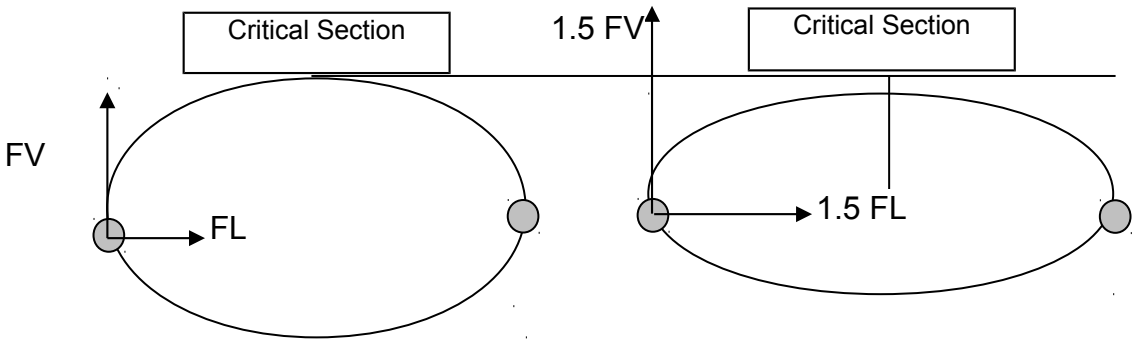
Response

Not accepted. Comment understood, however once again we should not forget that we are dealing with helicopters structural components that in some cases may be quite different from those installed on a fixed wing aircraft. (eg. main rotor blades).

The intent of the rule here is requiring an application of a 1.5 safety factor to the resulting "limit internal" stress if it is more conservative than applying the same factor to the external

load only. This could be the case of the bending stresses acting on the cross tube component of a skid landing gear.

Referring to the sketch below, it can be seen that the resulting root bending stress may be actually lower when a factor of 1.5 is applied to the external limit lateral ground reaction following the reduction of the reaction arm due to flexibility.



14. VLR.305

Comment

This paragraph contains a 'typographical' error that is common to both JAR/FAR 27 and 29. The sentence reads:

"The structure must be able to support limit loads without detrimental or permanent deformation"

The word "or" should be removed and this will then be consistent with the fixed wing codes. The reason for this is that limit loads are a rare (approximately once per aircraft lifetime) event and good design may allow insignificant permanent deformation to take place at this load level. A further problem with the sentence as written is that demonstration of compliance will be impossible since the permanent deformation involved is likely to be too small to detect. The paragraph continues;

" At any load up to limit loads, the deformation may not interfere with safe operation"

Which is consistent with allowing non-detrimental permanent deformation to occur.

Proposal: Revise the text of JAR VLR.305(a) per JAR/FAR 25 as follows:

"The structure must be able to support limit loads without detrimental permanent deformation. At any load up to limit loads, the deformation may not interfere with safe operation"

For further clarification, the following alternative text is suggested.

"The structure must be able to support limit loads up to and including limit load. Elastic and permanent deformation that occurs during application of these loads must not interfere with the safe operation of the rotorcraft. Any permanent deformation that remains after removal of these loads must not significantly reduce the airworthiness of the rotorcraft."

Response

Agreed, comment fully understood : the word "or" to be removed from JAR-VLR.305 text.

15. VLR.351

Comment

Sub para (b)(2), Typo, the word "or" is missing, the sentence should read: "Attain a resulting sideslip angle or 90°, whichever is less; and"

Response

Agreed, text changed.

16. VLR.361

Comment

Needs to recognise rotary engines as well. What factor would be applied?

Response

Noted. The WG member expertise is not such as to propose any suitable factor for this type of engine. If any proposal is made a supporting rationale should be provided. As far as we know there are no JAR codes (including JAR-VLA) where specific factors are required for rotary engines. However, the matter will be referred to the ESG for advice.

17. VLR.397

Comment

Whilst I don't disagree with the meaning of this paragraph, the wording is sloppy, with some of the parentheses making it appear at first reading that SI and Imperial units are being multiplied by each other (which admittedly is sometimes valid, but not the intention here). The author also seems unaware that "pounds force" are conventionally abbreviated to "lbf", which is inconsistent with his routine abbreviation of Newtons. Also, no other JAA standard routinely refers to N, daN being the common unit with which this should be consistent.

Finally, may I suggest that this entire paragraph is summarised in a table, as is the case for JAR-VLA.397.

Response

Not accepted. We don't know on which elements the sentence that "no other JAA standard routinely refers to N, daN being the common unit" was based on. Both JAR 27 and JAR 29 express force in Newton. The text of JAR-VLR.397 is the same as JAR 27 and JAR 29 and it incorporates the latest changes of NPA 27-11 as already suggested in an earlier comment provided by UK CAA

18. VLA.411

Comment

I note from other comments that it is accepted that Fenestron or Notar configurations may be accepted under this code. This paragraph could be better worded to reflect this, since the underlying assumption of the wording seems to be that only a tailrotor would be fitted.

Response

Agreed, Paragraph 411 and ACJ VLR 1 amended. A Notar style device can not be included in the basic configuration for a VLR helicopter. Since typically it needs an automated control system to make it work effectively, which is outside of the scope of the definition of a simple helicopter.

19. VLR.473

Comment

Amend text: "~~A~~ Rotor lift …"

Response

Agreed, text changed.

20. VLR.475

Comment

If wheeled undercarriages are not covered by the basic VLR Code what are the "Tires" referred to in VLR.475?

Response

Agreed, text changed. See also comments 68 and 110.

21. VLR.501

Comment

Could these paragraphs be condensed to tables of conditions to be met?

Response

Not accepted. We understand the comment, the paragraphs in question have been taken directly form JAR 27 and they have never caused any misinterpretation or confusion during past certification exercises. However, if the commentator still believes that the loading conditions of these paragraphs should be expressed in a tabular format then he is invited to submit a proposal that will be evaluated by the WG and if accepted it will be incorporated in to JAR-VLR.

22. VLR.505 & VLR.521

Comment

Both these paragraphs refer to VLR.473(b) to identify the limit landing load factor. VLR.473(b) does not define this factor, it refers to the drop test of VLR.725.

Proposal: Since the reference to VLR.473(b) does not add anything of use it would be better to refer directly to VLR.725.

Response

Not accepted. Reference to JAR-VLR 473 should be maintained. In JAR-VLR 473 (b) establishes the limit load factor that should be used for compliance with JAR-VLR 505 and 521, this limit loads factor should not be less than the one substantiated from the drop test of JAR-VLR 725. In principle a manufacturer may determine this load factor without executing the drop test of JAR-VLR 725 if sufficient experience, accumulated from drop tests on similar landing gears, indicates that this load factor is unlikely to be exceeded .

23. VLR.547(a)

Comment

Is the definition of "rotor assembly" intended to include blade dampers, pitch control mechanisms and other rotating parts? If not, should there be a definition somewhere? This is a difference between JAR-27 and JAR-29 but needs clarification.

Response

Agreed. Same text as JAR 27, however we agree that explanatory material should be added to provide a definition of "rotor assembly". ACJ material has been added.

24. VLR.547(e)(2)

Comment

What is "a rational manner"? JAR-29 says "equally and rationally" which we believe are better words.

Response

Not accepted. We would rather stick with the JAR 27 text as the wording " equally and rationally" may be misunderstood.

The intent of the rule is that the main rotor torque should be distributed in a rational way among the main rotor blades depending on the loading conditions under consideration. As an example for a 4 bladed rotor, the main rotor torque, associated to the engine start condition, is usually calculated by considering the rotational inertia of only 2 blades instead of 4. This is based on the "rational" assumption that at the very initial moment when rotor starts rotating there are only 2 blades in contact with the main rotor hub (usually through the lead-lag stops) and so capable to provide a contribution to the actual main rotor inertia.

25. VLR.561

Comment

The rationale presented in the response to comments section of the paper regarding the reduced (by comparison with JAR 27 and 29) inertia factors is inappropriate for the following reasons:

Making the new rule compatible with the existing FAR based fleet is an unacceptable reduction in the target safety levels of the JAR rules. Improvement in airworthiness codes is a progressive process and there is no rational reason why a new design should not meet the newer factors of JAR 27 and 29.

It is well known that smaller structures have lower impulse attenuation than large structures. This is why JAR23.562 requires more severe deceleration pulses than JAR25.562. There is a case for demanding higher crash inertia factors in JAR VLR than those found in JAR 27/29.

It is erroneous to suggest that compliance with these higher factors will be more difficult for a smaller aircraft. Smaller structures can carry much higher loads with respect to their dimensions and weights than larger structures. Examples of this are the many light aircraft secondary structures that are designed for manufacturing/handling requirements rather than strength, also, this is why small insects can carry many times their own weight and fall from proportionately greater heights without injury than larger creatures.

The impact on small rotorcraft designs of higher inertia load factors was addressed in the Explanation and Justification of NPA 27-2 (circulated in 1994) that was adopted by OP Amendment 27/98/1 effective 16/2/98 which *states. "The proposals will enhance occupant safety by providing increased protection, but will not necessitate any significant changes to*

current design practices. It is also considered that the impact of the changes on the weight of a new design of rotorcraft would be minimal." These comments remain applicable to VLR discussions, as there is no minimum weight for JAR 27 rotorcraft.

The contention in the response document that the progressive weight increase of JAR 27 rotorcraft was the 'main drive' for the inertia factor changes in JAR 27 is incorrect. The introduction of NPA material proposing increased weights for JAR 27 post dates NPA 27-2 considerably.

For the above reasons, the inertia factors used in JAR VLR should be at least as high as those found in JAR 27 and 29 and there is a strong case for making them higher.

Proposal: Adopt the inertia load factors of JAR 27.561(b)(3) and (c) into JAR VLR.561

Response

Agreed. The WG has reviewed the arguments that originally led it to introduce lower inertia factors. The WG finds that the arguments that originally prevailed are no longer valid. Also as it is now agreed in principle to increase the maximum take off weight of the VLR helicopter from 600 kg to 750 kg then there is no reason not to introduce the JAR 27.561 inertia factors. Accordingly the text has been amended to include the JAR 27.561 inertia factors.

26. VLR.561(b)(3)(iv)

Comment

This sub para reads;

"Downward, 9g, after the intended displacement of the seat device."

Firstly, this is the only mention of a seat energy absorber in this code since VLR.562 does not exist and perhaps this reference should be removed or amended. Second, this sub-para does not only apply to seats.

Proposal:

In the absence of VLR.562 it would be better to revise the sentence to;

"Downward - 20g. When applied to seat supporting structure it must be assumed that any seat energy absorption device is in a configuration appropriate to the end of its stroke." (Note: inertia from JAR 27/29)

Response

Partially agreed. We have deleted the text "after the intended displacement of the seat device".

27. VLR.561(b)(3)(v)

Comment

This sub para is missing from VLR and should be re-instated for the reasons given above. (see JAR 27.561(b)(3)(v)/29.561(b)(3)(v))

Response

Not accepted. See response for comment 25.

28. VLR.571

Comment

It is suggested that additional advisory material to that currently provided for FAR/JAR 27 would be beneficial for this category of rotorcraft, considering the probable lack of experience and resources of constructors in this category.

In addition, no response has been made to the proposal that the option of fail-safe design (as provided for in JAR27) should be considered for inclusion in VLR.571.

Response

Not accepted. The fail-safe option as provided by FAR 27 would imply damage tolerance consideration (fracture mechanic analysis for determination of crack growth) that in all probability are beyond the current capabilities of VLR manufacturers both in terms of cost (testing device) and technical expertise. However there is nothing to stop an applicant with an active certification project making a proposal to the Authority to follow this route. Appropriate CRIs and special conditions would be raised and progressed in the normal manner.

29. VLR.601(a).

Comment

Rotor drive system should be included in the definition of flight structure as it is in JAR-27.

Response

Agreed. But the comment as presented does not make any sense because it is written against VLR.601(a). However we determine that it actually refers to VLR.571(a) and on that basis we have changed the text of that paragraph.

30. VLR.601(a)

Comment

The use in this paragraph of the wording "it may have no" is at variance with the remainder of the draft JAR where the equivalent wording is "must not have any". "May" is less strong than "must" and I wonder what the reason is for this change in emphasis.

Response

Not accepted. The text is the same as that in JAR 27.

31. VLR.602

Comment

It should be noted that these are the old words which were in JAR-27 prior to NPA 27-12. NPA 27-12 changes the wording to the rule and the ACJ material and should be adopted in this case. CAUTION: JAR 27/29.602 is currently the subject of an FAA/JAA HWG review and a proposal to change the wording to the ACJ (and possibly the rule) is expected in the next few months.

Why is the reference made to ACJ 27.602? There should be a specific ACJ written for this code.

Response

Not accepted. The text is the same as that in JAR 27 prior to NPA 27-12. The outcome of NPA 27-12 is by no means certain. It would be a foolhardy act on our part to adopt something that was still the subject of international debate before that debate had been concluded. However, we have introduced an ACJ VLR.602 that incorporates the text of ACJ 27X602 as found in JAR 27 change 1.

32. VLR.610

Comments

The WG response is noted. I would counter, however, that there have been many day VFR strikes recorded. These are going to be relatively simple aircraft, and perhaps a fairly simple lightning strike requirement could be considered.

Response

Not accepted. As far as we know there are no statistics available for determining the severity and the occurrence of lightning strikes on very small helicopter operated under VFR day operation. In fact our information suggests the incidence of such strikes is non-existent. Therefore we still believe that there is no need for the introduction of this requirement for this type of helicopters.

In fact there are a very large number of pre amendment 27-21 (November 1984) Part 27 certified helicopters, [Robinson R22, Bo 105, SA341, AS 350/355, Bell 206 etc and at least 1,000 of which are on the UK register] that obviously do not have any lightning protection measures applied. And they have not exhibited any adverse service experience due to lightning. The in service lighting data that does exist applies almost exclusively to large helicopters (Part 29 certified) being operated in marginal or adverse weather conditions. This data also indicates that the larger the helicopter the more prone it is to suffering a lightning strike.

33. VLR.619(c)

Comment

The Working Group position that the JAR VLA values may be too general is correct. It is therefore surprising that the text of ACJ VLR.613(c) proposes to allow the use of a 1.25 factor in lieu of testing at temperature. Experience shows that the material strength of low temperature cure resin systems can reduce dramatically at high temperatures and certainly more than allowed by the use of a 1.25 factor. It is suggested that the option of producing design allowables for high temperature conditions through use of a 1.25 factor in lieu of testing should not be permitted. (see comment to ACJ VLR.613 below)

The HASG chairman appears to have recommended that composite materials be refused for blades, tailbooms and hub components. This seems unreasonable, since these should be judged on their merits, in fact, the use of composites for rotor blades has been one of these materials most successful application due to the particular loading characteristics of these components.

Response

Not accepted. Considering the reference surface temperature is 54°C, we believe that the degradation factor of 1.25 for temperature effects only is a conservative assumption and in line with the factors applied in the helicopter industry.

54°C is a surface temperature value which provide a good margin with respect to the glass transition temperature values of the epoxy resins more commonly used for composite structure (70-80°C). It is understood that for higher surface temperature, higher degradation factors can be expected and have to be substantiated by test considered the closer proximity to the glass transition temperature values.

As for utilization of composite material we believe that some misunderstanding has occurred as far as we understand the HASG chairman was concerned that composite material on primary structures are not adequately addressed by the requirements of JAR-VLR. We fully agree with above, as a matter of fact due to the high vibratory loads of the loading spectrum of helicopters we expect that compliance be demonstrated against more stringent criteria than those established under JAR-VLA.

The WG had no time to develop specific fatigue and static requirements for composite structure, however it is understood that the means of compliance as outlined in AC 20-107A are fully acceptable and can be introduced through a Special Condition as it has been done in the past for several JAA projects (EH101, EC135).

34. VLR.629

Comment

The earlier CAA comment stated that this should also mention control divergence and reversal. The response to this was that this paragraph has "The same contents as JAR27.629" This response seems inadequate as there can be no valid reason to replicate the deficiencies of another code in a new requirement.

Response

Not accepted. We don't see any deficiency in a consolidated text in JAR 27 or JAR 29 that has never been questioned before. As far as we know no control reversal of divergence of main/tail rotor blade has ever been experienced. Conversely dynamic stability is a much more critical issue as the external forces are acting in resonance with the first modes of vibration of the main rotor blade for this scope is mandated the utilization of mass balance as required by JAR-VLR 659. The main reason for which control reversal is not an issue on the helicopter is that, apart from some KAMAN helicopters, no control surfaces are used to change the blade pitch and the system made by blade, pitch control horn, and pitch control rod is generally very stiff.

The stage an NPA such as this one has currently reached is not the place to be unilaterally introducing significant new regulatory material. If the commentator feels that JARS VLR, 27 and 29 are deficient in the area he suggests then he is recommended to make proposals for improvement to JAA HQ in the normal manner.

35. VLR.663, VLR.725(a)(2) and VLR.727(b)

Comment

The response to comments regarding paragraphs VLR.663, VLR.725(a)(2) and VLR.727(b), include the expression "Not accepted at this time.", when will these comments be accepted?

Response

Noted. VLR.663 text is the same as that in JAR 27.663. It is not the WG's intention to unilaterally change common text. If the commentator believes this item of common text needs clarifying then he is recommended to make a proposal to JAA HQ in the normal manner.

The concern reference VLR.725 is fully understood, however we believe the requirement as written allows for alternative means of compliance if the first means is found to be too onerous.

VLR.727(b) text is the same as that in JAR 27.727(b). It is not the WG's intention to unilaterally change common text. If the commentator believes this item of common text needs clarifying then he is recommended to make a proposal to JAA HQ in the normal

36. VLR.685

Comment

Advice included at BCAR App T689b should be included in this paragraph [probably at d(4)]. The lack of this advice in other FAR/JAR standards has caused in-flight cable failures to our certain knowledge, and the opportunity should be taken to prevent further continuation of poor design practice.

Why is a 2.38mm (3/32") cable acceptable in JAR-VLH, whilst JAR-VLA requires a 3mm (1/8") cable? If there is a good reason for this inconsistency, it should have been justified to us.

Response

Agreed. Whilst we adopted the same text as JAR 27.685 we accept that the advice to which the commentator refers has been taken from recent airworthiness codes written for a variety of very small flying machines, hence it has been added to VLR as ACJ material.

37. VLR.785

Comment

We do not agree with the deletion of "at least" as included in JAR-VLA. Perhaps a better wording would be to delete "weighing 86kg", and substitute "at the maximum permitted seat load, which must not be less than 86kg". The current wording is too inflexible - technically an aircraft with seats designed for 100kg would be non-compliant.

Response

Agreed. The phrase "at least" reinstated in order to maintain consistency with JAR VLA.

38. VLR.901(b)(4)

Comment

Can 'extremely improbable' be defined. Is this intended to be <1e-9, or (since capital letters are not used) is it indeterminate? If so, how can it be 'shown'?

Response

Not Accepted. This is the same text as JAR 27 and has the same meaning and implications.

39. VLR.901

Comment

Inconsistent numbering system: Replace (c)(i) and (c)(ii) with (c)(1) and (c)(2)

Response

Agreed, text changed.

40: VLR.907

Comment

Change '… may not subject …' to '… must not subject …'

Response

Agreed, text changed.

41. VLR.923

Comment

Is the intent that this requirement should be carried out during the ground test phase, and not combined with flight testing. If so, this should be explicitly stated.

Response

Noted. These are the standard JAR 27 tests that are always performed as ground tests, AC 27-1B refers.

42. VLR.999(b)(3)(ii)

Comment

If wheeled undercarriages are not permitted there will presumably, be no "landing gear" to be retracted, and would not a Very Light Rotorcraft be more likely to have a fixed undercarriage anyway?

Response

Agreed, .999(b)(3)(ii) deleted and ACJ VLR 1 amended to specify non-retracting undercarriages.

43. VLR.1305

Comment

This paragraph would be improved by the inclusion of a requirement for the provision of a Starter Engaged Warning Indication.

Response

Not accepted. The requirement is consistent with JARs VLA and 27.

44. VLR.1323

Comment

The wording in JAR-VLA seems to have been taken and subtly altered to make the meaning less clear. Part (a) is largely meaningless and serves only to make less clear parts (b) and (c),

Part (b) should give a maximum figure, either VNE or VH, presumably the former for consistency with JAR-VLA. The term "and over" is unacceptably vague.

The calibration in flight of pitot-static systems is a process over which there is considerable disagreement between practitioners concerning best practice.

Response

Not accepted. Comment not understood, the text is the same as that used in JAR 27.

45. VLR.1325(a)

Comment

We do not accept the reasoning for deleting airflow variations in the static system requirement. Airflow variations will be addressed by a suitably located static pressure port, not by installing a more expensive instrument in the panel. The R22 has an entirely conventional Barometric Altimeter in the panel, and a plastic pipe hanging loose in the transmission bay as a pressure port, and it complies with JAR/FAR27.

Response

Agreed. Text re-instated.

46. VLR.1327

Comment

This is inconsistent with JAR-VLA, which requires a maximum of 15° total deviation with the operation of electrical equipment. The paragraph is also not entirely consistent with VLR.1547 and should be reviewed.

Response

Agreed. JAR VLA.1327 text used to replace JAR 27.1327 text and paragraph JAR VLR 1547(e) deleted.

47. VLR.1583

Comment

Whilst it is accepted that VLR.51 and 73 are introducing the concept of a take off WAT, there is no requirement in 1583 for this to be presented as a limitation.

Response

Not accepted. We fail to understand the comment, in the area concerned JAR-VLR 1583 is identical to JAR 27.1583. JAR 27 is a well-established airworthiness code. The WAT data is presented under the performance section of the Flight Manual as requested by JAR-VLR 1587 which also is identical to JAR 27.1587.

48. Powertrain – General

Comment

The instructions in Appendix B, and those in para 923 are not strictly compatible - it seems rather odd to require an applicant with one helicopter and one engine, to carry out a 50

hour test upon the engine and a 100 hour test upon the rotor system, particularly given that the loading profiles differ. Surely with a little work, these requirements can be combined, without degrading the assurance of airworthiness, but significantly reducing the (expensive!) effort required of the applicant.

Response

Noted. We understand the comment and accept the reasons for it. The existing test requirements have been taken from well the established JAR 27 and FAR 33. Certification of products to either code are entirely independent of each other and leads to awards of type certificates in their own right for helicopter and engine. JAR VLR allows for an engine to be certificated as part of the helicopter and be included as an integral part of the helicopters type certificate.

Therefore there is no reason why the engine and transmission test requirements should not be harmonised. However to do so would require some fundamental changes to the existing tried and proven test regimes. So we will review this matter with the Engine Study Group outside of the remit of this NPA. With the intention of determining if it is possible to produce harmonised engine and transmission test requirements. And if it is possible then introduce them at a later date.

49. VLR.B1

Comment

Notwithstanding Comment 3, if engine approval is to be granted in accordance with sub-part B a similar process to that allowed in JAR-22 for the issue of a 'JAR-22 Subpart H' type certificate (see JAR 22.1801) should be considered. Thus allowing engines approved to the subpart to be eligible for fitment to any JAR-22 or JAR-VLA aircraft, subject to compliance with any installation requirements. This policy should be reflected here to allow the issue of 'JAR VLR Appendix B' type certificates. The text should therefore be changed to read:-

'This Appendix B prescribes the requirements for the issue of type certificates or equivalent and changes to those certificates for spark and compression ignition engines for JAR-VLR type certificated rotorcraft'.

Response

Not Accepted. There is no intention to issue a Type Certificate for an engine meeting the requirements of Appendix B of JAR-VLR. Our experience suggests:

(i) Existing "off the shelf" engines intended for aeroplanes may not always function to the same level of reliability in helicopters as they do in aeroplanes.

(ii) And as a consequence that for this class of helicopters, the engine design is highly dependent on the type of helicopter on which it will be installed.

In that respect we believe that the engine has to be regarded as a part of the helicopter (similarly to any other part such as landing gear or transmission). Having said that it is understood that the results of tests carried out for compliance with the Appendix B of JAR-VLR may be extended to two or more helicopters. But only if the applicant can demonstrate that the engine design is marginally affected by the type of installation as it is in general true for the JAR E engines.

50. VLR.B3

Comment

Remove (a). This is simply a statement, not a requirement. Amend text as follows:-

'Engine ratings and operating limitations required under JAR VLR B.2 are based on..'

Response

Agreed, text changed.

51. VLR.B4

Comment

Please clarify the reason for (a). What is the objective of this requirement? If it is decided that it is not required, then it is suggested that (b) is moved to JAR VLR B.3.

Response

Not accepted. The JAR-VLR B.4 (now B.7) text is the same as FAR 33.8 and it emphasises that it is the responsibility of the Applicant to select the ratings intended for which compliance with the requirements of Appendix B is intended. However we have note an error in sub paragraph (a). It refers to thrust which clearly is not applicable to this class of engine. The words "and thrust" have been deleted.

52. VLR.B5

Comment

Clarification required amend text as follows:-

'… or with a single ignition system of at least equal reliability to a dual system.'

Response

Agreed, text changed.

53. VLR.B8

Comment

What is the expected means of compliance with this requirement? Is it a safety analysis?

Response

Noted. Yes a safety assessment is the anticipated means of compliance.

54. VLR.B11

Comment

Amend text of (a) as follows:-

'(a) The engine must be designed and constructed to function from idling to 103% crankshaft rotational speed at maximum take off conditions without vibration levels which may affect the integrity of parts and assemblies.'

Response

Agreed, text changed.

55. VLR.B11

Comment

Paragraph (b) refers to JAR VLR 90. This requirement does not exist. Should reference be to JAR VLR.907?

Paragraph (b) should refer to take off conditions rather than maximum continuous.

Response

Agreed, text changed.

56. VLR.B11

Comment

Since paragraph (b) refers to the effect of the engine in the helicopter, it should be rewritten taking into account the comments above and moved to become JAR VLR.907 (d), as follows:-

'(d) The engine must undergo a vibration survey when installed in the airframe. The survey must be conducted throughout the expected operating range of rotational speed

and power of the engine up to 103% of the maximum take off speed without vibration levels. No hazardous condition may be present. Each accessory drive and mounting attachment must be loaded with the critical loads expected in service.'

Please explain how compliance with the accessory drive requirement is to be met. How is critical defined?

Response

Agreed. JAR VLR-907 is assessing the effects of engine vibration on the helicopter while JAR VLR B.21 is requiring the evaluations of helicopter vibration on the engine. This assessment is performed during the load survey requested by JAR-VLR 571 when the critical flight conditions normally expected in service are evaluated in terms of vibratory loads. These vibratory loads are in turn used to calculate the fatigue life of the engine. ACJ material for VLR B.21 has been added in order to help clarify the intent of the requirement.

57. VLR.B12

Comment

For (d), please provide examples of the fluids that may be injected and the purpose of these fluids. If fluids other than fuel are to inject into the intake, test requirements must be inserted to determine the effect on engine performance, including as a result of failure of the fluid's control system.

Response

Agreed, paragraph B.23(d) will be removed from JAR-VLR as it reflects FAR 33.67(c) which is applicable to turbine engines. The intent was to state the engine control requirements not only for antidetonant injection (ADI) systems, but for other fluid injection systems (other than fuel) as well such as water or alcohol .

58. VLR.B19

Comment

Change the opening sentence to read:-

'After completing the endurance test, and engine component tests as required,'

Response

Agreed, text changed.

59. VLR B.20(b)

Comment

Could "excessive frequency" be quantified? This is too open to interpretation and argument.

Response

Noted, The requirement has been taken from FAR 33.57 (b). Reference to AC 33 -2B for this requirement states that the requirement is "self evident" which we agree is not particularly helpful. However, it appears that interpretation will have to be made on a case by case basis.

60. ACJ.VLR.1

Comment

The term "VFR night operations" should not be used, since this is an operational consideration. It should read "VMC night operations" for consistency with normal JAR practice.

In addition, discussion detailed in the document attached to the draft has indicated that fenestron or Notar considerations may be accepted. So perhaps the term "A single tail rotor" should read "A single torque reaction system (e.g. a tail rotor)".

Response

Agreed, text changed.

61. ACJ VLR.613(c)

Comments

See comment to VLR.619(c) above

Proposal: Delete the second sentence of ACJ VLR 613(c) a.

Response

Not accepted. See response to comment 33

62. ACJ VLR.901

Comment

Please clarify a 'simple fuel system'. Does this include fuel injection (as would be required for any diesel, for example)? If so, are both mechanical and electronic systems acceptable? If electronic systems are acceptable, under what requirements should they be qualified?

Response

Agreed. VLR.901 refers to the airframe fuel system, not that of the engine. Simple is expected to be the norm found on light aircraft. i.e. one or two fuel tanks, filter, water drain valves, feed / boost pump, selector and shut off valves, and associated pipelines. ACJ VLR 1 has been expanded a little to take account of this comment.

The final sentence about qualification of electronic systems has prompted the working group to add ACJ material for VLR B9 Ignition Systems and B23(a) Fuel and Induction Systems. The ACJ refers to an exception that the detrimental effects of electromagnetic radiation will be minimised for electronic fuel injection, ignition and related engine management systems. Cross reference is also made to VLR.1309(b).

63. General

Comment

Referring to your letter of 1 August 2001, we are peased to inform you that the above mentioned NPA VLR-1 doe not give rise to any comments from the Civil Aviation Administration – Denmark.

Response

Noted.

64. Appendix A

Comment

Appendix A of this rule should mention as one of the documents for continued airworthiness the manufacturer's parts catalogue or IPC.

The parts catalogue has become an essential part of a/c maintenance. This is especially true at the lighter end of the spectrum, where maintenance is not always carried out in a structured environment.

The parts manual helps the maintenance personnel to order and to install the correct part on the helicopter, thus increasing safety.

On the contrary, we have seen incidents or accidents due to the installation of incorrect parts on aircraft with little or no IPC.

Response

Noted. We understand the comment but we conclude that it has been generated from an activity that is becoming custom and practice amongst maintenance engineers. Who are having to use an IPC to make up for short comings in the maintenance instructions. We believe that maintenance manuals provided under the requirements for continued airworthiness should contain all necessary information to allow a proficient mechanic to undertake any maintenance task competently and restore the aircraft to the standard dictated by the manufacturer.

65. General

Comment

With regard too NPA VLR-1 the Netherlands CAA wishes to inform you that we have no comments.

Response

Noted.

66. VLR.339

Comment

There is a mistake in the formula contained in JAR VLR.339 - „+" is printed instead of „Ω" [omega]. The mistake is repeated in the legend below the formula.

Response

Agreed, text changed.

67. VLR.397

Comment

There are two incomplete expressions in JAR VLR.397 (b)(1). The correct ones should read as follows: [**1**+R]/2.5 x 75N and [**1**+R]/3 x 50 pounds.

Response

Agreed, text changed.

68. VLR.475

Comment

Tires should not be the subject of JAR VLR.475. The proposed reading of the text is:

"JAR VLR.475 Shock absorbers

Unless otherwise prescribed, for each specified landing condition, the shock absorbers must be assumed to be in their most critical position."

ACJ JAR-VLR1 Applicability excludes wheeled landing gear.

Response

Agreed, text changed. See also comments 20 and 110.

69. ACJ VLR.785(e)

Comment

In three places [in Figure 1(a), Figure 2(a), and Note 2 below Figure 2(b)] the word “aeroplane" is used instead of “aircraft" or “rotorcraft".

Response

Agreed, text changed.

70. VLR.853

Comment

The paragraph starts with a statement: "For each compartment to be used by the crew or passengers –“ which suggests that there can be more than one personnel compartment or more than one passenger in a rotorcraft. Since the applicable limitation is "not more than two occupants" it is proposed to change this statement to read as follows: "For each personnel compartment-"

Response

Agreed, text changed.

71. VLR.859(a)

Comment

The subparagraph (a) ends with a statement: "... from entering any cabin or pilot compartment." which suggests that there can be more than one personnel compartment in a rotorcraft. It is proposed to change this statement to read as follows: "...the personnel compartment."

Response

Agreed, text changed.

72. VLR.901(c)(i), VLR.1141(a), ACJ VLR.903(a) and ACJ VLR.907 - 2

Comment

Small printing / orthographic mistakes:

JAR VLR.901 (c) (i) - remove hyphen from the word "instruc-tions"

JAR VLR.1141 (a) - correct the word "locate" to "located"

ACJ VLR 903(a) - correct the ACJ title to read "Engine Type Certification"

ACJ VLR 907 - 2. - correct the word "mean" to read "means"

Response

Agreed, text changed.

73. VLR.1191(a)

Comment

The subparagraph requires the engine to be isolated from "personnel compartments" which suggests that there can be more than one personnel compartment in a rotorcraft. It is proposed to use the singular expression i.e. "personnel compartment".

Response

Agreed, text changed.

74. General

Comment

ENAC Italy agrees with the NPA.

Response

Noted.

75. VLR.785

Comment

I note that with respect to the requirement that any energy absorbing designs or devices there is no mention that the devices should remain in tact and not interfere with rapid evacuation of the rotorcraft as is the case FAR 27.785(j). I think that if such designs or devices are used on even a very light rotorcraft they should not be permitted to become a impediment to evacuation.

Response

Agreed in principle. This paragraph is related to the dynamic seat loading requirements of paragraph 562. Paragraph 562 has not been incorporated into JAR VLR. JAR VLR 785(a) requires the seats to remain intact under the loads prescribed in paragraph 561. None the less the commentators concern is acknowledged and 785(i) has been amended to include a requirement for energy absorption devices (e.g. airbags) to not interfere with post accident emergency egress.

76. VLR.853

Comment

I note that several requirements in JAR VLA.853 are not included in JAR VLR.853. These are JAR VLA.853(d) which prohibit lines, tanks or equipment containing fuel, oil or other flammable fluids to be installed in the personnel compartment unless adequately shielded, isolated or otherwise protected so that nay breakage or failure of such an item would not create a hazard and JAR VLA.853(e) which addresses flammability of materials on the cabin side of the firewall. I think that these requirements are as valid for very light rotorcraft as they are for very light aeroplanes.

Response

Agreed. JAR VLR 853 has been amended incorporate the text from JAR VLA 853. Similarly JAR VLA Appendix F has been incorporated into JAR VLR as Appendix C.

77. VLR 1541

Comment

I note that a requirement in JAR VLA.1541 (c) has been omitted in JAR VLR.1541. The JAR VLA requirement concerns the consistency of units of measurement on placards with those used on the indicators. Again, I think that these requirements are as valid for very light rotorcraft as they are for very light aeroplanes.

Response

Agreed, JAR VLR 1541 has been amended by incorporating the text from JAR VLA.1541 (c).

78. VLR 1581

Comment

I note that two requirements in JAR VLA 1581 have been omitted in JAR VLR.1581. The JAR VLA requirements (1581 (c) & (d)) concern the treatment of non-approved information in the RFM and as with 1541 above consistency of the units of measurement in the RFM with those on the indicators. Once again, I think that these requirements are as valid for very light rotorcraft as they are for very light aeroplanes.

Response

Agreed, JAR VLR 1581 has been amended by incorporating the text from JAR VLA.1581 (c) and (d).

79. ACJ VLR 1583(d)

Comment

Very light rotorcraft are normally restricted to VFR day operation. VFR night operation will be addressed with a special condition and/or in accordance to applicable JAR-27 requirements or equivalent."

Reason(s) for proposed text/comment:

In NPA-VLR-1, the VFR day restriction was formerly included in the rule (see comment on JAR-VLR-1), and the special condition on VFR night operations was included in the corresponding ACJ. It was not considered as acceptable to restrict the applicability of VLR in the rule, and to give exemptions in the ACJ. Furthermore, JAR-VLR.1583 (d) could be interpreted as being less restrictive than the previous JAR-VLR.1.

It is therefore suggested to create a new ACJ which contains on the one hand the common kind of operation applicable to VLR (i.e. VFR day), and on the other hand the special condition applicable to night VFR.

Response

Not Accepted. There is no need of any extra ACJ material. Via JAR VLR 1 we chose to limit the rotorcraft to VFR day only in order to provide for a simplified design that optimised safety. The ACJ does not provide any exemption it merely guides the applicant as to what extra activity would be required of him if he wanted to certify the rotorcraft for night flying.

80. VLR 571

Comment

At the first sentence, we propose to replace:

- (……includes rotors, controls, fuselage, and their related……)

by

- (……includes rotors, rotor drive systems between the rotor hubs, controls, fuselage, and their related……)

Reason(s) for proposed text/comment:

In some flight cases, there is no difference in term of event criticality between a complete tail boom loss and a rupture of the tail rotor transmission which lead to the loss of the helicopter control for these two events. As the fuselage is already mentioned as a part of the flight structure, we propose to add the "rotor drive systems" as a part of the flight structure.

In JAR27.571 (a), the following text is used: "rotor drive systems between the engines and the rotor hubs" which is more compelling.

Response

Agreed, text changed.

81. VLR 1 and ACJ VLR 1

Comment

It is suggested to rephrase as follows

"JAR-VLR-1 Applicability

This code prescribes airworthiness standards for the issue of a type certificate or changes to those certificates for very light rotorcraft with a maximum certificated take-off weight of 600 kg or less which

(a) Are of a very simple design, which.

(1) Incorporates:
- (i) a single engine,
- (ii) a single main rotor,
- (iii) a single tail rotor,
- (iv) a fixed landing gear.

(2) Does not include
- (i) Boosted flight controls,
- (ii) Combustion heaters

(b) Are not powered by turbine and rocket engines.
(c) Are designed to carry not more than two occupants
(see ACJ VLR.1)"

'ACJ VLR 1 Applicability
(Interpretative Material)

A very light rotorcraft design is assumed to be very simple if it incorporates:
- a skid, ski or fixed float landing gear
- a single engine spark or compression ignition engine (turbine and rocket engines are excluded) –
- a simple fuel system

Specific configurations such as hydraulic systems, pop-out emergency floatation gear, wheeled undercarriages, external lights, load and related attaching means will be addressed with a special condition and/or in accordance to applicable JAR-27 requirements or equivalent."

Reason(s) for proposed text/comment:

1 - In JAR-VLR.1, there is a paragraph (a) without a paragraph (b) : then, "(a)" should be deleted. The sub-paragraphs 1 to 4 should be numbered (1) to (4) to be consistent with the overall numbering system of this JAR-VLR (or with guidelines of ACJ 11.045 paragraph 4.3). However, because of the comment above, they should now be numbered (a) to (c).

2 - Is the wording "simple design" used in VLR.I the same as the one used in JAR 21.13? If not, then the wording should be different or the ACJ should indicate that this is not the same meaning as in JAR-21. One possibility is to use the wording "very simple design" in both JAR VLR-1 and ACJ VLR-1, to avoid confusion (as proposed above).

Note that a JAR-27 rotorcraft is apparently considered as being of simple design according to JAR-21 (see JAA certification / validation procedures, §3.2.4 (a) : Joint Local Procedures are acceptable for such aircraft when they are not for a turbine engine).

3 - The rule in JAR VLR-1 is not restrictive enough. It is suggested to add what is considered as being "essential" restrictions in the rule itself. Indeed, it is not acceptable to put exceptions to the rule in the ACJ (no more rulemaking in advisory material).

The restriction on VFR day operation has also been deleted from the rule, and transferred to a new ACJ VLR-1583 (d) (see separate comment).

4 -The wording "maximum weight of 600 kg or less" is confusing. It is suggested to use the wording that exists in JAR-VLA, i.e. "maximum certificated take-off weight" (a similar change could be considered for JAR-27). Another option could be to use the wording of JAR-27 ("maximum weights" instead of "maximum weight").

5 - Currently proposed VLR.I stated "a type certificate" and "changes to those certificates". This inadequate mixing of singular and plural is proposed to be corrected in the proposal above.

Response

Accepted in part, typographical errors corrected. We believe the regulation as written and interpreted is clear in its intent and allows both manufacturer and regulator flexibility in interpretation without becoming overly prescriptive and restrictive, which is our intention. The term simple design as used in JAR 21.13 is interpreted by the ACJ material for that code. Which states that the term *"relates primarily to the task of showing compliance, and, in particular, to where the task is relatively simple due to the nature of the design, or to the nature of the requirements or criteria applied."*

82. VLR A1(b)

Comment

At the first sentence, we propose to replace:

- ", for each appliance required by this chapter,"

by

- ", for each appliance required by any applicable JAR or operating rule,"

Reason(s) for proposed text/comment:

As it seems to us there is no difference between all JAA helicopter airworthiness codes in this mater, the proposed text is the one used in JAR 27 and 29.

Response

Agreed, text changed.

83. General

Comment

In the justification of the NPA, in response-to-comment "c" in § 4, the statement that an applicant for a small helicopter could have sufficient technical skill to adapt an ACJ from another code which, as stated ill this NPA, is different, is not accepted.

It is well know that the writing of ACJs is sometimes as complex as the writing of the rules themselves, with the well known difficulty of avoiding rulemaking by advisory material. Therefore, it is unlikely that an applicant for certification of a JAR-VLR rotorcraft would have sufficient skills to perform such task.

JAR-VLR should be self contained (rule and advisory material), except for material common to more than one JAR code (see NPA 20-4 on AMJs). It is acknowledged that to adapt AC 27-1B to JAR-VLR is a huge task and cannot be done at that time. However, such task should not be left to each individual applicant without control by the authorities as stated in the NPA ("We believe that the problem of adapting .... delegated to the technical skill of the manufacturer").

Reason(s) for proposed text comment:

Consistency in application of JAR-VLR.

Response

Not accepted. The commentator is correct in stating that adapting AC27-1B to JAR VLR is a huge task. To do so at this time is considered to be an economic dis-benefit to both the JAAs and the potential industry sector to which it is aimed. Given that large tracts of JAR VLR are identical to JAR 27 then referencing AC27-1B as being applicable to JAR VLR is an entirely appropriate action to take.

Also JAR VLR contains large sections of JAR VLA. JAR VLA has very little AC material associated with it. But where AC material is published in JAR VLA then it has been transferred to JAR VLR when its parent VLA requirement material has been included in VLR.

Where JAR VLR differs from JAR 27 and AC material has not been included in JAR VLR then we restate our previously published position. We believe that the problem of adapting the corresponding AC 27-1 material when JAR-VLR and JAR 27 requirements are different is a job that can be safely delegated to the technical skill of the manufacturer. This is an entirely reasonable approach since - as stated above - much of the originating VLA text never had AC material to start with. And it has been left to the manufacturer, relying on his knowledge and skills, to propose acceptable means of compliance.

The use of AC 27-1B is for guidance only and is not the only means of compliance. It is for the applicant to determine how he intends to demonstrate compliance. If that means of compliance is novel or deviates from commonly accepted practice (e.g. AC27 -1B) then the applicant needs to agree this with the appropriate certification authority.

Under the JAA system a CRI would be raised for each non-standard means of compliance, in order to record the decisions made. Which in itself now becomes AC material. As a consequence the finalised CRI is then entered onto the JAA's database for the benefit of all NAAs and future applicants.

84. VLR 901(c)(i)

Comment

The text of VLR.901 (c)(i) is ambiguous if the engine has not a separate type certificate (note that there is a typographical error in "instruc-tions")

For an engine which is type certificated under JAR-E, instructions for installing the engine will be provided under JAR-E 20 (d). This is a normal, well known situation. FAR 33.5 is similar.

When the applicant for the rotorcraft takes responsibility for the engine, as allowed under VLR.903 (a), VLR.901(c)(i) is not appropriate: the instructions from the engine manufacturer could be "commercial" instructions, not "certification" ones.

It is noted that the numbering is incorrect : (c)(i) instead of (c)(1).

We propose a simple re-write of VLR 901 (c)(1) and a change in numbering as follows:

VLR.901 (c)(1)

The instructions for installing the engine required in the relevant code defined under JAR-VLR 903 (a).

In addition, for additional clarity for people not very familiar with engine codes, we propose to create an ACJ VLR 901 (c) to read as follows

ACJ VLR 901(c)

The instructions for installing the engine referred to in JAR-VLR.901 (c)(1) are those required under JAR-E 20 (d), FAR 33.5 or JAR-VLR B2, as relevant.

Reason(s) for proposed text/comment:

Clarification of the interpretation.

It is noted that the same comment would apply to JAR-VLA and could be considered for improvement of this code.

Response

Agreed. Typographical and editorial comments agreed, text changed and ACJ material will be added.

85. VLR 903(a) and associated ACJ

Comment

1. In the justification of the NPA, in § 3 under the heading "appendix B", the statement is very clear : an engine is either type certificated separately or as part of the aircraft. This position is supported. However, the proposed paragraph VLR.903 (a) is not consistent with this position. We also note that title of VLR.903 is "engines" (plural) when only single engine rotorcraft are considered in JAR-VLR.

It is suggested to write it as follows:

VLR903 Engine

(a) Engine type certification. The engine must either
  (1) Have a separate type certificate based on an acceptable code, or
  (2) Be approved as part of the rotorcraft and meet the requirements of Appendix B to this JAR VLR.

2. Associated to this change, it is proposed to modify ACJ VLR 903 (a) as follows

ACJ VLR 903(a) Engine type certification

(Acceptable means of compliance)

Acceptable codes for compliance with JAR-VLR.903(a)(1) are JAR-E, FAR 33 or JAR-VLR Appendix B. Acceptance of the original type certificate of the engine by other Airworthiness Authorities will depend upon the basis of its type certification as follows:

a. Engines type certificated to JAR-E or JAR-VLR appendix B:

An engine type certificated to the applicable issue of JAR-E or JAR.-VLR appendix B will be acceptable to other Participating Authorities in accordance with the provisions of the Arrangements Document.

b. Engines not type certificated to JAR-E or JAR-VLR appendix B:

An engine type certificated to a code other than JAR-E or JAR-VLR appendix B will need to be found acceptable to each Airworthiness Authority in accordance with its national regulations. This may include showing compliance with the applicable issue of JAR-E or JAR-VLR appendix B.

3. It is also suggested to create a new ACJ VLR 903(a)(2) which reads as follows

ACJ VLR 903(a)(2) Engine Type Certification

(Interpretative Material)

If provisions of JAR-VLR.903 (a)(2) are used, then the applicant for the rotorcraft type certificate is responsible for the design and the continued airworthiness of the engine, and must demonstrate compliance of the engine with the relevant paragraphs of JAR-VLR.

Reason(s) for proposed text/comment:

1. The currently proposed ACJ VLR 903 (a) is setting rules by advisory material (use of the word "must") : this is no longer an option in JARs. However, moving the reference to FAR 33 into VLR.903 (a) is not an acceptable option as noted in the justification of the NPA.

In addition, it is noted that it is possible to grant an engine type certificate based on various codes (JAR21 does specify the technical code to be complied with): for example, some engine type certificates are delivered based on JAR-22 sub-part H.

We understand that three codes would be acceptable for an engine to be installed in a JAR-VLR rotorcraft: JAR-E, FAR 33 and Appendix B of JAR-VLR.

Then, the above proposed paragraph (a)(1) provides the option of a separate engine type certificate and allows interpretation by ACJ on the "acceptable" code. There is no reason to refuse an engine type certificate based on Appendix B to JAR-VLR : this appears as being an acceptable set of rules under the text proposed in the NPA itself.

The above proposed paragraph (a)(2) is simply consistent with the objective found in the justification of the NPA.

2. The above proposed text for the ACJ clarifies the "acceptable" codes and the acceptance of engines not type certificated to JAR-E: this is a copy of the existing ACJ 23.903(a)(1). A similar change should be made for ACJ 27.903.

3. The proposed ACJ clarifies the responsibilities in case of use of JAR-VLR (a)(2) as a useful reminder.

Response

Partially Accepted. It is not the WGs intention that an Engine Type Certificate be issued for an engine shown to be compliant with Appendix B. Amendments in line with some of the commentator's proposals have been made to ACJ 903 (a).

Further the WG notes that the commentator under his Reason(s) for proposed text/comment item 1, states that the currently proposed ACJ VLR 903(a) is setting rules by advisory material (use of the word “must”). He then promptly falls into the same trap himself by liberally applying the mandatory (rule making) words “will” and “must” to his own proposals for ACJ material.

86. VLR 903(b)(1)(i) and (ii)

Comment

1 - There is an "or" between sub-paragraphs (ii) and (iii) in VLR.903 (b)(1). There is nothing between (i) and (ii) : therefore, this is understood as meaning, implicitly, "and".

Then, this paragraph is not logical: if the fan blade is contained, there is no point in considering its location. The safety is ensured by the requirement for containment, unless the word "contained" has not the general meaning.

It is suggested to add the word "or" at the end of VLR.903 (b)(1)(i).

2 - In VLR.901 (b)(1)(ii), "will not jeopardize safety" is unclear. The "safety" objective should be clarified. Is the intent to save the rotorcraft but to accept killing one occupant or people on ground around the rotorcraft ? Note that VLR.1461 (d) in this respect is clearer.

Note that the word "jeopardize" is misspelled (American spelling, not English spelling).

It is however noted that the proposed JAR-VLR is similar to JAR-27. Therefore, these comments would also be applicable to JAR-27. The improvement requested for JAR-VLR could then be used for improving JAR27.

Reason(s) for proposed text/comment:

Clarification of the interpretation.

Response

Not accepted, other than the noted spelling mistake, which has been corrected. The text in VLR is identical to that in JARs 27 and 29. The intent and interpretation of which is well understood by both Manufacturers and Certificating Authorities alike.

87. VLR 903(b)(2)

Comment

The reference to “JAR VLR.27.571” should be clarified. Should it be “JAR VLR.571” ?

Reason(s) for proposed text/comment:

Clarification of the text because of a typographical error.

Response

Agreed, text changed.

88. VLR 1145 and 1165

Comment

The wording of these paragraphs seems to imply that JAR-VLR did not consider engines using a diesel cycle (compression ignition).

Many diesel engine projects have been or are in the process of being type certificated. The new JAR-VLR should be made more general : it would not be good to publish now a code which could be immediately outdated by reality. The fact that this text is similar to JAR-VLA is not in itself a reason for not improving a new JAR code. JAR-VLA may benefit from a similar improvement.

Therefore, unless JAR-VLR itself excludes installation of diesel engines, it is suggested to add flexibility in all paragraphs such as 1145 or 1165, may be by adding : "except for engines using the compression ignition".

Reason(s) for proposed text/comment:

To make JAR-VLR more universal, in line with current technology.

Response

Not Accepted. ACJ VLR 1 is quite clear on the use of diesel engines, they are permitted! Inclusion of a paragraph for a system component does not mean that its inclusion is mandatory unless specifically stated. Clearly if a diesel engine is used then an applicants CCL will be annotated against paragraphs 1145 and 1165 as "not applicable diesel engine

installed". Similar arguments exist for .1147 mixture controls - not normally used on fuel-injected engines; and .1151 - rotor brakes. The latter if available on smaller simpler helicopters are always included as a customer option.

89. VLR 1183

Comment

1 - The reference to "engine fire conditions" in VLR.1183 (a) is not understood. The fire could have another source than the engine! It is suggested to delete the words "in any area subject to engine fire conditions".

2 - The format of all of paragraph VLR.1183 could be revised if another comment on VLR B.7 is accepted (see separate comment) to be clearer.

3 - The exemption in (b)(1) is not understandable: even the engine components must comply with these rules!! It is suggested to completely delete VLR.1183 (b)(1). It should be noted that the comment made on VLR B.7 would make JAR-E, FAR 33 and JAR-VLR totally consistent. Note also a typographical error in currently proposed VLR.1183 (b)(1) ("which and are").

The fact that this text is similar to text of JAR-27 is not in itself a reason for propagating unclear requirements. JAR-27 might benefit from a similar improvement.

Reason(s) for proposed text/comment:

To make JAR-VLR clearer.

Response

Not accepted, other than the noted typographical error, which has been corrected. The specific items of text in VLR to which the commentator refers are identical to that in numerous JAR codes including VLA, 25, 27 and 29. The intent and interpretation of which is well understood by both Manufacturers and Certificating Authorities alike.

90. VLR 1191(d), (e) and (f)

Comment

It is suggested to clarify these requirements, based on the FAR 33 / JAR-E harmonisation work as follows.

To delete (e) (replaced by the below proposed (3)) and (f) (replaced by the below proposed (1) and (2)) and to change (e) to read

VLR.1191

(d) Each component designed, constructed and installed to act as a firewall must be -

(1) Fireproof and,

(2) Constructed so that no hazardous quantity of air, fluid or flame can pass around or through the firewall; and,

(3) Protected against corrosion.

There is no change to requirements of (f), as they are in the NPA.

The change to requirements of (d), as they are in the NPA, is minor : the missing part ("from any engine compartment to ...)" is already covered by VLR.1183 (a).

The requirements of (e), as they are in the NPA., are prescribing a particular design and are not adding to the safety objective already defined in VLR.1183 (d).

The fact that this text is similar to text of JAR-27 or VLA is not in itself a reason for propagating unclear requirements. JAR-27 and JAR-VLA might benefit from a similar improvement.

Reasons) for proposed text/comment:

To make JAR-VLR clearer and "less design prescriptive".

Response

Not Accepted. The JAR VLR text as written is specific to the airframe. It would be inappropriate to adopt engine specific requirements for inclusion in a code that addresses the airframe.

91. VLR 1305

Comment

What is the definition of an "altitude engine" found in VLR.1305 (e) ? This wording cannot be understood.

Again, the wording of this paragraph seems to imply that JAR-VLR did not consider engines using a diesel cycle (compression ignition), making mandatory some equipment which could not be provided by some designs or would not be relevant (for example, what would be the use of the "manifold pressure indicator" required in (e) for a diesel engine ?).

The list should be completely revised to be applicable to more than one type of engines. In general, the list of necessary instruments should come from the engine safety analysis and not be imposed by such requirements without real justification.

The fact that this text is similar to text of JAR-27 is not in itself a reason for propagating unclear requirements. JAR-27 might benefit from a similar improvement.

Reason(s) for proposed text/comment:

To understand JAR-VLR text and to make it more general.

Response

Not Accepted. An altitude engine is defined as: "A reciprocating aircraft engine having a rated take-off power that is producible from sea level to an established higher altitude." Sometimes these engines are referred to as "turbo-normalised". Practically the usual means of achieving this situation is by installation to the engine of a super-charger or turbo-super-charger with an automatically controlled waste-gate. To aid clarification the definition of an altitude engine will be included in the ACJ material.

A manifold pressure gauge would be entirely appropriate on a diesel engine since many of them are turbo-super-charged and could easily be of the altitude type. The point about the list of necessary instruments should come from the engine safety analysis and not be imposed by such requirements without real justification, is not accepted. The list is based on very many years of bitter experience and is therefore thoroughly tried and tested. Which means it is entirely logical in its concept for the safe operation of the helicopter.

As an example it would be almost impossible to safely fly the helicopter with out the tachometer required by .1305(k). Nevertheless, should an applicant wish to obtain an exemption from the requirements then he is quite at liberty to ask the Authority to grant an equivalent safety finding. Based on a safety analysis or, whatever other means the applicant chooses.

92. VLR 1461

Comment

If this paragraph is applicable also to engine equipment, then there is an issue. These requirements are not 100% consistent with the requirements of JAR-E 80 (d). Either engine equipment are excluded from this paragraph or harmonisation with engine requirement is considered.

In Sub-paragraph (a), note the typographical error : "(b), (c) or (d) of this paragraphs".

In Sub-paragraph (b)(2), note the typographical error : "integrity off high ".

Reason(s) for proposed text/comment:

Consistency for engine equipment.

Some people were of the opinion that engine equipment would not considered but the explanation was to be found in AC 27.1461. This is not an acceptable method for making

rules. The fact that this text is similar to text of JAR-27 is not in itself a reason for propagating unclear requirements. JAR-27 might benefit from a similar improvement.

Response

Partially accepted, the noted typographical error, has been corrected. AC 27.1461 adequately interprets the requirement, which after all is its purpose. However, there is a case for including the requirement material of JAR E.80 (d) in appendix B, to cover such devices as superchargers, turbo chargers etc; and this has been done.

93. VLR 1521

Comment

1 - In VLR.1521 (a), there is reference to "for which the engines are type certificated". This is not consistent with the concept, as announced in this NPA, of an engine being accepted as part of the rotorcraft without having a separate type certificate. The use of the plural (engines) is also not consistent with the definition of the simple design (see ACJ VLR 1) which specifies a single engine.

It is suggested to revise (a) to read : " .... do not exceed the corresponding limits established for the engine. "

2 - In (b), there is confusion on the referenced speeds. The paragraph starts with "the powerplant take-off operation" : this is clearly the engine. Sub-paragraph (b)(1) addresses the "maximum rotational speed" : again this is the engine. Still consistent. But, then, Sub-paragraph (b)(1)(i) speaks of the rotor design: is this an engine rotor or the rotorcraft rotor (do we speak of "rotor" for a reciprocating engine ?) ? Sub-paragraph (b)(1)(ii) does not help : which "type tests" ? The confusion is even increased when we discover that (c)(1) is identical to (b)(1) (except a typographical error) with (b)(2) (manifold pressure) being clearly an engine reference and (c)(2) being clearly an aircraft reference!

This paragraph cannot be sufficiently understood for being able to suggest a new wording. It is suggested to determine the exact intent and, only after that action, to define the appropriate, understandable, wording.

3 - In (b)(3) the reference to manifold pressure clearly shows that this JAR-VLR was not written with consideration of compression ignition engines (despite what is stated in ACJ VLR 1). See comment on VLR 1145.

Reason(s) for proposed text/comment:

Clarification is needed.

The fact that this text is similar to text of JAR-27 is not in itself a reason for propagating unclear requirements. JAR-27 might benefit from a similar improvement.

Response

Comment 1 Agreed , text changed

Comment 2 Not Accepted.

It is important to differentiate between the rotorcraft powerplant limitations and the engine limitations as established under Appendix B of JAR VLR or JAR E. For some parameters, these two limits may be identical, but frequently, the engines will be capable of exceeding the maximum limitations substantiated for the combined powerplant installation as dictated by other components such as rotors.

Limitations established according to this rule may not exceed the engine limitations established in accordance with this requirement but may be less than the Appendix B of JAR VLR or JAR E limits as desired by the Applicant.

Finally c(1) and b(1) are not identical; b(1) refers to Take-Off Power conditions while c(1) to Maximum Continous Power conditions

Comment 3 Not Accepted. See response to comment 91.

94. VLR 1549(d)

Comment

It is interesting to note that, according to this text, a JAR-VLR rotorcraft can be fitted with a propeller. Should the words "or propeller" be deleted ?

Reason(s) for proposed text/comment:

Clarification is needed.

The fact that this text is similar to text of JAR-27 is not in itself a reason for propagating unclear requirements. JAR-27 might benefit from a similar improvement.

Response

Agreed, text changed.

95. VLR A.3

Comment

The first sentence of JAR VLR.A3 must be deleted.

Reason(s) for proposed text/comment:

It is not acceptable to impose the English language for the writing of the instructions for continued airworthiness.

The fact that this text is similar to text of JAR-27 and 29 is not in itself a reason for propagating such requirement. These other codes might benefit from a similar improvement.

Response

Not accepted, no logical reason has been given to support the comment. However, the Multi-National Working Group notes the commentator's cultural sensitivities. A review of all JAR codes has been made for evidence of the statement to which he objects. Only JARs 23, 25, 27 and 29 appear to make reference to the language to be used for continued airworthiness instructions. JARs 23, 27 and 29 state "English Language" whilst JAR 25 states "language acceptable to the Authority". This statement is underlined to show it is a difference from FAR 25.

As JARs 23, 27 and 29 are the more recent publications and are more or less fully harmonised with FARs (where as JAR 25 still has some way to go) then the statement that appears in VLR A.3 is considered to be correct. However, if the commentator still considers that it is unacceptable to ask that the instructions for continued airworthiness be written in the English Language (which after all is the lingua franca of aviation). Then he is recommended to refer his objection to the JAA's Regulations Director for policy review and if agreed amendment of the offending JAR codes.

96. VLR B.1

Comment

The paragraph should be modified to read as follows

> VLR B.I
>
> This Appendix prescribes the requirements for the approval of an engine under JAR- VLR.903 (a) (2) as part of a JAR- VLR type certificated rotorcraft.

Reason(s) for proposed text/comment:

Note a typographical error ("JAA-VLR" instead of "JAR-VLR").

A cross reference to VLR.903 which is felt appropriate, in relation to the other comment made on this paragraph VLR.903 (a).

Response

Agreed, text changed.

97. VLR B.7

Comment

It is proposed to make good use of the FAR 33 / JAR-E harmonisation effort to make the Appendix B consistent with these rules.

In addition, it is noted that the rules of Appendix B are not always consistent with the rules of VLR.1183 and following paragraphs (see other, separate, comments).

Then it is suggested to change VLR B.7 to read as follows

JAR-VLR B.7 Fire precaution

(a) The design and construction of the Engine and the materials used must minimise the probability of the occurrence and spread of fire during normal operation and failure conditions and must minimise the effects of such a fire.

(b) Except as required by JAR-VLR B.7 (c), each external line, fitting and other component which contains or conveys flammable fluid during normal engine operation must be at least Fire Resistant. Components must be shielded or located to safeguard against the ignition of leaking flammable fluid.

(c) Tanks which contain flammable fluid and any associated shut-off means and supports, which are part of and attached to the Engine, must be Fireproof either by construction or by protection, unless damage by fire will not cause leakage or spillage of a hazardous quantity of flammable fluid. For a reciprocating Engine having an integral oil sump of less than 23.7 litres capacity, the oil sump need- not be Fireproof nor be enclosed by a Fireproof shield but still must comply with JAR-VLR B.7 (b).

(d) An Engine component designed, constructed and installed to act as a firewall must be -

(1) Fireproof; and,

(2) Constructed so that no hazardous quantity of air, fluid or flame can pass around or through the firewall; and,

(3) Protected against corrosion.

(e) In addition to requirements of JAR-VLR B.7 (a) and (b), Engine control system components which are located in a designated fire zone must be at least Fire Resistant (see AMJ 20X-1 for electronic control).

(f) Any components, modules, equipment and accessories which are susceptible to or are potential sources of static discharges or electrical fault currents must be designed and constructed so as to be grounded to the Engine reference in order to minimise the risk of ignition in external areas where flammable fluids or vapours could be present.

(g) Those features of the Engine which form part of the mounting structure or Engine attaclunent points must be Fireproof, either by construction or by protection, in order to comply with JAR-VLR.861.

Reason(s) for proposed text/comment:

Consistency with the other relevant engine codes (FAR 33 and JAR-E) as well as consistency with JAR VLR itself.

The fact that this text is similar to text of JAR 22.1817 is not in itself a reason for not improving the requirements. JAR-22 might benefit from a similar improvement.

Response

Agreed. The JAR E / FAR 33 harmonisation programme is not yet complete and to pre-empt its conclusions would be dangerous. However the JAA Regulations Director was asked to advise on this specific matter and he stated that in this instance it would be safe to pre-empt the conclusions of the harmonisation activity.

Appendix B applies to the engine whilst Sub Part E applies to the airframe power-plant requirements. It will be inappropriate to merge the engine and power-plant installation requirements as inferred by the commentator because it is quite acceptable to install a JAR E / FAR 33 type certificated engine to the helicopter. However, VLR B.13 has been amended in line with some of the commentators suggestions such that when taken in conjunction with VLR.1183 it forms a comprehensive engine fire protection requirement.

98. VLR B.8

Comment

1 - It is noted that there are currently piston engines type certificated under JAR-22 or JAR-E whose maintenance is not done under the concept of "overhaul". These engines are not even under the "on condition" concept.

Therefore, this paragraph VLR B.8 is not adequate. It is also noted that this text comes from FAR 33.19 which .... is not applied otherwise engines currently installed on Airbus or Boeing aircraft (and others), for which no overhaul period is defined, could not be certified !

It is then suggested to entirely delete this paragraph.

2 - This should be compensated by a requirement to provide instructions for continued airworthiness for the engine (which are referenced by JAR-VLR.A.1 (b) but nowhere required).

It is then suggested to create a new paragraph JAR-VLR B.x (may be B.5, imposing a change to numbering of current B.5, B.6 and B.7) to read

JAR-VLR B.x Instructions for continued airworthiness

Instructions which are acceptable to the Authority for continued airworthiness of the Engine shall be prepared for compliance with JAR VLR.AI.

Reason(s) for proposed text/comment:

To make JAR-VLR more universal. The fact that this text is similar to text of JAR 22.1819 is not in itself a reason for not improving the requirements. JAR-22 might benefit from a similar improvement.

JAR VLR.AI (b) refers to the engine but there is no requirement in sub-part B imposing compliance with VLR.AI for the engine. This closes the loop.

Response

Not Accepted. There is no need to create a new paragraph. The Continued Airworthiness Instruction requested by Appendix A are applicable to the engine as well; namely the engine retirement lives and mandatory inspections to be inserted in Airworthiness Limitation Sections will be based on :

a) The fatigue evaluations requested by JAR-VLR 571 using the vibratory loads as found in the load survey requested by JAR-VLR B.21.

b) The results of the engine endurance test requested under JAR-VLR B.33.

c) The reliability analysis requested by JAR-VLR B.15

99. VLR B.18

Comment

It is suggested to change title of the paragraph and the content of sub-paragraph (a) to read as follows

JAR-VLR B.18 Engine systems and components

(a) For those systems or components which cannot be adequately substantiated by the endurance testing of B.16, additional tests or analyses must be conducted to demonstrate that the systems or components are able to perform the intended functions in all declared environmental and operating conditions.

Reason(s) for proposed text/comment:

Tests are not always requested for compliance: similarity or analysis are also acceptable. The proposed text is taken from the FAR 33 / JAR-E harmonisation.

The fact that this text is similar to text of JAR 22.1853 is not in itself a reason for not improving the requirements. JAR-22 might benefit from a similar improvement.

Response

Agreed. The JAR E / FAR 33 harmonisation programme is not yet complete and to pre-empt its conclusions would be dangerous. However the JAA Regulations Director was asked to advise on this specific matter and he stated that in this instance it would be safe to pre-empt the conclusions of the harmonisation activity.

VLR B.37 has been amended in line with the commentator's proposals.

100. VLR 175

Comment

The answer to question b. under QESTIONS & ANSWERS in NPA VLR-1: Draft JAR-VLR (Very Light Rotorcraft) - Explanatory Note regarding incorporating the anticipated outcome of PHQHWG in JAR-VLR is appreciated. However, this is an area where the JAR-VLR requirements could provide some regulatory relief. Both the helicopter regulatory and industry communities are generally familiar with the PHQHWG proposals for §§27.173 and 27.175. The requirements for static longitudinal stability proposed by PHQHWG could be incorporated in JAR-VLR without compromising safety.

Response

Not accepted. The PHQHWG programme is not yet complete and to pre-empt its conclusions would be dangerous. However we believe the Authority would favourably consider requests for equivalent safety findings in these areas.

101. VLR 73(2)

Comment

In the answer to question f. under QESTIONS & ANSWERS in NPA VLR-1: Draft JAR-VLR Very Light Rotorcraft) - Explanatory Note there is mention of the introduction of a WAT chart within the Limitations Section. We do not see any difference in the Limitations Sections of Part 27 and JAR-VLR.

Response

Noted. We have reviewed the original comment and conclude that VLR.1587 (a)(1)(i) covers this situation.

102. VLR 1

Comment

We do not concur on the decision to set the maximum MGW limitation at 600 kg. While we recognize that the MGW limitation has to be set at some arbitrary value, we consider 600

kg to be lower than optimum for this class of aircraft. This MGW limit will require the applicant to marginalize the structure, and dictates design decisions that will have negative impacts on crashworthiness. Our position is that its more reasonable for the standard to allow the other valid criteria already contained in JAR-VLR-1 and ACJ VLR 1 -- namely; reciprocating engine, two place, single main rotor, unboosted flight controls, simple fuel system -- to dictate the design, and allow the applicant the flexibility to propose a robust, substantial & crashworthy structure that may exceed the 600 kg MGW limit. However, since we recognize that an arbitrary maximum weight limit must be set, we propose a 750 kg limit MGW for JAR-VLR (750 kg is the MGW limit in the analogous JAR VLA standard).

Response

Agreed. The maximum weight limit will be increased to 750 kg to bring JAR VLR into line with JAR VLA. However a separate NPA will be produced. See also comments 1 and part of 111.

103. VLR 33

Comment

We are concerned that the expected reliability of the critical Low NR Warning System is not identified in the JAR-VLR standard. We recognize that JAR-VLR-1309 will dictate the design reliability, and that Part 27 contains similar wording in 27.33 and 27.1309, but we remain concerned that the critical nature of the Low NR Warning System may be overlooked during JAR-VLR certification. It is possible that the Low NR Warning System is the only critical system on a JAR-VLR aircraft, and is the only system that the design reliability standard of JAR-VLR-1309, " . . . minimize hazards to the rotorcraft in the event of a probable malfunction or failure", is inadequate to address. We propose that the expected design reliability of the Low NR Warning System be identified in the JAR-VLR standard or associated ACJ (not necessarily in paragraph JAR-VLR-33).

Response

Not accepted. We note the comment but are having difficulty understanding what is causing the concern and why only this particular device should be singled out for special attention. We do not agree that this device would possibly be the only critical system on a VLR helicopter and believe the exiting requirements adequately addresses the concerns stated. We note that pre take off checks on any helicopter will require the device to be tested prior to commencement of each and every flight.

104. VLR.33 (a)(1)

Comment

The sentence, "With power-on, provides adequate margin to accomodate the variations in rotor speed occurring in any autorotative maneuver..." should read, "With power-on, provides adequate margin to accommodate the variations in rotor speed occurring in any appropriate maneuver...".

Response

Agreed, text changed.

Attachment 1

In ACJ VLR-143 the t/k parameter has been introduced.

This parameter was adopted at Bell as a useful criteria to appreciate the main rotor rotational decay occurring in case of a sudden engine failure. The higher is this parameter (expressed in seconds) the higher will be the time available after an engine failure for the pilot to droop the collective and entering the autorotation flight. It could be shown that the expression proposed in the ACJ is a simplified form of the equation governing the main rotor rotational decay occurring in case of a sudden engine failure.

As a matter of fact, assuming the following simplified equation for the rotor motion :

$$NI_b \dot{\Omega} = -Q$$

where NI_b = total rotor moment of inertia ;
Q = decelerating torque on the rotor

Furthermore it is assumed that, during the first few seconds after the engine failure, both the rotor thrust and decelerating torque are changed only by variations of the rotor speed:

$$T = W\left(\frac{\Omega}{\Omega_o}\right)^2 \; ; \; Q = Q_o\left(\frac{\Omega}{\Omega_o}\right)^2$$

Where Ω_0 is the rotor speed at the instant of engine failure and Q_0 is the reacting torque at the instant of engine failure (obviously dependant on the flight conditions taken in exam: HOGE, level flight) and W is the helicopter weight

The rotor speed governing equation then becomes : $NI_b \dot{\Omega} = -Q_o\left(\frac{\Omega}{\Omega_o}\right)^2$

Which integrates to :

(1) $$\frac{\Omega}{\Omega_o} = \left(1 + \frac{tQ_o}{NI_b\Omega_o}\right)^{-1}$$

if we introduce the time constant $\tau = \frac{NI_b\Omega_o}{Q_o}$

equation (1) becomes :

(2) $$\frac{\Omega}{\Omega_o} = \left(\frac{\tau}{t+\tau}\right)$$

The largest permissible reaction time can be estimated by setting the rotor speed decrease equal to the blade stall limit :

$$\left(\frac{\Omega}{\Omega_0}\right)^2 = \frac{C_T/\sigma}{(C_T/\sigma)_{STALL}}$$

If we indicate $KE = \frac{1}{2} N I_b \Omega_0^2$ the kinetic energy stored in the rotor at the instant of engine failure (**K**enetic **E**nergy) then the time constant τ can be expressed as :

$$\tau = \frac{2KE}{P}$$

Where P is the power required for the flight condition taken in exam.

Then the largest permissible reaction time may be expressed as

$$t_{MAX} = 2\frac{KE}{P}\left[\left(\frac{C_T/\sigma}{(C_T/\sigma)_{STALL}}\right)^{\frac{1}{2}} - 1\right] \qquad (3)$$

This equation is very similar to the expression used for the t/k parameter and reported in the ACJ.

As a matter of fact it can be shown that a good correlation between tmax and t/k exists as shown in attachment 2; a value of 1.3 seconds of the t/k parameter corresponds to a t_{max} value of 2.9 seconds.

Considering that the Bell criteria defines as " very good " the autorotational characteristics of an helicopter having a t/k equals to 2 (corresponding to a t_{max} value of 5,42 seconds) it can be concluded that the suggested theoretical minimum value of t/k of 1.3 can be considered acceptable for the purpose of this ACJ.

ACJ JAR VLR 143 (d)

Before starting flight tests, it should be determined that the following disc rotor coefficient τ be at least equal to 1.3 seconds :

$$t/k = \frac{KE\left(1 - \frac{(Ct_w/\sigma)}{0.8\cdot(Ct/\sigma)_{stall}}\right)}{(746\cdot Hp_{OGE})}$$

$Ct_w = \frac{T}{\rho A V_{tip}^{\ 2}}$; Thrust Coefficent

(CT/σ) stall = 0.166 may be assumed for conventional main rotor blade airfoil

T = rotor thrust in level flight [N] ;

A = Area Disc [m2] ;

Vtip = Tip Blade Velocity [m/s]

ρ = SSL air density 1.22 [kg/m3]

$\sigma = \frac{N_b \cdot c}{\pi \cdot R}$; solidity ratio

Nb = Blades number

c = mean blade chord [m]

R = rotor radius [m]

KE = rotor inertia = $\frac{1}{2} J \Omega^2$

J= Rotor Inertia [kg m^2]

Ω = Rotor Speed [rad/s]

Hp_{OGE} = Power Required for hover in OGE condition [HP]

Attachment 2