

DISPOSITION OF INTERDIRECTORATE COMMENTS

DRAFT AC 25.851-X, *Built-in Fire Extinguisher/Suppression Systems in Class C and Class F Cargo Compartments*

FAA Contact: Steve Happenny, ANM-112, stephen.happenny@faa.gov

No.	Comment	Requested Change	Disposition
Commenter: John Neff, ANM-160S, (425) 917-6521			
1	Para 6.2.5, Page 3: First two referenced regulations are not in numerical order.	Reorder regulations; place 25.855(h) before 25.857(f).	Agree. Change made.
2	Para. 6.3.2, Page 4: Mid paragraph the term “should” is used on two occasions. Seems the term “shall” would be more appropriate (even though this is an AC). Just a thought!	Change “should” to “shall” in two locations.	Disagree. Latest Order of 1320.46D, writing guidance, and plain language mandates discourage the use of <i>shall</i> because it is ambiguous. We use <i>must</i> only when it refers to a regulatory requirement. <i>Should</i> is used when it is recommended but not required.
3	Para. 8.5, Bottom of page 7 & top of page 8: Last sentence of page 7 states that “Airplane climb flight phase and the descent flight phase no data need be acquired during these transient flight phases” Do we really want to encourage no data collection for those conditions? Accuracy is still good, and the effects of “sloshing” and changes in incoming/outgoing airflow can be seen, this is still good point concentration data that could be useful.	Delete the subject sentence and the “However” at the beginning first full sentence of page 8.	While the original proposed language agrees with the current European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) on this subject, we concur with the intent of the comment and acknowledge that these data would be useful to review as part of certification. The historical means to measure fire suppression/extinguishing agent concentration has been via the use of a binary gas analyzer (e.g., Halonizer, Statham-derivative analyzer, etc.). Length of sampling tubes, response of the analyzer, the need for calibration curves at different altitudes, etc., have all resulted in difficulty in obtaining or showing an absence of data during transient airplane conditions. However, other means may be developed that overcome these difficulties and enable real-time measurements of concentration during all phases of flight. Rather than delete the sentence, we believe that it is more appropriate to provide additional clarification. So, in lieu of deleting the sentence as suggested, we will

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			<p>revise the sentence to state:</p> <p><i>Airplane climb flight phase and the descent flight phase represent dynamic environments and historically have represented a challenge for accurate data acquisition. While real-time data should be acquired during all phases of airplane flight, applicants may submit the results of analysis for these transient flight phases if the intended instrumentation would preclude accurate data acquisition and the FAA agrees with the use of the instrumentation.</i></p>
4	<p>Para. 8.5: Revise “NOTE” to read as in “Requested Change” (new text in bold).</p>	<p>NOTE: Due to EPA restrictions, an FAA approved/accepted halon simulant, such as HFC-125, should be used....</p>	<p>Agree. Change made to paragraph 8.8 (new number):</p> <p><i>Note: Due to EPA restrictions, an FAA-accepted halon simulant, such as HFC-125, should be used for testing (see section 11 of this AC).</i></p>
5	<p>Para. 9.2, Page 8: Third sentence refers to “several factors” but does not state or discuss what they are.</p>	<p>Add description or test of what those “factors” are, or delete the sentence.</p>	<p>While this language is present in the EASA AMC and the Federal Aviation Administration (FAA) strives to harmonize our advisory material with that of EASA, we agree with the intent of the commenter.</p> <p>The factors in question include the cargo load factor, the location of any leakage paths within the cargo compartment such as seals around cargo loading door, light fixtures, etc. Any leakage path that permits fire suppression agent to exit the cargo compartment or allows air to enter the cargo compartment or internal discontinuity (i.e., presence of cargo) will change the local concentration.</p> <p>We revised the paragraph to clarify:</p> <p><i>8.2 The cargo compartment should be empty for the</i></p>

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			<p><i>above tests. However, as shown in figure 1 of this AC, the fire extinguishing agent concentration level decreases more quickly in a compartment with cargo than it would in the same compartment without cargo. This is because discharging the same quantity of fire extinguishing agent into a smaller volume results in a larger percentage of extinguishing agent by volume. For a cargo compartment with a constant leakage rate, the result of the smaller volume and constant leakage rate will be that the fire extinguishing agent concentration level decreases more quickly. The duration that the concentration is maintained (or conversely, how quickly it decreases) depends on several factors (e.g., cargo load factor, location of leakage within the cargo compartment such as seals around cargo loading door and light fixtures, etc.). Rather than requiring numerous flight tests with varying load factors to demonstrate compliance, applicants may conduct analysis to account for these effects as shown in figure 2 of this AC.</i></p>
6	<p>Para. 9.2, Page 8: The fourth sentence states “Even with a “pure” dump system, having cargo does not necessarily mean a marginally performing system during an empty cargo compartment test will result in a “bad” system with cargo.”... but then it could mean just that...not sure what the benefit is of having this sentence...</p>	<p>Delete the fourth sentence or expand to cover what to do if the data shows that the system could be “bad” with cargo.</p>	<p>While this language is present in the EASA AMC and the FAA strives to harmonize our advisory material with that of EASA, we agree with the commenter that there are numerous scenarios that could occur, depending on the specifics of the fire suppression system. In general, the presence of cargo in a cargo compartment when conducting volumetric concentration tests results in higher concentrations (i.e., than required for knock-down) being measured. Cargo compartment fire suppression design typically assumes an empty compartment as this represents the maximum amount of agent necessary to initially knock-down the flames and</p>

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			<p>then to ensure an inert environment to prevent growth of the fire. The presence of cargo results in less volume available for the same quantity of agent present, resulting in higher volumetric concentrations. Other results are possible depending on the fire suppression system design and airplane operations.</p> <p>We revised the paragraph as stated in the previous comment.</p>
7	<p>Para. 9.8, Page11: Last sentence states “For example, cargo compartment door seals present during the flight test should reflect the worn state prior to replacement according to instructions for continued airworthiness”. REALLY?? I AGREE that this SHOULD be a requirement, but have NEVER seen this done in flight test. In my experience, the applicant ensures that all seals are brand new and they use tape and “pucky” to seal every hole, crack and crevice that they can find to enhance the ability to pass to the point of being ridiculous. I called the applicant on the issue, stopped the test and requested a new conformity with drawings revised to address all of the “touchups” made and was told (by senior FAA Mgt.) ” to “cease and desist” any such activities.....</p>	<p>If this is truly a requirement, then the word “should” needs to be revised to “shall.” If not a requirement, just a recommendation” then leave as written. I do believe that this SHOULD be a requirement....</p>	<p>As stated in paragraph 2.2, the material in this advisory circular (AC) is <i>neither mandatory nor regulatory in nature and does not constitute a regulation. It describes acceptable means, but not the only means, for demonstrating compliance with the applicable regulations. The FAA will consider other methods of demonstrating compliance that an applicant may elect to present.</i></p> <p>We believe that the clarification provided by this material represents a reasonable test condition. This clarification is based in part on discussions with other regulatory authorities and industry.</p> <p>However, we have revised the sentence to read:</p> <p><i>8.8 Prior to flight testing and during the conformance inspection of the airplane, it should be confirmed that the cargo compartment door seals represent a worn state per maintenance instructions provided by the airplane manufacturer for seal replacement.</i></p>
8	<p>Para. 9.8, Page 11 “Note”: Revise as noted above in comment No. 4 - Revise “NOTE” to read as in “Requested Change” (new text in</p>	<p>NOTE: Due to EPA restrictions, an FAA approved/accepted halon simulant, such</p>	<p>Agree. The sentence following the new paragraph number 8.8 is revised to read:</p>

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	bold).	as HFC-125, should be used....	<i>Note: Due to EPA restrictions, an FAA-accepted halon simulant, such as HFC-125, should be used for testing (see section 11 of this AC).</i>
9	Para 12.1, Page 14: Next to last sentence, change the word affective to effective .	Revise word to affective” to “effective.”	Agree. Change made.
10	Para. 12.3.5, Page 15: “Conductance” is usually an electrical or fluids term.	Revise the term “conductance” to “conduct.”	Partially agree. We revised the sentence in this paragraph, which is now 11.3.4, to read: <i>Note: Any unique observances during development testing or minimum performance standards testing will need to be addressed appropriately prior to the start of airplane certification testing.</i>
11	Para. 13.1, Page 16: First sentence says “to combat the fire anywhere where baggage and cargo”.....	Revise to delete the word “where.”	Agree. Deletion made.
12	Para 14.1, Page 17: This is the first use of the acronym AFM I see.	Spell out “Airplane Flight Manual”	Disagree. We defined the acronym on page 12, paragraph 8.7.
13	Para 14.2 Page 17: This is the first use of the acronym ETOPS I see.	Spell out “ExTended OPerationS” (or the old versions: Engines Turn Or Pax Swim / Engines Turn or Packages Swim).	Disagree. We defined the acronym on page 6, paragraph 7.1.
14	Para. 15.1, Page 18: Revise the second sentence as shown with changes in bold (current verbiage seems awkward) - “Especially, pallets may be loaded higher than certificated....	Revise the word “Especially” to something like “ Of concern is that pallets may be“ or “ A major concern is that pallets...”	Agree. Deleted <i>Especially</i> and changed <i>may be</i> to <i>have been</i> since it is an example of what <i>experience has shown</i> in the first sentence. It now reads: <i>Pallets have been loaded higher than certified....</i>
15	All in all VERY well done!! A lot of really		No change requested.

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No.	Comment	Requested Change	Disposition
	good information all in one place. Great job!		

No.	Comment	Requested Change	Disposition
Commenter: Francis Smith, ANM-150S, Cabin Safety/ECS, (425) 917-6596			
1	<p>The following two statements may suggest conflicting points:</p> <p>“A Class F compartment (see § 25.857(f)) is one that has a means to control or extinguish a fire without requiring a crewmember to enter the compartment.”</p> <p>&</p> <p>“Class B and Class F cargo compartments are limited to the main deck for accessibility reasons.”</p>	<p>Paragraph 7.6</p> <p>Recommend: rewording of either/both sentences or some additional clarification to avoid confusion.</p>	<p>Agree. We made changes to both paragraphs, which are now 6.2 and 6.6 to clarify. Both Class B and F are limited to the main deck.</p>
2	Minor change.	<p>Paragraph 12.1, fifth sentence</p> <p>Change:</p> <p style="padding-left: 40px;">Is: “An affective simulant (HFC-125)...”</p> <p style="padding-left: 40px;">Should be: “An effective simulant (HFC-125)...”</p>	<p>Agree. Change made.</p>
3	Clarity suggested for placement of markings and placards.	Paragraph 15.2, second sentence	<p>We partially concur. The markings and placards should have the indicated properties independent of the specific</p>

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		<p>Change:</p> <p style="padding-left: 40px;">Is: “Markings and placards should not be easily erased, disfigured, or obscured.”</p> <p style="padding-left: 40px;">Should be: “Markings and placards should not be easily removed, disfigured, or obscured during normal loading and carriage operations.”</p>	<p>airplane operations. Therefore, the text will be changed to read:</p> <p><i>Markings and placards should not be easily erased, removed, disfigured, or obscured.</i></p> <p>However, we do not agree with adding the additional text, <i>during normal loading and carriage operation</i>. The FAA does not want the markings and placards to be easily removed, disfigured, or obscured at any time for any reason. Including the text, <i>during normal loading and carriage operation</i> might be misinterpreted that it would be acceptable to permit removal or disfiguring during other normal operations or for certain abnormal conditions. The current text is considered to be more stringent than the commenters suggested text to limit it to certain operations.</p>

No.	Comment	Requested Change	Disposition
	Commenter: Shannon Lennon, ANM-100B, (425) 917-6436		
1	Under Section 8.0, there does not appear to be any information or reference to an alternate resource for testing concentration levels should testing be conducted with a simulant such as HFC-125.	Provide information relevant to testing utilizing a simulant or make reference to Section 12 of the AC for more information.	We concur with the intent of the comment. We added a reference to section 11 (previously section 12) to the note at the end of section 7 (previously section 8). Section 11 refers to the reference guidance from the FAA Technical Center in paragraph 4.4.6. Section 11 and the referenced documents provide further explanation on the use of HFC-125 as a simulant. No

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			additional action will be taken.
2	In Figure 2, the equation for effective time for one air change should be explained for clarity.	Provide the equation for this effective time for clarity.	<p>We will provide the following explanation in the first paragraph following figure 2 (8.4) to describe the effective time. However, as explained below, the actual value of the effective time depends upon the specific design of the cargo compartment. We have revised this paragraph to read:</p> <p><i>8.4 This simulation of cargo loading assumes that the Halon 1301 concentration is homogeneous throughout the compartment, and that the volume taken up by the loaded cargo is uniformly distributed throughout the compartment. Both of these assumptions are not true in an actual loaded compartment, so caution should be exercised to relate the measurements taken to an actual loaded compartment in flight. Figure 2 shows a time history of the volumetric concentration of a fire extinguishing agent (Halon 1301) in a cargo compartment with various percentages of cargo loaded. Historically, the time that it takes for the airplane ventilation system to completely replace the volume of air in a cabin or cargo compartment has been called the air exchange rate. The effective time used in figure 2 of this AC refers to the time that it would take to completely remove the entire quantity of fire suppression agent once it is discharged. This depends on the specific design of the cargo compartment (e.g., volume of the compartment, the amount of cargo present, sources of air entry, and sources of air and suppression agent leakage).</i></p>
3	Section 9.8 indicates the expectation that flight	Provide instruction/definition on how cargo	We concur with the intent of the recommendation.

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	<p>testing should be conducted with cargo compartment door seals that reflect the worn state prior to replacement. There is no further information to indicate how this would be verified.</p>	<p>compartment door seals can be verified that they reflect a suitable worn state for testing purposes.</p>	<p>However, there is no industry standard that addresses when worn cargo compartment door seals should be replaced. Those maintenance instructions are provided by the airplane manufacturer. Prior to flight-testing and during the conformance inspection of the airplane, it should be confirmed that the cargo compartment door seals represent a worn state just prior to replacement.</p> <p>The following text will be added:</p> <p><i>Prior to flight testing and during the conformance inspection of the airplane it should be confirmed that the cargo compartment door seals represent a worn state per maintenance instructions provided by the airplane manufacturer just prior to seal replacement.</i></p>
4	<p>Section 13.6.2 provides an example where the maximum protection time provided by the cargo fire extinguishing system does not agree with the example for maximum planned diversion time excluding the 15-minute allowance.</p>	<p>Please check example 2 in Section 13.6.2 for accuracy.</p>	<p>We confirmed that the example is accurate as written. Section 13.6.2 (now 12.6.2) example presents a case where the maximum protection time afforded by the cargo compartment fire suppression system does not agree with the airplane planned route diversion structure. As noted below the table, <u>the intent of this example was to show a suppression system that would not support the planned route.</u> The example shows the maximum suppression time demonstrated via certification flight test as 68 minutes; however, the required diversion time is 75 minutes. The suppression system does not provide the needed protection for that diversion and that route structure should not be approved. Or, the FAA could approve the route if additional suppression agent was provided that would extend the suppression time to 75 minutes. Clarification was added following <i>68 minutes</i> that says, <i>(less than the maximum planned diversion time)</i>. We also added to the</p>

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			Note: <i>The FAA could approve the route if additional suppression agent was provided that would extend the suppression time to 75 minutes.</i>

No.	Comment	Requested Change	Disposition
	Commenter: L.B. Taylor, ACE-100		
1	Page 2, Paragraph 4.1 cites 25.851(b), but both (a) and (b) will be changed.	Delete (b).	Agree. (b) deleted.

No.	Comment	Requested Change	Disposition
	Commenter: AIR-500		
1.	Cover page/Last page Missing reference to AC feedback template and the template itself. Per AIR-501 instructions	Add reference to feedback template on the cover page and include the template as a new appendix on the last page.	We agree that the first page of the AC should refer to the feedback form and have made that change as proposed. However, we disagree that it should be labeled as an appendix. The AC and appendices should provide guidance on complying with Title 14, Code of Federal Regulations (14 CFR). Since the feedback form does not contain guidance related to the regulations, we believe it is more appropriate to keep it as an attachment

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			to the AC.
2.	Cover page: There is no signature block in this draft AC. As per the template (5.10.1.2), an AC with an introduction/cover page has the signature block 5 lines below the opening paragraph on the cover page. Incorrect format	Insert signature block with name, title, and organization.	This information will be inserted at the time the AC is ready for signature.
3.	Page ii, Table of Contents Refer to this section as the “Table of Contents” as opposed to “Contents.” Clarity and consistency with other documents	Change title to read “Table of Contents”	Disagree. <i>Contents</i> is an acceptable alternative and more commonly used today. (See the GPO Style Manual or Chicago Manual of Style.) No change made.
4.	Page 1, paragraph 1 The term “Advisory Circular” has already been defined. Refer to acronym after the term has been previously defined	Replace “Advisory Circular (AC)” with “AC” in the first sentence.	Agree. Change made.
5.	Page 1, paragraph 3 The "Cancellation" section implies just one "FAA policy" is cancelled by this AC. Clarity.	Since more than one policy is cancelled, change to "...FAA policies are cancelled by this AC."	Agree. Changed <i>FAA policy</i> to <i>FAA policy memoranda...</i>
6.	Page 2, paragraph 4.2, Advisory Circulars." has already been abbreviated. Refer to acronym after the term has been previously defined	Use the acronym and strike the full wording for this subheading: "FAA ACs."	Agree. Change made.

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7.	Page 2, paragraph 4.2. Recommend rewriting to refer to the latest revision of the listed documents as opposed to listing the revision level and date in this AC. Extend currency of document.	Rewriting to refer to the latest revision of the listed documents. Delete revision level and dates from the documents listed.	Disagree. The intro paragraph explains that this is the current version and that the reader should refer to the latest version. By referring to the version that was available at the time of publication of this AC, the reader may be better able to understand it in context.
8.	Page 2, paragraph 4.3 The template shows "FAA Orders." as a subheading in bold for this new section -- even with just one entry. Incorrect format.	Please insert "FAA Orders." as a subheading in bold for 4.3 (as per 3.1 of template) and insert a bullet for the order.	Agree. Format change made.
9.	The text under "Definitions." is not a definition. Is there a better way to highlight the two terms "extinguishing system" and "suppression system"? Clarity.	Please see if you can better highlight these two terms so that the reader's eyes are drawn to them. Possibly retitle the paragraph.	Rather than retitling the paragraph, we added a note to the Purpose paragraph where those terms are first used.
10.	Page 3, paragraph 6.2 A comma is missing after the series of part 25 sections listed. Typo.	Please add a comment after "...and 25.857, a Class F..."	Agree. Comma added.
11.	Page 5, paragraph 7.2 Missing comma. Grammer.	Insert a comma in the first sentence between "flight" and "but"	Disagree. This is a compound predicate, not two independent clauses, so a comma is not needed.
12.	Page 7, paragraph 8.3 The font for the paragraph number is with strikethrough/deletion marks. Typo.	Remove strikethrough font	Agree. Strikethrough removed.

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13.	Page 7, paragraph 8.4 In the 6th line, the word "assure" is the wrong word for this sentence. Incorrect word usage.	Please replace "assure" with "ensure"	Agree. Change made.
14.	Page 7, paragraph 8.5, 4 th sentence Possessive case needed. Grammar.	Rewrite to read "...documented in the applicant's certification plan."	Agree. Change made.
15.	Page 8, paragraph 9.1 and Universal The use of "i.e." (id est (i.e.), that is, "That is (to say)") inside the parentheses here and many places below does not seem to be the proper choice if what is meant is "as per" some section of the CFR. Grammar	Please consider striking each usage of "i.e." and replace with "as per."	Agree, all instances checked and corrected, as necessary.
16.	Page 8, paragraph 9.2, second sentence The reference to figure 1 should be in lowercase. Per template	Rewrite as "figure 1"	Agree. Change made.
17.	The figure should appear immediately after being referenced. This paragraph refers to figure 2, so figure 2 should be located to immediately follow paragraph 9.3.	Move figure 2 to the space between paragraphs 9.3 and 9.4.	Agree. Paragraph moved.
18.	Page 10, figure 2 The text located in the shaded part of this	Reformat the figure so that the key can be more easily read.	Agree. We reformatted the picture.

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	figure is difficult to read. Clarity		
19.	Page 11, paragraph 9.8 The term STC has already been defined. Refer to acronym after the term has been previously defined	Replace “supplemental type certificate (STC)” with “STC”.	Partially agree. “Supplemental type certificate” is only used twice in this AC. We deleted the acronym in this paragraph, so it is spelled out in both instances.
20.	Page 11, "Note:" after paragraph 9.8 The same note is used here as above in the text. Is that intentional? Clarity.	Adjust as appropriate if appropriate.	Yes, the text and the note appear in multiple sections. Designated engineering representatives and others interested in the contents of the AC typically focus on a specific section. For example, someone who wants to conduct a fire suppression agent concentration test in a cargo compartment via the use of a simulant may only review the section in the AC pertaining to the use of simulants. We believe that certain key points and notes are worth repeating. No change made.
21.	Page 11, paragraph 10.1, 5 th sentence. EU stands for “European Union.” Incomplete acronym definition.	Replace “European (EU)” with “European Union (EU)”	Agree. Addition made.
22.	Page 11, paragraph 10.2, 1 st sentence In this case, the term halon should not be capitalized. Consistency with rest of document.	Rewrite “Halon” as “halon”	Agree. Change made.
23.	Page 11, paragraph 10.3 At the end of the 11th line, a comma is used	Please remove the comma used in: "...now carries the name,"	Agree. Change made.

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	that should be removed. Grammar.		
24.	Page 12, paragraph 10.4.4 The word "which" is used when what follows is essential to the understanding of the sentence. Grammar.	Please replace "which" with "that."	Agree. Change made.
25.	Pages 12-13, paragraphs 10.5, 10.6, and 10.7 The word "which" is used when what follows is essential to the understanding of the sentence. Grammar.	Replace the colons with periods	Agree. Change made.
26.	Page 12, paragraph 10.5.1 and universal. Several times in the text it states: "An analyzer (for example, Statham-derivative analyzer)..." Since "i.e." was used above, "e.g." could be used in each case here to replace "for example." Clarity.	If appropriate, replace "(for example...)" with "(e.g., Statham...)"	Agree. Changes made to all instances.
27.	Page 14, paragraph 12.1 In the 10th line, the word "affective" is used to describe "simulant." This seems to be the wrong word choice. Incorrect word usage.	Replace "affective" with "effective" (since the former means "relating to, arising from, or influencing feelings or emotions")	Agree. Change made.
28.	Page 15, paragraph 12.3.5 Rewrite for clarity. Plain Language.	Rewrite to read "Any unique observations noted during development testing or during the conduct of the minimum performance..."	Agree. Deleted "conductance of the..." The sentence makes sense without either "conductance" or "during conduct of..."
29.	Page 15, paragraphs 12.5, 12.6, and 12.7	Replace the colons with periods	Agree. Changes made.

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	Paragraph titles should be followed by a period. Per template		
30.	Page 16, paragraph 13.1 At the end of the first line, a comma is used where there should be no comma. Grammar	Please remove comma after the word "mean"	Agree. Change made.
31.	Page A-3 The reference to "figure A-1" comes after the actual figure appears in the text. Incorrect format.	Please move figure A-1 such that the reference to "figure A-1" comes before the figure in the text (after A.3.4).	Agree. Moved figure to follow A.3.4.
32.	Page B-1 Document titles should be italicized. Consistency in format.	Italicize document titles	Agree. Changes made.
33.	Page B-1 Why aren't these documents included in paragraph 4? It would be clearer to the reader for all referenced documents to be located in one location.	Incorporate the documents referenced here into paragraph 4	Agree. References moved to section 4.