U.S. Department of Transportation
Federal Aviation Administration

Policy Statement

Subject: Use of Hydrophobic Coating in lieu of Windshield Wipers

Date: DRAFT

Policy No: DRAFT PS-AIR-25-31

Initiated By: AIR-623

1 SUMMARY

This policy statement describes means of compliance with title 14, Code of Federal Regulations (14 CFR) §§ 25.603, 25.773, 25.1501, and 25.1529 when hydrophobic coatings are used as the primary means to maintain a clear view through the flightdeck windshield during precipitation conditions.

2 DEFINITION OF KEY TERMS

In this policy, the terms “must,” and “should,” have specific meanings:

- The term “must” refers to a regulatory requirement that is mandatory for design approval. The functional impact of the term “must” is that the requirement has to be met to achieve design approval.
- The term “should” refers to instructions for a particular acceptable means of compliance (MOC). The functional impact of the term “should” is that any alternative MOC has to be approved by issue paper.

3 CURRENT REGULATORY AND ADVISORY MATERIAL

The following regulations are relevant to this policy’s method of using hydrophobic coatings as the primary means to maintain a clear view through the flightdeck windshield.

- Section 25.603, Materials.
- Section 25.773, Pilot compartment view.
- Section 25.1501, General.
- Section 25.1529, Instructions for Continued Airworthiness.

Although no previous specific guidance related to the subject of this policy has been issued, the following advisory circulars (ACs) contain information related to the requirement of section 25.773(b) to maintain a clear view through the flightdeck windshield in precipitation conditions:

- AC 25-22, *Certification of Transport Airplane Mechanical Systems,* dated March 14, 2000, re-emphasizes that the intent of § 25.773 is for the flightdeck windshield to provide sufficient external vision to permit the pilot to safely perform any maneuvers within the operating limits of the airplane and, at the same time, afford an unobstructed view of the flight instruments and other critical components and displays from the same eye position.
- AC 25.773-1, *Pilot Compartment View Design Considerations,* dated January 8, 1993, contains guidance related to pilot compartment view. The guidance in this AC is general enough to be relevant even though the use of hydrophobic coatings is not specifically mentioned.

4 RELEVANT PAST PRACTICE

Section 25.773(b)(1), in pertinent part, historically required a means to ensure both pilots have a sufficiently extensive view along the flight path during precipitation conditions. Specifically, § 25.773(b)(1)(i) required a means to maintain a clear portion of the windshield during precipitation in heavy rain at speeds up to 1.5 V_{SR1}[1]. Traditionally, the means used by applicants to maintain a clear view under these conditions was the use of windshield wipers. Unlike windshield wipers, hydrophobic coatings may depend to some degree on airflow to maintain a clear vision area. The heavy rain and high speed conditions previously specified in § 25.773(b)(1) do not necessarily represent the limiting condition for hydrophobic coatings. For example, airflow over the flightdeck windshield, which may be necessary to remove moisture from the flightdeck windshield, may not be adequate to maintain a sufficiently clear area in low speed flight and during ground operations. In addition, airflow over the flightdeck windshield may be disturbed during such critical times as the approach to land, where the airplane is at a higher than normal pitch attitude. In these cases, areas of airflow disturbance or separation on the flightdeck windshield may cause failure to maintain a clear vision area.

The FAA considers hydrophobic coatings to be a novel or unusual design feature, and therefore has required special conditions when this technology is used as the primary means of maintaining a clear view. Such conditions ensure that the appropriate critical conditions are assessed during the certification process. These special conditions also require the hydrophobic coating and associated instructions for its use to comply with §§ 25.603 and 25.1529.

Section 25.773(b)(1) has since been revised in Amendment ## to require a means to ensure both pilots have a sufficiently extensive view for all operations throughout the operating envelope of the airplane, including taxiing, takeoff, approach, and landing. In addition, the means to maintain a clear view through the windshield requires consideration in precipitation conditions likely to be the most critical for hydrophobic coatings. Light precipitation conditions, such as mist, drizzle, or light rain with little or no airflow over the windshield, are typically the most critical for hydrophobic coatings;

[1] V_{SR1} refers to the stall speed in a specific configuration.

these conditions are generally encountered during landing as well as ground operations. It is these light precipitation conditions with little or no airflow over the windshield that were previously addressed by special conditions.

5 POLICY

5.1 The Pilot Compartment View Must Comply With § 25.773.

The applicant proposes, for FAA approval, the intended method of showing compliance to § 25.773 in the project-specific certification plan. This method should include evaluation of non-precipitation conditions as well as foreseeable precipitation conditions such as rain and snow that may occur throughout the operating envelope of the airplane. In addition, various airplane speeds and airplane configurations that may result in areas on the windshield where airflow is stagnated or may otherwise interfere with maintaining the required clear vision area should be considered. These considerations are intended to enable the flightcrew to safely perform any maneuvers within the operating limitations of the airplane, including taxiing, takeoff, approach, and landing in accordance with § 25.773(b)(1). Both light precipitation conditions such as mist, drizzle, and light rain as well as heavy rain conditions should be addressed. The analyses and tests supporting the Instructions for Continued Airworthiness (ICA) of the hydrophobic coating should consider the probability of encountering the environmental conditions specified in § 25.773 as one.

5.2 The Hydrophobic Coating Must Be Included In The Airplane Proposed Type Design In Accordance With § 21.31.

Making the hydrophobic coating part of the type design will necessitate that the manufacturer of the coating produces the coating according to the material specification unique for their hydrophobic coating and an FAA-approved quality system.

5.3 The Materials Used In Hydrophobic Coating Must Comply With § 25.603.

5.3.1 The windshield coating should be considered a part of the airplane, or component, the failure of which could adversely affect the safety of the airplane. It must therefore comply with § 25.603. Service experience shows that such coatings may have a limited and variable effective life, and the failure of the coating may be latent. In general, the hydrophobic coating should not be corrosive in nature nor cause degradation of the airplane's external protective coating. The applicant should describe how it will ensure the continued airworthiness of the hydrophobic coating. This information should include consideration of any factors that can cause degradation of the effectiveness of the coating over time, such as aging, aerodynamic erosion, thermal effects, and exposure to water and expected ground operations or use of chemicals such as anti-ice and de-icing fluids. In addition, the applicant should identify any factors that may cause unacceptable degradation of the coating from a single environmental exposure, such as hail, volcanic ash, or wind-blown sand, and describe how continued airworthiness will be ensured following an exposure event.

5.3.2 In addition to these considerations, the FAA is aware that hydrophobic coatings may be particularly susceptible to degradation in a manner that would not cause a problem for windows having more conventional means of precipitation removal. To ensure the coating functions as designed and to show compliance with § 25.603, the applicant should provide specifications that include material characteristics of the coating, procedures on applying the coating, and proper handling of the coating material (e.g., storage procedures, and coating processes that take into account environmental conditions that might affect proper application such as temperature or humidity.) The purpose of these specifications is to ensure consistent and predictable performance of the means to maintain a clear view through the windshield.

5.4 **Instructions To Maintain The Hydrophobic Coating Must Comply With § 25.1529.**

5.4.1 The continued airworthiness of the coating should be addressed in the ICA required by § 25.1529. If the continued airworthiness of the coating is premised on an inspection interval, the applicant should substantiate that the interval is appropriate considering the variable effective life of the coating.

5.4.2 The inclusion of appropriate information and/or limitations in the aircraft maintenance manual (AMM) is an acceptable means to mitigate risk associated with component degradation.

5.4.3 The ICA should address specific areas to include:

1. Installation instructions for application and maintenance of the coating and what substrates it is compatible with, since windshields may be made by different vendors. Instructions should include the approved materials needed for application of the coating, such as the type of rag used for application, type of cleaners, waxes, etc.
2. Approved cleaning procedures.
3. Instructions for re-application of the coating along with inspection criteria to know if the coating is still effective or not, and
4. any limitations regarding the use of anti-ice or de-icing fluids or ground operation procedures expected in service.

5.5 **Operating Limitations or Other Information Necessary for Safe Operations In Accordance With § 25.1501.**

In pertinent part, § 25.773(b)(1) requires that the airplane have a means to maintain a clear portion of the windshield, during precipitation conditions, sufficient for both pilots to have a sufficiently extensive view for all operations within the operating limitations of the airplane, including taxiing, takeoff, approach, and landing.. The precipitation conditions encountered during landing or ground operations may be most critical with respect to the performance of the hydrophobic coating due to limited airflow over the windshield and small water drops, rather than the heavy rain described in § 25.773(b). The applicant should propose, for FAA approval, the intended method of addressing precipitation conditions that may be encountered during landing, ground operations, or

other critical conditions where airflow may be limited over the windshield. Any operating limitations or special instructions necessary for safe operation in consideration of the hydrophobic windshield coating must be established in accordance with § 25.1501 and made available to crewmembers.

5.5.1 The inclusion of appropriate usage instructions and/or operational limitations in the aircraft flight manual (AFM) may be used to mitigate risk associated with component degradation.

5.5.2 The AFM should include information to the flightcrew of conditions that may cause the hydrophobic coating to degrade in performance (e.g., operating in volcanic ash, sandstorms, hail, etc.) to alert the maintenance crew of possible maintenance actions.

5.5.3 In addition, the AFM should include any necessary procedures or limitations when crew action is required following a single environmental exposure that is likely to degrade coating effectiveness and there is no immediate opportunity to evaluate the coating.

6 EFFECT OF POLICY

The contents of this policy statement do not have the force and effect of law and are not meant to bind the public in any way. This policy statement is intended only to provide clarity to the public regarding existing requirements under the law or agency policies.

This policy statement does not constitute a new regulation. Agency employees and their designees and delegations must not depart from this policy statement without the concurrence of the policy issuing office. The authority to deviate from this policy statement is delegated to the Manager, Transport Standards Branch.

If a proposed method of compliance appears to differ from the guidance expressed in this policy statement, the Aircraft Certification Service office responsible for the project should coordinate any proposed approval or compliance finding with the policy issuing office. Conversely, if a proposed method of compliance that appears to follow this policy statement should not be approved, in the opinion of the reviewing office, then the responsible office should coordinate any proposed denial with the policy issuing office.

Additional information on the effect of FAA policy statements may be found in FAA Order IR 8100.16, *Aircraft Certification Service Policy Statement, Policy Memorandum, and Deviation Memorandum Systems*.

7 IMPLEMENTATION

This policy statement discusses compliance methods that should be applied to type certificate, amended type certificate, supplemental type certificate, and amended supplemental type certificate programs. The compliance methods apply to those programs with an application date that is on or after the effective date of the final policy and include the latest amendment of § 25.773 in the certification basis. If the date of application precedes the effective date of the final policy, 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.

8 CONCLUSION

This policy describes compliance methods that can be used to show compliance with §§ 25.603, 25.773, 25.1501 and 25.1529 as they relate to the use of hydrophobic coatings as the means to maintain a clear view through the windshield in precipitation conditions. As required in § 25.773(b)(1), each pilot compartment must be arranged to give the pilots a sufficiently extensive, clear, and undistorted view, to enable them to safely perform all operations within the operating limitations of the airplane, including taxiing, takeoff, approach, and landing. The methods of compliance described in this policy are in alignment with previous special conditions related to the use of hydrophobic coatings in lieu of windshield wipers and may be used to show compliance when such coatings are used.

END