Comment	Response
Cmt. *3 / F Fagegaltier* CS 25.621 (all) The proposal is mixing the current FAR 25.621 text with new text. This makes it a lengthy and complex paragraph which is difficult to read : this can result in errors when reading or interpreting it, especially in light of the new legal and administrative texts in Europe. Words which are OK as part of the FARs have sometimes a totally different meaning when used in a European text. All these points will be developed in separate comments. It is suggested a complete re-formatting of the paragraph when all comments have been analysed. A possible solution is nevertheless attached to this comment as a straw man (important note : this is a counter proposal for the format, not for the wording). CS 25.621 Casting factors. (a) General. For castings used in structural applications, the factors, tests, and inspections specified in CS 25.621 (b) through (e) must be applied in addition to those necessary to establish foundry quality control. The inspections must meet approved specifications. CS 25.621 (b) and (c) apply to any structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads. (b) Critical castings. Each casting whose failure could preclude continued safe flight and landing of the aeroplane or could result in serious injury to occupants is considered a critical casting. Each critical casting must have a factor associated with it for showing compliance with strength and deformation requirements, and must comply with the following criteria associated with that factor: (1) A casting factor equal to 1.0 may be used, provided that – (i) It is demonstrated, in the form of process qualification, proof of product, and process monitoring that, for each casting design and part number, the castings produced by each foundry and process combination have coefficients of variation of the material properties that are equivalent to those of wrought alloy products of similar composition. Process monitoring must include testing of coupons cut from the prolongations of each casting (or each set of castings, if produced from a single pour into a single mould in a runner system) and, on a sampling basis, coupons cut from critical areas of production castings. The acceptance criteria for the process monitoring inspections and tests must be established and included in the process specifications to ensure the properties of the production castings are controlled to within levels used in design. (ii) Each casting complies with CS 25.621 (e)(1) and (2). (iii) One casting is tested according to CS 25.621 (e)(3) (2) A casting factor equal to 1.25 may be used, provided that – (i) Each casting complies with CS 25.621 (e)(1) and (2). (ii) Three castings are tested according to CS 25.621 (e)(3) (3) A casting factor equal to 1.50 may be used, provided that – (i) Each casting complies with CS 25.621 (e)(1) and (2). (ii) One casting is tested according to CS 25.621 (e)(3) (c) Noncritical castings. For each casting other than critical castings, the following apply:	Noted. The attempt to provide an alternative to the text of CS 25.621 as proposed in NPA 08-2004, which according to the commenter would be easier to read, is appreciated. Both this proposal and the original NPA text have advantages and disadvantages. The advantage of the text as proposed in NPA 08-2004 is, that it lists all relevant conditions for each casting factor for both critical and non-critical castings without cross-references to other sub-paragraphs. On balance the Agency prefers the latter approach.

Comment	Response

(1) A casting factor equal to 1.0 may be used, provided that

(i) The requirements of CS 25.621 (b)(1) are met, or:
(ii) (A) Castings are manufactured to approved specifications that specify the minimum mechanical properties of the material in the casting and provides for demonstration of these properties by testing of coupons cut from the castings on a sampling basis.
(B) Each casting complies with CS 25.621 (e)(1) and (2).
(C) Three sample castings are tested according to CS 25.621 (e)(3)

(2) A casting factor equal to 1.25 may be used, provided that each casting complies with CS 25.621 (e)(1) and (2).

(3) A casting factor equal to 1.5 may be used, provided that each casting complies with CS 25.621 (e)(1).

(4) A casting factor equal to 2.0 may be used, provided that each casting receives inspection of 100 percent of its surface using visual inspection methods.

(5) The percentage of castings inspected by non-visual methods in accordance with CS 25.621 (c)(2) and (c)(3) may be reduced when an approved quality control procedure is established.

(d) Bearing stresses and surfaces. The casting factors specified in CS 25.621 (b) -

(1) Need not exceed 1.25 with respect to bearing stresses regardless of the method of inspection used; and

(2) Need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

(e) Criteria
(1) Inspection of 100 percent of its surface, using visual and liquid penetrant, or equivalent inspection methods;

(2) Inspection of structurally significant internal areas and areas where defects are likely to occur, using radiographic, or equivalent, inspection methods.

(3) Static tests are performed to meet:
(i) The strength requirements of CS 25.305 at an ultimate load corresponding to the minimum factor specified above for the considered casting; and
(ii) The deformation requirements of CS 25.305 at a load of 1.15 times the limit load.

Comment	Response
Cmt. *4 / F Fagegaltier* The comment is on possible application of this aircraft requirement to engine or propeller parts. The wording “structural applications” is not clear enough (found in “for castings used in structural applications”, in the first sentence). Note that paragraph CS 25.621 is located in subpart D “design and construction” and not in subpart C “structure”. Therefore, no immediate link between “structural applications” and the airframe “structure” will be implied (if this was the intent) although there is a cross reference to 25.305. It is suggested changing this wording so that the applicability of this paragraph is more clearly defined. Was the intent to refer to “castings used in a part of the aircraft structure which is submitted to flight loads”? Or was the intent to refer to all castings including, for instance, the body of a fuel pump or the combustor casing in an engine ? It is noted that the last sentence of CS 25.621 (a) seems to define this wording in a negative manner by exclusion of some castings but this is not sufficient for a good understanding. Not knowing the real intent, no specific alternate wording is proposed.	Not agreed. In general CS 25 specifications are not applicable to the parts of engines and/or propellers covered by the type design as included in the engine or propeller type certificate unless specifically called for in the CS-25 paragraph. More specifically for this case enough indications can be found that this paragraph is not applicable to engines and propellers: There are more provisions in Subpart D whose purpose is to provide conditions for demonstrating the mechanical strength of structural parts of the aeroplane. The aeroplane structure is not limited to those parts which are submitted to flight loads. This can be easily concluded from a review of Subpart C of CS 25. Typically Subpart C is providing the provisions for demonstrating static and fatigue strength under defined loading conditions for flight loads, supplementary conditions, control surface and system loads, ground loads and emergency landing conditions. There are also requirements for lightning protection in Subpart C. For demonstrating adequate strength and deformation characteristics a factor of safety (CS 25.303) must be applied to the prescribed load. In Subpart D a number of special factors (see CS 25.619 up to and including CS 25.625) are prescribed as multiplicator to be applied, as prescribed in conditions in the mentioned CS 25 paragraphs, to the factor of safety prescribed in CS 25.303. Casting factors are among those special factors. In this context there may be a need to apply CS 25.621 “Casting Factors”. CS 25.619 is “referring to CS 25.621 and is using the words ”…..for each part of the structure….”. This has not led to difficulties of interpretation. Similarly the exclusion with regard to structural castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads, is the same as the one in current FAR 25, and has not led to difficulties of interpretation.
Cmt. *5 / F Fagegaltier* The sentence 'the inspections must meet approved specifications' is copied from FAR 25.621 (a). In the European context, this is not appropriate. - On the one hand, the word 'specifications' refers to the CS-25 document itself ('certification specifications') or to another equivalent document. Consequently, the proposed sentence of CS 25.621 cannot give a clue on the intent : where are these 'specifications'? They should be spelled out by giving the appropriate reference in EASA texts, if this was the intent. In addition, it must be noted that there is no provision in EASA regulations for an 'approval' : certification specifications are 'published' by the Agency. - On the other hand, if the intent was to refer to some industry inspection standard, the word 'approved' would not be appropriate : with Part 21A.263 (b), anything submitted by the applicant is accepted by the Agency without verification. There is no place for an 'approval'. Was the intent to say something like 'the inspections must be made according to published industry standards'? Deletion of the sentence is possible because the proposed CS 25.621 (c)(1)(i) provides for some conditions. It is suggested either deleting the sentence (the preferred option) or using the above noted alternate wording.	Noted and partially agreed. The use in EASA regulations of the notion Certification Specifications has a specific connotation. In article 14 of the EASA Basic Regulation 1592/2002 Certification Specifications are specified and include airworthiness codes and acceptable means of complance. This does not preclude the use of the word “specification” with a meaning different from Certification Specifications. (Example: Part 21 A.305 Approval of Parts and Appliances). Additionally, it is commented that under Part 21A.263(b) there is no place for approval of the test specification by the Agency. This observation is not correct since the acceptance by the Agency in accordance with 21A263(b) is conditional on 21A257(b) which allows for verification by the Agency of compliance statements. It is agreed however that the word “approved” may suggest a certain legal action by the Agency, which is not the intent. What is meant is a specification which is established under a controlled process and accepted by the Agency for showing compliance with this sub-paragraph of CS-25. Therefore the word “approved” will be replaced by “accepted” to better reflect this intent.

Comment	Response
Cmt. *6 / F Fagegaltier* CS 25.621 (b) The text of 25.621 (b) is not very clear. It refers solely to subparagraph (c) which is related to critical castings when (b) is, apparently, not limited to such parts. This text also states that the applicable casting factors are not applicable (circular argument) when some (undefined) bearing factors are greater : this is confusing. An improvement is suggested as follows. (b) Bearing stresses and surfaces. When a bearing includes a critical casting, (1) with respect to bearing stresses, the casting factor specified in CS 25.621 (c) need not exceed 1.25, regardless of the method of inspection used. (2) with respect to bearing surfaces, when the bearing factor defined in CS 25.623 is larger than the casting factor defined in CS 25.621 (c), the casting factor will be taken equal to 1.0. To place this text after the currently proposed (c) and (d) would be more logical. Indeed, the wording “critical casting” would then be defined before its use, and the “exemption” from factors found in (c) would not be placed before the requirement itself. Then, instead of (b), the above proposed alternate text should be in a new (d) and the currently proposed (c) and (d) should be re-numbered (b) and (c) respectively.	Noted. Bearing stresses and surfaces are related to parts having normal relative motion to other parts. The intent of the provision is not intended to be restricted to bearings only. Moreover CS 25.621 (b) should be applicable to sub-paragraphs (c) as well as (d), critical and non-critical castings. The cross-reference will be extended to sub-paragraph (d). See also FAA comment No. 1. Bearing stresses must be taken into account when determining the appropriate casting factor for both critical and non-critical castings as prescribed in CS 25.621(b). As such, it is logical that (b) comes after (a) “General” and preceeds (c) and (d). This is also logical because of CS 25.621(b)(2). The text as proposed by the commenter is not accepted, since: - it applies to critical castings only; - it applies only to bearings and not in general to surfaces having relative motion to parts of other surfaces.
Cmt. *7 / F Fagegaltier* CS 25.621 (c) The use of examples in the middle of the paragraph is not appropriate as a general rule and because the listed items are not necessarily critical castings. Indeed, the list is probably wrong : is there any example of a 'seat belt' made of casting ? In current civil aircraft, the 'fuel' is a liquid and is obviously not made of casting. Note that this confusion might result from a very bad grammar in the proposed text : was the intent to list 'fuel'? Or 'fuel supports'? Or 'fuel tank supports'? This list of examples should be deleted from CS 25.621 and added to AMC to CS-25.621, if there is any need for it at all.	Agreed. The comment that the list of examples should be deleted from CS 25.621(c) is accepted. In view of the comment No.4 on the applicability of CS 25.621 the list of examples is moved to an AMC 25.621(c). In this new AMC the text “…..,fuel, and oil tank supports and attachments;…” should be changed into “….., and fuel and oil tank supports and attachments;…”.
Cmt. *8 / F Fagegaltier* CS 25.621 (c)(1)(i) This subparagraph is long, complex and not clear enough for an average reader. A counter proposal for (c)(1)(i) is provided below, limiting the text to the necessary certification specifications (giving the 'safety objective') and leaving the interpretation and guidance into the AMC to CS 25.621.	Not agreed. The text of CS 25.621(c)(1)(i) as proposed in NPA 08-2004 is clear concerning the minimum elements of the process monitoring specification. Therefore the text is maintained.

Comment	Response
(1) A casting factor equal to 1.0 may be used, provided that - (i) The casting process is defined, documented and controlled in a manner such that each cast part is individually checked and such that variation of the material properties in these parts are equivalent to those of parts made of wrought alloy and are within the tolerance bands specified in the type design.	
Cmt. *9 / F Fagegaltier* CS 25.621 (c)(1)(iii), (c)(2)(ii), (c)(3)(ii) and (d)(1)(iii) The specialists may understand these requirements but they are not so obvious for an average reader. Certification specifications should be understandable by anyone having to comply with, having a long experience or being a new comer. This would provide some protection against undetected deviation from the rule, outside of the control by certification programme managers. The integration of CS 25.303, 25.305, 25.619 and 25.621 altogether is not an easy task. The consistency of all these paragraphs should be checked and corrected, or explained in the AMC. Note that paragraph 2.1 of the proposed AMC to CS 25.621 introduces further confusion by referencing 25.307 and that addition of CS 25.302 by means of NPA 11/2004 does not facilitate the task. 25.619 reads : The factor of safety prescribed in CS 25.303 must be multiplied by the highest pertinent special factor of safety prescribed in CS 25.621'. 25.303 reads : Unless otherwise specified, a factor of safety of 1.5 must be applied to the prescribed limit load which are considered external loads on the structure. When loading condition is prescribed in terms of ultimate loads, a factor of safety need not be applied unless otherwise specified'. The logic seems to be : define the limit load, then multiply it by 1.5 (according to 25.303) then multiply it by the casting factor of 25.621 (according to 25.619). For instance, when applied to CS 25.621 (c)(2), apparently, this would require a test value of 1.5 x 1.25 x limit load. But, then, what is the 1.15 factor found in CS 25.621 (c)(2)(ii)(B) ? This situation is not very clear for an average reader. But the text is even more confusing. Indeed, 25.619 refers to the highest pertinent value specified in 25.621. Then, when we refer to 25.621 (c)(2), this factor is 1.50 and not 1.25, according to the currently proposed opening sentence of this sub-paragraph. So, the extreme interpretation, using also the 1.15 factor found in CS 25.621 (c)(2)(ii)(B) as an additional safety factor, would require a test value of 1.15 x 1.50 x 1.5 x limit load. In short, should we consider '1.5 x 1.25 x limit load' or '1.15 x 1.50 x 1.5 x limit load' or something else in between? Similarly, the texts related to ultimate loads should be clarified. It is noted that the proposed 25.621 (c)(2)(ii)(A) refers to an 'ultimate load corresponding to a casting factor of 1.25'. A definition would be welcome. Should this be understood as meaning 'limit load multiplied by a safety factor of 1.25' (to stick with 25.301 definition of ultimate loads)?	Noted and partially agreed. Current CS 25.305 has two main structural objectives in the case of testing: -. Support of limit loads without detrimental permanent deformation, and up to limit load without interfering with safe operation (CS 25.305(a) - Support of ultimate load without failure for 3 seconds or less (CS 25.305(b) The application of CS 25.305 is clear. If applied for example (quoted in the comment) to CS 25.621(c)(2)(ii), in the understanding that a casting factor is a special factor as identified in CS 25.619 and ignoring for simplicity CS 25.305(c), this leads in case of a factor of safety (s.f.) required under CS 25.303 to the following: Compliance with CS 25.305(a) must be shown at 1.15x limit load (CS 25.621(c)(2)(ii)(B) Compliance with CS 25.305(b) must be shown at 1.25x s.f.x limit load (CS 25.621(c)(2)(ii)A). The text of CS 25.621(c)(1)(iii),(c)(2)(ii),(c)(3)(ii) and (d)(1)(iii) will be improved by referring to the specific sub-paragraphs of CS 25.305. This becomes more important with the addition of additional sub-paragraphs to CS 25.305 under NPA 11-2004. The comment with regard to the complexity of paragraph 2.1 of the proposed AMC 25.621 is rejected. The informed reader should be able to understand the purpose of the references to CS 25.305, CS 25.307 and CS 25.571.

Comment	Response
Cmt. *10 / F Fagegaltier* CS 25.621 (c)(1), (2) and (3), CS 25.621 (d)(1), (2), (3) and (4) The addition of an upper limit to the casting factor has no logical justification : only the lower value would be used in the specifications of CS 25.621 (c)(1)(iii), (c)(2)(ii)(A) and (d)(1)(iii). If an applicant elects to comply with a factor of 1.50 instead of 1.0 when complying with 25.621 (c)(1), this would be safe. Therefore, in CS 25.621 (c)(1) and (2), CS 25.621 (d)(1), the upper limits should be eliminated and, in all relevant paragraphs, the text should be 'A casting factor equal to 1.0 (or1.25/1.5/2.0, as appropriate) may be used, provided that'.	Agreed. The upper limits will be deleted.
Cmt. *11 / F Fagegaltier* CS 25.621 (d)(1) (1) The wording 'approved specifications' has already been commented (see comment on 25.621 (a)) and is not appropriate. The materials and processes, as well as manufacture methods, are part of the type design (21A.31). The 'approved specifications that specify the minimum mechanical properties of the material in the casting' are then, simply, the type design. The added value of this sentence is not obvious. A counter proposal for (d)(1)(i) is proposed as follows (i) Compliance of the castings with the minimum mechanical properties of the material, which are specified in the type design, is checked by testing of coupons, on a sampling basis. (2) There is an 'or' between (1) and (i); there is nothing between (i) and (ii) and nothing between (ii) and (iii). Then, the text should be read as (1) or (i) or (ii) or (iii). May be, the intent was to use an 'and'. It is then suggested a new format as follows (1) A casting factor equal to 1.0 may be used, provided that (i) The requirements of CS 25.621 (b)(1) are met, or (ii) (A) Compliance of the castings with the minimum mechanical properties of the material, which are specified in the type design, is checked by testing of coupons, on a sampling basis, (B) Each casting complies with CS 25.621 (e)(1) and (2), (C) Three sample castings are tested according to CS 25.621 (e)(3). Note : addition of 25.621 (e) has been proposed in another comment	1) Agreed. It is agreed that the word “approved” may suggest a certain legal action by the Agency, which is not the intent. What is meant is a specification which is established under a controlled process and accepted by the Agency for showing compliance with this sub-paragraph of CS-25. Therefore the word “approved” will be replaced by “accepted” to better reflect this intent. 2) Noted and partially agreed. The text can be improved to make the intent more clear: “A casting factor of greater than or equal to 1.0 may be used, provided that compliance is shown with subparagraph (c)(1) of this paragraph, or with the following three conditions:”
Cmt. *12 / F Fagegaltier* CS 25.621 (d)(5) What is an 'approved quality control procedure' ? Who is approving it ? The word 'approved' would not be appropriate : with Part 21A.263 (b), anything submitted by the applicant is accepted by the Agency without verification. There is no provision for an 'approval' of such procedures.	Agreed. It is agreed that the word “approved” may suggest a certain legal action by the Agency, which is not the intent. What is meant is a specification which is established under a controlled process and accepted by the Agency for showing compliance with this sub-paragraph of CS-25. Therefore the word “approved” will be replaced

Comment	Response
In addition, (d)(2) and (d)(3) refer to 'percent of its surface' when (d)(5) refers to 'percentage of castings'. These references are different. Therefore, the text of (d)(5) cannot be understood with only the reference to (d)(2) and (d)(3). A counter proposal could be : (5) The percentage of castings surface to be inspected by non-visual methods, in accordance with CS 25.621 (d)(2) and (d)(3), may be reduced when a specific quality control procedure is established and documented.	by “accepted” to better reflect this intent. Noted and partially agreed. With regard to the second comment, the benefit of the approved quality control procedure is that no longer each casting must be inspected, but only a “percentage of castings”. It is however agreed that the current text may be difficult to understand in combination with the texts of subparagraphs (d)(2) and (d)(3). Therefore the following improvement is envisaged: “Not each casting will have to be inspected by non-visual methods in accordance with sub-paragraphs (d)(2) and (d)(3) of this paragraph when an accepted quality control procedure is established.”
Cmt. *13 / F Fagegaltier*	
CS 25.621 The proposal contains references to CS 25.305 without indication of any sub-paragraph. It happens that NPA 11/2004 adds some sub-paragraphs to 25.305. Does this means that 25.621 would also imply compliance with the new sub-paragraphs, with the specified factor in addition to factors defined in 25.302 and appendix K? This should be clarified by cross referencing in 25.621 the exact sub-paragraphs which must be complied with, instead of the not-so-clear reference to 'strength/deformation requirements of CS 25.305'.	Agreed. The text of CS 25.621(c)(1)(iii),(c)(2)(ii),(c)(3)(ii) and (d)(1)(iii) will be improved by referring to the specific sub-paragraphs of CS 25.305.
Cmt. *14 / DGAC, France*	
CS 25.621 (a) The applicability of this paragraph should be clarified in relation to engine and propeller parts.	Noted. CS 25 specifications are not applicable to the engines and/or propellers as covered by the type design as included in the engine or propeller type certificate unless specifically called for in the CS-25 paragraph. The suggestion to transform AMC 25.621(c)(1) into an AMC-20 series AMC will be considered when experience shows a need for this.
B. Proposals	
Paragraph *1(b)*	
Cmt. *1 / FAA, USA*	
Change to read: "The casting factors specified in sub-paragraphs (c) and (d) of this paragraph - ... "	Agreed. The cross-reference is extended to subparagraph (d)

Comment	Response
B. Proposals	
Paragraph *2.*	
Cmt. *2 / F Fagegaltier*	
1 - The entire AMC (content and format) should be adapted after the review of all comments on CS 25.621, for consistency. -I t should be limited to interpretation of 25.621 and should not address means of compliance with other paragraphs (such as 25.307, 25.571, etc). - Paragraphs 2.2, 2.3, 2.4 and 2.5 are misplaced as not related to the title of paragraph 2.	1. Noted and partially agreed. The first comment is proposing an adaptation of the entire AMC after the review of all comments on CS 25.621, for consistency. This is agreed for the 2nd and 3rd bullet item. The 1st bullet is not accepted, because AMC 25.621 only clarifies the relationship between CS 25.621 and other paragraphs of CS 25.
- The use of 'rule', 'must' 'required' should be checked.	2. Noted and partially agreed. With the new text of CS 25.621(d)(5) it should be clear that the AMC does not deviate from the text in Book 1. However it is agreed that the words “approval” need to be replaced by “acceptance” in the AMC as well.
2 - The AMC may not imply an alleviation of the certification specifications 'with the approval of the Agency' (see paragraph 2.3 of the AMC). Possibility for exemption from a 'rule' should be specified in that 'rule' itself.	
3 - The relevance of paragraph 2.5 to interpretation of 25.621 is not obvious. The intent is not to address manufacturing specifications or design drawings.	3. Noted. The intent is to anticipate on the need for weld rework which may affect the casting factor. Therefore the extent of the rework possibilities should be predefined by the applicant.
4 - What are 'pre-production castings' referred to in paragraph 5.2 ? Sub-paragraph 5.2 (d) seems to conflict with Part 21 : production should be made according to the type design defined in 21A.31.	4. Noted. The comment seems to originate from a misunderstanding of the text of sub-paragraph 5.2 (d). It is normal that series production of parts takes place using procedures identical to those used for the parts employed for the proof of concept.
5 - Paragraph 7 does not recognise the fact that changes to processes associated to materials are controlled by means of the procedures of subpart D of Part 21. The wording 'this should be approved', which is found in paragraph (b) of table 1, is not consistent with EASA regulations which obliges Agency’s acceptance without verification of data presented by DOA holders (21A.263 (b)). The AMC to 25.621 should be limited to interpretation of	5. Noted and partially agreed It is commented that under Part 21A.263(b) there is no place for approval of the test specification by the Agency. This observation is not correct since the acceptance by the Agency in accordance with 21A263(b) is conditional on 21A257(b) which allows for verification by the Agency of compliance statements. It is agreed that the words “this should be approved” in paragraph (b) of table 1 are superfluous and these will be deleted
GENERAL COMMENT(S)	
Paragraph ---	
Cmt. *15 / CAA, UK*	
No comments.	Noted
Cmt. *16 / ACG, Austria*	
No comments	Noted.