Disposition of Public Comments
Type Certification Policy for Approval of Use of Type II, III, and IV Deicing/Anti-Icing Fluids on Small and Transport Category Airplanes

	Comment	Requested Change	Disposition
1.	Airbus (1 of 23) "Current Regulatory and Advisory Material" The given sections of part 25 certification regulations do not require evaluation by any means including flight testing of thickened anti/de-icing fluids before they can be used operationally. In addition part 25 guidance material does not include such considerations. For certification the accepted means of compliance for the given part 25 regulations have never included the effect of thickened fluids. The draft policy statement is not in accordance with the provisions of paragraph 2.2 of FAA Order IR 8100.16. Note Airbus has not proposed any changes with part 23 regulations. This is purely as Airbus is unfamiliar with them and should not be construed as agreement.	The applicable regulations in 14 CFR parts 23 and 25 are: • § 23.143(c) and **~~§ 25.143(d)~~** Controllability and Maneuverability – General • § 23.251(b) and **~~§ 25.251(d)~~** Vibration and Buffeting • § 23.1529 and § 25.1529 Instructions for Continued Airworthiness • § 23.1581 and **~~§ 25.1581~~** Airplane Flight Manual and Approved Manual Material — General • **~~§ 25.1587 Performance information~~** • Appendix G to part 23 **~~and appendix H to part 25~~** Instructions for Continued Airworthiness	The use of Type II, III, and IV deicing/anti-icing fluids on both small and transport category airplanes raises safety concerns and have resulted, in a couple of instances, in the issuance of Airworthiness Directives as well as other safety actions. The level of analysis and review of these particular fluids may not have been accomplished in previous programs or considered at the time the applicable rules were developed. However, the noted 14 CFR part 23 and part 25 regulations are applicable performance standards that encompass the resulting effect from the introduction and use of these fluids. Specifically, § 25.1581(a)(2) requires furnishing information in the airplane flight manual (AFM) that is necessary for safe operation because of design, operating, or handling characteristics. If the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics, that information must be furnished in the AFM. The applicable regulations cited in the policy statement are the performance standards by which it can be determined whether the operating or handling characteristics may affect safe operations when Type II, III, or IV deicing/anti-icing fluid is applied. Appendix H to part 25 requires information to be provided in the Instructions for Continued Airworthiness on the types of fluids to be used and scheduling information for cleaning and inspecting each part of the airplane. We consider Type II, III, and IV deicing/anti-icing fluids to be fluids covered by these requirements.

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			We did not make any changes to the policy statement in response to this comment.
2.	Airbus (2 of 23) Page 12, "Effect of Policy," 1st paragraph The applicability of the policy statement is unclear; there are contradictions regarding applicability highlighted in later comments. Airbus requests the second part of this paragraph to be deleted as, contrary to the first sentence, there is an unclear divide between this policy statement and certification rulemaking. This is not in accordance with the provisions of paragraph 2.2 of FAA Order IR 8100.16.	Effect of Policy The general policy statement stated in this document does not constitute a new regulation. The FAA personnel who implement this policy statement should follow it when it is applicable to a specific project. **~~If an applicant's proposed method of compliance is outside this policy statement, the project aircraft certification office must coordinate it with the policy statement issuing office using an issue paper. Similarly, if the project aircraft certification office becomes aware of reasons that an applicant's proposal that meets this policy statement should not be approved, the office must coordinate its response with the policy statement issuing office.~~**	We added a new section, "Applicability," to clarify the applicability of each of the evaluations covered by this policy statement. The paragraph in the "Effect of Policy" section that Airbus commented on is both consistent with other portions of the policy statement, and it is consistent with how other means of compliance guidance material is applied. We revised the paragraph, but not in response to this comment.
3.	Airbus (3 of 23) Page 4, "Relevant Past Practice," 2nd paragraph It is not accurate to state that the effects of Type II and IV fluids are unknown for aircraft with rotation speeds below 100 knots. It is however true that these fluid types are not evaluated using the low speed ramp test described in AS 5900.	However, Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900, so the aerodynamic effects on airplanes with a takeoff rotation speed of less than 100 knots are **~~unknown~~** **not evaluated as defined in AS5900**.	We agree. We changed the text in a manner similar to what Airbus suggested. We also changed the speed value from 100 knots to 110 knots to be consistent with SAE AS 5900.
4.	Airbus (4 of 23) Page 4, "Relevant Past Practice," 3rd paragraph The practices described in this paragraph are not true of Airbus. Whilst Airbus cannot be aware of all of the details and practices of all other manufacturers we do not believe this practice described by the FAA to be typical.	**Some of** **~~Typically~~**, the type certificate holder**s** **have** evaluated the effect of fluids on airplane takeoff performance and handling characteristics…	We changed the text in a similar manner as what Airbus suggested.

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5.	Airbus (5 of 23) Page 4, "Relevant Past Practice," 4th paragraph To the best of Airbus's knowledge all of the incidents reported were for turbo-propeller aircraft with unpowered flight controls. The cause of these problems is believed to be due to contaminants causing aerodynamic effects on the control surfaces. Problems have never occurred with powered flight controls.	The FAA received reports of safety concerns regarding **some turbo-propeller** airplanes **with unpowered flight controls when** treated with thickened anti-icing fluids. Those reports came from flightcrews that conducted rejected takeoffs after their airplanes were treated with thickened anti-icing fluids.	We do not consider the type of propulsion system used by the airplane to be relevant to the issue of fluid effects on the flight controls. We revised the text to clarify that the airplanes associated with the reports were certain airplanes with unpowered longitudinal flight controls.
6.	Airbus (6 of 23) Page 4, "Relevant Past Practice," 5th paragraph See Airbus comment 5. Additionally, it is not completely correct to state that there is a "100-knot minimum rotation speed needed to use Types II and IV anti-icing fluid." Approximately 100 knots is towards the lower end of the speed range of testing thickened fluids described in AS 5900, it is not defined as a lower limit for operational use.	~~**A c**~~**C**ommon factor**s** in these incidents ~~**is**~~ **are the rotation speeds which are close to 100-knots and the airplane configuration**; ~~**which were below, at, or slightly above the 100-knot minimum rotation speed needed to use Types II and IV anti-icing fluids**~~. ~~**In addition,**~~ the airplanes involved were all **turbo-propeller** equipped with unpowered elevator flight controls.	We revised the text for clarity. We also changed the speed discriminant from 100 knots to 110 knots to be consistent with SAE AS 5900. We consider the type of propulsion system used on the airplane to be irrelevant to this issue. Therefore, we did not add the reference to turbopropeller airplanes that Airbus suggested.
7.	Airbus (7 of 23) Page 5, "Relevant Past Practice," 7th paragraph Airbus aircraft have had no recorded issues relating to frozen re-hydrated fluids. This is believed to be due to using powered fly-by-wire control surfaces. It should also be noted that there is an industry belief that most of the problems caused by residues were during one season of unusual weather. Since then there has been improved operator awareness, inspection, and cleaning.	In addition to the effect of thickened fluids on takeoff performance and handling characteristics, European operators reported a large number of stiff or frozen flight control system events. These events occurred with ~~**both powered and**~~ unpowered flight control systems.	As stated in the policy statement, these events have occurred on airplanes with powered as well as unpowered flight control systems. We did not make any changes in response to this comment.

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8.	Airbus (8 of 23) Page 5, "Relevant Past Practice," 8th paragraph To the best of Airbus' knowledge, the Airbus fleet has no recorded issues relating to frozen re-hydrated fluids. This is believed to be due to using powered fly-by-wire control surfaces. It should also be noted that there is an industry belief that most of the problems caused by residues were during one season of unusual weather. Since then there has been improved operator awareness, inspection, and cleaning.	When the residue of the evaporated thickened fluid is re-hydrated by humidity, rain, or washing the airplane, it may freeze and ~~**lock**~~ **reduce movement of** the control surface when the airplane climbs to altitudes where temperatures are below freezing. Re-hydrated fluid has been found in and around gaps between stabilizers, elevators, tabs, and hinge areas. **Residues have also been detected on cables and pulleys for control surfaces.** This issue has not been reported by North American operators because those operators deice with heated mixtures of Type I fluid and water that remove residues; therefore, the residues never get a chance to accumulate.	We clarified the text to state that movement of the flight control surfaces has been restricted rather than locked. We also added text to identify other areas where residues have been detected (e.g., flight control actuators, cables, and pulleys, and in control surface balance bays).

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9.	Airbus (9 of 23) Page 6, "Policy," 1st paragraph Airbus believes that the testing and approval of fluids should not be a part of aircraft type certification. Fluids are tested for aerodynamic acceptance as described in AS 5900, this testing does not require additional testing within the aircraft type certification process. Furthermore it would be impractical to test all fluid types from all fluid manufacturers. The testing of a fluid representing all fluid types II and IV (or III) may be more pragmatic. This policy statement constitutes a change in the icing regulations. Testing of the effects of de-icing fluids has not normally been performed because FAR 25 and CS 25 do not demand it. Flight testing is not the only possible means of compliance, wind tunnel or computational analysis may also be acceptable means of compliance.	The safety of using Type II, III, or IV deicing and anti-icing fluids should be addressed before operational use of such fluids is authorized. ~~**It is recommended, but not required, that the fluids be tested during the airplane's type certification process**~~. If using thickened fluids results in significant or unusual flight or ground handling characteristics, this information ~~**must**~~ **should** be provided in the AFM in accordance with §§ 23.1581 and 23.1585, ~~**or §§ 25.1581 and 25.1587, as applicable**~~. To make this determination, applicants should **consider** ~~**conduct**~~ **performing** flight test **or analysis via another means such as CFD or wind tunnel testing**. In addition, applicants should provide the information identified later in this policy statement in the Instructions for Continued Airworthiness (ICA). The specific fluid~~**s**~~ **types** that have been approved should be identified in the AFM, and the use of other fluid~~**s**~~ **types** should be prohibited.	Type II, III, and IV deicing/anti-icing fluids that have been tested for aerodynamic acceptability as described in SAE AS 5900 have resulted in the issuance of Airworthiness Directives as well as other safety actions on both small and transport category airplanes. The applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address safety issues. Section 25.1581(a)(2) **requires** furnishing information in the AFM that is necessary for safe operation because of design, operating, or handling characteristics. If the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics, § 25.1581(a)(2) **requires** that information to be furnished in the AFM. This policy statement describes the safety issues associated with the use of Type II, III, and IV deicing/anti-icing fluids and provides a means for determining, during the type certification process, if the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations. Because the safety issues with fluids involve dynamic phenomena interacting with flight control design, we do not believe that these issues can be addressed through analysis or simulation. However, as stated in the "Effect of Policy" section, an applicant can propose a different means of compliance through use of an issue paper. No changes were made to the policy statement in this area. We agree that testing of all fluids of each type would be impractical and unnecessary. We revised the policy statement accordingly.

	Comment	Requested Change	Disposition
10.	Airbus (10 of 23) "1. Takeoff Performance," paragraph 1 (page 6) "Therefore, for airplanes with takeoff rotations speeds less than 100 KCAS, the effect of Type II and Type IV fluids on takeoff speeds and distance should be determined." "2. Controllability," paragraph 7 (page 7) "For airplanes with reversible longitudinal controls, the control forces during takeoff and climb should be shown to comply with § 23.143 or § 25.143 (as applicable). For airplanes with reversible control surfaces, thickened fluids may require the pilot to apply additional longitudinal control forces during takeoff rotation and climb a. For airplanes with reversible longitudinal controls…"	It is not clear what the applicability of this draft policy statement is as various criteria are used and the criteria differ throughout the document. Airbus requests that this is clarified.	We added a new section, "Applicability," to clarify the applicability of each of the evaluations covered in this policy statement.
11.	Airbus (11 of 23) Page 6, paragraph 1, "Takeoff Performance." Fixed pitch angle takeoffs have been discussed several times within the SAE G12 Aerodynamics Working Group, where it is felt that fixed pitch angle takeoffs are too conservative. Fixed pitch angle takeoffs are typically at a higher angle of attack and lower rotation speed than "normal" takeoffs. Fluid flow-off is a function of time to rotation and aerodynamic shear forces, both of these are reduced with fixed pitch takeoffs.	~~**Fixed Pitch Angle**~~ **Takeoffs.** Perform **normal** takeoffs at ~~**fixed pitch angles**~~ with and without thickened fluid applied. ~~**Test several pitch angles representing the range of pitch angles at liftoff**~~.	We agree and replaced the method of evaluation from takeoffs at fixed pitch angles to normal takeoffs under "Lift Loss Determination."

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12.	Airbus (12 of 23) Page 8, 4th paragraph under "b. Takeoff Angle-of-Attack (AOA) Margin Tests." "Also conduct simulated one-engine-inoperative takeoffs, with maximum takeoff flap and rotation at V_R." Is this symmetrical all engines operating with reduced thrust of with one engine inoperative?	Please clarify, either: Also conduct simulated one-engine-inoperative takeoffs **with both engines set to reduced power**, with maximum takeoff flap and rotation at V_R. Or Also conduct simulated one-engine-inoperative takeoffs **with one engine set to flight idle** with maximum takeoff flap and rotation at V_R.	We added a note stating that the one-engine-inoperative condition can be simulated by conducting the test with all engines operating, but with the engines at reduced power or thrust.
13.	Airbus (13 of 23) "2. Controllability," pages 7-8 2(a)1 Control power and control force during rotation at the scheduled V_R 2(b)1 Control power and control force during rotation at the scheduled V_R	Please clarify that the whole of section 2 only applies to aircraft with unpowered, reversible flight controls.	We added a new section, "Applicability," to clarify the applicability of each of the evaluations requested by this policy statement. As noted in the new "Applicability" section, all of paragraph 2 applies only to airplanes with reversible flight controls.

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14.	Airbus (14 of 23) Page 9, section 3, "Vibration and Buffeting" "To evaluate potential effects of thickened fluids on vibration and buffet, the evaluation tests should include flights to V_{MO} as soon as practicable after takeoff. The evaluation must meet the vibration and buffeting requirements of § 23.251(b) or § 25.251(d), as applicable." The requirement is not operationally valid because an aircraft will not attain V_{MO} shortly after take-off. This ensures that the fluid will flow off the wing long before the aircraft attains V_{MO} speeds. In addition many aircraft have high V_{MO} speeds ensuring that the fluid has flown off the aircraft long before V_{MO} is attained. It is also requested that the meaning of the words "as applicable" at the end of the requirement be clarified. It is suggested that operationally valid criteria are developed to define the applicability of these requirements.		This evaluation calls for attaining V_{MO} as soon as practicable after takeoff. Fluid trapped in elevator balance bays after flowing off the horizontal stabilizer has resulted in limit cycle oscillations of the elevator tab in a transport category airplane and an airworthiness directive limiting the maximum airspeed after use of deicing/anti-icing fluids until the elevator tab and balance bays are cleaned. Although operating at V_{MO} shortly after takeoff may not be typical or common, it is not a prohibited operation. The words "as applicable" refer to the regulatory paragraph to be used in showing compliance. We added the words "for the category of airplane" after "as applicable" for clarification. Section 23.251(b) applies to small airplanes and § 25.251(d) applies to transport category airplanes. As shown in the "Current Regulatory and Guidance Material" section, the text of §§ 23.251(b) and 25.251(d) is exactly the same.

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15.	Airbus (15 of 23) Page 9, "4. Post-Flight Inspections." Airbus request a clarification or the expected extent of such inspections and an explanation of what the implications would be if residual fluids or residues are found. The implications could be quite different between a turbo-propeller airplane with manual flight controls and a large jet airplane with fly-by-wire. Airbus reminds the FAA that, to the best of Airbus' knowledge, there is no evidence of fluid residues affecting Airbus aircraft and there have been no incidents of jammed or sluggish flight controls linked to frozen, rehydrated de-icing fluid residues on the Airbus fleet. Many other aircraft manufacturers have experienced the same excellent in-service record. The record shows that the combination of aircraft design and inspection and maintenance activities are adequate. It is therefore not necessary to require all manufacturers to update their ICAs considering there is no evidence of a safety issue. Airbus has communicated with operators of its fleet via Service Information Letters describing the issue and requesting feedback of any issues. To date no significant comments have been received. No special inspections have been specified by Airbus.	~~**Conduct**~~ **p**Post-flight inspections **could be performed** to determine if thickened fluid residue is present on the airplane.	We added text stating that the results of this inspection should be used to guide the development of the maintenance instructions specified in section 9, "Instructions for Continued Airworthiness." In this respect, the policy statement is consistent with guidance we previously provided in separate letters to type certificate holders.

	Comment	Requested Change	Disposition
16.	Airbus (16 of 23) Page 10, paragraph 5.c, "Test Day Temperature" "The test day temperature should result in the maximum allowable BLDT per SAE AS 5900." Testing in the field rarely gives the required conditions on the given day and hence this condition is not practicable.		We agree that the proposed guidance for the test day temperature is not practical. We revised this guidance to provide for a tolerance in achieving the maximum allowable BLDT. This guidance calls for a test day temperature that results in a fluid BLDT within 1 mm of the maximum allowable BLDT per for the results of the SAE 5900 testing for that fluid.
17.	Airbus (17 of 23) Page 10, "7. Airplane Configuration," paragraph a, 2nd and 3rd sentences. Airbus does not agree that the video recording of the fluid flow-off is necessary unless the data is used to calibrate simulations. For type certification, the performance data (forces and moments) should be all that is necessary to demonstrate acceptable fluid flow-off behavior.	Delete the two sentences: ~~**In addition, record fluid flow-off characteristics on video and time synchronize this video recording with the recorded takeoff parameters. Use the video recording to verify acceptable flow-off characteristics.**~~	We removed the text on video recording as suggested.
18.	Airbus (18 of 23) Page 10, section 7 "Airplane Configuration," paragraph a, 4th sentence. The nature of the fluid flow-off will be a function of the airplane configuration, namely the high lift devices. The pass/fail criteria for this test are not consistent with sections 1 and 2. The pass/fail criteria should be based solely on the aircraft performance and controllability as described in sections 1 and 2.	Delete the sentence: ~~**The wing leading edge should be essentially clean at rotation, and there should not be any significant standing ridges of fluid further back on the wing after rotation.**~~	We removed this text as suggested.

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19.	Airbus (19 of 23) Page 10, section 7, "Airplane Configuration," paragraph b. Airbus does not agree that the minimum production tolerance should be necessary for these tests, and could be impractical for testing if specific re-rigging is required. Furthermore, the effect of gap is a theory applied to on airplane type with un-powered flight controls.	The elevator/horizontal stabilizer gap should be **measured and recorded** ~~**relative to at the minimum**~~ production ~~**tolerance**~~ **standard**	We agree and revised the text accordingly.

	Comment	Requested Change	Disposition
20.	Airbus (20 of 23) Page 11, Section 8, "Airplane Flight Manual," paragraph c. The Airbus maintenance manuals contain information regarding inspections which are considered adequate to detect fluid residues. This should not be a part of the AFM. The implications could be quite different between a turbo-propeller airplane with manual flight controls and a large jet airplane with fly-by-wire. Airbus reminds the FAA that, to the best of Airbus' knowledge, there is no evidence of fluid residues affecting Airbus aircraft and there have been no incidents of jammed or sluggish flight controls linked to frozen, rehydrated de-icing fluid residues on the Airbus fleet. Many other aircraft manufactures have experienced the same excellent in-service record. The record shows that the combination of aircraft design and inspection and maintenance activities are adequate. It is therefore not necessary to require all manufacturers to update their ICAs considering there is no evidence of a safety issue. Airbus has communicated with operators of its fleet via Service Information Letters describing the issue and requesting feedback of any issues. To date no significant comments have been received. No special inspections have been specified by Airbus.	Delete this section: ~~**c. Procedures. Furnish procedures for pre-flight or post-flight inspection and cleaning of areas in which fluid residue is shown to occur.**~~	We agree that the maintenance manuals are the appropriate documents for inspection and cleaning procedures. We deleted this paragraph as suggested.

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21.	Airbus (21 of 23) Page 12, 3rd paragraph, "Effect of Policy," and the 2 bullets at the bottom of the page. This could be clarified because it could easily be misunderstood. It is unclear whether this applies to airplanes with rotation speeds below 100 knots and reversible flight controls, or either of the two categories.	3rd paragraph: "This policy statement does not prevent an aircraft certification office from delegating approval of test plans and reports, and test witnessing. However, for airplanes with takeoff rotation speeds less than 100 knots, **and/or** ***(please clarify)*** with reversible longitudinal control systems…" • Airplanes with a takeoff rotation speed below 100 KCAS; **and/or** ***(please clarify)*** • Airplanes with reversible flight controls	We revised the "Effect of Policy" and the "Applicability" sections of the policy statement, which addresses this comment. 1. The "Takeoff Performance" criteria applies only to airplanes with takeoff rotation speeds (V_R) below 110 knots KCAS. 2. Takeoff Performance criteria also applies to airplanes with a time from brake release to V_R of less than 30 seconds. 3. "Controllability" criteria apply only to airplanes with reversible flight controls. For a given airplane that meets **any** of these criteria, delegation may be limited.
22.	Airbus (22 of 23) General comment The policy statement describes in some detail a means of compliance by flight test for the use of thickened fluids on airplanes. Alternative means of compliance are possible such as simulations in a wind tunnel or Computational Fluid Dynamics (CFD).	Airbus request that additional means of compliance are added.	Because the safety issues with fluids involve dynamic phenomena interacting with flight control design, we do not believe that these issues can be addressed through analysis or simulation. However, as stated in "Effect of Policy," an applicant can propose a different means of compliance. We did not make any changes in response to this comment.

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23.	Airbus (23 of 23) Page 12, "Implementation" As stated in comment 1 this is considered a change to the regulations and hence should be implemented through the FAA rulemaking process. Nevertheless if the policy statement/new regulation is intended to apply to new type certificate, derivatives (CPR) or supplemental type certificate applications then its applicability should be determined if the application letter is sent on or after the effective date of publication of the final policy statement and should not be discussed with the FAA in the middle of an aircraft certification program. The applicability should consider the in-service record of the applicant's fleet of aircraft.	The compliance methods identified in this policy statement apply to those programs for which ~~**approval is sought**~~ **application for approval is filed** on or after the effective date of the final policy statement. ~~**If the date of application precedes the effective date of the final policy statement, and the methods of compliance have already been coordinated with and approved by the FAA or its designee, the applicant may choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy statement.**~~	As stated in our response to Airbus comment #1, this policy statement provides an acceptable means of compliance with existing regulatory requirements. It does not constitute a change to the regulations, and hence does not need to be implemented through the FAA rulemaking process. However, we agree with the suggested text changes and revised the text accordingly.

	Comment	Requested Change	Disposition
24.	Cessna (1 of 26) As discussed in "Relevant Past Practice," approval of deicing/anti-icing fluids has been historically addressed by the type certificate holder. This practice has been coordinated with the FAA for many years, during which application of part 23 and part 25 rules has not been part of the approval process. Per FAA Order 8100.16, policy statements "must not create or change the regulatory requirement," "may contain additional guidance to help the reader understand the methods of compliance the FAA considers acceptable" and "should not impose or relieve a burden on anyone." Cessna believes that adding approval of deicing/anti-icing fluids to certification activities conducted per FAA Order 8110.4C does effectively change regulatory requirements, goes beyond helping applicants understand methods of compliance and imposes a significant burden. While no rules are being added by the policy statement, the proposal is a significant addition to the scope of certification requirements and imposes additional costs on all applicants. Without the benefit of the rulemaking process, it is not apparent that the benefit of this new policy statement is consistent with the safety benefit, or whether there are viable alternatives to resolve the stated concerns. As such, introduction of the procedures is out of scope for a policy statement and should be subject to the rulemaking process.		The use of Type II, III, and IV deicing/anti-icing fluids on both small and transport category airplanes raises safety concerns and have resulted in the issuance of Airworthiness Directives as well as other safety actions. The applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address safety issues. We did not make any changes in response to this comment.

	Comment	Requested Change	Disposition
25.	Cessna (2 of 26) Applicability of various sections of this policy statement is unclear. At different points in the document airplanes are divided into groups based on: 1) rotation speeds above or below 100 knots and 2) reversible or irreversible flight controls. However, in each section, applicability of individual flight evaluations to each group is not consistently identified.	Each item to be addressed by flight tests should clearly identify the design and performance characteristics of airplanes intended for evaluation.	We added a new section, "Applicability," to clarify the applicability of each of the evaluations requested by this policy statement.
26.	Cessna (3 of 26) There are distinctions made throughout this draft policy statement between those airplanes with rotation speeds below 100 knots, and those above. Yet there is also reference to incidents with thickened anti-icing fluids with rotation speeds slightly above 100 knots. The use of 100 knots as an appropriate threshold is not adequately substantiated by the data provided.	Provide adequate data and rationale to substantiate the use of 100-knot rotation speed as threshold for flight testing.	We revised the applicability from 100 to 110 knots, which is the highest speed referenced in SAE AS 5900.
27.	Cessna (4 of 26) The proposed need for several controllability evaluations is dependent on type of flight controls (reversible/irreversible). Some types of airplanes include powered flight controls that while not fully irreversible do exhibit control force characteristics that are insensitive to aerodynamic feedback, especially at takeoff speeds. Alternatively, some airplanes with fully irreversible flight control systems have experienced control issues due to fluid residue contamination. It is not clear that the proposed applicability of individual evaluations is justified.	Cessna suggests the FAA more fully explain the rationale for evaluating airplanes with certain flight control system design characteristics such that applicants can clearly determine the applicability of each evaluation to a more complete range of flight control systems.	In the case of airplanes with powered flight controls, to avoid controllability tests, the airplane manufacturer would need to provide data that shows the longitudinal control is essentially irreversible. The decision would be made on project-by-project basis, and we did not revise the policy statement. The issue of residue is not addressed by the tests in this policy statement. However, it is addressed in section 9, "Instructions for Continued Airworthiness," which applies to all airplanes, regardless of type of flight control.

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28.	Cessna (5 of 26) The title of the policy statement is "Type Certification Policy for Approval of Use of Type II, III, and IV Deicing/Anti-icing Fluids on Small and Transport Category Airplanes." However, fight testing is the only means of compliance offered as acceptable for approving use of these fluids. If an airplane type has an acceptable service history using these fluids, a similarity analysis should be an acceptable means of showing compliance without the need for a flight test program.	Add an applicability section stating that other means of approving the use of thickened fluids are acceptable. A similarity analysis to other model(s) that have acceptable service history is also an acceptable means of compliance.	We partially adopted the requested change. In the first paragraph, we added similarity to another previously tested airplane as an alternate means for the flight tests. We do not concur with similarity to another model based solely on that model's service history.
29.	Cessna (6 of 26) It isn't clear that this policy statement has been harmonized with EASA.		Although EASA has not proposed or issued a similar policy statement, we coordinated this policy statement with EASA.

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30.	Cessna (7 of 26) Page 6, "Policy," 2nd paragraph Cessna understands the desire to follow the Type Certification procedures spelled out in FAA Order 8110.4C. The weather requirements for these tests, for safety reasons and fluid performance, are very specific and difficult to achieve. The temperature required is typically -25ºC to -30ºC with winds less than 10kts, no precipitation, day VFR, and dry runway, to name most of the constraints. To adhere to the maximum temperature requirement, the testing typically must be stopped around mid-day due to the ambient temperature warming above the max allowable. The environmental conditions window for this testing is very small in days per year and available hours per day. The ODA procedures for this type of testing require the applicant to perform the tests then to have the FAA pilots participate. Due to the short environmental condition window it may not be possible to perform this testing twice in a winter season (once by the company and once with the FAA).	… As a result, the tests should be conducted in accordance with a TIA, with an FAA-approved test plan, and an FAA-approved test report. **It is acceptable to have a properly qualified FAA designated pilot perform this testing, with prior coordination with the applicable ACO, so that it does not have to be performed by the company and then repeated by an FAA pilot due to weather/time constraints.** As part of evaluating the effect of fluids on airplane takeoff performance and handling characteristics…	We added guidance for reviews by the AEG in addition to the appropriate FAA certifying office (e.g., BASOO or ACO) in the second paragraph of the "Policy" section. We addressed the main concern of the comment by adding to the delegation discussion in "Effect of Policy." We added that the testing may be accomplished concurrently due to weather or time constraints.

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31.	Cessna (8 of 26) Page 4, "Relevant Past Practice," 2nd paragraph Cessna believes it is also important that fluids are qualified based on the boundary layer thickness at 30 seconds during the AS 5900 wind tunnel testing. Many airplanes rotate sooner than 30 seconds from brake release which can lead to a thicker boundary layer. This is due to the fact that the fluid has not had as much time to shear off the airplane.	"Whether or not a fluid is acceptable depends on the fluid's boundary layer thickness **at 30 seconds**, the boundary layer thickness of a reference fluid, and……"	We agree and added "after 30 seconds of acceleration."
32.	Cessna (9 of 26) Page 4, "Relevant Past Practice," 2nd paragraph Some Type II and Type IV fluids are tested against the low speed ramp test. It is done at the discretion of the fluid manufacturer. It has the potential to lower the LOUT when used in this manner.	"However, **not all** Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900, so the aerodynamic effects on airplanes with a takeoff rotation speed of less than 100 knots are unknown.	We are unaware of any Type II or IV fluids having been tested on the low-speed ramp test. We did not adopt the requested change.
33.	Cessna (10 of 26) Page 5, "Policy," 2nd paragraph Involvement of the AEG in the proposed process should be clarified. Cessna believes that involving AEG pilots with certification or post certification flight evaluations of characteristics with fluids applied is impractical. Any required AEG involvement to determine flightcrew training emphasis items should be clearly limited to review of AFM procedures and should not include direct involvement with flight testing.	~~As part of evaluating the effect of fluids on airplane takeoff performance and handling characteristics, t~~**T**he responsible Airplane Evaluation Group should **review the proposed AFM and** determine if any unique procedures or handling characteristics resulting from the use of thickened fluids should be emphasized in flightcrew training.	We revised the policy statement to clarify that the appropriate FAA certifying office (e.g., ACO or BASOO) and the AEG will review the test data in addition to the proposed AFM.

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34.	Cessna (11 of 26) Page 6, "Policy" 1st paragraph The policy statement states, "It is recommended, but not required, that the fluids be tested during the airplane's type certification process." Cessna believes that for a block point change certification project, a similarity analysis to an airplane that has been previously approved to use thickened fluids is sufficient.	It is recommended, but not required, that the fluids be tested during ~~the~~ **an** airplane's **original** type certification process.	We agree with Cessna's comment. However, we did not adopt the wording suggested by Cessna because, depending on the nature and extent of the design change(s) involved (e.g., for a minor/minor change, amended type certificate, supplemental type certificate, etc.), tests that were conducted during the airplane's original type certification process may not be adequate. Also, it may be unclear what is meant by an airplane's "original" type certification process. Instead we revised the text to state, "The fluid approval process described in this policy statement should be addressed during an airplane's type certification process…To make this determination, applicants should conduct flight tests or show similarity to a previously tested model." This revision clarifies that either flight tests or similarity to a previously tested model should be used to evaluate the effect of thickened fluids on the airplane.

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35.	Cessna (12 of 26) Page 6, "Policy," 1st paragraph The policy statement states, "The specific fluids that have been approved should be identified in the AFM, and the use of other fluids should be prohibited." All SAE-approved fluids are tested to the same SAE aerodynamic acceptance test. If a fluid is chosen that is close to the aerodynamic acceptance line for the temperature on the day of flight testing then this is sufficient to approve all SAE Type II and Type IV fluids (and Type III if the same AFM procedures are implemented). In this case, the specific fluids that have been approved are not necessary. A test program that approves every new fluid introduced to the market may require this specific fluid list.	"The **types of** fluids that have been approved should be identified in the AFM, and the use of other **types of** fluids should be prohibited."	We agree. We revised the policy statement to clarify that the AFM should identify the specific types (i.e., Type II, III, or IV) of fluids that are approved.

	Comment	Requested Change	Disposition
36.	Cessna (13 of 26) Page 6, "1. Takeoff Performance," 1st paragraph The ground deice/anti-ice fluid aerodynamic acceptance standard (SAE AS 5900) and corresponding lift loss are all based the Boeing 737ADV airplane (airfoil and wing configuration). Just because an airplane has a rotation speed above 100kts does not mean there will not be takeoff issues with Type II/Type IV fluids. There are many factors that determine the fluid effect on an airplane such as the leading edge configuration (slat or hard leading edge) time from brake release to V_R (a longer time provides more time for the fluid to shear off the wing), horizontal tail and elevator configuration (affects rotation aspects). The AS 5900 fluid aerodynamic acceptance test measures the BLDT at 30 seconds after the start of the airspeed ramp up. This is intended to simulate aircraft rotation 30 seconds after brake release. The majority of Cessna business jets (part 23 and part 25) rotate sooner than 30 seconds after brake release with many rotation speeds at or above 100 knots. All models tested to date have exhibited slow or delayed rotation that resulted in takeoff field length adjustments and takeoff flap limitations. The Cessna flight test results suggest that using the 100-knott rotation speed as the lone discriminator for when flight testing is required is incorrect. The SAE AS5900 aerodynamic acceptance specification only evaluates the lift loss of the wing. It does not evaluate potential issues with aircraft rotation.	"1. Takeoff Performance. The aerodynamic effect of Type II or Type IV fluid on **airplane takeoff performance (lift loss and effect on aircraft rotation) must be addressed by flight test or analysis (aerodynamic modeling or similarity analysis to other aircraft approved for use of Type II or Type IV fluids).** ~~wings at less than 100 knots calibrated airspeed (KCAS) is unknown because these fluids are not tested below the "high speed ramp test" speed specified in SAE AS 5900. Therefore, for airplanes with takeoff rotations speeds less than 100 KCAS, the effect of Type II and Type IV fluids on takeoff speeds and distance should be determined~~."	In the new "Applicability" section, we added airplanes with a time from brake release to rotation of less than 30 seconds for the takeoff performance evaluations described in paragraph 1.

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37.	Cessna (14 of 26) Page 6, "1. Takeoff Performance," 2nd paragraph "Typically, the lowest takeoff gross weight…is considered critical for this evaluation because of the lower scheduled takeoff speed." Is this based on real evidence or conjecture? There are a number of reasons a heavy weight takeoff might be more critical. It is possible that a heavy weight aircraft might see a larger effect due to the presence of the fluid, as it is less likely to be limited by V_{MC} and therefore have less margin over stall (more likely to be at V_{2MIN}). The cg envelope at heavy weights on a particular airframe might also be more forward, resulting in reduced elevator authority which might be more critical with fluid applied. Stabilizer trim settings scheduled with weight and cg could also have an effect on available pitch authority.	Add a sentence following the first sentence that reads "**However, it is recommended to also test heavy weight takeoffs to investigate low airspeed awareness and pitch authority with anti-ice fluid applied**."	We agree and added the following sentence: "However, heavy weight takeoff tests should also be conducted to investigate the angle of attack margin (paragraph 1.b.), the pitch authority at takeoff rotation, and any effects on takeoff performance." The "2. Controllability" section already includes evaluations at a heavy gross weight.

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38.	Cessna (15 of 26) Page 7, 1.a. "Fixed Pitch Angle Takeoffs." Fixed pitch takeoffs covering a range of pitch angles are difficult or impossible to conduct on aircraft with limited pitch authority, particularly at lighter weights. Liftoff can occur at small pitch angles as the nose begins to lift, making capture of a specific pitch target at liftoff difficult or impossible. This issue is compounded if application of anti-ice fluid reduces elevator effectiveness. The decrement in lift coefficient can be determined by analysis of normal takeoff technique without the need to perform fixed pitch takeoffs, and would be more operationally representative, as the shearing forces the fluid is subjected to would be comparable to those experienced in normal operations.	**"~~Fixed Pitch Angle takeoffs.~~ Lift Loss Determination.** Perform takeoffs ~~at fixed pitch angles~~ with and without thickened fluid applied **and determine the resulting percentage of lift loss.** ~~Test several pitch angles representing the range of pitch angles at liftoff.~~ Tests at maximum pitch attitude are not needed.…"	We agree. This comment was similar to other comments received. (See comment 11.) We replaced "fixed pitch" takeoffs with "normal" takeoffs.
39.	Cessna (16 of 26) Page 8, "Takeoff Angle-of-Attack (AOA) Margin Tests, 3rd paragraph "If V_R was increased as a result of those tests, use the increased V_R speed for these tests." This statement is not clear. If V_R has been adjusted, are these all-engine takeoffs performed only at the adjusted V_R, or also at the adjusted V_R minus 7% or 10 knots?	"If V_R was increased as a result of those tests, use the increased V_R speed **minus 7 percent or the increased V_R speed minus 10 knots, whichever results in the higher rotation speed,** for these tests."	We adopted the requested change.

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40.	Cessna (17 of 26) Page 7, "b. Takeoff Angle-of-Attack (AOA) Margin Tests," 4th paragraph "Also conduct simulated one-engine-inoperative takeoffs, with maximum takeoff flap and rotation at V_R." This testing need only be performed up to the maximum flap setting that will be allowed for takeoff with anti-ice fluid applied (which may not be the maximum takeoff flap setting of the aircraft), and using the proposed takeoff speed adjustments, if any.	"Also conduct simulated one-engine-inoperative takeoffs, with maximum takeoff flap **setting for which approval of takeoff with anti-ice fluid is sought,** and rotation at **the** V_R **according to procedures for takeoff with anti-ice fluid applied**."	We agree. We revised the sentence to state: "Also conduct simulated one-engine-inoperative takeoffs, with the maximum takeoff flap setting for which approval of takeoff with a thickened fluid is sought and rotation at the V_R according to procedures for takeoff with a thickened fluid applied."
41.	Cessna (18 of 26) Page 9, "4. Post-Flight Inspections" Is the point of this inspection just to document where fluid may collect?	Add sentence – Include photo documentation in the post test report showing where fluid does and does not collect inside the aircraft. Access panels may need to be removed for thorough documentation. Any fluid accumulation in a flight critical area or component could be cause for special periodic inspections.	We agree to add the rationale. We added: "Include photo documentation in the post-test report showing where fluid does and does not collect inside the aircraft. Access panels may need to be removed for thorough documentation. Use the results of this inspection to guide the development of the maintenance instructions specified in paragraph 9 of this policy statement. Any fluid accumulation in a flight critical area or component could be cause for special periodic inspections."
42.	Cessna (19 of 26) Page 9, "2. Controllability," paragraph a.(3) "…, depending on airplane category." Some part 23 category aircraft have special conditions to include requirements outside their category. The certification basis should dictate which requirements are applicable.	"…, depending on airplane category **and certification basis**."	We adopted the requested change.

	Comment	Requested Change	Disposition
43.	Cessna (20 of 26) Page 9, 5. Fluids, paragraph a. **"Number of Thickened Fluids**. Apply a Type IV fluid brand(s) so the test day temperature allows testing near the maximum allowable boundary layer displacement thickness (BLDT).[6]" Since Type II and Type IV fluids are both tested to the same aerodynamic acceptance test it should not matter if a Type II or Type IV fluid is tested as long as the test day temperature is close to the LOUT. It would be helpful to applicants conducting certification testing if the phrase "near the maximum allowable boundary layer displacement thickness" could be quantified. Cessna has successfully conducted testing at outside air temperatures that were within 1mm of the maximum BLDT. Footnote 6 (Follow the procedures in the most recent version of SAE AS 5900) at the end of this sentence is confusing. Should this be referring to the draft ARP currently in work by the SAE G-12 Aerodynamics working group? Cessna does not believe there are procedures in AS 5900 that would provide assistance in this flight testing.	**"Number of Thickened Fluids**. Apply a Type **II or** IV fluid brand(s) so the test day temperature allows testing **within approximately 1mm of the maximum allowable boundary layer displacement thickness (BLDT) for the fluid being tested.** ~~near the maximum allowable boundary layer displacement thickness (BLDT).6~~ "	The FAA agrees that testing a Type II or Type IV at critical conditions would allow approval of all thickened fluids and made the requested change. The comment regarding tolerance was similar to other comments, except this comment was the only one that suggested a testing tolerance. Since this tolerance seems reasonable and has been used in the past, we adopted it into the policy statement.
44.	Cessna (21 of 26) Page 9, "5. Fluids, b. Fluid Application," paragraph (1) This bullet currently reads as if Type II, III, and IV fluids are required to be tested.	**(1)** Apply undiluted Type II, III, ~~and~~ **or** IV fluids.	We made changes to the consistent with the intent of this comment. We revised the text to state: "(1) Apply the fluid undiluted."

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45.	Cessna (22 of 26) Page 10, "5. Fluids, c. Test day temperature." The test day temperature should result in the maximum allowable BLDT per SAE AS 5900. The environmental conditions required for this testing make it impractical to conduct testing exactly at the ambient temperature that gives the maximum allowable BLDT. Suggest allowing the applicant some tolerance on this. As stated earlier, Cessna has successfully conducted testing at outside air temperatures that were within 1mm of the maximum BLDT.	**c. Test day temperature**. The test day temperature should result in the ~~maximum allowable~~ BLDT **being within 1 mm of the maximum allowable BLDT for the fluid being used for this testing** per SAE AS 5900.	We agree with this comment and revised the policy statement accordingly.
46.	Cessna (23 of 26) Page 10, "7. Airplane Configurations," paragraph a The use of video review to determine acceptable flow-off characteristics is problematic since there are no accepted criteria for associating flow patterns with any quantitative or qualitative flight characteristic. It is not clear what FAA or designee engineering disciplines would be responsible for or even qualified to make a compliance finding of acceptable flow patterns. Cessna believes that acceptable standards for operation with deice/anti-ice fluids should be based on performance and handling flight tests that utilize standard Subpart B evaluation techniques and criteria. While video is potentially valuable as a diagnostic tool, making compliance findings for the rules identified based on review of flow patterns is not appropriate.	Delete paragraph 7a.	We agree and deleted the guidance calling for video recording of fluid flow-off characteristics.

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47.	Cessna (24 of 26) Page 10, "Airplane Configurations," paragraph b Rigging the elevator/stabilizer gap is typically not practical and is not adjusted for any other certification flight test. The purpose for requiring this airplane configuration for all aircraft is unclear. Cessna acknowledges that the elevator leading edge gap appeared to be the cause of takeoff rotation issues with fluid applied to the BAE ATP turboprop. However, it is not clear that setting the gap to a tolerance limit is critical for all aircraft types and all elevator configurations.	Unless it can be shown that the elevator/stabilizer gap is the actual cause of rotation issues, delete Paragraph 7b. If the gap can be shown to be critical for some configurations, provide criteria for determining when rigging the elevator/stabilizer gap is necessary.	We agree with this comment and revised the policy statement to only call for measuring the gap for potential future reference.
48.	Cessna (25 of 26) Page 12, "Effect of Policy," 3rd paragraph It appears the discussion on receiving test delegation for the two types of longitudinal control systems is reversed.	"However, for airplanes with takeoff rotation speeds less than 100 knots, or with reversible longitudinal control systems, **the first approval of test plans and test reports should not be delegated**. ~~delegation will be limited, at least for the first approval conducted by a given type certificate holder~~. For airplanes with takeoff rotation speeds less than 100 knots that have irreversible longitudinal flight controls, **delegation will be limited, at least for the first approval conducted by a given type certificate holder** ~~the first approval of test plans and test reports should not be delegated~~."	We revised the policy statement and deleted this section. However, for irreversible controls, control force at rotation should not be an issue, hence the FAA can delegate the actual testing. However, for the first approval, review of the test plan and report should not be delegated.
49.	Cessna (26 of 26) Page 12, "Effect of Policy," 4th paragraph Request this document be clear that the type certificate holder is approving types of fluids.	This policy statement will affect the approval of the AFM and maintenance manual for all airplanes for which approval to use Type II, III, or IV de-icing fluids is desired, changes to the list of approved fluid **types**, or for airplane modifications that may affect previous approvals for the use of those fluids.	We adopted the requested change.

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50.	Ken Dickenson (1 of 1) With regard to Instructions for Continued Airworthiness, the policy statement refers only to § 23.1529 and § 25.1529 'Instructions for Continued Airworthiness' and to §23.3(b)(1) of appendix G and §25.3(b)(1) of appendix H 'Scheduling information' as applicable regulations in 14 CFR parts 23 and 25. These latter paragraphs deal with recommendations only. No consideration is given to the need for mandatory ICAs. This implies that instructions developed and published by the design approval holders may eventually be disregarded by operators.	Require explicitly that design approval holders develop mandatory and/or recommended ICA, as appropriate (i.e., taking into account the implications on operators' sides), and to categorize these ICA as following: - Mandatory or Recommended, and - Scheduled or Unscheduled, and - Essential or Non-Essential This will help operators in managing their maintenance manual (Refer to CFR 121.367 and also to NPRM 12-07).	The policy statement references the correct ICA regulations, which already require the design approval holder to do what the commenter suggested. No changes were made in response to this comment.
51.	Embraer (1 of 9) "Relevant Past Practice" 2nd paragraph (page 4) The policy statement states that "However, Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900 ..."	Notwithstanding, no Type II and IV are tested for the low-speed ramp. It is not true that their effects is unknown for airplanes with rotation speeds of less than 100 knots, since some manufacturers of such airplanes already conduct tests or employ analytical techniques to evaluate the effect of these fluids, and adjust their performance parameters, as necessary to keep the safety margins.	We revised the text to clarify that the effects of Type II and IV fluids are not evaluated under the SAE AS 5900 standard for airplanes with takeoff rotation speeds below 110 knots rather than being unknown. (We changed the speed value from 100 knots to 110 knots to be consistent with SAE AS 5900.)
52.	Embraer (2 of 9) "Relevant Past Practice" 6th paragraph (page 5) The policy statement states that "These events occurred with both powered and unpowered flight control systems ..." Embraer believes the majority of events occurred with unpowered controls. Therefore Embraer believes that the focus of the residue problems should be directed at this kind of control surfaces.		Although the majority of events occurred on airplanes with unpowered controls, at least one event occurred on an airplane with powered controls. We did not make any changes in response to this comment.

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	With regard to the residue issue there is a possible link between one particular fluid and a large number of incidents. After this fluid was removed from the market, the number of events reduced drastically or even faded out. Embraer believes this fluid may be the responsible for the high level of concern that had been raised in the recent past years, and the focus of the authorities should be direct for the qualification (or certification) of the fluids, preventing a bad fluid to enter the market. This would have a greater beneficial effect on safety than the proposed certification policy statement.		Although there was a fluid (no longer on the market) suspected of causing large amounts of residue, incidents occurred before this fluid became available and continue to occur. All thickened fluids cause residue, and the issue of potential re-hydration of the residue needs to be addressed. No changes have been made to the policy statement in response to this comment.
53.	Embraer (3 of 9) "Policy," 1st paragraph (page 6) "The specific fluids that have been approved should be identified in the AFM ..."	Embraer recommends FAA should clarify how specific shall be the AFM identification. May we say the all SAE T.IY or II fluids are approved for use, or need we list the fluid brands (which could lead to annual AFM revisions, since every year there are new brands entering the market)?	We revised the policy statement to clarify that the AFM should identify the specific types (i.e., Type II, III, or IV) of fluids that are approved.
54.	Embraer (4 of 9) "Policy," "1. Takeoff Performance" (page 6) Typically, the lowest takeoff gross weight and maximum flap position approved for takeoff is considered critical for this evaluation because of the lower scheduled takeoff rotation speed ..."	Embraer would like to say that the time to rotation is as important as the V_R, so I would suggest FAA to include it, as a consideration.	We agree that the time between brake release and rotation is an important parameter. We revised the text in this paragraph to include it as a consideration. We also revised the policy statement to include applicability of the takeoff performance evaluations described in paragraph 1 of this policy statement to include airplanes with times of less than 30 seconds between brake release and V_R.
55.	Embraer (5 of 9) "Policy," "1. Takeoff Performance" a. "Fixed Pitch Angle Takeoffs" (page 6) Embraer would like to say that the fixed pitch angle takeoffs are excessively conservative procedures, since fluid will not flow off of the wing as in a normal takeoff.	Embraer suggests that FAA should accept other rotation techniques more representatives of an operational takeoff.	We agree and revised the text accordingly.

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	The policy statement states that "This level of lift loss also corresponds to the lift loss measured during fluid testing on a Model 737-200ADV ..."	Embraer also believes that this criteria was not derived from the 737-200ADV flight tests. Indeed this criteria was proposed from Transport Canada in recent Embraer development programmes as a guidance.	Only some of the results of fluid testing on the 737-200ADV data indicate a 6% lift loss. We revised the text to clarify this point. The policy statement does not say the criteria were derived from the 737-200ADV tests.
56.	Embraer (6 of 9) "2. Controllability" (Section b.2) (page 9)	Embraer believes it is not clear if this section only applies for unpowered controls. Embraer would like to request to FAA to clarify this point.	We added a new paragraph on applicability to clarify the applicability of each of the evaluations requested by this policy statement.
57.	Embraer (7 of 9) "5.a. Fluids to be Tested" (page 9) "Apply a Type IV fluid brand(s) so the test day temperature allows testing near the maximum allowable boundary layer displacement thickness (BLDT)."	A tolerance for the maximum acceptable test day temperature deviation should be accepted.	We agree. We incorporated a tolerance for the maximum test day temperature in the policy statement.
	c. Test day temperature (page 10) "The test day temperature should result in the maximum allowable BLDT per SAE AS 590011…"	Embraer believes that this item is not practical, and perhaps not even possible for test logistics. A margin (tolerance) for the BLDT limit should be allowed, as permitted in paragraph 7A (" ... near the maximum available BLDT").	We agree. We incorporated a tolerance for the maximum test day temperature in the policy statement.
	d. "Conduct a viscosity check ..."	Embraer requests FAA to clarify if this viscosity check is performed only on an on-wing sample.	The text was revised to clarify that the viscosity check is to be performed on an "on-wing" sample.
58.	Embraer (8 of 9) "Airplane Configuration" paragraph 7.a (page 10) "Use the video recording to verify acceptable flow-off characteristics."	Embraer believes the "flow-off" visualization is only a reference. The acceptable characteristics shall be verified through the performance and handling characteristics.	We agree. We removed the guidance calling for video recording of the fluid flow-off characteristics.
	Paragraph l.b, states "The elevator/stabilizer gap should be at the minimum production tolerance."	Embraer also believes that again this is impractical for test logistics, due to the characteristics of these tests (out of OEM facilities to adjust/rigging the surfaces). Additionally the effect of the elevator/stabilizer gap on the increased rotation forces is a theory applied for one specific airplane type.	We agree. We revised the text to have applicants measure and record the elevator/stabilizer gap for potential future reference.

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59.	Embraer (9 of 9) "Effect of Policy" (page 12) "...for airplanes… with reversible longitudinal control systems, delegation will be limited, at least for the first approval conducted. ... For airplanes ... that have irreversible longitudinal flight controls ... test plans and test reports should not be delegated."	Embraer believes this statement is confusing. For the most critical case (reversible) limited delegation is possible, while for the less critical (irreversible) no delegation is allowable.	We revised the "Effect of Policy" significantly. Delegation is limited, at least for the first approval by a given type certification holder, for airplanes with takeoff rotation speeds that meet any of the following criteria: (1) 110 KCAS, or (2) time from brake release to rotation of less than 30 seconds, or (3) reversible longitudinal flight controls. For airplanes with takeoff rotation speeds less than 110 KCAS or a time from brake release to rotation of less than 30 seconds, but do not have reversible longitudinal flight controls, the first approval of test plans and test reports should not be delegated. For airplanes with reversible longitudinal flight controls, the *first* approval of test plans and test reports, and the witnessing of tests to evaluate takeoff control forces should not be delegated. We revised the text for additional clarification.

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60.	Boeing (1 of 29) "Current Regulatory and Advisory Material" pages 1-3 The specified part 25 certification regulations do not require flight tests, evaluations, or any other considerations of the effects of thickened deicing/anti-icing fluids (hereinafter referred to as "fluids") in order for them to be used operationally. The part 25 guidance material likewise does not include such considerations. For the certification of Boeing airplanes, previously accepted means of compliance for the specified part 25 regulations have never included evaluation of the effects of fluids. Therefore, Boeing does not concur that the specified part 25 regulations are "applicable" to the subject and substance of the proposed policy statement. As proposed, the draft policy statement violates the provisions of paragraph 2-2 of FAA Order IR 8100.16, "Aircraft Certification Service Policy Statement, Policy Memorandum, and Deviation Memorandum Systems," dated May 13, 2011. Note that Boeing is not specifically familiar with part 23 regulations and have thus not included them in these comments.	**§ 23.**143(c) ~~and § 25.143(d)~~ Controllability and Maneuverability – General § 23.251(b) ~~and § 25.251(d)~~ Vibration and Buffeting § 23.1529 ~~and § 25.1529~~ Instructions for Continued Airworthiness The applicant must prepare Instructions for Continued Airworthiness in accordance with appendix G of part 23 ~~or appendix H of part 25~~ that are acceptable to the Administrator. . . . § 23.1581 and § 25.1581 Airplane Flight Manual and Approved Manual Material — General ~~• § 25.1587 Performance information~~ Appendix G to part 23 ~~and appendix H to part 25~~ Instructions for Continued Airworthiness Appendix G to part 23.3 ~~and appendix H to part 25.3~~ Content	The use of Type II, III, and IV deicing/anti-icing fluids on both small and transport category airplanes raises safety concerns and have resulted in the issuance of Airworthiness Directives as well as other safety actions. The applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address safety issues. Specifically, § 25.1581(a)(2) requires furnishing information in the AFM that is necessary for safe operation because of design, operating, or handling characteristics. If the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics, that information must be furnished in the AFM. The applicable regulations cited in the policy statement are the performance standards by which it can be determined whether the operating or handling characteristics may affect safe operations when Type II, III, or IV deicing/anti-icing fluid is applied. Appendix H to part 25 requires information to be provided in the Instructions for Continued Airworthiness on the types of fluids to be used and scheduling information for cleaning and inspecting each part of the airplane. We consider Type II, III, and IV deicing/anti-icing fluids to be fluids covered by these requirements.

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	Comment	Requested Change	Disposition
61.	Boeing (2 of 29) "Relevant Past Practice," page 3 Provide the correct titles of the SAE standards documents.	[1] SAE AS 5900, Standard Test Method for Aerodynamic Acceptance of SAE AMS 1424; **and SAE AMS 1428 Aircraft Deicing/Anti-Icing Fluids**. [2] SAE AMS 1428, **Fluid**, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV."	We changed the text as suggested.
62.	Boeing (3 of 29) "Relevant Past Practice," page 4, and "Policy" page 6 Boeing considers it misleading to state that the effects of Types II and IV fluids are simply "unknown" for airplanes with rotation speeds of less than 100 knots. While it is true that these fluid types are not evaluated via the low-speed ramp test of SAE AS 5900, we are aware that several manufacturers of such airplanes already conduct various tests and/or employ analytical techniques to evaluate the aerodynamic effects of fluids on their airplanes and adjust their performance parameters as necessary to maintain safety. We also understand that for part 23 airplanes those manufacturers typically perform evaluations in accordance with AC 23.1419-2D. These test evaluations are discussed in "Relevant Past Practice."	For "Relevant Past Practice," 2nd paragraph (p. 4) revise the text as follows: Either: "… However, Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900**,** so the aerodynamic effects on airplanes with a takeoff rotation speed of less than 100 knots are ~~unknown~~ **not evaluated per AS 5900.** ..." Or: "… However, Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900~~, so the aerodynamic effects on airplanes with a takeoff rotation speed of less than 100 knots are unknown~~. …" For Policy, paragraph 1 (p. 6), revise the text as follows: **"1. Takeoff Performance.** ~~The aerodynamic effect of~~ Type II ~~or~~ **and** Type IV fluid**s** ~~on airplane wings at less than 100 knots calibrated airspeed (KCAS) is unknown because these fluids~~ are not tested below the "high speed ramp test" speed specified in SAE AS 5900. Therefore, …"	We agree. We changed the text to: "However, Type II and IV fluids are not tested below speeds used in the "high-speed ramp test" specified in SAE AS 5900, so the aerodynamic effects on airplanes using a takeoff rotation speed of less than 110 knots are not evaluated under the AS 5900 standard." We changed the speed value from 100 knots to 110 knots to be consistent with the highest speed quoted in SAE AS 5900. Instead of revising the text of the first sentence in paragraph 1 as suggested, we removed that sentence. The information conveyed by that sentence is provided in the "Relevant Past Practice" section.

	Comment	Requested Change	Disposition
63.	Boeing (4 of 29) "Relevant Past Practice" Pursuant to paragraph 2-3(a) of Order IR 8100.16, "each element" of a policy statement should have "a clear regulatory reference."	Boeing respectfully requests that the relevant regulation(s) associated with the described past practices be identified.	"Relevant Past Practice" provides background information considered relevant to the development of the policy statement. These past practices include non-regulatory actions, descriptive information, and case histories for which a regulatory reference is not applicable. We did not make any changes in response to this comment.
64.	Boeing (5 of 29) "Relevant Past Practice," page 4 The past practices described in the quoted material are not applicable to Boeing. While we are not familiar with the practices of all TC holders, we assume that the description reflects recent past practices for part 23 TC holders and perhaps some others. Boeing respectfully requests that the text be revised to clarify that the description is not universal.	"Typically, ~~the~~ **some [**or **"part 23," or whatever is factual]** type certificate holders evaluated …"	We agree and revised to text to state that "some type certificated holders evaluated…"

	Comment	Requested Change	Disposition
65.	Boeing (6 of 29) "Relevant Past Practice," p. 4 Boeing considers it important to clarify that, to the best of our knowledge, only certain small turbo-prop airplanes have experienced the described problem. As proposed in the policy statement, the impression is that safety reports have been received involving many types of airplanes, including large jets, which is not the case. This clarification will put the events in proper perspective. It is not accurate to state that there is a "minimum rotation speed needed to use Types II and IV fluids." There are no industry-standard speed restrictions for the use of particular fluid types. While approximately 100 knots is the lower end of the speed range for the testing of thickened fluids via AS 5900, this does not limit operational use. Boeing is aware that the SAE Aerodynamics Working Group has reviewed evidence indicating that, for at least one particular model that experienced several of these events, the lack of rotation response to normal pilot input was caused by fluid migration onto the elevator leading edge, causing air flow separation and flow reversal. When this occurs, the elevator's aerodynamic performance is severely compromised. While it is not known whether this phenomenon has caused all of the events, it is quite possible that the cause(s) could be diagnosed relatively easily, potentially leading to solutions for affected models. This would be far less onerous for all aircraft manufacturers than application of the proposed policy statement to address this issue.	"The FAA received reports of safety concerns regarding **certain turbo-prop** airplanes treated with thickened anti-icing fluids. … "~~A c~~ **C**ommon factor**s** in these incidents ~~is~~ **are** the rotation speeds **and airplane configurations. Rotation speeds for the airplanes involved** ~~which~~ were below, at, or slightly above ~~the~~ 100-knot**s.** ~~minimum rotation speed needed to use Types II and IV anti-icing fluids~~. In addition, the airplanes involved were all **turbo-props,** equipped with unpowered elevator flight controls. In most of the reported cases, the use of thickened anti-icing fluids had been approved for use on the airplane. Also, the flightcrews had followed	We do not consider the type of propulsion system used by the airplane relevant to the issue of fluid effects on the flight controls. We revised the text to clarify that the airplanes associated with the reports were certain airplanes with unpowered longitudinal flight controls.

	Comment	Requested Change	Disposition
66.	Boeing (7 of 29) "Relevant Past Practice," page 5 Boeing is aware of several events where the control surfaces were not "locked" or "frozen" but, rather, were reported only as "stiff" or that rotation was difficult to achieve. Our suggested revision would clarify this aspect. Some operators have also found re-hydrated gel residues on flight control actuators, cables and pulleys**,** and in control surface balance bays. We suggest adding this information for completeness. The stated lack of reports from North American operators is not entirely accurate. Boeing is aware of one report of a stiff flight-control event, with gel residues subsequently found, on a CRJ-700 in 2010. The airplane had been operated only in North America. With regard to this issue, it should be noted that there is a strong belief among the industry experts that one particular fluid caused most of the re-hydrated gel residue events, most of which occurred during a season of unusual weather patterns as well. In 2010, the Appendix A dry-out and re-hydration test of SAE AMS 1428 was revised to limit the amount of gel residue permitted to pass the test. This resulted in the particular fluid of concern being removed from the market. Since then, coupled with operator awareness efforts, as well as cleaning and inspection programs recommended by OEMs and adopted by operators, we are not aware that operational problems with re-hydrated gel residues continue to be a widespread problem. Rather, to the best of our knowledge, they have diminished and the issue is under control.	"When the residue of the evaporated thickened fluid is re-hydrated by humidity, rain, ~~or~~ washing the airplane, **or by another deicing procedure**, it may freeze and ~~lock~~ **limit movement of** the control surface when the airplane climbs to altitudes where temperatures are below freezing. Re-hydrated fluid has been found in and around gaps between stabilizers, elevators, tabs, and hinge areas. **It has also been found on flight control actuators, cables and pulleys, and in control surface balance bays.** This issue has **been prevalent in Europe, where operators often repeatedly deice and anti-ice with thickened fluids via the one-step application process. It has** not **often** been reported by North American operators because those operators deice with heated mixtures of Type I fluid and water that remove residues; therefore**, re-hydrated gel** residue~~s never get a chance to accumulate~~ **accumulation is typically prevented**."	We revised the text to address this comment in a manner similar to that suggested by Boeing.

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	Comment	Requested Change	Disposition
67.	Boeing (8 of 29) "Summary," page 1 and "Policy," page 6	Revise the text as follows: **Summary** (p. 1) – "This policy statement establishes Federal Aviation Administration (FAA) certification policy statement for approving the use of Type II, III, and IV deicing/anti-icing fluids on small ~~**and transport category**~~ airplanes. This policy statement also describes an approval process that may be used by type certificate holders and applicants for a type certificate under part~~s~~ 23 ~~and 25~~ to support operational use of these fluids on their airplanes." **Policy statement**, 1st & 2nd paragraphs (p. 5) – "The safety of using Type II, III, or IV deicing and anti-icing fluids should be addressed before operational use of such fluids is authorized. ~~**It is recommended, but not required, that the fluids be tested during the airplane's type certification process.**~~ If using thickened fluids results in significant or unusual flight or ground handling characteristics, this information ~~must~~ **should** be provided in the AFM in accordance with §§ 23.1581 and 23.1585, ~~**or §§ 25.1581 and 25.1587, as applicable**~~. To make this determination, applicants should **consider** conduct**ing** flight tests. …The specific fluid **type**s that have been approved should be identified ~~**in the AFM**~~, and the use of other fluid **type**s should be prohibited **in the AFM.** Because the purpose of these tests is to show compliance with part 23 ~~**or part 25**~~ regulatory requirements, the FAA will follow the procedures in FAA Order 8110.4C, Type Certification, for these tests. …"	We do not agree with applying this policy statement only to small (non-transport category) airplanes. The potential safety issues addressed by this policy statement affects both small and transport category airplanes. The use of mandatory versus non-mandatory language in this policy statement is in accordance with FAA Order IR 8100.16, "Aircraft Certification Service Policy Statement, Policy Memorandum, and Deviation Memorandum Systems," dated May 13, 2011. Key terms are defined in Attachment 1. We agree that testing of all fluids of each type would be impractical and unnecessary. We revised the text accordingly.

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68.	Boeing (9 of 29) "Policy," pages 6-12 The use of mandatory language in the draft policy statement is inappropriate per paragraph 2-2(c) of Order IR 8100.16, which quotes the following from the OMB GGP, 72 FR 3432: "Each guidance document should not include mandatory language such as 'shall,' 'must,' 'required,' or 'requirement,' ..." The regulatory definition of such mandatory language is also noted in Table A-1 of Attachment 1 of the draft policy statement. If by issuing the draft policy statement, the FAA desires to provide part 25 guidance for purely optional, non-required evaluations of the effects of thickened fluids, in accordance with the Order, we recommend that the FAA remove all mandatory language and regulatory-type requirements such as shown in the examples. If, on the other hand, the FAA expects part 25 airplane manufacturers to conduct flight test evaluations of deicing/anti-icing fluid effects in order for the operational use of fluids to be approved by the FAA, Boeing respectfully requests that the draft policy statement be withdrawn and the proper legal means of accomplishing that be employed, i.e., the normal rulemaking process (including the required Regulatory Evaluation).	Boeing respectfully requests that the FAA remove or revise all mandatory language and regulatory-type "requirements" within the document.	We do not agree that the policy statement includes mandatory language equivalent to that of rulemaking. Although including this level of review of the subject fluids as part of type certification may not have been applied in the past, it does not preclude the FAA from applying rules that apply. These fluids have been shown to have a negative impact on airplane performance and handling. How these fluids are addressed is outlined in this policy statement for standardization and a consistent application for the level of safety intended by the regulation. Policies only contain one method of compliance. Applicants are free to suggest other means to show compliance. Attachment 1 to the policy statement clearly defines use of these terms. We have not changed the policy statement in response to this comment.

	Comment	Requested Change	Disposition
69.	Boeing (10 of 29) "Summary," "Policy," "Effect of Policy," and "Implementation" As evidenced by our preceding comments, beginning with the Summary on page 1, the policy statement initially appears to be applicable to all part 23 and part 25 airplanes. However, page 6, paragraph 1 of "Policy" includes a limited applicability statement (i.e., airplanes with less than 100 KCAS takeoff rotation speed) that seems to apply only to paragraph 1. Paragraph 2 of the policy statement (p. 8) contains a different limited applicability than paragraph 1 (i.e., airplanes with reversible longitudinal controls). The remaining paragraphs 3 through 9 of the "Policy" section (pp. 9-12) do not contain applicability statements. It is not clear whether those paragraphs are proposed to apply to all part 23 and part 25 airplanes. Although applicability for those paragraphs that specifically address various aspects of the testing described in paragraphs 1 and 2 can be inferred to be likewise limited, readers would benefit from explicit clarification of the applicability of each paragraph.	Boeing respectfully requests that the applicability and its various provisions be clarified. The noted statement in the first paragraph of the "Effect of Policy" section (p. 11) implies that the draft policy statement is not applicable for all projects, but it fails to clearly describe those projects for which it would be applicable. In the third paragraph of the "Effect of Policy" section (p. 11), the FAA delegation statements indicate limited applicability. However, the fourth paragraph's first sentence states that it will affect approval of manuals for *"all airplanes,"* while the second sentence specifies an impact on flight testing for only certain airplanes. This is very confusing. Clarification regarding the intended applicability of the various aspects of the policy statement would avoid such confusion.	We added a new section, "Applicability," to clarify the applicability of each of the evaluations requested by this policy statement.

	Comment	Requested Change	Disposition
70.	Boeing (11 of 29) "Policy," pages 6, 8, and 9	Paragraphs 1, 4, 5, 6, and 7 need regulatory references. Pursuant to paragraph 2-3(a) of Order IR 8100.16, "each element" of a policy statement must have "a clear regulatory reference."	The regulatory references are provided in the section entitled, "Current Regulatory and Guidance Material." The regulatory basis for this policy statement in the section entitled "Policy." No changes were made in response to this comment.
71.	Boeing (12 of 29) "Policy," "1.a. Lift Loss Determination," page 7 Boeing notes that both fixed-pitch and normal takeoffs were conducted during the Model B-737-200 Advanced research flight testing of fluids, and it was found that fixed-pitch takeoffs were reasonably representative of normal takeoffs. (This is publicly documented in many publications, including that shown in footnote 5 of the draft policy statement.) Since that time, via the SAE G-12 Aerodynamics Working Group, Boeing has become aware that other manufacturers have determined that fixed-pitch takeoffs can be excessively conservative relative to normal takeoffs. This would be due to reduced shear forces acting upon the fluid when the airplane is at an increased pitch angle during the takeoff roll, resulting in less fluid elimination, and thus greater lift losses, than for a normal takeoff. Because of speed and takeoff profile differences, this may affect smaller airplanes differently than big jets. Boeing therefore suggests that normal takeoffs be recommended for this type of testing. [Note that the suggested revisions would also necessitate revision of the reference to fixed-pitch takeoffs in paragraph 2(b).]	"a. ~~Fixed-Pitch-Angle~~ Takeoffs. ~~Perform~~ **Normal** takeoffs **should be conducted** ~~at fixed-pitch angles~~ with and without thickened fluid applied. ~~Test several pitch angles representing the range of pitch angles at liftoff. Tests at maximum pitch attitude are not needed.~~"	We agree and revised the text accordingly.

	Comment	Requested Change	Disposition
72.	Boeing (13 of 29) "Policy," page 6 Our revisions to the proposed mandatory language correspond to our separate comments regarding compliance with Order IR 8100.16. Without these or similar revisions, the policy statement violates the Order by establishing a regulatory-type accountability threshold and related *de facto* requirements. Relative to the first paragraph, Boeing notes that, for the referenced research data (in the second paragraph), the lift losses were measured at a liftoff attitude typical for a one-engine inoperative climb for that model (fixed-pitch angle takeoffs were conducted). Boeing therefore recommends that the policy statement include guidance as to the airplane attitude at which the lift loss should be measured. In the first sentence of the second paragraph, it should be clarified that not all aircraft manufacturers have used this criteria, and those that have, typically have done so per guidance from the authorities. Relative to the stated justifications for recommending a 6% accountability threshold, Boeing maintains that it is inappropriate to use the flight-in-icing regulatory accountability threshold for takeoff ice as such justification. They are two different measures and scenarios. (It should also be noted that until late 2010, there was no FAA regulatory threshold for takeoff ice. JAA/EASA, however, permitted a 5% increase in takeoff speeds.) In the case of takeoff ice, ice accretes during the takeoff climb and remains on the airframe until removed by an ice protection system or sublimation. For takeoff with fluids, the lift decrement decreases after liftoff as additional fluid is eliminated from the wings during climb. When the aerodynamic acceptance test for fluids, SAE AS 5900, was developed, the V_2 margin was agreed to be the single most critical of several takeoff parameters. Since the loss of lift due to thickened fluids is transient, the rationale for recommending that it be measured at liftoff is unclear and not explained. (What is the concern at liftoff? For example, if it is considered a tailstrike risk, then Boeing would recommend that the amount of lift loss "allowable" be determined by the manufacturer.). Boeing also notes that only some of the results of the referenced research data indicate a 6% lift loss (at a liftoff attitude corresponding to a typical one-engine inoperative climb as noted above).	"… A 6% decrement in lift coefficient at liftoff ($C_{L_{LOF}}$) **measured at an airplane attitude corresponding to a typical engine-inoperative climb** ~~is~~ **should be** considered **a reasonable guideline for determining** significan**ce**~~t~~. For decrements greater than 6%, **an** increase takeoff speeds by at least one-half **of** the percentage decrement in $C_{L_{LOF}}$. **should be considered.** (For example, for an 8% decrement in CLLOF ~~increase~~ takeoff speeds V_R and V_2 **could be increased** by at least 4%.) ~~Increase t~~**T**akeoff distances specified in the AFM **should be increased** accordingly. The 6% ~~allowable~~ **suggested** decrement in $C_{L_{LOF}}$ before adjusting takeoff speeds has been employed by **some** airplane manufacturers and accepted by a number of aviation regulatory authorities. This decrement has been accepted on the basis that with the airplane at the same rotation pitch attitude and angle-of-attack (AOA), it will take a speed about 3% higher to generate the same lifting force. ~~The part 25 standards for icing certification allow up to a 3% increase in takeoff speeds before the effects of icing must be taken into account.~~ This level of lift loss also corresponds to ~~the lift loss measured during~~ **some of the results of** fluid testing on a Model 737-200ADV that was part of the research effort to develop the aerodynamic acceptance test for fluids."	We revised the text to include the suggested reference attitude for measuring the lift loss and to use language appropriate for identifying an acceptable means, but not the only means, of compliance.

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73.	Boeing (14 of 29) "Policy," page 8-9 The referenced part 25 certification regulations, 14 CFR §§ 25.143 and 25.251(d), and the associated AC 25-25 guidance material, do not include evaluation of the effects of deicing/anti-icing fluids. Without the suggested deletions, these paragraphs constitute the establishment of new *de facto* requirements under the part 25 certification regulations. This violates paragraphs 2-2(a) and (b) of Order IR 8100.16. Further, the means of compliance previously and currently accepted by the FAA for §§ 25.143 and 25.251(d) have never included evaluation of the effects of deicing/anti-icing fluids on Boeing airplanes. Since neither the regulations nor their AC 25-25 guidance material have been amended for this purpose, the draft policy statement would violate Order IR 8100.16's paragraph 2-2(b), which requires that "[e]ach method of compliance provided in a policy statement must be firmly based in the rule," and paragraph 2-2(d) with respect to previously acceptable means of compliance.	"**2. Controllability.** For airplanes with reversible longitudinal controls, the control forces during takeoff and climb should be shown to comply with § 23.143 ~~or § 25.143~~. … Even if compliance with § 23.143 ~~or § 25.143~~ is shown …" "**3. Vibration and Buffeting.** … The evaluation must meet the vibration and buffeting requirements of § 23.251(b) ~~or § 25.251(d), as applicable~~."	The part 25 standards referenced in these paragraphs provide an appropriate reference for determining if the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics. If so, § 25.1581(a)(2) requires furnishing such information in the AFM. Although including this level of review of the subject fluids as part of type certification may not have been applied in the past, that does not preclude application of the rules that apply as these fluids have been shown to have an impact on airplane performance and handling. How these fluids are addressed is outlined in this policy for standardization and a consistent application for the level of safety intended by the regulation. We have not changed the policy statement in response to this comment.

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74.	Boeing (15 of 29) "Policy," page 9 Should this paragraph be applicable to large jet transports (presumably with reversible controls per paragraph 2), Boeing does not recommend conducting ± 30º bank angle maneuvers at V_2. The guidance "as soon as practical after liftoff" should be determined in cooperation with the airplane manufacturer.	2.b.(2) "Controllability evaluations after takeoff (± 30º bank angle changes, +1.3/+0.8g or stall warning) with takeoff flaps, as soon as practical after liftoff~~, either at V2 or the speed at 50 feet height, depending on airplane category~~."	We agree that the guidance "as soon as practical after liftoff" should be determined in cooperation with the airplane manufacturer. This determination should include consideration of a safe height for conducting these evaluations. However, the evaluation should be done at the appropriate takeoff safety speed for the airplane category – V_2 or the speed at the 50 foot height. A 30 degree bank capability is required by 14 CFR 25.143(h) at V_2 speed, and this maneuver capability should not be reduced by the use of deicing/anti-icing fluids. We made no changes to the policy statement in response to this comment.
75.	Boeing (16 of 29) "Policy," page 9	"**4. Post-Flight Inspections.** ~~Conduct p~~**P**ost-flight inspections **should be conducted** to determine if thickened fluid residue is present on the airplane in aerodynamically quiet areas or on internal control system components. In addition, Boeing respectfully requests further clarification of the intended extent of such inspections, as well as recommended actions to be taken in the event that residual fluid is present.	The lead-in to the evaluations and guidance provided in paragraphs 1 through 9 states that the fluid approval process should address the applicable items identified in those paragraphs. We see no need to revise the text of paragraph 4 as Boeing suggested. We added text to clarify the purpose of the inspection and what would be done with the results.
76.	Boeing (17 of 29) "Policy," page 8 The footnote implies that the aircraft manufacturer is to conduct the fluid's aerodynamic acceptance testing per SAE AS 5900. This is not appropriate. Boeing is uncertain about the intention of the footnote but assumes that it should instead refer to using the results of the AS 5900 testing.	[6] ~~Follow the procedures in~~ **Consult** the most recent **results** ~~version~~ of SAE AS 5900 **for the fluid to be used in flight tests.**"	We deleted the footnote.

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77.	Boeing (18 of 29) "Policy," page 9 The revision of *"[a]pply"* to *"should be applied"* corresponds to our separate comments regarding compliance with Order IR 8100.16. Without these revisions, this paragraph violates the Order by including mandatory language that attempts to establish a *de facto* requirement. As drafted, the policy statement indicates that all three fluid types should be applied together. Boeing assumes that this is an inadvertent error, since only one thickened fluid should be applied for a given test.	5. Fluids. b. Fluid Application (1) ~~Apply u~~**U**ndiluted Type II, III, ~~and~~ **or** IV fluid**s should be applied**.	The lead-in to the evaluations and guidance provided in paragraphs 1 through 9 states that the fluid approval process should address the applicable items identified in those paragraphs. We see no need to revise the text of paragraph 4 as Boeing suggested. We did not change the policy statement in response to this comment.
78.	Boeing (19 of 20) "Policy," page 10 Boeing does not consider that it is practical, nor perhaps even possible, to achieve a test-day temperature that results in precisely the maximum allowable BLDT for a particular fluid. Therefore, an appropriate BLDT tolerance should be determined and included in the recommendation. The additional revisions shown are suggested to provide clarification.	**c. Test day temperature.** The test day temperature should result in the maximum allowable BLDT **for the test fluid, +/- [TBD],** per **the results of** SAE AS 5900 **for that fluid**.	We agree and incorporated a tolerance for the maximum test day temperature in the policy statement.

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79.	Boeing (20 of 29) "Policy," page 9 Boeing does not concur that video recording of fluid flow-off is typically necessary for non-research testing. The performance data should normally be all that are needed to determine acceptable flow-off characteristics. While videos might be useful if there are data that are not understood, these should be rare situations perhaps warranting another test with video recording.	Boeing suggests deleting these two sentences. 7. Airplane Configuration. ~~a. … In addition, record fluid flow-off characteristics on video and time synchronize this video recording with the recorded takeoff parameters. Use the video recording to verify acceptable flow-off characteristics.~~	We removed the text on video recording as suggested.

	Comment	Requested Change	Disposition
80.	Boeing (21 of 29) "Policy," page 10 Boeing requests that the noted language be deleted because the described condition may be airplane configuration-dependent. Referencing the results of the Boeing Model 737-200Adv testing noted in footnote 5 of the proposed policy statement, for testing with extended leading-edge high-lift devices, it was consistently found that a secondary wave aft of the leading edge occurred immediately after liftoff. This caused higher lift losses at increased angles of attack, but was not deemed adverse to safe flight. Testing with the leading-edge devices retracted, however, did not experience the secondary wave. Considering that flow-off characteristics for airplanes with similar deflected leading-edge high-lift devices have always existed when thickened fluids have been applied, there is no operational experience indicating a concern. For airplanes without deployed leading-edge high-lift devices, the effect of waves or ridges existing after rotation will be evident in the performance data. Boeing therefore submits that the presence of waves or ridges should not be a criterion; rather, the data should guide evaluations.	7. Airplane Configuration. a. … The wing leading edge should be essentially clean at rotation~~, and there should not be any significant standing ridges of fluid further back on the wing after rotation~~.	We removed this entire paragraph on video recording of fluid flow-off characteristics.

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	Comment	Requested Change	Disposition
81.	Boeing (22 of 29) "Policy," page 10 Boeing does not concur that a "minimum production tolerance" should be necessary for such tests. The potential effect of the size of the elevator/horizontal stabilizer gap with regard to the issue of increased rotation forces is merely a hypothesis. (Please see our separate comment regarding evidence pertinent to the actual cause of at least some of the events.) If testing is conducted at a location remote from the aircraft manufacturer's facilities, adjusting the rigging of the surfaces is likely very impractical or perhaps even impossible. Likewise, measuring the gap off-site may also be impractical. We therefore suggest that the gap size be "determined" (e.g., measured at the manufacturers' facilities) for the purpose of acquiring data regarding any potential effect of gap size on the issue of increased rotation forces for a particular model.	7. Airplane Configuration. b. The elevator/horizontal stabilizer gap should be **determined and reported relative to** ~~at~~ the ~~minimum~~ production tolerance.	We agree and revised the text to request determining and recording the elevator/stabilizer gap.

	Comment	Requested Change	Disposition
82.	Boeing (23 of 29) "Policy," page 10 Boeing does not consider it appropriate to include as an AFM Limitation a statement regarding the types of fluid that can be used; rather, only fluids that cannot be used should constitute a limitation. Pursuant to the guidance contained in paragraph 5(a), if a Type IV fluid is appropriately and successfully tested: "This allows approval of Type II, Type III, and Type IV fluids. Type III fluid does not need to be tested if a Type II or IV fluid is tested. …" Our suggested revisions are intended to correspond to this guidance.	**8. Airplane Flight Manual.** **a. Fluids.** In the AFM Limitations section identify the type(s) of fluid **not** approved as an operating limitation. . . . . If Type ~~II, III, or~~ IV fluid~~s were~~ **was** not evaluated, the AFM Limitations section should state **that** the use of **Type IV** fluids is prohibited**. If only a Type III fluid was tested, the AFM Limitations section should state that the use of fluid Types II and IV is prohibited**." **b. Limitations. Any airplane-specific restrictive i**~~I~~nformation considered necessary for safe airplane operations with deicing or anti-icing fluids applied should be furnished in the AFM Limitations section. An example is restrictions in the use of flaps.	We disagree with this comment. We consider it necessary for the operating limitations furnished in the AFM to include the type(s) of fluids that are approved for use on the airplane. We do not consider it appropriate to imply a fluid type is approved simply by not listing it as prohibited. This is similar to "Kinds of operations," which must each be specifically identified in accordance with § 25.1583(e). We did not make any changes in response to this comment.
83.	Boeing (24 of 29) "Policy," page 11 This paragraph could be interpreted to mean that all information necessary for safe operation with fluids should be included in the AFM Limitations section. This could constitute many pages of basic information on safe operation with fluids, such as application and holdover time information, etc., that is not appropriate for the AFM (and is likely not the intention of this paragraph). Rather, Boeing considers that only restrictive types of information for a particular airplane, such as the example, are appropriate as AFM limitations.	**8. Airplane Flight Manual.** **b. Limitations. Any airplane-specific restrictive i**~~I~~nformation considered necessary for safe airplane operations with deicing or anti-icing fluids applied should be furnished in the AFM Limitations section. An example is restrictions in the use of flaps.	We revised the text as suggested.

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	Comment	Requested Change	Disposition
84.	Boeing (25 of 29) "Policy," page, 12, paragraph 8.c. Boeing provides fluid-residue inspection information in the maintenance manuals. We do not consider it appropriate to include such procedures in the AFM.	8. Airplane Flight Manual. ~~"**c. Procedures.** Furnish procedures for pre-flight or post-flight inspection and cleaning of areas in which fluid residue is shown to occur."~~ Boeing respectfully requests that this paragraph be deleted.	We agree that the maintenance manuals are the appropriate documents for inspection and cleaning procedures. We deleted this paragraph as suggested.
85.	Boeing (26 of 29) "Effect of Policy," first paragraph, page 12 Note that the emphasized phrase in the second sentence is addressed in one of our separate comments relative to unclear applicability. Boeing recommends that the remainder of the paragraph be deleted. Contrary to the first sentence, the described potential for certification issue papers puts the policy statement into the realm of certification rulemaking. This violates Order IR 8100.16, paragraph 2-2(a), which states: "Policy statements must not create or change the regulatory requirement."	"The general policy statement stated in this document does not constitute a new regulation. The FAA personnel who implement this policy statement should follow it **when it is applicable** to a specific project~~. If an applicant's proposed method of compliance is outside this policy statement, the project aircraft certification office must coordinate it with the policy statement issuing office using an issue paper. Similarly, if the project aircraft certification office becomes aware of reasons that an applicant's proposal that meets this policy statement should not be approved, the office must coordinate its response with the policy statement issuing office.~~"	We added a paragraph to clarify the applicability of this policy statement in response to this and other comments. We disagree that the remainder of the paragraph creates or changes a regulatory requirement. We also clarified the "Implementation" section to indicate that the compliance methods identified in this policy statement apply to those programs for which application for type certification approval is sought on or after the effective date of the final policy statement.

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86.	Boeing (27 of 29) "Effect of Policy," 2nd paragraph, page 12 Boeing respectfully requests that the language be modified in the first sentence such that it does not refer to "findings of compliance" or "approvals for the use" of fluids. As noted in separate comments, the part 25 certification requirements do not include evaluations relative to the use of fluids; thus, the FAA does not provide certification approval for the use of fluids on Boeing airplanes. Boeing suggests the addition of the last sentence to make the policy statement compliant with Order IR 8100.16, paragraph 2-2(d), which states: "When the policy statement contains a method of compliance that may be perceived as more stringent, the policy statement must make clear that the previously acceptable method is still acceptable."	"Applicants should expect that the certificating officials will consider this information ~~when making findings of compliance relevant to new approvals for~~ **relative to** the use of Type II, III, or IV deicing and anti-icing fluids. In addition, as with all guidance material, this statement of policy statement identifies one means, but not the only means, of compliance. **Previously acceptable methods of compliance with the relevant regulatory requirements remain acceptable.**"	As stated in response to Boeing comment 1, the applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address newly emergent safety issues. There were no previous acceptable means of compliance to address these safety issues. Although we did revise the "Effect of Policy" section, we did not make any changes in response to this comment.

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87.	Boeing (28 of 29) "Implementation," page 12 Each sentence of this paragraph appears to be contrary to Order IR 8100.16, via either objectionable text or unclear guidance that is addressed in separate comments. For example: • Neither the part 25 certification regulations nor their associated AC guidance materials include evaluation of the effects of applied fluids. • Type certification approval or other FAA authorization for the use of fluids on Boeing airplanes has never before been needed. • The intended applicability of various provisions of the policy statement is unclear and confusing. • Since the policy statement contains methods of compliance that can be perceived as more stringent than previously acceptable methods, it must be explicitly stated that previously acceptable methods of compliance with the relevant regulations remain acceptable.	Revise the text to read as follows: "This policy statement discusses compliance methods that should be applied to type certification approval for use of Type II, III, or IV deicing and anti-icing fluids on a part 23 ~~or part 25~~ airplane. Type certification approval will be needed to facilitate authorization for operational use of such fluids on the airplane. **[clarify applicability]** The compliance methods identified in this policy statement apply to those programs for which approval is sought on or after the effective date of the final policy statement. **[clarify applicability] Previously acceptable methods of compliance with the relevant regulatory requirements remain acceptable.** ~~If the date of application precedes the effective date of the final policy statement, and the methods of compliance have already been coordinated with and approved by the FAA or its designee,~~ **Therefore,** the applicant may choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy statement."	The use of Type II, III, and IV deicing/anti-icing fluids on both small and transport category airplanes raises safety concerns and have resulted in the issuance of Airworthiness Directives as well as other safety actions. The applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address safety issues. Specifically, § 25.1581(a)(2) requires furnishing information in the AFM that is necessary for safe operation because of design, operating, or handling characteristics. If the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics, that information must be furnished in the AFM. The applicable regulations cited in the policy statement are the performance standards by which it can be determined whether the operating or handling characteristics may affect safe operations when Type II, III, or IV deicing/anti-icing fluid is applied. Appendix H to part 25 requires information to be provided in the Instructions for Continued Airworthiness on the types of fluids to be used and scheduling information for cleaning and inspecting each part of the airplane. We consider Type II, III, and IV deicing/anti-icing fluids to be fluids covered by these requirements. Although we significantly revised the "Implementation" section, we did not make any changes to the policy statement in response to this comment.

	Comment	Requested Change	Disposition
88.	Boeing (29 of 29) "Conclusion," page 13 Neither the cited part 25 certification regulations nor their associated AC guidance materials require evaluation of the effects of thickened fluids. Inclusion of part 25 regulations in the policy statement violates paragraph 2-2(a) of Order IR 8100.16, which states: "Policy statements must not create or change the regulatory requirement." Boeing is not particularly familiar with part 23 regulatory requirements. Our lack of comments on those aspects should not be construed as concurrence with the proposals.	"… Flight tests should be conducted to evaluate the effect of thickened fluids on airworthiness to show compliance with §§ 23.143(c), 23.1529, 23.1581, 23.1583, 23.1585, and appendix G to part 23~~; or §§ 25.143(d), 25.1529, 25.1581, 25.1583, 25.1587, and appendix H to part 25, as applicable~~."	The use of Type II, III, and IV deicing/anti-icing fluids on both small and transport category airplanes raises safety concerns and have resulted in the issuance of Airworthiness Directives as well as other safety actions. The applicable 14 CFR part 23 and part 25 regulations are performance standards that allow the addition of new means of compliance to address safety issues. Specifically, § 25.1581(a)(2) requires furnishing information in the AFM that is necessary for safe operation because of design, operating, or handling characteristics. If the use of Type II, III, or IV deicing/anti-icing fluids may affect safe operations due to operating or handling characteristics, that information must be furnished in the AFM. The applicable regulations cited in the policy statement are the performance standards by which it can be determined whether the operating or handling characteristics may affect safe operations when Type II, III, or IV deicing/anti-icing fluid is applied. Appendix H to part 25 requires information to be provided in the Instructions for Continued Airworthiness on the types of fluids to be used and scheduling information for cleaning and inspecting each part of the airplane. We consider Type II, III, and IV deicing/anti-icing fluids to be fluids covered by these requirements. We did not make any changes to the policy statement in response to this comment.

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89.	Bombardier (1 of 8)	Under "Relevant Past Practice," the second-to-last paragraph contains several inaccuracies. In our experience, controls do not suddenly "lock" but instead become increasingly stiff. Several instances of "stiff" aileron flight controls have been reported on Bombardier aircraft. These incidents have occurred mostly in Europe as the policy statement indicates, but in at least one case, a North American operator has reported stiff controls as the result of anti-icing/de-icing fluid residues. Post-flight inspections have indicated that anti-icing/de-icing fluid gel residues in the aileron flight control system caused some stiffness. We recommend correcting the inaccuracies in this section to reflect that difficulties have been encountered by North American operators, and to delete references to control "lock."	We revised the text to address this comment. We revised the paragraph to clarify that the control surfaces may have restricted movements, rather than becoming "locked."
90.	Bombardier (2 of 8)	The policy statement calls for testing each type of fluid that will be approved for use on the aircraft. We recommend retaining the current approach, where one fluid is tested and additional-fluid types are approved by similarity.	We agree that testing each type of fluid would be unnecessary. We revised the text accordingly.

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91.	Bombardier (3 of 8)	**1.a. Fixed Pitch Angle takeoff testing:** Bombardier experience has shown that high attitude fixed pitch take-offs require that the aircraft be rotated early, typically at less than 100 knots. Fluid flow-off is a function of the aerodynamic shear forces which in turn are a function of the airspeed over the wing; hence, the amount of residual fluid on the wing at lift-off during the high attitude fixed pitch tests, for aircraft with typical rotation speeds greater than 100 knots, was greater than for a normal take-offs. This can cause larger loss of lift than that which occurs during normal take-offs where rotation occurs at higher speeds. To guarantee that data collected during the anti-ice fluid tests is representative and to maintain an adequate level of safety Bombardier does not advocate the extensive use of fixed pitch attitude take-off demonstrations for fluid testing, and recommends that no "high attitude" fixed pitch tests be performed at all.	We agree and revised the text to remove the need to conduct the lift loss evaluations using fixed pitch angles takeoffs.
92.	Bombardier (4 of 8)	**1.b. and 2.b.Take-off AOA margin tests and controllability tests** – unclear on definition of "simulated one engine inoperative takeoff"—symmetrical reduced thrust or reduced thrust on one engine only. We recommend specifying the use of symmetrical thrust reduction for safety reasons.	We added a note stating that the one-engine-inoperative condition can be simulated by conducting the test with all engines operating, but with the engines at reduced power or thrust.

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93.	Bombardier (5 of 8)	**4. Post-Flight Inspections** – The purpose of this inspection would be to gather data to be used to develop procedures for pre-flight or post-flight inspection and cleaning of areas in which fluid residue is shown to occur. We recommend describing the purpose of the post-test-flight inspection in the policy statement. Emphasis should be placed on the evaluation of application methods (including control surface position at the time of application) and training for de-icing crews to prevent inappropriate spraying techniques, such as spraying from the rear of the wing, to prevent penetration of fluids into sensitive areas of the wing where the flight control cables and pulleys may reside.	We added text to state that the results of this inspection should be used to guide the development of the maintenance instructions specified in section 9, "Instructions for Continued Airworthiness."
94.	Bombardier (6 of 8)	**5.c. Test day temperature** – The requirement for "maximum" BLDT, typically encountered at temperatures approaching -20°C is impractical, and to some extent ignores the qualification testing of the fluids. We recommend stating an allowable tolerance for maximum BLDT.	We agree and incorporated a tolerance for the maximum test day temperature.
95.	Bombardier (7 of 8)	**7.b. Airplane Test Configuration** – We have seen no evidence that elevator/horizontal stabilizer gap is a proven critical parameter for this type of testing. We recommend deleting all reference to this parameter in the policy statement.	We revised the text to have applicants only measure and record the elevator/stabilizer gap instead of setting the gap to the minimum production tolerance.

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96.	Bombardier (8 of 8)	**Effect of Policy.** The description of applicability is unclear and confusing. "This policy statement will affect… changes to the list of approved fluids…." There is no previous mention in the policy statement on amending the list of approved fluids. We recommend rewriting this section of the document to clarify that the policy statement is applicable only to aircraft with reversible flight controls and a $V_r < 100$ KCAS.	We added a new section, "Applicability," to clarify the applicability of each of the evaluations covered by this policy statement. We also revised the "Effect of Policy" section and deleted this sentence. We also changed the speed value from 100 knots to 110 knots to be consistent with the highest speed quoted in SAE AS 5900.