AIPS Aviation Inc.

TP 15692E
Final Version 1.0
November 2025

AIRCRAFT GROUND DE/ANTI-ICING FLUID HOLDOVER TIME DEVELOPMENT PROGRAM FOR THE 2024-25 WINTER





Prepared for:

Transport Canada
Programs Group
Innovation Centre

In cooperation with:

Federal Aviation Administration
William J. Hughes Technical Center for Advanced Aerospace

Transport Canada
Civil Aviation

Federal Aviation Administration
Flight Standards – Air Carrier Operations

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Prepared by:

Dany Posteraro

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Neither the Transport Canada Programs Group Innovation Centre nor the co-sponsoring organizations endorse the products or manufacturers. Trade or manufacturers' names appear in this report only because they are essential to its objectives.

DOCUMENT ORIGIN AND APPROVAL RECORD

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May 11, 2026

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Un sommaire français se trouve avant la table des matières.

This report was first provided to Transport Canada as Final Draft 1.0 in November 2025.
It has been published as Final Version 1.0 in May 2026.

PREFACE

Under contract to the Transport Canada Programs Group Innovation Centre, APS Aviation Inc. has undertaken a research program to advance aircraft ground de/anti-icing technology. The primary objectives of the research program are the following:

- To develop holdover time data for all new de/anti-icing fluids;
- To conduct testing to determine holdover times for Type II, III, and IV fluids in snow at temperatures below -14°C;
- To evaluate and develop the use of artificial snow machines for holdover time development;
- To conduct wind tunnel testing with a thin high performance wing model to support the development of guidance material for operating in ice pellet conditions;
- To conduct comparative endurance time testing and evaluate endurance times in several mixed conditions;
- To conduct general and exploratory de/anti-icing research;
- To conduct analysis to support harmonization of the Transport Canada and the Federal Aviation Administration visibility table guidance;
- To finalize the publication and delivery of current and historical reports;
- To update the regression information report to reflect changes made to the holdover time guidelines; and
- To update the holdover time guidance materials for annual publication by Transport Canada and the Federal Aviation Administration.

The research activities of the program conducted on behalf of Transport Canada during the winter of 2024-25 are documented in five reports. The titles of the reports are as follows:

- TP 15692E Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2024-25 Winter;
- TP 15693E Regression Coefficients and Equations Used to Develop the Winter 2025-26 Aircraft Ground Deicing Holdover Time Tables;
- TP 15684E Aircraft Ground Icing General Research Activities During the 2024-25 Winter;
- TP 15685E Wind Tunnel Trials to Support Further Development of Ice Pellet Allowance Times: Winter 2024-25; and
- TP 15686E Testing and Evaluation of Mixed Phase Icing Conditions: Winter 2024-25.

In addition, the following interim report is being prepared:

- *Artificial Snow Research Activities for the 2024-25 Winter*.

This report, TP 15692E, has the following objective:

- To develop holdover time data for new de/anti-icing fluids and to document changes made to the holdover time guidelines.

This objective was met by conducting endurance time tests with fluids in simulated freezing precipitation at the National Research Council Canada Climatic Engineering Facility in Ottawa, in artificial snow at PMG Technologies Inc. in Blainville, and in natural snow at the APS Aviation Inc. test site at the Montréal–Pierre Elliot Trudeau International Airport in Montreal.

PROGRAM ACKNOWLEDGEMENTS

This multi-year research program has been funded by the Transport Canada Programs Group Innovation Centre, with support from the Federal Aviation Administration William J. Hughes Technical Center for Advanced Aerospace, Transport Canada Civil Aviation, and Federal Aviation Administration Flight Standards – Air Carrier Operations. This program could not have been accomplished without the participation of many organizations. APS Aviation Inc. would therefore like to thank Transport Canada, the Federal Aviation Administration, National Research Council Canada, and supporting members of the SAE International G-12 Aircraft Ground Deicing Committees.

APS Aviation Inc. would also like to acknowledge the dedication of the research team, whose performance was crucial to the acquisition of hard data, completion of data analysis, and preparation of reports. This includes the following people: Brandon Auclair, Steven D. Baker, David Beals, Benjamin Bernier, Chloë Bernier, Megane Brien, Sarah Chadzak, Kasandra Cook, Devin Costain, John D'Avirro, Peter Dawson, Sean Devine, Akvile Gigaite, Tyler Groleau, Cassidy Kinderman-McCormick, Kyra Kinderman-McCormick, Peter Kitchener, Francine De Ladurantaye, Shamim Nakhaei, Dany Posteraro, Marc Quesnel, Salvatore Rosato, Marco Ruggi, Javad Safari, James Smyth, Yi Tian, Jeffrey Wajsberg, and Ian Wittmeyer.

Special thanks are extended to Antoine Lacroix, Yvan Chabot, Carlos Carreiro, Warren Underwood, Timothy McClain, Timothy G. Smith, Stephanie Divito, and Thomas Natoli who on behalf of Transport Canada and the Federal Aviation Administration, have participated, contributed, and provided guidance in the preparation of these documents.

PROJECT ACKNOWLEDGEMENTS

APS Aviation Inc. would like to acknowledge the contributions of the following organizations to this project: Meteorological Services Canada and Aéroports de Montréal for providing an outdoor testing location, and the fluid manufacturers for providing support and funding.

Transport Canada / Transports Canada

PUBLICATION DATA FORM

1. Transport Canada Publication No.	2. Project No.	3. Recipient's Catalogue No.
TP 15692E	B14W/9A0A/8258	

4. Title and Subtitle	5. Publication Date
Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2024-25 Winter	November 2025
	6. Performing Organization Document No.: 301351
7. Author(s): Dany Posteraro	8. Transport Canada File No.: T8009-220126
9. Performing Organization Name and Address: APS Aviation Inc., 6700 Côte-de-Liesse Rd., Suite 102, Montreal, Quebec, H4T 2B5	10. PWGSC File No.: 013sl T8009-220126
	11. PWGSC or Transport Canada Contract No.: CW2270722
12. Sponsoring Agency Name and Address: Transport Canada, Programs Group Innovation Centre, 330 Sparks St., 18th Floor, Ottawa, Ontario, K1A 0N5	13. Type of Publication and Period Covered: Final
	14. Project Officer: Antoine Lacroix

15. Supplementary Notes (Funding programs, titles of related publications, etc.)

Several research reports for testing of de/anti-icing technologies were produced for previous winters on behalf of Transport Canada (TC). These are available from the TC Programs Group Innovation Centre. Several reports were produced as part of this winter's research program. Their subject matter is outlined in the preface. This project was co-sponsored by the Federal Aviation Administration.

16. Abstract

The primary objective of the 2024-25 holdover time (HOT) test program was to evaluate the performance of new deicing and anti-icing fluids over the entire range of conditions encompassed by the HOT Guidelines. The objective was met by conducting endurance time tests. The procedure for these tests consisted of pouring fluids onto clean aluminum test surfaces inclined at 10º. The onset of failure was recorded as a function of time in various precipitation conditions. A total of 1151 tests were conducted with eleven fluids. The research conducted in the winter of 2024-25 resulted in the below changes to the HOT Guidelines for the winter of 2025-26.

- Fluid-specific HOT Guidelines were created for six new fluids, while dilutions for one fluid were removed. These changes resulted in increases to the Type II generic HOTs and decreases to the Type IV generic HOTs. Three new fluids also completed supplemental very cold snow testing and received fluid-specific HOTs in snow below -14°C.
- The holdover times for Type I aluminum and composite fluids in the "Snow mixed with Freezing Fog" column have been increased.
- A new "Moderate Snow mixed with Rain" column has been added to all Type I, II, III, and IV HOT tables with fluid-specific values.
- The note regarding the 90-minute rule has been updated to add clarity and to include the new allowance time condition.
- A caution has been modified to the following guideline: "Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilutions of Type II or IV are not to be used for the anti-icing step because fluid freezing may occur."
- The following note has been modified across all HOT tables to improve clarity: "Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist."
- The following note has been removed from the generic HOT tables as it was deemed redundant: "If the lowest operational use temperature (LOUT) is unknown, no holdover time guidelines exist below -X °C (-X °F)."
- The following note has been modified across all HOT tables to prevent misinterpretation: "The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required to confirm that the precipitation intensity is no greater than 'moderate.' No holdover times exist if the reported visibility correlates to a 'heavy' precipitation intensity."
- The table "List of Fluid Validated for Use with Allowance Times" has been updated, indicating which Type III and Type IV fluids are validated for use with which allowance times.
- Increases have been made to the condition "Moderate Ice Pellets mixed with Moderate Snow" in the Type IV ethylene glycol (EG) and Type IV propylene glycol (PG) allowance time tables.
- Additional intensity references were added to the allowance time tables for conditions regarding Light or Moderate Ice Pellets mixed with Drizzle or Freezing Drizzle.
- Editorial changes were made to the note regarding small hail reporting to add clarity on how the METAR indicates small hail in various parts of the world.
- Minor editorial changes have been made to the "Above 0°C" column to clarify the Fahrenheit values.
- Changes were made to the allowance time values.

It is recommended that any new de/anti-icing fluids be evaluated over the entire range of conditions in the HOT Guidelines.

17. Key Words	18. Distribution Statement
Anti-icing, composite, deicing, deicing fluid, holdover times, precipitation, endurance times, Type I, Type II, Type III, Type IV, aircraft, ground, test, winter	Available from the Transport Canada Programs Group Innovation Centre

19. Security Classification (of this publication)	20. Security Classification (of this page)	21. Declassification (date)	22. No. of Pages	23. Price
Unclassified	Unclassified	—	xviii, 38 apps	—

CDT/TDC 79-005
Rev. 96

Canada

Transports Canada Transport Canada

FORMULE DE DONNÉES POUR PUBLICATION

1. No de la publication de Transports Canada	2. No de l'étude	3. No de catalogue du destinataire
TP 15692E	B14W/9A0A/8258	

4. Titre et sous-titre	5. Date de la publication
Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2024-25 Winter	Novembre 2025
	6. No de document de l'organisme exécutant 301351
7. Auteur(s) Dany Posteraro	8. No de dossier - Transports Canada T8009-220126
9. Nom et adresse de l'organisme exécutant APS Aviation Inc. 6700, Chemin de la Côte-de-Liesse, Bureau 102 Montréal (Québec) H4T 2B5	10. No de dossier - TPSGC 013sl T8009-220126
	11. No de contrat - TPSGC ou Transports Canada CW2270722
12. Nom et adresse de l'organisme parrain Transports Canada Centre d'innovation du groupe de programmes 330, rue Sparks, 18ième étage Ottawa (Ontario) K1A 0N5	13. Genre de publication et période visée Final
	14. Agent de projet Antoine Lacroix

15. Remarques additionnelles (programmes de financement, titres de publications connexes, etc.)

Plusieurs rapports de recherche sur des essais de technologies de dégivrage et d'antigivrage ont été produits au cours des hivers précédents pour le compte de Transports Canada (TC). Ils sont disponibles auprès du Centre d'innovation du groupe de programmes de TC. De nombreux rapports ont été rédigés dans le cadre du programme de recherche de cet hiver. Leur objet apparaît à l'avant-propos. Ce projet était coparrainé par la Federal Aviation Administration.

16. Résumé

Le principal objectif du programme d'essai sur les durées d'efficacité de l'hiver 2024-2025 était d'évaluer la performance de nouveaux liquides de dégivrage et d'antigivrage pour la gamme entière des conditions couvertes par les lignes directrices sur les durées d'efficacité. Pour atteindre cet objectif, des essais d'endurance ont été menés. La procédure suivie pour ces essais consistait à verser les liquides sur des surfaces d'aluminium propres, inclinées à 10°. On notait ensuite l'amorce de la perte d'efficacité en fonction du temps, sous diverses conditions de précipitations. Un total de 1 151 essais ont été menés, avec onze liquides. Les recherches menées au cours de l'hiver 2024-2025 ont permis d'apporter les changements suivants aux lignes directrices sur les durées d'efficacité pour l'hiver 2025-2026.

- On a élaboré des lignes directrices sur les durées d'efficacité spécifiques aux liquides pour six nouveaux liquides, et retiré les dilutions pour un liquide. Ces changements ont entraîné l'augmentation des durées d'efficacité génériques des liquides de type II et la réduction des durées d'efficacité génériques des liquides de type IV. Trois nouveaux liquides ont également été soumis à des essais supplémentaires dans des conditions de neige très froide, et des durées d'efficacité spécifiques aux liquides dans des conditions de neige au-dessous de -14 °C ont été établies pour ces derniers.
- Les durées d'efficacité des liquides de type I sur les surfaces en aluminium et celles en matériaux composites dans la colonne « Neige mêlée de brouillard verglaçant » ont été augmentées.
- Une nouvelle colonne « Neige modérée mêlée de pluie » a été ajoutée à tous les tableaux des durées d'efficacité spécifiques aux liquides de type I, II, III et IV.
- La note relative à la règle de 90 minutes a été mise à jour pour la rendre plus claire et afin d'inclure les marges de tolérance associées à la nouvelle condition.
- Une mise en garde a été modifiée pour obtenir la ligne directrice suivante : « Chaque fois qu'il y a apparition de givre ou de glace sur la surface inférieure de l'aile, près du réservoir de carburant, cela indique que l'aile est imprégnée de froid et, par conséquent, que le liquide de type II ou de type IV dilué 50/50 ne doit pas être utilisé à l'étape d'antigivrage, car le liquide pourrait geler. »
- La note suivante a été modifiée dans tous les tableaux des durées d'efficacité pour la rendre plus claire : « Utiliser les durées d'efficacité dans des conditions de brouillard verglaçant en présence de cristaux de glace mêlés de brouillard verglaçant ou de brume verglaçante. »
- La note suivante a été retirée des tableaux génériques des durées d'efficacité, car elle a été jugée redondante : « Si la température minimale d'utilisation opérationnelle (LOUT) est inconnue, il n'existe aucune ligne directrice sur les durées d'efficacité au-dessous de -X °C (-X °F). »
- La note suivante a été modifiée dans tous les tableaux des durées d'efficacité pour éviter qu'elle soit mal interprétée : « Le tableau des intensités des chutes de neige en fonction de la visibilité dominante (Tableau 48) est nécessaire pour confirmer que l'intensité des précipitations n'est pas supérieure à la forme "modérée". Il n'existe aucune durée d'efficacité si la visibilité rapportée correspond à une intensité de précipitations "forte". »
- Le tableau « Liste de liquides dont l'utilisation en fonction des marges de tolérance a été confirmée » a été mis à jour de façon à indiquer les liquides de type III et de type IV dont l'utilisation en fonction des marges de tolérance a été confirmée.
- Des augmentations ont été apportées aux valeurs relatives à la condition « granules de glace modérés mêlés de neige modérée » dans les tableaux de marges de tolérance applicables aux liquides de type IV à base d'éthylène glycol (EG) et aux liquides de type IV à base de propylène glycol (PG).
- Des références supplémentaires sur l'intensité ont été ajoutées aux tableaux de marges de tolérance pour les conditions relatives aux granules de glace légers ou modérés mêlés de bruine ou de bruine verglaçante.
- Des modifications rédactionnelles ont été apportées à la note concernant le signalement de petite grêle, afin de préciser la façon dont les rapports METAR désignent la petite grêle dans diverses parties du monde.
- Des modifications rédactionnelles mineures ont été apportées à la colonne « Au-dessus de 0 °C » pour préciser les valeurs en Fahrenheit.
- Des changements ont été apportés aux valeurs des marges de tolérance.

Il est recommandé que tout nouveau liquide de dégivrage ou d'antigivrage soit évalué pour la gamme entière des conditions couvertes par les lignes directrices sur les durées d'efficacité.

17. Mots clés	18. Diffusion
Antigivrage, composite, dégivrage, liquide de dégivrage, durées d'efficacité, précipitations, durées d'endurance, type I, type II, type III, type IV, aéronef, sol, essai, hiver	Disponible auprès du Centre d'innovation du groupe de programmes de Transports Canada

19. Classification de sécurité (de cette publication)	20. Classification de sécurité (de cette page)	21. Déclassification (date)	22. Nombre de pages	23. Prix
Non classifiée	Non classifiée	—	xviii, 38 ann.	—

CDT/TDC 79-005
Rev. 96

Canada

EXECUTIVE SUMMARY

Under contract to the Transport Canada (TC) Programs Group Innovation Centre, with support from the Federal Aviation Administration (FAA) and several fluid manufacturers, APS Aviation Inc. (APS) has undertaken a testing and research program to further advance aircraft ground de/anti-icing technology. The program has a number of objectives, and work completed to address these objectives is documented in a series of related reports. The primary objective, the development of holdover time (HOT) Guidelines for new de/anti-icing fluids, is addressed in this report. The objective was met by conducting endurance time tests with several de/anti-icing fluids. This report also documents changes made to the HOT Guidelines for the winter of 2025-26.

Test Procedures

Test conditions, test parameters, and test bed specifications were determined based on the requirements of Aerospace Recommended Practice (ARP) 5485B and ARP5945A, which were developed by the SAE International (SAE) G-12 HOT Subcommittee for Type II/III/IV and Type I fluids, respectively. The tests consisted of pouring freezing point depressant fluids onto clean, inclined (10°), standard flat aluminum plates. The plates were mounted on test stands and systematically exposed to a variety of natural or simulated icing conditions. For each plate, the elapsed time required to reach a predefined end condition was recorded.

The variables recorded during testing included: failure time, type of precipitation, rate of precipitation, visibility, wind speed, wind direction, ambient temperature, test surface temperature, relative humidity, fluid brand, fluid type, and fluid concentration.

Data Collection and Testing

During the 2024-25 test season, data was collected during natural snow and natural frost events at the APS test site at the Montréal–Pierre Elliot Trudeau International Airport (YUL) in Montreal and several mobile test sites, in simulated precipitation conditions (freezing drizzle, light freezing rain, freezing fog, rain on cold-soaked surface, snow mixed with freezing fog, and mixed moderate snow and rain) at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and in artificial snow conditions at PMG Technologies Inc. (PMG) in Blainville.

APS conducted 1151 endurance time tests with eleven fluids in the winter of 2024-25. The results of testing were incorporated into the Winter 2025-26 HOT Guidelines.

Changes to the Holdover Time Guidelines

The research resulted in several changes to the HOT Guidelines for Winter 2025-26, as described below.

- Fluid-specific HOT Guidelines tables have been created for six new fluids:
  - ESSPO CHEMICALS D.O.O Nordwing PG2 (Type II);
  - AFLRUS LLC Green Flo Type 4 (Type IV);
  - AllClear Systems Clear IV Flight (Type IV);
  - ESSPO CHEMICALS D.O.O Nordwing PG4 (Type IV);
  - Newave Aerochemical FCY-EGIV PLUS (Type IV); and
  - Xinjiang Zhongtian Liyang Aviation Clearice-IV (Type IV).
- Further testing in very cold snow conditions has enabled fluid-specific holdover times to be provided in natural snow (below -14°C) for three existing fluids:
  - MKS DevO Chemicals COREICEPHOB TYPE II (Type II);
  - ALAB International PROFLIGHT EG4 (Type IV); and
  - ALAB International PROFLIGHT PG4 (Type IV).
- The 75/25 and 50/50 dilutions for Newave Aerochemical FCY-2 (Type II) have been removed.
- Several increases have been made to the Type II generic holdover times as a result of removed fluid data.
- Several decreases have been made to the Type IV generic holdover times as a result of the newly added fluids.
- The holdover times for Type I aluminum and composite surfaces in the "Snow mixed with Freezing Fog" column have been increased.
- A new "Moderate Snow mixed with Rain" column has been added to all Type I, II, III, and IV HOT fluid-specific tables.
- Editorial changes have been made to several notes to improve clarity and reduce redundancy.
- The note regarding the 90-minute rule has been updated to add clarity and to include the new allowance time condition.

Recommendations

It is recommended that any new Type I, II, III, or IV fluids be evaluated over the entire range of conditions encompassed by the HOT tables.

SOMMAIRE

En vertu d'un contrat avec le groupe des programmes du Centre d'innovation de Transports Canada (TC) et avec l'appui financier de la Federal Aviation Administration (FAA) et de plusieurs fabricants de liquides, APS Aviation Inc. (APS) a entrepris un programme d'essais et de recherche visant à faire progresser les technologies associées au dégivrage et à l'antigivrage d'aéronefs au sol. Le programme comporte plusieurs objectifs, et les travaux réalisés en ce sens sont documentés dans une série de rapports connexes. Le principal objectif, c'est-à-dire la mise au point de lignes directrices sur les durées d'efficacité relatives aux nouveaux liquides de dégivrage et d'antigivrage, est abordé dans ce rapport. Pour atteindre cet objectif, des essais sur les durées d'endurance ont été menés avec plusieurs liquides de dégivrage et d'antigivrage. Le présent rapport documente également les changements apportés aux lignes directrices sur les durées d'efficacité pour l'hiver 2025-2026.

Procédures d'essais

Les conditions d'essai, les paramètres d'essai et les spécifications relatives au banc d'essai ont été déterminés en vertu des exigences des pratiques recommandées en aérospatiale (ARP) 5485B et ARP5945A, élaborées par le sous-comité G-12 de la SAE International (SAE) sur les durées d'efficacité pour les liquides de types II/III/IV et de type I, respectivement. Les essais consistaient à verser des liquides abaisseurs du point de congélation sur des plaques d'aluminium standards, propres et inclinées (à 10°). Les plaques étaient montées sur des supports d'essai et systématiquement exposées à une gamme de conditions de givrage, naturelles ou simulées. Pour chaque plaque, on notait le temps écoulé avant l'atteinte d'un état final prédéfini.

Parmi les variables mesurées dans le cadre de ces essais, on notait : le délai de perte d'efficacité, le type de précipitation, le taux de précipitation, la visibilité, la vitesse du vent, la direction du vent, la température ambiante, la température de la surface d'essai, l'humidité relative, la marque du liquide, le type de liquide et la concentration du liquide.

Collecte de données et essais

Les données recueillies au cours de la saison d'essais 2024-2025 concernaient des tests sous neige naturelle et givre naturel menés à l'installation d'essai d'APS, à l'aéroport international Pierre-Elliott-Trudeau de Montréal (YUL), à Montréal, ainsi que sur plusieurs sites d'essai mobiles dans des conditions de précipitations simulées (bruine verglaçante, faible pluie verglaçante, brouillard verglaçant, pluie sur une surface imprégnée de froid, neige mêlée de brouillard verglaçant et conditions mixtes de neige et de pluie modérées) à l'installation de génie climatique du Conseil national

de recherches Canada (CNRC), à Ottawa, et dans des conditions de neige artificielle chez PMG Technologies Inc. (PMG) à Blainville. APS a mené 1 151 essais relatifs aux durées d'endurance, avec onze liquides au cours de l'hiver 2024-2025. Les résultats des essais effectués ont été inclus dans les lignes directrices sur les durées d'efficacité pour l'hiver 2025-2026.

Modifications apportées aux lignes directrices sur les durées d'efficacité

Les recherches effectuées ont entraîné plusieurs changements dans les lignes directrices sur les durées d'efficacité pour l'hiver 2025-2026, comme décrit ci-dessous.

- Des tableaux des lignes directrices sur les durées d'efficacité spécifiques aux liquides ont été élaborés pour six nouveaux liquides, à savoir :
  - ESSPO CHEMICALS D.O.O Nordwing PG2 (type II);
  - AFLRUS LLC Green Flo de type 4 (type IV);
  - AllClear Systems Clear IV Flight (type IV);
  - ESSPO CHEMICALS D.O.O Nordwing PG4 (type IV);
  - Newave Aerochemical FCY-EGIV PLUS (type IV);
  - Xinjiang Zhongtian Liyang Aviation Clearice-IV (type IV).
- Des essais supplémentaires dans des conditions de neige très froide ont permis l'élaboration de durées d'efficacité spécifiques aux liquides dans des conditions de neige naturelle (température au-dessous de -14 °C) pour trois liquides existants, à savoir :
  - MKS DevO Chemicals COREICEPHOB TYPE II (type II);
  - ALAB International PROFLIGHT EG4 (type IV);
  - ALAB International PROFLIGHT PG4 (type IV).
- Les dilutions 75/25 et 50/50 du liquide de type II Newave Aerochemical FCY-2 ont été retirées.
- En raison du retrait de données sur les liquides, plusieurs augmentations ont été apportées aux durées d'efficacité génériques des liquides de type II.
- En raison des nouveaux liquides ajoutés, plusieurs réductions ont été apportées aux durées d'efficacité génériques des liquides de type IV.
- Les durées d'efficacité des liquides de type I sur les surfaces en aluminium et celles en matériaux composites dans la colonne « Neige mêlée de brouillard verglaçant » ont été augmentées.

- Une nouvelle colonne « Neige modérée mêlée de pluie » a été ajoutée à tous les tableaux des durées d'efficacité spécifiques aux liquides de type I, II, III et IV.
- Des modifications rédactionnelles ont été apportées à plusieurs notes pour les rendre plus claires et moins redondantes.
- La note relative à la règle de 90 minutes a été mise à jour pour la rendre plus claire et afin d'inclure les marges de tolérance associées à la nouvelle condition.

Recommandations

Il est recommandé que tout nouveau liquide de type I, II, III ou IV soit évalué pour la gamme entière des conditions couvertes par les tableaux des durées d'efficacité.

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GLOSSARY

APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
CEF	Climatic Engineering Facility
DSHOT	Degree-Specific Holdover Time
EG	Ethylene Glycol
FAA	Federal Aviation Administration
HOT	Holdover Time
IREQ	Institut de Recherche d'Hydro-Québec
LOUT	Lowest Operational Use Temperature
NRC	National Research Council Canada
PG	Propylene Glycol
PMG	PMG Technologies Inc.
SAE	SAE International
TC	Transport Canada
WSET	Water Spray Endurance Test
YUL	Montréal–Pierre Elliot Trudeau International Airport

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1. INTRODUCTION

Under winter precipitation conditions, aircraft surfaces are cleaned prior to takeoff. This is typically done with aircraft ground deicing fluids, which are freezing point depressant fluids developed specifically for aircraft use. If required, aircraft are then protected against further accumulation of precipitation by the application of aircraft ground anti-icing fluids, which are also freezing point depressant fluids. Most anti-icing fluids contain thickeners to extend protection time.

Prior to the 1990s, aircraft ground de/anti-icing had not been extensively researched. However, following several ground icing related incidents in the late 1980s, an aircraft ground icing research program was initiated by Transport Canada (TC). The objective of the program is to improve knowledge, enhance safety, and advance operational capabilities of aircraft operating in winter precipitation conditions.

Since its inception in the early 1990s, the aircraft ground icing research program has been managed by TC, with the co-operation of the United States Federal Aviation Administration (FAA), the National Research Council Canada (NRC), several major airlines, and de/anti-icing fluid manufacturers.

There is still an incomplete understanding of some of the hazards related to aircraft ground icing. As a result, the aircraft ground icing research program continues, with the objective of further reducing the risks posed by the operation of aircraft in winter precipitation and other icing conditions.

Under contract to the TC Programs Group Innovation Centre, with support from the FAA William J. Hughes Technical Center for Advanced Aerospace, TC Civil Aviation, and FAA Flight Standards – Air Carrier Operations, APS Aviation Inc. (APS) carried out research in the winter of 2024-25 in support of the aircraft ground icing research program. Each major project completed as part of the 2024-25 research is documented in a separate individual report. This report documents the aircraft ground de/anti-icing holdover time (HOT) development project.

1.1 Background

APS has completed considerable testing related to de/anti-icing fluids on behalf of TC since 1990. Specifically, research has been conducted to determine fluid HOTs, substantiate HOT tables, and advance the knowledge and development of deicing technology. A summary of the HOT-related research activities completed by APS is provided in Table 1.1.

Table 1.1: Summary of APS Holdover Time Testing Activities

Year	TC Publication #	Conditions Tested	Fluid Types Tested	Test Locations
1990-91	TP 11206E	• Natural Precipitation (mostly snow)	• Type II (100%)	Mostly Montreal, QC Worldwide
1991-92	TP 11454E	• Natural Precipitation (mostly snow)	• Type III (first gen.)	Mostly Montreal, QC St. John's, NL
1992-93	TP 11836E	• Natural Snow • Simulated Freezing Drizzle (prelim.) • Simulated Freezing Fog • Artificial Snow (prelim.)	• Type I • Type II (100%) • Type III (first gen.)	Montreal, QC Ottawa, ON (NRC) Rigaud, QC
1993-94	TP 12915E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog	• Type I • Type II (dilutions primarily, neat)	Montreal, QC Ottawa, ON (NRC)
1994-95	TP 12654E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface (prelim.)	• Type I • Type II • Type IV (prelim.)	Montreal, QC Ottawa, ON (NRC)
1995-96	TP 12896E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC)
1996-97	TP 13131E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface	• Type I • Type II (100%) • Type III (first gen.) • Type IV	Montreal, QC Ottawa, ON (NRC)
1997-98	TP 13318E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface	• Type IV	Montreal, QC Ottawa, ON (NRC)
1998-99	TP 13477E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type I • Type II • Type IV (low viscosity)	Montreal, QC Ottawa, ON (NRC)
1999-2000	TP 13659E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Preliminary Frost	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC) Varennes, QC (IREQ)

Table 1.1: Summary of APS Holdover Time Testing Activities (cont'd)

Year	TC Publication #	Conditions Tested	Fluid Types Tested	Test Locations
2000-01	TP 13826E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Preliminary Frost	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC) Varennes, QC (IREQ)
2001-02	TP 13991E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Preliminary Frost	• Type I • Type II • Type IV	Montreal, QC North Bay, ON Ottawa, ON (NRC) Thompson, MB Val-d'Or, QC
2002-03	TP 14144E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Preliminary Frost	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC) Saint-Alexis, QC Varennes, QC (IREQ)
2003-04	TP 14374E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost • Artificial Snow	• Type II • Type III	Montreal, QC Ottawa, ON (NRC) Sainte-Adèle, QC Val-d'Or, QC
2004-05	TP 14443E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost	• Type II • Type III • Type IV	Montreal, QC Ottawa, ON (NRC)
2005-06	TP 14712E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost • Ice Pellets/Mixed Conditions	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC)
2006-07	TP 14776E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost • Artificial Snow • Ice Pellets/Mixed Conditions	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC)

Table 1.1: Summary of APS Holdover Time Testing Activities (cont'd)

Year	TC Publication #	Conditions Tested	Fluid Types Tested	Test Locations
2007-08	TP 14869E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost • Artificial Snow • Ice Pellets/Mixed Conditions • Snow Pellets	• Type II • Type III • Type IV	Montreal, QC Ottawa, ON (NRC)
2008-09	TP 14933E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Natural Frost • Ice Pellets/Mixed Conditions	• Type II • Type III • Type IV	Montreal, QC Ottawa, ON (NRC)
2009-10	TP 15050E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Ice Pellets/Mixed Conditions • Snow Pellets	• Type I • Type II • Type IV	Dolbeau-Mistassini, QC Montreal, QC Ottawa, ON (NRC) Saint-Sauveur, QC Thetford Mines, QC Val-d'Or, QC
2010-11	TP 15156E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Ice Pellets/Mixed Conditions	• Type I • Type II • Type IV	Montreal, QC Ottawa, ON (NRC)
2011-12	TP 15203E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type I • Type II • Type III	Edmundston, NB Gaspésie, QC Montreal, QC Ottawa, ON (NRC) Rimouski, QC Saint-Jovite, QC
2012-13	TP 15228E	• Natural Snow • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type I • Type II • Type III	Montreal, QC Ottawa, ON (NRC)
2013-14	TP 15271E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type I • Type II • Type III • Type IV	Kuujjuaq, QC Montreal, QC Ottawa, ON (NRC) Timmins, ON Val-d'Or, QC
2014-15	TP 15321E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type I • Type II • Type III • Type IV	Beaconsfield, QC Grande Prairie, AB Mirabel, QC Montreal, QC Morin-Heights, QC Ottawa, ON (NRC)

Table 1.1: Summary of APS Holdover Time Testing Activities (cont'd)

Year	TC Publication #	Conditions Tested	Fluid Types Tested	Test Locations
2015-16	TP 15338E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type III • Type IV	Beaconsfield, QC Blainville, QC (PMG) Iqaluit, NU Montreal, QC Ottawa, ON (NRC) Schefferville, QC Sainte-Adèle, QC
2016-17	TP 15372E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type III • Type IV	Beaconsfield, QC Blainville, QC (PMG) Calgary, AB Iqaluit, NU Montreal, QC Ottawa, ON (NRC) Red Deer, AB Wabush, NL
2017-18	TP 15396E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type IV	Beaconsfield, QC Blainville, QC (PMG) Coaticook, QC Forestville, QC Fort St. John, BC Montreal, QC Ottawa, ON (NRC) Pink Mountain, BC
2018-19	TP 15425E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type IV	Alma, QC Beaconsfield, QC Blainville, QC (PMG) Edmundston, NB Montreal, QC Ottawa, ON (NRC) Saint-Jérôme, QC
2019-20	TP 15450E	• Natural Snow/Frost	• Type I • Type II • Type IV	Alma, QC Cochrane, ON Montreal, QC Temiskaming Shores, ON Yellowknife, NWT
2020-21	TP 15494E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Natural Mist	• Type I • Type II • Type IV	Blainville, QC (PMG) Chibougamau, QC Fort McMurray, AB Grande Prairie, AB High Level, AB Kuujjuaq, QC La Ronge, SK Mont-Laurier, QC Montreal, QC Ottawa, ON (NRC) Rimouski, QC Whitecourt, AB

Table 1.1: Summary of APS Holdover Time Testing Activities (cont'd)

Year	TC Publication #	Conditions Tested	Fluid Types Tested	Test Locations
2021-22	TP 15534E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow • Snow mixed with Freezing Fog (Indoor)	• Type I • Type II • Type IV	Alma, QC Baie-Saint-Paul, QC Blainville, QC (PMG) Chibougamau, QC Fort McMurray, AB Grande Prairie, AB Manning, AB Montreal, QC Ottawa, ON (NRC) Saint-Georges, QC Val-d'Or, QC
2022-23	TP 15557E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type IV	Blainville, QC (PMG) Montreal, QC Ottawa, ON (NRC) Saint-Michel-des-Saints, QC St-Jérôme, QC Timmins, ON
2023-24	TP 15606E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type IV	Blainville, QC (PMG) Calgary, AB Hartland, NB Hearst, ON Inuvik, NWT La Sarre, QC Montreal, QC Murdochville, QC Ottawa, ON (NRC) Val-d'Or, QC
2024-25	TP 15692E	• Natural Snow/Frost • Simulated Freezing Drizzle • Simulated Light Freezing Rain • Simulated Freezing Fog • Snow mixed with Freezing Fog (Indoor) • Moderate Snow mixed with Rain (Indoor) • Rain on a Cold-Soaked Surface • Artificial Snow	• Type II • Type IV	Blainville, QC (PMG) Inuvik, NWT Labrador City, NL Montreal, QC Ottawa, ON (NRC) Pink Mountain, BC Regina, SK Timmins, ON

1.2 Objectives

The primary objectives of the 2024-25 HOT test program were to conduct flat plate tests under conditions of natural and simulated precipitation to determine de/anti-icing fluid endurance times for new fluids, to develop HOT Guidelines based on samples of newly and previously qualified deicing and anti-icing fluids, and to document changes made to the HOT Guidelines for the winter of 2025-26. The detailed objectives of the 2024-25 test program are provided in the statement of work excerpt in Appendix A.

1.3 Report Content

APS has written a report on the HOT test program for each year it has been carried out. In 2003-04, the report was condensed to increase readability and to present the reader with, for the most part, only new and up-to-date information from the previous year's report.

Notably, the reader is now directed to the TC report, TP 14144E, *Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2002-03 Winter* (1), for the detailed test methodology and individual fluid test information. These are provided in appendices to the report rather than within the report itself.

In the winter of 2009-10, a decision was made to include detailed test information only for fluids that are expected to be qualified and commercialized. Test information for other fluids is not included. Additionally, supplemental test data for existing fluids that is not expected to be published in the TC/FAA HOT Guidelines is also not included.

1.4 Report Format

The subsequent sections of this report contain the following:

a) Section 2 summarizes the testing conducted in 2024-25;
b) Section 3 documents changes to the Type I HOT Guidelines;
c) Section 4 documents changes to the Type II HOT Guidelines;
d) Section 5 documents changes to the Type III HOT Guidelines;
e) Section 6 documents changes to the Type IV HOT Guidelines;
f) Section 7 documents other changes to HOT Guidelines content;
g) Section 8 presents conclusions derived from the test program; and
h) Section 9 lists recommendations for future testing.

1.5 Publication of Holdover Time Guidelines

HOT Guidelines are published annually by both TC and the FAA.

1.5.1 Publication by Transport Canada

The TC HOT Guidelines can be requested from the following website:

- https://tc.canada.ca/en/aviation/general-operating-flight-rules/holdover-time-hot-guidelines-icing-anti-icing-aircraft

The TC HOT Guidelines are intended to be used in conjunction with TP 14052E, *Guidelines for Aircraft Ground Icing Operations (Tenth Edition)* (2), which includes reference material related to ground icing operations. TP 14052E (2) is available on the TC website.

In addition to the standard HOT Guidelines, TC publishes an annual degree-specific holdover time (DSHOT) database. This database provides an expanded set of snow precipitation HOTs for all Type II, III, and IV anti-icing fluids listed in the HOT Guidelines. For a given fluid, this expanded set contains HOTs calculated at degree decrements (in °C) down to the fluid's lowest operational use temperature (LOUT). A copy of the TC DSHOT database can be requested on the following website:

- https://tc.canada.ca/en/aviation/general-operating-flight-rules/holdover-time-hot-guidelines-icing-anti-icing-aircraft/degree-specific-holdover-time-dshot-database

1.5.2 Publication by the Federal Aviation Administration

The FAA HOT Guidelines are published on the following website:

- https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/

The 2025-26 FAA HOT Guidelines are intended to be used in conjunction with the FAA document *Ground Deicing Program General Information* (3), which is available for download on the same website. This document provides additional guidance and reference material applicable to the current winter, and it includes the guidance formerly in the annual N 8900 series notice, *Revised FAA-Approved Deicing Program Updates, Winter 20xx-20xx* (4). The N 8900 series notice will continue to be published annually but will now contain only a list of changes to the guidance recommendations for the current year.

In addition to the standard HOT Guidelines, the FAA publishes an annual DSHOT database. This database provides an expanded set of snow precipitation HOTs for all Type II, III, and IV anti-icing fluids listed in the HOT Guidelines. For a given fluid, this expanded set contains HOTs calculated at degree decrements (in °C) down to the fluid's LOUT. The FAA DSHOT database can be downloaded from the same website as the FAA HOT Guidelines.

2. TESTING IN 2024-25

An overview of the testing completed in the winter of 2024-25 is provided in this section.

2.1 Procedures

Test procedures for HOT testing of Type II, III, and IV fluids were developed in accordance with SAE International (SAE) Aerospace Recommended Practice (ARP) 5485B, *Endurance Time Test Procedures for SAE Type II/III/IV Aircraft Deicing/Anti-Icing Fluids* (5). Test procedures for HOT testing of Type I fluids were developed in accordance with ARP5945A, *Endurance Time Test Procedures for SAE Type I Aircraft Deicing/Anti-Icing Fluids* (6).

The procedures valid for Winter 2024-25 are included in Appendix B. They include the following:

- Endurance Time Testing in Simulated Freezing Precipitation with SAE Type I, II, III, and IV De/Anti-Icing Fluids;
- Endurance Time Testing in Natural Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids;
- Endurance Time Testing in Simulated Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids;
- Endurance Time Testing in Active Frost with SAE Type I, II, III, and IV De/Anti-Icing Fluids;
- Endurance Time Testing in Mixed Icing Conditions with SAE Type I, II, III, and IV De/Anti-Icing Fluids;
- Overall Program of Tests at NRC, March 2025; and
- Overall Program of Tests at PMG, April 2025.

The first procedure provides the detailed test methodology for indoor simulated light freezing rain, freezing fog, freezing drizzle, and rain on a cold-soaked surface testing. The second procedure provides the detailed test methodology for natural snow testing. The third procedure provides the detailed test methodology for artificial snow testing. The fourth procedure provides the detailed test methodology for natural active frost testing. The fifth procedure provides the detailed test methodology for mixed icing conditions. The sixth procedure was developed to coordinate HOT testing and other aircraft ground icing research projects during the APS indoor simulated freezing precipitation test sessions. The seventh procedure was developed to coordinate HOT testing during the APS indoor artificial snow test sessions.

The endurance time test methodology is described in detail in TP 14144E (1).

The primary details of the test procedures used each winter, including details specific to the given winter (i.e., test sites), are summarized annually in a test methodology report. A copy of the relevant edition of this report is included as Appendix C. The reports are also included as annexes to each fluid manufacturer report.

2.2 Test Sites

Natural snow and natural frost testing were conducted primarily at the APS test site at the Montréal–Pierre Elliot Trudeau International Airport (YUL). Simulated freezing precipitation and mixed icing tests were conducted at the NRC Climatic Engineering Facility (CEF) in Ottawa. Artificial snow tests were conducted at PMG Technologies Inc. (PMG) in Blainville.

Several natural snow tests were also conducted at remote locations using a mobile test site. The remote locations were as follows:

- Regina, SK;
- Inuvik, NWT;
- Pink Mountain, BC;
- Labrador City, NL; and
- Timmins, ON.

2.3 Fluids Tested

Eleven fluids underwent endurance time testing in the winter of 2024-25. As described in Subsection 1.3, only the endurance time test results for fluids that are expected to be commercialized are published in this report; any test results that are not expected to be published in the TC/FAA HOT Guidelines are provided only to the fluid manufacturers.

Three Type II fluids were tested, as listed below.

- **ESSPO CHEMICALS D.O.O Nordwing PG2:** This new Type II fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix D.
- **LNT Solutions P250:** This new Type II fluid was tested in 2024-25; however, the manufacturer ultimately decided not to commercialize it.
- **MKS DevO Chemicals COREICEPHOB Type II:** This existing Type II fluid was retested in 2024-25, and its HOTs were updated for 2025-26.

Eight Type IV fluids were tested, as listed below.

- **ESSPO CHEMICALS D.O.O Nordwing PG4:** This new Type IV fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix E.
- **AFLRUS LLC Green Flo Type 4:** This new Type IV fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix F.
- **AllClear Systems Clear IV Flight:** This new Type IV fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix G.
- **Newave Aerochemical FCY-EG IV PLUS:** This new Type IV fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix H.
- **Xinjiang Zhongtian Liyang Aviation Clearice-IV:** This new Type IV fluid was tested in 2024-25 and will be commercialized in 2025-26. The detailed test results are provided in Appendix I.
- **LNT Solutions P450:** This new Type IV fluid was tested in 2024-25; however, the manufacturer ultimately decided not to commercialize it.
- **ALAB International PROFLIGHT EG 4:** This existing Type IV fluid was retested in 2024-25, and its HOTs were updated for 2025-26.
- **ALAB International PROFLIGHT PG 4:** This existing Type IV fluid was retested in 2024-25, and its HOTs were updated for 2025-26.

Table 2.1 and Table 2.2 provide additional relevant fluid receipt and fluid characteristic data, respectively, for the fluids documented in this report.

Table 2.1: Fluid Receipt Data (Commercialized Fluids)

Fluid Manufacturer	Fluid Name	Fluid Type	Fluid Formulation	Date Received	Batch #	Dilutions Received (%)
ESSPO CHEMICALS D.O.O	Nordwing PG2	II	Propylene Glycol	23-Dec-24	PG2-24-01	100
ESSPO CHEMICALS D.O.O	Nordwing PG4	IV	Propylene Glycol	14-Jan-25	PG4-24-01	100
AFLRUS LLC	Green Flo Type 4	IV	Ethylene Glycol	24-Dec-24	AFEG-T4/021224	100
AllClear Systems	Clear IV Flight	IV	Propylene Glycol	03-Dec-24	TAB24-CP1127	100
Newave Aerochemical	FCY-EGIV PLUS	IV	Ethylene Glycol	05-Dec-24	241120001	100
Xinjiang Zhongtian Liyang Aviation	Clearice-IV	IV	Propylene Glycol	27-Nov-24	FS24110801	100

Table 2.2: Fluid Characteristic Data (Commercialized Fluids)

Fluid	Fluid Dilution (%)	Brix (Measured)	WSET (mins)	Freezing Point (Stated, °C)	Aerodynamic LOUT (Stated, °C)	Viscosity (Measured, mPa.s)	
						Mfr. Method	Alternate Method
Nordwing PG2	100	35.25°	94	-38.2	-31.0	11,450[(1)]	9,500[(2)]
Nordwing PG4	100	34.75°	98	-38.5	-31.0	11,550[(1)]	9,800[(2)]
Green Flo Type 4	100	32.5°	118	-41	-31.0	6,550[(1)]	n/a
Clear IV Flight	100	36.25°	84	-37	-23.0	22,300[(3)]	21,900[(4)]
FCY-EGIV PLUS	100	35.25°	120	-43.6	-29.0	27,400[(5)]	n/a
Clearice-IV	100	33.25°	102	-38.0	-30.0	35,600[(6)]	n/a

(1). LV1 (with guard leg), 600 mL low form (Griffin) beaker, 575 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.
(2). SC4-31/13R, small sample adapter, 10 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.
(3). SC4-31/13R, small sample adapter, 9 mL of fluid, 0°C, 0.3 rpm, for 10.0 minutes.
(4). SC4-31/13R, small sample adapter, 9 mL of fluid, 0°C, 0.3 rpm, for 15.0 minutes.
(5). SC4-31/13R, small sample adapter, 10 mL of fluid, 0°C, 0.3 rpm, for 30.0 minutes.
(6). LV2-disc (with guard leg), 600 mL low form (Griffin) beaker, 575 mL fluid, 20°C, 0.3 rpm, for 10.0 minutes.

2.4 Description of Tests

In total, 1151 endurance time tests were conducted during the 2024-25 testing season as summarized in Table 2.3.

Table 2.3: Summary of Tests Conducted

Precipitation Type	Tests Conducted
Natural Snow	687
Artificial Snow	68
Freezing Fog	131
Freezing Drizzle	78
Light Freezing Rain	76
Rain on a Cold-Soaked Surface	36
Natural Frost	75
Total	**1151**

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3. CHANGES TO THE TYPE I HOLDOVER TIME GUIDELINES

Changes made to the Type I HOT Guidelines for the winter of 2025-26 are documented in this section. The TC and FAA 2025-26 Type I HOT Guidelines are included in Appendix J.

3.1 New Fluids/Data

A significant body of previous research and testing has indicated that all Type I fluids formulated with glycol perform similarly from an endurance time perspective. As a result, regulators no longer require Type I deicing fluids formulated with propylene glycol (PG), ethylene glycol (EG), or diethylene glycol to undergo endurance time testing. However, regulators do require testing of fluids formulated with other glycol bases or with non-glycol bases to ensure their endurance time performance is similar to that of the Type I fluids used to generate the current Type I HOTs.

Endurance times of Type I fluids are still tested in some years, either (a) at the request of the fluid manufacturer or (b) because the fluid is not based on PG, EG, or diethylene glycol.

No Type I fluids were submitted for HOT testing during the 2024-25 winter season.

3.2 Type I Generic Holdover Time Values

The generic moderate snow mixed with rain HOTs for Type I fluids were added following the completion of mixed icing conditions research in 2024-25. The generic Type I HOTs for this condition, for both aluminum and composite surfaces, are equivalent to 100 percent of the shortest HOT from the Rain on Cold-Soaked Wing HOTs. In addition, the holdover times for Type I aluminum and composite fluids in the "Snow mixed with Freezing Fog" column have been increased. The research supporting these changes is described in detail in the TC report, TP 15686E, *Testing and Evaluation of Mixed Phase Icing Conditions: Winter 2024-25* (7).

The TC version of the updated Type I generic aluminum HOT table, including the moderate snow mixed with rain HOTs, is shown in Figure 3.1 for reference.

Outside Air Temperature[2,3]	Freezing Fog, Freezing Mist[4], or Ice Crystals[5]	Snow mixed with Freezing Fog[6]	Very Light Snow, Snow Grains or Snow Pellets[7,8]	Light Snow, Snow Grains or Snow Pellets[7,8]	Moderate Snow, Snow Grains or Snow Pellets[7,8]	Freezing Drizzle[9]	Light Freezing Rain	Moderate Snow mixed with Rain[10,11]	Rain on Cold-Soaked Wing[11]	Other[12]
-3°C and above (27°F and above)	0:11 - 0:17	0:06 - 0:11	0:18 - 0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:04 - 0:06	0:02 - 0:02	0:02 - 0:05	
below -3 to -6°C (below 27 to 21°F)	0:08 - 0:13	0:05 - 0:08	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:04 - 0:06	CAUTION: No holdover time guidelines exist		
below -6 to -10°C (below 21 to 14°F)	0:06 - 0:10	0:04 - 0:06	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05			
below -10°C (below 14°F)	0:05 - 0:09	0:02 - 0:04	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04					

NOTES

1 These holdover times apply to aircraft with critical surfaces constructed predominantly or entirely of aluminum materials that have demonstrated satisfactory use of these holdover times. Takeoff after the longest applicable holdover time has been exceeded is not permitted for Type I fluids.
2 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
5 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
6 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
7 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
11 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
12 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 11.

Figure 3.1: TC Type I Aluminum HOT Guidance from the 2025-26 HOT Guidelines

4. CHANGES TO THE TYPE II HOLDOVER TIME GUIDELINES

Changes made to the Type II HOT Guidelines for the winter of 2025-26 are documented in this section. The TC and FAA 2025-26 Type II HOT Guidelines are included in Appendix J.

4.1 New Fluids/Data

This subsection documents changes to the Type II HOT Guidelines that were made due to the introduction of new fluids or new data and analysis.

4.1.1 New Fluids

One Type II fluid was added to the HOT Guidelines for the winter of 2025-26.

- **ESSPO CHEMICALS D.O.O Nordwing PG2:** This fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix D).

4.2 Removed Fluids/Data

One Type II fluid with two dilutions (75/25 and 50/50), Newave Aerochemical FCY-2 (Type II), was removed from the Type II HOT Guidelines for the winter of 2025-26 at the request of the manufacturer.

4.3 Addition of Moderate Snow Mixed with Rain Guidance

HOT guidance for conditions of "Moderate Snow mixed with Rain" has been added to all Type II fluid-specific HOT tables and to the Type II generic HOT table. The HOTs for this condition are equivalent to 75 percent of the shortest HOT from the Rain on Cold-Soaked Wing HOTs. The research supporting this change is described in detail in TP 15686E (7).

4.4 Type II Generic Holdover Time Values

Type II generic HOTs are published annually. These HOTs represent the worst-case performance of all Type II fluids and can be used with any Type II fluid. The protocol used to determine the Type II generic HOT values each winter is described in Subsection 4.4.1. Subsection 4.4.3 describes the impact of new and removed data on the generic HOTs. Subsection 4.4.4 presents the changes to the generic HOTs for Winter 2025-26 and details the fluids responsible for each generic HOT value.

4.4.1 Protocol for the Determination of Type II Generic Holdover Times

The values in the Type II generic HOT table are generated each year by taking the shortest HOTs of all Type II fluids listed in the TC and FAA HOT Guidelines. It should be noted that the HOT Guidelines include fluids whose qualifications have recently expired (i.e., within four years – after four years the fluid becomes obsolete and is removed from the HOT Guidelines). Fluids are only removed from the generics analysis when they are removed from the HOT Guidelines.

4.4.2 Use of Generic Holdover Times in Very Cold Snow

Fluid-specific HOTs are provided for very cold snow (temperatures below -14°C) only for those Type II fluids that have undergone the necessary supplemental testing. All other fluids are provided with generic HOTs for very cold snow.

In very cold snow, generic HOTs for Type II PG fluids have been determined based on recent and historical fluid-specific data. Additional details concerning the development of these generic HOT values can be found in the TC report, TP 15425E, *Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2018-19 Winter* (8).

4.4.3 Impact of New and Removed Fluids/Data

The impact of the removed fluids on the Type II generic HOTs was as follows:

- The 75/25 and 50/50 dilutions for Newave Aerochemical FCY-2 (Type II) have been removed.

4.4.4 Type II Generic Holdover Time Values and the Fluids Responsible

The Type II generic HOTs and the fluids that are responsible for them are shown in Table 4.1 and Table 4.2 for Winter 2024-25 and Winter 2025-26, respectively. All increases made to the HOTs for Winter 2025-26 are shown in Table 4.2 in green. The Winter 2024-25 table is included for reference. An oversight in Table 4.1 of last year's (2023-24) HOT report has been corrected, as shown in green for the Light Freezing Rain and Freezing Drizzle HOT values at -3°C and above.

Due to space limitations, the following abbreviations are used in the tables:

- ABAX ECOWING AD-2 (A-AD2);
- Aviation Shaanxi Cleanwing II (AS-CII);
- Clariant Safewing MP II FLIGHT (C-Flight);
- Kilfrost ABC-K Plus (K-AK+);
- MKS DevO Chemicals COREICEPHOB Type II (MKS-CTII);
- Newave Aerochemical FCY-2 (N-FCY-2);
- ROMCHIM ADD-PROTECT NG Type II (R-AP); and
- ROMCHIM ADD-PROTECT Type II (R-NG).

In both tables, the following abbreviations are also used:

- A "U" indicates that the fluid is responsible for the upper value in the cell;
- An "L" indicates that the fluid is responsible for the lower value in the cell; and
- A "B" indicates that the fluid is responsible for both the upper and lower values in the cell.

Table 4.1: Type II Generic HOT Values and Responsible Fluids – Winter 2024-25

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/Water	Freezing Fog or Ice Crystals	Mixed Snow and Freezing Fog	Snow, Snow Grains, or Snow Pellets	Freezing Drizzle	Light Freezing Rain	Rain on a Cold-Soaked Wing
-3 and above	100/0	**0:55 – 1:50**	**0:20 – 0:40**	**0:30 – 0:55**	**0:35 – 1:05***	**0:25** – 0:35**	**0:07 – 0:45**
		AS-CII **(B)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(U)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(B)**	AS-CII **(B)** N-FCY-2 **(B)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(B)**	N-FCY-2 **(U)** R-NG **(L)**
	75/25	**0:40 – 1:10**	**0:15 – 0:25**	**0:15 – 0:30**	**0:25 – 0:40**	**0:15 – 0:25**	**0:04 – 0:25**
		R-AP **(B)**	N-FCY-2 **(L)** R-AP **(B)**	R-AP **(B)**	N-FCY-2 **(L)** R-AP **(B)**	N-FCY-2 **(B)** R-AP **(B)**	A-AD2 **(L)** N-FCY-2 **(U)** R-AP **(U)**
	50/50	**0:15 – 0:30**	**0:05 – 0:10**	**0:07 – 0:15**	**0:09 – 0:15**	**0:06 – 0:09**	CAUTION: No holdover time guidelines exist.
		A-AD2 **(B)**	K-AK+ **(B)** A-AD2 **(B)**	A-AD2 **(B)** K-AK+ **(B)** R-AP **(U)**	A-AD2 **(B)**	A-AD2 **(B)**	
below -3 to -8	100/0	**0:30 – 0:45**	**0:15 – 0:30**	**0:20 – 0:40**	**0:20 – 0:45**	**0:15 – 0:20**	
		K-AK+ **(L)** R-AP **(B)**	R-AP **(B)** AS-CII **(B)** N-FCY-2 **(B)**	N-FCY-2 **(B)** R-AP **(B)** AS-CII **(U)**	N-FCY-2 **(B)**	N-FCY-2 **(B)** K-AK+ **(L)**	
	75/25	**0:25 – 0:55**	**0:09 – 0:15**	**0:10 – 0:25**	**0:15 – 0:30**	**0:08 – 0:15**	
		K-AK+ **(L)** C-Flight **(L)** R-AP **(U)**	R-AP **(B)**	R-AP **(B)** N-FCY-2 **(U)**	A-AD2 **(L)** N-FCY-2 **(B)** R-AP **(U)**	N-FCY-2 **(B)**	
below -8 to -14	100/0	**0:30 – 0:45**	**0:10 – 0:25**	**0:15 – 0:30**	**0:20 – 0:45**	**0:15 – 0:20**	
		K-AK+ **(L)** R-AP **(B)**	N-FCY-2 **(B)** R-AP **(U)** AS-CII **(U)**	R-AP **(L)** N-FCY-2 **(B)**	N-FCY-2 **(B)**	N-FCY-2 **(B)** K-AK+ **(L)**	
	75/25	**0:25 – 0:55**	**0:07 – 0:15**	**0:09 – 0:20**	**0:15 – 0:30**	**0:08 – 0:15**	
		K-AK+ **(L)** C-Flight **(L)** R-AP **(U)**	R-AP **(B)** N-FCY-2 **(U)**	N-FCY-2 **(U)** R-AP **(B)**	A-AD2 **(L)** N-FCY-2 **(B)** R-AP **(U)**	N-FCY-2 **(B)**	
below -14 to -18	100/0	**0:15 – 0:20**	**0:01 – 0:05**	**0:02 – 0:07**			
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**			
below -18 to -25	100/0	**0:15 – 0:20**	**0:00 – 0:02**	**0:01 – 0:03**			
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**			
below -25 to LOUT	100/0	**0:15 – 0:20**	**0:00 – 0:00**	**0:00 – 0:01**			
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**			
	L = DRIVES LOWER LIMIT U = DRIVES UPPER LIMIT B = DRIVES BOTH						

**Note: Time adjusted from 1:00 to 1:05 for 100/0 fluid in freezing drizzle at temperatures of -3°C and above.*
***Note: Time adjusted from 0:20 to 0:25 for 100/0 fluid in light freezing rain at temperatures of -3°C and above.*

Table 4.2: Type II Generic HOT Values and Responsible Fluids – Winter 2025-26

Outside Air Temperature	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist, or Ice Crystals	Mixed Snow and Freezing Fog	Snow, Snow Grains, or Snow Pellets	Freezing Drizzle	Light Freezing Rain	Mixed Moderate Snow and Rain	Rain on Cold-Soaked Wing	Other
-3°C and above (27°F and above)	100/0	**0:55 – 1:50**	**0:20 – 0:40**	**0:30 – 0:55**	**0:35 – 1:05**	**0:25 – 0:35**	**0:05 – 0:05**	**0:07 – 0:45**	
		AS-CII **(B)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(U)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(B)**	AS-CII **(B)** N-FCY-2 **(B)**	R-AP **(L)** AS-CII **(B)** N-FCY-2 **(B)**	R-NG **(B)**	N-FCY-2 **(U)** R-NG **(L)**	
	75/25	**0:40 – 1:10**	**0:15 – 0:25**	**0:15 – 0:30**	**0:25 – 0:40**	**0:15 – 0:25**	**0:03 – 0:03**	**0:04 – 0:25**	
		R-AP **(B)**	R-AP **(B)**	R-AP **(B)**	R-AP **(B)**	R-AP **(B)**	A-AD2 **(B)**	A-AD2 **(L)** R-AP **(U)**	
	50/50	**0:15 – 0:30**	**0:05 – 0:10**	**0:07 – 0:15**	**0:09 – 0:15**	**0:06 – 0:09**			
		A-AD2 **(B)**	A-AD2 **(B)** K-AK+ **(B)**	A-AD2 **(B)** K-AK+ **(B)** R-AP **(U)**	A-AD2 **(B)**	A-AD2 **(B)**			
below -3 to -8°C (below 27 to 18°F)	100/0	**0:30 – 0:45**	**0:15 – 0:30**	**0:20 – 0:40**	**0:20 – 0:45**	**0:15 – 0:20**			
		K-AK+ **(L)** R-AP **(B)**	N-FCY-2 **(B)** R-AP **(B)** AS-CII **(B)**	N-FCY-2 **(B)** R-AP **(B)** AS-CII **(U)**	N-FCY-2 **(B)**	N-FCY-2 **(B)** K-AK+ **(L)**			
	75/25	**0:25 – 0:55**	**0:09 – 0:15**	**0:10 – 0:25**	**0:15 – 0:30**	**0:09 – 0:20**			
		K-AK+ **(L)** C-Flight **(L)** R-AP **(U)**	R-AP **(B)**	R-AP **(B)**	A-AD2 **(L)** R-AP **(U)**	K-AK+ **(L)** R-AP **(U)**			
below -8 to -14°C (below 18 to 7°F)	100/0	**0:30 – 0:45**	**0:10 – 0:25**	**0:15 – 0:30**	**0:20 – 0:45**	**0:15 – 0:20**			
		K-AK+ **(L)** R-AP **(B)**	R-AP **(U)** N-FCY-2 **(B)** AS-CII **(U)**	R-AP **(L)** N-FCY-2 **(B)**	N-FCY-2 **(B)**	N-FCY-2 **(B)** K-AK+ **(L)**			
	75/25	**0:25 – 0:55**	**0:07 – 0:15**	**0:09 – 0:20**	**0:15 – 0:30**	**0:09 – 0:20**			
		K-AK+ **(L)** C-Flight **(L)** R-AP **(U)**	R-AP **(B)**	R-AP **(B)**	A-AD2 **(L)** R-AP **(U)**	K-AK+ **(L)** R-AP **(U)**			
below -14 to -18°C (below 7 to 0°F)	100/0	**0:15 – 0:20**	**0:01 – 0:05**	**0:02 – 0:07**					
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**					
below -18 to -25°C (below 0 to -13°F)	100/0	**0:15 – 0:20**	**0:00 – 0:02**	**0:01 – 0:03**					
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**					
below -25°C to LOUT (below -13°F to LOUT)	100/0	**0:15 – 0:20**	**0:00 – 0:00**	**0:00 – 0:01**					
		A-AD2 **(L)** R-AP **(L)** R-NG **(B)** MKS-CTII **(L)**	Generic **(B)**	Generic **(B)**					

CAUTION:
No holdover time guidelines exist.

L = DRIVES LOWER LIMIT U = DRIVES UPPER LIMIT B = DRIVES BOTH

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5. CHANGES TO THE TYPE III HOLDOVER TIME GUIDELINES

Changes made to the Type III HOT Guidelines for the winter of 2025-26 are documented in this section. The TC and FAA 2025-26 Type III HOT Guidelines are included in Appendix J.

5.1 New Fluids/Data

No new Type III fluids were added to the HOT Guidelines for the winter of 2025-26.

5.2 Removed Fluids/Data

No Type III data was removed from the HOT Guidelines for the winter of 2025-26.

5.3 Addition of Moderate Snow Mixed with Rain Guidance

HOT guidance for conditions of "Moderate Snow mixed with Rain" has been added to all Type III fluid-specific HOT tables. The HOTs for this condition are equivalent to 75 percent of the shortest HOT from the Rain on Cold-Soaked Wing HOTs. The research supporting this change is described in detail in TP 15686E (7).

5.4 Type III Generic Holdover Time Values

As there is only one Type III fluid currently in the HOT Guidelines, there is no need to provide generic HOTs for Type III fluids. Therefore, a Type III generic HOT table is not included in the 2025-26 HOT Guidelines.

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6. CHANGES TO THE TYPE IV HOLDOVER TIME GUIDELINES

Changes made to the Type IV HOT Guidelines for the winter of 2025-26 are documented in this section. The TC and FAA 2025-26 Type IV HOT Guidelines are included in Appendix J.

6.1 New Fluids/Data

This subsection documents changes to the Type IV HOT Guidelines that were made due to the introduction of new fluids or new data and analysis.

6.1.1 New Fluids

Five new Type IV fluids were added to the HOT Guidelines for the winter of 2025-26.

- **ESSPO CHEMICALS D.O.O Nordwing PG4:** This new fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix E).
- **AFLRUS LLC Green Flo Type 4:** This new fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix F).
- **AllClear Systems Clear IV Flight:** This new fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix G).
- **Newave Aerochemical FCY-EGIV PLUS:** This new fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix H).
- **Xinjiang Zhongtian Liyang Aviation Clearice-IV:** This new fluid underwent endurance time testing in the winter of 2024-25. Additional details related to this testing can be found in the associated test report (included in Appendix I).

6.2 Removed Fluids/Data

No Type IV data was removed from the HOT Guidelines for the winter of 2025-26.

6.3 Addition of Moderate Snow Mixed with Rain Guidance

HOT guidance for conditions of "Moderate Snow mixed with Rain" has been added to all Type IV fluid-specific HOT tables and to the Type IV Generic table. The HOTs for this condition are equivalent to 75 percent of the shortest HOT from the Rain on Cold-Soaked Wing HOTs. The research supporting this change is described in detail in TP 15686E (7).

6.4 Type IV Generic Holdover Time Values

Type IV generic HOTs are published annually. These HOTs represent the worst-case performance of all Type IV fluids and can be used with any Type IV fluid. The protocol used to determine the generic HOT values each winter is described in Subsection 6.4.1. Subsection 6.4.3 describes the impact of new and removed data on the generic HOTs. Subsection 6.4.4 presents the changes to the generic HOTs for Winter 2025-26 and details the fluids responsible for the values.

6.4.1 Protocol for the Determination of Type IV Generic Holdover Times

The values in the Type IV generic HOT table are generated each year by taking the shortest HOTs of all Type IV fluids listed in the TC and FAA HOT Guidelines. It should be noted that the HOT Guidelines include fluids whose qualifications have recently expired (i.e., within four years). Fluids are only removed from the generics analysis when they are removed from the HOT Guidelines.

6.4.2 Use of Generic Holdover Times in Very Cold Snow

Fluid-specific HOTs are provided for very cold snow (temperatures below -14°C) only for those Type IV fluids that have undergone the necessary supplemental testing. All other fluids are provided with generic HOTs for very cold snow.

In very cold snow, generic HOTs specific to Type IV PG and Type IV EG fluids have been determined based on recent and historical fluid-specific data. Additional details concerning the development of these generic HOT values can be found in TP 15425E (8).

6.4.3 Impact of New and Removed Fluids/Data

No fluids were removed on the Type IV generic HOTs for 2025-26.

6.4.4 Type IV Generic Holdover Time Values and the Fluids Responsible

The Type IV generic HOTs and the fluids that are responsible for them are shown in Table 6.1 and Table 6.2 for Winter 2024-25 and Winter 2025-26, respectively. All decreases made to the HOTs for Winter 2025-26 are shown in Table 6.2 in red. The Winter 2024-25 table is included for reference.

Due to space limitations, the following abbreviations are used in Table 6.1 and Table 6.2:

- ABAX ECOWING AD-49/Dow UCAR FlightGuard AD-49 (A/D-49);
- AFLRUS LLC Green Flo Type 4 (AF-GFT4);
- ALAB International PROFLIGHT PG4 (ALB-PFP4);
- ASGlobal 4Flite EG (AS-4FE);
- ASGlobal 4Flite PG (AS-4FP);
- AVIAFLUID AVIAFlight EG (A-AVE);
- AVIAFLUID AVIAFlight PG (A-AVP);
- CHEMCO Inc. ChemR EG IV (CH-R-EGIV);
- Clariant Safewing MP IV LAUNCH (C-L);
- Clariant Safewing MP IV LAUNCH PLUS (C-L+);
- Cryotech Polar Guard® Advance (CR-PGA);
- Inland Technologies ECO-SHIELD (IT-ES);
- JSC Defrost ECO 4 (JSC-DN4);
- Kilfrost ABC-S PLUS (K-AS+);
- MKS DevO Chemicals COREICEPHOB Type IV (MKS-CTIV);
- Newave Aerochemical FCY 9311 (N-9311);
- Newave Aerochemical FCY-EGIV (N-EG4);
- Shaanxi Cleanway Aviation Cleansurface IV (SC-CIV); and
- Xinjiang Zhongtian Liyang Aviation Clearice-IV (XZ-CIIV).

The following abbreviations are also used in Table 6.1 and Table 6.2:

- A "U" indicates that the fluid is responsible for the upper value in the cell;
- An "L" indicates that the fluid is responsible for the lower value in the cell; and
- A "B" indicates that the fluid is responsible for both the upper and lower values in the cell.

In Table 6.1 and Table 6.2, HOTs are provided for given precipitation rates in snow. These correspond to the snow HOTs as follows:

- Very light snow: lower limit = 3 g/dm²/h; upper limit = 4 g/dm²/h;
- Light snow: lower limit = 4 g/dm²/h; upper limit = 10 g/dm²/h; and
- Moderate snow: lower limit = 10 g/dm²/h; upper limit = 25 g/dm²/h.

Finally, it should be noted that TC caps snow HOTs at two hours, while the FAA caps them at three hours. The values in Table 6.1 are capped at three hours.

Table 6.1: Type IV Generic HOT Values and Responsible Fluids – Winter 2024-25

Outside Air Temp. (°C)	Fluid Concentration Neat Fluid/Water	Freezing Fog, Freezing Mist, or Ice Crystals	Snow mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets				Freezing Drizzle	Light Freezing Rain	Rain on a Cold-Soaked Wing
				25 g/dm²/h	10 g/dm²/h	4 g/dm²/h	3 g/dm²/h			
-3 and above	100/0	**1:15 – 2:15**	**0:25 – 0:45**	**0:30**	**1:00**	**1:55**	**2:20**	**0:40 – 1:10**	**0:20 – 0:35**	**0:08 – 1:05**
		IT-ES **(L)** ALB-PFP4 **(U)**	AS-4FE **(B)** CH-R-EGIV **(L)** N-9311 **(L)** N-EG4 **(L)**	AS-4FE	AS-4FE	A-AVE	AV-AVE	IT-ES **(L)** AS-4FE **(B)**	AS-4FE **(B)**	AS-4FE **(B)**
	75/25	**1:25 – 2:40**	**0:30 – 0:55**	**0:40**	**1:15**	**2:05**	**2:25**	**1:00 – 1:20**	**0:30 – 0:50**	**0:09 – 1:20**
		K-AS+ **(B)**	CR-PGA **(L)** K-AS+ **(B)**	CR-PGA	K-AS+	K-AS+	K-AS+	K-AS+ **(B)**	K-AS+ **(B)**	K-AS+ **(U)** CR-PGA **(L)**
	50/50	**0:30 – 0:55**	**0:07 – 0:20**	**0:10**	**0:25**	**1:00**	**1:10**	**0:15 – 0:40**	**0:09 – 0:20**	CAUTION: No holdover time guidelines exist.
		K-AS+ **(B)**	CR-PGA **(B)**	CR-PGA	CR-PGA	K-AS+	K-AS+	K-AS+ **(B)**	CR-PGA **(B)** C-L+ **(U)** K-AS+ **(U)**	
below -3 to -8	100/0	**0:15 – 0:35**	**0:20 – 0:40**	**0:25**	**0:55**	**1:45**	**2:05**	**0:25 – 1:10**	**0:20 – 0:25**	
		MKS-CTIV **(B)**	AS-4FE **(B)** N-9311 **(B)** N-EG4 **(L)** SC-CIV **(L)**	AS-4FE N-EG4 SC-CIV	AS-4FE N-9311	A-AVE	A-AVE	A/D-49 **(L)** C-L+ **(L)** K-AS+ **(L)** AS-4FE **(U)** AS-4FP **(U)** ALB-PFP4 **(U)**	A/D-49 **(B)** K-AS+ **(L)** AS-4FE **(L)** N-9311 **(L)** MKS-CTIV **(L)**	
	75/25	**0:40 – 1:20**	**0:25 – 0:50**	**0:30**	**1:05**	**1:50**	**2:10**	**0:20 – 1:05**	**0:15 – 0:25**	
		C-L+ **(L)** CR-PGA **(L)** C-L **(B)**	CR-PGA **(B)** K-AS+ **(U)**	CR-PGA	CR-PGA K-AS+	K-AS+	K-AS+	C-L+ **(B)** K-AS+ **(L)** CR-PGA **(U)**	K-AS+ **(B)**	
below -8 to -14	100/0	**0:15 – 0:35**	**0:15 – 0:35**	**0:20**	**0:45**	**1:30**	**1:50**	**0:25 – 1:10**	**0:20 – 0:25**	
		MKS-CTIV **(B)**	SC-CIV **(B)** AS-4FE **(U)** A-AVP **(U)** N-9311 **(U)**	SC-CIV	SC-CIV	A-AVP	A-AVP	See "below -3 to -8" row.	See "below -3 to -8" row.	
	75/25	**0:40 – 1:20**	**0:20 – 0:45**	**0:25**	**0:55**	**1:45**	**2:00**	**0:20 – 1:05**	**0:15 – 0:25**	
		C-L+ **(L)** CR-PGA **(L)** C-L **(B)**	CR-PGA **(B)** K-AS+ **(U)**	CR-PGA	CR-PGA	K-AS+	K-AS+	See "below -3 to -8" row.	See "below -3 to -8" row.	
below -14 to -18	100/0	**0:15 – 0:30**	**0:01 – 0:06**	**0:02**	**0:09**	**0:30**	**0:45**			
		MKS-CTIV **(B)**	Generic	Generic	Generic	Generic	Generic			
below -18 to -25	100/0	**0:15 – 0:30**	**0:00 – 0:02**	**0:01**	**0:03**	**0:10**	**0:20**			
		MKS-CTIV **(B)**	Generic	Generic	Generic	Generic	Generic			
below -25 to LOUT	100/0	**0:15 – 0:30**	**0:00 – 0:01**	**0:00**	**0:02**	**0:07**	**0:10**			
		MKS-CTIV **(B)** SC-CIV **(U)**	Generic	Generic	Generic	Generic	Generic			

L = DRIVES LOWER LIMIT U = DRIVES UPPER LIMIT B = DRIVES BOTH

Table 6.2: Type IV Generic HOT Values and Responsible Fluids – Winter 2025-26

Outside Air Temp. (°C)	Fluid Concentration Neat Fluid/Water	Freezing Fog, Freezing Mist, or Ice Crystals	Snow mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets				Freezing Drizzle	Light Freezing Rain	Mixed Moderate Snow & Rain	Rain on a Cold-Soaked Wing
				25 g/dm²/h	10 g/dm²/h	4 g/dm²/h	3 g/dm²/h				
-3 and above	100/0	**1:15 – 2:15**	**0:20 – 0:40**	**0:25**	**0:55**	**1:50**	**2:15**	**0:35 – 1:10**	**0:15 – 0:30**	**0:06 – 0:06**	**0:08 – 1:05**
		IT-ES **(L)** AF-GFT4 **(L)** ALB-PFP4 **(U)**	AF-GFT4 **(B)**	AF-GFT4	AF-GFT4	AF-GFT4	AF-GFT4	AF-GFT4 **(B)** AS-4FE**(U)**	AF-GFT4 **(B)**	AS-4FE **(B)** JSC-DN4 **(B)** AF-GFT4 **(B)**	AS-4FE **(B)** AF-GFT4 **(L)**
	75/25	**1:25 – 2:40**	**0:30 – 0:55**	**0:40**	**1:15**	**2:05**	**2:25**	**1:00 – 1:20**	**0:30 – 0:50**	**0:07 – 0:07**	**0:09 – 1:20**
		K-AS+ **(B)**	CR-PGA **(L)** K-AS+ **(B)**	CR-PGA	K-AS+	K-AS+	K-AS+	K-AS+ **(B)**	K-AS+ **(B)**	CR-PGA **(B)**	K-AS+ **(U)** CR-PGA **(L)**
	50/50	**0:30 – 0:55**	**0:07 – 0:20**	**0:10**	**0:25**	**1:00**	**1:10**	**0:15 – 0:40**	**0:09 – 0:20**		
		K-AS+ **(B)**	CR-PGA **(B)**	CR-PGA	CR-PGA	K-AS+	K-AS+	K-AS+ **(B)**	CR-PGA **(B)** C-L+ **(U)** K-AS+ **(U)**		
below -3 to -8	100/0	**0:15 – 0:35**	**0:20 – 0:35**	**0:25**	**0:45**	**1:35**	**2:00**	**0:25 – 1:00**	**0:20 – 0:25**		
		MKS-CTIV **(B)**	AS-4FE **(L)** N-EG4 **(L)** N-9311 **(L)** AF-GFT4 **(B)** XZ-CIIV **(L)** SC-CIV **(L)**	AS-4FE N-EG4 SC-CIV AF-GFT4 XZ-CIIV	AF-GFT4	AF-GFT4	AF-GFT4	AF-GFT4 **(U)** A/D-49 **(L)** C-L+ **(L)** K-AS+ **(L)**	A/D-49 **(B)** K-AS+ **(L)** AS-4FE **(L)** N-9311 **(L)** MKS-CTIV **(L)** AF-GFT4 **(L)**		
	75/25	**0:40 – 1:20**	**0:25 – 0:50**	**0:30**	**1:05**	**1:50**	**2:10**	**0:20 – 1:05**	**0:15 – 0:25**		
		C-L+ **(L)** CR-PGA **(L)** C-L **(B)**	CR-PGA **(B)** K-AS+ **(U)**	CR-PGA	CR-PGA K-AS+	K-AS+	K-AS+	C-L+ **(B)** K-AS+ **(L)** CR-PGA **(U)**	K-AS+ **(B)**		
below -8 to -14	100/0	**0:15 – 0:35**	**0:15 – 0:30**	**0:20**	**0:45**	**1:25**	**1:50**	**0:25 – 1:00**	**0:20 – 0:25**		
		MKS-CTIV **(B)**	SC-CIV **(L)** XZ-CIIV **(L)** AF-GFT4 **(B)**	SC-CIV AF-GFT4 XZ-CIIV	SC-CIV AF-GFT4 XZ-CIIV	AF-GFT4	A-AVP AF-GFT4	See "below -3 to -8" row.	See "below -3 to -8" row.	CAUTION: No holdover time guidelines exist.	
	75/25	**0:40 – 1:20**	**0:20 – 0:45**	**0:25**	**0:55**	**1:45**	**2:00**	**0:20 – 1:05**	**0:15 – 0:25**		
		C-L+ **(L)** CR-PGA **(L)** C-L **(B)**	CR-PGA **(B)** K-AS+ **(U)**	CR-PGA	CR-PGA	K-AS+	K-AS+	See "below -3 to -8" row.	See "below -3 to -8" row.		
below -14 to -18	100/0	**0:15 – 0:30**	**0:01 – 0:06**	**0:02**	**0:09**	**0:30**	**0:45**				
		MKS-CTIV **(B)**	Generic	Generic	Generic	Generic	Generic				
below -18 to -25	100/0	**0:15 – 0:30**	**0:00 – 0:02**	**0:01**	**0:03**	**0:10**	**0:20**				
		MKS-CTIV **(B)**	Generic	Generic	Generic	Generic	Generic				
below -25 to LOUT	100/0	**0:15 – 0:30**	**0:00 – 0:01**	**0:00**	**0:02**	**0:07**	**0:10**				
		MKS-CTIV **(B)** SC-CIV **(U)**	Generic	Generic	Generic	Generic	Generic				

7. OTHER CHANGES TO HOLDOVER TIME GUIDELINES

In addition to the changes made to the Type I, II, III, and IV HOT Guidelines, several other changes were made to the HOT Guidelines for Winter 2025-26. These changes are documented in this section.

7.1 Updated Notes and Cautions in HOT Tables

Several notes and cautions were updated within the HOT tables. The changes are listed below.

- A caution has been modified to the following guideline: "Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilutions of Type II or IV [are] not to be used for the anti-icing step because fluid freezing may occur."
- The following note has been modified across all HOT tables to improve clarity: "Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist."
- The following note has been removed from the generic HOT tables as it was deemed redundant: "If the LOUT is unknown, no holdover time guidelines exist below -X °C (-X °F)."
- The following note has been modified across all HOT tables to prevent misinterpretation that could discourage the use of HOTs when they are applicable to a METAR code: "The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required to confirm that the precipitation intensity is no greater than 'moderate.' No holdover times exist if the reported visibility correlates to a 'heavy' precipitation intensity."

7.2 Active Frost Holdover Time Guidelines

Endurance time testing in active frost was conducted with all fluids submitted for standard endurance time testing in Winter 2024-25. Additional active frost tests were conducted with retained samples of fluids that were tested in Winter 2023-24 and commercialized for Winter 2024-25; the active frost data sets are now complete for all fluids that were submitted for testing in Winter 2023-24.

The test data for the fluids submitted in 2024-25 can be found within the relevant test reports appendices (Appendix D to Appendix I). The test durations were compared to their respective generic HOTs. All completed ("failed") tests surpassed the generic HOTs, as did all tests that were not completed (due to active frost ending before fluid failure could occur).

The generic frost HOTs can be considered substantiated for all fluids added to the HOT Guidelines for Winter 2025-26. As a result, no changes were made to the active frost HOTs for Winter 2025-26.

Additional active frost data will be collected in Winter 2025-26 with retained samples of the fluids that were submitted for testing in Winter 2024-25.

7.3 Allowance Time Tables

The list of fluids validated for use with the allowance time table was updated in the HOT Guidelines. This list, which precedes the allowance time tables, indicates which Type III and Type IV fluids are validated for use with which allowance times.

The changes below have been made to the allowance time table format.

- The table "List of Fluids Validated for Use with Allowance Times" has been updated, indicating which Type III and Type IV fluids are validated for use with which allowance times.
- Increases have been made to the condition "Moderate Ice Pellets mixed with Moderate Snow" in the Type IV EG and Type IV PG allowance time tables.
- Additional intensity references have been added to the allowance time tables for conditions regarding Light or Moderate Ice Pellets mixed with Drizzle or Freezing Drizzle.
- Editorial changes have been made to the note regarding small hail reporting to add clarity on how the METAR indicates small hail in various parts of the world.
- Minor editorial changes have been made to the "Above 0°C" column to clarify the Fahrenheit values.

The changes below have been made to the allowance time values.

- Further testing in mixed conditions at the wind tunnel has resulted in allowance times for Type IV EG and PG fluids in three new conditions: Moderate Ice Pellets mixed with Moderate Snow (down to -16°C), Light Ice Pellets mixed with Light Freezing Rain and Light Snow (0°C to -5°C), and Light Ice Pellets mixed with Light Rain and Light Snow (above 0°C).
- The existing allowance times for Type IV EG fluids in Light Ice Pellets below -5 to -10°C have been expanded from 50 minutes to 70 minutes.
- The existing allowance times for Type IV EG fluids in Moderate Ice Pellets (or Small Hail) below -5 to -10°C have been expanded from 25 minutes to 35 minutes.

The research supporting these changes is documented in the TC report, TP 15685E, *Wind Tunnel Trials to Support Further Development of Ice Pellet Allowance Times: Winter 2024-25* (9).

8. CONCLUSIONS

The conclusions derived from the testing conducted as part of the Winter 2024-25 HOT development program are provided in this section.

8.1 Annual Testing and Research

Endurance time testing was carried out with eleven de/anti-icing fluids in the winter of 2024-25. The results of this testing, along with additional research, led to several changes being made to the HOT Guidelines. The changes, described below, were included in the Winter 2025-26 HOT Guidelines.

- Fluid-specific HOT Guidelines tables have been created for six new fluids:
  - ESSPO CHEMICALS D.O.O Nordwing PG2 (Type II);
  - AFLRUS LLC Green Flo Type 4 (Type IV);
  - AllClear Systems Clear IV Flight (Type IV);
  - ESSPO CHEMICALS D.O.O Nordwing PG4 (Type IV);
  - Newave Aerochemical FCY-EGIV PLUS (Type IV); and
  - Xinjiang Zhongtian Liyang Aviation Clearice-IV (Type IV).
- Further testing in very cold snow conditions has enabled fluid-specific holdover times to be provided in natural snow (below -14°C) for three existing fluids:
  - MKS DevO Chemicals COREICEPHOB TYPE II (Type II);
  - ALAB International PROFLIGHT EG4 (Type IV); and
  - ALAB International PROFLIGHT PG4 (Type IV).
- The 75/25 and 50/50 dilutions for Newave Aerochemical FCY-2 (Type II) have been removed.
- Several increases have been made to the Type II generic holdover times as a result of removed fluid data.
- Several decreases have been made to the Type IV generic holdover times as a result of the newly added fluids.
- The holdover times for Type I aluminum and composite fluids in the “Snow mixed with Freezing Fog” column have been increased.
- A new “Moderate Snow mixed with Rain” column has been added to all Type I, II, III, and IV HOT tables with fluid-specific values.
- Editorial changes have been made to several notes to improve clarity and reduce redundancy.
- The note regarding the 90-minute rule has been updated to add clarity and to include the new allowance time condition.

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9. RECOMMENDATIONS

It is recommended that any new Type II, III, or IV fluids be evaluated over the entire range of conditions encompassed by the HOT tables.

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REFERENCES

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2. *Guidelines for Aircraft Ground Icing Operations (Tenth Edition)*, Transport Canada, October 2025, TP 14052E.

3. *Ground Deicing Program General Information*, Federal Aviation Administration, August 2025.

4. *Revised FAA-Approved Deicing Program Updates, Winter 20xx-20xx,* Federal Aviation Administration, N 8900.xxx.

5. SAE International Aerospace Recommended Practice 5485B, *Endurance Time Test Procedures for SAE Type II/III/IV Aircraft Deicing/Anti-Icing Fluids*, October 2017.

6. SAE International Aerospace Recommended Practice 5945A, *Endurance Time Test Procedures for SAE Type I Aircraft Deicing/Anti-Icing Fluids*, October 2017.

7. Bernier, B., *Testing and Evaluation of Mixed Phase Icing Conditions: Winter 2024-25*, APS Aviation Inc., Transport Canada, Montreal, December 2025, TP 15686E, XX (to be published).

8. Bernier, B., *Aircraft Ground De/Anti-Icing Fluid Holdover Time Development Program for the 2018-19 Winter*, APS Aviation Inc., Transport Canada, Montreal, December 2019, TP 15425E, 56.

9. Ruggi, M., *Wind Tunnel Trials to Support Further Development of Ice Pellet Allowance Times: Winter 2024-25*, APS Aviation Inc., Transport Canada, Montreal, November 2025, TP 15685E, XX (to be published).

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APPENDIX A

TRANSPORT CANADA
STATEMENT OF WORK EXCERPT –
AIRCRAFT & ANTI-ICING FLUID WINTER TESTING 2024-25

TRANSPORT CANADA
STATEMENT OF WORK EXCERPT –
AIRCRAFT & ANTI-ICING FLUID WINTER TESTING 2024-25

3. Endurance Time Testing for Maintenance and Publication of HOT Guidance Material

This program element is funded by the fluid manufacturers. The extent of effort for this program element will be determined by the number of new fluids submitted for testing.

It is anticipated that four thickened HOT fluids (one full dilution and three neat-only) will be submitted for testing in 2024-25.

a) Conduct endurance time tests with samples of Type I, Type II, Type III, and Type IV fluids supplied by fluid manufacturers. Testing will be conducted using the methodology provided in Aerospace Recommended Practice (ARP) 5485 and/or ARP5945 under the following activities:

   i. Setup and planning for natural snow, natural frost, artificial snow, and simulated freezing precipitation testing;

   ii. Fluid management, training, and updates to project-specific software systems (covered under a related program element);

   iii. Natural snow testing at the P.E.T. test site under a wide range of temperature, precipitation rate, and wind conditions (in some cases, travel to other locations may be necessary to collect a more complete set of data);

   iv. Natural frost testing at the P.E.T. test site under a wide range of temperatures;

   v. Simulated freezing precipitation at the NRC CEF (in freezing drizzle, light freezing rain, freezing fog, and rain on a cold-soaked surface);

   vi. Conduct artificial snow testing (as required) at the P.E.T. test site and/or an alternate temperature-controlled facility;

   vii. Complete any outstanding testing required for fluid samples submitted in previous years; and

   viii. For all testing conducted, record individual fluid endurance times, log, and file data.

b) Analyse the data collected and disseminate to fluid manufacturers, as required.

c) Prepare reports on the findings and disseminate to TC/FAA and fluid manufacturers as required.

d) Prepare presentation material for the SAE G-12 meetings.

10. Endurance Time Testing in Very Cold Snow Conditions (Temperatures Below -14°C)

This program element is funded by the fluid manufacturers. This testing is available to either new fluids or current fluids that do not have fluid-specific HOTs for very cold snow.

Typically, a minimum of two fluids is required to move ahead with testing.

a) Conduct flat plate tests with samples of Type II, Type III, and Type IV 100/0 fluids using the methodology provided in ARP5485 in very cold snow conditions to develop fluid specific holdover times for temperatures below -14°C.

   i. Setup and plan for natural snow and artificial snow (if fluid LOUT is below -29°C) testing.

   ii. Conduct natural snow testing under a range of temperature, precipitation rate, and wind conditions. Travel is expected to collect a complete set of data (6 trips expected).

   iii. Conduct artificial snow testing (if fluid LOUT is below -29°C, additional required tests completed as part of program element #1) at the PMG chamber in Blainville, QC.

   iv. For all testing conducted, record individual fluid endurance times, and log and file data.

b) Analyse the data collected and disseminate to TC/FAA and fluid manufacturers, as required.

c) Prepare reports on the findings and disseminate to TC/FAA and fluid manufacturers, as required.

d) Prepare presentation material for the SAE G-12 meetings.

10A. Pre-Paid 2023-24 Completion: Endurance Time Testing in Very Cold Snow Conditions (Temperatures Below -14ºC)

This program element describes the completion of the outstanding 2023-24 very cold snow testing, analysis, and reporting activities that could not be completed previously due to late receipt of fluid samples.

This program element has been funded with funds from the previous contract year.

a) Conduct flat plate tests with samples of Type II, Type III, and Type IV 100/0 fluids using the methodology provided in ARP5485 in very cold snow conditions to develop fluid specific holdover times for temperatures below -14ºC.

   i. Setup and plan for natural snow testing.

   ii. Conduct natural snow testing under a range of temperature, precipitation rate, and wind conditions. Travel will be required to collect the necessary data (2 trips expected).

   iii. For all testing conducted, record individual fluid endurance times, and log and file data.

b) Analyse the data collected and disseminate to TC/FAA and fluid manufacturers, as required.

c) Prepare reports on the findings and disseminate to TC/FAA and fluid manufacturers, as required.

d) Prepare presentation material for the SAE G-12 meetings.

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APPENDIX B

PROCEDURES FOR HOLDOVER TIME TESTING

- Procedure: Endurance Time Testing in Simulated Freezing Precipitation with SAE Type I, II, III, and IV De/Anti-Icing Fluids
- Procedure: Endurance Time Testing in Natural Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids
- Procedure: Endurance Time Testing in Artificial Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids
- Procedure: Endurance Time Testing in Active Frost with SAE Type I, II, III, and IV De/Anti-Icing Fluids
- Procedure: Endurance Time Testing in Mixed Icing Conditions with SAE Type I, II, III, and IV De/Anti-Icing Fluids
- Procedure: Overall Program of Tests at NRC, March 2025
- Procedure: Overall Program of Tests at PMG, April 2025

PROCEDURE:
ENDURANCE TIME TESTING IN SIMULATED FREEZING PRECIPITATION WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

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PROCEDURE:

ENDURANCE TIME TESTING IN SIMULATED FREEZING PRECIPITATION WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
William J. Hughes Technical Center

Transport Canada
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Federal Aviation Administration
Flight Standards – Air Carrier Operations

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APS Aviation Inc.

December 21, 2023
Final Version 1.0

PROCEDURE:
ENDURANCE TIME TESTING IN SIMULATED FREEZING PRECIPITATION WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

1. BACKGROUND

SAE International (SAE) has published standards detailing acceptable practices for endurance time testing in simulated freezing precipitation conditions. The Aerospace Recommended Practice (ARP) documents ARP5945 and ARP5485 outline these practices for Type I and Type II/III/IV de/anti-icing fluids, respectively. These documents set the requirements for fluid samples, testing materials, test conditions, and test practices for anti-icing fluid endurance time testing. These standards are continually reviewed and updated at the discretion of the SAE Holdover Time committee.

APS Aviation Inc. (APS) has been conducting outdoor simulated freezing precipitation endurance time testing with the goal of measuring the effectiveness of new holdover time fluids since the early 1990s. All testing is conducted in accordance with the established SAE standards, ARP5945, and ARP5485.

This procedure serves as an update to the previous APS procedure, *Endurance Time Testing in Simulated Freezing Precipitation with SAE Type I, II, III, and IV De/Anti-icing Fluids*, which was issued in November 2018. This new document serves to incorporate refinements to the procedure that have been made in the intervening years, as well as to provide additional information relating to event planning and APS specific processes.

2. OBJECTIVE

This procedure describes the testing procedures used to evaluate the endurance time performance of Type I, II, III, and IV fluids in simulated freezing precipitation conditions.

This procedure also describes the testing procedure used to measure fluid thickness profiles of Type I, II, III, and IV fluids.

A related procedure is produced annually containing year-specific test plans, equipment needs, as well as details on other projects being undertaken during the annual simulated freezing precipitation holdover time test session.

3. PRE-TESTING ACTIVITIES

This section describes activities that need to be performed prior to commencing a simulated freezing precipitation testing session.

3.1. Event Coordination and Scheduling

Simulated freezing precipitation testing is a highly coordinated activity requiring the use of advanced testing facilities, numerous personnel (from both APS and the National Research Council Canada [NRC]), and significant resources. To that end, a significant effort must be put into planning these activities in order to keep testing running as smoothly, with as few costly disruptions as possible.

A typical test session will require that all fluids being qualified are tested in every simulated freezing precipitation condition found within a typical fluid holdover time table. This results in testing being done in discrete blocks (referred to as “conditions”) which are defined by the following:

- Precipitation Type;
- Test Temperature; and
- Target Precipitation Rate.

These parameters of each condition are designed to replicate the boundary conditions governing each freezing precipitation holdover time table cell.

Given that each fluid being tested must be tested in all boundary conditions, each simulated freezing precipitation test session will consist of a known amount of conditions, each of whose length can be estimated with the following information:

- Number of tests to be run (determined by the number of fluids to be tested); and
- Expected endurance time of each test (estimated based on fluid performance in natural snow).

Additionally, each fluid being qualified must also undergo fluid film thickness testing. This is generally performed concurrently with the standard endurance time testing, but must also be accounted for when scheduling a test session. As fluid film thickness testing is conducted at a chamber temperature of -3°C, the testing should be scheduled to be done during the -3°C condition blocks.

It is the responsibility of the event coordinator to arrange the schedule of conditions in such a way as to ensure that each testing day will conclude at an appropriate time, and that time between conditions is minimized. To this end, like precipitation types/temperatures should be grouped as much as possible to avoid unnecessary temperature and spray equipment changes.

3.2. Data Requirements and Test Planning

Unlike natural snow testing, where data is gathered at a range of rates and temperatures, simulated freezing precipitation testing is conducted at a specific set of rates and temperatures representing the boundary conditions for each precipitation type. Table 3.1 lists all of the test conditions that comprise a standard simulated freezing precipitation holdover time test session.

Table 3.1: Standard Holdover Time Freezing Precipitation Test Conditions

Condition Abbreviation	Precipitation Type	OAT (°C)	Test Rate (g/dm²/h)	Notes
ZF, -3, 2	Freezing Fog	-3	2	
ZF, -3, 5	Freezing Fog	-3	5	
ZF, -10, 2	Freezing Fog	-10	2	Type III only
ZF, -10, 5	Freezing Fog	-10	5	Type III only
ZF, -14, 2	Freezing Fog	-14	2	
ZF, -14, 5	Freezing Fog	-14	5	
ZF, -25, 2	Freezing Fog	-25	2	
ZF, -25, 5	Freezing Fog	-25	5	
ZF, -35, 2	Freezing Fog	-35	2	LOUT ≤ -29.5°C
ZF, -35, 5	Freezing Fog	-35	5	LOUT ≤ -29.5°C
ZD, -3, 5	Freezing Drizzle	-3	5	
ZD, -3, 13	Freezing Drizzle	-3	13	
ZD, -6, 5	Freezing Drizzle	-6	5	Type I only
ZD, -6, 13	Freezing Drizzle	-6	13	Type I only
ZD, -10, 5	Freezing Drizzle	-10	5	
ZD, -10, 13	Freezing Drizzle	-10	13	
ZR, -3, 13	Freezing Rain	-3	13	
ZR, -3, 25	Freezing Rain	-3	25	
ZR, -6, 13	Freezing Rain	-6	13	Type I only
ZR, -6, 25	Freezing Rain	-6	25	Type I only
ZR, -10, 13	Freezing Rain	-10	13	
ZR, -10, 25	Freezing Rain	-10	25	
CS, 1, 5	Rain on Cold-Soaked Wing	-1	5	
CS, 1, 75	Rain on Cold-Soaked Wing	-1	75	

As the test conditions are standardized and finite in number, the amount of tests required for a given fluid in a typical holdover time test session is always known. For thickened fluids, this number is determined by how many dilutions are to be tested, as well as the fluid lowest operational use temperature (LOUT). For Type I fluids, data must be obtained using both aluminum and composite test surfaces for all conditions. Table 3.2 lists the data requirements in simulated freezing precipitation for all fluid types.

Table 3.2: Freezing Precipitation Data Requirements

Fluid Type, Dilution(s)	Fluid LOUT	Number of Tests Required
Type I	Any	56
Type II/IV, Neat Only	Above -29.5°C	32
	-29.5°C or Below	36
Type II/IV, All Dilutions	Above -29.5°C	72
	-29.5°C or Below	76
Type III, Neat Only	Above -29.5°C	32
	-29.5°C or Below	36
Type III, All Dilutions	Above -29.5°C	72
	-29.5°C or Below	76

Note that the totals in the above table do not include any tests which must be repeated (see Subsection 5.4.3 for details relating to repeated tests).

Refer to the above tables when planning an upcoming freezing precipitation test event; tests must be planned for each appropriate condition, and the number of tests for a given fluid should be equivalent to the appropriate number from the table above.

As a reminder, test plans for a given simulated freezing precipitation testing session are included in a related procedure that is prepared annually prior to that year's testing session.

3.3. Equipment Preparation

As all simulated freezing precipitation testing takes place at the NRC Climatic Engineering Facility (CEF) in Ottawa, there are several equipment preparation activities that must be completed prior to arrival at the NRC facility. These activities are listed below.

1) Mark all test surfaces with gridlines and with plate numbers on the back and front (note that markings should be at the bottom of the test surfaces).
2) Ensure all test plates are equipped with an operational SmartButton, and ensure that all temperature loggers have been properly configured. Loggers must be able to log a full week's worth of data as data will only be exported at the end of each testing week.
3) Locate the rate pans: check the quantity, confirm that all pans properly labelled and fully intact (no holes/cracks), and verify that spare pans are available.
4) Prepare labels for pour containers, as needed.
5) Confirm that the primary and backup rate station laptops are working normally, confirm that the rate station software runs on both laptops.
6) Confirm that the primary and backup rate station weigh scales are working normally and calibrated, confirm that both weigh scales are communicating properly with both the primary and backup rate station laptops.
7) Confirm that the APS closed-circuit television (CCTV) camera system is properly functioning, including all supporting equipment.
8) Ensure that sufficient copies of all data forms, procedures and condition sheets have been printed in advance.

3.4. Fluid Preparation Management

This subsection describes the steps necessary to ensure that the fluids to be tested are properly prepared for testing.

3.4.1. Type I Fluid Preparation

Type I fluids will generally be sent to APS by the manufacturer in concentrate form. Prior to commencing a test session, appropriately buffered mixtures of the fluid must be prepared for each test temperature that is planned for the session. As per ARP5945A, Type I fluids must be tested at dilutions where the freezing point of the solution is 10°C colder than the outside air temperature (OAT) at which testing is taking place.

To prepare the buffered solution, you must first identify the temperatures at which the testing will take place. Separate solutions must be prepared for each discrete testing temperature, and each prepared solution must be stored at the correct temperature. For example, if the daily schedule calls for tests at both -3°C and -10°C, two separate batches of Type I fluid must be prepared (with freezing points of -13°C and -20°C respectively). Each batch must be stored at ambient room temperature (20°C).

The Type I concentrate must be diluted with hard water, which is prepared by dissolving 400 mg of calcium acetate dehydrate and 280 mg of magnesium sulfate heptahydrate into 1 L of water (the quantities can be scaled up proportionally if preparing a larger batch). Consult the dilution chart associated with the Type I fluid being tested in order to determine the appropriate glycol/hard water ratio necessary to achieve the desired freeze point. Dilution charts are generally available on the fluid manufacturer's website or provided directly from the manufacturer upon fluid receipt.

Confirm that the glycol concentration in your prepared solution is appropriate by measuring the Brix (generally Type I dilution charts will indicate the target Brix for the desired fluid freeze point). Ensure that the container in which the solution is mixed is clearly marked with the freeze point and Brix of the fluid. Pour container labels listing the fluid name, Brix and freeze point should also be created and affixed to all pour containers to be used during the test session.

Note that although ARP5945A stipulates that Type I fluid samples be sheared in a laboratory blender prior to testing, previous work has indicated that the effects of this shearing process on resulting Type I fluid endurance times are negligible. The Type I fluid shearing process is generally not performed with fluid samples as part of the typical simulated freezing precipitation testing process.

3.4.2. Type II/III/IV Fluid Management

In order to ensure that a testing session runs smoothly with minimal disruptions, it is critical that a sufficient number of filled 1 L pour containers for each fluid to be tested are prepared and tempered prior to the start of a given test condition. The required amount of each fluid for each condition will be known in advance; it is good practice to have additional fluid ready for testing in the event of unexpected circumstances.

Used pour containers should be periodically refilled when time permits to prevent delays in the fluid application process. At a minimum, empty pour containers should be refilled at the conclusion of each testing day. All pour containers must be affixed with labels listing the fluid name, batch number and dilution and special care must be taken when refilling to ensure that the proper fluid, batch, and dilution are used.

At the testing manager's discretion, the fluid names on the pour container labels may need to be coded to preserve fluid anonymity in the presence of visitors.

All fluids to be used in simulated freezing precipitation endurance time testing must be properly stored in order to ensure that they are at the correct temperature when a test session begins. Given that simulated freezing precipitation testing takes place at several discrete testing temperatures, a series of programmable chest freezers set to the various testing temperatures should be available at the NRC such that a sufficient quantity of fluid can be kept at each temperature being tested.

Fluid can also be stored within the test chamber itself, provided that the temperature of the chamber is the desired storage temperature for the fluid in question.

As stated in ARP5485B, the temperature of Type II, III (unheated) or IV fluid being applied to a test surface in a simulated freezing precipitation endurance time test must be within 3°C (ideally 1°C) of the OAT. Valuable testing time can be lost waiting for fluids to temper if the proper storage procedures have not been followed.

4. TEST SITE

All testing in simulated freezing precipitation is conducted indoors at the NRC CEF located in Ottawa Canada, where precipitation is artificially produced using a specialized spray assembly capable of producing droplets of precisely calibrated size. This spray assembly (and the nozzles it contains) were developed by the NRC in conjunction with APS over the course of several years of research.

Photo 4.1 provides an outdoor view of the facility (U-88) giving a general indication of its size (30 m by 5.4 m, height 8 m). The facility was originally designed for the testing of locomotives; Photo 4.2 provides an interior view of the CEF set up for endurance time testing. The lowest temperature achievable in the CEF is -46°C.

Photo 4.1: Outdoor View of NRC Climatic Engineering Facility



Photo 4.2: Inside View of NRC Climatic Engineering Facility



5. TESTING PROCEDURES

This section describes the procedures to be followed during a simulated freezing precipitation test event.

The procedures conform to the requirements for simulated freezing precipitation testing outlined in Section 11 of ARP5485B – *Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type II, III and IV*.

The procedures also conform to the requirements for simulated freezing precipitation testing outlined in Section 11 of ARP5945A – *Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type I*.

5.1. Set-Up

The set-up steps to be performed once upon initial arrival at the CEF for a freezing precipitation endurance time testing session are listed below.

1) Unload all equipment from the truck upon arriving at the CEF. General equipment boxes should be stored in the women's washroom off of the client area. Office equipment is to be kept in the client area.
2) Set up the fluid storage freezers within the hallway off of the client area. Ensure that there is a freezer set to each of the target test temperatures at which testing will take place during the test session.
3) Set up the rate station within the client area: ensure that the scale being used is properly leveled and test that the scale and chosen rate station computer are functioning normally together.
4) Store the cold-soaked box fluid jugs (brought from the test site) inside the cold NRC freezer and confirm that the freezer is set to < -30°C.
5) Set up two full six-position test stands within the spray area inside the testing chamber. The initial position of the test stands is dependent upon the first condition being tested; refer to the NRC Continuous Rate form to determine the appropriate starting position for the test stands. Ensure the stands are levelled such that the test surfaces lie at a 10° angle (within 9.8° and 10.2° is acceptable, check each test surface). The angle of the test stand can be adjusted as needed by placing poker chips under the stand legs. Whenever the configuration is adjusted by adding or removing chips, ensure that the stand is reasonably stable and that all test surfaces are at the proper angle. Ensure the fluid collection pans are placed beneath the test stands to collect fluid runoff, however equip the collection pans with white covers to prevent their filling with sprayed precipitation.

6) Equip the two six-position test stands with aluminum test plates. Half plates may be used for one test in each duplicate pair of tests in order to increase the number of available test positions. Note that Type I fluids need to be tested on both composite and aluminum test surfaces, test surfaces can be adjusted on the test stands as needed. Note also that a special test surface is used for rain on cold-soaked wing condition testing with all fluid types. See Subsection 5.6 for additional details. All test plates used must be equipped with SmartButtons that are actively logging temperature data. Figure 5.1 depicts the proper plate set-up for the two test stands.

7) Install four of the five CCTV cameras (2.8 mm focal length) on the back corners of both test stands. Adjust the Manfrotto® arms accordingly so that optimal plate coverage is obtained for the complete stand. Install the fifth CCTV camera (2.8 mm focal length) in the climate chamber so than an overall view of the testing is obtained. Figure 5.2 illustrates the position of the five CCTV cameras.

8) Sync all digital clocks and install them in the large end of the test chamber (near spray area), and in the small end of the test chamber.

9) Confirm that the NRC personnel have properly set-up the CCTV camera system. It is critical that the camera system provides a good view of the testing area; the rate station manager must be able to have a clear view of the test stands while seated at the rate station. Ensure that the digital clocks are visible on the camera screens.

10) Post copies of the condition testing schedules and rate tolerance guidelines inside the client area.

11) Fill out the General Session Conformance Checklist (Attachment 1)

12) Prior to departing the facility on setup day, confirm that all personnel (NRC/APS) are aware of the starting time and initial test condition for the first testing day.

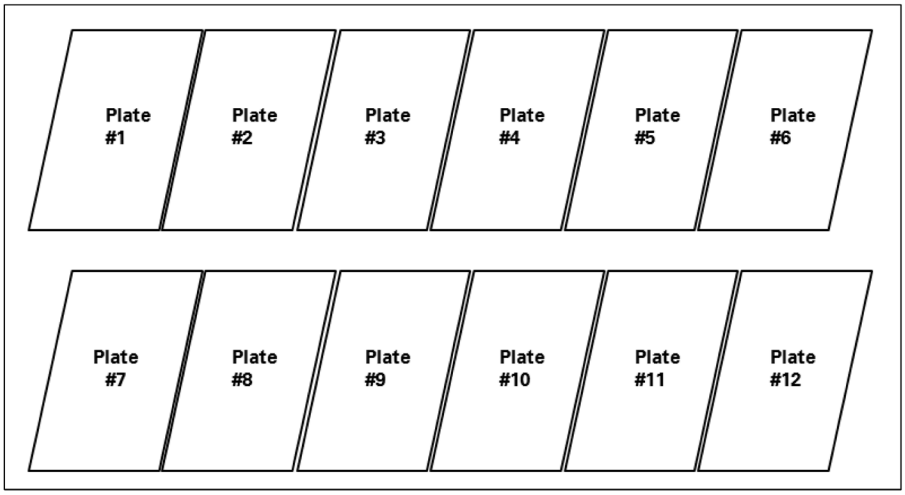


Figure 5.1: Test Stand Set-Up

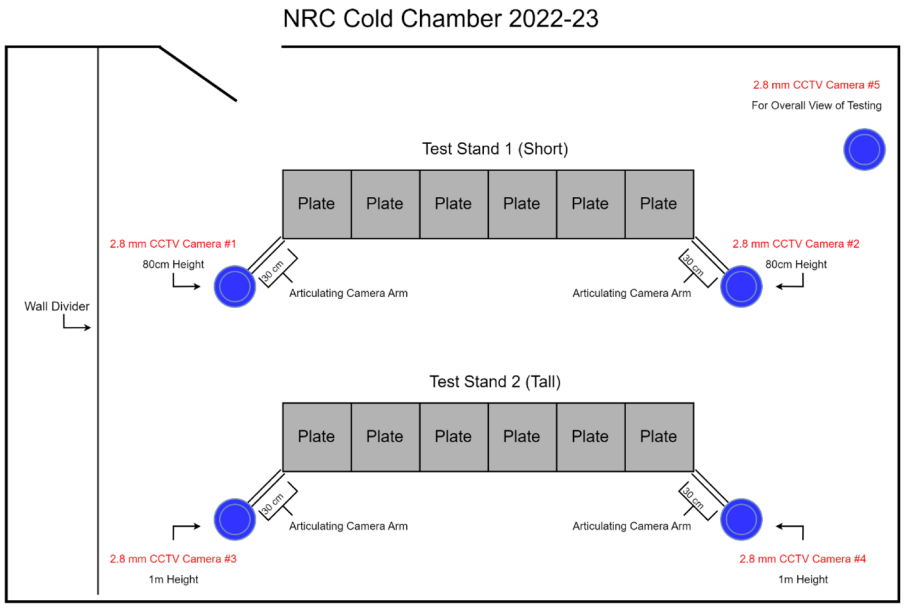


Figure 5.2: Camera Location During Holdover Time Testing

5.2. Testing Process for a Typical Condition

A simulated freezing precipitation endurance time testing session is comprised of discrete blocks of tests known as conditions. Different conditions will vary in terms of precipitation type, precipitation rate, and test chamber temperature.

The general flow of work for each condition is very similar; the steps in the testing process are listed below.

1) Confirm the condition being tested with NRC personnel. NRC personnel will install the proper spraying equipment/needles and set the flow rate specific to the condition precipitation type and will set the testing chamber temperature to the appropriate target test temperature.
2) While NRC personnel are configuring the chamber and spray equipment, APS personnel must confirm that the test stands are in the proper starting position relative to the condition being tested (refer to the NRC Continuous Rate Form for proper stand position coordinates). Ensure that the test stands are equipped with the appropriate test surfaces, APS CCTV cameras are properly positioned, and confirm that all fluids to be tested in the upcoming condition are at the appropriate temperature.
3) Once the chamber has reached the appropriate temperature, NRC personnel will activate the spraying equipment and begin precipitation.
4) Once precipitation has begun, pre-test rate collection and calibration takes place. This process continues until stable, in-tolerance rates have been achieved on a sufficient number of test stand positions to allow testing. In order for a position to be used for testing, two consecutive in-tolerance rates must have been recorded on that position.
5) All required endurance time tests are conducted and the results are validated. Note that for a given condition, the number of tests to be conducted will be known beforehand and all tests to be run will be listed on a condition-specific test plan known as a "Condition Sheet". Two data points must be collected with each dilution of each fluid being tested in a given condition. Note that if the endurance time results obtained failed to satisfy preliminary data validation checks, supplemental test runs may be required.
6) As endurance time tests are completed, post-testing rate collection cycles are performed. Two rate collection cycles are required for a given position after an endurance time test is completed.
7) After the final post-test rate collection cycle is complete, the condition is considered complete. Rate and endurance time data processing takes place, and APS/NRC personnel can begin their set-up steps for the following condition.

5.3. Rate Collection

The rate collection process for simulated freezing precipitation differs significantly from the process employed during natural snow. Unlike natural snow rate collection, where one rate pan in one position is used to collect rates for the entire test stand, rate collection in simulated freezing precipitation is performed on each position of the test stand that is used for testing, resulting in unique rates being obtained for each position.

Additionally, while natural snow rate collection is a continuous process (occurring before, during and after a test), simulated freezing precipitation rate collection is performed only immediately prior and immediately following an endurance time test. The test rate for a given freezing precipitation endurance time test is determined by taking the average of four recorded rates; two rates taken immediately prior to the test, and two rates taken immediately following the test. All rates associated with a test must be collected from the same position on which the test is conducted. Similar to natural snow rate collection, the target time period for a recorded rate is ten minutes.

Test rates for simulated freezing precipitation endurance time tests must fall within a set of tolerances stipulated within ARP5945A and ARP5485B (for Type I and Type II/III/IV fluids, respectively). These tolerances dictate allowable ranges for the average rate of a test, as well as the allowable standard deviation of the individual rate measurements comprising a test rate. These tolerances are condition specific; they vary depending on precipitation type and target test rate. It is the responsibility of the rate station manager to ensure that test rates are falling within these tolerances; out-of-tolerance rates can result in the invalidation of an endurance time test. Table 5.1 lists the average test rate tolerances for the various simulated freezing precipitation conditions.

Table 5.1: Simulated Freezing Precipitation Average Test Rate Tolerances

Precipitation Type	Target Test Rate ($g/dm^2/h$)	Tolerance for Average Test Rate ($g/dm^2/h$)
Freezing Fog	2	±0.3
	5	±0.4
Freezing Drizzle	5	±0.4
	13	±0.5
Freezing Rain	13	±0.5
	25	±1.0
Rain on Cold-Soaked Wing	5	±0.4
	75	±3.0

5.3.1. Procedure for Rate Collection

The rate collection process is generally performed by the rate station manager with two Ottawa personnel assisting. The steps for rate collection in simulated freezing precipitation are summarized below.

1) Open the rate station software (RateStation.Winforms). Complete initial configuration of the rate station software by selecting your test condition and specifying the temperature. If any positions on the test stand are not being used for testing in a given condition, retire them immediately in the software by clicking the "Retire" button under the unused positions.
2) Open a copy of the Excel sheet used to record the rates (RateStationTemplate). Rename the Excel sheet with a name that describes the condition being (ex. "ZD -10 5 - 2023-24" for low rate freezing drizzle at -10°C) and close the file.
3) Confirm that the test stands are in the correct starting position for the condition being tested (refer to the NRC Continuous Rate Form which lists the stand starting positions for each condition).
4) Ensure that the rate station scale is level, and pre-weigh dry "Inside" rate pans for all unretired positions. To record the pre-weight of the pans in the rate station software, click "Start Rate" under the appropriate position and input the weight from the scale in the "Weight" dialog box. Do not click "Start" after recording the pre-weight – this will signal to the software that the rate collection period has begun for that position.
5) Note that each numbered rate pan set corresponds to a specific numbered position on the test stand (see Figure 5.1) and consists of an "Inside" and an "Outside" plastic pan; whenever a pan is being weighed, only the "Inside" pans are to be placed on the scale. After weighing an "Inside" pan, place it back inside its corresponding "Outside" pan. Once all pans are pre-weighed, arrange them in numerical order on the shelves adjacent to the rate station. Figure 5.3 depicts the rate station software window after all pre-weights have been recorded (but before any rate cycles have begun).
6) Once the NRC personnel have started the precipitation for the condition, begin collecting initial rates for all available positions. In a typical two test stand set up, positions 2 through 12 should all be initially available. Bring the empty pans (Inside + Outside together) into the test chamber, and carefully place them on their respective positions one at a time, taking care to avoid covering other positions with the rate pan as it is placed on the stand. The rate station manager is to monitor this process closely on the NRC cameras; as each pan is placed on the stand, the rate station manager must click the "Start" button for the position in question to indicate the start of the rate collection period.

7) As the ten-minute mark of the initial rate cycle approaches, begin collecting the rates pans from the test stand and returning them to the rate station, again in numerical order. Ensure that no precipitation is lost from inside each pan as they are transported – any lost precipitation will cause inaccuracies in the measured rate for that collection period. The rate station manager must once again monitor the process closely, and click the appropriate "Stop Rate" button at the moment that each pan is collected, signalling the end of the rate collection period. A dialog box will appear prompting the user for the final weight of the collection pan.

8) Weigh the "Inside" pans, record the weight in the dialog box and click "Save Rate". Repeat this process for each of the pans collected.

9) As the final weights are entered, the program will automatically calculate the measured rate of precipitation over the collection period for each position. The program will show the calculated rate on the screen, highlighted either green (for an in-tolerance rate) or red (for an out-of-tolerance rate). Figure 5.4 depicts the rate station software window after one cycle of rates have been collected for each available position in a standard two stand set-up, with both in and out of tolerance rates being shown.

10) After the initial rate cycle is complete (and prior to starting the second rate cycle), review the measured rates shown on-screen. If most or all positions are out-of-tolerance and a consistent trend is noted in the rates (i.e. all too high or all too low), consider asking the NRC personnel to adjust the back pressure (lower if rates are too high, higher if rates are too low).

11) If changing the back pressure does not bring the rates back in tolerance, or if there is no discernable trend in the rates across the positions, consider adjusting the position of the test stands. If making any adjustments, allow time for the adjustment to be made and come into effect before bringing pans back out to start a new rate cycle.

12) Begin a second rate cycle with all pans, repeating the same process as was completed for the first cycle.

13) After the second cycle is complete, the rate station manager can begin allocating positions to the testing team provided that both measured rates on the position in question are within tolerance. Tests can only be run on positions that have had two consecutive valid rates collected. Making further changes to the back-pressure settings or stand position after testing has begun is discouraged – it is generally advisable to adjust early in the process with the goal of bringing as many positions in tolerance as possible.

14) Once a given position has been allocated for use to the testing team, click "Start Test" in the rate station software window. The display for this position will change colour, and will indicate that a test is running. At this point, rate pans will no longer need to be placed on this position until the testing team has completed their test(s). Figure 5.5 depicts the rate station software window with several active tests running (test numbers have been added).

15) After the testing team pours a test on an allocated position, input the test number in the "Test #" section in the software.

16) If two tests are poured simultaneously on a position equipped with half-plates, input both test numbers separated by a slash (ex. 6/7, with test 6 being poured on the left-hand half plate and test 7 being poured on the right-hand half-plate).

17) If two tests are poured consecutively on a position (known as a "test-test"), input both test numbers separated by a plus sign (ex. 6 + 7, with test 6 being poured first and test 7 being poured on the same position after test 6 is complete.

18) Continue rate collection cycles on all positions that are not currently allocated for testing. Positions can be allocated to the testing team whenever two consecutive in-tolerance rates are obtained. Ensure that at all times rate cycles are continuously run on a minimum of one position – unexpected changes in the measured rates on this position will highlight changes in precipitation that may be difficult to detect otherwise.

19) When the testing team has completed their tests on a given position, they will communicate to the rate station manager that the position in question is now ready for post-test rates. Click "End Test" in the rate station software window for the position in question, and resume rate collection cycles on this position. A minimum of two post-test rate collection cycles must be completed in order to generate the final test rate for all tests run on that position. If the two post test rate cycles generate in-tolerance rates, the position can immediately be allocated back to the testing team (if more tests are to be run).

20) Once all tests and post-test rate cycles have been completed for a given condition, the rate data must be exported from the rate station software. To do so, click "Fill Excel Sheet" in the rate station software and locate the previously created Excel file.

21) Once the Excel sheet is populated, open the "Output" tab in the Excel file. Click "Update All" – the sheet will now process all of the imported rate data. Once complete, the rates for all tests run in the condition should be shown in this tab.

22) Double check that test numbers for all tests run in the condition appear in Column D (refer to the condition sheet to confirm nothing was missed), and click "Status Calculator". The sheet will now verify that the rates for each test are conforming to the tolerances stipulated. Results of the checks are shown in columns P, Q, and R. If any of the tests fail any of the tolerance checks, advise the testing manager – they will make the decision whether to re-run the affected tests.

23) Once confirmed that all tests are present in the Excel sheet with in-tolerance rates, print out a copy of the details in the Output tab (columns D through S) and provide the printout to the testing assistant for filing.

24) Finally, at the conclusion of each condition, assess the overall difficulty of the rate process for that condition on a scale from 1-5 and note this difficulty on the NRC Continuous Rate Form.



Figure 5.3: Rate Station Software Window after Pre-Weighing of Pans

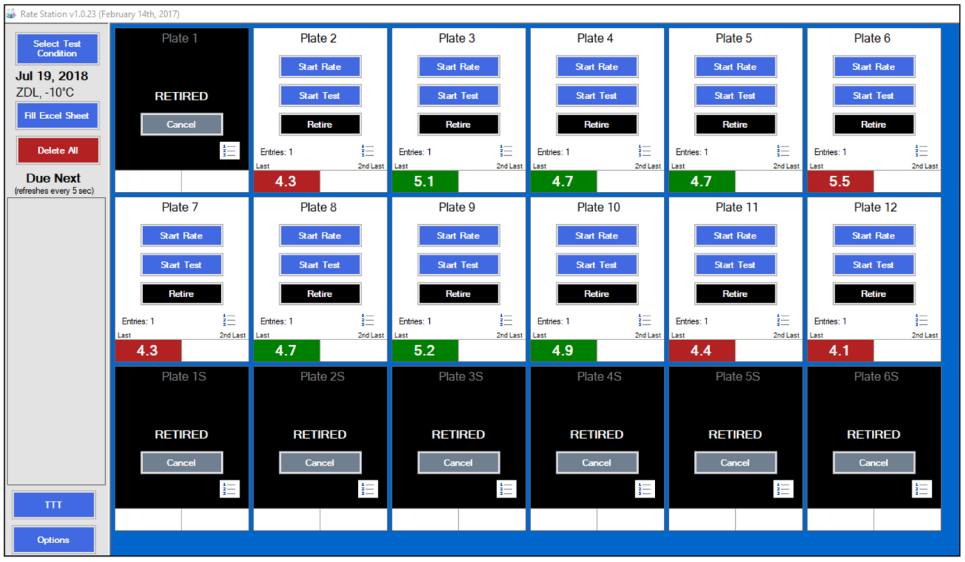


Figure 5.4: Rate Station Software Window after One Rate Cycle



Figure 5.5: Rate Station Software Window with Active Tests Running

5.3.2. Challenges and Additional Information Concerning Rate Collection

Note that managing the rate station is a challenging role which requires a large amount of focus. The rate station manager should work closely with both the testing manager and NRC personnel in order to obtain valid, in-tolerance rates on as many positions as possible. Obtaining in-tolerance rates is not always straight-forward, and the challenge varies from condition to condition. Frequently, the rate station manager will need to make a decision between allocating fewer in-tolerance plates to the testing team (thus reducing the amount of tests that can be run concurrently) or attempting to tweak the water flow back pressure settings / stand positioning further (which delays the start of testing, with the goal of freeing up more usable positions).

The rate station manager should refer to the "Continuous Rate Form" in order to obtain an understanding of the relative difficulties of rate collection in the different conditions. This knowledge is helpful when attempting to make the "tweak or test" decisions alluded to in the previous paragraph. Finally, an internal companion document has been developed detailing common issues encountered during rate collection and troubleshooting suggestions. This document is available on the APS SharePoint.

5.4. Fluid Endurance Time Tests

The steps for conducting simulated freezing precipitation fluid endurance time tests are summarized below.

5.4.1. Procedure for Testing Unheated Fluids (Type II, III-Unheated, and IV)

1) Prepare the data form / data form app by recording the fluids to be poured in their respective positions.
2) Measure the initial fluid temperature of all fluids that are to be poured during the test session. Confirm that all fluids are within 3°C (ideally 1°C) of the current target test temperature. If fluids are not at the correct temperature, warm them in the client area or cool them in a chest freezer as needed.
3) Coordinate with the rate station manager to determine which positions on the test stand have rates suitable for testing.
4) Once test stand positions have been allocated to the testing team by the rate station manager, clear the test surfaces to be used of existing contamination using a scraper. To ensure that each position is properly cleaned, apply a small quantity of the fluid being tested to the test surface and use a squeegee to spread it across the full test surface.

5) Confirm that the data form manager is ready to begin the fluid application process. At each position, remove the plate cover and pour 1 L of the selected fluid onto the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer. During the pouring process, use the removed plate cover to shield the test surface from the falling precipitation. Record the time of fluid application on the chosen data form.

6) After fluid application is complete, each plate must be inspected periodically in order to assess the condition of the fluid layer. A section of the plate is considered failed when it is covered with frozen contamination.

7) If more than one-third of a given plate is determined to be "failed" (or if fluid failure is noted at any five of the crosshair marks on the plate), the plate as a whole is considered to be failed. Announce the fluid failure and ensure the failure time is recorded by the data form manager. Take a photo of the failed fluid from the back side, slightly above the plate, to capture full coverage. Place a "poker chip" on the plate once failure has been declared to indicate that the plate is no longer running an active test.

8) Alternately, if a test reaches the maximum run time (representing the maximum allowable holdover time for the freezing precipitation condition being tested), the test can be stopped immediately. For freezing fog, the maximum run time is four hours. For all other simulated freezing precipitation conditions, that maximum run time is two hours. The data form manager must note that the test did not fail (typically by noting "Did Not Fail (DNF)" on the data form).

9) If there are no other tests currently running or immediately to be run on the position, reinstall the plate cover and signal the rate station manager to begin post-test rate collection cycles. Note that a given position can be used for no more than two consecutive tests; post-test rate collection cycles must be performed after the second consecutive test.

10) Ensure fluid for the next condition is available and tempered to the correct temperature.

5.4.2. Procedure for Testing Heated Fluids (Type I and III-Heated)

1) Prepare the data form / data form app by recording the fluids to be poured in their respective positions.

2) Measure the initial fluid temperature of all fluids that are to be poured during the test session. Confirm that all fluids are within 5°C (ideally 1°C) of 20°C. If fluids are not at the correct temperature, warm them in the client area or cool them in a chest freezer as needed.

3) Coordinate with the rate station manager to determine which positions on the test stand have rates suitable for testing.

4) Once test stand positions have been allocated to the testing team by the rate station manager, clear the test surfaces to be used of existing contamination using a scraper. To ensure that each position is properly cleaned, apply a small quantity of the fluid being tested to the test surface and use a squeegee to spread it across the full test surface.

5) Confirm that the data form manager is ready to begin the fluid application process. At each position, remove the plate cover and pour 1 L of the selected fluid onto the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer. During the pouring process, use the removed plate cover to shield the test surface from the falling precipitation. Record the time of fluid application on the chosen data form.

6) After fluid application is complete, each test surface must be inspected periodically in order to assess the condition of the fluid layer. A section of the plate is considered failed when it is covered with frozen contamination. For Type I fluids, failure may occur quickly after fluid application.

7) If more than one-third of a given plate is determined to be “failed” (or if fluid failure is noted at any five of the crosshair marks on the plate), the plate as a whole is considered to be failed. Announce the fluid failure and ensure the failure time is recorded by the data form manager. Place a “poker chip” once failure has been declared to indicate that the plate is no longer running an active test.

8) Alternately, if a test reaches the maximum run time (representing the maximum allowable holdover time for the freezing precipitation condition being tested), the test can be stopped immediately. For freezing fog, the maximum run time is four hours. For all other simulated freezing precipitation conditions, that maximum run time is two hours. The data form manager must note that the test did not fail (typically by noting “Did Not Fail (DNF)” on the data form).

9) If there are no other tests currently running or immediately to be run on the position, reinstall the plate cover and signal the rate station manager to begin post-test rate collection cycles.

10) Prepare for the next condition.

5.4.3. Criteria for Validation of Fluid Endurance Time Test Results

Two data points must be collected with each dilution of each fluid being tested in a given condition. After both tests are complete, the endurance time results of the two tests must be compared to confirm that they conform to the reproducibility criteria outlined in ARP5945A / ARP5845B.

The standard states that if the endurance time of one of the two tests lies outside ±10 percent from the average, then two additional data points must be collected with the fluid in question. In cases where additional data must be gathered, no data is to be discarded. All four data points will ultimately be used when analysing the test results and determining fluid holdover times.

It is the responsibility of the testing manager to ensure that all results obtained conform to the reproducibility criteria, and that additional data is collected when the reproducibility criteria is not met. A spreadsheet was developed for quick verification of the reproducibility criteria; as matched pairs of tests are completed, their results should be entered into the spreadsheet for verification of conformance.

5.5. Fluid Film Thickness Testing

In addition to fluid endurance time testing, a standard simulated freezing precipitation endurance time test session will also include fluid film thickness testing for each dilution of each fluid being tested. This testing performed in the “small end” of the test chamber (away from the spray area) as no precipitation is required. The testing is performed at -3°C, and is generally run concurrently to fluid endurance time tests.

The steps for conducting fluid film thickness tests are summarized below.

1) Set up a full six-position test stand in the “small end” of the testing chamber (away from the spray area). The exact position of the test stand is not important, but ensure that the stand is levelled such that the test surfaces lie at a 10° angle (within 9.8° and 10.2° is acceptable, check each test surface). Equip the test stand with aluminum test plates.
2) Prepare the data form by recording the fluids to be poured in their respective positions.
3) Measure the initial fluid temperature of the fluids that are undergoing thickness testing. Unheated fluids (Types II, III-Unheated and IV) must be within 3°C (ideally 1°C) of -3°C. Heated fluids (Types I and III-Heated) must be within 5°C (ideally 1°C) of 20°C. If fluids are not at the correct temperature, warm them in the client area or cool them in a chest freezer as needed.

4) Pour 1 L of each fluid onto the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer. Start recording time on a stopwatch after the first fluid is poured. Stagger each pour in order to ensure that all thickness measurements can be captured at the appropriate times. Record the time of fluid application on the data form for each pour.

5) At the five minute mark (as noted on the stopwatch), measure the thickness of the first poured fluid layer along the six-inch line of the plate with a film thickness gauge. Confirm the measured value by taking a second reading at a different point along the six-inch line of the plate. If there is disagreement between the first and second thickness values, take a third measurement at another point along the six-inch line. If all three values are different, record all three values obtained. Otherwise, discard the non-conforming value.

6) Repeat the thickness measurement process for the other fluid layers, staggering the measurements in the same manner as the fluid application process, to ensure that each fluid film thickness is measured at its respective five minute mark. Record the measured fluid film thicknesses on the data form.

7) Repeat the thickness measurement process at the 15 minute mark, and again at the 30 minute mark. Ensure that all measurements are recorded for each fluid being tested.

5.6. Procedure for Cold-Soaked Box Preparation

For rain on a cold-soaked wing endurance time testing, the test surface to be used is a leading edge thermal equivalent box filled with cold Type I fluid (known as a cold-soaked box). As per ARP5945A and ARP5485B, the boxes must be prepared such that the surface temperature of the plate at the start time of an endurance time test is -10 ± 1°C.

The cold-soaked box preparation should begin during the initial rate collection cycles of the cold-soaked wing condition in order to ensure that the surfaces are ready for testing as soon as the rate collection process is complete.

The steps for preparing cold-soaked boxes for testing are listed below.

1) Close the large door in the test chamber, dividing the chamber into the large end (containing the spray area and the test stands) and the small end. Have the NRC personnel set the temperature of the small end of the chamber to -10°C.

2) Retrieve the containers of cold Type I fluid from the cold (-30°C) freezers and place in the small end of the chamber.

3) Using a combination of the cold Type I fluid jugs removed from the freezers and the warmer Type I fluid found in the barrel at the small end of the chamber, prepare a large batch of Type I fluid with a fluid temperature of -12 ± 1°C. The Brix of the fluid mixture should fall between 26.00 and 29.00. Note that a very large volume of cold fluid is required to fill the boxes; the batch should be prepared in the largest container available on-hand. Mix the fluid frequently while preparing the batch and monitor the fluid temperature at all times during the box preparation process.

4) Place the empty cold-soaked boxes and cold-soaked box filling stand on the large metal table found in the small end of the testing chamber.

5) Place a box in the filling stand and fill with the prepared Type I fluid mixture. Once full, agitate the box within the stand to free any trapped air within. Refill the box and agitate once again, repeating the process until the box is completely full with no trapped air.

6) Close the box and verify that the surface temperature of the box is -11 ± 1°. Remove the box from the filling stand and place on a dolly to await transfer to the testing team for use.

7) Repeat the process with the remaining empty boxes. Note that the filled boxes are heavy – avoid placing too many on the dolly at one time.

8) As positions on the test stand become available for testing, the testing team will advise the box preparation team that filled boxes are needed. Transfer prepared boxes to the testing team as needed by raising the doors dividing the testing chamber and passing the dolly underneath. Avoid transferring boxes too early or transferring unneeded boxes, as the surface temperature of the filled boxes will change rapidly in the warmer end of the testing chamber.

9) As tests are completed, filled boxes that have been used by the testing team will be returned to the box preparation team. Empty the used boxes back into the prepared fluid mixture, ensuring that the temperature of the mixture remains at -12 ± 1°C.

10) Continue preparing boxes until a sufficient quantity has been prepared to complete all planned tests (as well as any supplemental tests required, as determined by the testing team).

11) At the end of the cold-soaked wing condition, return all Type I fluid to the barrel for future use.

5.7. End of Testing Day Activities

The steps for concluding a freezing precipitation endurance time testing day are summarized as below.

1) Ensure all test surfaces are properly cleaned after testing and that all fluid within the collection pans is disposed of appropriately (all glycol waste must be vacuumed up and disposed of in the waste fluid tote).
2) Ensure that all fluids to be tested during the first condition planned for the following day are available and are stored at the proper temperature. Refill empty pour containers as needed.
3) Ensure copies of the rate station Excel outputs for each condition tested have been saved in the Data and Rates folder of the APS SharePoint.
4) If using the HOT Data Form app to record endurance times, export the data files for each condition tested and save copies in the Data and Rates folder of the APS SharePoint.
5) If using paper data forms, place the completed forms in an envelope and mark the envelope with the date and number of forms.
6) If it is the final testing day of the week, ensure that the CCTV video camera footage has been downloaded and saved in the appropriate location on the APS SharePoint or external hard drive.
7) If it is the final testing day of the week, ensure that all SmartButton data from all test surfaces used is downloaded from the buttons and saved to the APS SharePoint.
8) If it is the final testing day of the session, ensure that the chamber temperature, relative humidity and video data is obtained from the NRC personnel.
9) Ensure that the SharePoint is synced and that all saved files have been uploaded.
10) Confirm starting time for the next testing day with all APS/NRC personnel prior to leaving for the day.

6. EQUIPMENT

The equipment required for endurance time testing in simulated freezing precipitation is listed in Attachment 2. The specific equipment needed for each session is listed in the annual NRC procedure.

7. PERSONNEL

Generally, five to six people are required for simulated freezing precipitation endurance time testing.

1) Testing Manager – responsible for overseeing the test event, determining which tests are to be run, applying fluids and calling all failures.
2) Rate Station Manager – responsible for overseeing the rate collection process and coordinating the testing assistants assigned to the rate station.
3) Data Form Manager – responsible for managing all data forms (paper and electronic) and ensuring all information is properly transcribed and captured.
4) Videographer – responsible for setting up and managing the CCTV camera system and ensuring all data is downloaded and saved in the proper location.
5) Testing Assistants (2 or 3) – responsible for set-up activities, rate collection, clean-up and assisting with any other tasks as determined by the testing manager.

Note that for simulated freezing precipitation testing, the testing assistants are generally part-time personnel who are based in the Ottawa area.

8. SAFETY

Testing in cold temperatures can pose significant safety issues. Jackets, gloves, and boots should be rated to very low temperatures and must be worn at all times when inside the testing chamber. Employees should be mindful of dangers associated with hypothermia and frostbite.

Additionally, as all simulated freezing precipitation testing takes place at an NRC controlled facility, all employees must adhere to any and all safety guidelines imposed by the NRC or its personnel.

Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

9. DATA FORMS AND SOFTWARE

The following data forms and software are typically used for simulated freezing precipitation endurance time testing:

1) Rate Station Software;
2) General Session Conformance Checklist (Attachment 1);
3) NRC Continuous Rate Form (Attachment 3);
4) End Condition Data Form for Endurance Time Tests – used as backup for app data form (Attachment 4);
5) App Data Form for Fluid Endurance Time Tests (Attachment 5); and
6) Fluid Film Thickness Testing Data Form (Attachment 6).

Attachment 1: General Session Conformance Checklist

LOCATION: CEF (Ottawa)	DATE:

Safety Issues Discussed ☐

Test Plate Material: ☐
(check the box if material used is Aluminum alloy AMS 4037)

Test Plate Dimensions: ☐
(check the box if the dimensions are 500mm long x 300mm wide x 3.2mm thick)

Test Box Dimensions: ☐
(only for CSW, check the box if the dimensions are 500mm long x 300mm wide x 75mm thick)

Surface Finish: ☐
(check the box if the average surface roughness is ≤ 0.5 µm)

Ice-catch Pan Dimensions: ☐
(check the box if the dimensions are 406mm long x 279mm wide with a 64mm height)

Water Supply to Nozzle: ☐
(check the box if the water supplied to the nozzles conforms to is ASTM D1193 Type IV water or a hardness of less than 300 ppm reported as $CaCO_3$)

Weigh Scale Verification ☐
(check the box if calibration was performed in the previous summer)

Distance between Nozzle and Test Plates ☐
(check the box if distance is 7±0.5, for ZD, ZR and CSW)

Distance between Temperature Sensor and Test Plates ☐
(check the box if distance is within 1.5m)

COMMENTS:

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.....

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LEADER: _____

Attachment 2: Equipment List for Simulated Freezing Precipitation Testing

SIMULATED FREEZING PRECIPITATION TESTING	
LOCATION: TEST SITE	
Barrel Opener to open CSW fluids	Rate Pan (aluminum HOT) x1
Bins for mixing CSW fluid x 5 (60L rubbermaids)	Rate Pans(white plastic) x all
Brixometer x 3	Sample bottles x 6
Camera x2 (small Canon) with accessories	Sartorius Scales x 2
Cart (IKEA) x 2	Scrapers x 14
Clear plastic clipboards x 5	Shop Vac + 2x18L open top pails
Clock (Large digital) x 2	SmartButton kits x 2 + extension wire
Cold-soak boxes (aluminum) x 16	Squeegees x 4 (small)
Empty 20L fluid container x 5 (for -30C CSW fluid)	Tape: Duct tape x 1
Extension Cords x 4	Tape: Electrical tape x 5
Flashlights x 2	Tape: Speed tape x 1
Fluids (separate table)	Tape measurer (large yellow + small)
Fluid carrying cases x 4	Temperature probes: immersion x 3
Folding table x 1 (small)	Temperature probes: surface x 3
Freezers x 3	Tents for Fog x 4
Funnels x 4 (very big, big, medium and small)	Test plate covers (white plastic) x 15
Gloves: rubber/winter x 4 pairs	Test plate covers (wooden boards) x 12
Gloves: cotton (1 large box)	Test Plates: Half plates x 12 (24 halves) w/buttons
Gloves: latex (2 boxes)	Test Plates: Full plates x 12 w/buttons
Ice Pic	Test Plates: Full plates x 8 no buttons
Inclinometer (yellow level) x 2	Test Stand Collection Pans (one per stand)
Isopropyl x 6	Test Stand Shims (poker chips) x 1 box
Lock for truck	Test Stands: 2 x 6-position (main stand)
Marker for Waste x 2	Test Stands: 1 x 6-position (thickness stand)
Measuring Cups x 3	Test Stands: 1 x 1-position (automated rate)
Paper Towels (4 packs)	Test Stands: 1 x 2-position (side stand)
Personnel clothing (testing coats/boots)	Thickness Gauges: 4 rectangle
Pour containers: (1-litre) - 6 empty	Thickness Gauges: 4 octagon
Pour containers: (1-litre) - see list of fluids	Tuques x 10
Power bars x 4	Vise grip (large) + rubber opener
Printer & Ink Cartridge	Whatman paper kit + dye
Rain Suits (all)	White poster board panels for water run-off
	EXTRA: Glycol for CSW boxes
LOCATION: OFFICE	
Blank Waterproof labels (1 page)	Laptop for Rate Station and SmartButtons
Condition Sheets x 6	Mouse for Rate Station and keypad
Data Forms (on water phobic paper)	Paper for printer x 1 pack
Envelopes (9x12) x box	Pencils + pens + markers
Falling Ball Viscometer + Syringes	Test Procedures x 5
File box x 2	Walkie Talkies and Accessories x 4
Hard Drive (if necessary)	Waterproof paper (40 sheets)
iPads x 2	

Equipment List for Simulated Freezing Precipitation Testing (cont'd)

SIMULATED FREEZING PRECIPITATION TESTING	
REMOTE VIEWING CAMERA EQUIPMENT: TEST SITE	
4K IP Camera with tripod mounts x 2	NVR Receiver
4K IP Camera Zoomed Lens with tripod mounts x 2	Power Cables for monitor and receiver x 2
Ethernet Cable (150ft) x 5	ZTE with large internet plan
Monitor with VGA cable	CCTV Camera x 5
REMOTE VIEWING CAMERA EQUIPMENT: OFFICE	
Camera Cover x 4	Manfrotto Arms with clamp inserts x 4
External HDD	
LOCATION: NRC	
Cold-soak box filling stand	Rubber Mats
Cold-soak fluid pump	Shelving unit x 1 (black one)
Copper tubing insulation (for passing wires)	Tie wraps
Fluid for cold-soak boxes (barrel)	Tools
NRC Auto Rate Form with Historical #'s	Tote for Waste Fluid

Attachment 3: NRC Continuous Rate Form

Condition	Historical Average Calculated Rate – Position 1	Standard Deviation of Historical Average Calculated Rate (Pos. 1)	Historical Average of Session Standard Deviation	Suggested Start Position	Previous Condition Difficulty Rating (1-5, 1 is easiest)	Historical Condition Difficulty Rating (1-5, 1 is easiest)	Comments
ZF, -3, 2	1.8	0.3	0.7	Pos. 10 (2'',0'')	1.0	1.3	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -3, 5	4.9	0.6	2.1	Pos. 4 (0'', 18'')	3.0	2.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -10, 2	1.9	0.3	0.6	Pos. 10 (2'',0'')	n/a	1.0	
ZF, -10, 5	4.9	1.0	0.9	Pos. 10 (2'',0'')	n/a	1.5	
ZF, -14, 2	2.1	0.2	0.7	Pos. 10 (2'',0'')	1.0	1.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -14, 5	4.8	0.3	1.1	Pos. 10 (2'',0'')	1.0	1.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -25, 2	2.0	0.4	1.0	Pos. 10 (2'',0'')	1.0	1.0	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -25, 5	4.8	0.4	1.2	Pos. 10 (2'',0'')	5.0	2.8	In 2020, we had to move stand to (23' 11'', 5' 10''), (24', 9')
ZF, -35, 2	2.1	0.1	1.0	Pos. 10 (2'',0'')	1.0	2.7	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -35, 5	5.1	0.0	1.5	Pos. 10 (2'',0'')	2.0	3.0	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZD, -3, 5	5.5	0.2	0.9	(23' 11'', 6' 7''), (24', 9')	1.0	2.5	
ZD, -3, 13	13.0	1.8	1.7	(23' 11'', 6' 7''), (24', 9')	1.0	3.5	
ZD, -6, 5	n/a	n/a	n/a	n/a	n/a	n/a	
ZD, -6, 13	n/a	n/a	n/a	n/a	n/a	n/a	
ZD, -10, 5	5.9	0.4	0.8	(23' 11'', 6' 7''), (24', 9')	4.0	1.5	
ZD, -10, 13	14.0	0.5	1.7	(23' 11'', 6' 7''), (24', 9')	1.0	2.3	
ZR, -3, 13	13.6	0.5	1.2	(23' 11'', 6' 7''), (24', 9')	1.0	2.0	
ZR, -3, 25	25.7	0.6	1.5	(23' 11'', 6' 7''), (24', 9')	1.0	1.0	
ZR, -6, 13	n/a	n/a	n/a	n/a	n/a	n/a	
ZR, -6, 25	n/a	n/a	n/a	n/a	n/a	n/a	
ZR, -10, 13	13.9	0.7	1.0	(23' 11'', 6' 7''), (24', 9')	1.0	4.0	
ZR, -10, 25	26.1	0.5	1.2	(23' 11'', 6' 7''), (24', 9')	1.0	1.0	
CS, 1, 5	4.9	0.2	4.0	(23' 11', Closest to Bottom), (24', 9')	4.0	3.0	
CS, 1, 75	75.6	3.4	13.1	(Closest to Bottom), (24', 9')	2.0	2.5	

*Initial position to be set to (24', 7'), (24', 9') for (x, y) & (x', y') based on the schedule.

Attachment 4: End Condition Data Form for Endurance Time Tests

REMEMBER TO SYNCHRONIZE TIME

LOCATION:	PRECIP. CONDITION:	DATE:	RUN NUMBER:	STAND # :

Time of Fluid Application: _____

Time of Fluid Failure: _____

Fluid Name/Dilution: _____

PLATE 1	PLATE 2	PLATE 3	PLATE 4	PLATE 5	PLATE 6

Failure Call: (describe) _____

Time of Fluid Application: _____

Time of Fluid Failure: _____

Fluid Name/Dilution: _____

PLATE 7	PLATE 8	PLATE 9	PLATE 10	PLATE 11	PLATE 12

Failure Call: (describe) _____

AMBIENT TEMPERATURE: _____ °C LEADER / MANAGER: _____ FAILURES CALLED BY: _____

COMMENTS: _____

NOTE:
Please ensure correct functioning of plate temperature logging system at the start of the test and at the end of the session

Attachment 5: Screenshot of Holdover Time Data Form App



Attachment 6: Fluid Film Thickness Testing Data Form

REMEMBER TO SYNCHRONIZE TIME

LOCATION: **DATE:** **TEMPERATURE °C:** **RUN NUMBER(S):** **TEST # :** **to**

Time of Fluid Application: _____

Fluid Name/Dilution: _____

RUN #: _____

PLATE 1		PLATE 2		PLATE 3		PLATE 4		PLATE 5		PLATE 6	
TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE

Time of Fluid Application: _____

Fluid Name/Dilution: _____

RUN #: _____

PLATE 1		PLATE 2		PLATE 3		PLATE 4		PLATE 5		PLATE 6	
TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE	TIME (min)	THICKNESS 6" LINE

PERFORMED BY: _____ **WRITTEN BY:** _____

COMMENTS: _____

NOTES:

- The quantity of fluid that will be poured for each test is 1.0 L on a full plate or 0.5L on a half plate
- Measurements should be made at the 6-inch line at the time of fluid application, and after 5 minutes, 15 minutes, and 30 minutes.
- If the results for one fluid vary by more than 10% repeat the two tests and disregard the highest and lowest values

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PROCEDURE:
ENDURANCE TIME TESTING IN NATURAL SNOW WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

301351

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Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
William J. Hughes Technical Center

Transport Canada
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Federal Aviation Administration
Flight Standards – Air Carrier Operations

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APS Aviation Inc.

January 8, 2024
Final Version 1.0

PROCEDURE:
ENDURANCE TIME TESTING IN NATURAL SNOW WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

1. BACKGROUND

SAE International (SAE) has published standards detailing acceptable practices for endurance time testing in natural snow conditions. The Aerospace Recommended Practice (ARP) documents ARP5945 and ARP5485 outline these practices for Type I and Type II/III/IV anti-icing fluids, respectively. These documents set the requirements for fluid samples, testing materials, test conditions, and test practices for anti-icing fluid endurance time testing. These standards are continually reviewed and updated at the discretion of the SAE Holdover Time committee.

APS Aviation Inc. (APS) has been conducting outdoor natural snow endurance time testing with the goal of measuring the effectiveness of new holdover time fluids since the early 1990s. All testing is conducted in accordance with the established SAE standards, ARP5945 and ARP5485.

This procedure serves as an update to the previous APS procedure, *Endurance Time Testing in Natural Snow with SAE Type I, II, III, and IV De/Anti-icing Fluids*, which was issued in November 2018. This new document serves to incorporate refinements to the procedure that have been made in the intervening years, as well as to provide additional information relating to event planning and APS-specific processes.

2. OBJECTIVE

This procedure describes the testing protocols used to evaluate the endurance time performance of Type I, II, III, and IV fluids in natural snow conditions.

3. PRE-TESTING ACTIVITIES

This section describes activities that need to be performed prior to commencing a natural snow testing session.

3.1 Forecasting Natural Snow

Natural snow events are generally identified and monitored up to a week in advance. Storm duration, temperature, and expected precipitation type and intensity must all be considered when evaluating a potential event. There are many forecasting resources available, each differing in accuracy and type of information offered. As such, it is generally best to consult multiple sources when attempting to evaluate an upcoming natural snow event.

The weather forecasting resources that are typically used are listed and described below.

3.1.1 Weather Network Montreal Forecast

Found at https://www.theweathernetwork.com/ca/weather/quebec/montreal

The Weather Network forecast contains a wide variety of general weather information for the Montreal area. General forecasts are available for up to 14 days after the search date. Hourly forecasts, including precipitation probabilities and estimated snowfall, are available for up to 72 hours from the search time.

As this forecast covers a relatively long time-period, it can be useful for early identification of upcoming testing opportunities. However, its short-term forecasts tend to be somewhat less accurate than the other forecasts. Therefore weather information should be confirmed using another source before making final testing event planning decisions.

3.1.2 Environment Canada Montreal Forecast

Found at https://weather.gc.ca/city/pages/qc-147_metric_e.html

The Environment Canada forecast provides similar information to the Weather Network forecast and is generally more accurate as the station issuing the reports is located directly adjacent to the APS test site.

General forecasts are available for up to seven days after the search date. Hourly forecasts are available for up to 24 hours from the search time. Given that the forecasting range is smaller than that of the Weather Network, the Environment Canada forecast is particularly useful in confirming details identified earlier as a prospective snow event approaches.

3.1.3 METAR/TAF Reports

Found at https://flightplanning.navcanada.ca

To access the METAR/TAF reports, select METAR/TAF from the menu and enter CYUL in the aerodrome ID field. Ensure that the output is set to "plain language" to obtain the information in an easily comprehensible format.

The TAF is a highly reliable source of short-term forecasting which is issued by airport authorities for use by air operators. Updated forecasts are issued every three/four hours and generally provide a forecast for the 24 hours following the time of publication.

A sample TAF report is shown in Figure 3.1. Note that all times listed in the TAF are in UTC (five hours ahead of EST during standard time). Wind direction is measured in degrees clockwise from due north. For example, a wind direction value of 90° would indicate that the wind is blowing due west (originating from due east). Snowfall intensity can be determined by comparing the predicted visibility to the Snowfall Intensities as a Function of Prevailing Visibility Table, published annually in the Transport Canada (TC)/Federal Aviation Administration (FAA) Holdover Time Guidelines.

TIMES [UTC]	WIND [DEGREES TRUE]	VISIBILITY [STAT. MILES]	WEATHER	CLOUDINESS [FEET AGL]
02 NOV - 1500 to 02 NOV - 1700	150 @ 7 KNOTS	6+	NIL	600 SCATTERED 3000 OVERCAST
TEMPORARY CHANGES 02 NOV - 1500 to 02 NOV - 1700		5	LIGHT RAIN MIST	600 BROKEN 3000 OVERCAST
02 NOV - 1700 to 02 NOV - 2300	180 @ 12 KNOTS	6+	NIL	1500 SCATTERED 2500 OVERCAST
TEMPORARY CHANGES 02 NOV - 1700 to 02 NOV - 2300		5	LIGHT RAIN SHOWER MIST	800 SCATTERED 1500 BROKEN
02 NOV - 2300 to 03 NOV - 0500	180 @ 12 KNOTS	6+	LIGHT RAIN SHOWER	3000 OVERCAST
03 NOV - 0500 to 03 NOV - 1200	190 @ 12 KNOTS	5	LIGHT RAIN MIST	1000 OVERCAST
BECOMING 03 NOV - 0700 to 03 NOV - 0900	260 @ 10 KNOTS			
REMARKS THE NEXT FORECAST WILL BE ISSUED BY 1800 UTC ON DAY 02				

Figure 3.1: Sample YUL TAF Report

METAR reports are real-time weather bulletins providing similar information to the TAF bulletins. They are issued on the hour, 24 hours a day and are meant to provide real-time weather information to air operators.

In cases where a sudden change in the current weather is observed, a special type of METAR report known as a SPECI is generally issued (this is to ensure that there is always up-to-date information on the current weather available to operators).

These reports can be used to confirm the current weather, particularly when a sudden change is observed. From a testing perspective, they are particularly useful for confirming suspected changes in wind direction or precipitation type.

3.1.4 BUFKIT Software (short-term)

The BUFKIT software package draws data from several meteorological models. The software has a lot of functionality; however, due to its complexity it is generally used by APS personnel to estimate total snowfall and corresponding temperatures for discrete one- or three-hour blocks (depending on the forecasting models used).

Note that BUFKIT forecasting is generally supplementary and is most often used to confirm details on storms for remote testing opportunities; however, it can be used to obtain or confirm information relating to snowfall for test events at the APS test site if additional information is desired.

3.1.5 McGill Weather Radar

Found at: https://radar.mcgill.ca/imagery/nowcasting.html

The McGill weather radar provides a radar view of the island of Montreal and the surrounding area. This view allows the user to visualize the path and intensity of an on-going storm over a one- or three-hour period.

This resource is primarily used during an event to determine upcoming changes to an on-going storm's intensity. By monitoring the path of the storm throughout the event, sudden changes in precipitation can be predicted and testing plans can be adjusted accordingly.

3.2 Event Coordination

It is the responsibility of the testing manager to determine personnel and appropriate start/end times for each testing session. Arrangements should be made for all personnel to arrive approximately one hour prior to the start of snowfall to allow for sufficient time for set-up activities and to maximize the usable testing time.

If a specific temperature range or snowfall intensity is being targeted, the testing manager can adjust start times such that testing will only begin once the desired conditions are present. It should be noted however that natural conditions can be unpredictable, and it is generally better to err on the side of caution (i.e., arrive early in case the weather suddenly changes).

The testing manager should review the fluids planned to be used prior to an event and should have an idea of the expected endurance times of the fluids in the expected snow conditions. This will allow the manager to make informed decisions when determining what tests to pour and in what order. Different fluids will have different measured endurance times and therefore differing test durations; understanding these differences is critical to ensure that testing sessions proceed in an efficient and timely fashion.

The testing manager should also monitor the status of the storm throughout the testing event. Upcoming changes to temperature, wind direction and precipitation rate should be considered when determining what tests to run, to avoid unnecessary scrapped tests.

3.3 Data Requirements and Test Planning

The testing manager should be mindful of the data requirements and current data set status for each of the fluids being tested in each session. This information should be used to steer testing decisions, both when deciding what events to pursue and what tests to run during an event.

3.3.1 Type I Fluid Data Requirements

For Type I fluids, a minimum of 20 natural snow data points is the target for validation of the existing holdover times. Tests run with Type I fluids should be equally divided between aluminum and composite test surfaces (to validate both sets of holdover times). Note that for each natural snow test run with a new Type I fluid, a baseline test must be run simultaneously with a known Type I fluid to serve as a point of comparison.

Natural snow data gathered with a specific dilution of a fluid should cover the full range of precipitation rates and temperatures as outlined in the Type I fluid holdover time tables.

3.3.2 Type II/III/IV Fluid Data Requirements

For neat and 75/25 dilutions of Type II/III/IV fluids, a minimum of 20 natural snow data points is required to generate the regression curves that are used to determine fluid holdover times. For 50/50 dilutions of Type II/III/IV fluids, the minimum is 15 natural snow data points.

Table 3.1 lists the recommended minimum data points required to determine fluid specific holdover times for neat and 75/25 dilutions of Type II/III/IV fluids in natural snow conditions.

Table 3.1: Minimum Natural Snow Data Points Required to Determine Fluid-Specific Holdover Times for Neat and 75/25 Dilutions

Temperature	Precipitation Rate (g/dm²/h)					
	0 to 4	>4 to 10	>10 to 25	>25 to 40	>40	All
≥-3°C	0	0	0	0	0	**4**
<-3 to -8°C	0	0	0	0	0	**6**
<-8 to -13°C	0	0	0	0	0	**4**
<-13 to -16°C	0	0	0	0	0	**1**
All	**2**	**5**	**5**	**2**	**1**	**20**

Table 3.2 lists the recommended minimum data points required to determine fluid specific holdover times for 50/50 dilutions of Type II/III/IV fluids in natural snow conditions.

Table 3.2: Minimum Natural Snow Data Points Required to Determine Fluid-Specific Holdover Times for 50/50 Dilutions

Temperature	Precipitation Rate (g/dm²/h)					
	0 to 4	>4 to 10	>10 to 25	>25 to 40	>40	All
≥-3°C	0	0	0	0	0	**7**
<-3 to -5°C	0	0	0	0	0	**2**
N/A	0	0	0	0	0	**N/A**
N/A	0	0	0	0	0	**N/A**
All	**1**	**2**	**3**	**1**	**1**	**15**

Data gathered with a specific dilution of a fluid should cover the full range of precipitation rates and temperatures as outlined in Table 3.1 and Table 3.2.

3.3.2.1 Very Cold Snow Data Requirements

For the development of the cold snow regression curves that are used to determine fluid specific holdover times, a minimum of 20 natural snow data points, during a minimum of 4 different events, is required.

This testing is optional and at the discretions of the fluid manufacturer.

Table 3.3 lists the recommended minimum data points required to determine fluid specific holdover times for very cold snow.

Table 3.3: Minimum Natural Snow Data Points Required to Determine Fluid-Specific Holdover Times for Very Cold Snow

Temperature	Precipitation Rate (g/dm²/h)					
	0 to 4	>4 to 10	>10 to 25	>25 to 40	>40	All
<-14 to -18°C	2	2	0	0	0	**6**
<-18 to -22°C	1	2	0	0	0	**4**
<-22 to -25°C	0	1	0	0	0	**2**
<-25°C to LOUT	0	0	0	0	0	**1**
All	**5**	**7**	**1**	**0**	**0**	**20**

3.4 Fluid Preparation and Management

This subsection describes the steps necessary to ensure that the fluids to be tested are properly prepared for testing.

3.4.1 Type I Fluid Preparation

Type I fluids will generally be sent to APS by the manufacturer in concentrate form. Prior to commencing a test session, an appropriately buffered mixture of the fluid must be prepared. As per ARP5945A, Type I fluids must be tested at dilutions where the freezing point of the solution is 10°C colder than the outside air temperature (OAT) at which testing is taking place.

To prepare the buffered solution, you must first determine the range of temperatures that the testing will take place in. The solution shall be prepared such that it is properly buffered for the coldest temperature to be experienced during the test session. If a very large change in temperature is expected during the test session, (>10°C), consideration shall be given to preparing two distinct batches of Type I fluid, with freeze points appropriate to the different expected phases of testing.

The Type I concentrate must be diluted with hard water, which is prepared by dissolving 400 mg of calcium acetate dehydrate and 280 mg of magnesium sulfate heptahydrate into 1 L of water (the quantities can be scaled up proportionally if preparing a larger batch). Consult the dilution chart associated with the Type I fluid being tested to determine the appropriate glycol/hard water ratio necessary to achieve the desired freeze point. Dilution charts are generally available on the fluid manufacturer's website or provided directly from the manufacturer upon fluid receipt.

Confirm that the glycol concentration in your prepared solution is appropriate by measuring the Brix (generally Type I dilution charts will indicate the target Brix for the desired fluid freeze point). Ensure that the container in which the solution is mixed is clearly marked with the freeze point and Brix of the fluid. Pour container labels listing the fluid name, Brix, and freeze point should also be created and affixed to all pour containers to be used during the test session.

Note that although ARP5945A stipulates that Type I fluid samples be sheared in a laboratory blender prior to testing, previous work has indicated that the effects of this shearing process on resulting Type I fluid endurance times are negligible. The Type I fluid shearing process is generally not performed with fluid samples as part of the typical natural snow testing process.

3.4.2 Type II/III/IV Fluid Management

To ensure that a testing session runs smoothly with minimal disruptions, it is critical that a sufficient number of filled 1 L pour containers are prepared and tempered prior to the start of the test session. The targeted amount is a minimum of four pour containers per fluid/dilution to be tested.

Used pour containers should be periodically refilled when time permits to prevent delays in the fluid application process. All pour containers must be affixed with labels listing the fluid name, batch number and dilution, and special care must be taken when refilling to ensure that the proper fluid, batch and dilution are used.

All fluids to be used in natural snow endurance time testing must be properly stored to ensure that they are at the correct temperature when a test session begins. As per Subsection 11.1.1 of ARP5485B, the temperature of Type II, III (unheated), or IV fluid being applied to a test surface in a natural snow endurance time test must be within 3°C of the OAT. Valuable testing time can be lost waiting for fluids to temper if the proper storage procedures have not been followed.

Fluid jugs and pour containers of neat and 75/25 formulations of Type II/III/IV fluids that are to be used in each test event should be stored outside such that their temperature consistently reflects the changing OAT. Note the exceptions below.

1) All containers containing 75/25 formulations of Type II/III/IV fluids must be temporarily stored inside the main trailer if the outdoor temperature on a given day is scheduled to drop below -14°C for a period exceeding four hours.
2) In the case of extreme cold (temperatures falling below -22°C for a period exceeding four hours), neat formulations of certain fluids may also need to be temporarily stored inside the main trailer. The freezing points of the individual fluids need to be consulted to determine which (if any) fluids will need to be moved.

Fluid jugs of 50/50 formulations of Type II/III/IV fluids that are to be used in each test event are to be stored inside the main trailer at all times due to the relatively warm freezing point of 50/50 fluids. Pour containers of 50/50 formulations of fluids to be used are to be stored inside a chest freezer set at a temperature of -3°C.

All fluids that are stored in clear jugs must be covered with an opaque covering to ensure that the fluid is not exposed to light in storage.

4. TEST SITES

This section documents the test sites where APS conducts natural snow endurance time testing with Type I, II, III, and IV fluids.

4.1 Pierre-Elliott-Trudeau International Airport Test Site

Natural snow testing is typically and predominantly performed at the APS test site located at the Montréal Pierre-Elliott-Trudeau International Airport. The test site is located near Environment Canada's Meteorological Services of Canada automated weather observation station, as shown in Figure 4.1 on a plan view of the airport.

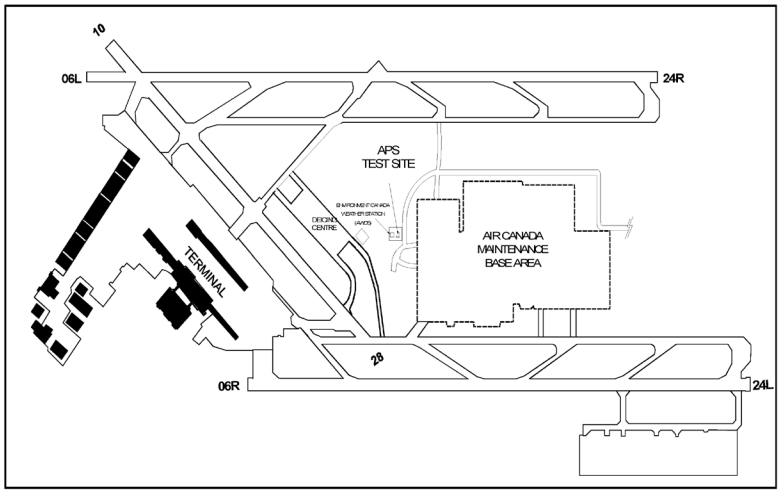


Figure 4.1: APS Test Site at Montréal-Pierre-Elliott-Trudeau International Airport

4.2 Remote Test Sites

There are instances where data requirements will necessitate natural snow testing at a location other than the APS test site. In the past, this has typically been due to a need to obtain data at specific temperatures (generally colder temperatures than typically experienced in Montreal) or times of the year (generally after the conclusion of the winter season when natural snow data is no longer obtainable in Montreal).

Remote test sites can be set up in any region where the desired natural snow conditions are expected to occur, using test stands that have been specially modified for improved transportability. When using a remote site for testing, the testing trailers are generally replaced by either rented vehicles or a rented hotel room (location permitting).

Several factors must be considered when choosing a location for a remote test site, including:

1) **Ground Surface**

   The ground surface should be level and firm to simplify the process of levelling the test stands.

2) **Wind Direction**

   The selected location must also be open to oncoming wind; all possible wind directions that may be experienced during a given event should be considered.

3) Foot/Vehicle Traffic

The selected location should also be out of the way of foot and vehicle traffic, if possible, to minimize the chance of outside forces interfering with a test session.

5. TESTING PROCEDURE

This section describes the procedure to be followed during a natural snow test event.

The procedure conforms to the requirements for natural snow testing outlined in Section 11 of ARP5485B*, Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type II, III, and IV*.

The procedure also conforms to the requirements for natural snow testing outlined in Section 11 of ARP5945A*, Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type I*.

5.1 Set-Up

The set-up steps for a natural snow endurance time testing session are listed below.

1) Ensure that the fluids to be tested are properly prepared as per the guidelines in Subsection 3.4. Prepare appropriately buffered mixtures of all Type I fluids to be tested. Confirm that all Type II/III/IV fluids being tested were stored correctly and are at the proper temperature relative to the current OAT.
2) Confirm the current wind direction and orient two full six-position test stands into the wind. Ensure they are levelled such that the test surfaces lie at a 10° angle (within 9.8° and 10.2° is acceptable, check each test surface). The angle of the test stand can be adjusted as needed by placing poker chips under the stand legs. Whenever the configuration is adjusted by adding or removing chips ensure that the stand is reasonably stable and that all test surfaces are at the proper angle. Ensure the fluid collection pans are placed beneath the test stands to collect fluid runoff.
3) Equip the two six-position test stands with the appropriate test surfaces (leading edge thermal equivalent boxes if testing Type I or heated Type III fluid, aluminum test plates if testing unheated Type II/III/IV fluids). All test surfaces used must be equipped with SmartButtons that are actively logging temperature data. Ensure that one position on one stand is equipped with a rate collection pan. Figure 5.1 depicts the proper plate set-up for the two test stands.

4) Clean the surface of the test surfaces by removing any adhered ice or contamination. If any solvent or heat is used in the cleaning process, ensure the plates are allowed to cold-soak long enough.

5) Ensure the CCTV cameras are properly positioned so that optimal plate coverage is obtained for the complete test stand (two cameras per stand).

6) Prepare the rate station inside the main trailer: ensure that the scale being used is properly leveled, open the latest version of the APS rate program on the rate computer (an Excel spreadsheet created to record frost rate measurements), and test that the scale and computer are functioning normally together.

7) If using paper data forms, prepare the forms to be used during the test session. Fill out as much information as possible ahead of time to streamline the subsequent fluid application process. If using the Data Form app to record the test data, ensure all fluids to be tested during the session have been added to the app database.

8) Prepare a digital camera (or iPhone®) for use by formatting the memory card and syncing the device time with the time that is displayed on the test site clocks.

9) Arrange all unheated fluids to be poured by placing the filled pour containers behind their respective positions on the test stands.

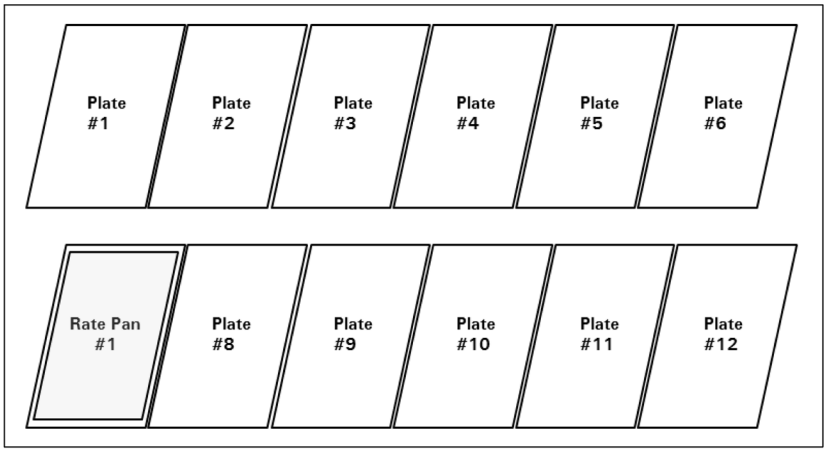


Figure 5.1: Test Stand Set-Up

5.2 Procedure for Rate Collection

The steps for rate collection in natural snow are summarized below.

1) After initial set-up is complete, fill an empty rate collection pan with a thin layer of anti-icing fluid from the container near the rate station (container will be marked "rate fluid"). This fluid layer allows natural snow collected in the rate pan to dissolve. Note that overfilling the pan should be avoided, as accurate rate collection will be compromised if any fluid is spilled during the collection process.
2) Open the APS Rate Program spreadsheet on the designated rate laptop and save a copy of the sheet with the current date in the file name. Measure and record the initial weight of the filled rate collection pan in the first empty cell in the Interface tab of the spreadsheet. Once recorded, place the rate collection pan outside on the test stand in the designated position.
3) Approximately once every ten minutes, the rate pan must be brought inside and weighed. Note that this rate cycle must be shortened during periods of high precipitation rate or wind speed (cycle can be shortened to as little as 2 minutes). Carefully transport the pan from the test stand to the rate station inside the main trailer, ensuring that none of the contents are lost in transit. If any fluid is lost from the pan, the rate cycle must be restarted by recording a new initial weight in the spreadsheet (ensure that a row is skipped in the spreadsheet to indicate to the program that a new cycle has begun).
4) Once inside the main trailer, clear off any precipitation accumulated on the outer edges of the pan (do not dump this mass into the pan). Weigh the rate pan and record the weight and time in the next empty cell of the spreadsheet.
5) Once recorded, return the pan to its position outside on the test. Note that this process should be completed as quickly as possible, ideally the rate pan should not be inside the main trailer for more than 14 seconds before being returned to the test stand (as 14 seconds is the amount of buffer time programmed into the rate spreadsheet).
6) Repeat this cycle every ten minutes. The rate collection cycle can be abbreviated as necessary; a new rate is generally collected whenever a failure is noted on an active endurance time test, for example.
7) At the halfway mark of the "outside" phase of each rate cycle, invert the orientation of the rate pan (the edge that previously rested on the lower end of the test stand should now rest on the upper end).

8) If at any point the rate pan begins to become overly saturated with absorbed precipitation, a new rate pan can be prepared and swapped in at the completion of a rate cycle. When introducing a new rate pan, a new initial weight must be recorded (ensure that a row is skipped in the spreadsheet to indicate to the program that a new cycle has begun).
9) Rate collection is to continue throughout the entire test session, with the last rate being collected after the failure of the last endurance time test.

5.3 Procedure for Fluid Endurance Time Tests

The steps for conducting natural snow fluid endurance time tests are summarized below.

5.3.1 Procedure for Unheated Fluids (Type II, III-Unheated and IV)

1) Prepare the data form/data form app by recording the fluids to be poured in their respective positions.
2) Measure the initial fluid temperature of all fluids that are to be poured during the test session. Confirm that all fluids are within 3°C of the current OAT. If fluids are not at the correct temperature, warm them in the main trailer or cool them in a chest freezer as needed.
3) Clear the test surfaces to be used of existing contamination using a squeegee. To ensure that each position is properly cleaned, apply a small quantity of the fluid being tested to the test surface and use a squeegee to spread it across the full test surface.
4) Confirm that the data form manager is ready to begin the fluid application process. At each position, pour 1 L of the selected fluid onto the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer. Record the time of fluid application on the chosen data form.
5) After fluid application is complete, each plate must be inspected periodically to assess the condition of the fluid layer. The fluid is considered failed when the accumulating snow is no longer being absorbed by the fluid. Typically, there are two types of failure observed in natural snow tests. Dilution failure occurs when the fluid layer has thinned due to exposure to precipitation and snow beings to accumulate on the plate surface. Snow-bridging failure occurs when the fluid layer does not thin considerably but instead eventually fails to absorb incoming snow, leading to white snow visibly accumulating on the top of the fluid.

6) If more than one-third of a given plate is determined to be "failed" (or if fluid failure is noted at any five of the crosshair marks on the plate), the plate as a whole is considered to be failed. Announce the fluid failure and ensure the failure time is recorded by the data form manager. It is good practice to collect a rate whenever a plate is deemed failed (foregoing the typical 10-minute rate period). A poker chip should be placed on the plate once failure has been declared to denote that the plate is no longer running an active test.

7) Ensure all test surfaces are properly cleaned after testing and that all fluid within the collection pans is disposed of appropriately (all glycol waste must be vacuumed up and subsequently disposed of in the waste fluid tote).

5.3.2 Procedure for Heated Fluids (Type I and III-Heated)

1) Prepare the data form/data form app by recording the fluids to be poured in their respective positions.

2) Clear the test surfaces to be used of existing contamination using a squeegee. To ensure that each position is properly cleaned, apply a small quantity of the fluid being tested to the test surface and use a squeegee to spread it across the full test surface. Note that the small quantity of fluid used to clean the surface must not be heated. If heat is required to clear the test surfaces, they must be allowed to cold-soak prior to fluid application.

3) Heat a batch of the fluid(s) to be applied using the microwaves or sous-vide within the main trailer. As fluids are to be applied at 60°C, a temperature of 62°C should be targeted when heating. If using a microwave, ensure that a microwave-safe container is used. It can take upwards of 10 minutes to attain the required temperature; the temperature of the mixture should be checked periodically during the heating process using a hand-held thermistor. Knowing that 0.5 L of fluid must be applied to each test surface, ensure that a sufficient total volume of fluid is heated. Once the full batch is heated, transfer the fluid to thermoses to preserve the temperature until the fluid is applied.

4) Confirm that the data form manager is ready to begin the fluid application process. At each position, pour 0.5 L of the heated fluid onto the top of the test surface using a 12-hole spreader to ensure even distribution. This process must be completed quickly after the fluid is heated to ensure that the fluid temperature is as close to 60°C as possible at the time of application. Record the time of fluid application on the chosen data form.

5) After fluid application is complete, each test surface must be inspected periodically to assess the condition of the fluid layer. The fluid is considered failed when the accumulating snow is no longer being absorbed by the fluid. For heated fluids, failure may occur quickly as the test surface cools after fluid application. It is best to remain close to the test stand after application to ensure that the failure time is not missed.

6) If more than one-third of a given plate is determined to be "failed" (or if fluid failure is noted at any five of the crosshair marks on the plate), the plate as a whole is considered to be failed. Announce the fluid failure and ensure the failure time is recorded by the data form manager. It is good practice to collect a rate whenever a plate is deemed failed (foregoing the typical 10-minute rate period). A poker chip should be placed on the plate once failure has been declared to denote that the plate is no longer running an active test.

The primary types of failure are depicted below in Photo 5.1 and Photo 5.2. Photo 5.1 depicts dilution failure of an anti-icing fluid on an aluminum plate. Photo 5.2 depicts snow-bridging failure of an anti-icing fluid on an aluminum plate.

Photo 5.1: Dilution Failure of Anti-Icing Fluid on an Aluminum Plate

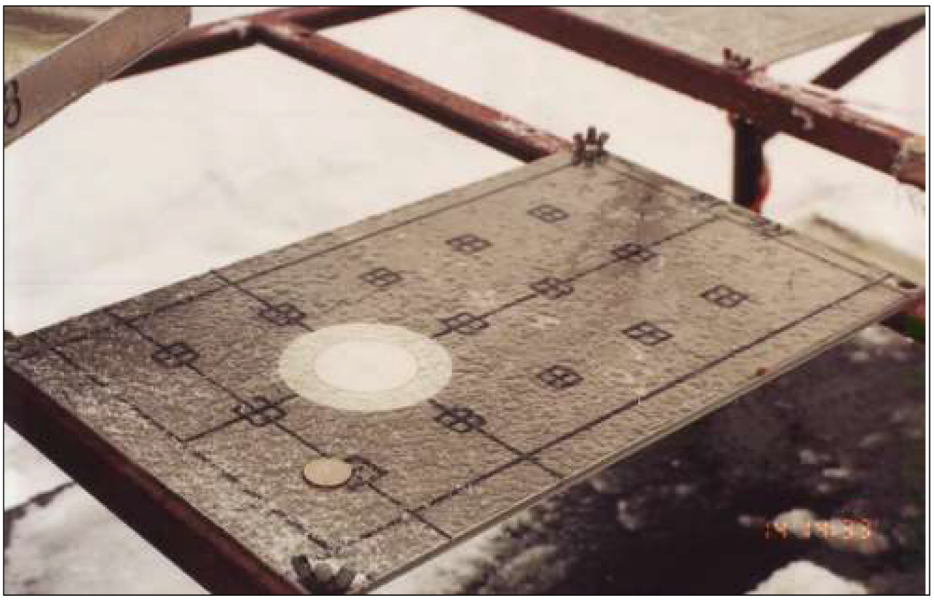


Photo 5.2: Snow-Bridging Failure of Anti-Icing Fluid on an Aluminum Plate



5.4 End of Test Session Activities

The steps for concluding a natural snow endurance time testing session are summarized below.

1) Ensure all test surfaces are properly cleaned after testing and that all fluid within the collection pans is disposed of appropriately (all glycol waste must be vacuumed up and disposed of in the waste fluid tote). Ensure that the fluid collection pans are flipped upside down so that they do not fill up with precipitation in between test sessions.
2) Save a copy of the completed APS Rate Program spreadsheet in the Data and Rates folder of the APS SharePoint.
3) If using the Holdover Time Data Form app to record endurance times, export the data file and save a copy in the Data and Rates folder of the APS SharePoint.
4) If using paper data forms, place the completed forms in an envelope and mark the envelope with the date and number of forms. Place the envelope in the designated bin to ensure it is returned to the APS office.

5) Ensure that all SmartButton data from all test surfaces used is saved and uploaded to the APS SharePoint.
6) Ensure that the CCTV video camera footage has been downloaded and saved on the APS SharePoint.
7) Complete a Test Session Summary form (available on the APS SharePoint). Save a completed copy in the Test Session Forms folder of the APS SharePoint. Print a copy of the completed form and place it in the data form envelope. Ensure that this envelope is brought to the APS offices the following day.
8) Ensure that files are synced and that all saved files have been uploaded.
9) Ensure that the heating system and lights are turned off, all doors are locked, and that the alarm system is armed prior to leaving the site.

6. EQUIPMENT

The equipment required for endurance time testing in natural snow at the APS test site is listed in Attachment 1. The equipment required for testing at remote test sites is listed in Attachment 2.

7. PERSONNEL

Generally, three people are required for natural snow endurance time testing:

1) **Testing Manager** – responsible for overseeing the test event, determining which tests are to be run, applying fluids and calling all failures;
2) **Data Form Manager** – responsible for managing all data forms and ensuring all information is properly transcribed and captured; and
3) **Testing Assistant** – responsible for set-up activities, rate collection, clean-up and assisting with any other tasks as determined by the testing manager.

Note that the above roles are not necessarily strict; any person participating in a test event may be required to perform tasks associated with any of the above roles at a given time.

8. SAFETY

Testing in cold temperatures can pose significant safety issues. Jackets, gloves, and boots should be rated to very low temperatures. Eye protection (ski goggles) and face protection should be worn if testing in very cold temperatures (<-20°C). Employees should be mindful of dangers associated with hypothermia and frostbite. Additional information can be found in the Test Site Safety Management manual, of which copies are available at the test site.

If ever one person is conducting testing alone, they must make use of the "Loner" monitoring system to ensure their safety during the testing event.

Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

9. DATA FORMS AND SOFTWARE

The following data forms and software programs are typically used for natural snow endurance time testing:

1) End Condition Data Form for Endurance Time Tests (Attachment 3);
2) App Data Form for Fluid Endurance Time Tests (Attachment 4);
3) APS Rate Program Spreadsheet (Attachment 5); and
4) Test Session Summary Form (Attachment 6).

Attachment 1: Equipment List for Natural Snow Testing

NATURAL SNOW APS SITE TESTING
LOCATION: TEST SITE
6–position test stand x 2
Air Temperature gauge x 1
Aluminum test plates (as needed)
Compass x 1
Data forms (as needed - if app not being used)
Digital Camera and accessories or iPhone®
Fluid collection pans x 2
Fluid pour containers x 4 per fluid
Fluids (as needed)
Immersion temperature probe x 1
Inclinometer x 1
iPad with data form app x 1
Leading edge thermal equivalent boxes aluminum + composite (as needed)
Microwave x 1 or Sous-vide x 2
Poker chips (for stand levelling) x 1 pack
Rate collection pan x 1
Rate computer x 1
Rate fluid (10 L) x 1
Scrapers x 2
Shop vacuum x 1
SmartButtons and SmartButton Kit (as needed)
Spreader (for heated fluid application) x 1
Squeegees x 2
Thermos (as needed)
Weigh scale + connectors x 1
REMOTE VIEWING CAMERA EQUIPMENT: TEST SITE
4K IP Camera with tripod mounts x 2
4K IP Camera Zoomed Lens with tripod mounts x 2
Ethernet Cable (150ft) x 5
Monitor with VGA cable
NVR Receiver
Power Cables for monitor and receiver x 2
CCTV Camera x 4
REMOTE VIEWING CAMERA EQUIPMENT: OFFICE
Camera Cover x 4
External HDD
Manfrotto Arms with clamp inserts x 4

Attachment 2: Equipment List for Remote Natural Snow Testing

NATURAL SNOW REMOTE TESTING	
LARGE LUGGAGE: GENERAL EQUIPMENT	
Air Probe x 1	Pencils, Sharpies, Erasers and Sharpener
APS Hats	Poker Chips x 3 Small Packs
Backup Scale (Ice Crystal Scale) x 1	Power Bars x 2
Batteries (16 AA and 2 x 9V)	Rate Pans x 2
Brixometer x 2	Scrapers x 2
Car Antenna Windsock x 1	Shop Towels x 2
Clipboards x 2	Shovel x 1
Compass x 1	Ski Goggles x 3
Cotton Gloves x 2	Small Garbage Bags x 3
Extension Cords x 2	Small Squeegee x 2
Extra Black Gloves x 3	Small White Extension Cords x 1
Extra Jacket x 1	Speed and Electrical Tape x 1 Each
First Aid Kit x 1	Standard Set of Tools x 1
Flashlights x 4	Stopwatch x 1
Garbage Bags x 2	Surface Probes x 2
Hammer x 1	Tarp x 1
Hand & Toe Warmers (many included)	Thickness Gauges (Octagonal) x 2
Immersion Probes x 2	Thickness Gauges (Rectangular) x 2
Inclinometers x 2	Tie Wraps x 10
Inverter x 2	Water Phobic Paper
Isopropyl x 1	Working Hands Cream
Latex Gloves x 1 Box	TC Contract and SDS
SMALL LUGGAGES: FLUIDS	
Small luggage #1 with 20 pour containers	Small luggage #2 with 20 pour containers
LONG LUGGAGE: SCALES	
Sartorius Scales with Styrofoam Top x 2 (Including Cables & Power Adapters)	
SKI CASE LUGGAGE: TEST STAND EQUIPMENT	
All Supporting Hardware and Crossbars	Remote Test Stand
Aluminum Test Plates x 5 Sets (10 half plates total)	
RATE STATION AND DATA FORMS	
Data Forms on water phobic paper	iPad with Sim Card
Electronic Copy of Log	Laptop and cables/adapters with Rate Program
5G Router	
ADDITIONAL EQUIPMENT FOR TYPE I	
Spreader (for heated fluid application) x 1	Dilution Charts
Hard Water	Measuring Cups
Collapsible tea kettles x 3	Thermos (as needed)
Leading edge thermal equivalent boxes aluminum + composite (as needed) and boards	
PHOTOGRAPHY	
Camera Batteries x 3	Digital Camera x 2 or iPhone®
Camera Memory Cards x 3	Small Tripod Mountable to Stand (Optional)
PERSONNEL CLOTHING	
Cold Rated Gloves	Winter Hats
Face Covers (Balaclava and Face Shield)	Winter Jackets
Winter Boots	

Attachment 3: End Condition Data Form for Endurance Time Tests

REMEMBER TO SYNCHRONIZE TIME

LOCATION:	PRECIP. CONDITION:	DATE:	RUN NUMBER:	STAND # :

Time of Fluid Application:						
Time of Fluid Failure:						
Fluid Name/Dilution:						
	PLATE 1	PLATE 2	PLATE 3	PLATE 4	PLATE 5	PLATE 6
Failure Call: (describe)						
Time of Fluid Application:						
Time of Fluid Failure:						
Fluid Name/Dilution:						
	PLATE 7	PLATE 8	PLATE 9	PLATE 10	PLATE 11	PLATE 12
Failure Call: (describe)						

AMBIENT TEMPERATURE: _____ °C LEADER / MANAGER: _____ FAILURES CALLED BY: _____

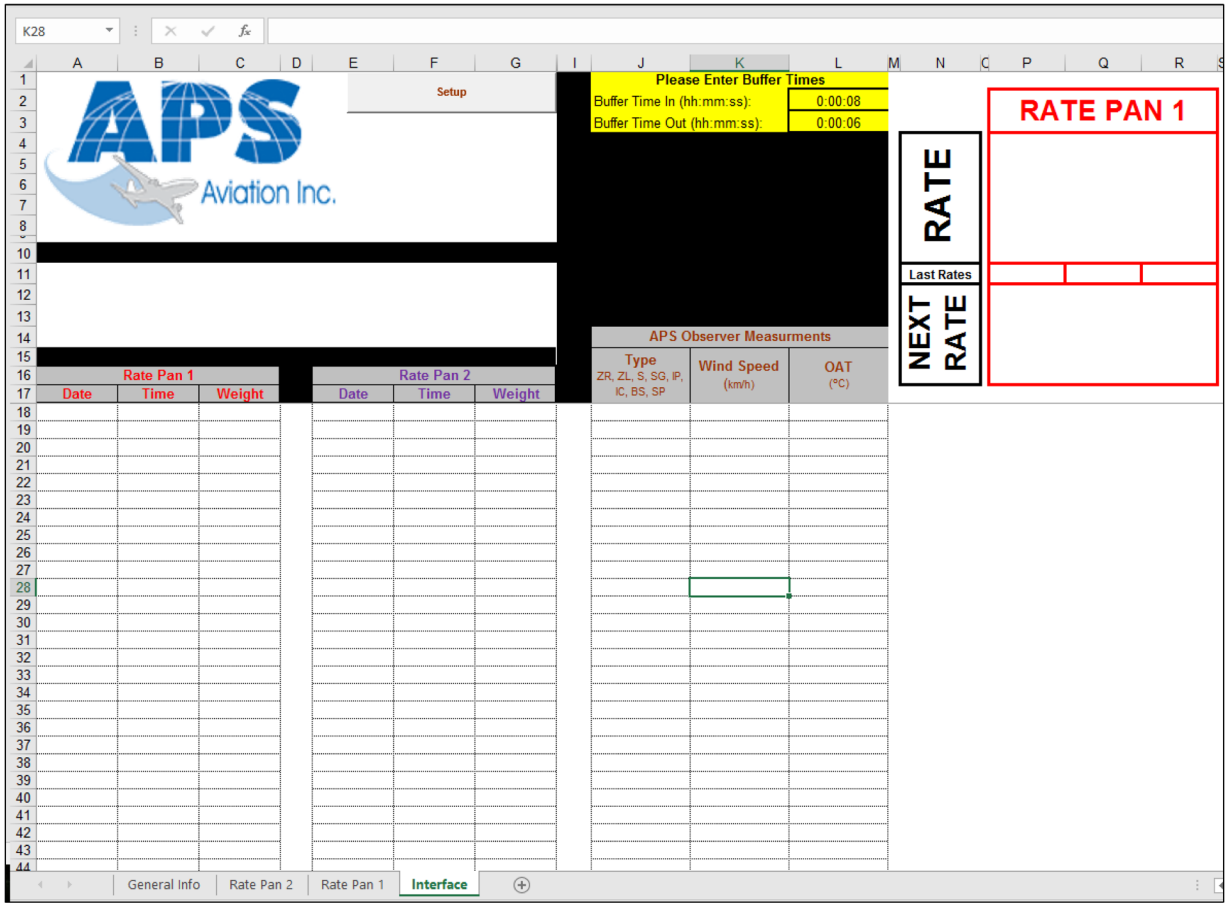
COMMENTS: _____

NOTE:
Please ensure correct functioning of plate temperature logging system at the start of the test and at the end of the session.

Attachment 4: Screenshot of Holdover Time Data Form



Attachment 5: Screenshot of Rate Program Spreadsheet



Attachment 6: Example of Test Session Summary Form

2023-24 TEST SESSION SUMMARY

TEST MANAGER: _____ DATE: _____

LOCATION: _____

# of Tests Conducted	# of Tests DNF	Project	Person Responsible	Data Forms (# or electronic)	Rate File (#)	Logger Files (#)	Photos (#)	Successful (Yes/No)	Comments (Key Notables)
NATURAL SNOW									
		HOT Snow							
		Very Cold Snow							
		Visibility Data Collection							
		High Viscosity Fluid Testing							
		Other _____							
ARTIFICIAL SNOW									
		HOT Snow Machine							
		Other _____							
FROST									
		HOT Frost							
		Other _____							
OTHER									
		Freezing Mist or Fog							
OTHER NON TC/FAA PROJECTS (DO NOT INCLUDE IN CALENDAR OF COMPLETED TESTS)									
		Other _____							

FOR OFFICE USE ONLY		
Verification of Electronic and Paper Filing	PERSON: _____	DATE: _____

PROCEDURE:
ENDURANCE TIME TESTING IN ARTIFICIAL SNOW WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

301351

PROCEDURE:

ENDURANCE TIME TESTING IN ARTIFICIAL SNOW WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
William J. Hughes Technical Center

Transport Canada
Civil Aviation

Federal Aviation Administration
Flight Standards – Air Carrier Operations

Prepared by: Dany Posteraro

Reviewed by: John D'Avirro

APS Aviation Inc.

January 8, 2024
Final Version 1.0

PROCEDURE:
ENDURANCE TIME TESTING IN ARTIFICIAL SNOW WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

1. BACKGROUND

The National Center for Atmospheric Research (NCAR) in Boulder, Colorado, developed an artificial snow generation system for conducting snow endurance time testing in controlled laboratory environments. The original system has been used for all indoor snow tests conducted by APS Aviation Inc. (APS) since 1998, while a second upgraded system was acquired by Transport Canada (TC) and the Federal Aviation Administration (FAA) in the 2010s.

Artificial snow generation systems allow testing agencies to evaluate the endurance times of de/anti-icing fluids in snow at any time of year. The specifications for their use were first described in the SAE International (SAE) Aerospace Standard (AS) 5485, *Endurance Time Tests for Aircraft Deicing/Anti-Icing Fluids: SAE Type II, III, and IV*. The document was later renamed Aerospace Recommended Practice (ARP) 5485.

Currently, the snow machine cannot accurately simulate natural snow conditions to the point where it can completely replace natural snow endurance time testing. Therefore, the snow machine should continue to be used in a similar capacity as it has been used in the past years. Some examples of this are described below.

- To support the use of generic holdover times (HOTs) for one winter when there is not sufficient data to provide fluid-specific HOTs. This is done by running tests at boundary temperatures/rates and comparing the results to the generic HOTs.
- To perform comparative evaluations with two or more different fluids under the same conditions to contrast their performance. For example, compare HOTs of a coloured/uncoloured fluid.
- To support other research activities such as the evaluation of HOTs for heavy snow and the evaluation/verification of HOTs at very cold (-25°C) temperatures.

The details pertaining to the operation of the snow machine can be found in the snowmaking machine operators' manual supplied by NCAR (refer to the TC report, TP 14148E, *Endurance Time Testing in Snow: Comparison of Indoor and Outdoor Data for 2002-03*).

Any person operating the snow machine should be thoroughly trained prior to conducting endurance time tests. Note, this procedure serves as a testing-specific guide and does not provide instruction on the operation of the snow machine.

2. OBJECTIVE

This procedure provides a brief summary of the test requirements and data forms needed for artificial snow flat plate testing. ARP5485 contains a detailed description of the test equipment, test parameters, snow measurement methods, snow test conditions, and snow test procedure for conducting endurance time tests for SAE Type II, III, and IV de/anti-icing fluids. For testing SAE Type I fluids, a detailed description can be found in ARP5945.

3. PRE-TESTING ACTIVITIES

This section describes activities that need to be performed prior to commencing an artificial snow testing session.

3.1 Event Coordination and Scheduling

Artificial Snow testing is a highly coordinated activity requiring the use of advanced testing facilities, numerous personnel, and significant resources. To that end, a significant effort must be put into planning these activities to allow testing to run as smoothly, with as few costly disruptions as possible.

It is the responsibility of the event coordinator to arrange the schedule of conditions in such a way as to ensure that each testing day will conclude at an appropriate time, and that time between conditions is minimized. To this end, like testing temperatures should be grouped as much as possible to avoid unnecessary temperature changes.

3.2 Data Requirements and Test Planning

The test plan for an artificial snow endurance time test session is considered project-specific. For many projects, the test plan has been dynamic in nature. Therefore, changes to the test plan can occur during testing. These changes are usually based upon testing results and/or shifting priorities.

3.2.1 Validating Use of Generic HOTs for New Fluids in Very Cold Snow

When a new fluid is submitted for endurance time testing, its performance in very cold snow must be assessed to ensure it can safely be used with the generic very cold snow HOTs.

This subsection provides the data targets for validating very cold snow generic HOTs for new Type II and Type IV fluids. Note: no generic HOTs currently exist for Type III fluids.

To validate the Type II/IV generic HOTs for very cold snow, testing with the snow machine at rates of 3 g, 4 g, 10 g, and 25 g/dm^2/h is required at -18°C, -25°C, and the lowest operational use temperature (LOUT). It should be noted that tests at the LOUT are only required if the LOUT of the fluid is below -29°C. If the endurance time of the fluid is shorter than the historical results of other fluids, conduct duplicate tests.

3.2.2 Determining Fluid Specific HOTs in Very Cold Snow for Fluids with LOUTs below -29°C

For determining fluid specific HOTs for fluids with LOUTs below -29°C, testing with the snow machine at rates of 3 g, 4 g, 10 g, and 25 g/dm^2/h is required at -25°C and at the LOUT of the fluid being tested. This testing is optional and at the discretion of the fluid manufacturer. To derive HOTs at the LOUT, performance in artificial snow at -25°C and the LOUT is compared. The average relative performance at the LOUT, less 2 standard deviations, is then applied to the natural snow derived HOTs for -25°C.

3.3 Equipment Preparation

In advance of testing, the snow machine must be set up according to the snow machines operators manual and as shown in Figure 3.1. The chamber should be cold-soaked to the desired ambient temperature. To ensure that the snow machine enclosure reaches ambient temperature, the enclosure doors should remain open during the cold-soak.

All timepieces should be synced to local time. This includes PC internal clocks and all cameras. If an iPhone® is used, the local time should be automatically adjusted.

Install the closed-circuit television (CCTV) video camera in one of the four mid-enclosure corners so that full plate coverage is obtained (as seen in Figure 3.1).

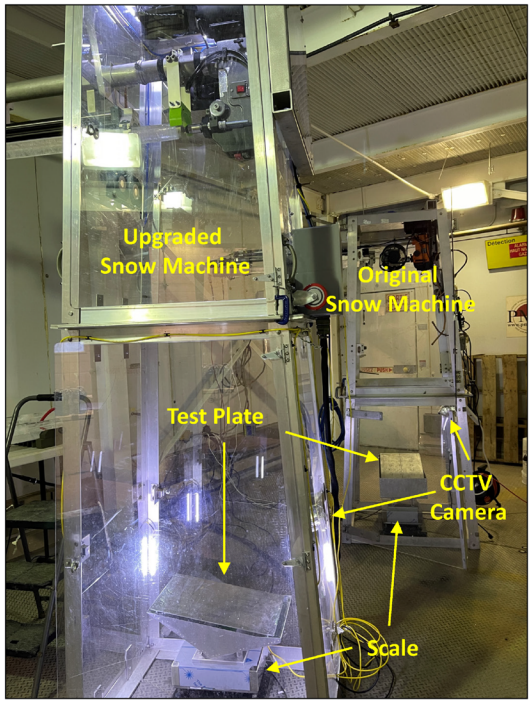


Figure 3.1: Artificial Snow Machine Setup Using Both Machines at PMG Technologies

3.4 Fluid Preparation and Management

This subsection describes the steps necessary to ensure proper fluid preparation. Fluid selection is considered project specific; therefore, all fluids must be indicated in a separate test plan prior to testing.

3.4.1 Type I Fluid Preparation

Type I fluids will generally be sent to APS by the manufacturer in concentrate form. Prior to commencing a test session, appropriately buffered mixtures of the fluid must be prepared for each test temperature that is planned for the session. As per ARP5945A, Type I fluids must be tested at dilutions where the freezing point of the solution is 10°C colder than the outside air temperature (OAT) at which the test is taking place.

To prepare the buffered solution, you must first identify the temperatures at which the testing will take place. Separate solutions must be prepared for each discrete testing temperature, and each prepared solution must be stored at the correct temperature. For example, if the daily schedule calls for tests at both -3°C and -10°C, two separate batches of Type I fluid must be prepared (with freezing points of -13°C and -20°C respectively). Each batch must be stored at ambient room temperature (20°C).

The Type I concentrate must be diluted with hard water, which is prepared by dissolving 400 mg of calcium acetate dehydrate and 280 mg of magnesium sulfate heptahydrate into 1 L of water (the quantities can be scaled up proportionally if preparing a larger batch). Consult the dilution chart associated with the Type I fluid being tested to determine the appropriate glycol/hard water ratio necessary to achieve the desired freeze point. Dilution charts are provided by the manufacturer. Confirm that the glycol concentration in your prepared solution is appropriate by measuring the Brix (generally Type I dilution charts will indicate the target Brix for the desired fluid freeze point). Ensure that the container in which the solution is mixed is clearly marked with the freeze point and the Brix of the fluid. Pour container labels listing the fluid name, Brix and freeze point should also be created and affixed to all pour containers to be used during the test session.

Note that although ARP5945A stipulates that Type I fluid samples be sheared in a laboratory blender prior to testing, previous work has indicated that the effects of this shearing process on resulting Type I fluid endurance times are negligible. The Type I fluid shearing process is generally not performed with fluid samples as part of the typical simulated freezing precipitation testing process.

3.4.2 Type II/III/IV Fluid Management

To ensure that a testing session runs smoothly with minimal disruptions, it is critical that a sufficient number of filled 1 L pour containers for each fluid to be tested are prepared and tempered prior to the start of a given test condition. The required amount of each fluid for each condition will be known in advance; it is good practice to have additional fluid ready for testing in the event of unexpected circumstances.

Used pour containers should be periodically refilled when time permits to prevent delays in the fluid application process. All pour containers must be affixed with labels listing the fluid name, batch number and dilution, and special care must be taken when refilling to ensure that the proper fluid, batch and dilution are used. At the testing manager's discretion, the fluid names on the pour container labels may need to be coded to preserve fluid anonymity in the presence of visitors.

All fluids to be used in artificial snow endurance time testing must be properly stored to ensure that they are at the correct temperature when a test session begins. Given that artificial snow testing takes place at several discrete testing temperatures, a series of temperature-controlled chest freezers set to the various testing temperatures should be available so that a sufficient quantity of fluid can be kept at each temperature being tested.

Fluid can also be stored within the test chamber itself, provided that the temperature of the chamber is the desired storage temperature for the fluid in question.

As stated in ARP5485B, the temperature of Type II, III (unheated) or IV fluid being applied to a test surface in an artificial snow precipitation endurance time test must be within 3°C (ideally 1°C) of the testing temperature. Valuable testing time can be lost waiting for fluids to temper if the proper storage procedures have not been followed.

4. TEST SITES

Indoor tests may be conducted in any temperature-controlled test chamber such as the refrigerated trailer at the APS test facility (limited to tests above -14°C), or the climate-controlled test chambers at PMG Technologies Inc. (PMG), Centre de recherche industrielle du Québec (CRIQ), the National Research Council (NRC), or L'Institut de recherche d'Hydro-Québec (IREQ).

5. TESTING PROCEDURE

5.1 Preparation of Ice Core

An ice core tube should be filled with deionized water to a level of 10 cm from the top edge of the metal tube. Styrofoam insulation should be affixed to the upper portion of the tube to allow water to freeze from the bottom to the top.

The ice core tube should be allowed to freeze for about 24 to 48 hours. The ice core should be allowed to temper to room temperature (approximately 20°C) for approximately 25 minutes before extraction from the ice tube. The ice core is ready to be extracted when it can be freely rotated within the tube using a finger. The ice core should be placed within the cold room for a minimum of 10 minutes before loading it into the machine.

5.2 Calibration and Verification of Precipitation Rate Distribution

The intensity of the snowfall produced by the snow machine is a controlled input parameter of the software. However, the distribution of the snowfall across the test plate is not controlled.

The methods described in the following subsections are described in greater detail in an internal document and are available during all testing activities with the snow machine.

Verification of the snow distribution can be completed in two ways:

- Calibration of snow distribution (primary method used at start-up of a new session); and
- Visual verification of snow distribution (secondary method used during testing).

5.2.1 Calibration of Snow Distribution

Although the frequency in which a calibration is performed is not specifically outlined in any standard, it should be conducted under the following conditions:

- At the beginning of any test session;
- If the machine is relocated in any way (i.e., from test site to a chamber facility); and
- When a major part is changed or repair is performed on the machine (i.e., change of a drill bit, or repair of broken translator).

Snow distribution across the test plate can be measured by sub-dividing the surface area of the test plate into 6 (2x3) equal sections. Snow catch pans are used to calculate the rate of participation for each individual section of the test plate.

ARP5485 indicates that the snow must be evenly distributed over the test plates. Therefore, each section must fall within a specified tolerance. For example, when conducting a calibration at a rate of 3 g/dm^2/h, each of the individual sections should be within a tolerance of ±0.9 g/dm^2/h from the average rate. Table 5.1 provides the ARP5485 recommended tolerances for rate distribution across the test plate.

Table 5.1: Range of Snow Intensity Differences Across Test Plate

Rate ($g/dm^2/h$)	Range of snow intensity differences from the average rate across a test plate ($g/dm^2/h$)
3	± 0.9
4	± 1.2
10	± 2.0
25	± 5.0

Once an acceptable calculated distribution is achieved, it is imperative that a visual snow distribution (see next subsection) be conducted, as this will serve as the "baseline picture" for subsequent visual verifications.

5.2.2 Visual Verification of Snow Distribution

This baseline visual documentation is performed by placing a black felt covered board (30 x 50 cm) onto the test plate. The snow machine will then precipitate onto this felt board until the operator observes approximately 50 percent snow coverage. By visual inspection, the observer will note the even distribution that should be exhibited across the plate and take a representative picture (90° with respect to the plate) of the felt board. This 90° top view picture must show the full plate and will be used as the baseline standard for subsequent visual snow distribution checks.

Subsequent visual snow distribution checks are performed in the exact same manner. Results of these checks should be verified against the baseline picture.

This method of distribution verification should be conducted under the following conditions:

- At the beginning of each day;
- When the rate of precipitation is changed; and
- When the test temperature is changed.

5.3 Test Temperatures and Rate of Precipitation Set Points

The following parameters must be set and/or regulated for each test:

- Condition/Chamber temperature;
- Enclosure temperature;
- Test plate temperature;
- Fluid temperature;
- Toggle switch to set plate surface area; and
- Rate of precipitation set point.

More detailed guidelines to condition temperature and standard temperature set points are provided in Attachment 1 and Attachment 2.

Subsections 5.3.1 to 5.3.4 indicate the specific requirements for each of these temperatures.

5.3.1 Condition / Chamber Temperature

The condition temperature is defined in accordance with the temperature breakdowns in the HOT tables. The actual chamber temperature, however, is typically set to approximately 2°C colder than the test plate temperature. Further details are provided in Attachment 1.

5.3.2 Enclosure Temperature

The enclosure temperature must be within 0.5°C of the test plate temperature.

5.3.3 Test Plate Temperature

The plate temperature set point is directly entered into the program. Research has shown that the best correlation between indoor and outdoor results is achieved when the plate temperature is set according to the following equation:

$$P_T = T_T - 0.065 * I_I - 0.5$$

- where: P_T = plate temperature in °C;
- T_T = test condition temperature in °C; and
- I_I = icing intensity (g/dm^2/h).

5.3.4 Fluid Temperature

The fluid temperature before application for Type II, III (unheated), and IV fluids should be within 3°C of the enclosure temperature, but ideally within 1°C. Type I fluids should be applied at 60°C.

5.3.5 Toggle Switch to Set Plate Surface Area

The snow machine is designed to test both Type I and Type II, III, and IV fluids. There is a difference in tray area when testing Type I fluids on an insulated box versus Type II, III and IV fluids on a plate. For this reason, the tray area switch must be set within the LabVIEW software to ensure proper rate calculation.

Under the tab "set points" in the program, toggle the tray area switch as follows:

- "New" – 18.57 dm^2 tray area for Type I heated fluids using an insulated box; or
- "Old" – 16.84 dm^2 tray area for all Type II, III, and IV fluids with no insulated box.

5.3.6 Rate of Precipitation Set Point

To achieve the desired rate, enter the rate into the program as described in the snow machine manual. Limitations with the snow machine can sometimes result in the indicated set point not being achieved. In this case, it may be necessary to enter an adjusted set point that is higher or lower to effectively achieve the desired rate. For example, if the required set point is 5 $g/dm^2/h$, but the rate achieved is only 4.8 $g/dm^2/h$, a set point of 5.2 $g/dm^2/h$ can be used to offset the difference. With the offset, the rate should settle to 5 $g/dm^2/h$.

Table 5.2 provides the ARP5485 recommended rate of precipitation tolerance.

Table 5.2: Rate of Precipitation Tolerance

Rate ($g/dm^2/h$)	Rate Tolerance ($g/dm^2/h$)
3	± 0.2
4	± 0.3
10	± 0.6
25	± 1.5

5.4 Fluid Application

The procedures for fluid application for artificial snow endurance time tests are summarized below.

Note that the balance used in this testing has a maximum capacity of 15,000 g. It is therefore important to empty the bucket assembly of spent fluid frequently to not exceed the capacity of the balance. The fluid should be poured directly onto the plate and no fluid should be allowed to accumulate on the sides of the bucket.

5.4.1 Heated Fluid Application

For Type I and Type III (heated) fluids; heat a batch of the fluid to be applied using a microwave (ensure that a microwave-safe container is used) or collapsible tea kettle to 60°C (+2°C, -0°C). Once the fluid is heated, transfer it to a thermos to preserve the temperature until it is applied. Pour 0.5 L of heated fluid, onto the top of the test surface using a 12-hole spreader to ensure even distribution.

5.4.2 Unheated Fluid Application

For Type II, Type III (unheated), and Type IV fluids, pour one litre of fluid at ambient temperature directly on the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer.

5.5 Execution of Test

The following indicates the steps required to conduct a test using the snow machine:

- Clean and prepare the test plate/box;
- Prepare a data form with the pertinent details required;
- Set required rate of precipitation and plate temperature parameters into LabVIEW;
- Apply Type I, II, III, or IV de/anti-icing fluid as per Subsection 5.4;
- Begin the test by pushing “start experiment” and toggle the “set linear rate function” to on;
- Record the start of the endurance time test after fluid is applied;
- Continue testing until at least five crosshairs or 30 percent of the plate has failed;
- End the test by pushing “end experiment”; and recording the pertinent data in LabVIEW;
- Record all pertinent data on data form; and
- Update log of tests in shared folder (if applicable).

5.6 Post-Test Measurements and Photos

Standard refractive index measurements should be taken at the end of each test. At minimum, measurement should be taken at position C2 (approximately 15 cm from the top of the plate). This is indicated on the data form.

At failure, three different photographs should be taken of the entire test plate:

- At a 10˚to 30˚ incident from the top end of the plate;
- At a 10˚to 30˚ incident from the bottom end of the plate; and
- At a 10˚to 30˚ incident from a 30˚ lateral position from the top end of the plate.

5.7 Guidance for Improved Test Efficiency

Increased efficiency in testing is required when trying to conduct many tests. A typical test day has both a fixed and a variable component.

The fixed component is comprised of activities in which the operator has no control over the time needed. Examples of this are: chamber cool down time, and test endurance times.

The variable component is comprised of the test turnaround activities in between tests. This component is mostly characterized by activities such as: failure of the previous test including photos, refractive index measurements, removal of spent fluid from the previous test, retraction of the translator to the load position, loading of a new ice core, advancement of the ice core to the start position, application of a new fluid for a new test, and scale stabilization period of one to two minutes.

Testing efficiency can be improved by proper planning and efficient management.

5.7.1 Efficient Turnaround Times

Attempts should be made to reduce the time spent in between tests. Efficiency can be obtained by proactive setup of a test day. The following activities can reduce turnaround times: remove and prepare enough ice cores to last the entire test day, prepare and temper all fluids for entire day, sequence tests in such a way to maximize use of each ice core (e.g., one long test and one short test using the same ice core), and take refractive index measurements and photos up to three minutes before failure.

6. EQUIPMENT

The equipment required for endurance time testing in artificial snow is listed in Attachment 3.

All additional equipment required for the operation of the snowmaking system is included in the snowmaking machine operators' manual, supplied by NCAR (refer to TP 14148E).

7. PERSONNEL

Personnel requirements differ based on the nature of the testing and locations.

- APS Test Facility: Testing at the test facility requires one senior experienced employee. An optional junior employee could be employed when numerous short tests are anticipated.
- Chamber Facility: Testing at a chamber facility would require one senior employee and one junior employee when testing with one snow machine. When two snow machines will be used simultaneously, two senior employees and one junior employee is recommended.

The senior experienced employee should have advanced knowledge in operating the snow machine, and a junior employee shall provide support.

8. SAFETY

Special attention will be given to working in a cold environment, and employees should be mindful of dangers associated with hypothermia and frost bite.

Employees will adhere to APS specific safety requirements when working in the refrigerated trailer at the APS test site. An employee who is working alone should use the employee safety monitoring device (Loner Device) located at the test site.

Employees working at a contracted facility shall adhere to the indicated safety regulations of that facility.

The following general precautions should be taken when executing tests to ensure the safety of all personnel:

- Appropriate footwear is to be worn by all personnel at the test site to prevent slipping;
- Warm clothing is to be worn by all personnel to prevent frostbite;
- Electrical appliances (including computers) are to be unplugged before any wires or connections are altered. If necessary, the affected breaker is to be turned off;
- If fluid comes into contact with skin, rinse hands under running water;
- If fluid comes into contact with eyes, flush with a portable eye wash station;
- Care must be taken when working inside the snow machine; and
- Ensure that drill is off when changing the ice core.

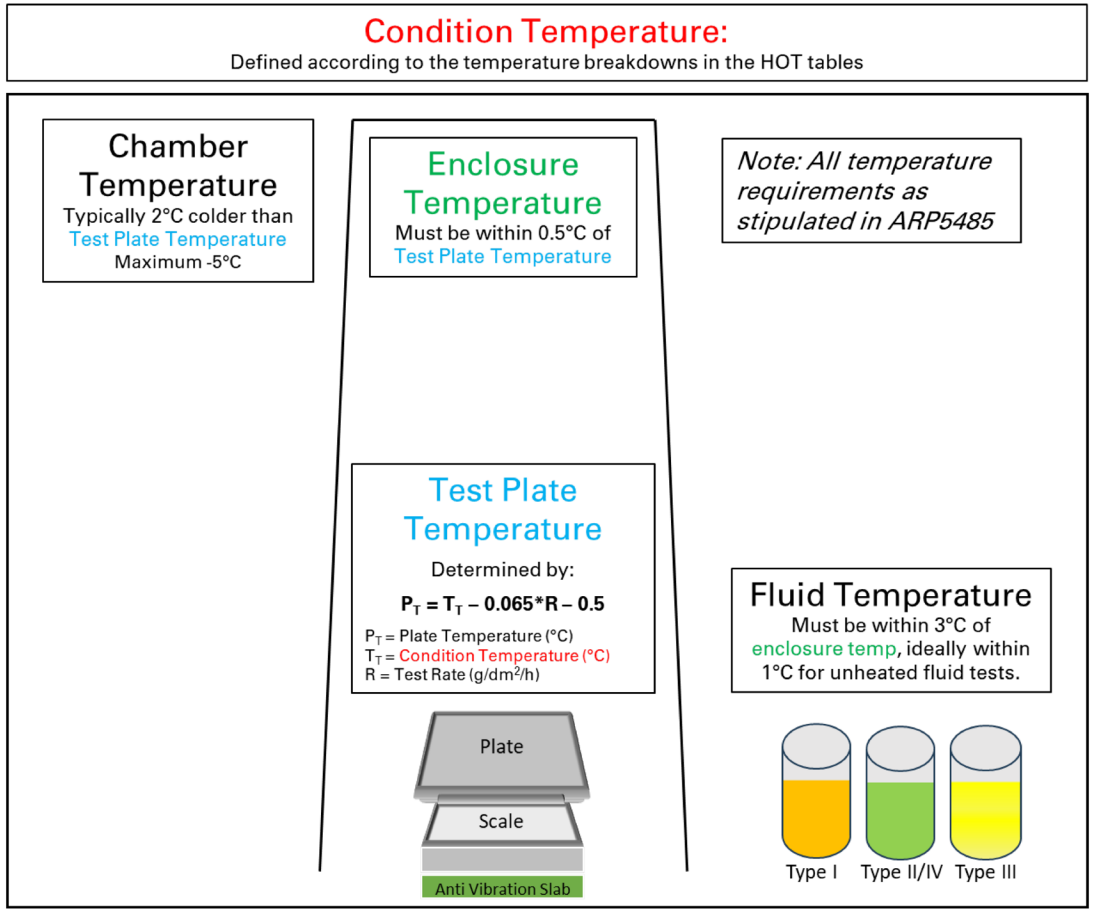
Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

9. DATA FORMS AND SOFTWARE

The following data forms and software programs are typically used for artificial snow endurance time testing:

1) End Condition Data Form for Artificial snow Endurance Time Tests (Attachment 4); and
2) LabVIEW Software.

Attachment 1: Snow Machine Temperature Guidelines



Attachment 2: Temperature Requirements at Start of Test

Condition Temperature (°C)	**Target Test Rate** (g/dm²/h)	**Test Plate Temperature Setting** (°C)	**Enclosure Temperature** (°C) (Test Plate Temp ± 0.5°C)	**Chamber Temperature** (°C) -5°C or Below (Typically 2°C Below Test Plate Temperature)	**Acceptable Fluid Application Temperature Range** (°C) (Enclosure Temperature ± 3°C Ideally within 1°C)
-3	3	-3.7	-3.2 to -4.2	-5.7	-0.2 to -7.2
	4	-3.8	-3.3 to -4.3	-5.8	-0.3 to -7.3
	10	-4.2	-3.7 to -4.7	-6.2	-0.7 to -7.7
	25	-5.1	-4.6 to -5.6	-7.1	-1.6 to -8.6
-14	3	-14.7	-14.2 to -15.2	-16.7	-11.2 to -18.2
	4	-14.8	-14.3 to -15.3	-16.8	-11.3 to -18.3
	10	-15.2	-14.7 to -15.7	-17.2	-11.7 to -18.7
	25	-16.1	-15.6 to -16.6	-18.1	-12.6 to -19.6
-18	3	-18.7	-18.2 to -19.2	-20.7	-15.2 to -22.2
	4	-18.8	-18.3 to -19.3	-20.8	-15.3 to -22.3
	10	-19.2	-18.7 to 19.7	-21.2	-15.7 to -22.7
	25	-20.1	-19.6 to -20.6	-22.1	-16.6 to -23.6
-25	3	-25.7	-25.2 to -26.2	-27.7	-22.2 to -29.2
	4	-25.8	-25.3 to -26.3	-27.8	-22.3 to -29.3
	10	-26.2	-25.7 to -26.7	-28.2	-22.7 to -29.7
	25	-27.1	-26.6 to -27.6	-29.1	-23.6 to -30.6

Attachment 3: Equipment List for Artificial snow Testing

ARTIFICIAL SNOW TESTING
LOCATION: TEST SITE or OTHER FACILITY
18 litre containers of water x 10
Additional PVC Sheild Complete with extra liners (Wizz Pads)
Air Compressor
All Large Ice Core Molds, 2-3 short Ice core molds
Aluminum test plates with heating pads x 2
Backup Drill Bit
Blue Towel
Clean Bucket and Clean Funnel for Ice Core Filling
Electronic NCAR files
Extension cord
Extra Coupler and GTCA coupler
Heat Gun
Insulated box for heated tests
Measuring Cup
Mettler Toledo Weigh Scale x2
NCAR Computer, Monitor and Control Box
NCAR tool box
PVC Pipe for Temporary Storage of Ice Cores
Revco Freezer for Ice Cores
Sartorius 2 g Scale for Distribution Analysis
Small box to transport small Allen keys and other equip
Small Folding Tables x 2
Small Important Allen Keys
Snow Distribution Pans 100mm X 150mm (6 Pans)
Snow machine and related equipment
Squeegee/scraper
Styrofoam Covers for Ice Core Molds x 6
Thermos x 1 and spreader x 1
Waste Container
Wet vacuum
Anti Vibration Slab
LOCATION: OFFICE
Data Forms
Procedures
Rate Distribution Excel file

Equipment List for Artificial snow Testing (cont'd)

ARTIFICIAL SNOW TESTING	
REMOTE VIEWING CAMERA EQUIPMENT: TEST SITE OR OTHER FACILITY	
4K IP Camera with tripod mounts x 2	NVR Receiver
4K IP Camera Zoomed Lens with tripod mounts x 2	Power Cables for monitor and receiver x 2
Ethernet Cable (150ft) x 5	ZTE with large internet plan
Monitor with VGA cable	CCTV Camera x 2
REMOTE VIEWING CAMERA EQUIPMENT: OFFICE	
Camera Cover x 4	Manfrotto Arms with clamp inserts x 4
External HDD	

Attachment 4: End Condition Data Form for Artificial snow Endurance Time Tests

Date: _____ Location: _____ Project: _____ Test Plan #: _____

Fluid: _____ Dilution: _____ Fluid Type: _____ Batch #: _____

SNOW MACHINE

First Generation APS: _____ (✓)

Second Generation APS: _____ (✓)

NCAR Machine _____ (✓)

TEMPERATURES

Condition Temp.: _____ °C

Fluid Temp.: _____ °C

Fluid Quantity Applied: _____ litres

Plate Temp. Set point: _____ litres

PRECIPITATION RATE

Test Plan Precip. Rate: _____ g/dm^2/h

Adjusted Precip. Rate: _____ g/dm^2/h

TEST DATA

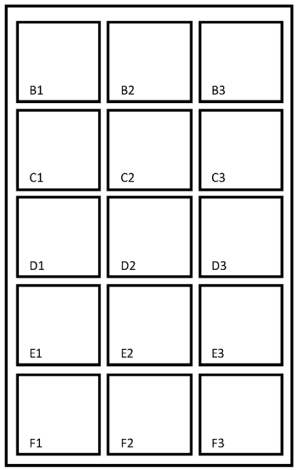
Output File Name: _____.txt

Time of Fluid Application: _____ hh:mm:ss

Time of Fluid Failure: _____ hh:mm:ss

Calculated Failure In Minutes: _____ minutes

Last Average Rate: _____ g/dm^2/h



Refractive Index Measurements
(Standard 15cm line)

Position C2: _____ °Brix *Additional brix measurements should be indicated directly on diagram in respective locations.*

Comments: _____

PROCEDURE:
ENDURANCE TIME TESTING IN ACTIVE FROST WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

301351

PROCEDURE:

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April 29, 2024
Final Version 1.1

PROCEDURE:
ENDURANCE TIME TESTING IN ACTIVE FROST WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

1. BACKGROUND

The active frost holdover time table was initially developed prior to the year 2000, based on limited data from earlier testing in a laboratory setting. Further research had indicated that testing active frost in an indoor setting was not an appropriate method for determining holdover times, and as a result, an outdoor testing program was initiated to update the active frost holdover times.

APS Aviation Inc. (APS) began outdoor testing in natural active frost conditions in 2002-03 and testing was continued over the course of six winter testing seasons. This work was concluded in 2008-09 and is documented in the Transport Canada (TC) report, TP 14938E, *Substantiation of Aircraft Ground Deicing Holdover Times in Frost Conditions*. A new, more conservative, frost holdover time table was developed based on the data that was collected and was published in the 2009-10 Holdover Time Guidelines.

The active frost holdover time table underwent a further revision in 2009-10 as a result of a project investigating the use of Type I fluids on composite aircraft surfaces. This work was documented in the TC report, TP 15052E, *Development of Type I Fluid Holdover Times for Use on Aircraft with Composite Surfaces*. Active frost holdover times for Type I fluids used on composite surfaces were added to the existing active frost table as of the 2010-11 Holdover Time Guidelines.

Frost holdover times remain generic to this day, and testing continues each year to ensure that new fluids meet the existing generic holdover times.

This procedure serves as an update to the APS procedure, *Endurance Time Testing in Active Frost with SAE Type I, II, III, and IV De/Anti-Icing Fluids*, which was issued in November 2018. This new document serves to incorporate refinements to the procedure that have been made in the interim years.

2. OBJECTIVE

This procedure describes the testing protocols used to evaluate the endurance time performance of Type I, II, III and, IV fluids in natural active frost conditions.

This procedure is to be used for testing new holdover time fluids as well as older holdover time fluids for which lowest on-wing viscosity (LOWV) samples are available. For the testing of new holdover time fluids, two tests per dilution is the minimum required for fluid qualification.

3. PRE-TESTING ACTIVITIES

This section describes activities that need to be performed prior to commencing an active frost testing session.

3.1 Forecasting Active Frost

Active frost events are less predictable than natural snow events. Most weather forecasts do not explicitly indicate if active frost will occur in a given night, therefore, forecasts must be closely monitored to determine if conditions are conducive to the formation of active frost.

The ideal conditions for the development of frost are as bellow.

1) Outside air temperature (OAT) near or below 0°C (the temperature of the test surface must be below 0°C for active frost to form and this can happen with OATs of +6°C or more if the radiative cooling is very effective).
2) Wind speeds of less than 10 km/h (lower is better as winds disrupt radiative cooling).
3) Clear skies/minimal cloud cover overnight (cloud cover prevents radiative cooling).
4) High relative humidity. The higher the relative humidity, the closer the dew (or frost) point will be to the current OAT. As a result, less radiative cooling will be required for frost formation.

Perfect conditions are not necessarily required for active frost formation. However, if one of the weather indicators is less-than-ideal (some cloud cover, winds at or near 10 km/h) it is best if the other indicators are strong.

3.2 Event Coordination

It is the responsibility of the testing manager to determine personnel and appropriate start/end times for each testing session. Arrangements should be made for all personnel to arrive approximately 90 minutes prior to the planned pour time to allow for sufficient time for set-up activities and to maximize the usable testing time.

Prior to beginning a test event, it is critical that the temperature band(s) at which testing will occur is identified and that the corresponding generic holdover times for the fluids that are to be tested are known. This is done by using the coldest OAT that is to be expected between the de/anti-icing fluid application and the end of the test session. This temperature will also be logged and used in the subsequent analysis for active frost HOT determination. Active frost endurance time tests are not considered valid if the duration of the active frost event is shorter than the holdover time corresponding to the fluid being tested and the temperature at which the test is run. Therefore, it is critical that fluids with long holdover times are poured sufficiently early to allow for a valid test.

As active frost formation ceases as the sun rises, test sessions will generally end at or near sunrise (around 7:00 AM). Prior to commencing a test session, the latest possible time that each fluid being tested can be poured while still providing a sufficient window to meet its holdover time should be determined.

Example:

A frost test session is planned for a night with temperatures ranging from -4 to -8°C. In this temperature band, neat Type IV fluids have an active frost holdover time of 10 hours. Given that sunrise is estimated to occur at 7:00 AM the following morning, any neat Type IV fluids being tested must be applied prior to 9:00 PM in order to allow the tests to run for the minimum 10 hours before sunrise.

Performing this exercise for all fluids being tested will allow the tester to determine the appropriate start time for the test event (determined by the longest corresponding generic holdover time). It will also allow a tester to stagger fluid application in a way that makes sense (i.e. if frost rates are weak/nil at the start of a test event, application can be delayed until rates improve for certain fluids with shorter holdover times).

It should also be noted that there is additional value in running frost tests as long as possible (ideally to the point where the fluid fails). Obtaining a large database of frost tests with times that exceed the current generic holdover times could potentially allow for future revisions of these holdover times.

Table 3.1 shows the 2023-24 generic active frost holdover times. Reference the latest publication of the TC or Federal Aviation Administration (FAA) Holdover Time Guidelines for the most up to date information.

Table 3.1 – 2023-24 Active Frost Generic Holdover Times*

Outside Air Temperature	Type I
-1°C and above (30°F and above)	0:45 *(0:35)*
below -1 to -3°C (below 30 to 27°F)	
below -3 to -10°C (below 27 to 14°F)	
below -10 to -14°C (below 14 to 7°F)	
below -14 to -21°C (below 7 to -6°F)	
below -21 to -25°C (below -6 to -13°F)	
below -25°C to LOUT (below -13°F to LOUT)	

Outside Air Temperature	Concentration Fluid/Water By % Volume	Type II	Type III	Type IV
-1°C and above (30°F and above)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	2:00	0:30	3:00
below -1 to -3°C (below 30 to 27°F)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	1:30	0:30	3:00
below -3 to -10°C (below 27 to 14°F)	100/0	8:00	2:00	10:00
	75/25	4:00	1:00	5:00
below -10 to -14°C (below 14 to 7°F)	100/0	6:00	2:00	6:00
	75/25	1:00	1:00	1:00
below -14 to -21°C (below 7 to -6°F)	100/0	3:00	2:00	6:00
below -21 to -25°C (below -6 to -13°F)	100/0	2:00	2:00	4:00
below -25°C (below -13°F)	100/0	No Holdover Time Guidelines Exist		

*See current HOT guidelines for most recent table.

3.3 Data Requirements and Test Planning

The testing manager should be mindful of the data requirements and current data set status for each of the fluids being tested in a given session. This information should be used to steer testing decisions, both when deciding what events to pursue and what tests to run during an event.

For Type I fluids, a minimum of two data points per fluid is required for validation of the existing generic active frost holdover times. The preferred target is four data points; ideally covering a range of temperatures.

For Type II/III/IV fluids, a minimum of two data points for each dilution of a fluid being tested is required for validation of the existing generic active frost holdover times. The preferred targets are six / four / two data points for 100/0, 75/25, and 50/50 fluids respectively. These tests ideally should cover a range of temperatures.

Holdover time fluids that do not meet the preferred data targets in their initial testing season may be retained for one additional test season, with the goal of achieving the preferred data targets with all dilutions.

3.4 Fluid Preparation and Management

This subsection describes the steps necessary to ensure that the fluids to be tested are properly prepared for testing.

3.4.1 Type I Fluid Preparation

Type I fluids will generally be sent to APS by the manufacturer in concentrate form. Prior to commencing a test session, an appropriately buffered mixture of the fluid must be prepared. As per the Aerospace Recommended Practice (ARP) 5945A, Type I fluids must be tested at dilutions where the freezing point of the solution is 10°C colder than the OAT at which testing is taking place.

To prepare the buffered solution, you must first determine the range of temperatures that the testing will take place in. The solution should be prepared such that it is properly buffered for the coldest temperature to be experienced during the test session. If a very large change in temperature is expected during the test session, (>10°C), consideration should be given to preparing two distinct batches of Type I fluid, with freeze points appropriate to the different expected phases of testing.

The Type I concentrate must be diluted with hard water, which is prepared by dissolving 400 mg of calcium acetate dehydrate and 280 mg of magnesium sulfate heptahydrate into 1 L of water (the quantities can be scaled up proportionally if preparing a larger batch). Consult the dilution chart associated with the Type I fluid being tested in order to determine the appropriate glycol/hard water ratio necessary to achieve the desired freeze point. Dilution charts are generally available on the fluid manufacturer's website or provided directly from the manufacturer upon fluid receipt.

Confirm that the glycol concentration in your prepared solution is appropriate by measuring the Brix (generally Type I dilution charts will indicate the target Brix for the desired fluid freeze point). Ensure that the container in which the solution is mixed is clearly marked with the freeze point and Brix of the fluid. Pour container labels listing the fluid name, Brix and freeze point should also be created and affixed to all pour containers to be used during the test session.

Note that although ARP5945A stipulates that Type I fluid samples be sheared in a laboratory blender prior to testing, previous work has indicated that the effects of this shearing process on resulting Type I fluid endurance times are negligible. The Type I fluid shearing process is generally not performed with fluid samples as part of the typical active frost testing process.

3.4.2 Type II/III/IV Fluid Management

In order to ensure that a testing session runs smoothly with minimal disruptions, it is critical that a sufficient number of filled 1 L pour containers are prepared and tempered prior to the start of the test session. The targeted amount is a minimum of two pour containers per fluid/dilution to be tested.

Used pour containers should be periodically refilled when time permits to prevent delays in the fluid application process. All pour containers must be affixed with labels listing the fluid name, batch number and dilution and special care must be taken when refilling to ensure that the proper fluid, batch, and dilution are used.

All fluids to be used in active frost endurance time testing must be properly stored in order to ensure that they are at the correct temperature when a test session begins. As per Subsection 12.1.1 of ARP5485B, the temperature of Type II, III (unheated), or IV fluid being applied to a test surface in an active frost endurance time test must be within 3°C of the OAT. Valuable testing time can be lost waiting for fluids to temper if the proper storage procedures have not been followed.

Fluid jugs and pour containers of neat and 75/25 formulations of Type II/III/IV fluids that are to be used in a given test event should be stored outside such that their temperature consistently reflects the changing OAT. Note the following exceptions:

1) All containers containing 75/25 formulations of Type II/III/IV fluids must be temporarily stored inside the main trailer if the outdoor temperature on a given day is scheduled to drop below -14°C for a period exceeding four hours; and
2) In the case of extreme cold (temperatures falling below -22°C for a period exceeding four hours), neat formulations of certain fluids may also need to be temporarily stored inside the main trailer. The freezing points of the individual fluids need to be consulted in order to determine which (if any) fluids will need to be moved.

Fluid jugs of 50/50 formulations of Type II/III/IV fluids that are to be used in a given test event are to be stored inside the main trailer at all times due to the relatively warm freezing point of 50/50 fluids. Pour containers of 50/50 formulations of fluids to be used are to be stored inside a chest freezer set at a temperature of -3°C.

All fluids that are stored in clear jugs must be covered with an opaque covering in order to ensure that the fluid is not exposed to light in storage.

4. TEST SITE

This section documents the test sites where APS conducts active frost endurance time testing with Type I, II, III, and IV fluids.

4.1 Pierre-Elliott-Trudeau International Airport Test Site

Active frost is typically and predominantly performed at the APS test site located at the Montréal Pierre-Elliott-Trudeau International Airport. The test site is located near Environment Canada's Meteorological Services of Canada automated weather observation station, as shown in Figure 4.1 on a plan view of the airport.

To increase the chances of obtaining successful testing events, a DFIR (Double Fence Intercomparison Reference) shield consisting of two concentric circles of fencing has been installed at the APS test site. The frost testing stands have been installed within this shield to prevent wind from affecting the testing area. Figure 4.2 illustrates the test stands within the DFIR shield.

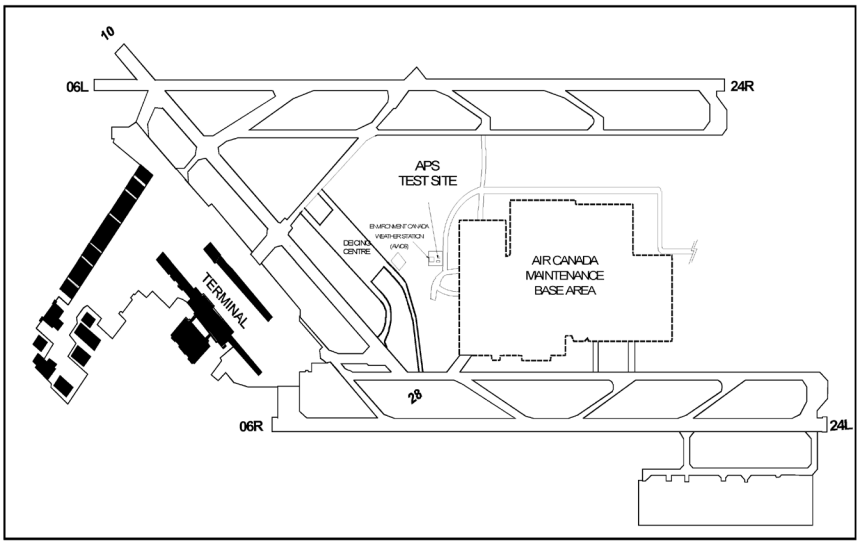


Figure 4.1: APS Test Site at Montréal-Pierre-Elliott-Trudeau International Airport



Figure 4.2: Frost Test Stands Within the DFIR Shield.

4.2 Mobile Test Sites

Although rare, there are instances where data requirements will necessitate active frost testing at a location other than the APS test site. In the past, this has typically been due to a need to obtain data at specific temperatures or time of year (generally after the conclusion of the winter season when active frost data is no longer obtainable in Montreal).

Mobile test sites can be set-up in any region where the desired active frost conditions are expected to occur, using test stands that have been specially modified for improved transportability. When using a mobile site for testing, the testing trailers are generally replaced by either rented vehicles or a rented hotel room (location permitting).

Several factors must be considered when choosing a location for a mobile test site, including:

1) **Ground Surface**

   The ground surface should be level and firm to simplify the process of levelling the test stands.

2) **Foot/Vehicle Traffic**

   The selected location should also be out of the way of foot and vehicle traffic, if possible, to minimize the chance of outside forces interfering with a test session.

5. TESTING PROCEDURE

This section describes the procedure to be followed during an active frost test event.

The procedure conforms to the requirements for natural frost testing outlined in Section 12 of ARP5485B – *Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type II, III, and IV*.

There is no section related to natural frost testing in the current edition of ARP5945 – *Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids, SAE Type I*, however it is expected that this section will be added in a future revision.

5.1 Set-Up

The initial set-up for frost testing is very similar to the initial set-up for standard natural snow endurance time testing, with some minor differences. The steps are summarized below.

1) Ensure that the fluids to be tested are at the proper temperatures. Type II, Type III unheated, and Type IV fluids are to be applied at a fluid temperature equivalent to the OAT and should be kept outdoors. Type I and Type III heated fluids are to be applied at a fluid temperature of 20°C and should be kept within the main trailer. If there is Type I fluid to be tested, prepare a mixture of Type I fluid buffered to the appropriate temperature (freezing point should be 10°C colder than OAT).
2) Confirm the current wind direction using the most recent YUL METAR report (available at https://flightplanning.navcanada.ca). Orient two full six-position test stands and an additional one-position test stand into the wind and ensure they are levelled such that the test surfaces lie at a 10° angle (within 9.8° and 10.2° is acceptable). Ensure the fluid collection pans are placed beneath the test stands to collect fluid runoff.
3) Equip the two six-position test stands and the one-position test stand with frosticator test plates (white-painted aluminum test plate with a 5 cm R:10 insulation backing) in all positions within the DFIR shield (to prevent the effects od wind on the formation of frost). Two of the frosticator plates will be used as rate plates and one will be used as a visual frost check plate. The visual frost check plate is generally equipped on the one-position test stand and placed to the left of the six-position test stands; this positioning is intended to simplify the rate collection process. Figure 5.1 depicts the proper plate set-up for the three test stands.
4) Clean the surface of the frosticator plates by removing any adhered ice or contamination. If any solvent or heat is used in the cleaning process, ensure the plates are allowed to cold-soak long enough.
5) Deactivate all lighting that may illuminate the test pad (lighting can interfere with active frost formation by imparting heat to the test surfaces).
6) Prepare the rate station inside the main trailer: ensure that the scale being used is properly leveled and calibrated (within one year), open the latest version of the frost rate program (an Excel spreadsheet created to record frost rate measurements), and test that the scale and computer are functioning normally together.
7) Prepare the data forms to be used during the test session. Fill out as much information as possible ahead of time in order to streamline the subsequent fluid application process.

8) Prepare a digital camera (or designated iPhone® camera) for use by formatting the memory card and syncing the device time with the time that is displayed on the test site clocks.

9) Ensure that the closed-circuit television (CCTV) camera (2.8 mm focal length) is functioning normally (general overview camera of the testing area).

10) Arrange all fluids to be poured by placing the filled pour containers behind their respective plates.

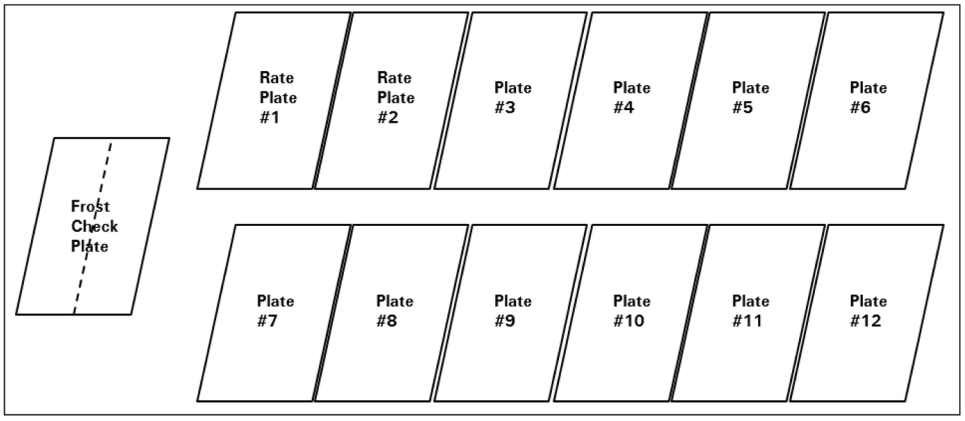


Figure 5.1 – Test Stand Set-Up

5.2 Procedure for Rate Collection

Rate collection for frost is performed using two rate plates. Rates are to be measured in 30-minute periods, with the two plates staggered such that a rate measurement is performed every fifteen minutes. The steps for rate collection are summarized below.

1) After initial set-up is complete, measure and record the initial weight of each of the rate plates. Once recorded, position both rate plates outside on the test stand. Note that the first rate measurement on rate plate #1 is to be performed after a 15 minute period in order to off-set the timing of the two rate plates, and that the rate collection process can be simplified by measuring rates at the :00, :15, :30, and :45 minute mark of every hour.

2) When collecting a rate, begin by measuring the surface temperature of the frost check plate using a hand-held surface temperature probe. Note that the probe will be able to measure an accurate surface temperature more quickly if it is left outside to cold-soak between rate measurements.

3) Scrape the surface of the frost check plate on the left-hand side (if rate plate #1 is being measured) or the right-hand side (if rate plate #2 is measured) to determine if there is visible frost accumulation. Once this is done, wipe clean the side of the plate used to perform the visual check to allow for the accumulation of new frost during the following rate period.

4) Bring the rate plate inside and record the weight of the rate plate as well as the measured surface temperature of the frost check plate and the results of the visual frost check (yes/no) in the frost rate program. Save the rate file after each measurement. Once done, return the plate to the test stand outdoors.

5) Repeat this process until the test session is complete. Ensure that final rates are taken on both plates after all tests have stopped running. At the conclusion of the test session, copy the completed rate file into the appropriate location.

5.3 Procedure for Fluid Endurance Time Tests

The steps for conducting active frost fluid endurance time tests are summarized below.

1) Measure the initial fluid temperature and Brix of all fluids that are to be poured during the test session. Record these values on the data form. Ensure that fluids are at the appropriate temperature (OAT for Type II/III-Unheated/IV fluids, 20°C for Type I/III-heated fluids).

2) Pour 0.5 L of Type I/III-heated fluid or 1 L Type II/III-Unheated/IV fluid onto the test surface from the top of the plate, ensuring that the entire surface of the plate is coated with an even fluid layer. Heated Type I/III fluids should be applied using a 12-hole spreader. If possible, fluid should only be applied once positive frost rates have been recorded for the session (i.e. visual frost check confirms presence of frost and an increase in weight is noted on the rate plates). If no positive rates have been recorded, fluid can still be applied early in order to ensure that a test is given a chance to run for a duration equivalent to its holdover time. After each fluid application, a photo is to be taken of the plate.

3) Five minutes after fluid application, measure the thickness of the fluid layer at the six-inch line of the plate with a fluid thickness gauge. Repeat this measurement at multiple points along the six-inch line to confirm that the reading is accurate. Record the measured thickness on the data form.

4) After every rate measurement, perform an inspection of each plate in order to assess its condition. Fluid failure in active frost can be determined by interacting with the fluid layer using a pencil or designated failure stick. A healthy (i.e. "non-failed") fluid layer will have a smooth appearance and will not form a hard crust when displaced with a pencil, and the displaced area will be readily replenished by the surrounding fluid. A "failed" fluid layer will appear rough or ridged. It will form a hard, jagged crust when displaced with a pencil, and the displaced area will not be readily replenished by the surrounding fluid. When surface temperature nears the fluid freeze point temperature, a different "freeze-point-failure" may occur which is described as freezing nucleation points starting at the interface of the plate and the fluid which are sporadically spread on the surface and spread quickly.

5) If more than one-third of a given plate is determined to be "failed" (or if fluid failure is noted at any five of the crosshair marks on the plate), the plate as a whole is considered to be failed and the failure time is to be recorded. A final Brix measurement and a photo of the failed plate are also to be taken for each failed surface.

6) A given test event is to continue until all surfaces have failed or until sunrise the following morning. Once the sun has risen, any unfailed surfaces should be photographed and have their final Brix measured. Their test end time is to be recorded as the time when the sun rose (or shortly thereafter), and "did not fail" will be indicated on the associated data form.

7) Ensure all test surfaces are cleaned after testing and that all fluid within the collection pans is disposed of appropriately.

8) Ensure that the CCTV camera data is downloaded and saved in the appropriate location on the SharePoint or external hard drive.

It should be noted that at warmer OATs (at or near 0°C) that unfrozen dew can accumulate on test surfaces over the course of the test duration. If this dew has accumulated on a surface and the OAT (or surface temperature of the plate) drops sufficiently, this dew may freeze and trigger a rapid fluid failure (dew frost failure) on the test surfaces. Special attention should be given to all plates when testing at these temperatures as this process can occur very quickly.

A similar phenomenon is observed when testing with diluted fluids at OATs at or near their lowest operational use temperature (LOUT). Because the surface temperature of a test surface can be several degrees colder than the OAT during a frost event due to radiation cooling, fluids applied to these surfaces can be cooled to temperatures below the OAT. For fluids that are being tested near their LOUT, this can result in a rapid freezing of the entire fluid layer on these cooled surfaces. This is known as a "freeze point failure", and like the aforementioned dew frost failure, this can occur very quickly.

6. EQUIPMENT

The equipment required for endurance time testing in active frost is listed in Attachment 1.

7. PERSONNEL

One person is required for testing; however, having a second person present for the initial set-up is beneficial. If one person is conducting the testing alone, they should make use of the "Loner" monitoring system to ensure their safety during the testing event.

8. SAFETY

Testing in cold temperatures can pose significant safety issues. Jackets, gloves, and boots should be rated to very low temperatures. Eye protection (ski goggles) and face protection should be worn if testing in very cold temperatures (< -20°C). Employees should be mindful of dangers associated with hypothermia and frostbite. Additional information can be found in the Test Site Safety Management manual, of which copies are available at the test site.

If ever one person is conducting testing alone, they must make use of the "Loner" monitoring system to ensure their safety during the testing event.

Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

9. DATA FORMS AND SOFTWARE

The following data forms are typically used for active frost endurance time testing:

1) End Condition Data Form for Endurance Time Tests (Attachment 2);
2) App Data Form for Fluid Endurance Time Tests (Attachment 3);
3) APS Rate Program Spreadsheet (Attachment 4); and
4) Test Session Summary Form (Attachment 5).

Attachment 1: Equipment List for Active Frost Testing

ACTIVE FROST TESTING
LOCATION: TEST SITE
1 or 2–position test stand
6–position test stand
Compass
Paper or Digital Data Form
Digital Camera or iPhone®
Fluid collection pans
Fluid Thickness Gauge
Fluids
Immersion Temperature Probe
Inclinometer
Rate Computer
Scrapers
Squeegees
Surface Temperature Probe
Temperature Gauge
Weigh Scale + Connectors
White–painted aluminum test plate with insulated backing (frosticator plates)

Attachment 2: End Condition Data Form for Endurance Time Tests

REMEMBER TO SYNCHRONIZE TIME

LOCATION:	PRECIP. CONDITION:	DATE:	RUN NUMBER:	STAND # :

Time of Fluid Application: _____

Time of Fluid Failure: _____

Fluid Name/Dilution: _____

PLATE 1	PLATE 2	PLATE 3	PLATE 4	PLATE 5	PLATE 6

Failure Call: (describe) _____

Time of Fluid Application: _____

Time of Fluid Failure: _____

Fluid Name/Dilution: _____

PLATE 7	PLATE 8	PLATE 9	PLATE 10	PLATE 11	PLATE 12

Failure Call: (describe) _____

AMBIENT TEMPERATURE: _____ °C LEADER / MANAGER: _____ FAILURES CALLED BY: _____

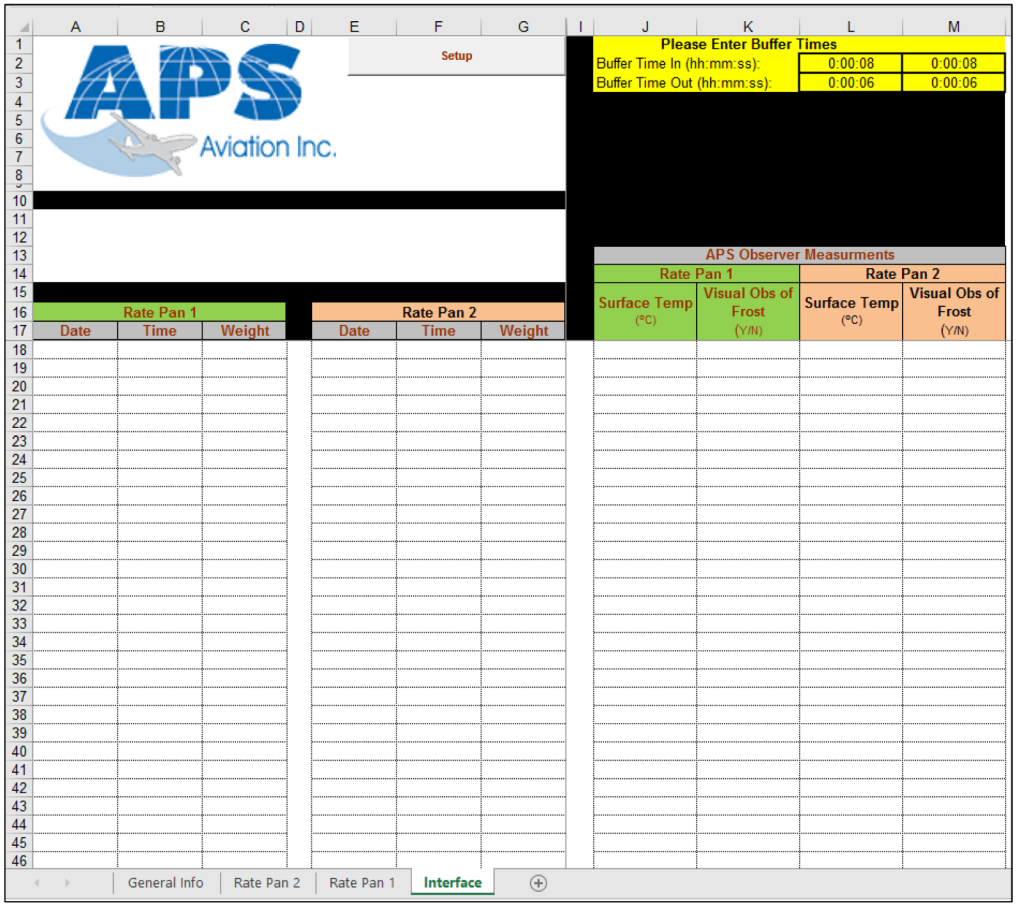
COMMENTS: _____

NOTE:
Please ensure correct functioning of plate temperature logging system at the start of the test and at the end of the session

Attachment 3: Screenshot of Holdover Time Data Form



Attachment 4: Screenshot of Frost Rate Program



Attachment 5: Example of Test Session Summary Form

2023-24 TEST SESSION SUMMARY

TEST MANAGER: _____ DATE: _____

LOCATION: _____

# of Tests Conducted	# of Tests DNF	Project	Person Responsible	Data Forms (# or electronic)	Rate File (#)	Logger Files (#)	Photos (#)	Successful (Yes/No)	Comments (Key Notables)
NATURAL SNOW									
		HOT Snow							
		Very Cold Snow							
		Visibility Data Collection							
		High Viscosity Fluid Testing							
		Other _____							
ARTIFICIAL SNOW									
		HOT Snow Machine							
		Other _____							
FROST									
		HOT Frost							
		Other _____							
OTHER									
		Freezing Mist or Fog							
OTHER NON TC/FAA PROJECTS (DO NOT INCLUDE IN CALENDAR OF COMPLETED TESTS)									
		Other _____							

FOR OFFICE USE ONLY		
Verification of Electronic and Paper Filing	PERSON: _____	DATE: _____

PROCEDURE:
EVALUATION OF ENDURANCE TIMES IN MIXED ICING CONDITIONS WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

301351

PROCEDURE:

EVALUATION OF ENDURANCE TIMES IN MIXED ICING CONDITIONS WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

Winter 2024-25

Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
William J. Hughes Technical Center

Transport Canada
Civil Aviation

Federal Aviation Administration
Flight Standards – Air Carrier Operations

Prepared by: Peter Kitchener

Reviewed by: Benjamin Bernier

Approved by: Marco Ruggi



February 19, 2025
Final Version 1.0

EVALUATION OF ENDURANCE TIMES IN MIXED ICING CONDITIONS WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

Winter 2024-25

1. BACKGROUND

Holdover time (HOT) guidance is currently provided to industry in the form of generic and fluid-specific guidance tables that provide operators time ranges for safe operation after anti-icing in various environmental conditions. Most of the HOT guidance that is currently published has been developed for conditions where only one precipitation type is present.

One of the primary goals of Transport Canada (TC) and the Federal Aviation Administration (FAA)'s ongoing HOT research and development is to maximize operational capabilities for air operators in winter conditions. In recent years, there have been calls from industry to make mixed icing conditions a research priority and to reduce the number of occurrences where operations are restricted by a lack of existing HOT guidance.

To provide continuous improvement to the existing mixed icing conditions guidance, APS Aviation Inc. (APS) provides support to the METAR Working Group (MWG), which includes technical experts and meteorologists from TC, the FAA, APS, and the National Center for Atmospheric Research (NCAR). This support includes participation in meetings, development of project objectives, discussions of technical content, and direction of research efforts.

TC and the FAA tasked APS with developing testing methodologies suitable for evaluating anti-icing fluid performance in mixed icing conditions identified as priorities by the MWG, with the intent to obtain the data necessary to develop HOT guidance for these conditions. These testing methodologies are detailed out in Section 4.

2. OBJECTIVE

The objective of this testing is to conduct endurance time testing in simulated mixed icing conditions.

To satisfy this objective, a series of flat plate fluid endurance time tests will be conducted at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in a variety of conditions including Snow and Freezing Mist, Moderate Rain and Snow, Moderate Snow and Rain, Snow and Freezing Fog, Light Rain and Snow, and Light Snow and Rain.

The data collected will be used to support the development of HOT guidance material for operations in mixed icing conditions and support the research into precipitation rate sensitivity in mixed conditions.

3. TIMING AND TEST PLAN

A total of ten days of testing are expected. The following four main testing objectives will be targeted:

- Snow + Freezing Mist;
- Moderate Rain/Snow + Snow/Rain;
- Snow + Freezing Fog; and
- Light Rain/Snow + Snow/Rain.

Testing will be conducted at the NRC during regular daytime hours of 8:00 am to 4:00 pm. Extra hours after 4 pm will be considered on a day-by-day basis as required. A test calendar is included in Table 3.1.

Table 3.1: Test Calendar

Monday	Tuesday	Wednesday	Thursday	Friday
Feb. 24 **SETUP DAY/ CALIBRATION - DAY 1** NO TESTING	*Feb. 25* **TESTING - DAY 2** Moderate Snow + Rain Guidance Development / Rate Sensitivity Research	*Feb. 26* **TESTING - DAY 3** Moderate Snow + Rain Guidance Development / Rate Sensitivity Research	*Feb. 27* **TESTING - DAY 4** Moderate Snow + Rain Guidance Development / Rate Sensitivity Research	*Feb. 28* **TESTING - DAY 5** Snow + Freezing Fog Light Snow + Rain Research
Mar. 3 **TESTING - DAY 6** Snow + Freezing Mist Guidance Development	*Mar. 4* **TESTING - DAY 7** Snow + Freezing Mist Guidance Development	*Mar. 5* **TESTING - DAY 8** Snow + Freezing Mist Guidance Development	*Mar. 6* **TESTING - DAY 9** Snow + Freezing Mist Guidance Development	*Mar. 7* **TESTING - DAY 10** Snow + Freezing Mist Guidance Development

4. TESTING METHODOLOGY

The NRC CEF is a temperature-controlled facility. Prior to testing, the desired temperature will be set by NRC staff and allowed to stabilize.

Representative Type I/II/III/IV propylene glycol (PG) and ethylene glycol (EG)-based fluids in the 100/0 dilution (10-degree buffer for Type I) shall be evaluated in a variety of mixed icing conditions.

The required fluids are shown in Table 4.1. Fluids that will be used the first day of testing should be placed inside the chamber overnight at the NRC. Fluids should be stored at their test temperature, either inside the chamber or in coolers, a minimum of 12 hours prior to testing.

Table 4.1: Fluids Available for Mixed Icing Tests

Fluid	Type	EG or PG	APS Fluid Code	Dilution	Jugs (L)	Pour Containers (1 L)	Total Fluids (L)
DOW PG ADF Concentrate	I	PG	097A	Conc.	3 x 20 L	8 (empty)	60
CHEMR REG I	I	EG	104A	Conc.	3 x 20 L	8 (empty)	60
Ecowing AD-2	II	PG	083A	100/0	5 x 20 L	8 (empty)	100
AeroClear MAX	III	EG	150A	100/0	5 x 20 L	8 (empty)	100
Polar Guard Advance	IV	PG	068A	100/0	5 x 20 L	8 (empty)	100
EG106	IV	EG	117A	100/0	5 x 20 L	8 (empty)	100
ABC-S Plus	IV	PG	123A	100/0	4 x 20 L	8 (empty)	80
Clearwing EG	IV	EG	093A	100/0	4 x 20 L	8 (empty)	80
ChemR EG IV	IV	EG	075A	100/0	4 x 20 L	8 (empty)	80
Total Fluids							**760**

Subsections 4.1 to 4.4 describe the basic test parameters for the different test sets that will be simulated.

A detailed test matrix (subject to change) is included in Attachment 3, Attachment 4, Attachment 5, and Attachment 6. As this testing is exploratory, changes to the test plan may be proposed and made by APS at the time of testing and will be confirmed by TC/FAA.

4.1 Mixed Snow and Freezing Mist

Mist and fog are commonly reported weather phenomena. Both are considered an obscuration rather than a type of precipitation and can be reported alone or in conjunction with other weather conditions such as snow, freezing rain, et cetera. Mist is defined as a lower-density form of fog rather than as a distinct type of obscuration; mist can reduce visibility to between 0.6 and 1.2 statute miles (~1 to 2 km), whereas fog reduces it to less than 0.6 statute miles (~1 km).

As part of the continuous effort for guidance development and support of separate concurrent research projects, TC/FAA has decided to conduct preliminary tests in conditions involving mixed snow and mist (below 0°C). For these tests, mist will be simulated by producing fog at a lower-than-typical rate.

Figure 4.1 demonstrates the basic test parameters for the mixed condition of mixed snow and freezing mist. When testing freezing mist, a rate of between 0.3 g/dm²/h to 0.4 g/dm²/h should be used at all temperatures. Different sets of test parameters may also be evaluated, based on the initial results obtained.

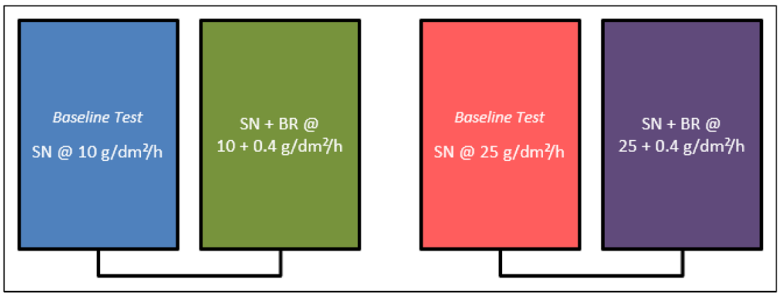


Figure 4.1: Comparative Test Sets (Snow & Freezing Mist)

4.2 Mixed Moderate Rain and Snow, and Moderate Snow and Rain

Rain (RA) consists of liquid water particles either in the form of drops of more than 0.5 mm diameter, or of smaller widely scattered drops. The precipitation rate limits for endurance time testing in moderate rain are 25 and 75 g/dm^2/h. The precipitation rate limits for endurance time testing in moderate snow are 10 and 25 g/dm^2/h.

During the 2022-23 testing in this mixed condition, an analysis of potential baseline conditions for comparison was conducted. It was determined that the "Rain on a Cold-Soaked Wing" condition was the most suitable baseline for comparison. This determination was based on the similarity in the rate limits used in testing (particularly the upper rate limit of 75 g/dm^2/h used in cold-soaked wing conditions).

Figure 4.2 demonstrates the basic test parameters for the mixed condition moderate rain/snow and snow/rain, as conducted, and analysed in the winter of 2024-25. Additional different sets of test parameters may also be evaluated, based on the initial results obtained.

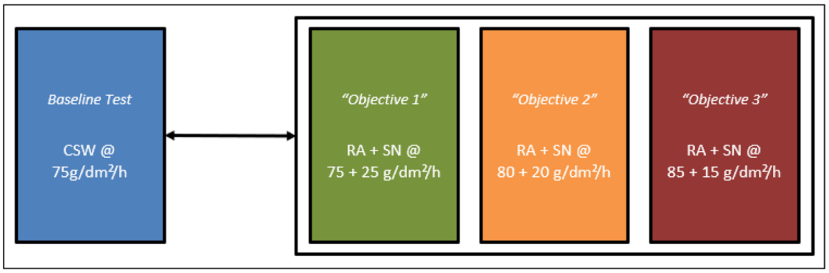


Figure 4.2: Comparative Test Sets (Moderate Snow & Rain)

4.3 Mixed Snow and Freezing Fog – Type I Testing

On behalf of the FAA and TC, APS conducted a series of mixed snow and freezing fog tests in the winter of 2021-22, 2022-23, and 2023-24, which led to the publication of fluid-specific HOTs for this mixed condition. Following the publication of the guidance, the industry continues to express concerns relating to limited operational usability and the duration of some of the shorter HOTs provided for Type I fluids. Testing in this condition has undergone improvements to the snow dispensing cycles to provide better minute-by-minute resolution for the shorter expected endurance times. Continuing the research from 2023-24, the objective is to conduct additional tests at lower freezing fog rates to determine whether a longer protection times for Type I fluids are possible in mixed snow and freezing fog.

Figure 4.3 demonstrates the basic test parameters for the mixed condition of snow mixed with freezing fog. When testing freezing fog, a rate of 1.0 g/dm²/h will be used for warmer temperatures, while a lower rate of 0.7 g/dm²/h will be used for colder temperatures. Different sets of test parameters may also be evaluated, based on the initial results obtained.

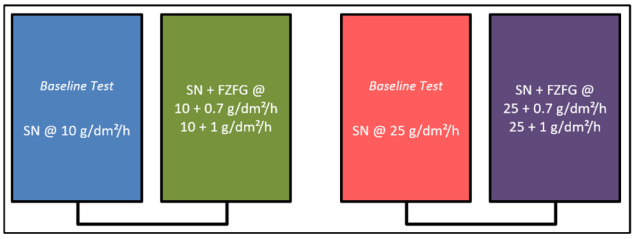


Figure 4.3: Comparative Test Sets (Snow & Freezing Fog)

4.4 Mixed Light Rain and Snow, and Light Snow and Rain

Light Rain (-RA) consists of liquid water particles either in the form of drops of more than 0.5 mm diameter, or of smaller widely scattered drops. The precipitation rate limits for endurance time testing in light rain are 13 and 25 g/dm^2/h. The precipitation rate limits for endurance time testing in light snow are 4 and 10 g/dm^2/h.

During the winter of 2008-09, testing was conducted to evaluate operations in mixed conditions, with a liquid water equivalent (LWE) rate of 25 g/dm²/h, combining 13 g/dm²/h of rain and 12 g/dm²/h of snow at +1°C. The analysis concluded that light freezing rain HOTs could be applied to light snow and rain conditions. Since then, the MWG has emphasized that testing should consider the additive effect of maximum rates for mixed conditions. The current testing aims for this winter is to validate the 2008-09 findings and improve the understanding of rate sensitivity in mixed conditions.

Figure 4.4 demonstrates the basic test parameters for the mixed condition light rain/snow and light snow/rain. Different sets of test parameters may also be evaluated, based on the initial results obtained.

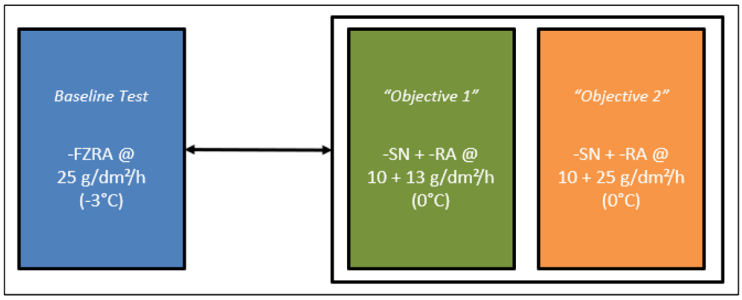


Figure 4.4: Comparative Test Sets (Light Snow & Rain)

5. TESTING PROCEDURE

The following subsections describe the tasks to be performed during each test conducted. The standard HOT testing procedures will be followed and modified as required to accommodate the mixed precipitation testing setup.

5.1 Fluid Application

The steps listed below should be followed for fluid application.

- Hand-pour 1 L of Type II, III, or IV fluid at outside air temperature (OAT) or 1 L of Type I fluid at 20°C over the test plate. The type of fluid poured on the designated test plate will be decided prior to the beginning of the test.
- Record fluid application time and fluid failure time.
- Measure the fluid Brix prior to pouring, the fluid thickness 5 minutes after application, and the Brix at time of fluid failure.
- Photograph the fluid as the test continues until fluid failure and 5 minutes after fluid failure.

5.2 Application of Precipitation

The simulated precipitation that can be generated include the following:

- Freezing Fog at rates of 0.7 or 1 g/dm²/h*;
- Freezing Mist at rates of 0.3 to 0.4 g/dm²/h;
- Snow at rates of 10 or 25 g/dm²/h;
- Rain at rates of 13, 25, 75, 80, or 85 g/dm²/h; and
- Freezing Rain at rates of 25 g/dm²/h.

*These rates were reduced from the usual 2-5 g/dm²/h for HOT testing based on the more recent data collected, which is included in Subsection 5.2.2.

A rate management program will be used to assist in managing the measurement of precipitation rates. When measuring precipitation rates in mixed conditions, a process is followed to ensure both precipitation types are measured correctly.

Firstly, freezing or non-freezing precipitation (e.g., freezing fog, rain) is measured using plastic rate pans across the test stand. Once a consistent and repeatable rate is established across the test stand, frozen precipitation (e.g., snow) is added to the test, using the dispensing method shown in Subsection 5.2.3 for a set period

(typically 10 minutes). The frozen precipitation rate is determined by subtracting the freezing condition rate from the total measured rate.

In addition, precipitation rates are continuously measured at the four corner locations of the test stand, with the average recorded rates serving as the final test rate applicable to the nearby tests (i.e., rate of plate 1 is associated to plates 2 and 3). Adjustments to the recorded endurance times can be made according to the ratio difference in rate to the baseline.

5.2.1 NRC Sprayer Assembly

Simulated precipitation is created using an NRC-developed sprayer assembly, providing a large scan area and appropriate spray uniformity over the test area. The scanner consists of a horizontal main shaft supported by two bearings. The actual spray head assembly is shaft-mounted on a rotating scanner, so that one scan covers a lateral running strip of the testing area. A stepper motor is synchronised to index the relative angle of the spray head between scans along an axis perpendicular to the scan axis. This provides two axes of rotation, essentially an x-y plane, one along each axis. Each scan is consecutively indexed to complete the precipitation coverage of the test bed area. This defines one cycle of the spray unit. The scan rate, index angle, and the number of scans per cycle are adjusted, along with the fluid delivery pressures (water and air) to obtain appropriate droplet sizes and precipitation rates. The sprayer system uses compressed air and distilled water. The sprayer assembly is shown in Photo 5.1.

Photo 5.1: Sprayer Assembly



5.2.2 Simulated Freezing Fog & Mist Rates

Deposition rates for mist were initially quantified during 2020-21. In 2021-22, the research scope expanded to include freezing fog. Previously, freezing fog deposition rates had been quantified in the early 2000s. For more information concerning this study, see Subsection 3 of the TC report, TP 15608E, *Aircraft Ground Icing General Research Activities During the 2023-24 Winter* (1).

The recommended deposition rates for mixed conditions based on the research conducted including simulated freezing fog and mist are provided in the Table 5.1.

Table 5.1: Summary of Simulated Freezing Fog & Mist Deposition Rates

Precipitation Condition	Temperature	Determined Deposition Rates (g/dm²/h)		Deposition Rates to be used for Simulated Testing (g/dm²/h)	
		Min. Rate	Max. Rate	Min. Rate	Max. Rate
Freezing Fog	-3°C and above	0.5	1	0.5	1
	-10°C	0.2	0.7	0.2	0.7
	-14°C	0.1	0.7		
	-25°C	0.1	0.6		
Mist	-3°C and above	0.2	0.4	0.2	0.4
	-10°C	0.1	0.3	0.1	0.3
	-14°C	0.1	0.3		
	-25°C	0.1	0.3		

5.2.3 Simulated Snow (Type II/III/IV Fluids)

Calibration work was completed during the winter of 2021-22 with the purpose of obtaining the dispenser's distribution footprint over two test stands based on the historical data used to support the wind tunnel tests. A series of tests was performed in low-wind conditions using rate pans. Pre-measured amounts of snow were dispersed over the area, and the amount collected by each pan was recorded.

5.2.3.1 Dispensing Snow for NRC Tests

Using the results from these calibration tests, a decision was made to use two dispensers on each side of the two test stands; each of the four dispensers are moved to four different positions along each edge during the dispensing process. Figure 5.1, Figure 5.2, and Figure 5.3 demonstrate the setup of the dispensers in relation to the

stand. Attachment 1 displays the data sheets that will be used during testing in the wind tunnel. These data sheets will provide all the necessary information related to the amount of snow needed, effective rates, and dispenser positions. The precipitation rates will be confirmed using the rate pan method at the time of testing.

5.2.4 Simulated Snow (Type I Fluids)

During the testing of the mixed condition of snow and freezing fog at the NRC CEF in the winter of 2021-22, it was determined that the original snow dispensing methodology was inappropriate for Type I fluids, as the shorter endurance times yielded by Type I fluids were found to be disproportionately impacted by the timing of the five-minute snow application cycle. This was revised to adapt a minute-by-minute resolution of endurance times.

Calibration work was completed prior to changing the methodology at the NRC CEF in a series of tests in low wind conditions using rate pans. Pre-measured amounts of snow were dispersed over the area, and the amount collected by each pan was recorded.

5.2.4.1 Dispensing Snow for NRC Tests

Using the results from these calibration tests, a decision was made to use two dispensers on each side of the two test stands, each dispenser covering one plate; each of the four dispensers are moved to two different positions along each edge during the dispensing process. Figure 5.1, Figure 5.2, and Figure 5.3, demonstrate the setup of the dispensers in relation to the stand. Attachment 1 display the data sheets that will be used during testing in the wind tunnel. These data sheets will provide all the necessary information related to the amount of snow needed, effective rates, and dispenser positions. The precipitation rates will be confirmed using the rate pan method at the time of testing.

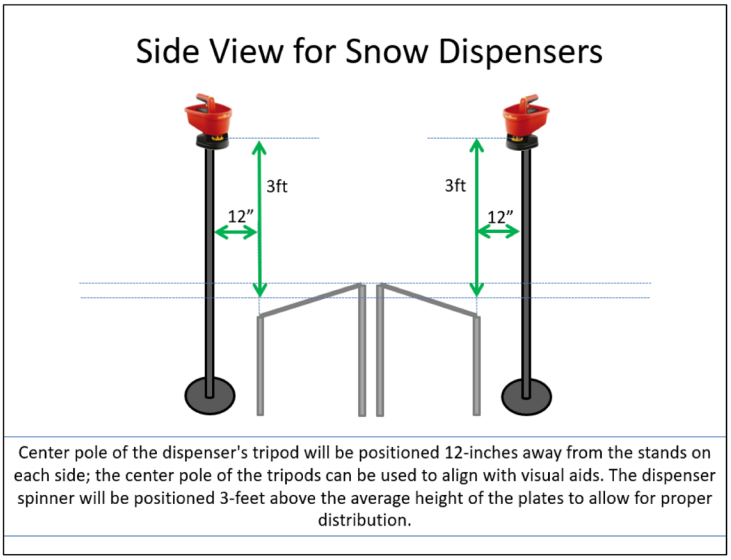


Figure 5.1: Side View of Positioning of Dispenser Relative to the Wing – Snow

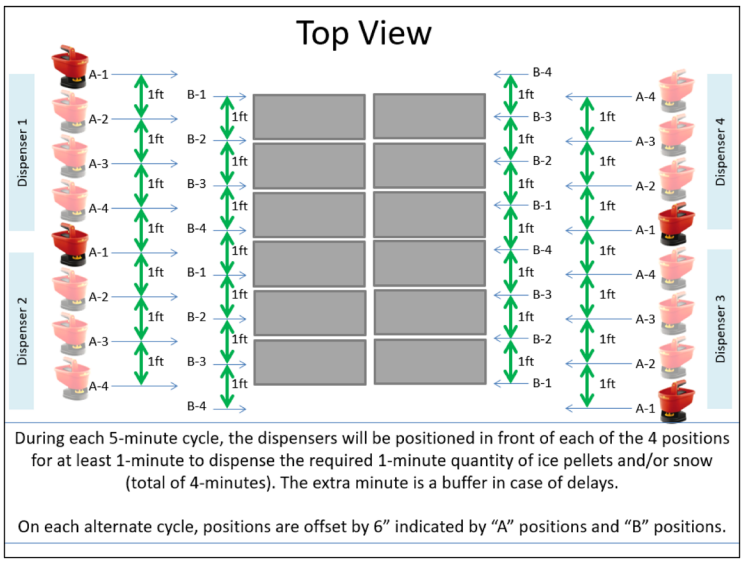


Figure 5.2: Top View of Positioning of Dispenser Relative to the Test Stands

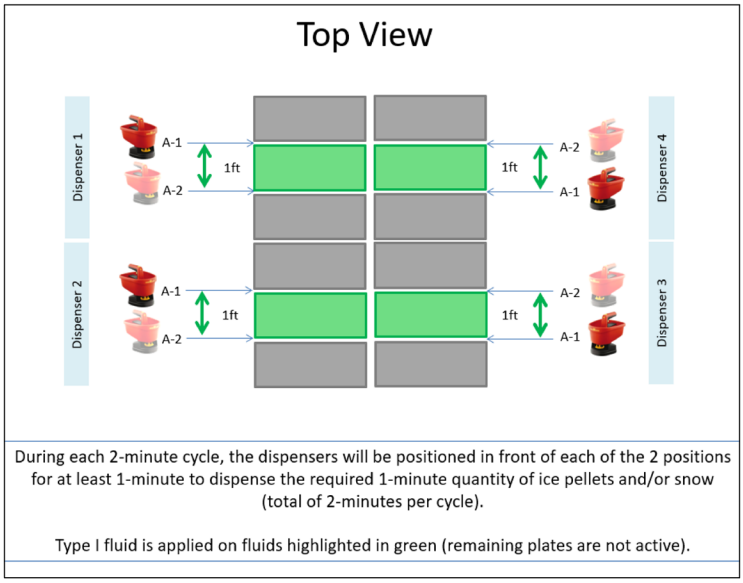


Figure 5.3: Top View of Positioning of Dispenser Relative to the Test Stands

5.3 At the End of Each Test Day

At the end of the testing day, the following tasks must be completed:

- Fluid clean-up and disposal (APS/YOW);
- Download plate temperature data (BB/MQ);
- Update the log of completed tests (PK); and
- Testing debrief meeting with TC and the FAA (MR).

6. PERSONNEL

Six APS staff members are required for the tests at the NRC cold chamber. Six additional persons from Ottawa will be required for making and dispensing the snow. An APS photographer will be required to photograph the testing and to support the remote camera viewing. Table 6.1 demonstrates the personnel required and their associated tasks.

Fluid and snow applications will be performed by APS/YOW personnel at the NRC cold chamber. NRC personnel will operate the NRC cold chamber and operate the sprayer (if requested).

Table 6.1: Personnel List

APS Personnel List	
Person	**Responsibility**
Marco Ruggi (MR)	Project Manager / TC FAA Liaison
John D'Avirro (JD)	SME and Remote Support
Benjamin Bernier (BB)	Rate Manager / Fluid Manager (inventory and application) / YOW Pers. Manager
Marc Quesnel (MQ)	Data Collection / Rate Support / Snow Dispensing and Production Manager
Peter Kitchener (PK)	Testing Manager / Data Documentation (Forms, logs, etc.)
Salvatore Rosato (SR)	Remote Camera Setup
APS YOW Personnel List	
Person	**Responsibility**
Photographer (SN)	Photography / Remote Camera Maintenance
Steve Baker (STB)	General Support Lead
YOW 1	Fluids / Snow Manufacturing / Dispensing
YOW 2	Fluids / Snow Manufacturing / Dispensing
YOW 3	Fluids / Snow Manufacturing / Dispensing
YOW 4	Fluids / Snow Manufacturing / Dispensing
YOW 5	Snow Manufacturing

7. EQUIPMENT

Table 7.1 provides a list of required equipment.

Table 7.1: Equipment List

EQUIPMENT	STATUS		EQUIPMENT	STATUS
General Support and Testing Equipment			**Camera Equipment**	
Brixometer x 3			4K IP Camera with tripod mounts x 4	
Clock (Large digital) x 2			Ethernet Cable (150 ft) x 5	
Extension cords (power bars x 6 + reels x 4)			Manfrotto® arms and mounts suitcase	
Flashlights x 2			Monitor with VGA cable	
Fluids (separate table)			NVR Receiver	
Folding Shelves x2			Osmo®/GoPro® Cameras + accessories	
Freezers x 3			Power Cables for monitor and receiver x 2	
Gloves: black (thermal layer) x12			Remote camera system	
Gloves: cotton (a lot)			Photography laptop with mouse/charger	
Gloves: latex (a lot)			SpaceX Starlink® System	
Hard water chemicals x 5 premixes				
Inclinometer (yellow level) x 2			**Snow Fabrication Equipment**	
Isopropyl x 12			Adherence Probes Kit	
Ladders x 4			Blenders x 12 in good condition	
Lock for truck			Folding tables (3 large, 2 small)	
Marker for Waste x 2			Ice bags	
Measuring Cups x 3			Snow control wires and boxes	
Paper towel (blue shop towel) x 40			Snow dispersers x 12	
Personnel clothing (testing coats/boots)			Sieves (solid base, 1.4 mm, 4 mm) x 2 each	
Pour containers: (1-litre) - 8 empty			Stands for Snow dispensing devices x 6	
Pour containers: (1-litre) - see list of fluids			Snow Styrofoam containers x40	
Printer & Ink Cartridge			Measuring cups (1 L + 1 cup/smaller)	
Rain Suits x 5			Ohaus 30KG scale	
Rate Pan (aluminum HOT) x1			Steel Frame Canopy x2 (10x5)	
Rate Pans (white plastic) x all			Rubber Mats x 4	
Sample bottles x 6			Wooden Spoons	
Ohaus weigh scales x 2				
Scrapers x 14			**Office Equipment**	
Shop Vac + 2x18 L open top pails			Blank Waterproof labels (1 page)	
SmartButton kits x 2 + extension wire			Calculators x 3	
Squeegees x 4 (small)			Clip boards x 5	
Tape: Duct tape x 2			Data Forms (on water phobic paper)	
Tape: Electrical tape x 5			Dry eraser markers	
Tape: Speed tape x 1			Envelopes (9x12) x box	
Tape measurer (large yellow + small)			Falling Ball Viscometer + Syringes	
Temperature probes: immersion x 3			File box x 2	
Temperature probes: surface x 3			Hard drive (if necessary)	
Test plate covers (white plastic) x 12			iPad® x 1	
Test plate covers (wooden boards) x 12			Laptop for Rate Station and SmartButtons	
Test Plates: Composite Full Plates x 4			Mouse for Rate Station and keypad	
Test Plates: Full plates x 12 w/buttons			Paper for printer x 1 pack	
Test Stand Collection Pans (one per stand)			Pencils + pens + markers	
Test Stand Shims (poker chips) x 1 box			Scissors	
Test Stands: 2 x Short 6-position			Test Procedures x 5	
Thickness Gauges: 4 rectangles			Walkie Talkies and Accessories x 12	
Thickness Gauges: 4 octagons			Waterproof paper (40 sheets)	
Type I Mixing Jug			Plastic Failure Rings (a lot)	
Vise grip (large) + rubber opener			Tuques x 10	
Water (4 x 18 L) for hard water				
Whatman paper kit + dye				
White poster board panels for water run-off				

8. PRE-TESTING AND TESTING ACTIVITIES

Table 8.1 demonstrates the activities that will be completed prior to arriving at the NRC.

Table 8.1: Task List for Setup and Actual Tests

No.	Task	Person	Status
	Planning and Preparation		
1	Coordinate with NRC personnel and check status of chamber	MR	
2	Ensure fluid is received and ready to be transported to NRC	PK/BA	
3	Arrange for hotel accommodations for APS personnel	JS	
4	Arrange truck rental	JS	
5	Arrange for ice delivery	JS	
6	Order walkie talkies	JS	
7	Organize personnel travel to Ottawa;	MR	
8	Hire YOW personnel	MR/FDL	
9	Complete contract for YOW personnel	FDL	
10	Coordinate with APS photographer	MR	
11	Prepare and arrange office materials for YOW	PK	
12	Prepare data forms and procedure	PK	
13	Prepare Test Log	PK	
14	Update (as necessary) fluid viscosity log, and have available viscosity of fluids	PK	
15	Finalize and complete list of equipment/materials required	PK/ALL	
16	Prepare and arrange site equipment for YOW	PK/BA	
17	Ensure proper functioning of snow dispenser equipment;	MR	
18	Prepare fluid pouring containers	BA//TGPK	
19	Review SN dispersal techniques and location	BB/MR/PK	
20	Update SN order form (if necessary)	BB/MR/PK	
21	Complete purchase list and shopping	PK	
22	Pack and leave YUL for YOW	APS	
23	Mark plates with plate numbers on back and front – marking should be at bottom	BA	
24	Calibrate snow dispensers for the NRC set-up	MQ/BA	
25	Conduct fluid variability calibration for simulated snow	MQ/BA	
26	Rate pans: check quantity, check properly labelled, and verify spares available	PK/BA	
27	Equip plates with operational and verified thermistors or SmartButtons	BA/BB	
28	Prepare coded labels for pour containers as per fluids list	AG	
29	Check laptops (2) work for rate station	BB	
30	Review "NRC Rate Station 101"	BB	
31	Confirm NRC availability of camera system + black shelving unit	MR	
32	Confirm NRC Setup Waste tote + floor mats in chamber for setup day	STB	
33	Confirm NRC availability of rate monitoring system	BB	
34	Confirm NRC that the freezer works and is on the day before testing	BB	
35	Confirm NRC will set up test area temperature sensors for morning of test	MR	
36	Confirm NRC will have hallways and chamber are free of clutter	MR	
37	Arrange special video camera equipment for monitoring and recording tests	BA	
	Setup Day		
38	General safety briefing and update on testing	APS/NRC/YOW	
39	Unload Truck and organize equipment	APS	
40	Verify and organize fluid	PK/STB	
41	Confirm ice delivery	BB	
42	Setup general office and testing equipment, confirm printer and projector available	PK	
43	Setup SN manufacturing material in cold chamber	STB	
44	Test and prepare SN dispensing equipment	STB	
45	Coordinate fabrication of snow	MQ/STB	
46	Setup still and video cameras	SR/SN	
47	Verify photo and video requirements	SN/MR	
	Testing Day 1		
48	Train SN making personnel (ongoing) and continue SN manufacturing	STB/YOW	
49	Start Testing	APS/NRC	

Table 8.1: Task List for Setup and Actual Tests (cont'd)

No.	Task	Person	Status
	Each Testing Day		
50	Deicide personnel requirements for following day for 24 hour notice	MR	
51	Prepare equipment and fluid to be used for test	BB	
52	Manufacture snow	MQ/YOW	
53	Prepare photography equipment	SN	
54	Prepare data forms for test	PK	
55	Conduct tests based on test plan	APS	
56	Modify test plan based on results obtained	TC/FAA/JD/MR	
57	Update snow, raw ice, and fluid inventory (end of day)	MQ/YOW	
58	Update fluid inventory (2 container left warning)	BB/STB	
59	Update test log and test plan (ongoing and end of day)	PK/MR	

9. SAFETY

Managers of the project must ensure that personnel involved in the setup and conduct of their respective projects are aware of the below.

- A safety briefing will be done on the first day of testing.
- Personnel should be familiar with NRC emergency procedures, i.e., DO NOT CALL 9-1-1, instead, call the NRC Emergency Center as they will contact and direct the necessary services.
- Fluid SDS sheets are available for review.
- Canadian Standards Association (CSA) approved footwear and appropriate clothing for frigid temperatures are to be worn by all personnel.
- Waterproof clothing and gloves are available.
- Fluid(s) should only be handled with protective gloves. If any fluid gets onto the skin, wash the affected area thoroughly.
- Rubber mats must be properly placed in and around the test area and cleaned as necessary.
- Care should be taken when circulating near the test stand due to slipperiness.
- If fluid comes into contact with skin, rinse hands under running water.
- If fluid comes into contact with eyes, flush with the portable eye wash station.
- First aid kit, water and fire extinguisher are available.
- All NRC safety guidelines must be followed.

A separate safety training may be required by NRC that staff will be required to complete prior to the start of testing.

Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

10. DATA FORMS

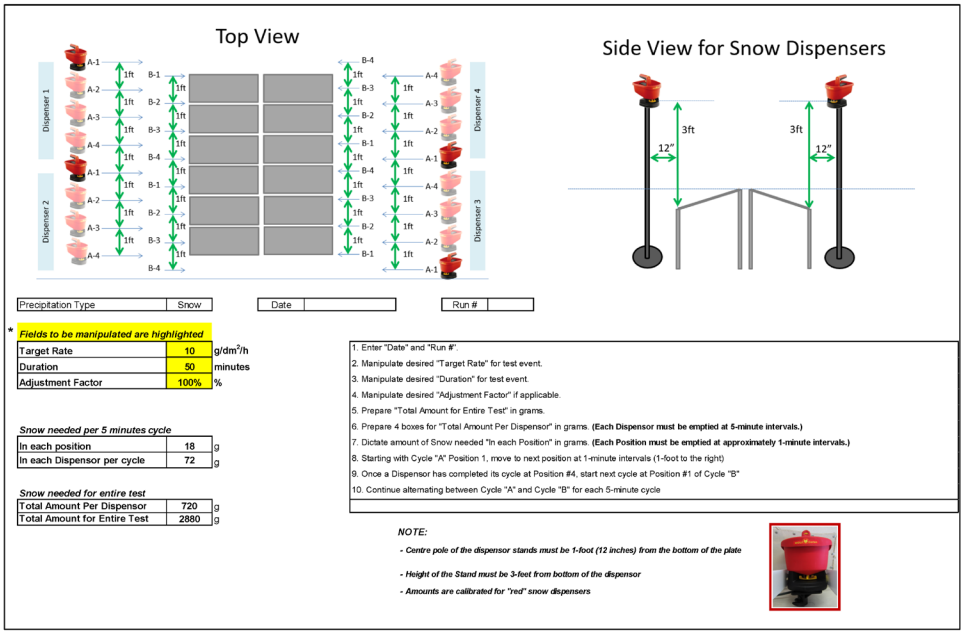
A snow dispensing form for calculating snow quantities required for each test is included in the data form used to record the endurance time for any of the conditions being completed is shown in Attachment 1. An additional endurance time testing form to be used for all tests is included in Attachment 2.

11. REFERENCES

1. APS Aviation Inc., *Aircraft Ground Icing General Research Activities During the 2023-24 Winter*, APS Aviation Inc., Transport Canada, Montreal, December 2024, TP 15608, XX (to be published).

EVALUATION OF ENDURANCE TIMES IN MIXED ICING CONDITIONS WITH SAE TYPE I, II, III, AND IV DE/ANTI-ICING FLUIDS

Attachment 1: Example of Snow Dispensing Form



Precipitation Type	Snow	Date		Run #	

* *Fields to be manipulated are highlighted*

Target Rate	10	g/dm²/h
Duration	50	minutes
Adjustment Factor	100%	%

Snow needed per 5 minutes cycle

In each position	18	g
In each Dispensor per cycle	72	g

Snow needed for entire test

Total Amount Per Dispensor	720	g
Total Amount for Entire Test	2880	g

1. Enter "Date" and "Run #".
2. Manipulate desired "Target Rate" for test event.
3. Manipulate desired "Duration" for test event.
4. Manipulate desired "Adjustment Factor" if applicable.
5. Prepare "Total Amount for Entire Test" in grams.
6. Prepare 4 boxes for "Total Amount Per Dispensor" in grams. **(Each Dispensor must be emptied at 5-minute intervals.)**
7. Dictate amount of Snow needed "In each Position" in grams. **(Each Position must be emptied at approximately 1-minute intervals.)**
8. Starting with Cycle "A" Position 1, move to next position at 1-minute intervals (1-foot to the right)
9. Once a Dispensor has completed its cycle at Position #4, start next cycle at Position #1 of Cycle "B"
10. Continue alternating between Cycle "A" and Cycle "B" for each 5-minute cycle

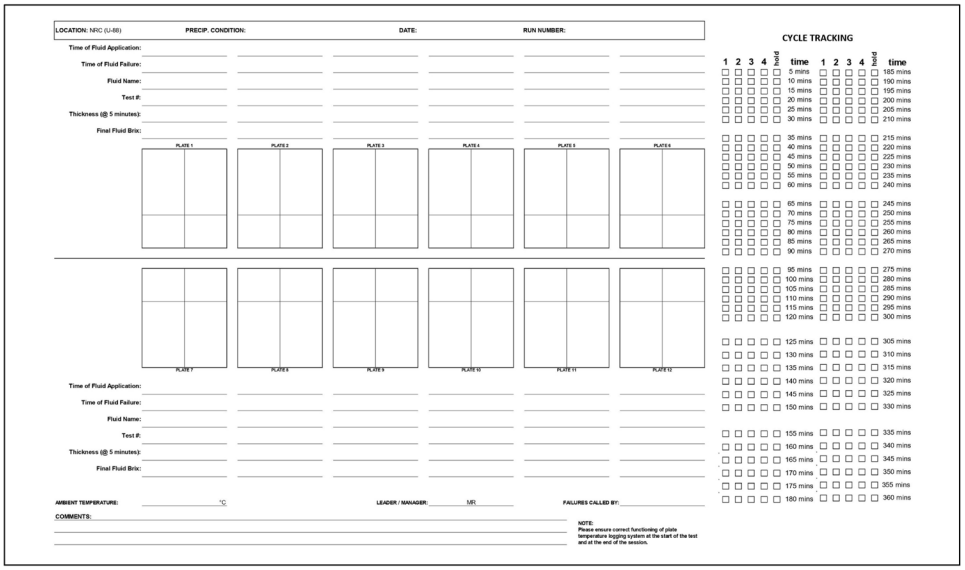
NOTE:

- Centre pole of the dispensor stands must be 1-foot (12 inches) from the bottom of the plate

- Height of the Stand must be 3-feet from bottom of the dispensor

- Amounts are calibrated for "red" snow dispensers

Attachment 2: Example of Endurance Time Data Form



Attachment 3: Proposed Test Plan for Testing Snow and Freezing Mist

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	BR Rate (g/dm²/h)
1	1	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	20°c	10	0.4
2	1	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -3, 10+0.4	Composite	-3	20°c	10	0.4
3	1	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	20°c	10	0.4
4	1	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -3, 10+0.4	Composite	-3	20°c	10	0.4
5	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
6	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
7	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
8	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
9	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
10	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
11	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
12	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -3, 10+0.4	Aluminum	-3	OAT	10	0.4
13	2	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	20°c	25	0.4
14	2	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -3, 25+0.4	Composite	-3	20°c	25	0.4
15	2	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	20°c	25	0.4
16	2	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -3, 25+0.4	Composite	-3	20°c	25	0.4
17	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
18	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
19	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
20	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
21	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
22	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
23	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
24	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -3, 25+0.4	Aluminum	-3	OAT	25	0.4
25	3	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-3	20°c	10	0.4
26	3	SNBR	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Mist, -14, 10+0.4	Composite	-3	20°c	10	0.4
27	3	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-3	20°c	10	0.4

Attachment 3: Proposed Test Plan for Testing Snow and Freezing Mist (Cont'd)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	BR Rate (g/dm²/h)
28	3	SNBR	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Mist, -14, 10+0.4	Composite	-3	20°C	10	0.4
29	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-3	OAT	10	0.4
30	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-3	OAT	10	0.4
31	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-3	OAT	10	0.4
32	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-14	OAT	10	0.4
33	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-14	OAT	10	0.4
34	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-14	OAT	10	0.4
35	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-14	OAT	10	0.4
36	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -14, 10+0.4	Aluminum	-14	OAT	10	0.4
37	3	SNBR	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	20°C	25	0.4
38	3	SNBR	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Mist, -14, 25+0.4	Composite	-14	20°C	25	0.4
39	3	SNBR	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	20°C	25	0.4
40	3	SNBR	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Mist, -14, 25+0.4	Composite	-14	20°C	25	0.4
41	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
42	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
43	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
44	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
45	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
46	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
47	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
48	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -14, 25+0.4	Aluminum	-14	OAT	25	0.4
49	3	SNBR	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	20°C	10	0.4
50	2	SNBR	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Mist, -25, 10+0.4	Composite	-25	20°C	10	0.4
51	3	SNBR	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	20°C	10	0.4
52	3	SNBR	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Mist, -25, 10+0.4	Composite	-25	20°C	10	0.4
53	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
54	1	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
55	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4

Attachment 3: Proposed Test Plan for Testing Snow and Freezing Mist (Cont'd)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	BR Rate (g/dm²/h)
56	1	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
57	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
58	1	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
59	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
60	1	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -25, 10+0.4	Aluminum	-25	OAT	10	0.4
61	3	SNBR	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	20°c	25	0.4
62	3	SNBR	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Mist, -25, 25+0.4	Composite	-25	20°c	25	0.4
63	3	SNBR	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	20°c	25	0.4
64	3	SNBR	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Mist, -25, 25+0.4	Composite	-25	20°c	25	0.4
65	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
66	2	SNBR	Ecowing AD-2	100/0	083A	II	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
67	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
68	2	SNBR	AeroClear MAX	100/0	150A	III	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
69	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
70	2	SNBR	Polar Guard Advance	100/0	068A	IV-PG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
71	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
72	2	SNBR	EG106	100/0	117A	IV-EG	Snow + Freezing Mist, -25, 25+0.4	Aluminum	-25	OAT	25	0.4
73	1	SN	AeroClear MAX	100/0	150A	III	Snow, -3, 10	Aluminum	-3	OAT	10	0
74	1	SN	AeroClear MAX	100/0	150A	III	Snow, -3, 10	Aluminum	-3	OAT	10	0
75	1	SN	EG106	100/0	117A	IV-EG	Snow, -3, 10	Aluminum	-3	OAT	10	0
76	1	SN	EG106	100/0	117A	IV-EG	Snow, -3, 10	Aluminum	-3	OAT	10	0
77	2	SN	AeroClear MAX	100/0	150A	III	Snow, -3, 25	Aluminum	-3	OAT	25	0
78	2	SN	AeroClear MAX	100/0	150A	III	Snow, -3, 25	Aluminum	-3	OAT	25	0
79	2	SN	EG106	100/0	117A	IV-EG	Snow, -3, 25	Aluminum	-3	OAT	25	0
80	2	SN	EG106	100/0	117A	IV-EG	Snow, -3, 25	Aluminum	-3	OAT	25	0
81	1	SN	AeroClear MAX	100/0	150A	III	Snow, -14, 10	Aluminum	-14	OAT	10	0
82	1	SN	AeroClear MAX	100/0	150A	III	Snow, -14, 10	Aluminum	-14	OAT	10	0
83	1	SN	EG106	100/0	117A	IV-EG	Snow, -14, 10	Aluminum	-14	OAT	10	0

Attachment 3: Proposed Test Plan for Testing Snow and Freezing Mist (Cont'd)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	BR Rate (g/dm²/h)
84	1	SN	EG106	100/0	117A	IV-EG	Snow, -14, 10	Aluminum	-14	OAT	10	0
85	2	SN	AeroClear MAX	100/0	150A	III	Snow, -14, 25	Aluminum	-14	OAT	25	0
86	2	SN	AeroClear MAX	100/0	150A	III	Snow, -14, 25	Aluminum	-14	OAT	25	0
87	2	SN	EG106	100/0	117A	IV-EG	Snow, -14, 25	Aluminum	-14	OAT	25	0
88	2	SN	EG106	100/0	117A	IV-EG	Snow, -14, 25	Aluminum	-14	OAT	25	0
89	1	SN	AeroClear MAX	100/0	150A	III	Snow, -25, 10	Aluminum	-25	OAT	10	0
90	1	SN	AeroClear MAX	100/0	150A	III	Snow, -25, 10	Aluminum	-25	OAT	10	0
91	1	SN	EG106	100/0	117A	IV-EG	Snow, -25, 10	Aluminum	-25	OAT	10	0
92	1	SN	EG106	100/0	117A	IV-EG	Snow, -25, 10	Aluminum	-25	OAT	10	0
93	2	SN	AeroClear MAX	100/0	150A	III	Snow, -25, 25	Aluminum	-25	OAT	25	0
94	2	SN	AeroClear MAX	100/0	150A	III	Snow, -25, 25	Aluminum	-25	OAT	25	0
95	2	SN	EG106	100/0	117A	IV-EG	Snow, -25, 25	Aluminum	-25	OAT	25	0
96	2	SN	EG106	100/0	117A	IV-EG	Snow, -25, 25	Aluminum	-25	OAT	25	0

Attachment 4: Proposed Test Plan for Testing Moderate Rain Mixed with Snow

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	RA Rate (g/dm²/h)
1	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
2	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
3	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
4	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
5	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
6	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
7	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
8	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 75 + 25	Aluminum	0	OAT	25	75
9	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
10	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
11	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
12	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
13	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
14	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
15	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
16	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 80 + 20	Aluminum	0	OAT	20	80
17	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
18	1	RASN	Ecowing AD-2	100/0	083A	II	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
19	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
20	1	RASN	AeroClear MAX	100/0	150A	III	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
21	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
22	1	RASN	Polar Guard Advance	100/0	068A	IV-PG	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
23	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
24	1	RASN	EG106	100/0	117A	IV-EG	Moderate Rain + Snow, 0, 85 + 15	Aluminum	0	OAT	15	85
25	1	RA	Ecowing AD-2	100/0	083A	II	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75
26	1	RA	Ecowing AD-2	100/0	083A	II	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75
27	1	RA	AeroClear MAX	100/0	150A	III	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75

Attachment 4: Proposed Test Plan for Testing Moderate Rain Mixed with Snow (Cont'd)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	RA Rate (g/dm²/h)
28	1	RA	AeroClear MAX	100/0	150A	III	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75
29	1	RA	EG106	100/0	117A	IV-EG	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75
30	1	RA	EG106	100/0	117A	IV-EG	Rain on Cold-Soaked Wing, 1, 75	Aluminum	1	OAT	0	75

Attachment 5: Proposed Test Plan for Testing Snow Mixed with Freezing Fog (Type I)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	FZFG Rate (g/dm²/h)
1	2	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 10+2	Aluminum	-14	20°C	10	2
2	2	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 10+2	Composite	-14	20°C	10	2
3	2	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 10+2	Aluminum	-14	20°C	10	2
4	2	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 10+2	Composite	-14	20°C	10	2
5	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 10+2	Aluminum	-25	20°C	10	2
6	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 10+2	Composite	-25	20°C	10	2
7	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 10+2	Aluminum	-25	20°C	10	2
8	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 10+2	Composite	-25	20°C	10	2
9	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 25+2	Aluminum	-25	20°C	25	2
10	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 25+2	Composite	-25	20°C	25	2
11	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 25+2	Aluminum	-25	20°C	25	2
12	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 25+2	Composite	-25	20°C	25	2
13	1	SNFZFG	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Fog, -3, 10+1	Aluminum	-3	20°C	10	1
14	1	SNFZFG	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Fog, -3, 10+1	Composite	-3	20°C	10	1
15	1	SNFZFG	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Fog, -3, 10+1	Aluminum	-3	20°C	10	1
16	1	SNFZFG	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Fog, -3, 10+1	Composite	-3	20°C	10	1
17	1	SNFZFG	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Fog, -3, 25+1	Aluminum	-3	20°C	25	1
18	1	SNFZFG	PG ADF Concentrate	33/67	097A	I-PG	Snow + Freezing Fog, -3, 25+1	Composite	-3	20°C	25	1
19	1	SNFZFG	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Fog, -3, 25+1	Aluminum	-3	20°C	25	1
20	1	SNFZFG	CHEMR REG I	28/73	104A	I-EG	Snow + Freezing Fog, -3, 25+1	Composite	-3	20°C	25	1
21	2	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 10+0.7	Aluminum	-14	20°C	10	0.7
22	2	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 10+0.7	Composite	-14	20°C	10	0.7
23	2	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 10+0.7	Aluminum	-14	20°C	10	0.7
24	2	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 10+0.7	Composite	-14	20°C	10	0.7
25	3	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 25+0.7	Aluminum	-14	20°C	25	0.7
26	3	SNFZFG	PG ADF Concentrate	46/54	097A	I-PG	Snow + Freezing Fog, -14, 25+0.7	Composite	-14	20°C	25	0.7
27	3	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 25+0.7	Aluminum	-14	20°C	25	0.7

Attachment 5: Proposed Test Plan for Testing Snow Mixed with Freezing Fog (Type I) (cont'd)

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	FZFG Rate (g/dm²/h)
28	3	SNFZFG	CHEMR REG I	43/57	104A	I-EG	Snow + Freezing Fog, -14, 25+0.7	Composite	-14	20°C	25	0.7
29	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 10+0.7	Aluminum	-25	20°C	10	0.7
30	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 10+0.7	Composite	-25	20°C	10	0.7
31	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 10+0.7	Aluminum	-25	20°C	10	0.7
32	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 10+0.7	Composite	-25	20°C	10	0.7
33	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 25+0.7	Aluminum	-25	20°C	25	0.7
34	3	SNFZFG	PG ADF Concentrate	55/45	097A	I-PG	Snow + Freezing Fog, -25, 25+0.7	Composite	-25	20°C	25	0.7
35	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 25+0.7	Aluminum	-25	20°C	25	0.7
36	3	SNFZFG	CHEMR REG I	53/47	104A	I-EG	Snow + Freezing Fog, -25, 25+0.7	Composite	-25	20°C	25	0.7

Attachment 6: Proposed Test Plan for Testing Light Rain Mixed with Snow

Test No.	Priority	Precip. Cond.	Fluid Name	Dilution	APS Fluid Code	Fluid Type	Precipitation	Test Surface	Test Temp. (°C)	Fluid Temp. (°C)	SN Rate (g/dm²/h)	RA Rate (g/dm²/h)
1	1	-SNRA	Ecowing AD-2	100/0	083A	II	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
2	1	-SNRA	Ecowing AD-2	100/0	083A	II	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
3	1	-SNRA	AeroClear MAX	100/0	150A	III	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
4	1	-SNRA	AeroClear MAX	100/0	150A	III	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
5	1	-SNRA	Polar Guard Advance	100/0	068A	IV-PG	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
6	1	-SNRA	Polar Guard Advance	100/0	068A	IV-PG	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
7	1	-SNRA	EG106	100/0	117A	IV-EG	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
8	1	-SNRA	EG106	100/0	117A	IV-EG	Light Snow + Rain, 0, 10+13	Aluminum	0	OAT	10	13
9	1	-SNRA	Ecowing AD-2	100/0	083A	II	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
10	1	-SNRA	Ecowing AD-2	100/0	083A	II	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
11	1	-SNRA	AeroClear MAX	100/0	150A	III	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
12	1	-SNRA	AeroClear MAX	100/0	150A	III	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
13	1	-SNRA	Polar Guard Advance	100/0	068A	IV-PG	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
14	1	-SNRA	Polar Guard Advance	100/0	068A	IV-PG	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
15	1	-SNRA	EG106	100/0	117A	IV-EG	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
16	1	-SNRA	EG106	100/0	117A	IV-EG	Light Snow + Rain, 0, 10+25	Aluminum	0	OAT	10	25
17	1	-FZRA	Ecowing AD-2	100/0	083A	II	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
18	1	-FZRA	Ecowing AD-2	100/0	083A	II	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
19	1	-FZRA	AeroClear MAX	100/0	150A	III	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
20	1	-FZRA	AeroClear MAX	100/0	150A	III	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
21	1	-FZRA	Polar Guard Advance	100/0	068A	IV-PG	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
22	1	-FZRA	Polar Guard Advance	100/0	068A	IV-PG	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
23	1	-FZRA	EG106	100/0	117A	IV-EG	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25
24	1	-FZRA	EG106	100/0	117A	IV-EG	Light Freezing Rain, -3, 25	Aluminum	-3	OAT	0	25

PROCEDURE:
OVERALL PROGRAM OF TESTS AT NRC, MARCH 2025

301351

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OVERALL PROGRAM OF TESTS AT NRC, MARCH 2025

Winter 2024-25

Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
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Federal Aviation Administration
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March 14, 2025
Final Version 1.0

OVERALL PROGRAM OF TESTS AT NRC, MARCH 2025

Winter 2024-25

1. INTRODUCTION

This document was prepared to bring together several elements of a project that require testing at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, Ontario. Tests will be carried out from March 17 to March 28, 2025.

The primary objective of the test session is to measure the endurance times of new de/anti-icing fluids. Thickness testing for new de/anti-icing fluids will be scheduled around the endurance time (ET) tests as time and space permit. This document provides the schedule, personnel, fluid, and equipment requirements for the project.

A tentative test schedule is included in Figure 1.

2. PROJECTS, PROCEDURES, AND OBJECTIVES

The projects that will be carried out at the March 2025 NRC test session are listed in this section. Each project has been given a shortened name (shown in brackets following the full title), which is used in subsequent sections of this document. A description of each project, its objective, and its test procedure is provided. The test procedures for some projects are provided in separate detailed documents, which are referenced in the appropriate subsection and listed in Section 9.

General comments on procedures and setup are listed below.

- There will be two test stands positioned under the sprayer (known as the main stand with two 6-position stands) and an additional stand that will be positioned outside the spray area in the small end of the climate chamber. The test stands should be situated in the cold chamber as per the measurements provided in Figure 2.
- A complex rate management program was developed in the early 2000s to assist in managing the measurement of precipitation rates. An update to the interface of this program was completed in 2014. This program will be used.
- To further assist in rate management, NRC has developed a precipitation rate monitoring system. This system will be positioned on a 1-position stand next to the main stand.
- Cameras will be set up around the test stands to allow for remote viewing of the test session.

2.1 Endurance Times of New Fluids (New Fluid ETs)

The objective of this project is to measure endurance times of new fluids. This will include Type II and Type IV fluid tests, listed as follows:

- New Type II fluid: coded as 161A (100/0 only);
- New Type II fluid: coded as 169A, 170A, and 171A (100/0, 75/25, and 50/50);
- New Type IV fluid: coded as 162A (100/0 only);
- New Type IV fluid: coded as 163A (100/0 only);
- New Type IV fluid: coded as 164A (100/0 only);
- New Type IV fluid: coded as 168A (100/0 only);
- New Type IV fluid: coded as 172A (100/0 only); and
- New Type IV fluid: coded as 173A (100/0 only).

Each fluid will be tested over the entire range of freezing precipitation conditions encompassed by the holdover time (HOT) table format that applies to its fluid type.

Endurance time tests will be carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485B, *Endurance Time Test Procedures for SAE Type II/III/IV Aircraft Deicing/Anti-Icing Fluids* (1), except as noted.

The procedure for conducting endurance time tests is given in the document *Endurance Time Testing in Simulated Freezing Precipitation with SAE Type I, II, III, and IV De/Anti-Icing Fluids* (2). Cold-soak boxes should be prepared using the procedure provided in Attachment 1.

The test plan for new fluid endurance time tests is given in Table 1. All tests will be conducted on the main test stand.

2.2 Thickness of New Fluids (New Fluid Thickness)

The objective of these tests is to measure the thickness of new fluids on flat plates. The procedure for these tests is entitled *Experimental Program to Establish Film Thickness Profiles for De-Icing and Anti-Icing Fluids on Flat Plates* (3) and can be found in Appendix I of the Transport Canada (TC) report, TP 13991E, *Aircraft Ground De/Anti-Icing Fluid Holdover Time and Endurance Time Testing Program for the 2001-02 Winter* (4). All tests will be conducted with fluid at -3°C.

The test plan for fluid thickness tests is given in Table 2. The tests will be conducted at the small end of the chamber outside of the spray area.

3. PERSONNEL REQUIREMENTS/RESPONSIBILITIES

The personnel requirements and responsibilities are provided in Table 3.

4. FLUIDS

The required fluids and fluid quantities are shown in Table 4. Fluids that will be used during the first day of testing should be placed inside the chamber overnight at the NRC. Note that fluids should be stored at their test temperature, either inside the chamber or in the coolers, a minimum of 12 hours prior to testing.

5. PRE-TESTING SETUP ACTIVITIES

The following activities need to be completed prior to the arrival at the NRC:

1. Mark plates with plate numbers on back and front – marking should be at bottom (BA/PK);
2. Locate rate pans: check quantity, check all pans are properly labelled, and verify spares are available (BA/CB);
3. Ensure plates are equipped with operational and verified thermistors or SmartButtons, and make sure they are set for logging the whole session (BA/BB);
4. Prepare coded labels for pour containers as per fluids list (if needed) (AG);
5. Ensure fluids are prepared in advance according to Table 4 (BA);
6. Clean and label 1 L pour containers (BA);
7. Check laptops work for rate station (BB);
8. Review “NRC Rate Station 101” (BB);
9. Rent cube truck (JS/YT);
10. Book hotel (JS/YT);
11. Print data forms and procedures (AG);
12. Print chamber condition sheets (AG);
13. Contact Medhat (JD/CB):
    - Confirm availability of NRC camera system + black shelving unit;
    - Waste tote + floor mats in chamber for setup day;
    - Cold-soak fluid + wooden stand + pump in chamber for setup day;

- Rate monitoring system;
- Update chamber settings file with the latest data available;
- Make sure that the freezer works and is ON the day before testing;
- Set up test area temperature sensors for morning of test;
- Have the desks in the test area and in the NRC office cleaned up and available to avoid mixing up NRC/APS Aviation Inc. (APS) equipment;
- Ensure hallways and chamber are free of clutter;
- Make sure dryer is operational and hooked up; and
- Confirm daily start time (JD).

14. Ensure sufficient propylene glycol (PG) fluid is available for cold-soak boxes and get more if necessary (BB);
15. Put cold-soaked wing (CSW) fluid into freezer at -30°C (BB);
16. Make all necessary purchases prior to NRC (BA);
17. Ensure fluids for research projects are available (BA/JD);
18. Determine team travel plans and daily start times (JD) (arrive at 8:00 AM, first rate at 8:30 AM);
19. Measure falling ball and viscosity of HOT fluids (AG/PK);
20. Confirm lowest operational use temperature (LOUT) of all Type II, III, and IV fluids (JD/AG);
21. If any LOUTs are -29.5°C or colder, schedule testing in freezing fog at the LOUT (CB/JD);
22. Provide final test plan to data form programmer (CB);
23. Arrange special video camera equipment for monitoring and recording tests (BA);
24. Gather equipment and pack truck (ALL); and
25. Arrange support from team in Ottawa to offload equipment and set up (CB/PK).

6. EQUIPMENT

Table 5 provides a list of required equipment.

7. SAFETY

Managers of each subproject must ensure that the personnel involved in the setup and conduct of their respective projects are aware of the following:

1. A safety briefing will be done on the first day of testing;
2. Personnel should be familiar with NRC emergency procedures, i.e., DO NOT CALL 9-1-1, instead, call the NRC Emergency Center as they will contact and direct the necessary services;
3. Fluid safety data sheets (SDS) are available for review;
4. Canadian Standards Association (CSA)-approved footwear and appropriate clothing for frigid temperatures are to be worn by all personnel;
5. Waterproof clothing and gloves are available;
6. Fluid(s) should only be handled with protective gloves. If any fluid gets onto the skin, wash the affected area thoroughly;
7. Rubber mats must be properly placed in and around the test area and cleaned as necessary;
8. Care should be taken when circulating near the test stand due to slipperiness;
9. If fluid comes into contact with skin, rinse hands under running water;
10. If fluid comes into contact with eyes, flush with the portable eye wash station;
11. First aid kit, water, and fire extinguisher are available; and
12. All NRC safety guidelines must be followed.

The NRC may require that all staff complete a separate safety training module prior to the start of testing.

Personnel must operate in accordance with the "Testing Safety Recommendations" and must follow the protocols for "Extended Work Hours Protocol for APS Personnel." These documents are included in the "APS Office Policies & Procedures," which is made available to all APS staff.

8. DATA FORMS

The data forms required for each project are listed as follows:

1. New Fluid ETs:
   - Freezing Precipitation Endurance Time Electronic Data Form;
   - NRC Continuous Rate Form (Figure 2);
   - Rate Management Form (Figure 3); and
   - End Condition Data Form for Endurance Time Tests – used as backup for electronic data form (Figure 4).
2. New Fluid Thickness:
   - Fluid Thickness Data Form (Figure 5).

9. REFERENCES

1. SAE International Aerospace Recommended Practice 5485B, *Endurance Time Test Procedures for SAE Type II/III/IV Aircraft Deicing/Anti-Icing Fluids*, October 2017.

2. *Endurance Time Testing in Simulated Freezing Precipitation with SAE Type I, II, III, and IV De/Anti-Icing Fluids,* Final Version 1.0, November 2018.

3. *Experimental Program to Establish Film Thickness Profiles for De-Icing and Anti-Icing Fluids on Flat Plates*, Version 1.0, April 3, 2002.

4. Campbell, R, Chaput, M., *Aircraft Ground De/Anti-Icing Fluid Holdover Time and Endurance Time Testing Program for the 2001-02 Winter*, APS Aviation Inc., Transportation Development Centre, Montreal, December 2002, TP 13991E, XX (to be published).

Table 1: New Fluid Endurance Times Test Plan

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
1	Freezing Fog, -3, 2	161A	100	Al. Plate	
2	Freezing Fog, -3, 2	161A	100	Al. Plate	
3	Freezing Fog, -3, 2	169A	100	Al. Plate	
4	Freezing Fog, -3, 2	169A	100	Al. Plate	
5	Freezing Fog, -3, 2	170A	75	Al. Plate	
6	Freezing Fog, -3, 2	170A	75	Al. Plate	
7	Freezing Fog, -3, 2	171A	50	Al. Plate	
8	Freezing Fog, -3, 2	171A	50	Al. Plate	
9	Freezing Fog, -3, 2	162A	100	Al. Plate	
10	Freezing Fog, -3, 2	162A	100	Al. Plate	
11	Freezing Fog, -3, 2	163A	100	Al. Plate	
12	Freezing Fog, -3, 2	163A	100	Al. Plate	
13	Freezing Fog, -3, 2	164A	100	Al. Plate	
14	Freezing Fog, -3, 2	164A	100	Al. Plate	
15	Freezing Fog, -3, 2	168A	100	Al. Plate	
16	Freezing Fog, -3, 2	168A	100	Al. Plate	
17	Freezing Fog, -3, 2	172A	100	Al. Plate	
18	Freezing Fog, -3, 2	172A	100	Al. Plate	
19	Freezing Fog, -3, 2	173A	100	Al. Plate	
20	Freezing Fog, -3, 2	173A	100	Al. Plate	
21	Freezing Fog, -3, 5	161A	100	Al. Plate	
22	Freezing Fog, -3, 5	161A	100	Al. Plate	
23	Freezing Fog, -3, 5	169A	100	Al. Plate	
24	Freezing Fog, -3, 5	169A	100	Al. Plate	
25	Freezing Fog, -3, 5	170A	75	Al. Plate	
26	Freezing Fog, -3, 5	170A	75	Al. Plate	
27	Freezing Fog, -3, 5	171A	50	Al. Plate	
28	Freezing Fog, -3, 5	171A	50	Al. Plate	
29	Freezing Fog, -3, 5	162A	100	Al. Plate	
30	Freezing Fog, -3, 5	162A	100	Al. Plate	
31	Freezing Fog, -3, 5	163A	100	Al. Plate	
32	Freezing Fog, -3, 5	163A	100	Al. Plate	
33	Freezing Fog, -3, 5	164A	100	Al. Plate	
34	Freezing Fog, -3, 5	164A	100	Al. Plate	
35	Freezing Fog, -3, 5	168A	100	Al. Plate	
36	Freezing Fog, -3, 5	168A	100	Al. Plate	
37	Freezing Fog, -3, 5	172A	100	Al. Plate	
38	Freezing Fog, -3, 5	172A	100	Al. Plate	
39	Freezing Fog, -3, 5	173A	100	Al. Plate	
40	Freezing Fog, -3, 5	173A	100	Al. Plate	
41	Freezing Fog, -14, 2	161A	100	Al. Plate	
42	Freezing Fog, -14, 2	161A	100	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
43	Freezing Fog, -14, 2	169A	100	Al. Plate	
44	Freezing Fog, -14, 2	169A	100	Al. Plate	
45	Freezing Fog, -14, 2	170A	75	Al. Plate	
46	Freezing Fog, -14, 2	170A	75	Al. Plate	
47	Freezing Fog, -14, 2	162A	100	Al. Plate	
48	Freezing Fog, -14, 2	162A	100	Al. Plate	
49	Freezing Fog, -14, 2	163A	100	Al. Plate	
50	Freezing Fog, -14, 2	163A	100	Al. Plate	
51	Freezing Fog, -14, 2	164A	100	Al. Plate	
52	Freezing Fog, -14, 2	164A	100	Al. Plate	
53	Freezing Fog, -14, 2	168A	100	Al. Plate	
54	Freezing Fog, -14, 2	168A	100	Al. Plate	
55	Freezing Fog, -14, 2	172A	100	Al. Plate	
56	Freezing Fog, -14, 2	172A	100	Al. Plate	
57	Freezing Fog, -14, 2	173A	100	Al. Plate	
58	Freezing Fog, -14, 2	173A	100	Al. Plate	
59	Freezing Fog, -14, 5	161A	100	Al. Plate	
60	Freezing Fog, -14, 5	161A	100	Al. Plate	
61	Freezing Fog, -14, 5	169A	100	Al. Plate	
62	Freezing Fog, -14, 5	169A	100	Al. Plate	
63	Freezing Fog, -14, 5	170A	75	Al. Plate	
64	Freezing Fog, -14, 5	170A	75	Al. Plate	
65	Freezing Fog, -14, 5	162A	100	Al. Plate	
66	Freezing Fog, -14, 5	162A	100	Al. Plate	
67	Freezing Fog, -14, 5	163A	100	Al. Plate	
68	Freezing Fog, -14, 5	163A	100	Al. Plate	
69	Freezing Fog, -14, 5	164A	100	Al. Plate	
70	Freezing Fog, -14, 5	164A	100	Al. Plate	
71	Freezing Fog, -14, 5	168A	100	Al. Plate	
72	Freezing Fog, -14, 5	168A	100	Al. Plate	
73	Freezing Fog, -14, 5	172A	100	Al. Plate	
74	Freezing Fog, -14, 5	172A	100	Al. Plate	
75	Freezing Fog, -14, 5	173A	100	Al. Plate	
76	Freezing Fog, -14, 5	173A	100	Al. Plate	
77	Freezing Fog, -25, 2	161A	100	Al. Plate	
78	Freezing Fog, -25, 2	161A	100	Al. Plate	
79	Freezing Fog, -25, 2	169A	100	Al. Plate	
80	Freezing Fog, -25, 2	169A	100	Al. Plate	
81	Freezing Fog, -25, 2	162A	100	Al. Plate	
82	Freezing Fog, -25, 2	162A	100	Al. Plate	
83	Freezing Fog, -25, 2	163A	100	Al. Plate	
84	Freezing Fog, -25, 2	163A	100	Al. Plate	
85	Freezing Fog, -25, 2	164A	100	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
86	Freezing Fog, -25, 2	164A	100	Al. Plate	
87	Freezing Fog, -25, 2	168A	100	Al. Plate	
88	Freezing Fog, -25, 2	168A	100	Al. Plate	
89	Freezing Fog, -25, 2	172A	100	Al. Plate	
90	Freezing Fog, -25, 2	172A	100	Al. Plate	
91	Freezing Fog, -25, 2	173A	100	Al. Plate	
92	Freezing Fog, -25, 2	173A	100	Al. Plate	
93	Freezing Fog, -25, 5	161A	100	Al. Plate	
94	Freezing Fog, -25, 5	161A	100	Al. Plate	
95	Freezing Fog, -25, 5	169A	100	Al. Plate	
96	Freezing Fog, -25, 5	169A	100	Al. Plate	
97	Freezing Fog, -25, 5	162A	100	Al. Plate	
98	Freezing Fog, -25, 5	162A	100	Al. Plate	
99	Freezing Fog, -25, 5	163A	100	Al. Plate	
100	Freezing Fog, -25, 5	163A	100	Al. Plate	
101	Freezing Fog, -25, 5	164A	100	Al. Plate	
102	Freezing Fog, -25, 5	164A	100	Al. Plate	
103	Freezing Fog, -25, 5	168A	100	Al. Plate	
104	Freezing Fog, -25, 5	168A	100	Al. Plate	
105	Freezing Fog, -25, 5	172A	100	Al. Plate	
106	Freezing Fog, -25, 5	172A	100	Al. Plate	
107	Freezing Fog, -25, 5	173A	100	Al. Plate	
108	Freezing Fog, -25, 5	173A	100	Al. Plate	
109	Freezing Fog, -30, 2	161A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
110	Freezing Fog, -30, 2	161A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
111	Freezing Fog, -30, 2	162A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
112	Freezing Fog, -30, 2	162A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
113	Freezing Fog, -30, 2	173A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
114	Freezing Fog, -30, 2	173A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
115	Freezing Fog, -30, 5	161A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
116	Freezing Fog, -30, 5	161A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
117	Freezing Fog, -30, 5	162A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
118	Freezing Fog, -30, 5	162A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
119	Freezing Fog, -30, 5	173A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
120	Freezing Fog, -30, 5	173A	100	Al. Plate	Very Cold LOUT Tests (below -29.0)
121	Freezing Drizzle, -3, 13	161A	100	Al. Plate	
122	Freezing Drizzle, -3, 13	161A	100	Al. Plate	
123	Freezing Drizzle, -3, 13	169A	100	Al. Plate	
124	Freezing Drizzle, -3, 13	169A	100	Al. Plate	
125	Freezing Drizzle, -3, 13	170A	75	Al. Plate	
126	Freezing Drizzle, -3, 13	170A	75	Al. Plate	
127	Freezing Drizzle, -3, 13	171A	50	Al. Plate	
128	Freezing Drizzle, -3, 13	171A	50	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
129	Freezing Drizzle, -3, 13	162A	100	Al. Plate	
130	Freezing Drizzle, -3, 13	162A	100	Al. Plate	
131	Freezing Drizzle, -3, 13	163A	100	Al. Plate	
132	Freezing Drizzle, -3, 13	163A	100	Al. Plate	
133	Freezing Drizzle, -3, 13	164A	100	Al. Plate	
134	Freezing Drizzle, -3, 13	164A	100	Al. Plate	
135	Freezing Drizzle, -3, 13	168A	100	Al. Plate	
136	Freezing Drizzle, -3, 13	168A	100	Al. Plate	
137	Freezing Drizzle, -3, 13	172A	100	Al. Plate	
138	Freezing Drizzle, -3, 13	172A	100	Al. Plate	
139	Freezing Drizzle, -3, 13	173A	100	Al. Plate	
140	Freezing Drizzle, -3, 13	173A	100	Al. Plate	
141	Freezing Drizzle, -3, 5	161A	100	Al. Plate	
142	Freezing Drizzle, -3, 5	161A	100	Al. Plate	
143	Freezing Drizzle, -3, 5	169A	100	Al. Plate	
144	Freezing Drizzle, -3, 5	169A	100	Al. Plate	
145	Freezing Drizzle, -3, 5	170A	75	Al. Plate	
146	Freezing Drizzle, -3, 5	170A	75	Al. Plate	
147	Freezing Drizzle, -3, 5	171A	50	Al. Plate	
148	Freezing Drizzle, -3, 5	171A	50	Al. Plate	
149	Freezing Drizzle, -3, 5	162A	100	Al. Plate	
150	Freezing Drizzle, -3, 5	162A	100	Al. Plate	
151	Freezing Drizzle, -3, 5	163A	100	Al. Plate	
152	Freezing Drizzle, -3, 5	163A	100	Al. Plate	
153	Freezing Drizzle, -3, 5	164A	100	Al. Plate	
154	Freezing Drizzle, -3, 5	164A	100	Al. Plate	
155	Freezing Drizzle, -3, 5	168A	100	Al. Plate	
156	Freezing Drizzle, -3, 5	168A	100	Al. Plate	
157	Freezing Drizzle, -3, 5	172A	100	Al. Plate	
158	Freezing Drizzle, -3, 5	172A	100	Al. Plate	
159	Freezing Drizzle, -3, 5	173A	100	Al. Plate	
160	Freezing Drizzle, -3, 5	173A	100	Al. Plate	
161	Freezing Drizzle, -10, 5	161A	100	Al. Plate	
162	Freezing Drizzle, -10, 5	161A	100	Al. Plate	
163	Freezing Drizzle, -10, 5	169A	100	Al. Plate	
164	Freezing Drizzle, -10, 5	169A	100	Al. Plate	
165	Freezing Drizzle, -10, 5	170A	75	Al. Plate	
166	Freezing Drizzle, -10, 5	170A	75	Al. Plate	
167	Freezing Drizzle, -10, 5	162A	100	Al. Plate	
168	Freezing Drizzle, -10, 5	162A	100	Al. Plate	
169	Freezing Drizzle, -10, 5	163A	100	Al. Plate	
170	Freezing Drizzle, -10, 5	163A	100	Al. Plate	
171	Freezing Drizzle, -10, 5	164A	100	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
172	Freezing Drizzle, -10, 5	164A	100	Al. Plate	
173	Freezing Drizzle, -10, 5	168A	100	Al. Plate	
174	Freezing Drizzle, -10, 5	168A	100	Al. Plate	
175	Freezing Drizzle, -10, 5	172A	100	Al. Plate	
176	Freezing Drizzle, -10, 5	172A	100	Al. Plate	
177	Freezing Drizzle, -10, 5	173A	100	Al. Plate	
178	Freezing Drizzle, -10, 5	173A	100	Al. Plate	
179	Freezing Drizzle, -10, 13	161A	100	Al. Plate	
180	Freezing Drizzle, -10, 13	161A	100	Al. Plate	
181	Freezing Drizzle, -10, 13	169A	100	Al. Plate	
182	Freezing Drizzle, -10, 13	169A	100	Al. Plate	
183	Freezing Drizzle, -10, 13	170A	75	Al. Plate	
184	Freezing Drizzle, -10, 13	170A	75	Al. Plate	
185	Freezing Drizzle, -10, 13	162A	100	Al. Plate	
186	Freezing Drizzle, -10, 13	162A	100	Al. Plate	
187	Freezing Drizzle, -10, 13	163A	100	Al. Plate	
188	Freezing Drizzle, -10, 13	163A	100	Al. Plate	
189	Freezing Drizzle, -10, 13	164A	100	Al. Plate	
190	Freezing Drizzle, -10, 13	164A	100	Al. Plate	
191	Freezing Drizzle, -10, 13	168A	100	Al. Plate	
192	Freezing Drizzle, -10, 13	168A	100	Al. Plate	
193	Freezing Drizzle, -10, 13	172A	100	Al. Plate	
194	Freezing Drizzle, -10, 13	172A	100	Al. Plate	
195	Freezing Drizzle, -10, 13	173A	100	Al. Plate	
196	Freezing Drizzle, -10, 13	173A	100	Al. Plate	
197	Light Freezing Rain, -3, 13	161A	100	Al. Plate	
198	Light Freezing Rain, -3, 13	161A	100	Al. Plate	
199	Light Freezing Rain, -3, 13	169A	100	Al. Plate	
200	Light Freezing Rain, -3, 13	169A	100	Al. Plate	
201	Light Freezing Rain, -3, 13	170A	75	Al. Plate	
202	Light Freezing Rain, -3, 13	170A	75	Al. Plate	
203	Light Freezing Rain, -3, 13	171A	50	Al. Plate	
204	Light Freezing Rain, -3, 13	171A	50	Al. Plate	
205	Light Freezing Rain, -3, 13	162A	100	Al. Plate	
206	Light Freezing Rain, -3, 13	162A	100	Al. Plate	
207	Light Freezing Rain, -3, 13	163A	100	Al. Plate	
208	Light Freezing Rain, -3, 13	163A	100	Al. Plate	
209	Light Freezing Rain, -3, 13	164A	100	Al. Plate	
210	Light Freezing Rain, -3, 13	164A	100	Al. Plate	
211	Light Freezing Rain, -3, 13	168A	100	Al. Plate	
212	Light Freezing Rain, -3, 13	168A	100	Al. Plate	
213	Light Freezing Rain, -3, 13	172A	100	Al. Plate	
214	Light Freezing Rain, -3, 13	172A	100	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
215	Light Freezing Rain, -3, 13	173A	100	Al. Plate	
216	Light Freezing Rain, -3, 13	173A	100	Al. Plate	
217	Light Freezing Rain, -3, 25	161A	100	Al. Plate	
218	Light Freezing Rain, -3, 25	161A	100	Al. Plate	
219	Light Freezing Rain, -3, 25	169A	100	Al. Plate	
220	Light Freezing Rain, -3, 25	169A	100	Al. Plate	
221	Light Freezing Rain, -3, 25	170A	75	Al. Plate	
222	Light Freezing Rain, -3, 25	170A	75	Al. Plate	
223	Light Freezing Rain, -3, 25	171A	50	Al. Plate	
224	Light Freezing Rain, -3, 25	171A	50	Al. Plate	
225	Light Freezing Rain, -3, 25	162A	100	Al. Plate	
226	Light Freezing Rain, -3, 25	162A	100	Al. Plate	
227	Light Freezing Rain, -3, 25	163A	100	Al. Plate	
228	Light Freezing Rain, -3, 25	163A	100	Al. Plate	
229	Light Freezing Rain, -3, 25	164A	100	Al. Plate	
230	Light Freezing Rain, -3, 25	164A	100	Al. Plate	
231	Light Freezing Rain, -3, 25	168A	100	Al. Plate	
232	Light Freezing Rain, -3, 25	168A	100	Al. Plate	
233	Light Freezing Rain, -3, 25	172A	100	Al. Plate	
234	Light Freezing Rain, -3, 25	172A	100	Al. Plate	
235	Light Freezing Rain, -3, 25	173A	100	Al. Plate	
236	Light Freezing Rain, -3, 25	173A	100	Al. Plate	
237	Light Freezing Rain, -10, 13	161A	100	Al. Plate	
238	Light Freezing Rain, -10, 13	161A	100	Al. Plate	
239	Light Freezing Rain, -10, 13	169A	100	Al. Plate	
240	Light Freezing Rain, -10, 13	169A	100	Al. Plate	
241	Light Freezing Rain, -10, 13	170A	75	Al. Plate	
242	Light Freezing Rain, -10, 13	170A	75	Al. Plate	
243	Light Freezing Rain, -10, 13	162A	100	Al. Plate	
244	Light Freezing Rain, -10, 13	162A	100	Al. Plate	
245	Light Freezing Rain, -10, 13	163A	100	Al. Plate	
246	Light Freezing Rain, -10, 13	163A	100	Al. Plate	
247	Light Freezing Rain, -10, 13	164A	100	Al. Plate	
248	Light Freezing Rain, -10, 13	164A	100	Al. Plate	
249	Light Freezing Rain, -10, 13	168A	100	Al. Plate	
250	Light Freezing Rain, -10, 13	168A	100	Al. Plate	
251	Light Freezing Rain, -10, 13	172A	100	Al. Plate	
252	Light Freezing Rain, -10, 13	172A	100	Al. Plate	
253	Light Freezing Rain, -10, 13	173A	100	Al. Plate	
254	Light Freezing Rain, -10, 13	173A	100	Al. Plate	
255	Light Freezing Rain, -10, 25	161A	100	Al. Plate	
256	Light Freezing Rain, -10, 25	161A	100	Al. Plate	
257	Light Freezing Rain, -10, 25	169A	100	Al. Plate	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
258	Light Freezing Rain, -10, 25	169A	100	Al. Plate	
259	Light Freezing Rain, -10, 25	170A	75	Al. Plate	
260	Light Freezing Rain, -10, 25	170A	75	Al. Plate	
261	Light Freezing Rain, -10, 25	162A	100	Al. Plate	
262	Light Freezing Rain, -10, 25	162A	100	Al. Plate	
263	Light Freezing Rain, -10, 25	163A	100	Al. Plate	
264	Light Freezing Rain, -10, 25	163A	100	Al. Plate	
265	Light Freezing Rain, -10, 25	164A	100	Al. Plate	
266	Light Freezing Rain, -10, 25	164A	100	Al. Plate	
267	Light Freezing Rain, -10, 25	168A	100	Al. Plate	
268	Light Freezing Rain, -10, 25	168A	100	Al. Plate	
269	Light Freezing Rain, -10, 25	172A	100	Al. Plate	
270	Light Freezing Rain, -10, 25	172A	100	Al. Plate	
271	Light Freezing Rain, -10, 25	173A	100	Al. Plate	
272	Light Freezing Rain, -10, 25	173A	100	Al. Plate	
273	Cold-Soak Box, 1, 5	161A	100	Al. Box	
274	Cold-Soak Box, 1, 5	161A	100	Al. Box	
275	Cold-Soak Box, 1, 5	169A	100	Al. Box	
276	Cold-Soak Box, 1, 5	169A	100	Al. Box	
277	Cold-Soak Box, 1, 5	170A	75	Al. Box	
278	Cold-Soak Box, 1, 5	170A	75	Al. Box	
279	Cold-Soak Box, 1, 5	162A	100	Al. Box	
280	Cold-Soak Box, 1, 5	162A	100	Al. Box	
281	Cold-Soak Box, 1, 5	163A	100	Al. Box	
282	Cold-Soak Box, 1, 5	163A	100	Al. Box	
283	Cold-Soak Box, 1, 5	164A	100	Al. Box	
284	Cold-Soak Box, 1, 5	164A	100	Al. Box	
285	Cold-Soak Box, 1, 5	168A	100	Al. Box	
286	Cold-Soak Box, 1, 5	168A	100	Al. Box	
287	Cold-Soak Box, 1, 5	172A	100	Al. Box	
288	Cold-Soak Box, 1, 5	172A	100	Al. Box	
289	Cold-Soak Box, 1, 5	173A	100	Al. Box	
290	Cold-Soak Box, 1, 5	173A	100	Al. Box	
291	Cold-Soak Box, 1, 75	161A	100	Al. Box	
292	Cold-Soak Box, 1, 75	161A	100	Al. Box	
293	Cold-Soak Box, 1, 75	169A	100	Al. Box	
294	Cold-Soak Box, 1, 75	169A	100	Al. Box	
295	Cold-Soak Box, 1, 75	170A	75	Al. Box	
296	Cold-Soak Box, 1, 75	170A	75	Al. Box	
297	Cold-Soak Box, 1, 75	162A	100	Al. Box	
298	Cold-Soak Box, 1, 75	162A	100	Al. Box	
299	Cold-Soak Box, 1, 75	163A	100	Al. Box	
300	Cold-Soak Box, 1, 75	163A	100	Al. Box	

Table 1: New Fluid Endurance Times Test Plan (cont'd)

Test #	Condition Name	Fluid Code	Fluid Dilution (%)	Test Surface	Comments
301	Cold-Soak Box, 1, 75	164A	100	Al. Box	
302	Cold-Soak Box, 1, 75	164A	100	Al. Box	
303	Cold-Soak Box, 1, 75	168A	100	Al. Box	
304	Cold-Soak Box, 1, 75	168A	100	Al. Box	
305	Cold-Soak Box, 1, 75	172A	100	Al. Box	
306	Cold-Soak Box, 1, 75	172A	100	Al. Box	
307	Cold-Soak Box, 1, 75	173A	100	Al. Box	
308	Cold-Soak Box, 1, 75	173A	100	Al. Box	

Table 2: New Fluid Thickness Test Plan

Test #	Ambient Air Temp.	Fluid Code	Fluid Dilution	Test Surface	Fluid Temp.
TH1	-3°C	161A	100/0	Al. Plate	-3°C
TH2	-3°C	161A	100/0	Al. Plate	-3°C
TH3	-3°C	169A	100/0	Al. Plate	-3°C
TH4	-3°C	169A	100/0	Al. Plate	-3°C
TH5	-3°C	170A	75/25	Al. Plate	-3°C
TH6	-3°C	170A	75/25	Al. Plate	-3°C
TH7	-3°C	171A	50/50	Al. Plate	-3°C
TH8	-3°C	171A	50/50	Al. Plate	-3°C
TH9	-3°C	162A	100/0	Al. Plate	-3°C
TH10	-3°C	162A	100/0	Al. Plate	-3°C
TH11	-3°C	163A	100/0	Al. Plate	-3°C
TH12	-3°C	163A	100/0	Al. Plate	-3°C
TH13	-3°C	164A	100/0	Al. Plate	-3°C
TH14	-3°C	164A	100/0	Al. Plate	-3°C
TH15	-3°C	168A	100/0	Al. Plate	-3°C
TH16	-3°C	168A	100/0	Al. Plate	-3°C
TH17	-3°C	172A	100/0	Al. Plate	-3°C
TH18	-3°C	172A	100/0	Al. Plate	-3°C
TH19	-3°C	173A	100/0	Al. Plate	-3°C
TH20	-3°C	173A	100/0	Al. Plate	-3°C
TH21	-10°C	161A	100/0	Al. Plate	-10°C
TH22	-10°C	169A	100/0	Al. Plate	-10°C
TH23	-10°C	170A	75/25	Al. Plate	-10°C
TH24	-10°C	162A	100/0	Al. Plate	-10°C
TH25	-10°C	163A	100/0	Al. Plate	-10°C
TH26	-10°C	164A	100/0	Al. Plate	-10°C
TH27	-10°C	168A	100/0	Al. Plate	-10°C
TH28	-10°C	172A	100/0	Al. Plate	-10°C
TH29	-10°C	173A	100/0	Al. Plate	-10°C
TH30	-14°C	161A	100/0	Al. Plate	-14°C
TH31	-14°C	169A	100/0	Al. Plate	-14°C
TH32	-14°C	170A	75/25	Al. Plate	-14°C
TH33	-14°C	162A	100/0	Al. Plate	-14°C
TH34	-14°C	163A	100/0	Al. Plate	-14°C
TH35	-14°C	164A	100/0	Al. Plate	-14°C
TH36	-14°C	168A	100/0	Al. Plate	-14°C
TH37	-14°C	172A	100/0	Al. Plate	-14°C
TH38	-14°C	173A	100/0	Al. Plate	-14°C

Table 2: New Fluid Thickness Test Plan (cont'd)

Test #	Ambient Air Temp.	Fluid Code	Fluid Dilution	Test Surface	Fluid Temp.
TH39	-25°C	161A	100/0	Al. Plate	-25°C
TH40	-25°C	169A	100/0	Al. Plate	-25°C
TH41	-25°C	162A	100/0	Al. Plate	-25°C
TH42	-25°C	163A	100/0	Al. Plate	-25°C
TH43	-25°C	164A	100/0	Al. Plate	-25°C
TH44	-25°C	168A	100/0	Al. Plate	-25°C
TH45	-25°C	172A	100/0	Al. Plate	-25°C
TH46	-25°C	173A	100/0	Al. Plate	-25°C

Notes:

- The quantity of fluid that will be poured for each test is 1.0 L on a full plate.
- Measurements should be made at the 15-cm line at the time of fluid application, and after 5 minutes, 15 minutes, and 30 minutes.
- If the results for one fluid vary by more than 10 percent, repeat the two tests and disregard the highest and lowest values.
- Consideration should be given to running additional thickness tests at -10°C, -14°C, and -25°C (Test # TH21-TH46).

Table 3: Personnel Requirements / Responsibilities

PERSONNEL ASSIGNMENTS	MAIN STAND	SMALL END CHAMBER
	ET	HOT Thickness
Manager	JD/PK	PK
Fluid Assistant	DB/DC	DB
CSW Assistant	DC	n/a
Data Form Manager	PK	PK
Rate Station Manager	BB	n/a
Rate Station Assistant	SB/DC	n/a

OTHER TASKS	PERSONNEL ASSIGNMENTS
Pre-Test Setup	JD
Equipment Manager	PK/JD
Fluid Management	JD/DB
Data Logging	PK
Box Prep (in CSW)	DC
Fluid Collection + Filling	DB/DC
Temperature Loggers	BB/YOW2
Photography Setup and Login	SN*

*Present for the first and last day for 4 hours each day.

Table 4: List of Fluids

Fluid Code	Viscosity Type	Batch #	Fluid Temp	Fluid Dilution	Litres Required per Project		Total Litres Required	Total Litres Required +50% extra	Pour Bottles	Large Containers	Notes
					ET	TH-HOT					
Type II, III, IV (HOT)											
161A	LOWV	PG2-24-01	OAT	100/0	36	5	41	61.5	8 empty	12 x 5 litre jugs	-29.5 and Below Testing
169A	LOWV	LV587	OAT	100/0	32	5	37	55.5	8 empty	3 x 25 litre jugs	
170A	LOWV	LV589	OAT	75/25	28	4	32	48	8 empty	1 x 25 litre jug	
171A	LOWV	LV592	OAT	50/50	12	2	14	21	8 empty	1 x 25 litre jugs	
162A	LOWV	PG4-24-01	OAT	100/0	36	5	41	61.5	8 empty	12 x 5 litre jugs	-29.5 and Below Testing
163A	LOWV	FS24110801	OAT	100/0	32	5	37	55.5	8 empty	6 x 10 litre jugs	
164A	LOWV	241120001	OAT	100/0	32	5	37	55.5	8 empty	3 x 20 litre jugs	
168A	LOWV	TAB24-CP1127	OAT	100/0	32	5	37	55.5	8 empty	3 x 20 litre jugs	
172A	LOWV	LV586	OAT	100/0	32	5	37	55.5	8 empty	2 x 25 litre jugs	
173A	LOWV	AFEG-T4/021224	OAT	100/0	36	5	41	61.5	8 empty	6 x 10 litre jugs	-29.5 and Below Testing
			All Fluids		308	46	354	531	80		

Table 5: Equipment List

HOT AND GENERAL EQUIPMENT	
LOCATION: TEST SITE	
Barrel Opener to open CSW fluids	Rate Pan (aluminum HOT) x1
Bins for mixing CSW fluid x 5 (60 L Rubbermaid®)	Rate Pans (white plastic) x all
Brixometer x 3	Sample bottles x 6
Camera x2 (small Canon®) with accessories	Sartorius® Scale x 2
Cart (IKEA) x 2	Scrapers x 14
Clear plastic clipboards x 5	Shop Vac + 2 x 18 L open top pails
Clock (Large digital) x 2	SmartButton kits x 2 + extension wire
Cold-soak boxes (aluminum) x 16	Squeegees x 4 (small)
Empty 20 L fluid container x 5 (for -30C CSW fluid)	Tape: Duct tape x 1
Extension Cords x 4	Tape: Electrical tape x 5
Flashlights x 2	Tape: Speed tape x 1
Fluids (separate table)	Tape measurer (large yellow + small)
Fluid carrying cases x 4	Temperature probes: immersion x 3
Folding table x 1 (small)	Temperature probes: surface x 3
Freezers x 3	Tents for Fog x 4
Funnels x 4 (very big, big, medium, and small)	Test plate covers (white plastic) x 15
Gloves: rubber/winter x 4 pairs	Test plate covers (wooden boards) x 12
Gloves: cotton (1 large box)	Test Plates: Half plates x 12 (24 halves) w/buttons
Gloves: latex (2 boxes)	Test Plates: Full plates x 12 w/buttons
Ice Pic	Test Plates: Full plates x 8 no buttons
Inclinometer (yellow level) x 2	Test Stand Collection Pans (one per stand)
Isopropyl x 6	Test Stand Shims (poker chips) x 1 box
Lock for truck	Test Stands: 2 x 6-position (main stand)
Marker for Waste x 2	Test Stands: 1 x 6-position (thickness stand)
Measuring Cups x 3	Test Stands: 1 x 1-position (automated rate)
Paper Towels (4 packs)	Test Stands: 1 x 2-position (side stand)
Personnel clothing (testing coats/boots)	Thickness Gauges: 4 rectangle
Pour containers: (1-litre) - 6 empty	Thickness Gauges: 4 octagon
Pour containers: (1-litre) - see list of fluids	Tuques x 10
Power bars x 4	Vise grip (large) + rubber opener
Printer & Ink Cartridge	Whatman® paper kit + dye
Rain Suits (all)	White poster board panels for water run-off
	EXTRA: Glycol for CSW boxes
LOCATION: OFFICE	
Blank Waterproof labels (1 page)	Laptop for Rate Station and SmartButtons
Condition Sheets x 6	Mouse for Rate Station and keypad
Data Forms (on water phobic paper)	Paper for printer x 1 pack
Envelopes (9x12) x box	Pencils + pens + markers
Falling Ball Viscometer + Syringes	Test Procedures x 5
File box x 2	Walkie Talkies and Accessories x 4
Hard Drive (if necessary)	Waterproof paper (40 sheets)
iPad® x 2	

Table 5: Equipment List (cont'd)

HOT AND GENERAL EQUIPMENT	
REMOTE VIEWING CAMERA EQUIPMENT: TEST SITE	
4K IP Camera with tripod mounts x 2	NVR Receiver
4K IP Camera Zoomed Lens with tripod mounts x 2	Power Cables for monitor and receiver x 2
Ethernet Cable (150ft) x 5	ZTE with large internet plan
Monitor with VGA cable	
REMOTE VIEWING CAMERA EQUIPMENT: OFFICE	
Camera Cover x 4	Manfrotto® Arms with clamp inserts x 4
External HDD	
LOCATION: NRC	
Cold-soak box filling stand	Rubber Mats
Cold-soak fluid pump	Shelving unit x 1 (black one)
Copper tubing insulation (for passing wires)	Tie wraps
Fluid for cold-soak boxes (barrel)	Tools
NRC Auto Rate Form with Historical #'s	Tote for Waste Fluid

Note: Pack coolers with first day fluids and plug into power overnight.

Figure 1: Test Schedule

	Mon Mar-17	Tues Mar-18	Wed Mar-19	Thurs Mar-20	Fri Mar-21	Mon Mar-24	Tues Mar-25	Wed Mar-26	Thurs Mar-27	Fri Mar-28
8:30	APS Drive to YOW	**ZF -30,5** HOT=6	**ZF -14,5** HOT=18	**ZF -3,2** HOT= 20 TH = 12	**ZF -3,5** HOT=20 TH = 8	APS Drive to YOW	**ZD -3,5** HOT=10	**ZD -10,13** HOT=18	**ZR -10,25** HOT=18	Pack up
9:00										
9:30										
10:00										
10:30		**ZF -30,2** HOT=6								APS Drive Home
11:00								**ZD -10,5** HOT=18 TH = 9	**CSW 1,5** HOT=18	
11:30										
12:00										
12:30		**ZF -25,2** HOT=16 TH = 8	**ZF -14,2** HOT=18 TH = 9		**ZR -3,13** HOT=20		**ZD -3,13** HOT=10			
13:00										
13:30										
14:00										
14:30										
15:00								**ZR -10,13** HOT=18	**CSW 1,75** HOT=18	
15:30		**ZF -25,5** HOT=16								
16:00				**ZR -3,25** HOT=20						
16:30										
17:00										
17:30					APS Drive Home					
18:00										
18:30										
19:00										
20:00										

Note: Setup at the NRC will take place during the mixed icing conditions testing the week before.

Project Abbreviations	
HOT = New Fluid ETs	TH = New Fluid Thickness

Figure 2: NRC Continuous Rate Form

Condition	Historical Average Calculated Rate (Position 1)	Standard Deviation of Historical Average Calculated Rate (Position 1)	Historical Average of Session Standard Deviation	Suggested Start Position	Previous Condition Difficulty Rating (1-5, 1 is easiest)	Historical Condition Difficulty Rating (1-5, 1 is easiest)	Comments
ZF, -3, 2	1.8	0.3	0.7	Pos. 10 (2'', 0'')	1.0	1.3	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -3, 5	4.9	0.6	2.1	Pos. 4 (0'', 18'')	3.0	2.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -10, 2	1.9	0.3	0.6	Pos. 10 (2'', 0'')	n/a	1.0	
ZF, -10, 5	4.9	1.0	0.9	Pos. 10 (2'', 0'')	n/a	1.5	
ZF, -14, 2	2.1	0.2	0.7	Pos. 10 (2'', 0'')	1.0	1.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -14, 5	4.8	0.3	1.1	Pos. 10 (2'', 0'')	1.0	1.3	In 2020, stand was at (23' 11'', 5' 10''), (24', 9')
ZF, -25, 2	2.0	0.4	1.0	Pos. 10 (2'', 0'')	1.0	1.0	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -25, 5	4.8	0.4	1.2	Pos. 10 (2'', 0'')	5.0	2.8	In 2020, we had to move stand to (23' 11'', 5' 10''), (24', 9')
ZF, -35, 2	2.1	0.1	1.0	Pos. 10 (2'', 0'')	1.0	2.7	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZF, -35, 5	5.1	0.0	1.5	Pos. 10 (2'', 0'')	2.0	3.0	In 2020, stand was at (23' 11'', 6' 7''), (24', 9')
ZD, -3, 5	5.5	0.2	0.9	(23' 11'', 6' 7''), (24', 9')	1.0	2.5	
ZD, -3, 13	13.0	1.8	1.7	(23' 11'', 6' 7''), (24', 9')	1.0	3.5	
ZD, -6, 5	n/a	n/a	n/a	n/a	n/a	n/a	
ZD, -6, 13	n/a	n/a	n/a	n/a	n/a	n/a	
ZD, -10, 5	5.9	0.4	0.8	(23' 11'', 6' 7''), (24', 9')	4.0	1.5	
ZD, -10, 13	14.0	0.5	1.7	(23' 11'', 6' 7''), (24', 9')	1.0	2.3	
ZR, -3, 13	13.6	0.5	1.2	(23' 11'', 6' 7''), (24', 9')	1.0	2.0	
ZR, -3, 25	25.7	0.6	1.5	(23' 11'', 6' 7''), (24', 9')	1.0	1.0	
ZR, -6, 13	n/a	n/a	n/a	n/a	n/a	n/a	
ZR, -6, 25	n/a	n/a	n/a	n/a	n/a	n/a	
ZR, -10, 13	13.9	0.7	1.0	(23' 11'', 6' 7''), (24', 9')	1.0	4.0	
ZR, -10, 25	26.1	0.5	1.2	(23' 11'', 6' 7''), (24', 9')	1.0	1.0	
CS, 1, 5	4.9	0.2	4.0	(23' 11', Closest to Bottom), (24', 9')	4.0	3.0	
CS, 1, 75	75.6	3.4	13.1	(Closest to Bottom), (24', 9')	2.0	2.5	

Note: Initial position to be set to (24', 7'), (24', 9') for (x, y) & (x', y') based on the schedule.

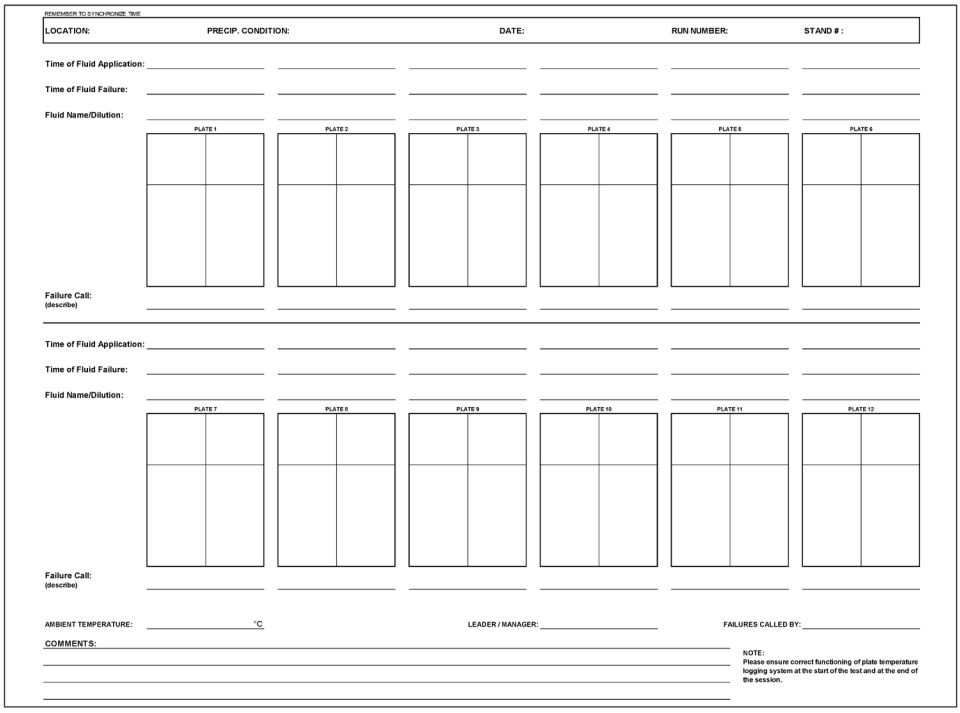
Figure 3: NRC Rate Management Form

DATE: _____

CONDITION: _____ TECHNICIAN: _____

PAN #	TAB	TIME OUT	1st or 2nd Rate	PAN #	TAB	TIME OUT	1st or 2nd Rate

Figure 4: Freezing Precipitation Endurance Time Data Form



REMEMBER TO SYNCHRONIZE TIME

LOCATION:	PRECIP. CONDITION:	DATE:	RUN NUMBER:	STAND # :

Time of Fluid Application:

Time of Fluid Failure:

Fluid Name/Dilution:

PLATE 1 | PLATE 2 | PLATE 3 | PLATE 4 | PLATE 5 | PLATE 6

Failure Call:
(describe)

Time of Fluid Application:

Time of Fluid Failure:

Fluid Name/Dilution:

PLATE 7 | PLATE 8 | PLATE 9 | PLATE 10 | PLATE 11 | PLATE 12

Failure Call:
(describe)

AMBIENT TEMPERATURE: °C

LEADER / MANAGER:

FAILURES CALLED BY:

COMMENTS:

NOTE:
Please ensure correct functioning of plate temperature logging system at the start of the test and at the end of the session.

Figure 5: Fluid Thickness Data Form

DATE: _____ TEMPERATURE °C (beg.): _____ PERFORMED BY: _____

TEST #: ____to____ WIND SPEED, kph (beg.): _____ WRITTEN BY: _____

STAND: _____ LOCATION: ___CEF (NRC)___

THICKNESS (mil)											
Plate: U Run #: Fluid: Application Time:		Plate: V Run #: Fluid: Application Time:		Plate: W Run #: Fluid: Application Time:		Plate: X Run #: Fluid: Application Time:		Plate: Y Run #: Fluid: Application Time:		Plate: Z Run #: Fluid: Application Time:	
TIME	6" LINE	TIME	6" LINE	TIME	6" LINE	TIME	6" LINE	TIME	6" LINE	TIME	6" LINE

I:\Groups\Cm1680 (01-02)\Procedures\Thickness\Thickness Form

Notes:

- The quantity of fluid that will be poured for each test is 1.0 L.
- Measurements should be made at the 15-cm line at the time of fluid application, and after 5, 15 and 30 minutes.
- If the results for one fluid vary by more than 10%, repeat the two tests and disregard the highest and lowest values.

Attachment 1: Cold-Soak Box Preparation Procedure

1. Put containers (5 x 20 L) of CSW box fluid (propylene 65/35, approximate Brix of 39.0) in cold (-30 ± 5°C) freezer overnight. Freezers to be kept in large end of the chamber.
2. Put all filled CSW boxes in warmer (-11 ± 1°C) freezer overnight.
3. Next morning, if freezer in Step 2 does not provide fluid and box temperature of -11 ± 1°C, then empty boxes in pail and achieve fluid at -12 ± 1°C in pail.
4. Prepare Step 3 in corner of large chamber that is at + 1°C; ensure boxes are cooled to about -11°C. Go to Step 6.
5. After first series of tests, empty fluid from boxes into separate pail. Put empty boxes in freezer to keep cool at -11 ± 2°C.
6. Prepare fluid to -12 ± 1°C by mixing (use small amounts of hot water and/or cold fluid). Agitate fluid mixture frequently.
7. Fill boxes, ensure -11 ± 1°C on surface of box. This process shall be done while rates are being measured.
8. Position on stand with cover, but no insulation on top surface. Connect thermocouples.
9. Allow warming to -10 ± 0.5°C. This process needs monitoring with rates measurement to not overshoot temperature (place insulation on top surface if required).
10. Start test.
11. At end of test, remove box from stand, measure rates, and go to Step 5.

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PROCEDURE:
OVERALL PROGRAM OF TESTS AT PMG, APRIL 2025

301351

PROCEDURE:

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Winter 2024-25

Prepared for:

Transport Canada
Programs Group Innovation Centre

In cooperation with:

Federal Aviation Administration
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Transport Canada
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Federal Aviation Administration
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March 26, 2025
Final Version 1.0

OVERALL PROGRAM OF TESTS AT PMG, APRIL 2025

Winter 2024-25

1. INTRODUCTION AND OBJECTIVE

The objective of this project is to collect data with the current holdover time (HOT) fluids at very cold temperatures of -18°C and -25°C. Additional tests will be carried out with specific fluids at their respective lowest operational use temperature (LOUT).

Testing will occur in a climate-controlled chamber at PMG Technologies Inc. (PMG) in Blainville, Quebec. This chamber is capable of reaching temperatures as low as -50°C.

A second snow machine constructed by the National Center for Atmospheric Research (NCAR) was purchased by Transport Canada (TC) in 2018. Testing in 2018-19 indicated that this new snow machine can be used for the current annual endurance time testing and research.

2. PROCEDURE

Endurance time tests will be conducted using the test protocols outlined in the procedure, *Endurance Time Testing in Simulated Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids* (1).

Testing will occur in the period from March 31 to April 11, 2025; in total 10 test days (from 6 AM to 6 PM) are scheduled, with a spare day on April 14.

It has been estimated that a total of eight tests (in some cases 10 tests) per day are feasible amongst the two snow machines. A test schedule is provided in Figure 1.

In total, 64 tests are planned. Priorities are provided for each test. A log of these tests is provided in Table 1.

2.1 Artificial Snow Requirements

For each test, the artificial snow requirements are denoted by the letters B through G.

Table 2 provides a summary of the artificial snow requirements that each test is categorized as.

3. PERSONNEL REQUIREMENTS/RESPONSIBILITIES

Due to the complexity of operating two snow machines, at least two and possibly three employees will be required as follows:

- Senior Employee #1 – operation of snow machine;
- Junior Employee #1 – support for testing; and
- Junior Employee #2 – operation of second snow machine.

3.1 Personnel Contingency Plan

A contingency plan has been put in place in the event of an absence of each individual employee. A personnel contingency plan is provided in Table 3.

4. FLUIDS

Table 4 provides a list of fluids that will be tested.

5. PRE-TESTING SETUP ACTIVITIES

The following activities need to be completed prior to testing at PMG:

1. Finalize list of participants for PMG (JD/BA/DP);
2. Finalize contract with PMG (BA/PK/JD);
3. Finalize test plan (BA/DP);
4. Verify fluid list (PK/BA);
5. Test backup scale (BA/DP);
6. Develop Excel file for daily communication of results (DP/BA); and
7. Develop drop-off equipment day plan (setting up freezer, water, ice core tubes et cetera) (DP/BA).

5.1 Packing Day

The packing day is scheduled for Thursday, March 27, 2025. The following activities will take place on this day:

- Preparing all fluids; and
- Packing all supporting equipment and fluids.

5.2 Setup Day

The setup day is scheduled for Friday, March 28, 2025. The following activities will take place on this day:

- Moving all equipment to PMG;
- Assembling snow machines at PMG;
- Setting up office;
- Tempering of fluids;
- Ensuring PMG places freezer next to chamber; and
- Preparing ice cores set to freeze.

6. EQUIPMENT

Table 5 includes a list of the required equipment for this testing.

7. SAFETY

Employees will adhere to both APS Aviation Inc. (APS)-specific and PMG-specific safety requirements when working in and around PMG facilities. Special attention will be given to working in a cold environment, and employees should be mindful of dangers associated with hypothermia and frost bite.

Managers of each subproject must ensure that personnel involved in the setup and conduct of their respective projects are aware of the items below.

1. Fluid SDS sheets are available for review.
2. Waterproof clothing and gloves are available.
3. Fluid(s) should only be handled with protective gloves. If any fluid gets onto the skin, wash the affected part thoroughly.
4. Care should be taken when circulating near the test area due to slipperiness.
5. First aid kit, water, and fire extinguishers are available.
6. All PMG safety guidelines must be followed.

8. DATA FORM

The data form required for this project is included in Figure 2.

9. REFERENCES

1. Youssef, D., *Endurance Time Testing in Simulated Snow with SAE Type I, II, III, and IV De/Anti-Icing Fluids*, APS Aviation Inc., Transport Canada, Montreal, November 2018.

April 2025

Monday	Tuesday	Wednesday	Thursday	Friday
			Mar. 27 Packing Day Test Site	Mar 28. **Move to PMG / Setup** • Freezer Placement • Make First Ice Cores
Mar. 31 • Calibration at -30 C Priority 1: 24 Tests @ -30 °C (4/24) • 4 Tests	Apr. 1 Priority 1: 24 Tests @ -30 °C (12/24) • 8 Tests	Apr. 2 Priority 1: 24 Tests @ -30 °C (20/24) • 8 Tests	Apr. 3 Priority 1: 24 Tests @ -30 °C (24/24) • 4 Tests • Calibration at -25 C	Apr. 4 Priority 1: 24 Tests @ -25 °C (8/24) • 8 Tests
Apr. 7 Priority 1: 32 Tests @ -25 °C (16/24) • 8 Tests	Apr. 8 Priority 1: 24 Tests @ -25 °C (24/24) • 8 Tests	Apr. 9 Priority 2: 8 Tests @ -25 °C (8/8) • 8 Tests	Apr. 10 • Calibration at -18 C Priority 2: 8 Tests @ -18 °C (4/8) • 4 Tests	Apr. 11 Priority 2: 8 Tests @ -18 °C (8/8) • 4 Tests **Dismantle and Move out**
Apr. 14	Apr. 15	Apr. 16	Apr. 17	Apr. 18 Good Friday
Apr. 21 Easter Monday	Apr. 22	Apr. 23	Apr. 24	Apr. 25

Figure 1: Daily Schedule

Table 1: Test Schedule

Test No.	Priority	Objective	Fluid Code	Fluid Batch #	Fluid Type	Ambient Temp. (°C)	Plate Set Temp. (°C)	Precip. Rate (g/dm²/h)
AS1	4	F	161A	PG2-24-01	II	-18	-18.7	3.0
AS2	4	F	161A	PG2-24-01	II	-18	-18.8	4.0
AS3	4	F	161A	PG2-24-01	II	-18	-19.2	10.0
AS4	4	F	161A	PG2-24-01	II	-18	-20.1	25.0
AS5	1	F	161A	PG2-24-01	II	-25	-25.7	3.0
AS6	1	F	161A	PG2-24-01	II	-25	-25.8	4.0
AS7	1	F	161A	PG2-24-01	II	-25	-26.2	10.0
AS8	1	F	161A	PG2-24-01	II	-25	-27.1	25.0
AS5R	1	F	161A	PG2-24-01	II	-25	-25.7	3.0
AS6R	1	F	161A	PG2-24-01	II	-25	-25.8	4.0
AS7R	1	F	161A	PG2-24-01	II	-25	-26.2	10.0
AS8R	1	F	161A	PG2-24-01	II	-25	-27.1	25.0
AS9	1	F	161A	PG2-24-01	II	-30	-30.7	3.0
AS10	1	F	161A	PG2-24-01	II	-30	-30.8	4.0
AS11	1	F	161A	PG2-24-01	II	-30	-31.2	10.0
AS12	1	F	161A	PG2-24-01	II	-30	-32.1	25.0
AS9R	1	F	161A	PG2-24-01	II	-30	-30.7	3.0
AS10R	1	F	161A	PG2-24-01	II	-30	-30.8	4.0
AS11R	1	F	161A	PG2-24-01	II	-30	-31.2	10.0
AS12R	1	F	161A	PG2-24-01	II	-30	-32.1	25.0
AS13	4	F	162A	PG4-24-01	IV	-18	-18.7	3.0
AS14	4	F	162A	PG4-24-01	IV	-18	-18.8	4.0
AS15	4	F	162A	PG4-24-01	IV	-18	-19.2	10.0
AS16	4	F	162A	PG4-24-01	IV	-18	-20.1	25.0
AS17	1	F	162A	PG4-24-01	IV	-25	-25.7	3.0
AS18	1	F	162A	PG4-24-01	IV	-25	-25.8	4.0
AS19	1	F	162A	PG4-24-01	IV	-25	-26.2	10.0

Table 1: Test Schedule (cont'd)

Test No.	Priority	Objective	Fluid Code	Fluid Batch #	Fluid Type	Ambient Temp. (°C)	Plate Set Temp. (°C)	Precip. Rate (g/dm²/h)
AS20	1	F	162A	PG4-24-01	IV	-25	-27.1	25.0
AS17R	1	F	162A	PG4-24-01	IV	-25	-25.7	3.0
AS18R	1	F	162A	PG4-24-01	IV	-25	-25.8	4.0
AS19R	1	F	162A	PG4-24-01	IV	-25	-26.2	10.0
AS20R	1	F	162A	PG4-24-01	IV	-25	-27.1	25.0
AS21	1	F	162A	PG4-24-01	IV	-30	-30.7	3.0
AS22	1	F	162A	PG4-24-01	IV	-30	-30.8	4.0
AS23	1	F	162A	PG4-24-01	IV	-30	-31.2	10.0
AS24	1	F	162A	PG4-24-01	IV	-30	-32.1	25.0
AS21R	1	F	162A	PG4-24-01	IV	-30	-30.7	3.0
AS22R	1	F	162A	PG4-24-01	IV	-30	-30.8	4.0
AS23R	1	F	162A	PG4-24-01	IV	-30	-31.2	10.0
AS24R	1	F	162A	PG4-24-01	IV	-30	-32.1	25.0
AS25	2	B	169A	LV587	II	-18	-18.7	3.0
AS26	2	B	169A	LV587	II	-18	-18.8	4.0
AS27	2	B	169A	LV587	II	-18	-19.2	10.0
AS28	2	B	169A	LV587	II	-18	-20.1	25.0
AS29	2	B	169A	LV587	II	-25	-25.7	3.0
AS30	2	B	169A	LV587	II	-25	-25.8	4.0
AS31	2	B	169A	LV587	II	-25	-26.2	10.0
AS32	2	B	169A	LV587	II	-25	-27.1	25.0
AS33	2	B	172A	LV586	IV	-18	-18.7	3.0
AS34	2	B	172A	LV586	IV	-18	-18.8	4.0
AS35	2	B	172A	LV586	IV	-18	-19.2	10.0
AS36	2	B	172A	LV586	IV	-18	-20.1	25.0
AS37	2	B	172A	LV586	IV	-25	-25.7	3.0
AS38	2	B	172A	LV586	IV	-25	-25.8	4.0

Table 1: Test Schedule (cont'd)

Test No.	Priority	Objective	Fluid Code	Fluid Batch #	Fluid Type	Ambient Temp. (°C)	Plate Set Temp. (°C)	Precip. Rate (g/dm²/h)
AS39	2	B	172A	LV586	IV	-25	-26.2	10.0
AS40	2	B	172A	LV586	IV	-25	-27.1	25.0
AS41	3	C	163A	FS24110801	IV	-18	-18.7	3.0
AS42	3	C	163A	FS24110801	IV	-18	-18.8	4.0
AS43	3	C	163A	FS24110801	IV	-18	-19.2	10.0
AS44	3	C	163A	FS24110801	IV	-18	-20.1	25.0
AS45	3	C	163A	FS24110801	IV	-25	-25.7	3.0
AS46	3	C	163A	FS24110801	IV	-25	-25.8	4.0
AS47	3	C	163A	FS24110801	IV	-25	-26.2	10.0
AS48	3	C	163A	FS24110801	IV	-25	-27.1	25.0
AS49	3	C	168A	TAB24-CP1127	IV	-18	-18.7	3.0
AS50	3	C	168A	TAB24-CP1127	IV	-18	-18.8	4.0
AS51	3	C	168A	TAB24-CP1127	IV	-18	-19.2	10.0
AS52	3	C	168A	TAB24-CP1127	IV	-18	-20.1	25.0
AS53	3	C	168A	TAB24-CP1127	IV	-25	-25.7	3.0
AS54	3	C	168A	TAB24-CP1127	IV	-25	-25.8	4.0
AS55	3	C	168A	TAB24-CP1127	IV	-25	-26.2	10.0
AS56	3	C	168A	TAB24-CP1127	IV	-25	-27.1	25.0
AS57	3	C	164A	241120001	IV	-18	-18.7	3.0
AS58	3	C	164A	241120001	IV	-18	-18.8	4.0
AS59	3	C	164A	241120001	IV	-18	-19.2	10.0
AS60	3	C	164A	241120001	IV	-18	-20.1	25.0
AS61	3	C	164A	241120001	IV	-25	-25.7	3.0
AS62	3	C	164A	241120001	IV	-25	-25.8	4.0
AS63	3	C	164A	241120001	IV	-25	-26.2	10.0
AS64	3	C	164A	241120001	IV	-25	-27.1	25.0
AS65	4	F	173A	AFEG-T4/021224	IV	-18	-18.7	3.0

Table 1: Test Schedule (cont'd)

Test No.	Priority	Objective	Fluid Code	Fluid Batch #	Fluid Type	Ambient Temp. (°C)	Plate Set Temp. (°C)	Precip. Rate (g/dm²/h)
AS66	4	F	173A	AFEG-T4/021224	IV	-18	-18.8	4.0
AS67	4	F	173A	AFEG-T4/021224	IV	-18	-19.2	10.0
AS68	4	F	173A	AFEG-T4/021224	IV	-18	-20.1	25.0
AS69	1	F	173A	AFEG-T4/021224	IV	-25	-25.7	3.0
AS70	1	F	173A	AFEG-T4/021224	IV	-25	-25.8	4.0
AS71	1	F	173A	AFEG-T4/021224	IV	-25	-26.2	10.0
AS72	1	F	173A	AFEG-T4/021224	IV	-25	-27.1	25.0
AS69R	1	F	173A	AFEG-T4/021224	IV	-25	-25.7	3.0
AS70R	1	F	173A	AFEG-T4/021224	IV	-25	-25.8	4.0
AS71R	1	F	173A	AFEG-T4/021224	IV	-25	-26.2	10.0
AS72R	1	F	173A	AFEG-T4/021224	IV	-25	-27.1	25.0
AS73	1	F	173A	AFEG-T4/021224	IV	-30	-30.7	3.0
AS74	1	F	173A	AFEG-T4/021224	IV	-30	-30.8	4.0
AS75	1	F	173A	AFEG-T4/021224	IV	-30	-31.2	10.0
AS76	1	F	173A	AFEG-T4/021224	IV	-30	-32.1	25.0
AS73R	1	F	173A	AFEG-T4/021224	IV	-30	-30.7	3.0
AS74R	1	F	173A	AFEG-T4/021224	IV	-30	-30.8	4.0
AS75R	1	F	173A	AFEG-T4/021224	IV	-30	-31.2	10.0
AS76R	1	F	173A	AFEG-T4/021224	IV	-30	-32.1	25.0

Note: When conducting duplicate testing the following acceptance criteria must be respected:

Test 1 and 2 are accepted if the difference from either endurance time to the average endurance time divided by the average endurance time is within 10%. Otherwise, a third test must be run. This third test is accepted if the difference from the test 3 endurance time to the average endurance time of tests 1 and 2 divided by the average endurance time of tests 1 and 2 is ±5%. Otherwise, a fourth test must be run.

Table 2: Artificial Snow Requirements

Letter Indicator	Artificial Snow Requirement Scenario	Artificial Snow Requirement Objective of Test
B	New Fluid LOUT ≥-29.5° HOTs: Generic	Validate fluid for use with generic VCS HOTs.
C	NEW FLUID LOUT: ≥ -29°C HOTs: Fluid-specific	Data can be used to refine generic HOTs in future.
D	EXISTING FLUID LOUT: ≥ -29°C HOTs: Fluid-specific	Data can be used to refine generic HOTs in future.
E*	NEW FLUID LOUT: ≤ -29.5°C HOTs: Generic	Validate fluid for use with generic VCS HOTs.
F	NEW FLUID LOUT: ≤ -29.5°C HOTs: Fluid-specific	Determine fluid-specific HOTs for LOUT.
G	EXISTING FLUID LOUT: ≤ -29.5°C HOTs: Fluid-specific	Determine fluid-specific HOTs for LOUT.

**Currently no generics below -29.5 °C. A test plan would need to be developed.*

Table 3: Personnel Contingency Plan

Scenario	Who to Inform?	Principal Personnel	Back-Up Personnel
Personnel working on-site are absent due to illness or other reasons.	JD + DP	BA + DP	PK
		SR	SD
		TG	SD

Table 4: List of Fluids

Fluid	Viscosity Type	Fluid Temp	Fluid Dilution	Litres Required for Planned Tests	Pour Bottles	Extra Fluid in Large Containers	Notes
161A	LOWV	OAT	100/0	20	8	1	-
162A	LOWV	OAT	100/0	20	8	1	-
169A	LOWV	OAT	100/0	8	8	1	-
172A	LOWV	OAT	100/0	8	8	1	-
163A	LOWV	OAT	100/0	8	8	1	-
168A	LOWV	OAT	100/0	8	8	1	-
164A	LOWV	OAT	100/0	8	8	1	-
173A	LOWV	OAT	100/0	20	8	1	-
			All Fluids	**100**	**64**		

Table 5: Equipment List

EQUIPMENT	LOCATION	STATUS
2 x Snow machines and related equipment	PMG	-
NCAR computer, monitor and control box	PMG	-
Mettler Toledo® weigh scale x 2	PMG	-
Mettler Toledo® backup scale x 1	Site	-
Heat gun x 2	Site	-
Small important Allen keys	Site	-
Ice core production freezer x 2	PMG	-
All large ice core molds, 2-3 short ice core molds	PMG	-
Styrofoam covers for ice core molds	Site	-
PVC pipe for temporary storage of ice cores	PMG	-
Clean bucket and clean funnel for ice core filling	Site	-
Large quantity of distilled water	Site	-
Sartorius® 2 g scale with cabling for comm. with laptop	Site	-
Aluminum plates with heating pads	Site	-
Insulated box for heated tests	Site	-
Snow distribution pans 100 mm x 150 mm (6 pans)	Site	-
Camera equipment	Site	-
Backup drill bit	Site	-
Extra coupler and GTCA coupler	Site	-
Additional small folding table x2	Site	-
Rate distribution black felt	Site	-
Electronic NCAR files	Site	-
Squeegee/scraper	Site	-
Extension cord	Site	-
Wet vacuum	Site	-
Blue towel	Site	-
Waste container	Site	-
Measuring cup	Site	-
Thermos x 1 and spreader x 1	Site	-
Small box to transport small Allen keys and other equipment	Site	-
NCAR toolbox	Site	-
Rate distribution Excel file	Office	-
Data forms	Office	-
Procedures	Office	-

Date: _____ Location: _____ Project: _____ Test Plan #: _____

Fluid: _____ Dilution: _____ Fluid Type: _____ Batch #: _____

SNOW MACHINE

First Generation APS: _____ (✓)

Second Generation APS: _____ (✓)

NCAR Machine _____ (✓)

TEMPERATURES

Condition Temp.: _____ °C

Fluid Temp.: _____ °C

Fluid Quantity Applied: _____ litres

Plate Temp. Set point: _____ °C

PRECIPITATION RATE

Test Plan Precip. Rate: _____ g/dm^2/h

Adjusted Precip. Rate: _____ g/dm^2/h

TEST DATA

Output File Name: _____.txt

Time of Fluid Application: _____ hh:mm:ss

Time of Fluid Failure: _____ hh:mm:ss

Calculated Failure In Minutes: _____ minutes

Last Average Rate: _____ g/dm^2/h

Last Average Plate Temp: _____ °C

B1	B2	B3
C1	C2	C3
D1	D2	D3
E1	E2	E3
F1	F2	F3

Refractive Index Measurements
(Standard 15cm line)

Position C2: _____ °Brix *Additional brix measurements should be indicated directly on diagram in respective locations.*

Comments: _____

Figure 2: Simulated Snow Endurance Time Data Form

APPENDIX C

METHODOLOGY FOR ENDURANCE TIME TESTING OF TYPE II, TYPE III, AND TYPE IV FLUIDS

METHODOLOGY FOR ENDURANCE TIME TESTING OF TYPE II, TYPE III, AND TYPE IV FLUIDS



Prepared by

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. M-2024-25

METHODOLOGY FOR ENDURANCE TIME TESTING OF TYPE II, TYPE III, AND TYPE IV FLUIDS

Prepared by:

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July 2, 2025
Date

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Vice President, Aviation Services

July 2, 2025
Date

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. M-2024-25

SUMMARY

This report documents the key aspects of the testing and analysis methodologies employed by APS Aviation Inc. (APS) to carry out endurance time testing with Type II, Type III, and Type IV fluids.

The testing and analysis methodologies used are based on the protocols provided in Aerospace Recommended Practice (ARP) 5485. This report includes detailed information on:

- Test Sites;
- Test Equipment;
- Test Procedures;
- Test Conditions (precipitation rate limits, ambient temperatures, and freezing precipitation droplet sizes); and
- Analysis Methodologies.

This report is intended to be used as a companion document to the reports written to document the individual performance of each Type II, III, and IV fluid tested. The data, analysis, and results provided in those reports are a function of the test and analysis methodologies described in this report, and therefore should be used in conjunction with the information contained herein.

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GLOSSARY

APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
CEF	Climatic Engineering Facility
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
ISO	International Organization for Standardization
LOUT	Lowest Operational Use Temperature
LUPR	Lowest Usable Precipitation Rate
LWC	Liquid Water Content
MVD	Median Volume Diameter
NRC	National Research Council Canada
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturers, Transport Canada (TC), and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they provide the duration of time that fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid HOTs without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Endurance time tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids.

This report documents the key aspects of the testing and analysis methodologies employed by APS Aviation Inc. (APS) to carry out endurance time testing with Type II, Type III, and Type IV fluids. It includes information on:

1) Section 2 – Test Sites;
2) Section 3 – Test Equipment;
3) Section 4 – Test Procedures;
4) Section 5 – Test Conditions (precipitation rate limits, ambient temperatures, and freezing precipitation droplet sizes); and
5) Section 6 – Analysis Methodologies.

This report is intended to be used as a companion document to the reports on individual fluid performance. The data, analysis, and results provided in those reports are a function of the test and analysis methodologies described in this report, and therefore should be used in conjunction with the information contained herein.

2. TEST SITES

This section documents the test sites where APS conducted endurance time testing with Type II, Type III, and Type IV fluids.

2.1 Natural Snow and Natural Frost

Natural snow and natural frost testing are typically and predominantly performed at the APS test site located at the Montréal–Pierre Elliott Trudeau International Airport (YUL). The test site is located near Environment Canada's Meteorological Services of Canada automated weather observation station, as shown in Figure 2.1 on a plan view of the airport.

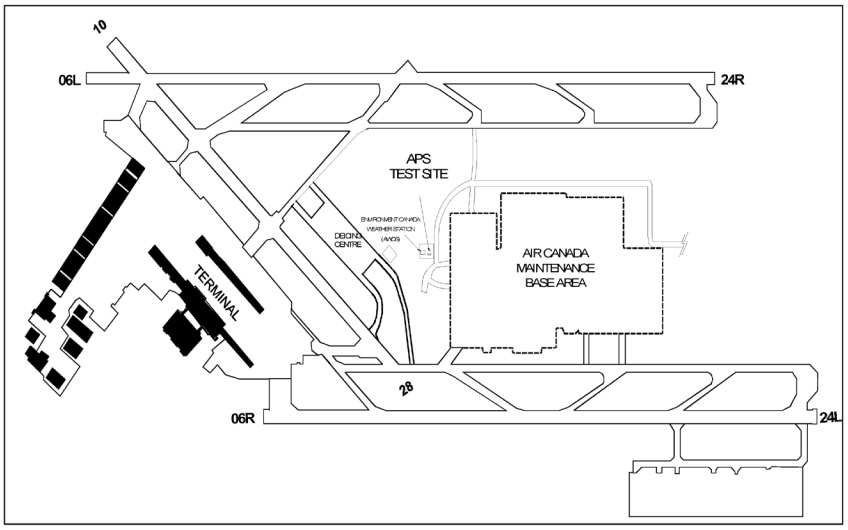


Figure 2.1: APS Test Site at Montréal-Pierre Elliott Trudeau International Airport

The APS test site consists of two trailers and three outdoor locations for test stands. Photo 2.1 and Photo 2.2 show the test site as seen from the test pads and main trailer, respectively.

When necessary, additional natural snow testing is also conducted using mobile test sites in various regions across Canada.

2.2 Artificial Snow

All artificial snow testing is typically conducted at PMG Technologies in Blainville, Quebec.

2.3 Freezing Precipitation

Tests under conditions of freezing fog, rain on cold-soaked surface, freezing drizzle, and light freezing rain were conducted indoors at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF), where precipitation was artificially produced.

Photo 2.3 provides an outdoor view of the facility giving a general indication of its size (30 m by 5.4 m, height 8 m). The facility was originally designed for the testing of locomotives; Photo 2.4 provides an interior view of the CEF set up for endurance time testing. The lowest temperature achievable in the CEF is -46°C.

Photo 2.1: APS Test Site – View from Test Pad



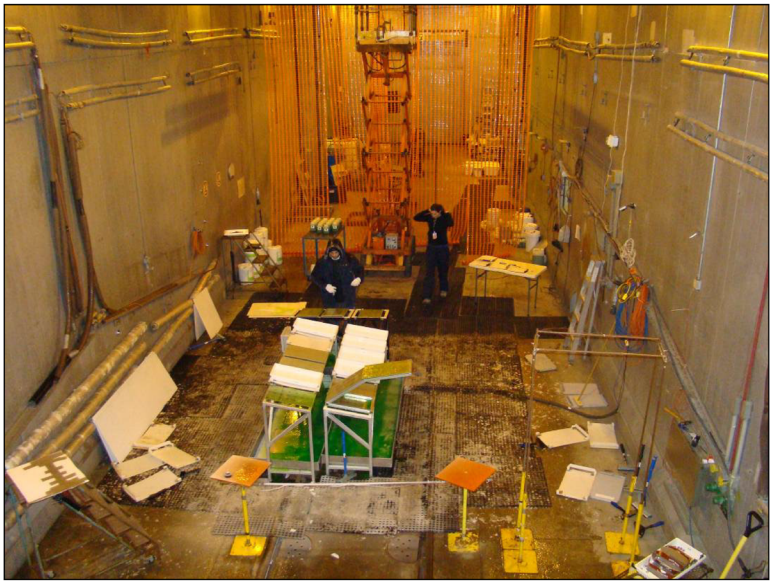
Photo 2.2: APS Test Site – View from Trailer



Photo 2.3: Outdoor View of NRC Climatic Engineering Facility



Photo 2.4: Inside View of NRC Climatic Engineering Facility



3. TEST EQUIPMENT

The key equipment used in endurance time testing is described in this section, as are the calibration procedures APS follows for ensuring the accuracy of its test equipment.

3.1 Calibration

APS measurement instruments and test equipment are calibrated and/or verified on an annual basis. This calibration is carried out according to a calibration plan based upon approved International Organization for Standardization (ISO) 9001:2008 standards and developed internally by APS.

3.2 Environmental Chamber Equipment

The general environmental chamber equipment used during tests (including air temperature sensor, data acquisition system, temperature control equipment, etc.) was as stipulated in the requirements set out in ARP5485.

3.3 Test Surface Structures

3.3.1 Flat Plates

The majority of endurance time testing is carried out on standard flat plates. A schematic of a standard flat plate is provided in Figure 3.1. It depicts the size and surface markings of a standard flat plate. Three parallel lines are positioned at 2.5 cm (1″), 15 cm (6″), and 30 cm (12″) from the top of the plate. The plates are marked with 15 crosshairs, which are used in determining when end conditions (see Subsection 4.5) are achieved. Photo 3.1, taken outdoors at the APS test site, shows six test plates mounted on a test stand.

3.3.2 Cold-Soak Boxes

Figure 3.2 shows a schematic of the sealed boxes used for tests simulating a cold-soaked wing. The top of the box consists of a flat plate identical to the standard flat plate. An insulated box shaped reservoir is welded to the bottom of the plate. Photo 3.2 shows a picture of a sealed box, which is referred to as a cold-soaked box when filled for simulated rain on cold-soaked wing tests.

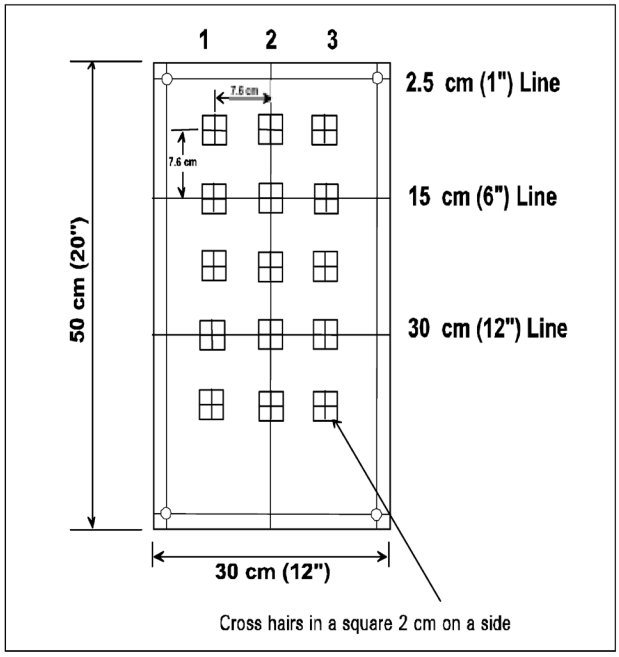


Figure 3.1: Standard Test Plate Schematic

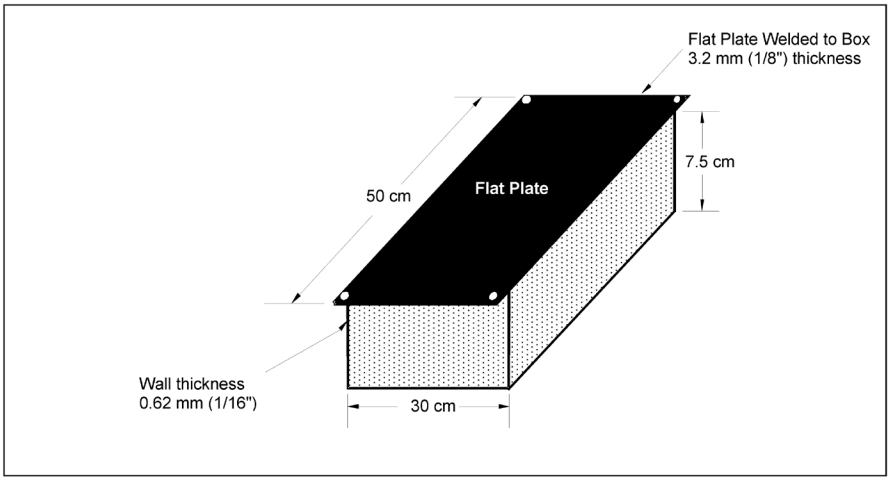


Figure 3.2: Cold-Soaked Box Schematic

3.3.3 Frosticator Plates

In natural frost, tests are conducted on frosticator plates, which are the current standard test surface used in frost HOT testing. The frosticator plates were constructed by attaching a Styrofoam insulation backing to the back of the test surface (either aluminum or composite). The insulation prevents heat exchange via the underside of the flat plate and allows for effective radiative cooling during active frost conditions. Photo 3.3 shows a white-painted aluminum frosticator plate.

3.3.4 Artificial Snow Machine Test Plate

In artificial snow, tests are conducted on a standard flat plate that has been mounted onto a specialized scale. This setup is shown in Photo 3.4.

3.4 Test Surface Materials

Testing of Type II, Type III, and Type IV fluids is carried out exclusively on aluminum surfaces. The aluminum used is 0.32 cm thick Alclad 2024 T3 aluminum.

3.5 Test Stands

Figure 3.3 shows a schematic of the test platform used for HOT testing. For natural snow tests, six test plates are normally mounted on the test stand, which has a working surface inclined at 10° to the horizontal. During normal winter operations two six-position stands are used in combination. Each plate represents a flat plate test. For simulated freezing precipitation tests at the NRC, 12 plates are mounted on two six-position stands. Photo 3.1 shows the test stands set up for testing.

3.6 Collection Pans

Figure 3.4 shows a schematic of the collection pan used for precipitation rate measurement in outdoor testing. It is the same size as a standard flat plate and is used to make precipitation rate measurements during outdoor tests. Photo 3.5 shows the collection pans used for measuring precipitation rates indoors at the NRC.

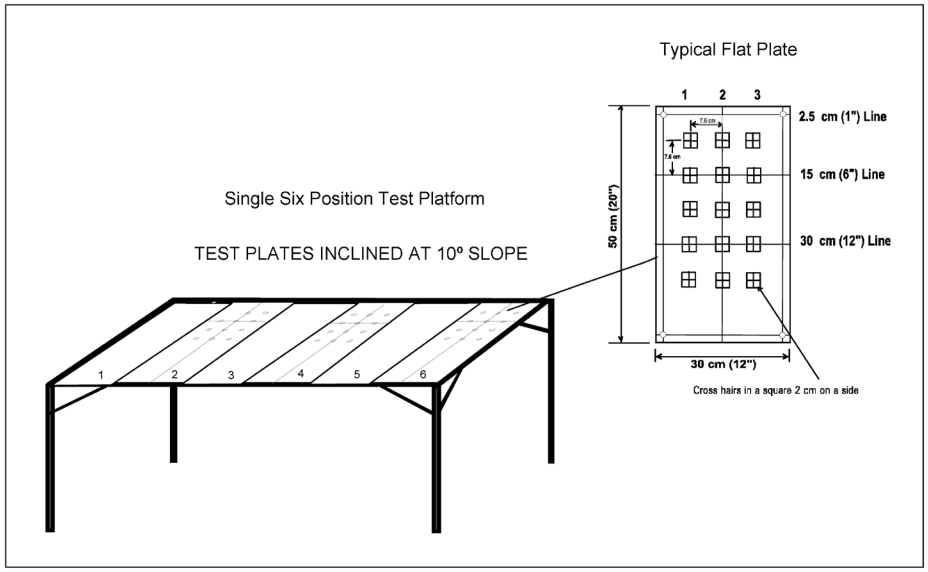


Figure 3.3: Test Stand Setup Schematic

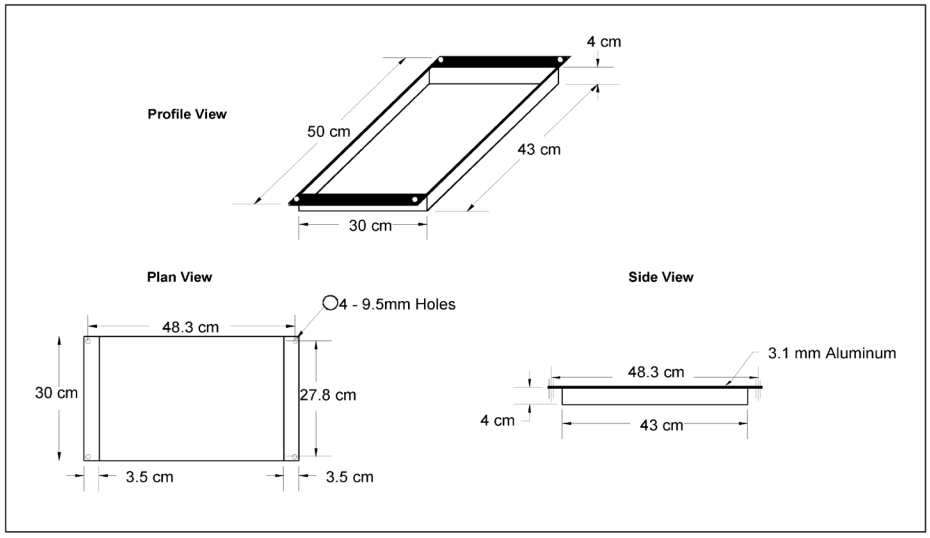


Figure 3.4: Schematic of Outdoor Precipitation Measurement Pan

3.7 NRC Sprayer Assembly

NRC developed an improved sprayer assembly, shown in Photo 3.6 and Photo 3.7, in 1997-98. The improved sprayer provides a larger scan area and improved spray uniformity over the test bed area. The scanner consists of a horizontal main shaft supported by two bearings. The actual spray head assembly is shaft-mounted on a rotating scanner, so that one scan covers a lateral running strip of the test bed area. A stepper motor is synchronized to index the relative angle of the spray head between scans along an axis perpendicular to the scan axis. This provides two axes of rotation, essentially an x-y plane; one along each axis. Each scan is consecutively indexed to complete the precipitation coverage of the test bed area. This defines one cycle of the spray unit. The scan rate, index angle, and the number of scans per cycle are adjusted, along with the fluid delivery pressures (water and air) to obtain appropriate droplet sizes and precipitation rates. The spray nozzle is shown in Photo 3.8.

3.8 Fluids

In most cases, testing was carried out with Type II, Type III, and Type IV fluids in the standard Type II, Type III, and Type IV fluid dilutions: 100/0, 75/25, and 50/50. Diluted fluids were prepared by the manufacturer; APS does not prepare diluted samples for endurance time testing of new fluids.

Photo 3.1: Test Plates Mounted on Stand

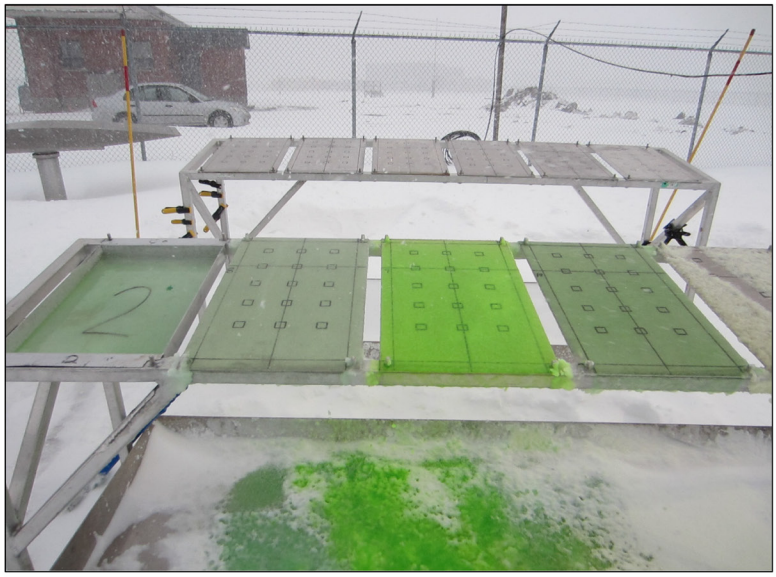


Photo 3.2: Cold-Soak / Leading Edge Thermal Equivalent Box

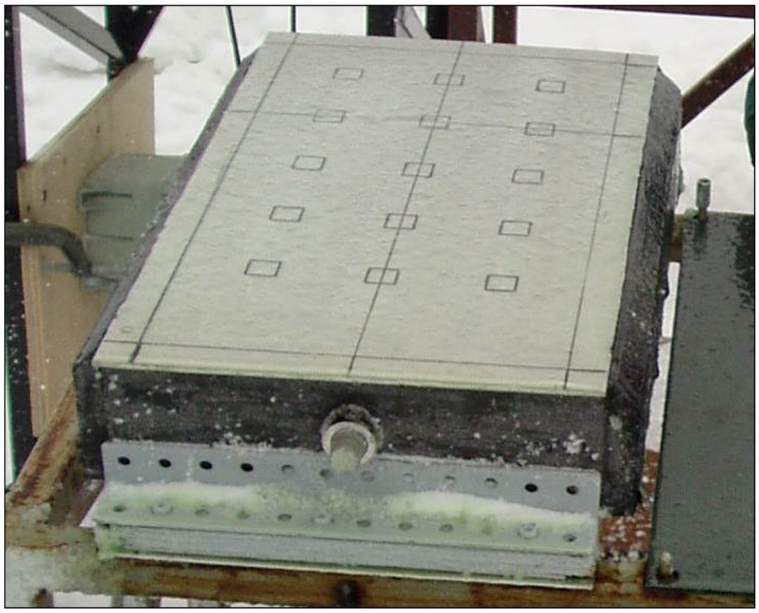


Photo 3.3: Frost Plate with Insulated Backing



Photo 3.4: Standard Plate Setup for Testing with Artificial Snow Machine



Photo 3.5: Collection Pans Used Indoors at the NRC



Photo 3.6: Sprayer Assembly

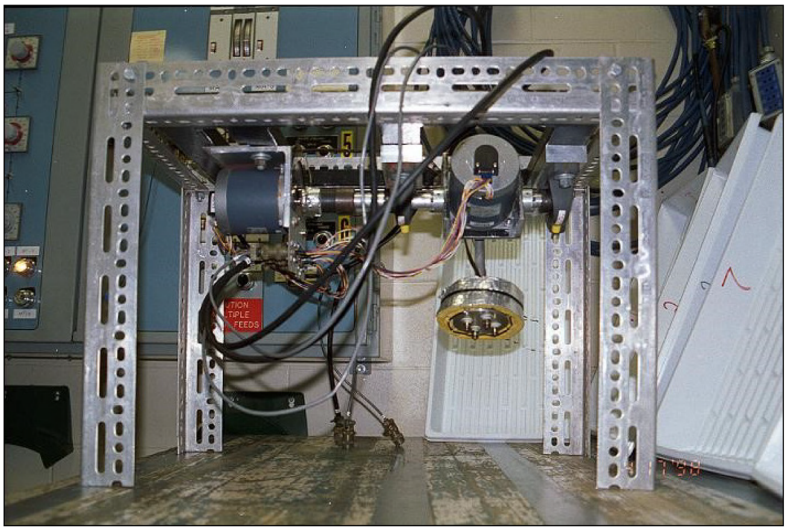


Photo 3.7: Sprayer Assembly in Use

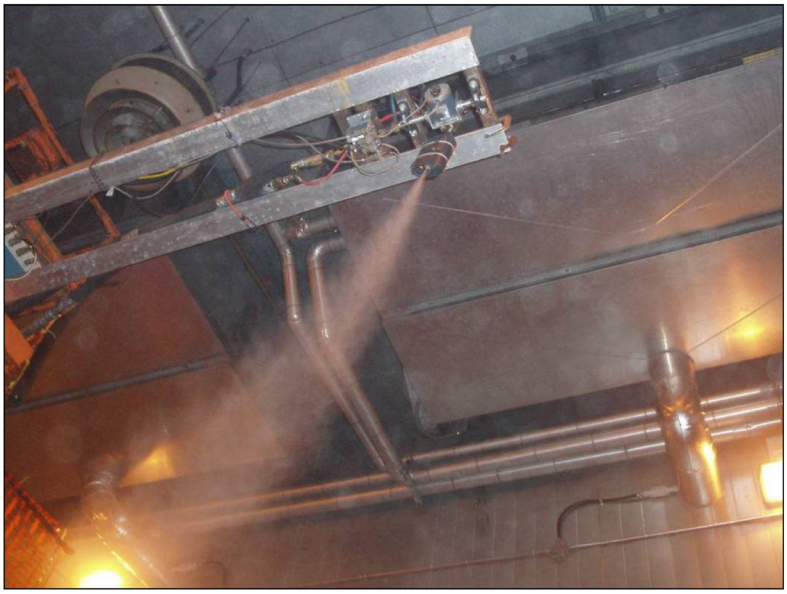
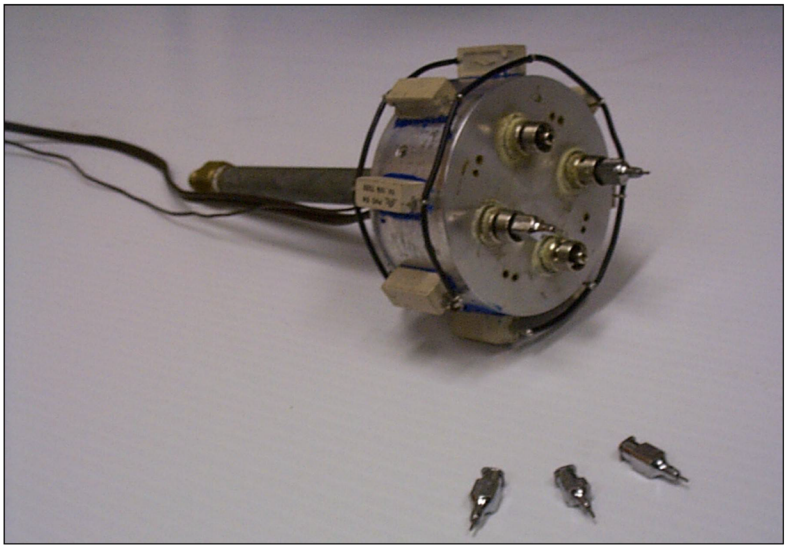


Photo 3.8: Sprayer Nozzle



4. TEST PROCEDURES

ARP5485 provides the standard procedure for endurance time testing of Type II, Type III, and Type IV fluids under natural and simulated precipitation conditions.

The procedure generally consists of pouring de/anti-icing fluids onto clean flat plates exposed to various winter precipitation conditions, and recording the elapsed time for the test to reach the defined end condition (see Subsection 4.5), when a specified degree of freezing occurs. The following subsections provide summaries of the test procedures followed for natural snow, natural frost, artificial snow, and simulated freezing precipitation testing.

4.1 Test Procedure – Natural Snow Tests

APS developed a specific procedure for Type II, Type III, and Type IV fluid testing in natural snow based on the requirements outlined in ARP5485. Key details of the procedure include:

- Tests are conducted on standard flat plates (see Subsection 3.3.1);
- Fluid is applied at ambient temperature; and
- 1 liter of fluid is hand-poured on the test surface.

4.2 Test Procedure – Natural Frost Tests

APS developed a specific procedure for Type II/III/IV testing in natural frost. Key details of the procedure include:

- Tests are conducted on frosticator plates (see Subsection 3.3.3);
- Fluid is applied at ambient temperature; and
- 1 liter of fluid is hand-poured on the test surface.

4.3 Test Procedure – Artificial Snow Tests

APS developed a specific procedure for testing in artificial snow based on the requirements outlined in ARP5485. Key details of the procedure include:

- Tests are conducted on a standard plate mounted on the snow machine scale (see Subsection 3.3.4);
- Fluid is applied at ambient temperature; and
- 1 liter of fluid is hand-poured on the test surface.

4.4 Test Procedure – Simulated Precipitation Tests

APS developed a specific procedure for Type II/III/IV testing in simulated precipitation based on the requirements outlined in ARP5485. Key details of the procedure include:

- Freezing fog, freezing drizzle, and light freezing rain tests are conducted on standard flat plates (see Subsection 3.3.1);
- Rain on cold-soaked surface tests are conducted on filled cold-soaked boxes (see Subsection 3.3.2);
- Fluid is applied at ambient temperature; and
- 1 liter of fluid is hand-poured on the test surface.

4.5 End Condition Definitions

Failure is called when 30 percent (1/3) of the plate or 5 crosshairs are covered with frozen contamination. Appearance of this frozen contamination includes, but is not limited to:

a) Ice front;
b) Ice sheet;
c) Slush, in clusters or as a front;
d) Disseminated fine ice crystals;
e) Frost on surface;
f) Clear ice pieces partially or totally imbedded in fluid; and
g) Snow bridges on top of the fluid.

4.6 Precipitation Rate Measurement Procedures

The procedures for measuring and determining precipitation rates during simulated precipitation and natural precipitation conditions are provided below.

4.6.1 Simulated Precipitation Conditions

Prior to the start of the rate collection period, the proper needles and nozzles are installed in the spray unit and both the air and water pressures are adjusted. Water spray calibration is performed by placing catch pans on the test stand, each pan marked with a number identifying the collection location on the test stand and exposing the pans to a predetermined precipitation collection period.

The pans are weighed prior to exposure to precipitation and the weights are recorded in a customized Microsoft® Excel® spreadsheet by using the print function on the digital weigh scale. Prior to the start of the precipitation catch period, the exact time (hh:mm:ss) is recorded using a pre-programmed time macro in the Microsoft® Excel® spreadsheet. The pans are re-weighed following this collection period and the precipitation rates over the area of the test stand are examined. If the rates are unacceptable, re-calibration of the water spray is necessary. If the rates are deemed to be acceptable, the pans are weighed and placed on the stand for a second collection period. After the second collection period has expired, the pans are again re-weighed, and the rates computed.

Once two rates have been collected at each test location, the catch rates of the first and second collection are compared. If the average catch rate for any location is deemed to be acceptable for the test condition, then the pouring of fluids may begin at this location.

Rates are continuously monitored at a minimum of two locations during a test to ensure there are no significant rate fluctuations. Pans will be placed at these locations and be re-weighed at fixed intervals (15 minutes, typically) during a test. If a rate fluctuation occurs, the test is stopped.

Following the failure of a test plate, a rate collection pan is weighed and placed at the plate location for a predetermined time interval. It is then re-weighed and placed again on the stand to collect a minimum of two additional rates at this location.

The rate of precipitation for any location on the stand is calculated by averaging the two rates collected prior to the test and the two rates collected following the test.

4.6.2 Natural Precipitation Conditions

Two rate collection pans per test stand are typically used to determine precipitation rates in natural conditions. Prior to the rate collection period, both pans are marked (upper and lower), and the inner bottom and sides of each pan are wetted with Type IV fluid to prevent blowing snow from escaping the pan. The wetted pans are then weighed to the nearest gram. The start time of the rate collection period is recorded (hh:mm:ss) using a customized Microsoft® Excel® spreadsheet in which the weight is also recorded by pressing the print function on the digital weigh scale.

The pans are positioned in locations 6 and 7 and allowed to collect precipitation for 10-minute intervals in normal conditions and 5-minute intervals in periods of high precipitation rates and high winds. In frost the collection interval is half hour to one hour depending on the frost accretion intensity.

Prior to removal of the plate pans from the test stand for re-weighing, any accumulated precipitation on the lips and outer sides of each plate pan is carefully removed. The plate pans are then carried to the rate station for re-weighing. Upon entering the trailer, the exact time is noted. The new weights of the plate pans are recorded, and the pans are brought back outside. This procedure is continued until the final plate on the test stand fails.

The rate for any HOT test in natural snow or frost is obtained by computing the time-weighted average of the rates collected in the upper and lower pans over the duration of the particular test.

An example of the rate calculation method for tests in natural conditions is displayed in Figure 4.1. Typically, two collections pans are used for each test. The start and end times of the test shown in Figure 4.1 are 10:15 and 10:45, respectively. Precipitation rates for one pan were collected at three periods during this test, indicated by t_1, t_2, and t_3 (minutes). The calculated rates for each collection period are indicated by R_1, R_2, and R_3 (g/dm²/h).

To calculate the average rate for this pan, the following formula is then used:

$$\frac{(R_1 \times t_1 + R_2 \times t_2 + R_3 \times t_3)}{t_1 + t_2 + t_3}$$

In the example shown in Figure 4.1, the rate is calculated as follows:

$$\frac{(25 \times 10 + 22 \times 8 + 34 \times 5)}{10 + 8 + 5}$$

The calculated average rate for this pan is 25.9 g/dm²/h. The average rate for the other collection pan is calculated in similar fashion, and the average of the two rates is then taken.

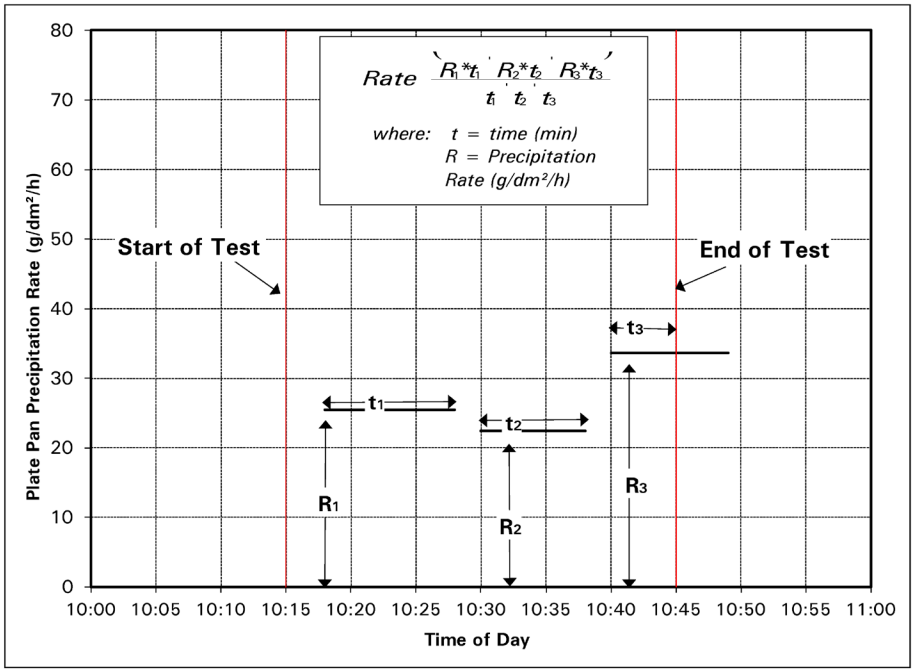


Figure 4.1: Calculation of Outdoor Precipitation Rate

5. TEST CONDITIONS

The conditions under which endurance time testing is conducted with Type II, Type III, and Type IV fluids are outlined in this section. Details are provided for precipitation rates, ambient temperatures, and droplet sizes.

5.1 Precipitation Rate Limits

Upper and lower precipitation rate limits are an important part of the test methodology for measuring fluid endurance times. Table 5.1 provides the meteorologically accepted definitions of weather phenomenon / precipitation types. It also includes the criteria used to determine precipitation intensity.

Table 5.1: Definition of Weather Phenomenon

Weather Phenomenon*	Definition*
FROST (No METAR code) Note: No Intensity is assigned to FROST.	Ice crystals that form from ice-saturated air at temperatures below 0°C (32°F) by direct sublimation on the ground or other exposed objects.
FREEZING FOG (FZFG) Note: No Intensity is assigned to FRZ FOG	A suspension of numerous minute water droplets which freezes upon impact with ground or other exposed objects, generally reducing the horizontal
SNOW (SN)	Precipitation of ice crystals, most of which are branched, star-shaped, or mixed with unbranched crystals. At temperatures higher than about -5°C
FRZING DRIZZLE (FZDZ)	Fairly uniform precipitation composed exclusively of fine drops [diameter less than 0.5 mm (0.02 in.)] very close together which freezes upon impact with
FREEZING RAIN (FZRA)	Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects, either in the form of drops of more than 0.5
RAIN (RA)	Precipitation of liquid water particles either in the form of drops of more than 0.5 mm (0.02 in.) diameter or of smaller widely scattered drops.
SNOW PELLETS (GS) and/or SMALL HAIL	Precipitation of white and opaque grains of ice. These grains are spherical or sometimes conical; their diameter
SNOW GRAINS (SG)	Precipitation of very small white and opaque grains of ice. These grains are fairly flat or elongated; their diameter is
HAIL (GR)	Precipitation of small balls or pieces of ice with a diame-
ICE PELLETS (PE)	Precipitation of transparent (sleet or grains of ice), or translucent (small hail) pellets of ice, which are spherical or irregular, and which have a diameter of 5 mm (0.2 in.)

Intensity Criteria**

	Snow(SN),Pellets(GS),Grains(SG)		Ice Pellets (PE)
Estimated Intensity	**Horizontal Visibility (statute mile)**	**Liquid Equivalent Snow (SN) Intensity*** **	**Definition and Horizontal Visibility**
Light (-)	If visibility is: **≥ 5/8 mi** (≥ 1.0 km)	**Trace to 0.05 in/hr** (≤ 1.0 mm/hr or 10 gr/dm²/hr)	Scattered pellets on the ground. Visibility not affected.
Moderate	If visibility is: **< 5/8 to 5/16 mi** (< 1.0 to 0.5 km)	**> 0.05 to 0.10 in/hr** (> 1.0 to 2.5 mm/hr) (> 10.0 to 25.0 gr/dm²/hr)	Slow accumulation on the ground. Visibility reduced to less than 7 mi.
Heavy (+)	If visibility is: **<5/16 mi** (< 0.5 km)	**More than 0.10 in/hr** (> 2.5 mm/hr or 25 gr/dm²/hr)	Rapid accumulation on the ground. Visibility reduced to less than 3 mi.

Note: Horizontal visibility is only an estimation of snow and freezing drizzle intensity. Measurements and observations have

	Drizzle Intensity (FZDZ)
Light(-)	Trace to 0.01 in/hr (0.254 mm/hr or 2.54 gr/dm²/hr)
Moderate	From 0.01 to 0.02 in/hr (2.54 to 5.08 gr/dm²/hr)
Heavy(+)	More than 0.02 in/hr (> 5.08 gr/dm²/hr) Note: Drizzle > 0.04 in/hr is usually in the form of rain.

	Rain (RA), Freezing Rain (FZRA), Ice Pellets (PE)
Measured Intensity	Up to 0.10 in/hr (2.5 mm/hr or 25 gr/dm²/hr) Maximum 0.01 inch in 6 minutes
Light (-) Estimated Intensity	From scattered drops that, regardless of duration, do not completely wet an
Measured Intensity	0.11 in to 0.30 in/hr (7.6 mm/hr or 76 gr/dm²/hr) More than 0.01 to 0.03 inch in 6 minutes
Moderate Estimated Intensity	Individual drops are not clearly identifiable; spray is observable just above
Measured Intensity	More than 0.30 in/hr (7.6 mm/hr or 76 gr/dm²/hr) More than 0.03 inch in 6 minutes
Heavy (+) Estimated Intensity	Rain seemingly falls in sheets; individual drops are not identifiable; heavy

* From World Meteorological Organization Guide to Meteorological Instruments and Methods of Observation (1983)
** From American Meteorological Society, Glossary of Meteorology WSOH #7 MAROBS (3/94)
*** NCAR/SAE Proposed Definition for Liquid Equivalent Snowfall Intensity

1) gm/dm² = 0.01 cm = 0.1 mm = 0.0039 in
2) in = 2.54 cm = 25.4 mm = 254 gm/dm²

Compiled by Jeff Cole and Roy Rasmussen of NCAR/RAP Sept 8, 1999 (Updated for METAR codes)

Table 5.1 was compiled by the National Centre for Atmospheric Research (NCAR) from the *World Meteorological Organization Guide to Meteorological Instruments and Methods of Observation* (1983) and from the *American Meteorological Society, Glossary of Meteorology WSOH # 7 Manual of Surface Weather Observations (MANOBS*) (3/94).

The precipitation rate limits established for Type II/III/IV endurance time testing are provided in ARP5485 and represented graphically in Figure 5.1. Subsections 5.1.1 to 5.1.5 provide detailed definitions and explanations of the precipitation types and rate boundaries used in Type II/III/IV endurance time testing. It should be noted that in many cases these limits are not the same as the meteorologically accepted definitions provided in Table 5.1.

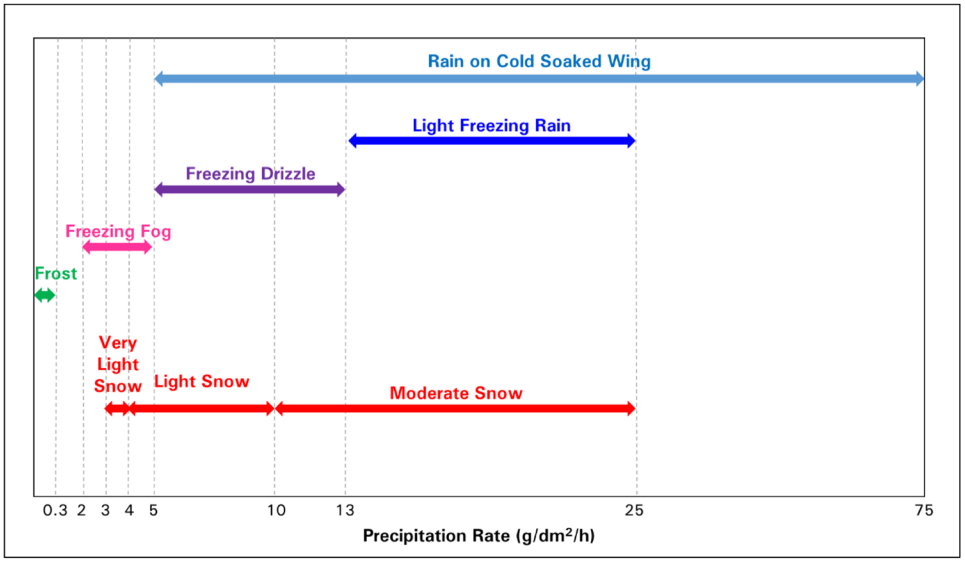


Figure 5.1: Precipitation Rate Limits Used in Endurance Time Testing

5.1.1 Freezing Fog

The precipitation rate limits for endurance time testing in freezing fog were set in 1997 at rates of 2 and 5 g/dm^2/h. These limits were determined with input from NRC meteorologists, who helped define an important parameter in the study of fog referred to as the *Liquid Water Content* (LWC). This quantity, expressed in density terms as the mass of water in grams contained in one cubic meter of air, can generally assume values in the range of 0.2 to 0.6 g/m^3.

5.1.2 Freezing Drizzle

The precipitation rate limits for endurance time testing in freezing drizzle are 5 and 13 g/dm^2/h. The upper limit in this range was adopted based on discussions with meteorological experts and aircraft operators on the SAE G-12 HOT Committee. This range corresponds to heavy drizzle and has been chosen to provide aircraft operators with a greater margin of safety.

5.1.3 Light Freezing Rain

The precipitation rate limits for endurance time testing in light freezing rain are 13 and 25 g/dm^2/h. This range corresponds to the category of light freezing rain and is the only freezing rain category considered, as operations in periods of moderate or heavy freezing rain are deemed unsafe.

5.1.4 Rain on a Cold-Soaked Surface

The precipitation rate limits for rain on cold-soaked surface are 5 and 75 g/dm^2/h. This range encompasses drizzle (5 to 13 g/dm^2/h), light rain (13 to 25 g/dm^2/h), and moderate rain (25 to 75 g/dm^2/h).

5.1.5 Snow

The precipitation rate limits used to determine HOTs for Type II/III/IV fluids in snow are 3, 4, 10, and 25 g/dm²/h. These rate limits encompass very light, light, and moderate snow.

5.2 Ambient Temperatures in Type II/III/IV Endurance Time Testing

HOTs are provided for six temperature bands in Type II, Type III, and Type IV HOT tables. These bands cover temperatures from the fluid's lowest operational use temperature (LOUT) and warmer.

For Type II/IV fluids the temperature bands are:

- -3°C and above (rain on cold-soaked surface limited to +1°C);
- Below -3°C to -8°C;
- Below -8°C to -14°C (freezing drizzle/light freezing limited to -10°C);
- Below -14°C to -18°C;
- Below -18°C to -25°C; and
- Below -25°C to LOUT (for fluids with LOUTs below -25°C).

For Type III fluids the temperature bands are:

- -3°C and above (rain on cold-soaked surface limited to +1°C);
- Below -3°C to -10°C; and
- Below -10°C to LOUT.

For Type III fluids with extremely low LOUTs (below -29.5°C), the third temperature band may be limited to -25°C and a fourth temperature band (below -25°C to LOUT) may be added.

In natural snow and natural frost testing, endurance time testing is carried out under a range of temperatures. In simulated freezing precipitation and artificial snow testing, endurance time testing is typically conducted at the lower limit of each temperature band. At this time, testing is not conducted at -8°C. The temperatures at which testing is conducted for each condition are listed below:

- Freezing Fog: -3°C, -10°C (Type III) / -14°C (Type II/IV), -25°C, LOUT (if LOUT < -29.5°C);
- Freezing Drizzle: -3°C and -10°C;
- Light Freezing Rain: -3°C and -10°C;
- Rain on Cold-Soaked Surface: +1°C; and
- Artificial Snow: -3°C, -10°C (Type III) / -18°C (Type II/IV), -25°C, LOUT (if LOUT < -29.5°C).

5.3 Freezing Precipitation Droplet Sizes

Research has shown that median volume diameter (MVD) of rain droplets is related to rate of precipitation as follows:

- MVD = (precipitation rate/10)$^{0.23}$, where MVD is in mm and rate of precipitation is in g/dm²/h

The theoretical MVDs for rain at various rates of precipitation were determined based on this equation. These values are listed in Table 5.2 beside the experimental MVDs for each precipitation condition.

To determine whether droplets produced at the NRC resembled droplets from natural precipitation, a test was conducted during natural light freezing rain conditions in 1997-98 at the APS test site. The droplet sizes were compared to those obtained in simulated light freezing rain at the NRC. The results of these tests are shown below.

a) *For the outdoor test:*

Location:	Montréal International Airport
Precipitation:	Natural Light Freezing Rain
Precipitation Rate:	20 g/dm²/h
Calibrated MVD:	1.0 mm

b) *For the indoor test:*

Location:	National Research Council CEF
Precipitation:	Simulated Light Freezing Rain
Precipitation Rate:	25 g/dm²/h
Calibrated MVD:	1.0 mm

The MVD for both natural and simulated light freezing rain was 1 mm, indicating that the NRC-produced droplets simulate natural precipitation.

As a result of this testing, the MVDs for freezing precipitation testing were established as follows:

- Freezing Fog, high precipitation rate (5 g/dm²/h): 30 μm
- Freezing Fog, low precipitation rate (2 g/dm²/h): 30 μm
- Freezing Drizzle, high precipitation rate (13 g/dm²/h): 350 μm
- Freezing Drizzle, low precipitation rate (5 g/dm²/h): 250 μm
- Light Freezing Rain, high precipitation rate (25 g/dm²/h): 1,000 μm
- Light Freezing Rain, low precipitation rate (13 g/dm²/h): 1,000 μm
- Rain on Cold-Soaked Surface, low precipitation rate (5 g/dm²/h): 250 μm
- Rain on Cold-Soaked Surface, high precipitation rate (75 g/dm²/h): 1,400 μm

Table 5.2: Theoretical and Experimental MVDs

Precipitation Condition	Experimental MVD (mm)	Theoretical MVD (mm)
Moderate Rain (High rate: 75 g/dm²/h)	1.4	1.6
Light Rain (Low rate: 13 g/dm²/h)	1.0	< 1.1
Light Rain (High rate: 25 g/dm²/h)	1.0	1.2
Drizzle (Low rate: 5 g/dm²/h)	0.25	< 0.5
Drizzle (High rate: 13 g/dm²/h)	0.35	< 0.5
Fog		< 0.1

5.4 Summary of Freezing Precipitation Test Conditions

The precipitation types/rates, ambient temperatures, and droplet sizes for freezing precipitation testing with Type II/III/IV fluids were described in the previous subsections. In summary, freezing precipitation tests are carried out under each of the 16 weather conditions listed in Table 5.3.

Table 5.3: Summary of Freezing Precipitation Test Conditions

Precipitation Type	Ambient Temperature	Precipitation Rate (Droplet Size)
Freezing Fog	-3°C	2 g/dm^2/h (30 μm)
		5 g/dm^2/h (30 μm)
	-14°C (Type II/IV) -10°C (Type III)	2 g/dm^2/h (30 μm)
		5 g/dm^2/h (30 μm)
	-25°C	2 g/dm^2/h (30 μm)
		5 g/dm^2/h (30 μm)
	LOUT (if < -29°C)	2 g/dm^2/h (30 μm)
		5 g/dm^2/h (30 μm)
Freezing Drizzle	-3°C	5 g/dm^2/h (250 μm)
		13 g/dm^2/h (350 μm)
	-10°C	5 g/dm^2/h (250 μm)
		13 g/dm^2/h (350 μm)
Light Freezing Rain	-3°C	13 g/dm^2/h (1,000 μm)
		25 g/dm^2/h (1,000 μm)
	-10°C	13 g/dm^2/h (1,000 μm)
		25 g/dm^2/h (1,000 μm)
Rain on Cold-Soaked Surface	+1°C	5 g/dm^2/h (250 μm)
		75 g/dm^2/h (1,400 μm)

6. ANALYSIS METHODOLOGIES

A multi-variable regression procedure is used to derive fluid-specific HOTs for Type II/III/IV fluids. The procedure is based on the refinement of an equation for a curve which best represents the test data, and then solving that equation at the upper and lower limits established for the precipitation type. These precipitation rate limits, set by the SAE G-12 HOT Committee, and detailed in ARP5485, were described in Subsection 5.1. This approach was developed in the winter of 1996-97 (see TC report, TP 13131E) and has since been used to derive fluid HOTs. There are some differences in the way the methodology is applied to freezing precipitation and natural snow data.

6.1 Freezing Precipitation Data

For each related freezing precipitation HOT table cell, four tests are conducted at the most restrictive (lowest) temperature in the temperature range for that cell: two tests at the low precipitation rate limit and two tests at the high precipitation rate limit (limits are detailed in Subsection 5.1). An exception to this is the "Below -3°C to -8°C" cell for Type II/IV fluids. No testing is conducted in this temperature range; this cell is instead populated with the same HOTs as the "Below -8°C to -14°C" cell.

The equation used to treat freezing precipitation data is:

$t = 10^{l}R^{a}$, where

t = Time (minutes)

R = Rate of precipitation (g/dm²/h)

l, a = coefficients determined from the regression

The upper and lower HOT values for each cell are determined from the points at which the best-fit curve intersects the lower and upper precipitation limits, respectively. The calculated HOTs derived from this analysis are subject to the rounding and capping rules detailed in Subsection 6.4.

6.2 Natural Snow Data

As outside air temperature and precipitation rate cannot be controlled under natural test conditions, natural snow tests are carried out at a variety of temperatures and precipitation rates. An attempt is made to gather data under all temperatures and precipitation rates encompassed by the HOT tables.

The general form of the regression equation is modified for natural snow to incorporate the variable of temperature and also to prevent taking the log of a negative number as natural snow can occur at temperatures approaching 2°C. The equation used to treat natural snow data is:

$t = 10^{l} R^{a} (2-T)^{b}$, where

t = Time (minutes)

R = Rate of precipitation (g/dm²/h)

l, a, b = coefficients determined from the regression

The upper and lower HOT values for each cell are determined from the points at which the best-fit curve intersects the lower and upper precipitation limits, using the most restrictive (lowest) temperature for that cell. The calculated HOTs derived from this analysis are subject to the rounding and capping rules detailed in Subsection 6.4.

The data included in a snow HOT regression analysis is dependent on the temperatures for which the HOTs are being derived. For warm snow HOTs (-14°C and above), all data collected at temperatures of -16°C and warmer is included in the analysis. For cold snow HOTs (below -14°C), all data collected at temperatures of -14°C and colder is included in the analysis.

6.3 Natural Frost Data

Regression analysis is not used in the determination of frost HOTs. The current Type II/III/IV generic frost HOTs were determined based on several years of testing using all fluids which were commercially available at the time. A "minimum values" analysis methodology was used to determine appropriate HOTs from the test data.

The purpose of natural frost testing with new fluids is to verify the fluids can be used with the generic frost HOTs. The analysis methodology is to compare the frost test data collected with the new fluid to the current generic HOTs. If the test data provides HOTs equal to or greater than the generic HOTs, then the generic HOTs have been validated for the new fluid.

As outside air temperature and precipitation rate cannot be controlled under natural test conditions, natural frost tests are carried out at a variety of temperatures and precipitation rates.

For a given Type II/III/IV fluid, a minimum of two data points (with acceptable results) per dilution are required to consider the generic active frost HOTs validated. The desired data targets are six tests for a neat dilution, four tests for a 75/25 dilution, and two tests for a 50/50 dilution. If these desired data targets are not achieved for

a given fluid in the year it is initially submitted for HOT testing, samples of the fluid will be retained, and additional active frost tests will be run the following year. Samples are not to be retained for testing longer than one additional year.

6.4 Artificial Snow Data

6.4.1 Fluids without Fluid-Specific Snow HOTs Below -14°C

Type II, Type III, and Type IV fluids that are submitted for endurance time testing undergo testing in artificial snow at -18°C and -25°C. The purpose of the testing is to verify that these fluids can be used with the generic very cold snow HOTs. Note that this testing is omitted for fluids with fluid-specific snow HOTs below -14°C.

The analysis methodology used to complete this verification is a comparison of the test data collected to a historical database of similar data. If the test endurance times are similar to those in the historical data set, then the generic HOTs are considered validated for the new fluid.

6.4.2 Snow HOTs at LOUT for Fluids with LOUT < -29°C

Type II, Type III, and Type IV fluids that are submitted for endurance time testing undergo additional testing in artificial snow at -25°C and at their respective LOUTs. The purpose of this testing is to determine the appropriate snow HOTs for these fluids at their LOUT.

The testing and analysis protocol used to determine the HOTs at LOUT is as follows:

1. Artificial snow tests are run at -25°C and at the LOUT at the boundary rates for very light, light, and moderate snow as outlined in the HOT Guidelines (3, 4, 10, and 25 g/dm²/h, with two tests at each rate/temperature pairing);
2. The relative performance of the fluid at -25°C vs. the LOUT is determined by dividing the endurance times of the tests run at the LOUT by the endurance times of the tests run at -25°C for each of the boundary rates;
3. The resulting relative performance outputs are averaged;
4. The final average endurance ratio is reduced by a factor of two sigma to ensure the final output remains conservative; and
5. The reduced endurance time ratio is applied to the HOTs derived for -25°C from the natural snow data to obtain HOTs for the LOUT.

6.5 Rounding and Capping Protocols

Regression-generated HOTs are subject to the rounding and capping protocols detailed below.

6.5.1 Rounding Protocols

All HOTs are rounded to the nearest whole "5" minute, i.e., 55.1 to 57.4 minutes is rounded down to 55 minutes; 57.5 to 59.9 minutes is rounded up to 60 minutes. The only exceptions are:

- In cases where the regression-generated HOTs for Type II/IV fluids are below 10 minutes, the numbers are rounded down to the nearest whole minute as a precautionary measure (e.g. 9.6 minutes is rounded down to 9 minutes); and
- In cases where the regression-generated HOTs for Type III fluids are below 20 minutes, the numbers are rounded down to the nearest whole minute as a precautionary measure (e.g. 19.6 minutes is rounded down to 19 minutes).

6.5.2 Capping Protocols

All HOT values are capped at maximum values. The caps differ by precipitation type, and in the case of snow, by regulator. The caps are as follows:

- Freezing Fog HOT values are capped at 4 hours;
- Freezing Drizzle, Light Freezing Rain, Rain on Cold-Soaked Wing HOTs are capped at 2 hours; and
- Snow HOTs are capped at 2 hours by TC and 3 hours by the FAA.

6.6 Regression Example

Sample plots of **Log t** versus **Log R** are shown in Figure 6.1. The plots contain data for one Neat Type IV fluid, in one temperature range (-10°C), in light freezing rain conditions. The best-fit regression line is superimposed onto the plot and was obtained from the analysis using the most restrictive temperature in the temperature range from which the data were chosen.

The same data plotted on a linear scale (failure time **t** versus precipitation rate **R**) are shown in Figure 6.2. The curve, generated from the power law form of the equation using the coefficients determined from the fit, is superimposed onto the plot. The HOT range is determined from the intersections of the curve with the precipitation rate limits defined for light freezing rain.

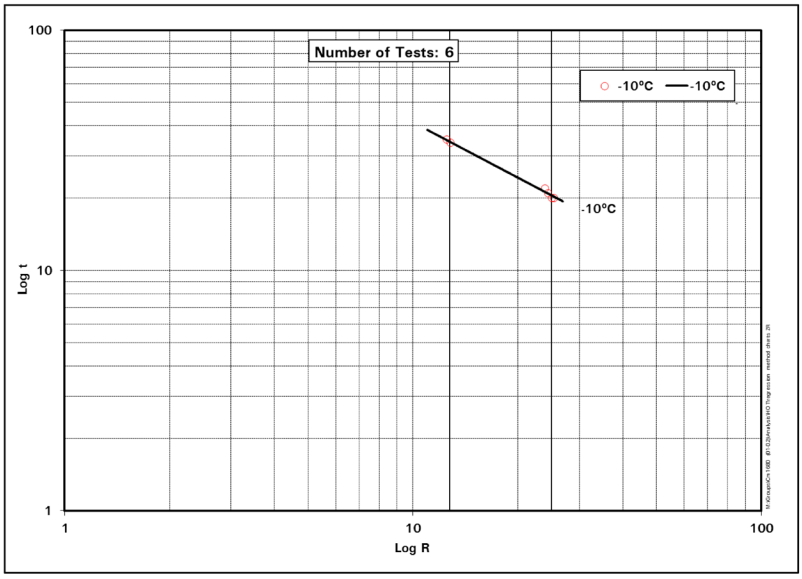


Figure 6.1: Regression Method on Log-Log Chart – Type IV Neat, Freezing Rain

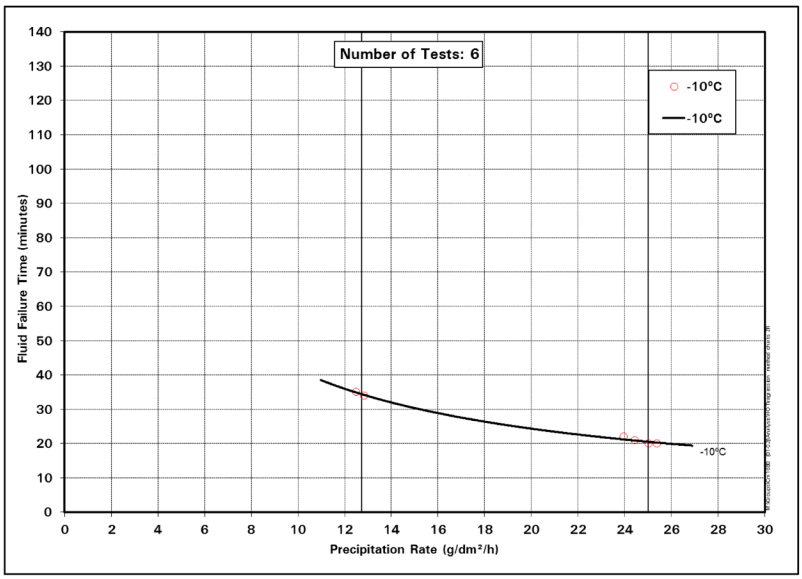


Figure 6.2: Regression Method on Standard Chart – Type IV Neat, Freezing Rain

The HOTs for this fluid at -10°C are 20 minutes at 13 g/dm^2/h and 35 minutes at 25 g/dm^2/h, establishing the HOT range for this particular fluid in the light freezing rain, neat fluid, below -3 to -10°C cell. This illustrates the general approach used in the determination of a fluid HOT range for any given cell in the HOT table.

6.7 Lowest and Highest Usable Precipitation Rates in Snow

A detailed analysis methodology was developed to determine if a snow data set is sufficient to determine HOTs for light and very light snow. Specifically, the analysis determines the lowest usable precipitation rate (LUPR) and the highest usable precipitation rate (HUPR), which are the lowest and highest rates, respectively, at which the data set is considered robust.

6.7.1 Temperatures of -14°C and Above

A three-factor weighted analysis methodology is used to determine the LUPR and HUPR values for a snow data set at temperatures of -14°C and above. Table 6.1 lists the three factors and their weightings. Each data set is given a rating of 0, 10, 20, 30, or 40 for each factor. The factor rating system is shown in Table 6.2.

The ratings are multiplied by the factor weighting to determine a final score for a specific precipitation rate. LUPR scores are calculated for each precipitation rate between 3 and 10 g/dm²/h. HUPR scores are calculated for 25 and 50 g/dm²/h and rates in multiples of 5 in between (25, 30, 35, 40, 45, 50).

The scores are compared to the minimum acceptance score, which is 26. The LUPR is the lowest precipitation rate at which a data set has a passing score; the HUPR is the highest precipitation rate at which a data set has a passing score.

6.7.2 Temperatures Below -14°C

The methodology described above for determining LUPR values at -14°C and above is also used for determining LUPR values below -14°C.

Moderate snow occurs rarely, and heavy snow occurs very rarely at temperatures below -14°C. Therefore, it is not feasible to collect sufficient natural snow data to support use of the regression curve at high precipitation rates. At this time, regulators have elected to allow use of regression coefficients for temperatures below -14°C up to a rate of 25 g/dm²/h. This is the default HUPR for all fluids below -14°C.

Table 6.1: Factors Used in LUPR/HUPR Calculations

Factor	Description – LUPR	Description – HUPR	Weight
1. Data Points with Precipitation Rates near the Precipitation Rate being Examined	• Number of data points with precipitation rates ≤ 0.5 g/dm²/h above the precipitation rate being examined	• Number of data points with precipitation rates ≥ 10 g/dm²/h below the precipitation rate being examined	30%
2. Data Points in High or Low Precipitation Rate Categories	• Number of data points with precipitation rates ≤ 10 g/dm²/h	• Number of data points with precipitation rates ≥ 20 g/dm²/h	50%
3. Negative Scatter of High or Low Precipitation Rate Data Points	• Difference between endurance time predicted by regression curve and measured endurance time calculated as a percentage • Scatter is set to 0% for data points with positive scatter (i.e., predicted endurance time < measured endurance time) • Average scatter is calculated for all data points ≤ 10 g/dm²/h	• Difference between endurance time predicted by regression curve and measured endurance time calculated as a percentage • Scatter is set to 0% for data points with positive scatter (i.e., predicted endurance time < measured endurance time) • Average scatter is calculated for all data points ≥ 25 g/dm²/h	20%

Table 6.2: LUPR/HUPR Factor Ratings

Factor #1: Data Points with Precipitation Rates near the Precipitation Rate being Examined		
Rating	**LUPR**	**HUPR**
Rating = 40	≥ 3 data points ≤ precipitation rate +0.5	≥ 5 data points ≥ precipitation rate -10
Rating = 30	2 data points ≤ precipitation rate +0.5	4 data points ≥ precipitation rate -10
Rating = 20	1 data point ≤ precipitation rate +0.5	3 data points ≥ precipitation rate -10
Rating = 10	n/a	2 data points ≥ precipitation rate -10
Rating = 0	0 data points ≤ precipitation rate +0.5	< 2 data points ≥ precipitation rate -10
Factor #2: Data Points at High or Low Precipitation Rate Categories		
Rating	**LUPR**	**HUPR**
Rating = 40	≥ 8 data points ≤ 10 g/dm²/h	≥ 5 data points > 20 g/dm²/h
Rating = 30	6-7 data points ≤ 10 g/dm²/h	4 data points > 20 g/dm²/h
Rating = 20	4-5 data points ≤ 10 g/dm²/h	3 data points > 20 g/dm²/h
Rating = 10	2-3 data points ≤ 10 g/dm²/h	2 data points > 20 g/dm²/h
Rating = 0	< 2 data points ≤ 10 g/dm²/h	< 2 data points > 20 g/dm²/h
Factor #3: Negative Scatter of High or Low Precipitation Rate Data Points		
Rating	**LUPR**	**HUPR**
Rating = 40	≥ -10%	≥ -10%
Rating = 30	-11 to -15%	-11 to -15%
Rating = 20	-16 to -20%	-16 to -20%
Rating = 10	n/a	n/a
Rating = 0	< -20%	< -20%

APPENDIX D

FLUID MANUFACTURER REPORT:
ESSPO CHEMICALS D.O.O NORDWING PG2 (TYPE II)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Nordwing PG2 (Type II)

Prepared for

ESSPO CHEMICALS D.O.O



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ECD-PG2 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Nordwing PG2 (Type II)

Prepared for

ESSPO CHEMICALS D.O.O

Prepared by: July 2, 2025

Yi Tian
Assistant, Publications and Delivery

Date

Reviewed by: July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems

Date

By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ECD-PG2 2024-25

Fluid Identification and Characteristics

Manufacturer:	ESSPO CHEMICALS D.O.O		
Fluid Test Name:	NORDWING PG2		
Fluid Commercial Name:	Nordwing PG2		
Fluid Type / Base / Colour:	Type II / Propylene Glycol / Straw		
Batch #:	PG2-24-01		
Date of Receipt:	December 23, 2024		
Brix (Measured):	Neat fluid:	35.25°	
Freeze Point (Stated):	Neat fluid:	-38.2°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-31°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	11,300 cP	11,450 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid[2]:	9,354 cP	9,500 cP
WSET (from AMIL):	Neat fluid:	94 minutes	

1. LV1 (with guard leg), 600 mL low form (Griffin) beaker, 575 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.
2. SC4-31/13R, small sample adapter, 10 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **Nordwing PG2** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport, at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

Nordwing PG2 Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	1:40 - 3:10	0:30 - 1:00	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20	1:05 - 1:50	0:50 - 1:05	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	1:05 - 2:20	0:25 - 0:45	2:00 - 2:30	1:00 - 2:00	0:30 - 1:00	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	1:05 - 2:20	0:20 - 0:40	1:45 - 2:10	0:50 - 1:45	0:25 - 0:50	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:20 - 0:35	0:10 - 0:25	1:15 - 1:40	0:30 - 1:15	0:15 - 0:30					
below -18 to -25	100/0	0:20 - 0:35	0:06 - 0:15	0:50 - 1:05	0:20 - 0:50	0:08 - 0:20					
below -25 to -30**	100/0	0:20 - 0:30	0:03 - 0:07	0:25 - 0:30	0:09 - 0:25	0:04 - 0:09					

FAA values displayed. TC caps snow holdover times at 2 hours.

***LOUT capped at -30°C in guidelines as fluid was tested at this temperature based on manufacturer instructions.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
PMG	PMG Technologies Inc.
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **Nordwing PG2**, a new Type II fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with Nordwing PG2 is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – Nordwing PG2, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	1	3	6	3	0
	Below -3 to -8	0	0	8	0	0
	Below -8 to -13	4	3	5	3	3
	Below -13 to -16	0	2	2	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – Nordwing PG2, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	5	7	0	0
	Below -18 to -22	4	4	0	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	0	6	0	0	0

3.3 Artificial Snow Tests

Artificial snow tests were conducted at PMG Technologies Inc. (PMG) in Blainville, QC. Table 3.3 shows the test counts in artificial snow for Nordwing PG2.

Table 3.3: Artificial Snow Test Counts – Nordwing PG2, 100/0

Artificial Snow		Precipitation Rate (g/dm²/h)			
		3	4	10	25
Temp. (°C)	-18	0	0	0	0
	-25	2	2	2	2
	-30	2	2	2	2

3.4 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.4 by precipitation type, fluid dilution, and test temperature.

Table 3.4: Freezing Precipitation Test Counts – Nordwing PG2, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog				CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	-30°C	+1°C
100/0	4	6	4	4	4	4	4	4	4

3.5 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.5 by fluid dilution and test temperature.

Table 3.5: Natural Frost Test Counts – Nordwing PG2, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	0	4	0

3.6 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.7 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.6 (natural snow), Table 3.7 (very cold snow), Table 3.8 (artificial snow), Table 3.9 (freezing precipitation), and Table 3.10 (natural frost).

Table 3.6: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
41	23-Dec-24	Nordwing PG2	100/0	-8.1	9.3	57.9
46	23-Dec-24	Nordwing PG2	100/0	-7.9	11.1	47.4
47	23-Dec-24	Nordwing PG2	100/0	-7.8	12.1	53.4
52	23-Dec-24	Nordwing PG2	100/0	-7.5	10.5	62.6
67	08-Jan-25	Nordwing PG2	100/0	-13.7	5.6	89.4
74	08-Jan-25	Nordwing PG2	100/0	-13.0	3.7	112.9
84	08-Jan-25	Nordwing PG2	100/0	-12.2	4.7	90.8
89	23-Jan-25	Nordwing PG2	100/0	-8.4	2.6	221.4
98	27-Jan-25	Nordwing PG2	100/0	-1.4	3.3	198.1
109	29-Jan-25	Nordwing PG2	100/0	-13.8	6.5	83.7
118	29-Jan-25	Nordwing PG2	100/0	-14.5	15.5	25.2
122	29-Jan-25	Nordwing PG2	100/0	-14.5	12.4	35.9
131	30-Jan-25	Nordwing PG2	100/0	-10.9	1.5	239.6
138	03-Feb-25	Nordwing PG2	100/0	-3.6	10.4	79.3
149	03-Feb-25	Nordwing PG2	100/0	-3.3	12.6	70.2
154	03-Feb-25	Nordwing PG2	100/0	-3.2	14.0	63.1
170	03-Feb-25	Nordwing PG2	100/0	-3.2	14.2	63.3
173	03-Feb-25	Nordwing PG2	100/0	-3.1	11.9	72.8
182	06-Feb-25	Nordwing PG2	100/0	-12.2	10.1	35.7
191	06-Feb-25	Nordwing PG2	100/0	-11.7	25.5	20.9
200	06-Feb-25	Nordwing PG2	100/0	-12.9	18.4	32.1
208	06-Feb-25	Nordwing PG2	100/0	-11.3	8.0	88.8
218	12-Feb-25	Nordwing PG2	100/0	-11.8	3.5	128.2
227	13-Feb-25	Nordwing PG2	100/0	-11.7	27.2	20.7
237	13-Feb-25	Nordwing PG2	100/0	-11.4	40.8	15.0
244	13-Feb-25	Nordwing PG2	100/0	-11.3	24.7	23.4
254	16-Feb-25	Nordwing PG2	100/0	-10.2	12.1	58.7
263	16-Feb-25	Nordwing PG2	100/0	-10.1	23.7	33.2
272	16-Feb-25	Nordwing PG2	100/0	-10.0	29.1	29.7
281	16-Feb-25	Nordwing PG2	100/0	-9.9	51.4	20.5
290	16-Feb-25	Nordwing PG2	100/0	-9.8	44.1	19.5
299	27-Feb-25	Nordwing PG2	100/0	-1.1	14.6	81.9
307	04-Mar-25	Nordwing PG2	100/0	0.8	6.8	148.2
321	04-Mar-25	Nordwing PG2	100/0	0.4	14.8	72.3
336	04-Mar-25	Nordwing PG2	100/0	-0.1	7.7	117.6
341	19-Mar-25	Nordwing PG2	100/0	1.1	5.6	161.1
354	19-Mar-25	Nordwing PG2	100/0	-0.1	10.5	96.5

Table 3.6: Log of Tests Performed (Natural Snow) (cont'd)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
368	19-Mar-25	Nordwing PG2	100/0	-0.5	10.7	94.1
377	19-Mar-25	Nordwing PG2	100/0	-0.5	25.6	57.5
390	19-Mar-25	Nordwing PG2	100/0	-0.8	36.3	40.9
399	20-Mar-25	Nordwing PG2	100/0	-1.2	29.6	51.2
409	24-Mar-25	Nordwing PG2	100/0	-2.8	16.5	63.7
420	24-Mar-25	Nordwing PG2	100/0	-1.7	17.5	57.9

Table 3.7: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
44	08-Jan-25	Nordwing PG2	100/0	-13.7	5.6	89.4
53	27-Jan-25	Nordwing PG2	100/0	-18.1	9.6	28.2
63	27-Jan-25	Nordwing PG2	100/0	-17.8	9.6	32.1
71	27-Jan-25	Nordwing PG2	100/0	-17.9	9.8	28.5
81	27-Jan-25	Nordwing PG2	100/0	-17.9	12.2	25.1
90	27-Jan-25	Nordwing PG2	100/0	-17.2	16.4	19.1
99	27-Jan-25	Nordwing PG2	100/0	-17.2	17.0	21.2
106	29-Jan-25	Nordwing PG2	100/0	-13.8	6.5	83.7
113	29-Jan-25	Nordwing PG2	100/0	-14.5	15.5	25.2
119	29-Jan-25	Nordwing PG2	100/0	-14.5	12.4	35.9
132	31-Jan-25	Nordwing PG2	100/0	-25.1	5.4	36.6
140	31-Jan-25	Nordwing PG2	100/0	-25.3	4.2	47.3
151	31-Jan-25	Nordwing PG2	100/0	-25.3	5.6	34.1
159	31-Jan-25	Nordwing PG2	100/0	-25.8	6.3	34.3
170	31-Jan-25	Nordwing PG2	100/0	-26.3	6.0	35.9
175	31-Jan-25	Nordwing PG2	100/0	-26.6	4.9	41.7
188	05-Feb-25	Nordwing PG2	100/0	-18.2	5.3	54.9
196	05-Feb-25	Nordwing PG2	100/0	-17.9	2.3	102.0
203	05-Feb-25	Nordwing PG2	100/0	-17.5	4.8	73.7
215	05-Feb-25	Nordwing PG2	100/0	-16.9	2.0	178.7
225	05-Feb-25	Nordwing PG2	100/0	-16.7	10.7	36.1
229	05-Feb-25	Nordwing PG2	100/0	-16.7	14.1	29.8
238	13-Feb-25	Nordwing PG2	100/0	-21.4	2.9	81.2
246	13-Feb-25	Nordwing PG2	100/0	-21.2	4.1	58.8
256	13-Feb-25	Nordwing PG2	100/0	-21.2	4.9	50.3
266	13-Feb-25	Nordwing PG2	100/0	-21.0	3.8	57.1
274	13-Feb-25	Nordwing PG2	100/0	-20.8	3.6	64.6
282	13-Feb-25	Nordwing PG2	100/0	-20.5	3.8	60.4

Table 3.8: Log of Tests Performed (Artificial Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
AS5	08-Apr-25	Nordwing PG2	100/0	-25	3.1	101
AS5R	08-Apr-25	Nordwing PG2	100/0	-25	3.0	122
AS6	07-Apr-25	Nordwing PG2	100/0	-25	4.0	93
AS6R	08-Apr-25	Nordwing PG2	100/0	-25	4.1	81
AS7	07-Apr-25	Nordwing PG2	100/0	-25	10.0	30
AS7R	08-Apr-25	Nordwing PG2	100/0	-25	10.4	34
AS8	07-Apr-25	Nordwing PG2	100/0	-25	23.5	18
AS8R	09-Apr-25	Nordwing PG2	100/0	-25	24.4	16
AS9	03-Apr-25	Nordwing PG2	100/0	-30	3.0	66
AS9R	04-Apr-25	Nordwing PG2	100/0	-30	3.1	71
AS10	03-Apr-25	Nordwing PG2	100/0	-30	4.0	58
AS10R	04-Apr-25	Nordwing PG2	100/0	-30	3.8	64
AS11	02-Apr-25	Nordwing PG2	100/0	-30	10.1	27
AS11R	04-Apr-25	Nordwing PG2	100/0	-30	10.0	32
AS12	02-Apr-25	Nordwing PG2	100/0	-30	24.3	10
AS12R	04-Apr-25	Nordwing PG2	100/0	-30	24.2	13

Table 3.9: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
1	20-Mar-25	Freezing Fog	Nordwing PG2	100/0	-3.3	1.8	193.1
2	20-Mar-25	Freezing Fog	Nordwing PG2	100/0	-3.3	2.0	201.0
21	20-Mar-25	Freezing Fog	Nordwing PG2	100/0	-3.1	4.9	104.4
22	20-Mar-25	Freezing Fog	Nordwing PG2	100/0	-3.2	5.2	91.9
41	19-Mar-25	Freezing Fog	Nordwing PG2	100/0	-14.3	1.9	142.6
42	19-Mar-25	Freezing Fog	Nordwing PG2	100/0	-14.3	2.0	142.0
59	19-Mar-25	Freezing Fog	Nordwing PG2	100/0	-13.4	4.9	68.6
60	19-Mar-25	Freezing Fog	Nordwing PG2	100/0	-13.4	5.0	67.1
77	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-24.7	2.3	32.5
78	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-24.7	2.3	31.6
93	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-24.7	4.8	20.2
94	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-24.7	4.7	18.8
109	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-30.3	2.0	27.9
110	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-30.2	1.9	29.3
115	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-30.3	5.0	20.5
116	18-Mar-25	Freezing Fog	Nordwing PG2	100/0	-30.3	4.9	21.1
121	25-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-3.0	13.0	62.9
122	25-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-3.0	13.2	63.9
141	25-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-3.2	5.4	109.0
142	25-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-3.2	5.4	97.7
161	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.2	5.2	84.1
162	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.2	5.4	87.7
179	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.4	13.1	35.5
R179	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.2	13.0	56.2
180	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.1	13.1	54.6
R180	26-Mar-25	Freezing Drizzle	Nordwing PG2	100/0	-10.2	13.4	54.5
197	21-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-3.2	13.1	65.0
198	21-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-3.2	12.7	64.2
217	21-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-3.3	24.7	53.0
218	21-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-3.3	25.3	49.6
237	26-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-9.8	13.1	49.8
238	26-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-9.8	13.1	49.4
255	27-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-10.1	25.5	26.0
256	27-Mar-25	Light Freezing Rain	Nordwing PG2	100/0	-10.1	25.9	27.1
273	27-Mar-25	Cold Soak Box	Nordwing PG2	100/0	1.1	5.2	104.0
274	27-Mar-25	Cold Soak Box	Nordwing PG2	100/0	1.1	4.8	103.7
291	27-Mar-25	Cold Soak Box	Nordwing PG2	100/0	0.7	77.2	19.6
292	27-Mar-25	Cold Soak Box	Nordwing PG2	100/0	0.6	73.1	19.6

Table 3.10: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
68	26-Dec-24	Natural Frost	Nordwing PG2	100/0	360	0.12	-15.0	6	85	Did Not Fail
73	20-Jan-25	Natural Frost	Nordwing PG2	100/0	250	0.00	-16.6	15	58	Did Not Fail
79	21-Jan-25	Natural Frost	Nordwing PG2	100/0	361	0.04	-15.3	9	63	Did Not Fail
88	24-Jan-25	Natural Frost	Nordwing PG2	100/0	360	0.07	-17.1	7	75	Did Not Fail
97	13-Mar-25	Natural Frost	Nordwing PG2	100/0	725	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type II HOT Guidelines. The figures include the current Type II generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.2 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type II fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.2 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Artificial Snow

In order to determine holdover times for Nordwing PG2 in snow in the coldest temperature band (below -25°C to -30°C), artificial snow testing was performed with Nordwing PG2 at -25°C and -30°C. Figure 4.7 shows the endurance time data collected in artificial snow at these temperatures.

Table 4.1 shows the relative endurance time performance of the fluid in artificial snow at -25°C vs. -30°C.

4.1.4 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.10. The test durations were compared to the Type II generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type II generic frost holdover times can be considered substantiated for Nordwing PG2.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of Nordwing PG2. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.5 Fluid Thickness Tests

Figure 4.8 shows the fluid thickness test data. As described in Subsection 3.6, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.9.

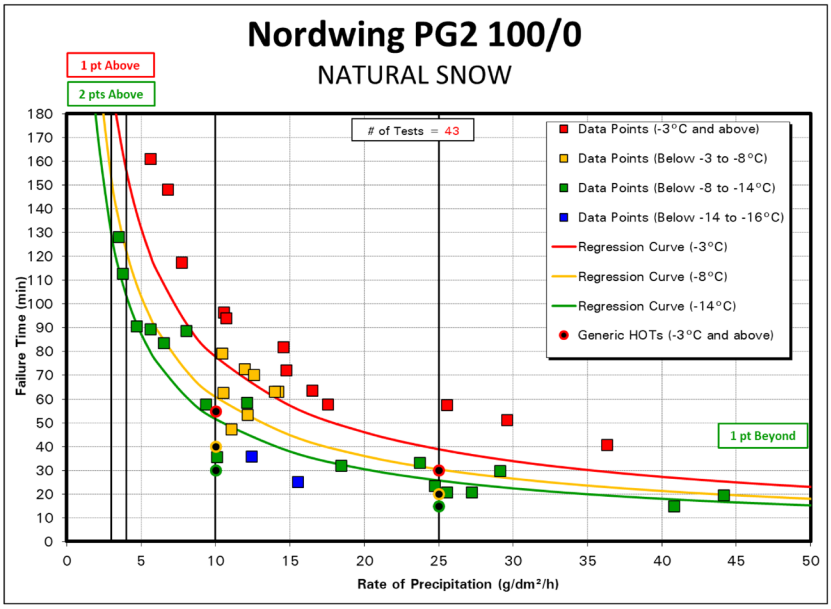


Figure 4.1: Type II 100/0 – Natural Snow

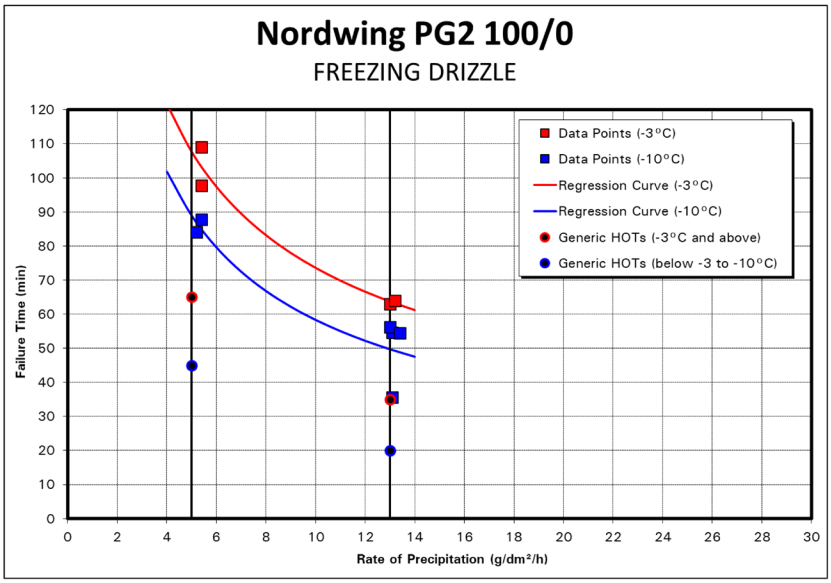


Figure 4.2: Type II 100/0 – Freezing Drizzle

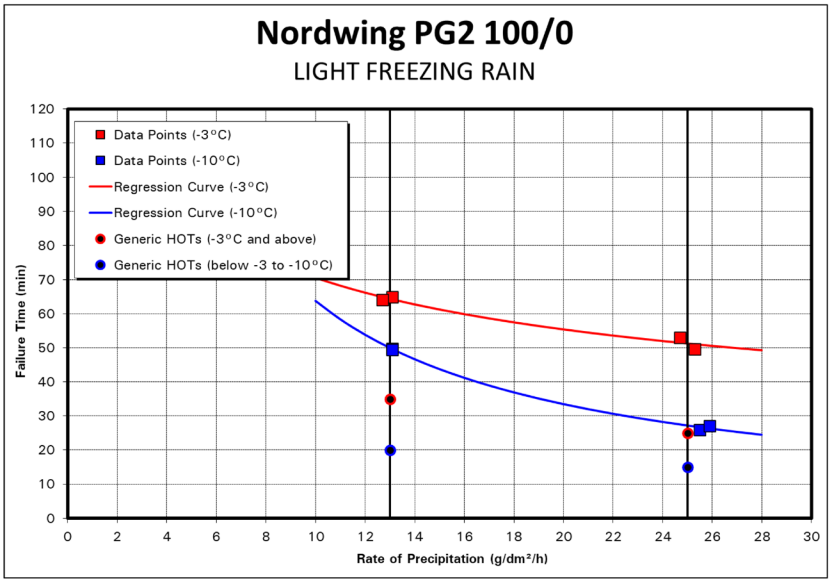


Figure 4.3: Type II 100/0 – Light Freezing Rain

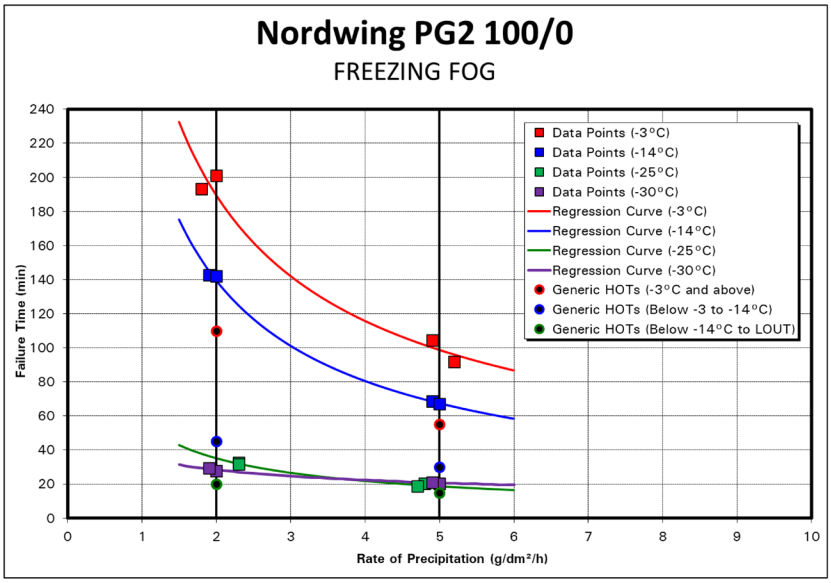


Figure 4.4: Type II 100/0 – Freezing Fog

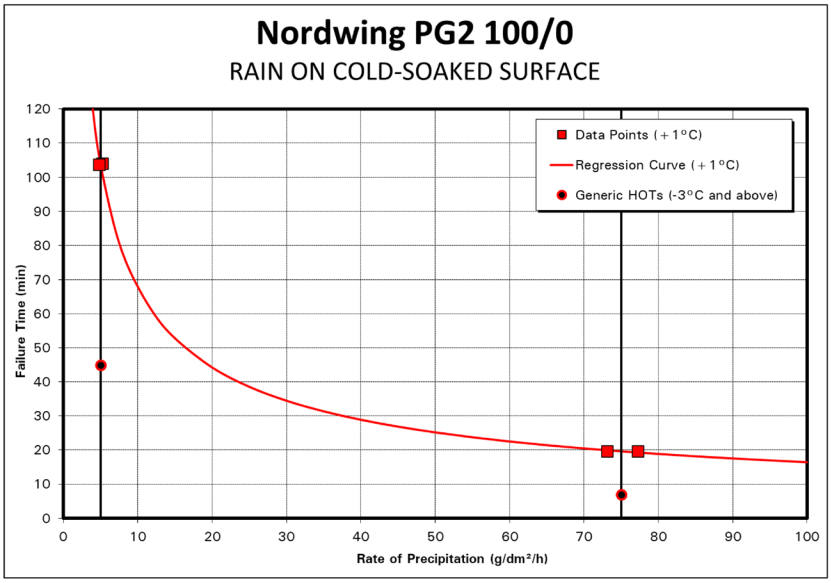


Figure 4.5: Type II 100/0 – Rain on Cold-Soaked Surface

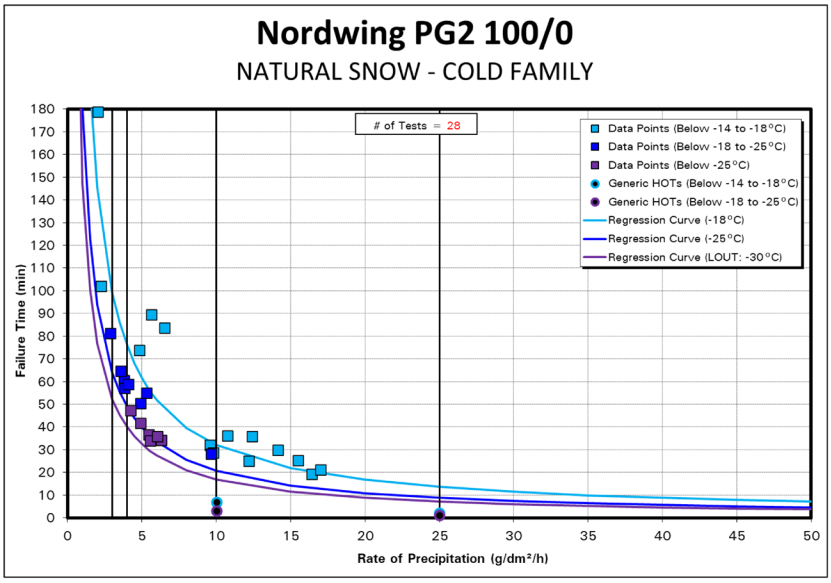


Figure 4.6: Type II 100/0 – Very Cold Snow

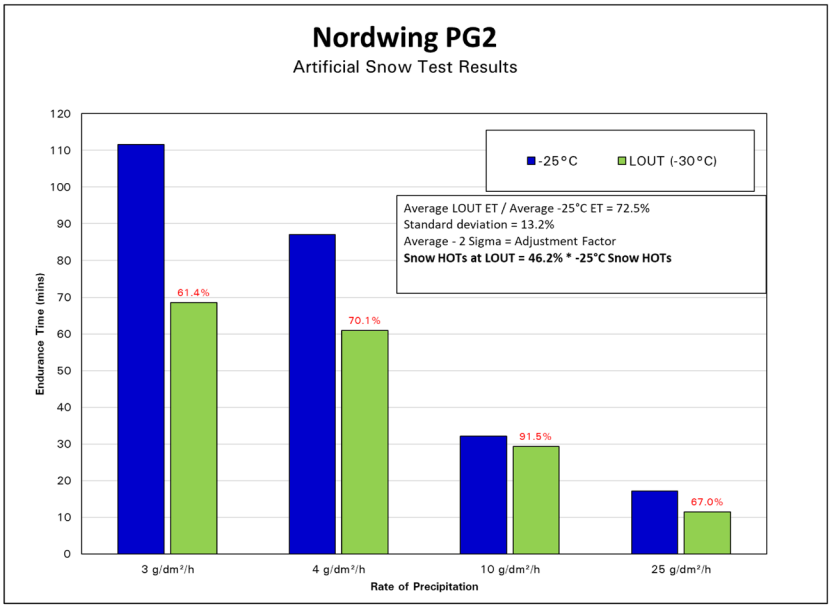


Figure 4.7: Type II 100/0 – Artificial Snow at -25°C and -30°C

Table 4.1: Nordwing PG2 Artificial Snow Performance at -25°C vs. -30°C

Rate (g/dm²/h)	Fail Time at -25°C (min)	Fail Time at -30°C (min)	-30°C HOT as % of -25°C HOT
3	111.6	68.6	61.4%
4	87.0	61.0	70.1%
10	32.1	29.3	91.5%
25	17.2	11.5	67.0%
Average			72.5%
Standard Deviation			13.2%

Table 4.2: Regression Equation Coefficients for Nordwing PG2

Natural Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Nordwing PG2	100/0	≥ -14°C	94%	2.8949	-0.7581	-0.3527	43

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG2	100/0	-3°C	98%	2.4914	-0.7105	4
Nordwing PG2	100/0	-14°C	100%	2.3833	-0.7941	4
Nordwing PG2	100/0	-25°C	98%	1.7518	-0.6827	4
Nordwing PG2	100/0	-30°C	99%	1.5558	-0.3434	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG2	100/0	-3°C	97%	2.4158	-0.5492	4
Nordwing PG2	100/0	-10°C	73%	2.3727	-0.6066	6

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG2	100/0	-3°C	96%	2.1981	-0.3494	4
Nordwing PG2	100/0	-10°C	100%	2.7322	-0.9280	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG2	100/0	+1°C	100%	2.4454	-0.6143	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Nordwing PG2	100/0	< -14°C	95%	4.3464	-0.9392	-1.4611	28

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

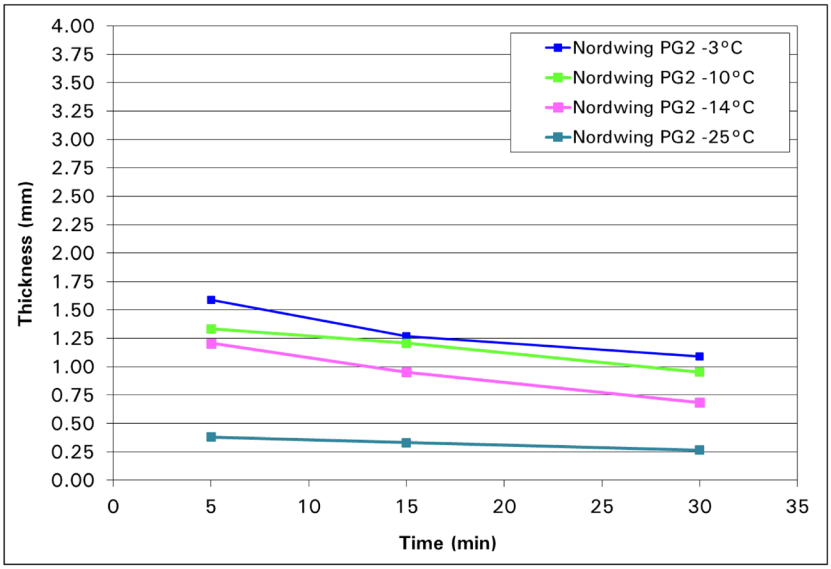


Figure 4.8: Fluid Thickness Profiles of Nordwing PG2

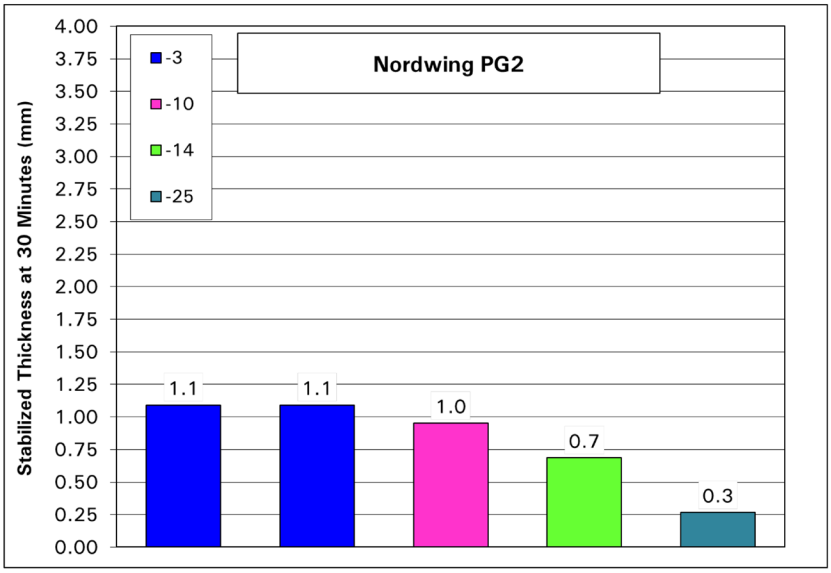


Figure 4.9: Final Fluid Thickness of Nordwing PG2

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for Nordwing PG2. The HOT table is shown in both the TC format (Table 4.3) and FAA format (Table 4.4) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the Nordwing PG2 fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The determined LOUT for Nordwing PG2 is -30°C (-22°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for Nordwing PG2 were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.5 (LUPR statistics) and Table 4.6 (HUPR statistics).

The analysis determined the LUPR for Nordwing PG2 is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for Nordwing PG2 is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for Nordwing PG2 in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As ESSPO CHEMICALS D.O.O intends to commercialize Nordwing PG2, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.3: Fluid-Specific Holdover Time Guidelines – Nordwing PG2 (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:40 - 3:10	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:05 - 1:50	0:50 - 1:05	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:20	0:25 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:20	0:20 - 0:40	1:45 - 2:00	0:50 - 1:45	0:25 - 0:50	0:50 - 1:30[11]	0:25 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:20 - 0:35	0:10 - 0:25	1:15 - 1:40	0:30 - 1:15	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:20 - 0:35	0:06 - 0:15	0:50 - 1:05	0:20 - 0:50	0:08 - 0:20					
below -25 to -30°C (below -13 to -22°F)	100/0	0:20 - 0:30	0:03 - 0:07	0:25 - 0:30	0:09 - 0:25	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page14.

Table 4.4: Fluid-Specific Holdover Time Guidelines – Nordwing PG2 (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:40 - 3:10	0:30 - 1:00	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20	1:05 - 1:50	0:50 - 1:05	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:20	0:25 - 0:45	2:00 - 2:30	1:00 - 2:00	0:30 - 1:00	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:20	0:20 - 0:40	1:45 - 2:10	0:50 - 1:45	0:25 - 0:50	0:50 - 1:30[11]	0:25 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:10 - 0:25	1:15 - 1:40	0:30 - 1:15	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:35	0:06 - 0:15	0:50 - 1:05	0:20 - 0:50	0:08 - 0:20					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:30	0:03 - 0:07	0:25 - 0:30	0:09 - 0:25	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.5: LUPR Statistics – Nordwing PG2

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	13	40
Data Points ≤ 9.5 g	13	40
Data Points ≤ 8.5 g	12	40
Data Points ≤ 7.5 g	10	40
Data Points ≤ 6.5 g	9	40
Data Points ≤ 5.5 g	6	40
Data Points ≤ 4.5 g	5	40
Data Points ≤ 3.5 g	4	40
Data Points ≤ 2.5 g	1	20
Negative Scatter 0-10 g	-5%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	40	pass

LUPR	100/0
	3 g/dm²/h

Table 4.6: HUPR Statistics – Nordwing PG2

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	11	40
Data Points ≥ 15 g	15	40
Data Points ≥ 20 g	11	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	4	40
Data Points ≥ 35 g	4	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-7%	40

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	40	pass
30 g/dm²/h	40	pass
35 g/dm²/h	40	pass
40 g/dm²/h	40	pass
45 g/dm²/h	40	pass
50 g/dm²/h	40	pass

HUPR	100/0
	50 g/dm²/h

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APPENDIX E

FLUID MANUFACTURER REPORT:
ESSPO CHEMICALS D.O.O NORDWING PG4 (TYPE IV)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Nordwing PG4 (Type IV)

Prepared for

ESSPO CHEMICALS D.O.O



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ECD-PG4 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Nordwing PG4 (Type IV)

Prepared for

ESSPO CHEMICALS D.O.O

Prepared by: _____ July 2, 2025

Yi Tian
Assistant, Publications and Delivery — Date

Reviewed by: _____ July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems — Date

By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ECD-PG4 2024-25

Fluid Identification and Characteristics

Manufacturer:	ESSPO CHEMICALS D.O.O		
Fluid Test Name:	NORDWING PG4		
Fluid Commercial Name:	Nordwing PG4		
Fluid Type / Base / Colour:	Type IV / Propylene Glycol / Green		
Batch #:	PG4-24-01		
Date of Receipt:	January 14, 2025		
Brix (Measured):	Neat fluid:	34.75°	
Freeze Point (Stated):	Neat fluid:	-38.5°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-31°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	12,100 cP	11,550 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid[2]:	9,053 cP	9,800 cP
WSET (from AMIL):	Neat fluid:	98 minutes	

1. LV1 (with guard leg), 600 mL low form (Griffin) beaker, 575 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.
2. SC4-31/13R, small sample adapter, 10 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **Nordwing PG4** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport, at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

Nordwing PG4 Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	1:35 - 3:10	0:30 - 0:55	2:35 - 3:00	1:15 - 2:35	0:35 - 1:15	1:05 - 1:45	0:50 - 1:00	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	0:55 - 2:25	0:25 - 0:50	2:10 - 2:40	1:05 - 2:10	0:30 - 1:05	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	0:55 - 2:25	0:20 - 0:45	1:55 - 2:25	0:55 - 1:55	0:30 - 0:55	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:30 - 0:45	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25	100/0	0:30 - 0:45	0:06 - 0:15	0:50 - 1:10	0:20 - 0:50	0:09 - 0:20					
below -25 to -30**	100/0	0:20 - 0:35	0:04 - 0:09	0:30 - 0:40	0:15 - 0:30	0:05 - 0:15					

FAA values displayed. TC caps snow holdover times at 2 hours.

***LOUT capped at -30°C in guidelines as fluid was tested at this temperature based on manufacturer instructions.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
PMG	PMG Technologies Inc.
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **Nordwing PG4**, a new Type IV fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with Nordwing PG4 is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – Nordwing PG4, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	1	4	6	3	0
	Below -3 to -8	0	0	5	0	0
	Below -8 to -13	3	1	5	3	3
	Below -13 to -16	0	1	1	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – Nordwing PG4, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	5	5	0	0
	Below -18 to -22	4	4	0	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	0	6	0	0	0

3.3 Artificial Snow Tests

Artificial snow tests were conducted at PMG Technologies Inc. (PMG) in Blainville, QC. Table 3.3 shows the test counts in artificial snow for Nordwing PG4.

Table 3.3: Artificial Snow Test Counts – Nordwing PG4, 100/0

Artificial Snow		Precipitation Rate (g/dm²/h)			
		3	4	10	25
Temp. (°C)	-18	0	0	0	0
	-25	2	2	2	2
	-30	2	2	2	3

3.4 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.4 by precipitation type, fluid dilution, and test temperature.

Table 3.4: Freezing Precipitation Test Counts – Nordwing PG4, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog				CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	-30°C	+1°C
100/0	4	4	4	4	4	4	4	4	4

3.5 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.5 by fluid dilution and test temperature.

Table 3.5: Natural Frost Test Counts – Nordwing PG4, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	0	2	0

3.6 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.7 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.6 (natural snow), Table 3.7 (very cold snow), Table 3.8 (artificial snow), Table 3.9 (freezing precipitation), and Table 3.10 (natural frost).

Table 3.6: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
90	23-Jan-25	Nordwing PG4	100/0	-8.4	2.8	230.1
99	27-Jan-25	Nordwing PG4	100/0	-1.4	3.2	193.6
110	29-Jan-25	Nordwing PG4	100/0	-13.9	6.8	90.3
123	29-Jan-25	Nordwing PG4	100/0	-14.5	12.5	42.1
132	30-Jan-25	Nordwing PG4	100/0	-10.9	1.5	239.2
139	03-Feb-25	Nordwing PG4	100/0	-3.6	10.4	80.1
150	03-Feb-25	Nordwing PG4	100/0	-3.3	12.2	63.3
155	03-Feb-25	Nordwing PG4	100/0	-3.2	13.4	58.1
165	03-Feb-25	Nordwing PG4	100/0	-3.2	17.4	50.8
169	03-Feb-25	Nordwing PG4	100/0	-3.2	16.5	48.2
177	03-Feb-25	Nordwing PG4	100/0	-3.0	11.5	73.9
183	06-Feb-25	Nordwing PG4	100/0	-12.1	10.9	37.2
194	06-Feb-25	Nordwing PG4	100/0	-11.7	25.9	22.4
201	06-Feb-25	Nordwing PG4	100/0	-12.9	19.2	33.1
210	06-Feb-25	Nordwing PG4	100/0	-11.2	7.9	94.3
219	12-Feb-25	Nordwing PG4	100/0	-11.8	3.5	128.0
228	13-Feb-25	Nordwing PG4	100/0	-11.7	27.3	20.5
236	13-Feb-25	Nordwing PG4	100/0	-11.4	40.3	16.1
242	13-Feb-25	Nordwing PG4	100/0	-11.3	24.1	30.3
255	16-Feb-25	Nordwing PG4	100/0	-10.2	12.1	57.9
264	16-Feb-25	Nordwing PG4	100/0	-10.1	23.8	32.9
273	16-Feb-25	Nordwing PG4	100/0	-10.0	29.2	29.6
282	16-Feb-25	Nordwing PG4	100/0	-9.9	51.4	20.2
291	16-Feb-25	Nordwing PG4	100/0	-9.8	44.6	19.4
308	04-Mar-25	Nordwing PG4	100/0	0.8	6.8	147.9
322	04-Mar-25	Nordwing PG4	100/0	0.4	14.7	72.2
337	04-Mar-25	Nordwing PG4	100/0	-0.1	7.5	122.9
342	19-Mar-25	Nordwing PG4	100/0	1.3	6.2	125.2
352	19-Mar-25	Nordwing PG4	100/0	0.1	7.4	103.9
362	19-Mar-25	Nordwing PG4	100/0	-0.4	13.7	71.3
370	19-Mar-25	Nordwing PG4	100/0	-0.6	11.6	74.8
382	19-Mar-25	Nordwing PG4	100/0	-0.5	27.0	46.1
391	19-Mar-25	Nordwing PG4	100/0	-0.8	34.6	35.1
401	20-Mar-25	Nordwing PG4	100/0	-1.2	30.5	43.3
410	24-Mar-25	Nordwing PG4	100/0	-2.9	20.4	43.4
417	24-Mar-25	Nordwing PG4	100/0	-2.1	13.7	72.3

Table 3.7: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
54	27-Jan-25	Nordwing PG4	100/0	-18.1	9.6	27.5
65	27-Jan-25	Nordwing PG4	100/0	-17.8	9.6	31.3
73	27-Jan-25	Nordwing PG4	100/0	-17.9	9.8	29.8
82	27-Jan-25	Nordwing PG4	100/0	-17.9	12.1	24.8
91	27-Jan-25	Nordwing PG4	100/0	-17.2	16.4	18.5
100	27-Jan-25	Nordwing PG4	100/0	-17.2	17.0	20.9
107	29-Jan-25	Nordwing PG4	100/0	-13.9	6.8	90.3
120	29-Jan-25	Nordwing PG4	100/0	-14.5	12.5	42.1
133	31-Jan-25	Nordwing PG4	100/0	-25.1	5.5	37.6
141	31-Jan-25	Nordwing PG4	100/0	-25.3	4.2	51.3
152	31-Jan-25	Nordwing PG4	100/0	-25.3	5.8	37.2
161	31-Jan-25	Nordwing PG4	100/0	-26.0	5.5	43.3
171	31-Jan-25	Nordwing PG4	100/0	-26.4	6.4	36.8
178	31-Jan-25	Nordwing PG4	100/0	-26.7	5.7	35.3
187	05-Feb-25	Nordwing PG4	100/0	-18.2	5.2	58.3
198	05-Feb-25	Nordwing PG4	100/0	-17.9	2.4	101.6
204	05-Feb-25	Nordwing PG4	100/0	-17.5	4.7	71.8
214	05-Feb-25	Nordwing PG4	100/0	-16.9	2.1	180.6
220	05-Feb-25	Nordwing PG4	100/0	-16.7	7.9	53.4
232	05-Feb-25	Nordwing PG4	100/0	-16.7	14.8	26.7
239	13-Feb-25	Nordwing PG4	100/0	-21.4	2.9	80.9
247	13-Feb-25	Nordwing PG4	100/0	-21.2	4.1	60.5
257	13-Feb-25	Nordwing PG4	100/0	-21.2	4.8	54.8
267	13-Feb-25	Nordwing PG4	100/0	-21.0	3.8	63.4
276	13-Feb-25	Nordwing PG4	100/0	-20.7	3.5	72.2
283	13-Feb-25	Nordwing PG4	100/0	-20.5	3.8	61.6

Table 3.8: Log of Tests Performed (Artificial Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
AS17	04-Apr-25	Nordwing PG4	100/0	-25	2.9	90
AS17R	08-Apr-25	Nordwing PG4	100/0	-25	3.0	92
AS18	04-Apr-25	Nordwing PG4	100/0	-25	4.0	87
AS18R	07-Apr-25	Nordwing PG4	100/0	-25	4.2	78
AS19	08-Apr-25	Nordwing PG4	100/0	-25	10.0	37
AS19R	07-Apr-25	Nordwing PG4	100/0	-25	9.9	33
AS20	04-Apr-25	Nordwing PG4	100/0	-25	24.5	17
AS20R	07-Apr-25	Nordwing PG4	100/0	-25	24.6	18
AS21	02-Apr-25	Nordwing PG4	100/0	-30	3.0	95
AS21R	03-Apr-25	Nordwing PG4	100/0	-30	3.0	74
AS22	02-Apr-25	Nordwing PG4	100/0	-30	3.9	73
AS22R	03-Apr-25	Nordwing PG4	100/0	-30	4.0	60
AS23	02-Apr-25	Nordwing PG4	100/0	-30	9.9	27
AS23R	03-Apr-25	Nordwing PG4	100/0	-30	10.1	20
AS24	02-Apr-25	Nordwing PG4	100/0	-30	21.4	13
AS24A	02-Apr-25	Nordwing PG4	100/0	-30	25.1	18
AS24R	03-Apr-25	Nordwing PG4	100/0	-30	23.5	12

Table 3.9: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
9	20-Mar-25	Freezing Fog	Nordwing PG4	100/0	-3.3	2.0	189.8
10	20-Mar-25	Freezing Fog	Nordwing PG4	100/0	-3.3	2.0	186.4
29	20-Mar-25	Freezing Fog	Nordwing PG4	100/0	-3.2	5.3	88.2
30	20-Mar-25	Freezing Fog	Nordwing PG4	100/0	-3.2	5.3	90.3
47	19-Mar-25	Freezing Fog	Nordwing PG4	100/0	-14.3	2.1	145.9
48	19-Mar-25	Freezing Fog	Nordwing PG4	100/0	-14.3	1.9	148.2
65	19-Mar-25	Freezing Fog	Nordwing PG4	100/0	-13.4	5.4	50.2
66	19-Mar-25	Freezing Fog	Nordwing PG4	100/0	-13.4	5.3	51.4
81	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-24.6	2.0	44.9
82	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-24.6	1.8	44.1
97	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-24.9	4.9	27.3
98	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-24.9	4.8	28.3
111	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-30.2	2.1	32.0
112	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-30.2	2.0	34.3
117	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-30.4	5.1	21.4
118	18-Mar-25	Freezing Fog	Nordwing PG4	100/0	-30.4	5.3	22.3
129	25-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-3.1	13.4	65.7
130	25-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-3.1	13.5	65.7
149	25-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-3.2	4.7	107.0
150	25-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-3.2	5.4	106.1
167	26-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-10.2	5.2	88.3
168	26-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-10.2	5.0	86.5
185	26-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-10.3	13.4	53.7
186	26-Mar-25	Freezing Drizzle	Nordwing PG4	100/0	-10.3	13.3	52.4
205	21-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-3.2	12.8	62.9
206	21-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-3.2	13.1	61.4
225	21-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-3.3	24.7	49.0
226	21-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-3.3	25.3	49.5
243	26-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-9.9	13.3	49.7
244	26-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-9.9	13.1	49.8
261	27-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-10.1	25.2	34.0
262	27-Mar-25	Light Freezing Rain	Nordwing PG4	100/0	-10.1	25.9	35.2
279	27-Mar-25	Cold Soak Box	Nordwing PG4	100/0	1.1	5.0	114.5
280	27-Mar-25	Cold Soak Box	Nordwing PG4	100/0	1.1	4.7	102.7
297	27-Mar-25	Cold Soak Box	Nordwing PG4	100/0	0.8	77.0	20.1
298	27-Mar-25	Cold Soak Box	Nordwing PG4	100/0	0.6	77.2	18.7

Table 3.10: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
80	21-Jan-25	Natural Frost	Nordwing PG4	100/0	361	0.04	-15.3	9	63	Did Not Fail
89	24-Jan-25	Natural Frost	Nordwing PG4	100/0	360	0.07	-17.1	7	75	Did Not Fail
98	13-Mar-25	Natural Frost	Nordwing PG4	100/0	725	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type IV HOT Guidelines. The figures include the current Type IV generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.2 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type IV fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.2 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Artificial Snow

In order to determine holdover times for Nordwing PG4 in snow in the coldest temperature band (below -25°C to -30°C), artificial snow testing was performed with Nordwing PG4 at -25°C and -30°C. Figure 4.7 shows the endurance time data collected in artificial snow at these temperatures.

Table 4.1 shows the relative endurance time performance of the fluid in artificial snow at -25°C vs. -30°C.

4.1.4 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.10. The test durations were compared to the Type IV generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type IV generic frost holdover times can be considered substantiated for Nordwing PG4.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of Nordwing PG4. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.5 Fluid Thickness Tests

Figure 4.8 shows the fluid thickness test data. As described in Subsection 3.6, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.9.

4. RESULTS AND DISCUSSION

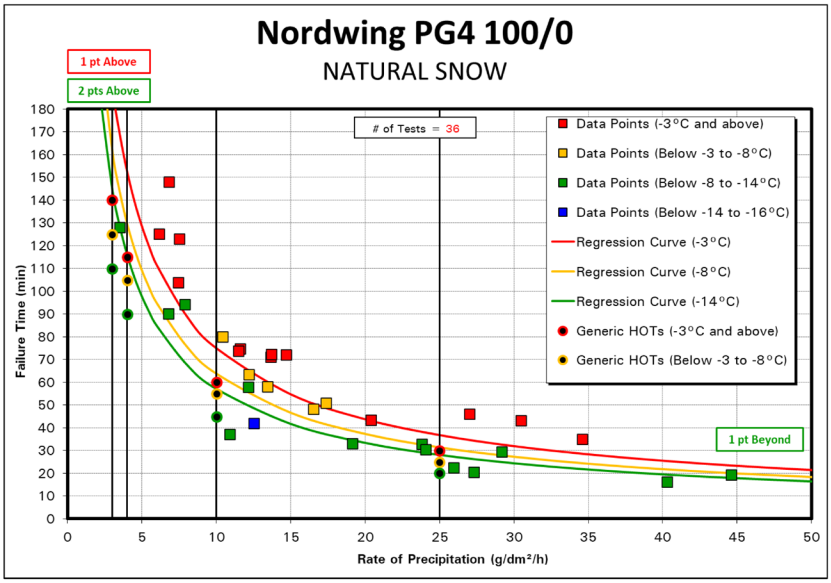


Figure 4.1: Type IV 100/0 – Natural Snow

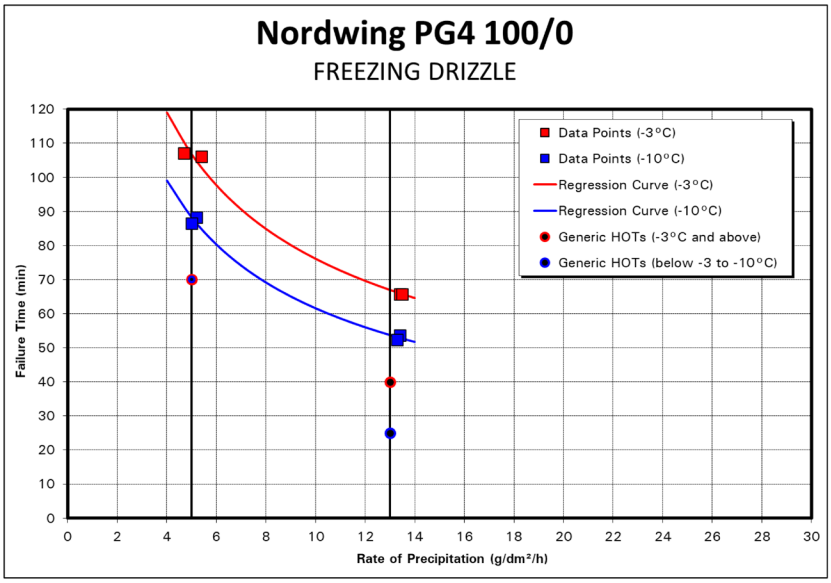


Figure 4.2: Type IV 100/0 – Freezing Drizzle

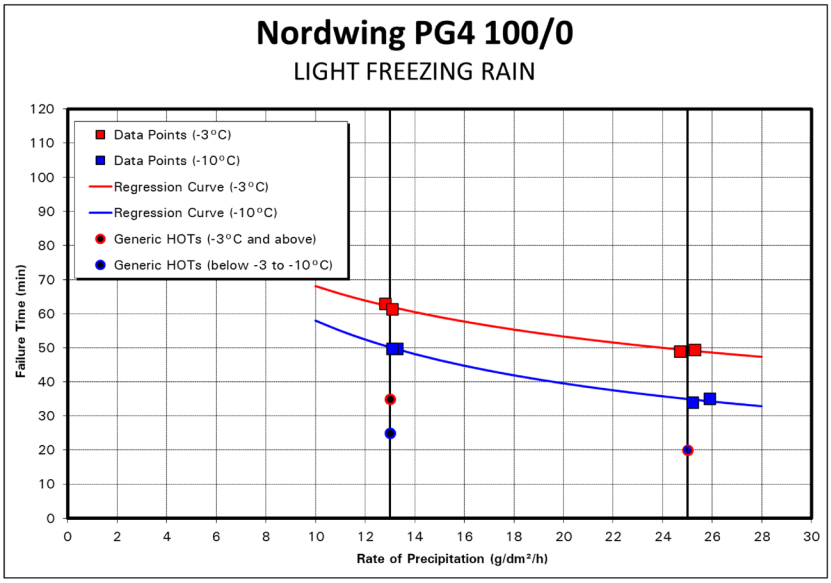


Figure 4.3: Type IV 100/0 – Light Freezing Rain

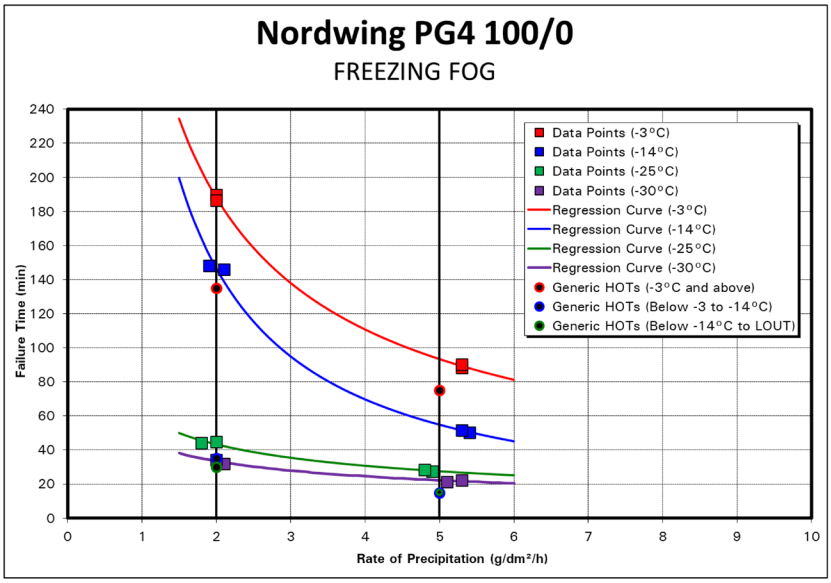


Figure 4.4: Type IV 100/0 – Freezing Fog

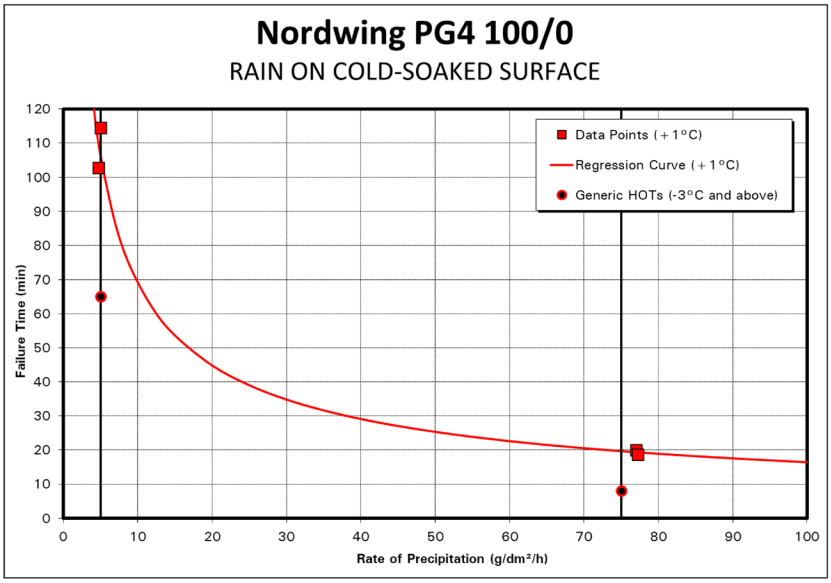


Figure 4.5: Type IV 100/0 – Rain on Cold-Soaked Surface

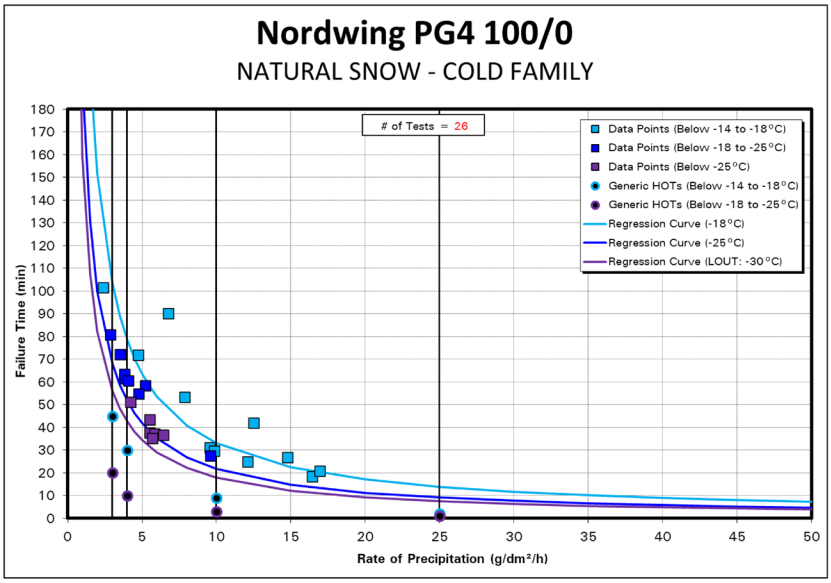


Figure 4.6: Type IV 100/0 – Very Cold Snow

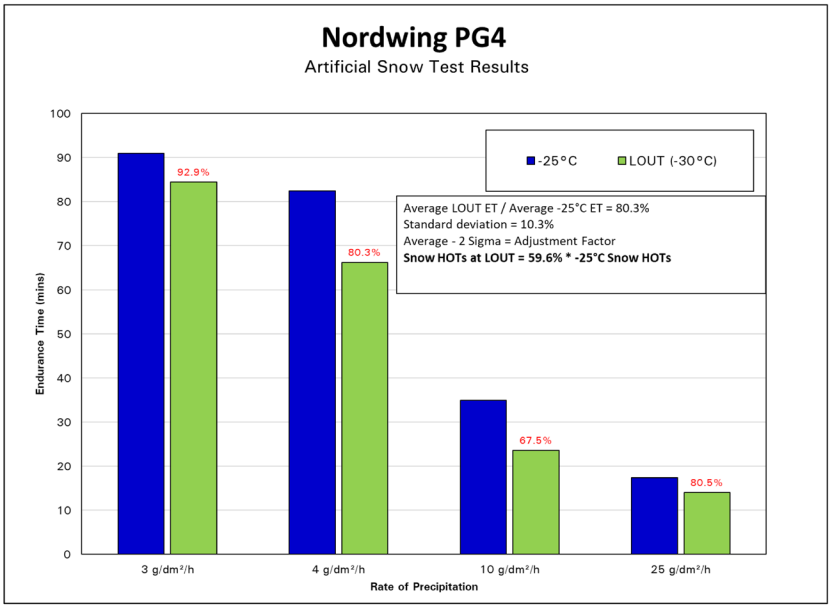


Figure 4.7: Type IV 100/0 – Artificial Snow at -25°C and -30°C

Table 4.1: Nordwing PG4 Artificial Snow Performance at -25°C vs. -30°C

Rate (g/dm²/h)	Fail Time at -25°C (min)	Fail Time at -30°C (min)	-30°C HOT as % of -25°C HOT
3	91.0	84.5	92.9%
4	82.5	66.3	80.3%
10	35.0	23.6	67.5%
25	17.4	14.0	80.5%
Average			80.3%
Standard Deviation			10.3%

Table 4.2: Regression Equation Coefficients for Nordwing PG4

Natural Snow

Fluid	Dil	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Nordwing PG4	100/0	≥ -14°C	95%	2.8170	-0.7760	-0.2363	36

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG4	100/0	-3°C	100%	2.5045	-0.7647	4
Nordwing PG4	100/0	-14°C	100%	2.4892	-1.0743	4
Nordwing PG4	100/0	-25°C	99%	1.7856	-0.4965	4
Nordwing PG4	100/0	-30°C	98%	1.6593	-0.4469	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG4	100/0	-3°C	99%	2.3693	-0.4879	4
Nordwing PG4	100/0	-10°C	100%	2.3076	-0.5179	4

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG4	100/0	-3°C	99%	2.1857	-0.3528	4
Nordwing PG4	100/0	-10°C	99%	2.3108	-0.5481	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Nordwing PG4	100/0	+1°C	100%	2.4613	-0.6221	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Nordwing PG4	100/0	< -14°C	94%	4.2823	-0.9467	-1.3959	26

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

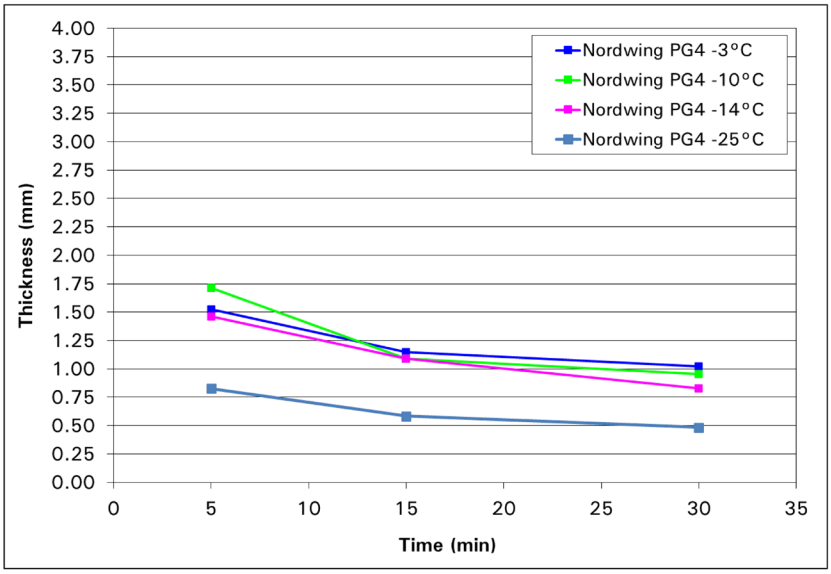


Figure 4.8: Fluid Thickness Profiles of Nordwing PG4

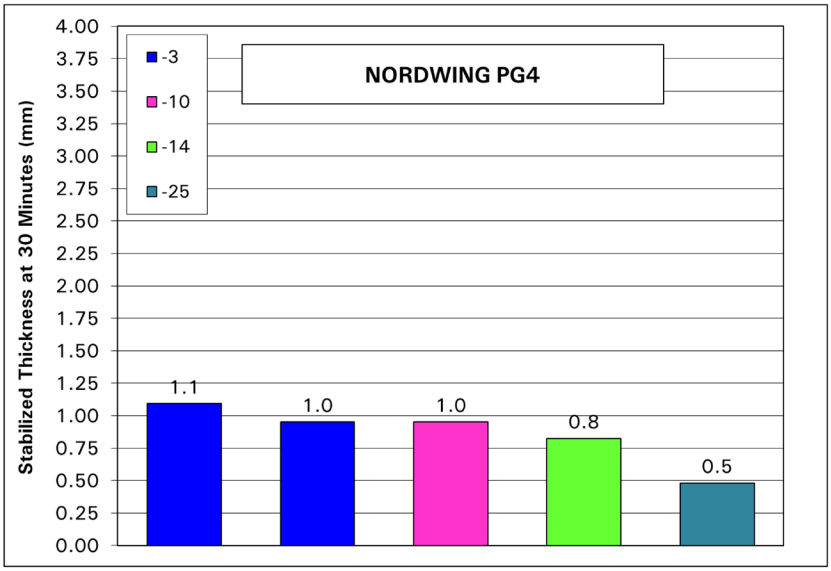


Figure 4.9: Final Fluid Thickness of Nordwing PG4

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for Nordwing PG4. The HOT table is shown in both the TC format (Table 4.3) and FAA format (Table 4.4) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the Nordwing PG4 fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The determined LOUT for Nordwing PG4 is -30°C (-22°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for Nordwing PG4 were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.5 (LUPR statistics) and Table 4.6 (HUPR statistics).

The analysis determined the LUPR for Nordwing PG4 is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for Nordwing PG4 is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for Nordwing PG4 in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As ESSPO CHEMICALS D.O.O intends to commercialize Nordwing PG4, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.3: Fluid-Specific Holdover Time Guidelines – Nordwing PG4 (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 3:10	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	1:05 - 1:45	0:50 - 1:00	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:25	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:25	0:20 - 0:45	1:55 - 2:00	0:55 - 1:55	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:45	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:45	0:06 - 0:15	0:50 - 1:10	0:20 - 0:50	0:09 - 0:20					
below -25 to -30°C (below -13 to -22°F)	100/0	0:20 - 0:35	0:04 - 0:09	0:30 - 0:40	0:15 - 0:30	0:05 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32.

Table 4.4: Fluid-Specific Holdover Time Guidelines – Nordwing PG4 (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 3:10	0:30 - 0:55	2:35 - 3:00	1:15 - 2:35	0:35 - 1:15	1:05 - 1:45	0:50 - 1:00	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:25	0:25 - 0:50	2:10 - 2:40	1:05 - 2:10	0:30 - 1:05	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:25	0:20 - 0:45	1:55 - 2:25	0:55 - 1:55	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:45	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:45	0:06 - 0:15	0:50 - 1:10	0:20 - 0:50	0:09 - 0:20					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:35	0:04 - 0:09	0:30 - 0:40	0:15 - 0:30	0:05 - 0:15					

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.5: LUPR Statistics – Nordwing PG4

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	10	40
Data Points ≤ 9.5 g	10	40
Data Points ≤ 8.5 g	10	40
Data Points ≤ 7.5 g	9	40
Data Points ≤ 6.5 g	5	40
Data Points ≤ 5.5 g	4	40
Data Points ≤ 4.5 g	4	40
Data Points ≤ 3.5 g	4	40
Data Points ≤ 2.5 g	1	20
Negative Scatter 0-10 g	-6%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	40	pass

LUPR	100/0
	3 g/dm²/h

Table 4.6: HUPR Statistics – Nordwing PG4

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	12	40
Data Points ≥ 15 g	15	40
Data Points ≥ 20 g	12	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	5	40
Data Points ≥ 35 g	3	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-7%	40

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	40	pass
30 g/dm²/h	40	pass
35 g/dm²/h	40	pass
40 g/dm²/h	40	pass
45 g/dm²/h	40	pass
50 g/dm²/h	40	pass

HUPR	100/0
	50 g/dm²/h

APPENDIX F

FLUID MANUFACTURER REPORT:
ALFRUS LLC GREEN FLO TYPE 4 (TYPE IV)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Green Flo Type 4 (Type IV)

Prepared for

AFLRUS LLC



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. AFL-EG4 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Green Flo Type 4 (Type IV)

Prepared for

AFLRUS LLC

Prepared by: _____ July 2, 2025

Yi Tian
Assistant, Publications and Delivery
Date

Reviewed by: _____ July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems
Date

By

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. AFL-EG4 2024-25

Fluid Identification and Characteristics

Manufacturer:	AFLRUS LLC		
Fluid Test Name:	AVIAFlight EG (Qatar)		
Fluid Commercial Name:	Green Flo Type 4		
Fluid Type / Base / Colour:	Type IV / Ethylene Glycol / Green		
Batch #:	AFEG-T4/021224		
Date of Receipt:	December 24, 2024		
Brix (Measured):	Neat fluid:	32.5°	
Freeze Point (Stated):	Neat fluid:	-41°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-31°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	n/a	6,550 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid:	n/a	n/a
WSET (from AMIL):	Neat fluid:	118 minutes	

1. LV1 (with guard leg), 600 mL low form (Griffin) beaker, 575 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **Green Flo Type 4** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport, at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

Green Flo Type 4 Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	1:15 - 2:30	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	0:50 - 2:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	0:50 - 2:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:35 - 1:10	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25	100/0	0:35 - 1:10	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					
below -25 to -30**	100/0	0:25 - 1:00	0:04 - 0:10	0:35 - 0:40	0:15 - 0:35	0:06 - 0:15					

**FAA values displayed. TC caps snow holdover times at 2 hours.*

***LOUT capped at -30°C in guidelines as fluid was tested at this temperature based on manufacturer instructions.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
PMG	PMG Technologies Inc.
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **Green Flo Type 4**, a new Type IV fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with Green Flo Type 4 is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – Green Flo Type 4, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	1	4	9	3	0
	Below -3 to -8	0	1	3	0	0
	Below -8 to -13	4	2	5	3	3
	Below -13 to -16	1	2	2	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – Green Flo Type 4, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	5	8	0	0
	Below -18 to -22	4	3	0	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	0	6	0	0	0

3.3 Artificial Snow Tests

Artificial snow tests were conducted at PMG Technologies Inc. (PMG) in Blainville, QC. Table 3.3 shows the test counts in artificial snow for Green Flo Type 4.

Table 3.3: Artificial Snow Test Counts – Green Flo Type 4, 100/0

Artificial Snow		Precipitation Rate (g/dm²/h)			
		3	4	10	25
Temp. (°C)	-18	0	0	0	0
	-25	3	2	2	2
	-30	2	2	3	2

3.4 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.4 by precipitation type, fluid dilution, and test temperature.

Table 3.4: Freezing Precipitation Test Counts – Green Flo Type 4, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog				CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	-30°C	+1°C
100/0	4	4	4	4	4	4	4	4	4

3.5 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.5 by fluid dilution and test temperature.

Table 3.5: Natural Frost Test Counts – Green Flo Type 4, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	0	3	0

3.6 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.7 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.6 (natural snow), Table 3.7 (very cold snow), Table 3.8 (artificial snow), Table 3.9 (freezing precipitation), and Table 3.10 (natural frost).

Table 3.6: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
54	07-Jan-25	Green Flo Type 4	100/0	-8.0	4.0	85.8
65	08-Jan-25	Green Flo Type 4	100/0	-13.8	7.6	52.6
70	08-Jan-25	Green Flo Type 4	100/0	-13.4	3.7	91.8
81	08-Jan-25	Green Flo Type 4	100/0	-12.3	5.0	73.4
91	23-Jan-25	Green Flo Type 4	100/0	-8.8	3.4	121.7
100	27-Jan-25	Green Flo Type 4	100/0	-1.3	2.7	142.0
111	29-Jan-25	Green Flo Type 4	100/0	-13.6	5.9	63.7
117	29-Jan-25	Green Flo Type 4	100/0	-14.4	10.7	39.6
124	29-Jan-25	Green Flo Type 4	100/0	-14.5	12.5	30.5
133	30-Jan-25	Green Flo Type 4	100/0	-10.9	1.5	239.1
140	03-Feb-25	Green Flo Type 4	100/0	-3.6	9.3	55.3
151	03-Feb-25	Green Flo Type 4	100/0	-3.4	10.7	47.4
158	03-Feb-25	Green Flo Type 4	100/0	-3.2	15.8	34.4
168	03-Feb-25	Green Flo Type 4	100/0	-3.2	18.6	30.2
184	06-Feb-25	Green Flo Type 4	100/0	-12.1	10.9	36.3
192	06-Feb-25	Green Flo Type 4	100/0	-11.7	25.3	18.4
202	06-Feb-25	Green Flo Type 4	100/0	-12.9	18.7	31.5
211	06-Feb-25	Green Flo Type 4	100/0	-11.4	7.6	72.6
220	12-Feb-25	Green Flo Type 4	100/0	-11.8	2.8	105.7
229	13-Feb-25	Green Flo Type 4	100/0	-11.7	27.5	20.3
238	13-Feb-25	Green Flo Type 4	100/0	-11.4	40.6	15.1
246	13-Feb-25	Green Flo Type 4	100/0	-11.3	24.2	26.1
256	16-Feb-25	Green Flo Type 4	100/0	-10.3	12.0	45.1
265	16-Feb-25	Green Flo Type 4	100/0	-10.1	21.8	22.1
274	16-Feb-25	Green Flo Type 4	100/0	-10.0	28.0	19.5
283	16-Feb-25	Green Flo Type 4	100/0	-9.9	54.7	11.4
292	16-Feb-25	Green Flo Type 4	100/0	-9.8	43.5	11.9
300	27-Feb-25	Green Flo Type 4	100/0	-1.5	11.9	49.0
309	04-Mar-25	Green Flo Type 4	100/0	0.9	4.0	119.1
315	04-Mar-25	Green Flo Type 4	100/0	0.5	21.0	33.8
326	04-Mar-25	Green Flo Type 4	100/0	0.4	14.6	40.7
331	04-Mar-25	Green Flo Type 4	100/0	0.0	7.5	80.8
343	19-Mar-25	Green Flo Type 4	100/0	1.4	6.5	96.8
351	19-Mar-25	Green Flo Type 4	100/0	0.5	5.7	99.0
360	19-Mar-25	Green Flo Type 4	100/0	-0.3	12.1	63.5
367	19-Mar-25	Green Flo Type 4	100/0	-0.5	10.3	71.5

Table 3.6: Log of Tests Performed (Natural Snow) (cont'd)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
374	19-Mar-25	Green Flo Type 4	100/0	-0.5	17.4	50.2
384	19-Mar-25	Green Flo Type 4	100/0	-0.5	28.7	29.8
388	19-Mar-25	Green Flo Type 4	100/0	-0.8	31.8	29.3
400	20-Mar-25	Green Flo Type 4	100/0	-1.1	32.5	30.4
411	24-Mar-25	Green Flo Type 4	100/0	-2.9	19.6	38.8
416	24-Mar-25	Green Flo Type 4	100/0	-2.3	12.0	53.0
423	24-Mar-25	Green Flo Type 4	100/0	-1.5	18.1	37.8

Table 3.7: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
42	08-Jan-25	Green Flo Type 4	100/0	-13.8	7.6	52.6
55	27-Jan-25	Green Flo Type 4	100/0	-18.0	9.1	41.6
66	27-Jan-25	Green Flo Type 4	100/0	-17.8	10.2	32.2
74	27-Jan-25	Green Flo Type 4	100/0	-17.9	10.6	43.5
85	27-Jan-25	Green Flo Type 4	100/0	-17.9	11.9	21.7
92	27-Jan-25	Green Flo Type 4	100/0	-17.2	16.8	22.6
103	27-Jan-25	Green Flo Type 4	100/0	-17.2	16.1	23.7
108	29-Jan-25	Green Flo Type 4	100/0	-13.6	5.9	63.7
111	29-Jan-25	Green Flo Type 4	100/0	-14.4	10.7	39.6
121	29-Jan-25	Green Flo Type 4	100/0	-14.5	12.5	30.5
129	31-Jan-25	Green Flo Type 4	100/0	-25.1	5.7	54.6
143	31-Jan-25	Green Flo Type 4	100/0	-25.4	4.5	67.5
156	31-Jan-25	Green Flo Type 4	100/0	-25.5	6.7	44.1
166	31-Jan-25	Green Flo Type 4	100/0	-26.3	5.7	51.8
177	31-Jan-25	Green Flo Type 4	100/0	-26.7	5.6	46.1
181	31-Jan-25	Green Flo Type 4	100/0	-26.7	6.8	37.7
183	05-Feb-25	Green Flo Type 4	100/0	-18.2	5.9	57.0
195	05-Feb-25	Green Flo Type 4	100/0	-17.9	2.5	110.3
205	05-Feb-25	Green Flo Type 4	100/0	-17.5	4.7	70.7
212	05-Feb-25	Green Flo Type 4	100/0	-16.9	1.7	167.7
222	05-Feb-25	Green Flo Type 4	100/0	-16.7	8.9	46.8
227	05-Feb-25	Green Flo Type 4	100/0	-16.7	13.8	33.4
233	13-Feb-25	Green Flo Type 4	100/0	-21.4	3.2	95.8
250	13-Feb-25	Green Flo Type 4	100/0	-21.2	4.2	77.4
262	13-Feb-25	Green Flo Type 4	100/0	-21.1	4.2	79.2
269	13-Feb-25	Green Flo Type 4	100/0	-20.9	3.6	86.1
273	13-Feb-25	Green Flo Type 4	100/0	-20.7	3.5	87.8
279	13-Feb-25	Green Flo Type 4	100/0	-20.6	3.9	83.3

Table 3.8: Log of Tests Performed (Artificial Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
AS69	04-Apr-25	Green Flo Type 4	100/0	-25	3.0	125
AS69A	07-Apr-25	Green Flo Type 4	100/0	-25	3.0	153
AS69R	07-Apr-25	Green Flo Type 4	100/0	-25	3.0	171
AS70	04-Apr-25	Green Flo Type 4	100/0	-25	4.0	120
AS70R	09-Apr-25	Green Flo Type 4	100/0	-25	3.9	117
AS71	07-Apr-25	Green Flo Type 4	100/0	-25	10.0	42
AS71R	07-Apr-25	Green Flo Type 4	100/0	-25	10.4	30
AS72	08-Apr-25	Green Flo Type 4	100/0	-25	23.5	23
AS72R	08-Apr-25	Green Flo Type 4	100/0	-25	23.5	21
AS73	02-Apr-25	Green Flo Type 4	100/0	-30	2.8	90
AS73R	03-Apr-25	Green Flo Type 4	100/0	-30	2.8	93
AS74	02-Apr-25	Green Flo Type 4	100/0	-30	3.8	68
AS74R	03-Apr-25	Green Flo Type 4	100/0	-30	3.9	96
AS75	02-Apr-25	Green Flo Type 4	100/0	-30	9.0	33
AS75A	02-Apr-25	Green Flo Type 4	100/0	-30	10.0	29
AS75R	03-Apr-25	Green Flo Type 4	100/0	-30	9.8	29
AS76	03-Apr-25	Green Flo Type 4	100/0	-30	23.9	13
AS76R	03-Apr-25	Green Flo Type 4	100/0	-30	25.1	14

Table 3.9: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
19	20-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-3.3	1.8	165.8
20	20-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-3.4	2.0	151.7
39	20-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-3.1	5.3	72.4
40	20-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-3.1	5.3	72.4
57	19-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-14.3	1.9	154.4
58	19-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-14.3	2.1	152.2
75	19-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-13.4	5.2	50.6
76	19-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-13.4	5.4	46.2
91	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-24.7	2.0	72.4
92	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-24.7	2.0	70.8
107	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-24.9	4.7	37.1
108	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-24.9	4.8	35.1
113	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-30.3	2.2	55.3
114	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-30.2	2.1	57.3
119	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-30.3	5.2	25.4
120	18-Mar-25	Freezing Fog	Green Flo Type 4	100/0	-30.3	5.1	26.9
139	25-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-3.2	12.9	37.3
140	25-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-3.0	13.4	33.6
159	25-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-3.2	4.6	69.7
160	25-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-3.2	4.8	71.6
177	26-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-10.0	5.4	56.7
178	26-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-9.9	4.7	63.6
195	26-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-10.3	13.2	37.5
196	26-Mar-25	Freezing Drizzle	Green Flo Type 4	100/0	-10.4	13.5	35.7
215	21-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-3.2	12.7	29.3
216	21-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-3.1	13.1	31.2
235	21-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-3.3	25.1	16.8
236	21-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-3.3	24.9	16.5
253	26-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-9.9	13.1	33.2
254	26-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-9.9	13.3	30.5
271	27-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-10.1	25.6	16.9
272	27-Mar-25	Light Freezing Rain	Green Flo Type 4	100/0	-10.1	25.5	18.1
289	27-Mar-25	Cold Soak Box	Green Flo Type 4	100/0	1.1	5.2	65.9
290	27-Mar-25	Cold Soak Box	Green Flo Type 4	100/0	1.0	5.2	70.2
307	27-Mar-25	Cold Soak Box	Green Flo Type 4	100/0	0.7	73.1	8.4
308	27-Mar-25	Cold Soak Box	Green Flo Type 4	100/0	0.7	77.1	9.5

Table 3.10: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
69	26-Dec-24	Natural Frost	Green Flo Type 4	100/0	360	0.12	-15.0	6	85	Did Not Fail
81	21-Jan-25	Natural Frost	Green Flo Type 4	100/0	361	0.04	-15.3	9	63	Did Not Fail
90	24-Jan-25	Natural Frost	Green Flo Type 4	100/0	360	0.07	-17.1	7	75	Did Not Fail
99	13-Mar-25	Natural Frost	Green Flo Type 4	100/0	725	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type IV HOT Guidelines. The figures include the current Type IV generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.2 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type IV fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.2 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Artificial Snow

In order to determine holdover times for Green Flo Type 4 in snow in the coldest temperature band (below -25°C to -30°C), artificial snow testing was performed with Green Flo Type 4 at -25°C and -30°C. Figure 4.7 shows the endurance time data collected in artificial snow at these temperatures.

Table 4.1 shows the relative endurance time performance of the fluid in artificial snow at -25°C vs. -30°C.

4.1.4 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.10. The test durations were compared to the Type IV generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type IV generic frost holdover times can be considered substantiated for Green Flo Type 4.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of Green Flo Type 4. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.5 Fluid Thickness Tests

Figure 4.8 shows the fluid thickness test data. As described in Subsection 3.6, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.9.

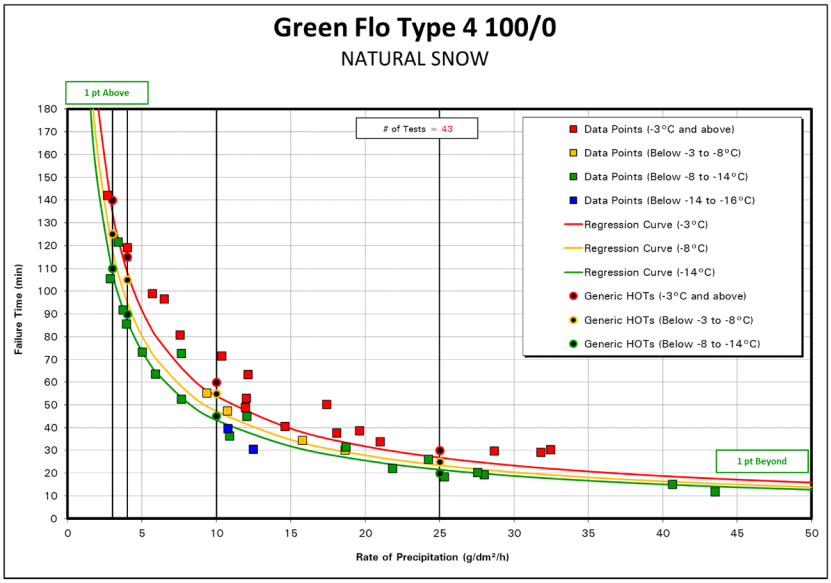


Figure 4.1: Type IV 100/0 – Natural Snow

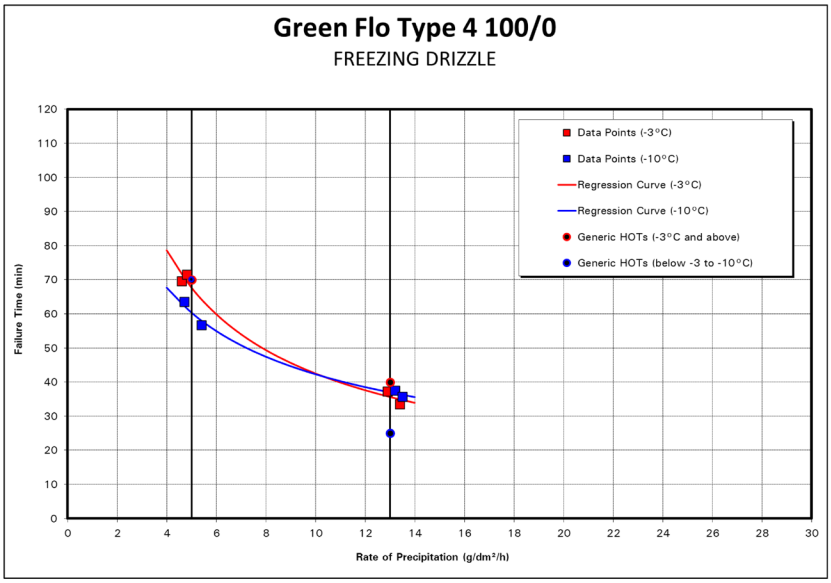


Figure 4.2: Type IV 100/0 – Freezing Drizzle

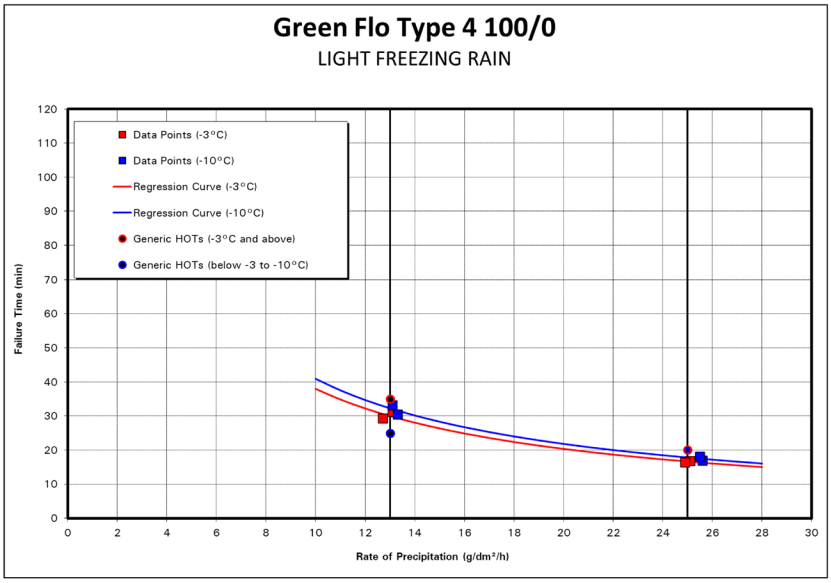


Figure 4.3: Type IV 100/0 – Light Freezing Rain

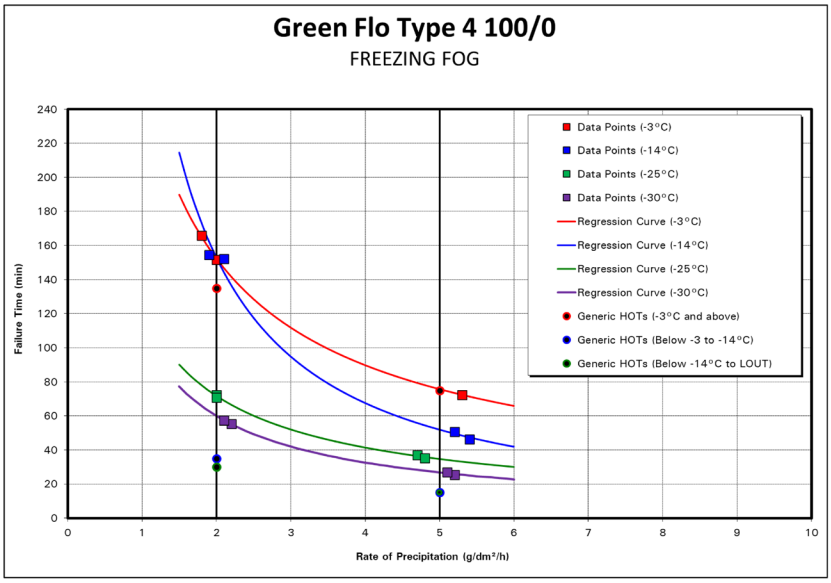


Figure 4.4: Type IV 100/0 – Freezing Fog

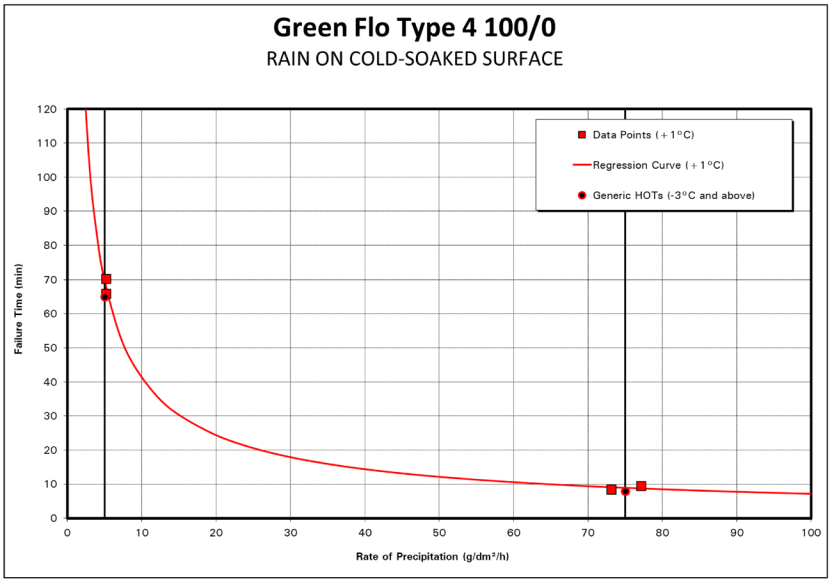


Figure 4.5: Type IV 100/0 – Rain on Cold-Soaked Surface

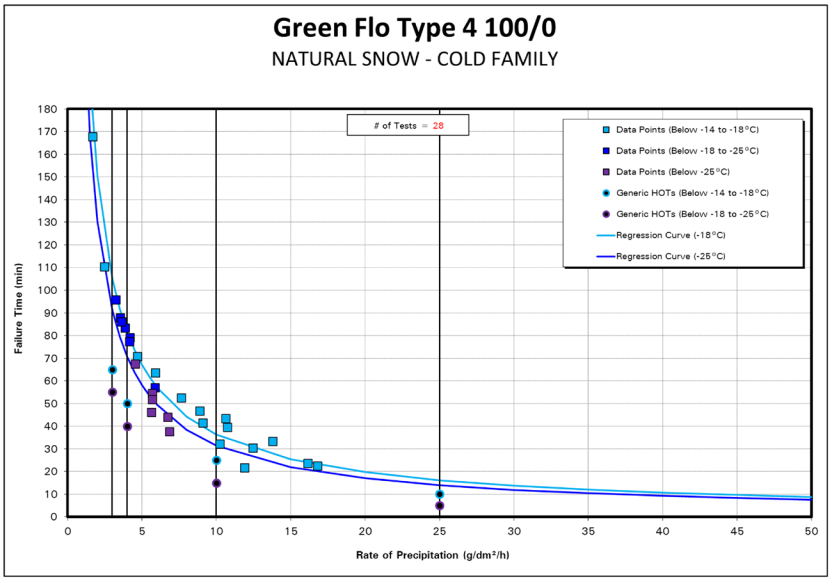


Figure 4.6: Type IV 100/0 – Very Cold Snow

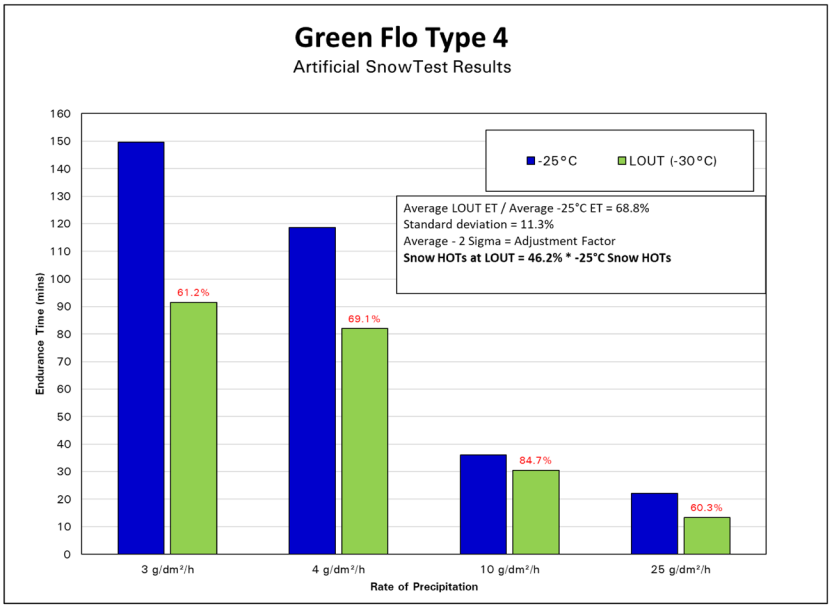


Figure 4.7: Type IV 100/0 – Artificial Snow at -25°C and -30°C

Table 4.1: Green Flo Type 4 Artificial Snow Performance at -25°C vs. -30°C

Rate (g/dm²/h)	Fail Time at -25°C (min)	Fail Time at -30°C (min)	-30°C HOT as % of -25°C HOT
3	149.6	91.5	61.2%
4	118.6	82.0	69.1%
10	36.0	30.5	84.7%
25	22.1	13.4	60.3%
Average			68.8%
Standard Deviation			11.3%

Table 4.2: Regression Equation Coefficients for Green Flo Type 4

Natural Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Green Flo Type 4	100/0	≥ -14°C	96%	2.6272	-0.7645	-0.1883	43

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Green Flo Type 4	100/0	-3°C	100%	2.4128	-0.7639	4
Green Flo Type 4	100/0	-14°C	100%	2.5388	-1.1787	4
Green Flo Type 4	100/0	-25°C	100%	2.0935	-0.7922	4
Green Flo Type 4	100/0	-30°C	100%	2.0430	-0.8798	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Green Flo Type 4	100/0	-3°C	99%	2.3004	-0.6719	4
Green Flo Type 4	100/0	-10°C	99%	2.1389	-0.5122	4

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Green Flo Type 4	100/0	-3°C	99%	2.4777	-0.8985	4
Green Flo Type 4	100/0	-10°C	99%	2.5160	-0.9044	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Green Flo Type 4	100/0	+1°C	100%	2.3769	-0.7605	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Green Flo Type 4	100/0	< -14°C	95%	3.0656	-0.8834	-0.4781	28

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

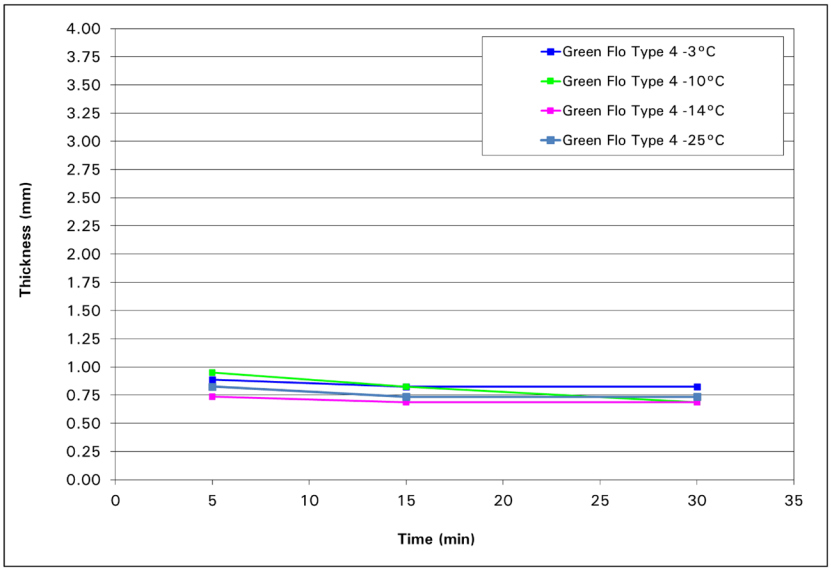


Figure 4.8: Fluid Thickness Profiles of Green Flo Type 4

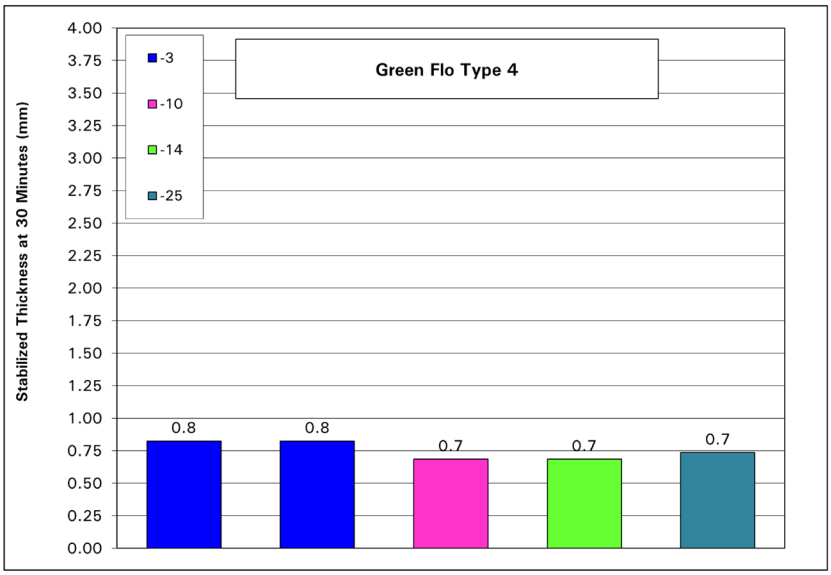


Figure 4.9: Final Fluid Thickness of Green Flo Type 4

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for Green Flo Type 4. The HOT table is shown in both the TC format (Table 4.3) and FAA format (Table 4.4) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the Green Flo Type 4 fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The determined LOUT for Green Flo Type 4 is -30°C (-22°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for Green Flo Type 4 were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.5 (LUPR statistics) and Table 4.6 (HUPR statistics).

The analysis determined the LUPR for Green Flo Type 4 is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for Green Flo Type 4 is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for Green Flo Type 4 in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As AFLRUS LLC intends to commercialize Green Flo Type 4, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.3: Fluid-Specific Holdover Time Guidelines – Green Flo Type 4 (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:15 - 2:30	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8°C (below 27 to 18°F)	100/0	0:50 - 2:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:50 - 2:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:35 - 1:00[11]	0:20 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:10	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:10	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					
below -25 to -30°C (below -13 to -22°F)	100/0	0:25 - 1:00	0:04 - 0:10	0:35 - 0:40	0:15 - 0:35	0:06 - 0:15					

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32.

Table 4.4: Fluid-Specific Holdover Time Guidelines – Green Flo Type 4 (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:30	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:50 - 2:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:50 - 2:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:35 - 1:00[11]	0:20 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:10	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:10	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:25 - 1:00	0:04 - 0:10	0:35 - 0:40	0:15 - 0:35	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.5: LUPR Statistics – Green Flo Type 4

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	15	40
Data Points ≤ 9.5 g	15	40
Data Points ≤ 8.5 g	14	40
Data Points ≤ 7.5 g	12	40
Data Points ≤ 6.5 g	11	40
Data Points ≤ 5.5 g	8	40
Data Points ≤ 4.5 g	7	40
Data Points ≤ 3.5 g	4	40
Data Points ≤ 2.5 g	1	20
Negative Scatter 0-10 g	-5%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	40	pass

LUPR	100/0
	3 g/dm²/h

Table 4.6: HUPR Statistics – Green Flo Type 4

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	12	40
Data Points ≥ 15 g	18	40
Data Points ≥ 20 g	12	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	5	40
Data Points ≥ 35 g	3	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-6%	40

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	40	pass
30 g/dm²/h	40	pass
35 g/dm²/h	40	pass
40 g/dm²/h	40	pass
45 g/dm²/h	40	pass
50 g/dm²/h	40	pass

HUPR	100/0
	50 g/dm²/h

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APPENDIX G

FLUID MANUFACTURER REPORT:
ALLCLEAR SYSTEMS CLEAR IV FLIGHT (TYPE IV)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Clear IV Flight (Type IV)

Prepared for

AllClear Systems LLC



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ACS-PG4 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Clear IV Flight (Type IV)

Prepared for

AllClear Systems LLC

Prepared by: _____ July 2, 2025

Yi Tian
Assistant, Publications and Delivery
Date

Reviewed by: _____ July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems
Date

By

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. ACS-PG4 2024-25

ii

Fluid Identification and Characteristics

Manufacturer:	AllClear Systems LLC		
Fluid Test Name:	Clear IV Flight		
Fluid Commercial Name:	Clear IV Flight		
Fluid Type / Base / Colour:	Type IV / Propylene Glycol / Green		
Batch #:	TAB24-CP1127		
Date of Receipt:	December 03, 2024		
Brix (Measured):	Neat fluid:	36.25°	
Freeze Point (Stated):	Neat fluid:	-37°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-23°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	23,600 cP	22,300 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid[2]:	23,200 cP	21,900 cP
WSET (from AMIL):	Neat fluid:	84 minutes	

1. SC4-31/13R, small sample adapter, 9 mL of fluid, 0°C, 0.3 rpm, for 10.0 minutes.
2. SC4-31/13R, small sample adapter, 9 mL of fluid, 0°C, 0.3 rpm, for 15.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **Clear IV Flight** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport (YUL), at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

Clear IV Flight Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	1:35 - 2:50	0:30 - 1:00	2:30 - 3:00	1:20 - 2:30	0:40 - 1:20	1:05 - 1:45	0:50 - 1:10	0:15 - 0:15	0:20 - 1:15	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	0:50 - 1:55	0:25 - 0:45	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	0:50 - 1:55	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:25 - 0:45	0:10 - 0:20	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30					
below -18 to -23	100/0	0:25 - 0:45	0:08 - 0:15	0:40 - 0:50	0:20 - 0:40	0:10 - 0:20					

**FAA values displayed. TC caps snow holdover times at 2 hours.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **Clear IV Flight**, a new Type IV fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with Clear IV Flight is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – Clear IV Flight, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	3	4	6	3	0
	Below -3 to -8	0	3	8	0	0
	Below -8 to -13	3	4	4	3	3
	Below -13 to -16	1	2	4	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – Clear IV Flight, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	7	9	0	0
	Below -18 to -22	4	7	0	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	1	5	0	0	0

3.3 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.3 by precipitation type, fluid dilution, and test temperature.

Table 3.3: Freezing Precipitation Test Counts – Clear IV Flight, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog			CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	+1°C
100/0	4	4	4	4	4	4	4	4

3.4 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.4 by fluid dilution and test temperature.

Table 3.4: Natural Frost Test Counts – Clear IV Flight, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	2	4	0

3.5 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.6 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.5 (natural snow), Table 3.6 (very cold snow), Table 3.7 (freezing precipitation), and Table 3.8 (natural frost).

Table 3.5: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
2	04-Dec-24	Clear IV Flight	100/0	-1.2	3.7	178.2
4	04-Dec-24	Clear IV Flight	100/0	-0.9	2.2	275.3
6	07-Dec-24	Clear IV Flight	100/0	-6.1	6.7	102.2
9	07-Dec-24	Clear IV Flight	100/0	-4.7	6.0	124.8
12	07-Dec-24	Clear IV Flight	100/0	-3.2	7.0	127.5
15	08-Dec-24	Clear IV Flight	100/0	-2.0	7.3	111.1
18	09-Dec-24	Clear IV Flight	100/0	-6.3	10.6	78.4
21	09-Dec-24	Clear IV Flight	100/0	-6.0	12.4	76.0
24	09-Dec-24	Clear IV Flight	100/0	-5.6	10.4	87.9
28	18-Dec-24	Clear IV Flight	100/0	-16.3	13.0	28.6
35	18-Dec-24	Clear IV Flight	100/0	-15.5	17.3	25.9
38	23-Dec-24	Clear IV Flight	100/0	-8.0	8.7	62.7
43	23-Dec-24	Clear IV Flight	100/0	-7.9	11.0	50.1
49	23-Dec-24	Clear IV Flight	100/0	-7.5	10.5	64.8
66	08-Jan-25	Clear IV Flight	100/0	-13.7	5.6	89.7
73	08-Jan-25	Clear IV Flight	100/0	-13.0	3.7	112.4
83	08-Jan-25	Clear IV Flight	100/0	-12.2	4.6	92.3
87	23-Jan-25	Clear IV Flight	100/0	-8.4	2.6	220.5
96	27-Jan-25	Clear IV Flight	100/0	-1.3	3.1	187.7
107	29-Jan-25	Clear IV Flight	100/0	-13.6	5.9	65.1
116	29-Jan-25	Clear IV Flight	100/0	-14.4	10.7	40.3
120	29-Jan-25	Clear IV Flight	100/0	-14.5	12.5	32.2
129	30-Jan-25	Clear IV Flight	100/0	-10.9	1.3	225.6
136	03-Feb-25	Clear IV Flight	100/0	-3.6	10.2	84.0
156	03-Feb-25	Clear IV Flight	100/0	-3.2	14.5	63.8
171	03-Feb-25	Clear IV Flight	100/0	-3.2	13.5	69.4
180	06-Feb-25	Clear IV Flight	100/0	-12.2	8.4	33.4
189	06-Feb-25	Clear IV Flight	100/0	-11.7	25.2	20.0
198	06-Feb-25	Clear IV Flight	100/0	-12.9	18.2	32.5
207	06-Feb-25	Clear IV Flight	100/0	-11.3	8.1	84.8
216	12-Feb-25	Clear IV Flight	100/0	-11.8	3.1	118.6
225	13-Feb-25	Clear IV Flight	100/0	-11.7	26.9	21.3
234	13-Feb-25	Clear IV Flight	100/0	-11.4	40.6	15.9
243	13-Feb-25	Clear IV Flight	100/0	-11.3	24.8	23.4
252	16-Feb-25	Clear IV Flight	100/0	-10.2	12.0	59.5
261	16-Feb-25	Clear IV Flight	100/0	-10.1	23.6	33.9

Table 3.5: Log of Tests Performed (Natural Snow) (cont'd)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
270	16-Feb-25	Clear IV Flight	100/0	-10.0	29.0	30.1
279	16-Feb-25	Clear IV Flight	100/0	-9.9	51.4	21.1
288	16-Feb-25	Clear IV Flight	100/0	-9.8	43.4	20.1
297	27-Feb-25	Clear IV Flight	100/0	-1.3	13.2	66.6
305	04-Mar-25	Clear IV Flight	100/0	0.8	6.1	143.1
320	04-Mar-25	Clear IV Flight	100/0	0.4	15.8	72.6
335	04-Mar-25	Clear IV Flight	100/0	-0.1	7.9	121.3
339	19-Mar-25	Clear IV Flight	100/0	1.1	5.5	169.2
355	19-Mar-25	Clear IV Flight	100/0	-0.2	11.4	91.5
365	19-Mar-25	Clear IV Flight	100/0	-0.5	10.8	95.0
376	19-Mar-25	Clear IV Flight	100/0	-0.5	25.3	56.2
387	19-Mar-25	Clear IV Flight	100/0	-0.8	36.0	40.0
397	20-Mar-25	Clear IV Flight	100/0	-1.2	29.9	51.1
407	24-Mar-25	Clear IV Flight	100/0	-2.8	16.5	65.0
418	24-Mar-25	Clear IV Flight	100/0	-1.7	17.2	64.7

Table 3.6: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
5	18-Dec-24	Clear IV Flight	100/0	-20.1	3.4	46.8
8	18-Dec-24	Clear IV Flight	100/0	-19.5	5.7	33.1
14	18-Dec-24	Clear IV Flight	100/0	-19.0	8.6	26.9
23	18-Dec-24	Clear IV Flight	100/0	-17.8	12.1	25.2
29	18-Dec-24	Clear IV Flight	100/0	-17.0	15.2	24.8
32	18-Dec-24	Clear IV Flight	100/0	-16.3	13.0	28.6
39	18-Dec-24	Clear IV Flight	100/0	-15.5	17.3	25.9
43	08-Jan-25	Clear IV Flight	100/0	-13.7	5.6	89.7
51	27-Jan-25	Clear IV Flight	100/0	-18.1	9.8	26.4
61	27-Jan-25	Clear IV Flight	100/0	-17.8	9.4	30.0
69	27-Jan-25	Clear IV Flight	100/0	-17.8	9.7	27.3
79	27-Jan-25	Clear IV Flight	100/0	-17.9	12.1	27.4
88	27-Jan-25	Clear IV Flight	100/0	-17.2	16.4	19.8
98	27-Jan-25	Clear IV Flight	100/0	-17.2	17.6	19.3
104	29-Jan-25	Clear IV Flight	100/0	-13.6	5.9	65.1
110	29-Jan-25	Clear IV Flight	100/0	-14.4	10.7	40.3
117	29-Jan-25	Clear IV Flight	100/0	-14.5	12.5	32.2
130	31-Jan-25	Clear IV Flight	100/0	-25.1	5.0	28.7
138	31-Jan-25	Clear IV Flight	100/0	-25.2	5.7	34.4
147	31-Jan-25	Clear IV Flight	100/0	-25.4	4.0	37.0
149	31-Jan-25	Clear IV Flight	100/0	-25.3	5.4	32.7
158	31-Jan-25	Clear IV Flight	100/0	-25.6	7.0	28.5
167	31-Jan-25	Clear IV Flight	100/0	-26.3	5.4	34.4
185	05-Feb-25	Clear IV Flight	100/0	-18.2	5.5	48.9
194	05-Feb-25	Clear IV Flight	100/0	-17.9	2.0	86.6
201	05-Feb-25	Clear IV Flight	100/0	-17.7	4.9	43.6
208	05-Feb-25	Clear IV Flight	100/0	-17.5	4.5	52.8
213	05-Feb-25	Clear IV Flight	100/0	-16.9	1.6	161.2
221	05-Feb-25	Clear IV Flight	100/0	-16.7	7.7	42.9
234	13-Feb-25	Clear IV Flight	100/0	-21.4	2.3	57.8
244	13-Feb-25	Clear IV Flight	100/0	-21.3	4.7	36.4
251	13-Feb-25	Clear IV Flight	100/0	-21.2	3.8	48.0
255	13-Feb-25	Clear IV Flight	100/0	-21.2	4.8	37.4
263	13-Feb-25	Clear IV Flight	100/0	-21.1	4.2	42.5
270	13-Feb-25	Clear IV Flight	100/0	-21.0	3.7	43.9

Table 3.7: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
15	20-Mar-25	Freezing Fog	Clear IV Flight	100/0	-3.3	2.1	165.4
16	20-Mar-25	Freezing Fog	Clear IV Flight	100/0	-3.3	2.1	164.5
35	20-Mar-25	Freezing Fog	Clear IV Flight	100/0	-3.2	5.3	93.0
36	20-Mar-25	Freezing Fog	Clear IV Flight	100/0	-3.2	5.3	92.0
53	19-Mar-25	Freezing Fog	Clear IV Flight	100/0	-14.3	2.1	115.6
54	19-Mar-25	Freezing Fog	Clear IV Flight	100/0	-14.3	1.9	117.0
71	19-Mar-25	Freezing Fog	Clear IV Flight	100/0	-13.3	5.3	49.1
72	19-Mar-25	Freezing Fog	Clear IV Flight	100/0	-13.3	5.4	48.3
87	18-Mar-25	Freezing Fog	Clear IV Flight	100/0	-24.6	2.0	41.5
88	18-Mar-25	Freezing Fog	Clear IV Flight	100/0	-24.6	2.1	44.9
103	18-Mar-25	Freezing Fog	Clear IV Flight	100/0	-24.9	5.0	26.7
104	18-Mar-25	Freezing Fog	Clear IV Flight	100/0	-24.9	4.8	28.2
135	25-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-3.0	13.2	68.2
136	25-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-3.0	13.5	64.3
155	25-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-3.2	5.3	98.4
156	25-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-3.2	5.2	102.1
173	26-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-10.1	5.4	82.6
174	26-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-10.1	4.7	88.7
191	26-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-10.3	13.4	50.4
192	26-Mar-25	Freezing Drizzle	Clear IV Flight	100/0	-10.3	13.3	45.9
211	21-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-3.2	12.8	67.3
212	21-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-3.2	13.1	68.8
231	21-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-3.3	24.6	48.6
232	21-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-3.3	24.7	47.9
249	26-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-9.9	13.5	49.9
250	26-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-9.9	13.1	48.8
267	27-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-10.1	25.7	38.5
268	27-Mar-25	Light Freezing Rain	Clear IV Flight	100/0	-10.1	26.0	38.2
285	27-Mar-25	Cold Soak Box	Clear IV Flight	100/0	1.1	5.2	74.4
286	27-Mar-25	Cold Soak Box	Clear IV Flight	100/0	1.1	5.1	76.1
303	27-Mar-25	Cold Soak Box	Clear IV Flight	100/0	0.7	74.7	20.0
304	27-Mar-25	Cold Soak Box	Clear IV Flight	100/0	0.6	76.4	18.3

Table 3.8: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
39	13-Dec-24	Natural Frost	Clear IV Flight	100/0	615	0.08	-10.6	6	66	Did Not Fail
48	14-Dec-24	Natural Frost	Clear IV Flight	100/0	421	0.12	-12.0	9	74	Did Not Fail
57	22-Dec-24	Natural Frost	Clear IV Flight	100/0	365	0.09	-15.7	9	69	Did Not Fail
66	26-Dec-24	Natural Frost	Clear IV Flight	100/0	360	0.12	-15.0	6	85	Did Not Fail
77	21-Jan-25	Natural Frost	Clear IV Flight	100/0	361	0.04	-15.3	9	63	Did Not Fail
86	24-Jan-25	Natural Frost	Clear IV Flight	100/0	361	0.07	-17.1	7	75	Did Not Fail
95	13-Mar-25	Natural Frost	Clear IV Flight	100/0	726	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type IV HOT Guidelines. The figures include the current Type IV generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.1 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type IV fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.1 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.8. The test durations were compared to the Type IV generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type IV generic frost holdover times can be considered substantiated for Clear IV Flight.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of Clear IV Flight. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.4 Fluid Thickness Tests

Figure 4.7 shows the fluid thickness test data. As described in Subsection 3.5, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.8.

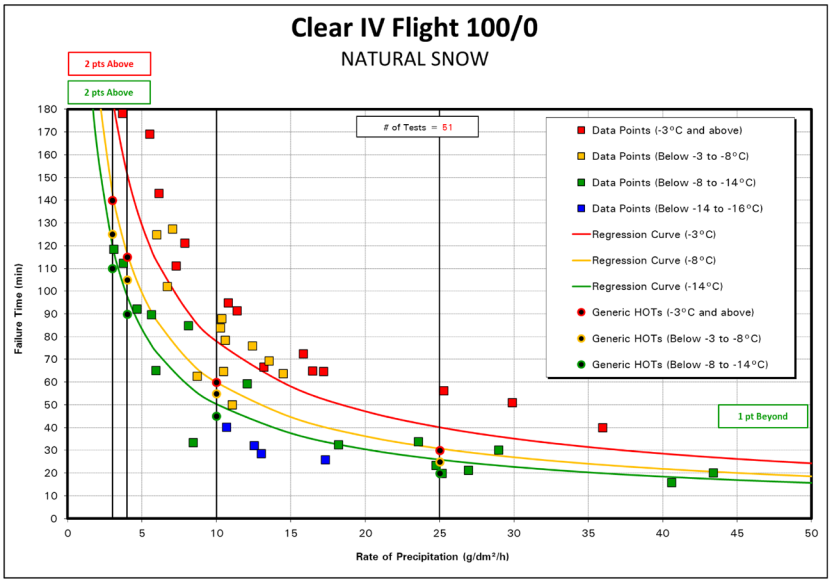


Figure 4.1: Type IV 100/0 – Natural Snow

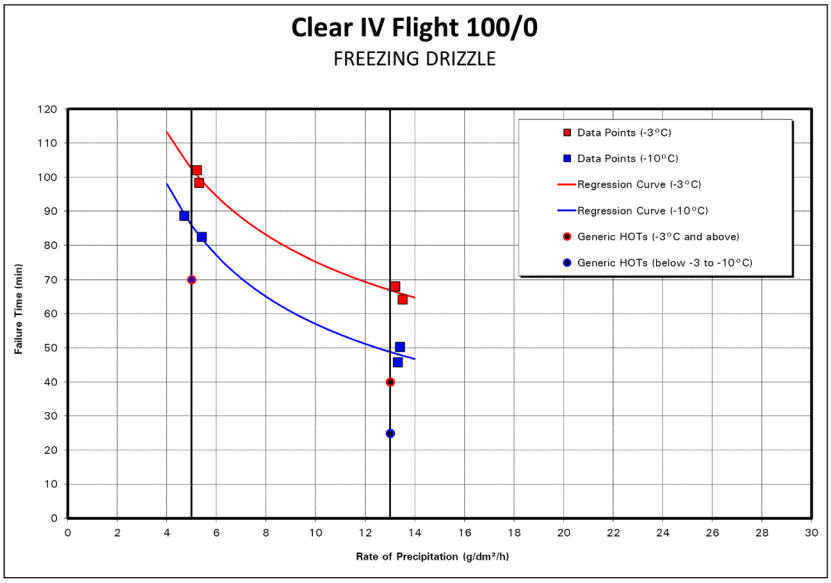


Figure 4.2: Type IV 100/0 – Freezing Drizzle

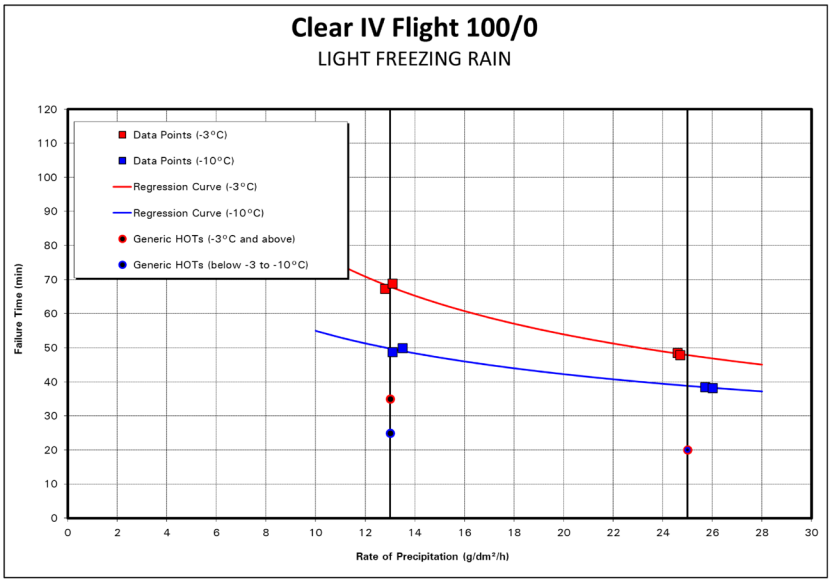


Figure 4.3: Type IV 100/0 – Light Freezing Rain

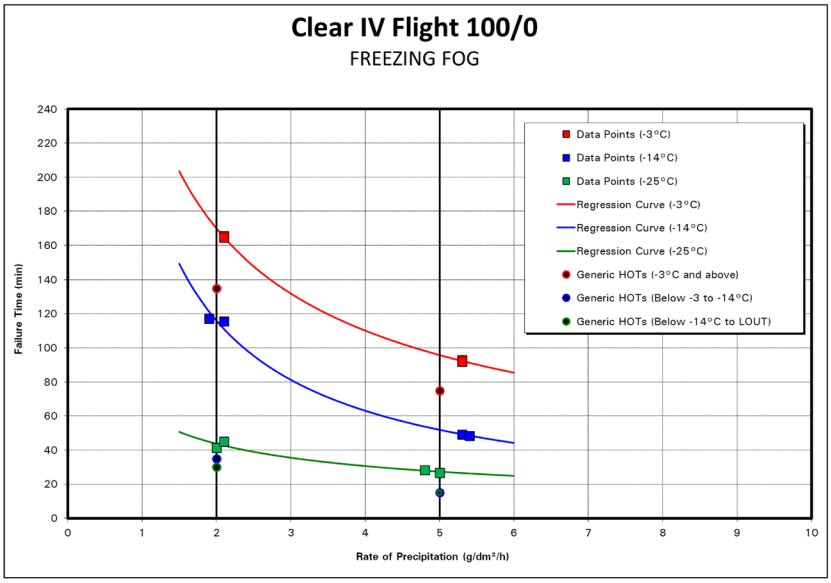


Figure 4.4: Type IV 100/0 – Freezing Fog

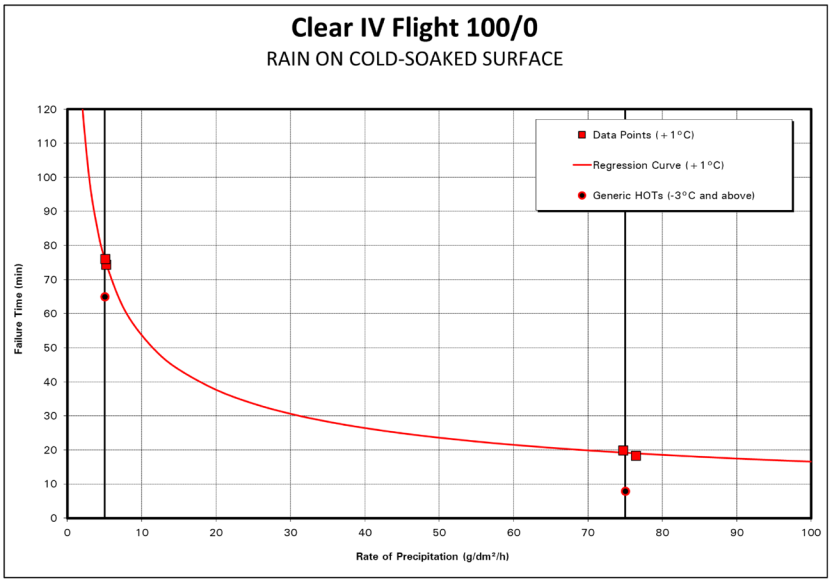


Figure 4.5: Type IV 100/0 – Rain on Cold-Soaked Surface

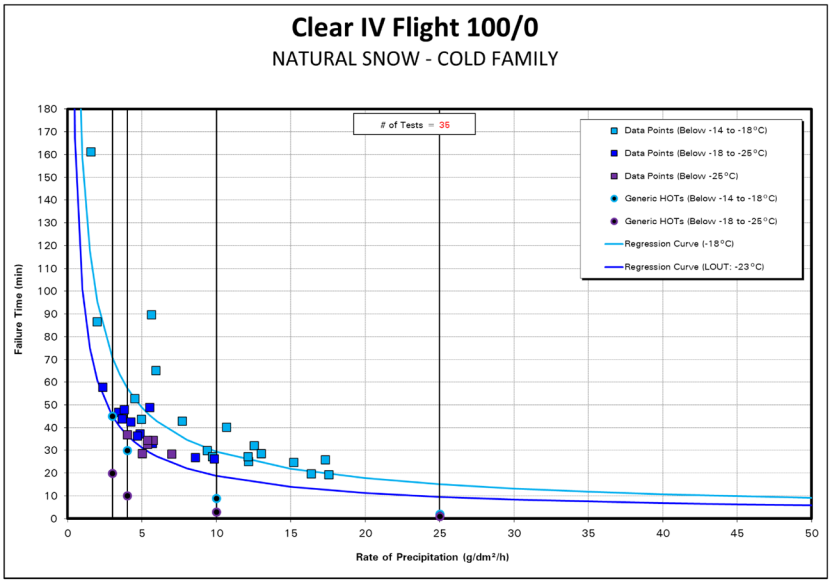


Figure 4.6: Type IV 100/0 – Very Cold Snow

Table 4.1: Regression Equation Coefficients for Clear IV Flight

Natural Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Clear IV Flight	100/0	≥ -14°C	92%	2.8809	-0.7265	-0.3761	51

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clear IV Flight	100/0	-3°C	100%	2.4187	-0.6251	4
Clear IV Flight	100/0	-14°C	100%	2.3291	-0.8799	4
Clear IV Flight	100/0	-25°C	97%	1.7949	-0.5150	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clear IV Flight	100/0	-3°C	99%	2.3220	-0.4456	4
Clear IV Flight	100/0	-10°C	99%	2.3473	-0.5912	4

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clear IV Flight	100/0	-3°C	99%	2.4277	-0.5350	4
Clear IV Flight	100/0	-10°C	99%	2.1188	-0.3788	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clear IV Flight	100/0	+1°C	100%	2.2397	-0.5102	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Clear IV Flight	100/0	< -14°C	91%	4.1571	-0.7309	-1.5046	35

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

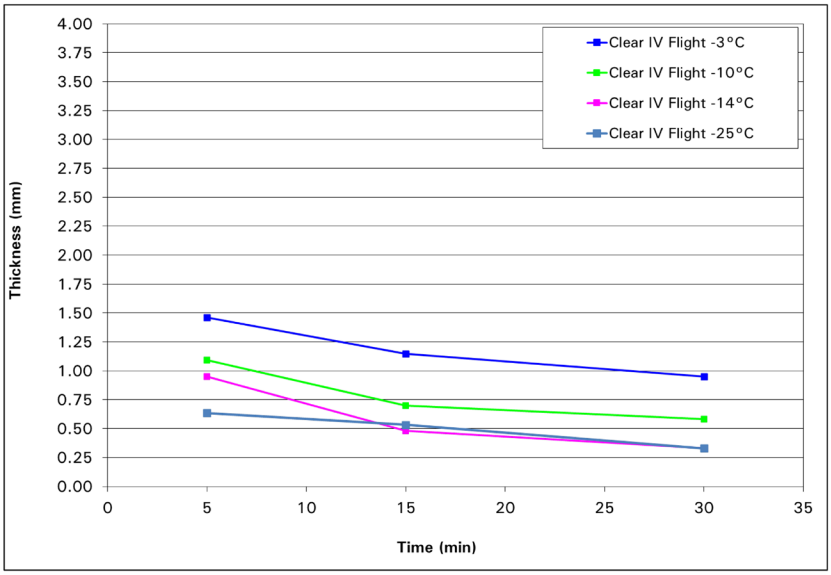


Figure 4.7: Fluid Thickness Profiles of Clear IV Flight

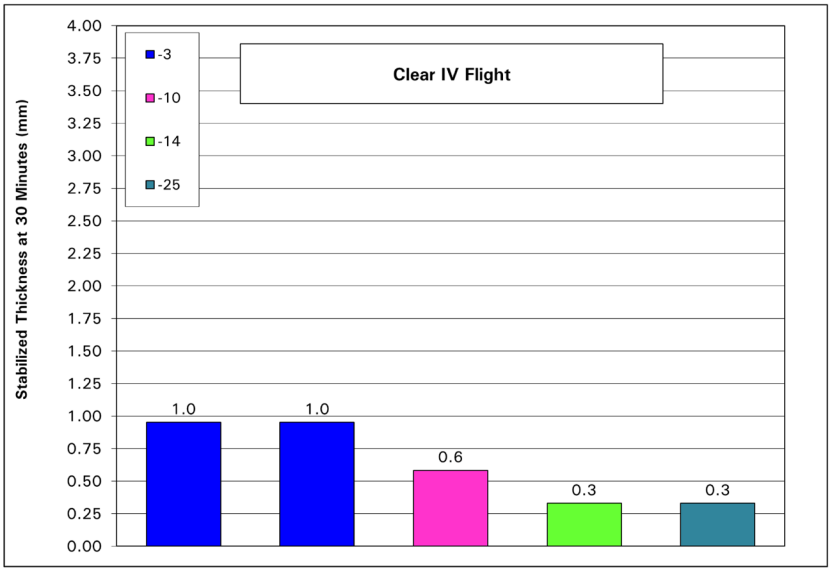


Figure 4.8: Final Fluid Thickness of Clear IV Flight

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for Clear IV Flight. The HOT table is shown in both the TC format (Table 4.2) and FAA format (Table 4.3) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the Clear IV Flight fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The calculated LOUT for Clear IV Flight is -23°C (-9°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for Clear IV Flight were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.4 (LUPR statistics) and Table 4.5 (HUPR statistics).

The analysis determined the LUPR for Clear IV Flight is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for Clear IV Flight is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for Clear IV Flight in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As AllClear Systems LLC intends to commercialize Clear IV Flight, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.2: Fluid-Specific Holdover Time Guidelines – Clear IV Flight (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 2:50	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:05 - 1:45	0:50 - 1:10	0:15 - 0:15	0:20 - 1:15	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:50 - 1:55	0:25 - 0:45	1:55 - 2:00	1:00 - 1:55	0:30 - 1:00	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:50 - 1:55	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:50 - 1:25[11]	0:40 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:45	0:10 - 0:20	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30					
below -18 to -23°C (below 0 to -9°F)	100/0	0:25 - 0:45	0:08 - 0:15	0:40 - 0:50	0:20 - 0:40	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32.

Table 4.3: Fluid-Specific Holdover Time Guidelines – Clear IV Flight (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:50	0:30 - 1:00	2:30 - 3:00	1:20 - 2:30	0:40 - 1:20	1:05 - 1:45	0:50 - 1:10	0:15 - 0:15	0:20 - 1:15	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:50 - 1:55	0:25 - 0:45	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:50 - 1:55	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:50 - 1:25[11]	0:40 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:45	0:10 - 0:20	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30					
below -18 to -23 °C (below 0 to -9 °F)	100/0	0:25 - 0:45	0:08 - 0:15	0:40 - 0:50	0:20 - 0:40	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.4: LUPR Statistics – Clear IV Flight

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	20	40
Data Points ≤ 9.5 g	20	40
Data Points ≤ 8.5 g	19	40
Data Points ≤ 7.5 g	16	40
Data Points ≤ 6.5 g	13	40
Data Points ≤ 5.5 g	9	40
Data Points ≤ 4.5 g	7	40
Data Points ≤ 3.5 g	5	40
Data Points ≤ 2.5 g	2	30
Negative Scatter 0-10 g	-7%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	40	pass

LUPR	100/0
	3 g/dm²/h

Table 4.5: HUPR Statistics – Clear IV Flight

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	11	40
Data Points ≥ 15 g	16	40
Data Points ≥ 20 g	11	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	4	40
Data Points ≥ 35 g	4	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-7%	40

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	40	pass
30 g/dm²/h	40	pass
35 g/dm²/h	40	pass
40 g/dm²/h	40	pass
45 g/dm²/h	40	pass
50 g/dm²/h	40	pass

HUPR	100/0
	50 g/dm²/h

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APPENDIX H

FLUID MANUFACTURER REPORT:
NEWAVE AEROCHEMICAL FCY-EGIV PLUS (TYPE IV)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

FCY-EGIV PLUS (Type IV)

Prepared for

Newave Aerochemical Co., Ltd.



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. NWA-EG4 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

FCY-EGIV PLUS (Type IV)

Prepared for

Newave Aerochemical Co., Ltd.

Prepared by: _____ July 2, 2025

Yi Tian
Assistant, Publications and Delivery
Date

Reviewed by: _____ July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems
Date

By

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. NWA-EG4 2024-25

Fluid Identification and Characteristics

Manufacturer:	Newave Aerochemical Co., Ltd.		
Fluid Test Name:	FCY-EGIV PLUS		
Fluid Commercial Name:	FCY-EGIV PLUS		
Fluid Type / Base / Colour:	Type IV / Ethylene Glycol / Green		
Batch #:	241120001		
Date of Receipt:	December 05, 2024		
Brix (Measured):	Neat fluid:	35.25°	
Freeze Point (Stated):	Neat fluid:	-43.6°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-29°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	28,100 cP	27,400 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid:	n/a	n/a
WSET (from AMIL):	Neat fluid:	120 minutes	

1. SC4-31/13R, small sample adapter, 10 mL of fluid, 0°C, 0.3 rpm, for 30.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **FCY-EGIV PLUS** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport, at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

FCY-EGIV PLUS Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	3:05 - 4:00	0:30 - 1:00	2:50 - 3:00	1:20 - 2:50	0:40 - 1:20	1:15 - 2:00	0:40 - 0:55	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	1:35 - 3:15	0:25 - 0:50	2:15 - 2:55	1:05 - 2:15	0:30 - 1:05	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	1:35 - 3:15	0:20 - 0:40	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:30 - 1:10	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -18 to -25	100/0	0:30 - 1:10	0:09 - 0:20	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30					
below -25 to -29	100/0	0:30 - 1:10	0:08 - 0:20	1:00 - 1:15	0:25 - 1:00	0:10 - 0:25					

**FAA values displayed. TC caps snow holdover times at 2 hours.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **FCY-EGIV PLUS**, a new Type IV fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with FCY-EGIV PLUS is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – FCY-EGIV PLUS, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	1	4	6	3	0
	Below -3 to -8	0	4	9	0	0
	Below -8 to -13	2	3	5	3	3
	Below -13 to -16	0	2	3	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – FCY-EGIV PLUS, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	5	10	0	0
	Below -18 to -22	5	5	1	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	0	6	0	0	0

3.3 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.3 by precipitation type, fluid dilution, and test temperature.

Table 3.3: Freezing Precipitation Test Counts – FCY-EGIV PLUS, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog			CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	+1°C
100/0	4	4	4	4	4	4	4	4

3.4 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.4 by fluid dilution and test temperature.

Table 3.4: Natural Frost Test Counts – FCY-EGIV PLUS, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	2	4	0

3.5 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.6 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.5 (natural snow), Table 3.6 (very cold snow), Table 3.7 (freezing precipitation), and Table 3.8 (natural frost).

Table 3.5: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
7	07-Dec-24	FCY-EGIV PLUS	100/0	-6.1	6.8	106.6
10	07-Dec-24	FCY-EGIV PLUS	100/0	-4.8	6.5	98.3
13	07-Dec-24	FCY-EGIV PLUS	100/0	-3.2	7.0	126.7
16	08-Dec-24	FCY-EGIV PLUS	100/0	-2.0	7.3	91.9
19	09-Dec-24	FCY-EGIV PLUS	100/0	-6.2	11.1	92.1
22	09-Dec-24	FCY-EGIV PLUS	100/0	-6.0	12.6	71.9
25	09-Dec-24	FCY-EGIV PLUS	100/0	-5.6	10.4	91.1
29	18-Dec-24	FCY-EGIV PLUS	100/0	-16.2	12.8	37.6
36	18-Dec-24	FCY-EGIV PLUS	100/0	-15.5	17.6	28.7
40	23-Dec-24	FCY-EGIV PLUS	100/0	-8.0	9.4	83.1
45	23-Dec-24	FCY-EGIV PLUS	100/0	-7.9	11.4	73.8
48	23-Dec-24	FCY-EGIV PLUS	100/0	-7.7	11.2	60.4
51	23-Dec-24	FCY-EGIV PLUS	100/0	-7.5	11.1	78.3
68	08-Jan-25	FCY-EGIV PLUS	100/0	-13.7	5.4	96.6
75	08-Jan-25	FCY-EGIV PLUS	100/0	-12.9	3.8	129.1
85	08-Jan-25	FCY-EGIV PLUS	100/0	-12.2	4.7	90.9
97	27-Jan-25	FCY-EGIV PLUS	100/0	-1.3	3.0	179.4
108	29-Jan-25	FCY-EGIV PLUS	100/0	-13.8	6.3	77.9
121	29-Jan-25	FCY-EGIV PLUS	100/0	-14.5	12.4	36.3
130	30-Jan-25	FCY-EGIV PLUS	100/0	-10.8	1.4	254.9
137	03-Feb-25	FCY-EGIV PLUS	100/0	-3.6	10.2	86.0
157	03-Feb-25	FCY-EGIV PLUS	100/0	-3.2	13.6	51.7
166	03-Feb-25	FCY-EGIV PLUS	100/0	-3.2	14.3	76.6
181	06-Feb-25	FCY-EGIV PLUS	100/0	-12.1	11.6	41.3
190	06-Feb-25	FCY-EGIV PLUS	100/0	-11.7	25.3	20.7
199	06-Feb-25	FCY-EGIV PLUS	100/0	-12.9	18.7	33.3
209	06-Feb-25	FCY-EGIV PLUS	100/0	-11.3	8.0	90.6
217	12-Feb-25	FCY-EGIV PLUS	100/0	-11.8	4.9	149.8
226	13-Feb-25	FCY-EGIV PLUS	100/0	-11.7	27.0	21.2
235	13-Feb-25	FCY-EGIV PLUS	100/0	-11.4	40.4	16.0
245	13-Feb-25	FCY-EGIV PLUS	100/0	-11.3	24.3	26.2
253	16-Feb-25	FCY-EGIV PLUS	100/0	-10.2	12.2	63.5
262	16-Feb-25	FCY-EGIV PLUS	100/0	-10.1	22.3	26.9
271	16-Feb-25	FCY-EGIV PLUS	100/0	-10.0	27.6	19.0
280	16-Feb-25	FCY-EGIV PLUS	100/0	-9.9	52.0	18.6
289	16-Feb-25	FCY-EGIV PLUS	100/0	-9.8	43.2	15.6

Table 3.5: Log of Tests Performed (Natural Snow) (cont'd)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
298	27-Feb-25	FCY-EGIV PLUS	100/0	-1.1	14.5	80.6
306	04-Mar-25	FCY-EGIV PLUS	100/0	0.8	6.0	141.3
319	04-Mar-25	FCY-EGIV PLUS	100/0	0.4	17.0	63.5
330	04-Mar-25	FCY-EGIV PLUS	100/0	-0.1	8.2	122.3
340	19-Mar-25	FCY-EGIV PLUS	100/0	1.0	5.5	172.5
356	19-Mar-25	FCY-EGIV PLUS	100/0	-0.2	11.6	87.9
366	19-Mar-25	FCY-EGIV PLUS	100/0	-0.5	10.9	98.4
379	19-Mar-25	FCY-EGIV PLUS	100/0	-0.5	25.8	51.0
389	19-Mar-25	FCY-EGIV PLUS	100/0	-0.8	36.0	39.5
398	20-Mar-25	FCY-EGIV PLUS	100/0	-1.2	30.4	47.5
408	24-Mar-25	FCY-EGIV PLUS	100/0	-2.8	16.6	63.7
419	24-Mar-25	FCY-EGIV PLUS	100/0	-1.6	17.2	63.6

Table 3.6: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
6	18-Dec-24	FCY-EGIV PLUS	100/0	-19.8	4.4	81.8
15	18-Dec-24	FCY-EGIV PLUS	100/0	-19.0	9.5	40.4
19	18-Dec-24	FCY-EGIV PLUS	100/0	-18.6	10.8	33.8
24	18-Dec-24	FCY-EGIV PLUS	100/0	-17.8	13.4	30.4
28	18-Dec-24	FCY-EGIV PLUS	100/0	-16.9	15.5	31.0
33	18-Dec-24	FCY-EGIV PLUS	100/0	-16.2	12.8	37.6
40	18-Dec-24	FCY-EGIV PLUS	100/0	-15.5	17.6	28.7
45	08-Jan-25	FCY-EGIV PLUS	100/0	-13.7	5.4	96.6
52	27-Jan-25	FCY-EGIV PLUS	100/0	-18.0	9.4	34.6
62	27-Jan-25	FCY-EGIV PLUS	100/0	-17.8	9.6	34.2
70	27-Jan-25	FCY-EGIV PLUS	100/0	-17.9	10.0	33.1
84	27-Jan-25	FCY-EGIV PLUS	100/0	-17.9	12.0	25.1
89	27-Jan-25	FCY-EGIV PLUS	100/0	-17.2	16.7	23.5
102	27-Jan-25	FCY-EGIV PLUS	100/0	-17.2	16.1	24.3
105	29-Jan-25	FCY-EGIV PLUS	100/0	-13.8	6.3	77.9
118	29-Jan-25	FCY-EGIV PLUS	100/0	-14.5	12.4	36.3
135	31-Jan-25	FCY-EGIV PLUS	100/0	-25.1	5.7	54.5
145	31-Jan-25	FCY-EGIV PLUS	100/0	-25.4	4.4	57.4
153	31-Jan-25	FCY-EGIV PLUS	100/0	-25.3	6.3	46.2
165	31-Jan-25	FCY-EGIV PLUS	100/0	-26.2	5.7	56.3
174	31-Jan-25	FCY-EGIV PLUS	100/0	-26.7	5.3	54.2
180	31-Jan-25	FCY-EGIV PLUS	100/0	-26.7	6.7	38.3
191	05-Feb-25	FCY-EGIV PLUS	100/0	-18.1	3.9	87.8
200	05-Feb-25	FCY-EGIV PLUS	100/0	-17.7	3.5	92.3
210	05-Feb-25	FCY-EGIV PLUS	100/0	-17.1	2.0	193.8
219	05-Feb-25	FCY-EGIV PLUS	100/0	-16.7	7.0	65.9
226	05-Feb-25	FCY-EGIV PLUS	100/0	-16.7	11.7	41.2
228	05-Feb-25	FCY-EGIV PLUS	100/0	-16.7	13.9	50.4
237	13-Feb-25	FCY-EGIV PLUS	100/0	-21.4	3.2	93.4
252	13-Feb-25	FCY-EGIV PLUS	100/0	-21.2	4.1	71.8
261	13-Feb-25	FCY-EGIV PLUS	100/0	-21.1	4.3	65.8
272	13-Feb-25	FCY-EGIV PLUS	100/0	-20.8	3.7	70.5
275	13-Feb-25	FCY-EGIV PLUS	100/0	-20.7	3.5	93.7
280	13-Feb-25	FCY-EGIV PLUS	100/0	-20.6	3.7	70.4

Table 3.7: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
13	20-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-3.3	1.9	258.5
14	20-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-3.3	2.0	256.9
33	20-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-3.1	4.7	193.8
34	20-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-3.1	5.2	178.5
51	19-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-14.3	1.9	184.4
52	19-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-14.3	2.1	210.8
69	19-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-13.5	5.2	94.6
70	19-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-13.5	5.4	87.5
85	18-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-24.7	2.0	71.7
86	18-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-24.7	2.0	69.7
101	18-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-24.9	4.9	29.8
102	18-Mar-25	Freezing Fog	FCY-EGIV PLUS	100/0	-24.9	4.7	31.0
133	25-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-3.1	13.0	77.0
134	25-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-3.1	13.2	77.2
153	25-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-3.2	5.0	129.1
154	25-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-3.2	5.4	129.5
171	26-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-10.1	5.2	128.9
172	26-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-10.1	5.2	125.7
189	26-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-10.2	13.1	75.9
190	26-Mar-25	Freezing Drizzle	FCY-EGIV PLUS	100/0	-10.2	13.0	78.0
209	21-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-3.2	12.8	57.0
210	21-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-3.2	13.4	57.1
229	21-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-3.3	25.0	37.5
230	21-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-3.3	25.0	40.0
247	26-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-9.9	13.5	47.7
248	26-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-9.9	13.1	43.5
265	27-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-10.1	25.7	32.3
266	27-Mar-25	Light Freezing Rain	FCY-EGIV PLUS	100/0	-10.1	25.2	28.4
283	27-Mar-25	Cold Soak Box	FCY-EGIV PLUS	100/0	1.0	5.0	126.6
284	27-Mar-25	Cold Soak Box	FCY-EGIV PLUS	100/0	1.0	4.7	126.0
301	27-Mar-25	Cold Soak Box	FCY-EGIV PLUS	100/0	0.8	77.2	14.4
302	27-Mar-25	Cold Soak Box	FCY-EGIV PLUS	100/0	0.7	76.4	16.3

Table 3.8: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
40	13-Dec-24	Natural Frost	FCY-EGIV PLUS	100/0	614	0.08	-10.6	6	66	Did Not Fail
49	14-Dec-24	Natural Frost	FCY-EGIV PLUS	100/0	421	0.12	-12.0	9	74	Did Not Fail
58	22-Dec-24	Natural Frost	FCY-EGIV PLUS	100/0	365	0.09	-15.7	9	69	Did Not Fail
67	26-Dec-24	Natural Frost	FCY-EGIV PLUS	100/0	360	0.12	-15.0	6	85	Did Not Fail
78	21-Jan-25	Natural Frost	FCY-EGIV PLUS	100/0	361	0.04	-15.3	9	63	Did Not Fail
87	24-Jan-25	Natural Frost	FCY-EGIV PLUS	100/0	360	0.07	-17.1	7	75	Did Not Fail
96	13-Mar-25	Natural Frost	FCY-EGIV PLUS	100/0	726	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type IV HOT Guidelines. The figures include the current Type IV generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.1 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type IV fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.1 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.8. The test durations were compared to the Type IV generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type IV generic frost holdover times can be considered substantiated for FCY-EGIV PLUS.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of FCY-EGIV PLUS. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.4 Fluid Thickness Tests

Figure 4.7 shows the fluid thickness test data. As described in Subsection 3.5, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.8.

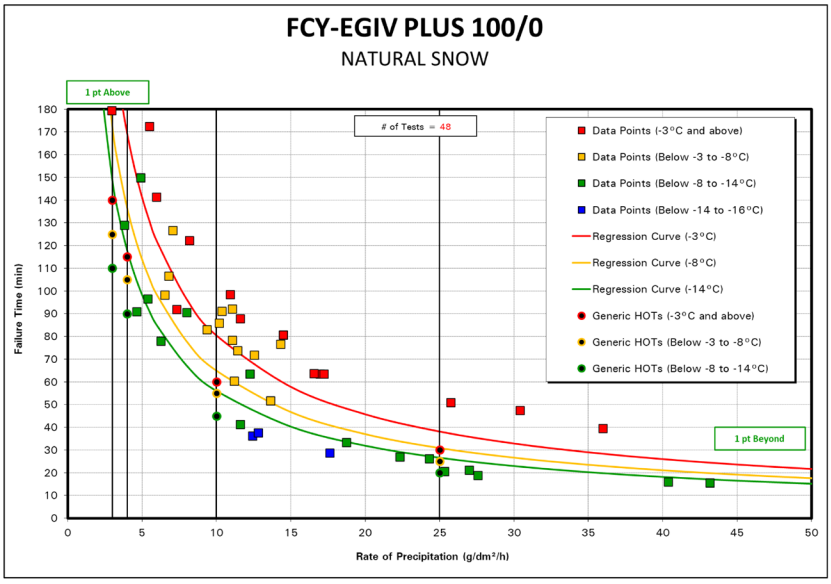


Figure 4.1: Type IV 100/0 – Natural Snow

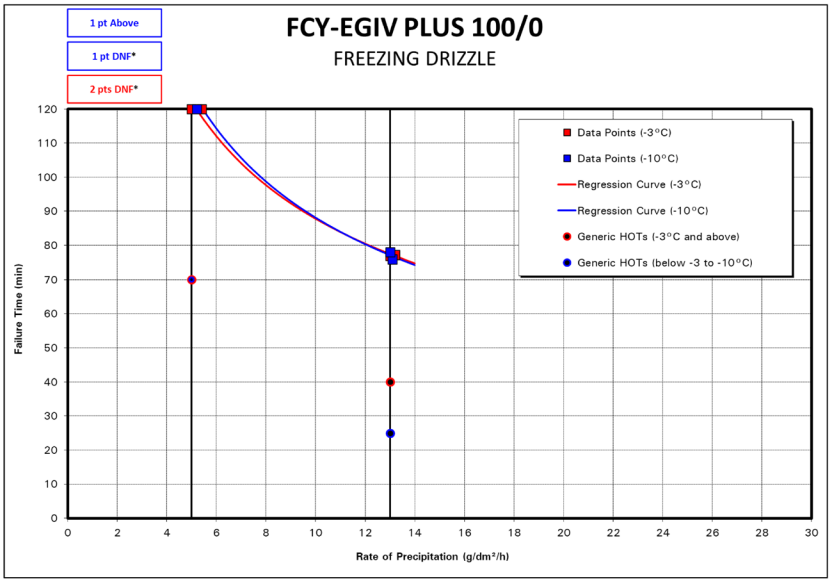


Figure 4.2: Type IV 100/0 – Freezing Drizzle

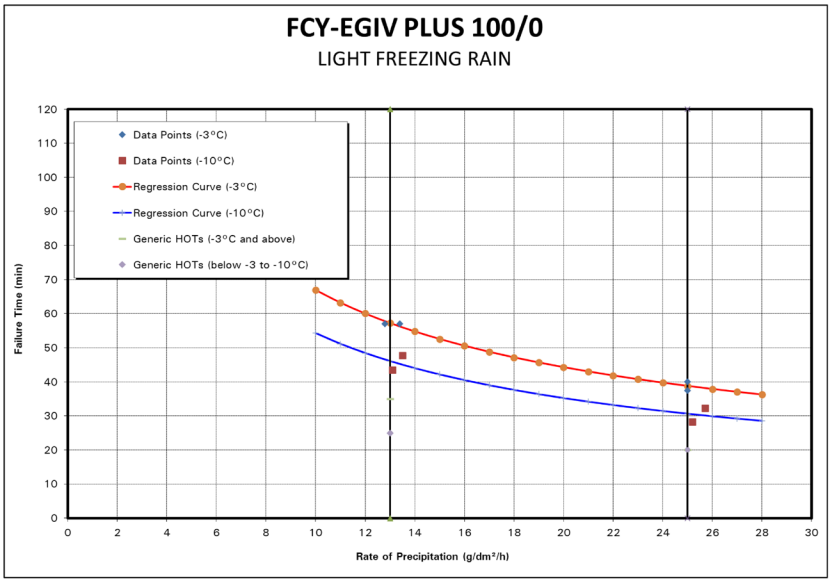


Figure 4.3: Type IV 100/0 – Light Freezing Rain

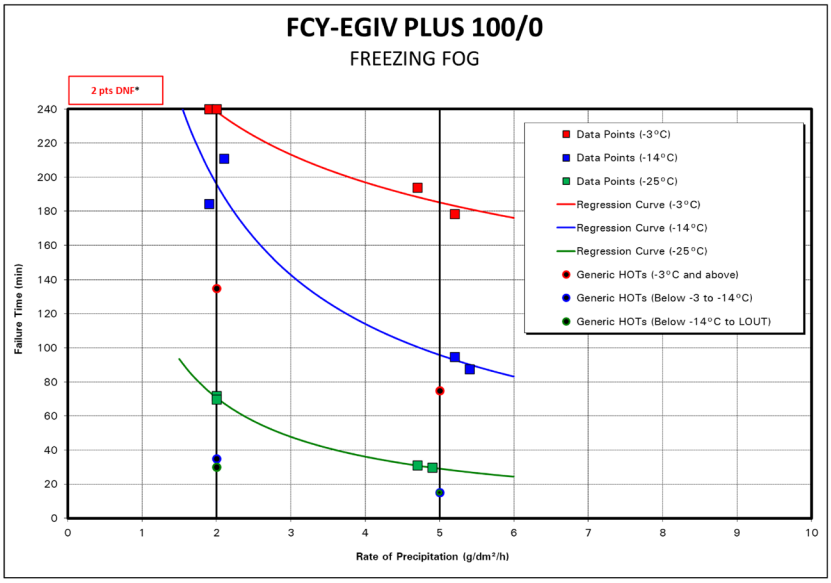


Figure 4.4: Type IV 100/0 – Freezing Fog

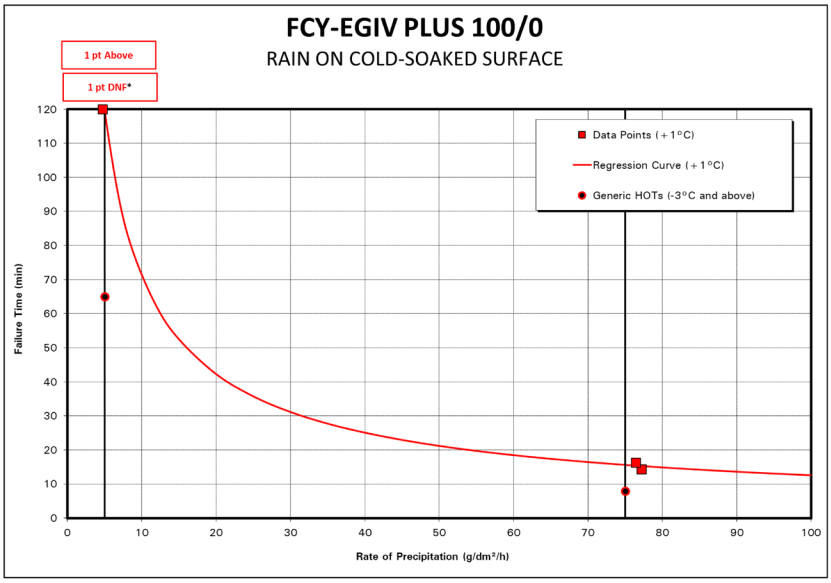


Figure 4.5: Type IV 100/0 – Rain on Cold-Soaked Surface

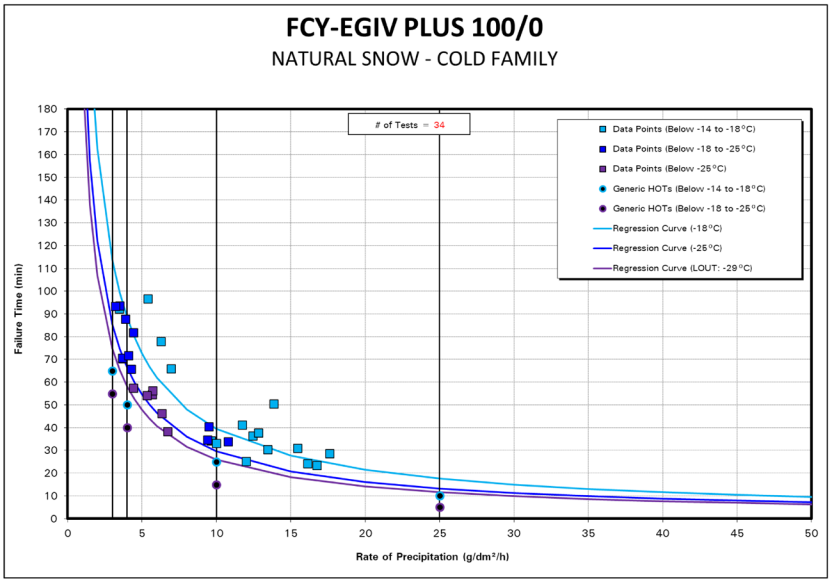


Figure 4.6: Type IV 100/0 – Very Cold Snow

Table 4.1: Regression Equation Coefficients for FCY-EGIV PLUS

Natural Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
FCY-EGIV PLUS	100/0	≥ -14°C	91%	2.9374	-0.8134	-0.3119	48

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
FCY-EGIV PLUS	100/0	-3°C	98%	2.4610	-0.2769	4
FCY-EGIV PLUS	100/0	-14°C	96%	2.5278	-0.7823	4
FCY-EGIV PLUS	100/0	-25°C	100%	2.1398	-0.9646	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
FCY-EGIV PLUS	100/0	-3°C	100%	2.4200	-0.4767	4
FCY-EGIV PLUS	100/0	-10°C	99%	2.4529	-0.5080	4

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
FCY-EGIV PLUS	100/0	-3°C	98%	2.4223	-0.5965	4
FCY-EGIV PLUS	100/0	-10°C	91%	2.3583	-0.6237	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
FCY-EGIV PLUS	100/0	+1°C	100%	2.6078	-0.7546	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
FCY-EGIV PLUS	100/0	< -14°C	91%	3.7216	-0.8810	-0.9570	34

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

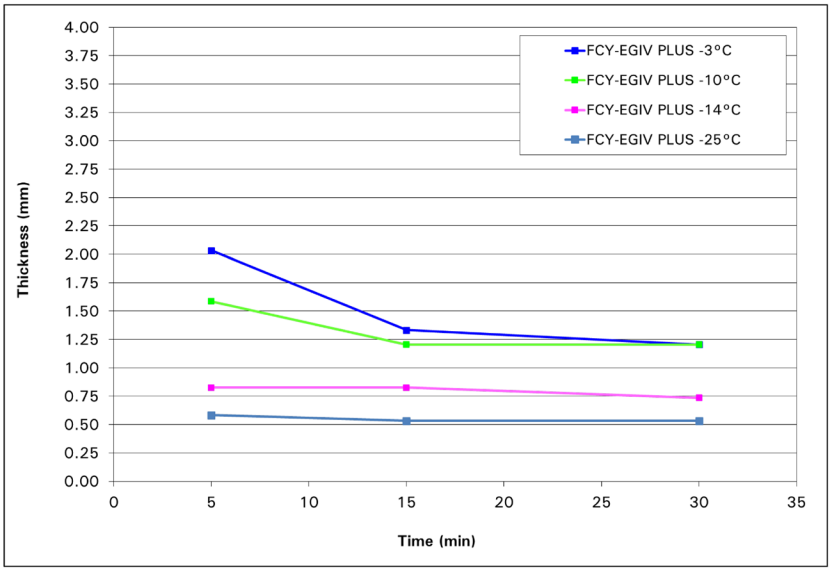


Figure 4.7: Fluid Thickness Profiles of FCY-EGIV PLUS

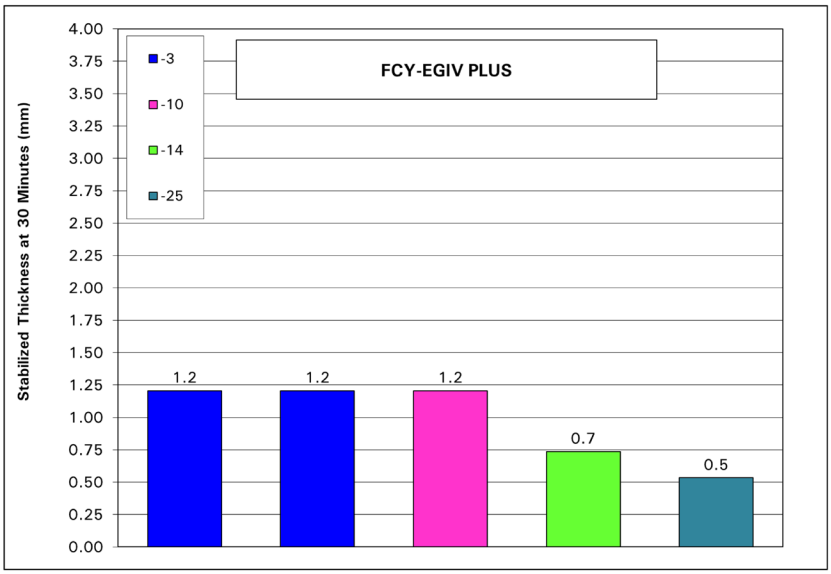


Figure 4.8: Final Fluid Thickness of FCY-EGIV PLUS

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for FCY-EGIV PLUS. The HOT table is shown in both the TC format (Table 4.2) and FAA format (Table 4.3) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the FCY-EGIV PLUS fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The calculated LOUT for FCY-EGIV PLUS is -29°C (-20°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for FCY-EGIV PLUS were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.4 (LUPR statistics) and Table 4.5 (HUPR statistics).

The analysis determined the LUPR for FCY-EGIV PLUS is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for FCY-EGIV PLUS is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for FCY-EGIV PLUS in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As Newave Aerochemical Co., Ltd. intends to commercialize FCY-EGIV PLUS, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.2: Fluid-Specific Holdover Time Guidelines – FCY-EGIV PLUS (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:05 - 4:00	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:15 - 2:00	0:40 - 0:55	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:35 - 3:15	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:35 - 3:15	0:20 - 0:40	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55	1:15 - 2:00[11]	0:30 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:10	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:10	0:09 - 0:20	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:10	0:08 - 0:20	1:00 - 1:15	0:25 - 1:00	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32.

Table 4.3: Fluid-Specific Holdover Time Guidelines – FCY-EGIV PLUS (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:05 - 4:00	0:30 - 1:00	2:50 - 3:00	1:20 - 2:50	0:40 - 1:20	1:15 - 2:00	0:40 - 0:55	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 3:15	0:25 - 0:50	2:15 - 2:55	1:05 - 2:15	0:30 - 1:05	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:35 - 3:15	0:20 - 0:40	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	1:15 - 2:00[11]	0:30 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:10	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:10	0:09 - 0:20	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:10	0:08 - 0:20	1:00 - 1:15	0:25 - 1:00	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.4: LUPR Statistics – FCY-EGIV PLUS

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	16	40
Data Points ≤ 9.5 g	16	40
Data Points ≤ 8.5 g	15	40
Data Points ≤ 7.5 g	13	40
Data Points ≤ 6.5 g	10	40
Data Points ≤ 5.5 g	7	40
Data Points ≤ 4.5 g	3	40
Data Points ≤ 3.5 g	2	30
Data Points ≤ 2.5 g	1	20
Negative Scatter 0-10 g	-8%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	35	pass

LUPR	100/0
	3 g/dm²/h

Table 4.5: HUPR Statistics – FCY-EGIV PLUS

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	11	40
Data Points ≥ 15 g	16	40
Data Points ≥ 20 g	11	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	5	40
Data Points ≥ 35 g	4	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-12%	30

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	38	pass
30 g/dm²/h	38	pass
35 g/dm²/h	38	pass
40 g/dm²/h	38	pass
45 g/dm²/h	38	pass
50 g/dm²/h	38	pass

HUPR	100/0
	50 g/dm²/h

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APPENDIX I

FLUID MANUFACTURER REPORT:
XINJIANG ZHONGTIAN LIYANG AVIATION CLEARICE-IV (TYPE IV)

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Clearice-IV (Type IV)

Prepared for

Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.



By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. XJZTLY-EG4 2024-25

AIRCRAFT GROUND ANTI-ICING FLUID ENDURANCE TIME TEST RESULTS

Clearice-IV (Type IV)

Prepared for

Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.

Prepared by: _____ July 2, 2025

Yi Tian
Assistant, Publications and Delivery
Date

Reviewed by: _____ July 2, 2025

Peter Kitchener
Leader – Icing Research, Technical Services, Digital Systems
Date

By

APS Aviation Inc.

These tests were made possible with the guidance, participation, and contribution of the Transport Canada Programs Group Innovation Centre and the Federal Aviation Administration.

July 2025
Version 1.0
Report No. XJZTLY-EG4 2024-25

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Fluid Identification and Characteristics

Manufacturer:	Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.		
Fluid Test Name:	Clearice-IV		
Fluid Commercial Name:	Clearice-IV		
Fluid Type / Base / Colour:	Type IV / Ethylene Glycol / Green		
Batch #:	FS24110801		
Date of Receipt:	November 27, 2024		
Brix (Measured):	Neat fluid:	33.25°	
Freeze Point (Stated):	Neat fluid:	-38°C	
Aerodynamic LOUT (AMIL):	Neat fluid:	-30°C	
Viscosity:	**Manufacturer Method**	**Stated**	**Measured**
	Neat fluid[1]:	32,393 cP	35,600 cP
	Alternate Method	**Stated**	**Measured**
	Neat fluid:	n/a	n/a
WSET (from AMIL):	Neat fluid:	102 minutes	

1. LV2-disc (with guard leg), 600 mL low form (Griffin) beaker, 575 mL of fluid, 20°C, 0.3 rpm, for 10.0 minutes.

SUMMARY

The primary objective of this project was to measure the endurance time performance of **Clearice-IV** over the entire range of conditions outlined in the holdover time (HOT) tables, including specific testing in very cold snow conditions (defined as snow occurring at temperatures below -14°C). This report contains the results of these measurements and was completed with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Tests were carried out according to the protocol provided in Aerospace Recommended Practice (ARP) 5485. The test procedure consisted of pouring fluids onto clean aluminum test surfaces inclined at 10°; the onset of failure was recorded as a function of time in natural and simulated precipitation.

Tests were performed at the APS Aviation Inc. (APS) test facility at Montréal–Pierre Elliott Trudeau International Airport, at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF) in Ottawa, and at several mobile test sites across Canada.

De/anti-icing fluid endurance times were derived from the data collected using multivariable regression analysis. This resulted in the generation of the fluid-specific holdover times shown in the following table. These holdover times will be published by regulators for use during the winter 2025-26 operating season.

SUMMARY

Clearice-IV Fluid-Specific Holdover Times

Outside Air Temperature (°C)	Fluid Concentration Neat Fluid/ Water (Vol %/Vol %)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)									
		Freezing Fog, Freezing Mist, or Ice Crystals	Snow Mixed with Freezing Fog	Snow, Snow Grains, or Snow Pellets*			Freezing Drizzle	Light Freezing Rain	Moderate Snow Mixed with Rain	Rain on Cold-Soaked Wing	Other
				Very Light	Light	Moderate					
-3 and above	100/0	2:25 – 4:00	0:25 – 0:50	2:15 – 2:50	1:05 – 2:15	0:30 – 1:05	1:05 – 1:55	0:35 – 0:55	0:09 – 0:09	0:15 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8	100/0	1:20 – 2:10	0:20 – 0:40	1:50 – 2:20	0:55 – 1:50	0:25 – 0:55	0:55 – 1:35	0:35 – 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14	100/0	1:20 – 2:10	0:15 – 0:35	1:35 – 2:00	0:45 – 1:35	0:20 – 0:45	0:55 – 1:35	0:35 – 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18	100/0	0:30 – 1:00	0:15 – 0:30	1:15 – 1:35	0:40 – 1:15	0:20 – 0:40					
below -18 to -25	100/0	0:30 – 1:00	0:15 – 0:25	1:10 – 1: 25	0:35 – 1:10	0:15 – 0:35					
below -25 to -29**	100/0	0:30 – 1:00	0:10 – 0:25	1:05 – 1:20	0:30 – 1:05	0:15 – 0:30					

FAA values displayed. TC caps snow holdover times at 2 hours.

***Calculated LOUT is -29°C. LOUT capped at -29°C in guidelines as fluid did not undergo additional LOUT testing.*

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GLOSSARY

AMIL	Anti-Icing Materials International Laboratory
APS	APS Aviation Inc.
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
CEF	Climatic Engineering Facility
CSW	Cold-Soaked Wing
FAA	Federal Aviation Administration
HOT	Holdover Time
HUPR	Highest Usable Precipitation Rate
LOUT	Lowest Operational Use Temperature
LOWV	Lowest On-Wing Viscosity
LUPR	Lowest Usable Precipitation Rate
NRC	National Research Council Canada
SAE	SAE International
TC	Transport Canada
YUL	Montréal–Pierre Elliott Trudeau International Airport

1. INTRODUCTION

This report has been created with the support of the fluid manufacturer, Transport Canada (TC) Programs Group Innovation Centre, and the Federal Aviation Administration (FAA).

Aircraft ground de/anti-icing has been the subject of concentrated industry attention in recent years due to the occurrence of several fatal icing-related aircraft accidents. Notably, attention has been placed on the enhancement of anti-icing fluids to provide an extended period of protection against further contamination following initial deicing. This emphasis has led to the development of fluid-specific de/anti-icing fluid holdover time (HOT) tables for Type II, Type III, and Type IV fluids. These tables, accepted by regulatory authorities, are used by aircraft operators for departure planning in adverse winter conditions. Specifically, they define the duration of time that qualified fluids provide protection against ice formation under specific weather conditions.

New anti-icing formulations continue to be developed by leading manufacturers with the specific objective of prolonging fluid holdover times without compromising the aerodynamic features of the airfoil. The purpose of the endurance time testing program is to measure the endurance times of these new fluids and develop fluid-specific HOT tables that provide guidance for their use.

Flat plate tests, conducted in natural and simulated precipitation, are used to develop HOT values for new fluids. These tests are carried out according to SAE International (SAE) Aerospace Recommended Practice (ARP) 5485, which provides the test protocols for measuring endurance times of Type II, Type III, and Type IV fluids. Along with its counterpart for measuring endurance times of Type I fluids ARP5945, ARP5485 has evolved into a refined procedure for measuring the duration of de/anti-icing fluid protection against ice formation.

The current data analysis protocol for developing HOT values from endurance time data was developed in 1996-97 and uses multivariable regression to obtain HOT values. HOT values are derived using this protocol for the majority of cells in Type II/III/IV HOT tables and are used to create a fluid-specific HOT table for each Type II/III/IV fluid tested.

This report provides a detailed account of the endurance time testing conducted by APS Aviation Inc. (APS) with **Clearice-IV**, a new Type IV fluid. It describes the test methodology used, endurance time data collected, and analysis completed to derive fluid-specific holdover times for the fluid.

2. METHODOLOGY

Tests were carried out according to SAE ARP5485, which provides the procedure and requirements for endurance time testing with Type II, Type III, and Type IV fluids under natural and simulated conditions.

The test methodology for endurance time testing carried out in the winter of 2024-25 is documented in detail in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids.* A copy of this report is provided as an annex to this document.

The methodology report summarizes the key aspects of the test methodology, including some aspects included in ARP5485 and some aspects that are not included in ARP5485. It includes sections on:

a) Test sites;

b) Test equipment;

c) Test procedures;

d) Precipitation rates used in Type I, Type II, Type III, and Type IV endurance time testing;

e) Ambient temperatures used in Type I, Type II, Type III, and Type IV endurance time testing;

f) Freezing precipitation droplet sizes; and

g) Analysis methodologies.

The data, analysis, and results provided in this report are a function of the test and analysis methodologies described in the methodology report. They should only be used in conjunction with the methodologies described therein.

3. DESCRIPTION OF DATA

This section provides a summary of the number of tests conducted. Breakdowns are provided for the number of tests performed by test type, precipitation type, fluid dilution, and test temperature.

3.1 Natural Snow Tests

Natural snow tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The number of tests conducted in natural snow with Clearice-IV is summarized below in Table 3.1.

Table 3.1: Natural Snow Test Counts – Clearice-IV, 100/0

Natural Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	-3 and above	2	6	9	3	0
	Below -3 to -8	0	3	8	0	0
	Below -8 to -13	3	3	5	3	3
	Below -13 to -16	1	3	3	0	0

3.2 Very Cold Snow (Natural Snow below -14°C) Tests

Natural snow (below -14°C) tests were conducted at the APS test site and at several mobile test sites (refer to the report annex for details).

The breakdown of tests conducted is summarized in Table 3.2 by test temperature and precipitation rate.

Table 3.2: Very Cold Snow Test Counts – Clearice-IV, 100/0

Very Cold Snow		Precipitation Rate (g/dm²/h)				
		Very Light Snow (0-4)	Light Snow (> 4-10)	Moderate Snow (> 10-25)	Heavy Snow (> 25-40)	Heavy Snow (> 40)
Temp. (°C)	Below -14 to -18	2	5	11	0	0
	Below -18 to -22	4	5	0	0	0
	Below -22 to -25	0	0	0	0	0
	Below -25	0	6	0	0	0

3.3 Freezing Precipitation Tests

Tests were conducted in freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface conditions at the National Research Council Canada (NRC) Climatic Engineering Facility (CEF). The number of tests conducted is summarized below in Table 3.3 by precipitation type, fluid dilution, and test temperature.

Table 3.3: Freezing Precipitation Test Counts – Clearice-IV, 100/0

Fluid Dilution	Freezing Drizzle		Light Freezing Rain		Freezing Fog			CSW
	-3°C	-10°C	-3°C	-10°C	-3°C	-14°C	-25°C	+1°C
100/0	4	4	4	4	4	4	4	4

3.4 Natural Frost Tests

Tests were conducted in natural frost at the APS test site. The breakdown of tests conducted is summarized below in Table 3.4 by fluid dilution and test temperature.

Table 3.4: Natural Frost Test Counts – Clearice-IV, 100/0

Fluid Dilution	Natural Frost					
	≥ -1°C	< -1°C to -3°C	< -3°C to -10°C	< -10°C to -14°C	< -14°C to -21°C	< -21°C to -25°C
100/0	0	0	1	2	4	0

3.5 Fluid Thickness Tests

Fluid thickness tests were conducted to measure the film thickness profiles of the fluid under dry conditions. Two tests were performed for each dilution at -3°C. Single tests were performed for each dilution at the following temperatures: -10°C, -14°C, and -25°C. For each test, 1 L of fluid was poured onto a flat plate mounted on a test stand inclined by 10°. Thickness measurements were taken at the 15-cm (6″) line at select time intervals over a 30-minute period.

3.6 Test Logs

Details of each test conducted are provided in the test logs included as Table 3.5 (natural snow), Table 3.6 (very cold snow), Table 3.7 (freezing precipitation), and Table 3.8 (natural frost).

Table 3.5: Log of Tests Performed (Natural Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
1	04-Dec-24	Clearice-IV	100/0	-1.3	4.3	125.9
3	04-Dec-24	Clearice-IV	100/0	-0.9	2.3	259.6
5	07-Dec-24	Clearice-IV	100/0	-6.3	6.1	87.3
8	07-Dec-24	Clearice-IV	100/0	-4.9	6.5	99.2
11	07-Dec-24	Clearice-IV	100/0	-3.5	6.9	95.7
14	08-Dec-24	Clearice-IV	100/0	-2.1	7.4	90.3
17	09-Dec-24	Clearice-IV	100/0	-6.3	10.3	66.3
20	09-Dec-24	Clearice-IV	100/0	-6.0	12.7	69.0
23	09-Dec-24	Clearice-IV	100/0	-5.7	10.3	81.2
27	18-Dec-24	Clearice-IV	100/0	-16.2	12.8	38.2
34	18-Dec-24	Clearice-IV	100/0	-15.5	17.6	28.9
39	23-Dec-24	Clearice-IV	100/0	-8.0	8.8	68.0
44	23-Dec-24	Clearice-IV	100/0	-7.9	11.2	52.1
50	23-Dec-24	Clearice-IV	100/0	-7.5	10.0	56.5
69	08-Jan-25	Clearice-IV	100/0	-13.8	7.8	47.3
71	08-Jan-25	Clearice-IV	100/0	-13.3	3.8	103.1
82	08-Jan-25	Clearice-IV	100/0	-12.3	4.7	87.3
86	23-Jan-25	Clearice-IV	100/0	-8.4	2.7	233.5
95	27-Jan-25	Clearice-IV	100/0	-1.3	2.9	178.1
106	29-Jan-25	Clearice-IV	100/0	-13.4	6.0	49.7
115	29-Jan-25	Clearice-IV	100/0	-14.4	8.0	39.5
119	29-Jan-25	Clearice-IV	100/0	-14.5	13.2	21.7
128	30-Jan-25	Clearice-IV	100/0	-10.9	1.3	230.6
135	03-Feb-25	Clearice-IV	100/0	-3.6	10.3	63.6
152	03-Feb-25	Clearice-IV	100/0	-3.3	11.6	59.8
163	03-Feb-25	Clearice-IV	100/0	-3.2	17.4	50.7
176	03-Feb-25	Clearice-IV	100/0	-3.0	11.6	66.7
179	06-Feb-25	Clearice-IV	100/0	-12.1	11.4	44.1
188	06-Feb-25	Clearice-IV	100/0	-11.7	25.2	21.5
197	06-Feb-25	Clearice-IV	100/0	-12.9	18.0	32.7
206	06-Feb-25	Clearice-IV	100/0	-11.6	7.3	54.3
215	12-Feb-25	Clearice-IV	100/0	-11.8	3.5	129.0
224	13-Feb-25	Clearice-IV	100/0	-11.7	26.9	22.7
233	13-Feb-25	Clearice-IV	100/0	-11.4	40.6	16.1
250	13-Feb-25	Clearice-IV	100/0	-11.3	24.8	20.0
251	16-Feb-25	Clearice-IV	100/0	-10.3	12.0	35.8

Table 3.5: Log of Tests Performed (Natural Snow) (cont'd)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
260	16-Feb-25	Clearice-IV	100/0	-10.1	20.9	21.2
269	16-Feb-25	Clearice-IV	100/0	-10.0	27.5	19.3
278	16-Feb-25	Clearice-IV	100/0	-9.9	54.0	13.3
287	16-Feb-25	Clearice-IV	100/0	-9.8	40.8	13.3
296	27-Feb-25	Clearice-IV	100/0	-1.3	13.1	66.4
304	04-Mar-25	Clearice-IV	100/0	0.8	4.8	133.4
318	04-Mar-25	Clearice-IV	100/0	0.5	21.6	32.0
327	04-Mar-25	Clearice-IV	100/0	0.4	13.4	49.8
334	04-Mar-25	Clearice-IV	100/0	-0.1	7.8	112.7
338	19-Mar-25	Clearice-IV	100/0	1.2	6.1	135.9
353	19-Mar-25	Clearice-IV	100/0	0.0	8.0	110.0
363	19-Mar-25	Clearice-IV	100/0	-0.5	13.0	80.8
371	19-Mar-25	Clearice-IV	100/0	-0.6	15.0	62.6
383	19-Mar-25	Clearice-IV	100/0	-0.6	29.1	34.4
386	19-Mar-25	Clearice-IV	100/0	-0.8	34.5	36.4
396	20-Mar-25	Clearice-IV	100/0	-1.1	32.5	37.1
405	24-Mar-25	Clearice-IV	100/0	-2.9	19.2	40.3
415	24-Mar-25	Clearice-IV	100/0	-2.3	12.4	54.4
422	24-Mar-25	Clearice-IV	100/0	-1.0	17.4	54.2

Table 3.6: Log of Tests Performed (Very Cold Snow)

Test No.	Date	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
4	18-Dec-24	Clearice-IV	100/0	-19.9	4.2	73.9
13	18-Dec-24	Clearice-IV	100/0	-19.0	8.6	41.4
22	18-Dec-24	Clearice-IV	100/0	-17.8	13.4	30.9
27	18-Dec-24	Clearice-IV	100/0	-16.9	15.5	31.4
31	18-Dec-24	Clearice-IV	100/0	-16.2	12.8	38.2
38	18-Dec-24	Clearice-IV	100/0	-15.5	17.6	28.9
46	08-Jan-25	Clearice-IV	100/0	-13.8	7.8	47.3
50	27-Jan-25	Clearice-IV	100/0	-18.0	9.1	44.8
67	27-Jan-25	Clearice-IV	100/0	-17.8	9.9	50.8
78	27-Jan-25	Clearice-IV	100/0	-17.9	11.8	35.1
86	27-Jan-25	Clearice-IV	100/0	-17.9	12.1	25.4
87	27-Jan-25	Clearice-IV	100/0	-17.2	16.8	26.4
97	27-Jan-25	Clearice-IV	100/0	-17.2	17.3	23.0
109	29-Jan-25	Clearice-IV	100/0	-14.4	8.0	39.5
116	29-Jan-25	Clearice-IV	100/0	-14.5	13.2	21.7
131	31-Jan-25	Clearice-IV	100/0	-25.1	5.7	53.7
144	31-Jan-25	Clearice-IV	100/0	-25.4	4.4	57.5
150	31-Jan-25	Clearice-IV	100/0	-25.3	6.3	48.2
164	31-Jan-25	Clearice-IV	100/0	-26.2	5.7	59.7
176	31-Jan-25	Clearice-IV	100/0	-26.7	5.3	49.7
182	31-Jan-25	Clearice-IV	100/0	-26.7	6.9	36.6
189	05-Feb-25	Clearice-IV	100/0	-18.2	5.2	56.4
197	05-Feb-25	Clearice-IV	100/0	-17.8	2.5	105.0
206	05-Feb-25	Clearice-IV	100/0	-17.5	4.7	70.0
217	05-Feb-25	Clearice-IV	100/0	-16.9	1.9	172.6
223	05-Feb-25	Clearice-IV	100/0	-16.7	10.2	42.9
231	05-Feb-25	Clearice-IV	100/0	-16.7	14.0	43.3
235	13-Feb-25	Clearice-IV	100/0	-21.4	3.1	87.2
249	13-Feb-25	Clearice-IV	100/0	-21.2	4.2	78.0
260	13-Feb-25	Clearice-IV	100/0	-21.1	4.4	71.4
271	13-Feb-25	Clearice-IV	100/0	-20.8	3.7	78.1
278	13-Feb-25	Clearice-IV	100/0	-20.6	3.6	72.2
281	13-Feb-25	Clearice-IV	100/0	-20.5	3.8	69.8

Table 3.7: Log of Tests Performed (Freezing Precipitation)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Temp. (°C)	Icing Intensity (g/dm²/h)	Endurance Time (min)
11	20-Mar-25	Freezing Fog	Clearice-IV	100/0	-3.3	2.1	246.7
12	20-Mar-25	Freezing Fog	Clearice-IV	100/0	-3.3	2.2	245.6
31	20-Mar-25	Freezing Fog	Clearice-IV	100/0	-3.1	4.8	150.4
32	20-Mar-25	Freezing Fog	Clearice-IV	100/0	-3.1	4.9	148.6
49	19-Mar-25	Freezing Fog	Clearice-IV	100/0	-14.3	2.1	125.5
50	19-Mar-25	Freezing Fog	Clearice-IV	100/0	-14.3	2.1	126.7
67	19-Mar-25	Freezing Fog	Clearice-IV	100/0	-13.4	5.4	78.9
68	19-Mar-25	Freezing Fog	Clearice-IV	100/0	-13.4	5.3	76.9
83	18-Mar-25	Freezing Fog	Clearice-IV	100/0	-24.7	2.0	62.3
84	18-Mar-25	Freezing Fog	Clearice-IV	100/0	-24.7	1.8	61.2
99	18-Mar-25	Freezing Fog	Clearice-IV	100/0	-24.9	4.7	31.0
100	18-Mar-25	Freezing Fog	Clearice-IV	100/0	-24.9	4.7	28.2
131	25-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-3.1	13.0	65.3
132	25-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-3.1	13.2	63.9
151	25-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-3.2	4.6	129.5
152	25-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-3.2	5.0	129.9
169	26-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-10.2	5.2	94.7
170	26-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-10.2	4.9	95.1
187	26-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-10.2	13.2	60.8
188	26-Mar-25	Freezing Drizzle	Clearice-IV	100/0	-10.3	13.5	49.2
207	21-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-3.2	13.1	60.0
208	21-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-3.2	12.7	55.5
227	21-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-3.3	25.1	35.5
228	21-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-3.3	24.9	35.6
245	26-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-9.9	13.2	46.5
246	26-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-9.8	13.1	55.4
263	27-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-10.1	25.5	33.4
264	27-Mar-25	Light Freezing Rain	Clearice-IV	100/0	-10.1	25.6	34.7
281	27-Mar-25	Cold Soak Box	Clearice-IV	100/0	1.1	4.7	94.2
282	27-Mar-25	Cold Soak Box	Clearice-IV	100/0	1.1	5.3	88.3
299	27-Mar-25	Cold Soak Box	Clearice-IV	100/0	0.7	77.0	14.2
300	27-Mar-25	Cold Soak Box	Clearice-IV	100/0	0.6	77.0	11.8

Table 3.8: Log of Tests Performed (Natural Frost)

Test No.	Date	Precipitation Type	Fluid Name	Fluid Dilution	Test Duration (min.)	Average Rate (g/dm²/h)	Temp (°C)	Wind Speed (km/h)	Average RH (%)	Comments
38	13-Dec-24	Natural Frost	Clearice-IV	100/0	615	0.08	-10.6	6	66	Did Not Fail
47	14-Dec-24	Natural Frost	Clearice-IV	100/0	422	0.12	-12.0	9	74	Did Not Fail
56	22-Dec-24	Natural Frost	Clearice-IV	100/0	366	0.09	-15.7	9	69	Did Not Fail
65	26-Dec-24	Natural Frost	Clearice-IV	100/0	361	0.12	-15.0	6	85	Did Not Fail
76	21-Jan-25	Natural Frost	Clearice-IV	100/0	361	0.04	-15.3	9	63	Did Not Fail
85	24-Jan-25	Natural Frost	Clearice-IV	100/0	361	0.07	-17.1	7	75	Did Not Fail
94	13-Mar-25	Natural Frost	Clearice-IV	100/0	727	0.11	-5.9	3	79	Did Not Fail

4. RESULTS AND DISCUSSION

The methods used to evaluate the test data are provided in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids,* which is provided as an annex to this report. The results of the data analyses and a discussion of the findings are presented in this section.

4.1 Results

The results of the endurance time and thickness tests are described in this subsection.

4.1.1 Endurance Time Tests – Natural Snow and Freezing Precipitation

Figure 4.1 to Figure 4.5 present the endurance time data collected in natural snow and freezing precipitation (freezing drizzle, light freezing rain, freezing fog, and rain on cold-soaked surface).

These figures show the effect of temperature, precipitation type, and precipitation rate on fluid endurance time in the conditions encompassed by the Type IV HOT Guidelines. The figures include the current Type IV generic holdover times for comparative purposes.

Multivariable regression analysis was performed on these data sets as described in the annex. Table 4.1 provides the outputs from the multivariable regression analyses. These outputs were used to derive fluid-specific holdover times for all conditions encompassed by Type IV fluid-specific HOT tables.

4.1.2 Endurance Time Tests – Very Cold Snow

Figure 4.6 presents the endurance time data collected in very cold snow. The figure shows the effect of temperature and precipitation rate on fluid endurance time in snow conditions at very cold temperatures.

Multivariable regression analysis was performed on this data set as described in the annex. Table 4.1 provides the outputs from the multivariable regression analysis. These outputs were used to derive fluid-specific holdover times for snow conditions at temperatures below -14°C.

4.1.3 Endurance Time Tests – Natural Frost

The natural frost data was presented in Table 3.8. The test durations were compared to the Type IV generic holdover times. Tests that were not completed (due to active frost ending before fluid failure could occur) surpassed the generic holdover times. This analysis indicates that the Type IV generic frost holdover times can be considered substantiated for Clearice-IV.

Additional natural frost tests will be completed in Winter 2025-26 with retained samples of Clearice-IV. Fluid viscosities will be measured prior to the winter 2025-26 testing to ensure that the sample viscosities have not changed significantly.

4.1.4 Fluid Thickness Tests

Figure 4.7 shows the fluid thickness test data. As described in Subsection 3.5, two tests were conducted at an ambient temperature of -3°C. The final fluid thicknesses are displayed in Figure 4.8.

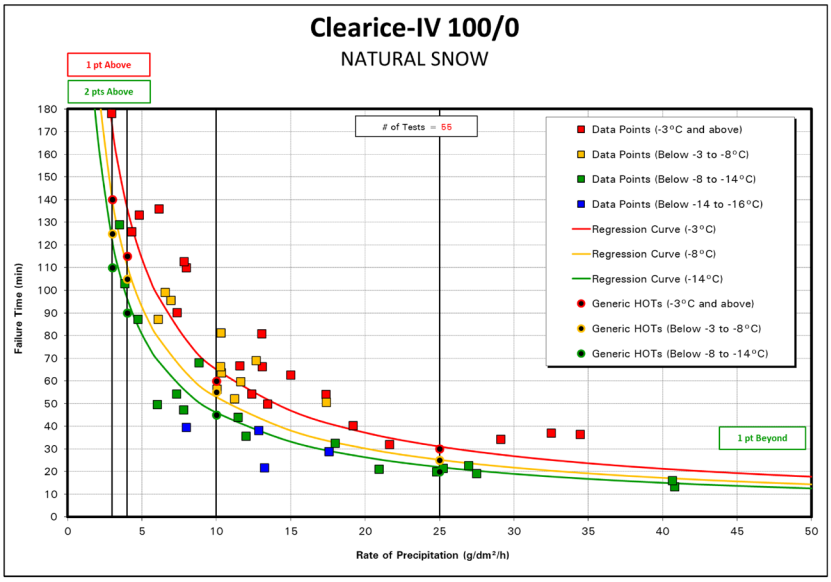


Figure 4.1: Type IV 100/0 – Natural Snow

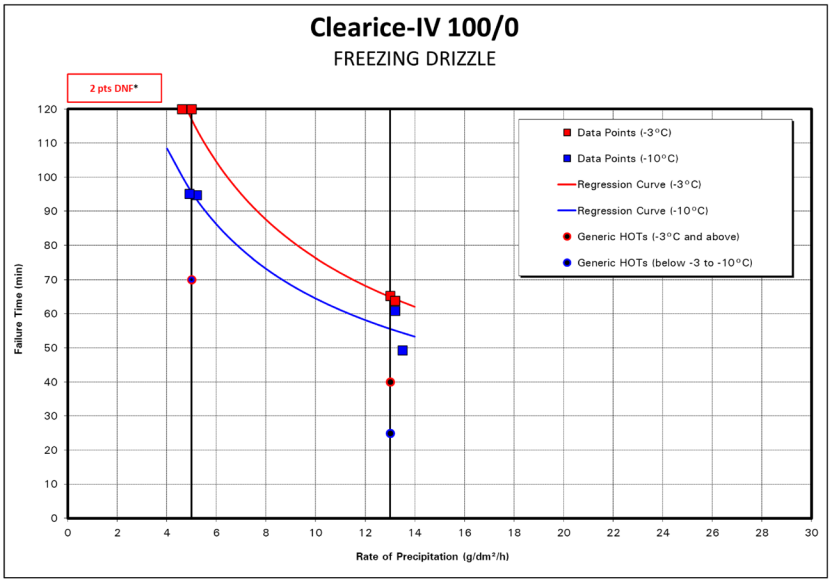


Figure 4.2: Type IV 100/0 – Freezing Drizzle

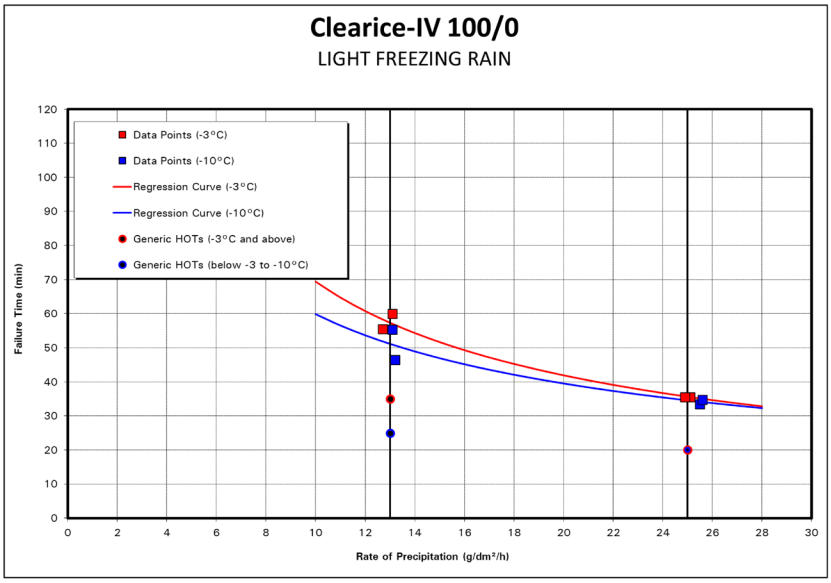


Figure 4.3: Type IV 100/0 – Light Freezing Rain

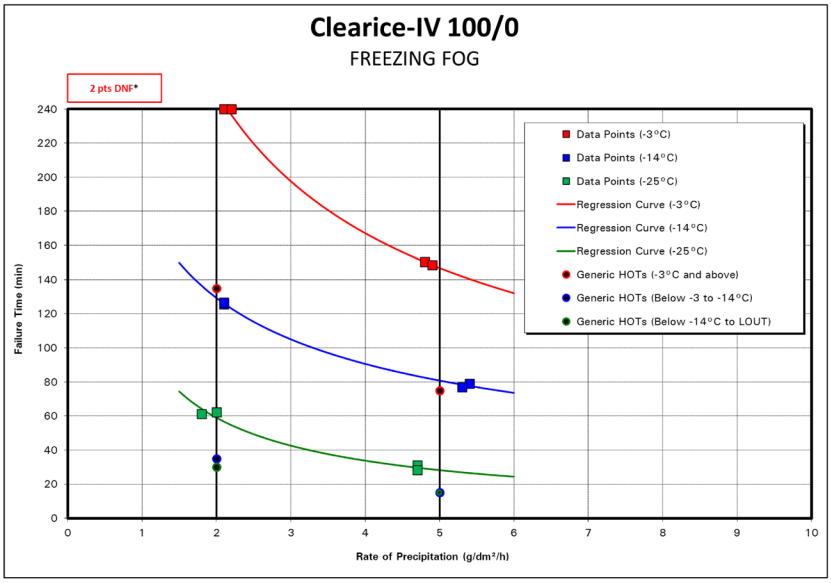


Figure 4.4: Type IV 100/0 – Freezing Fog

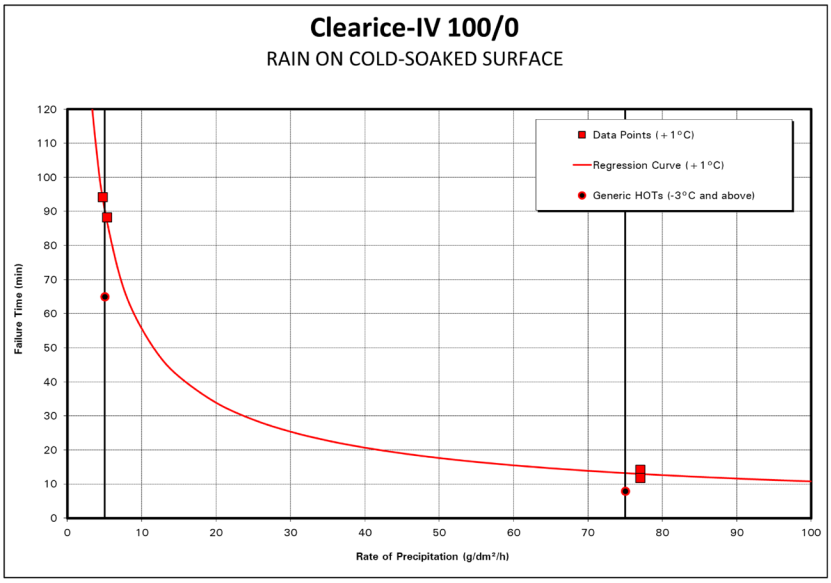


Figure 4.5: Type IV 100/0 – Rain on Cold-Soaked Surface

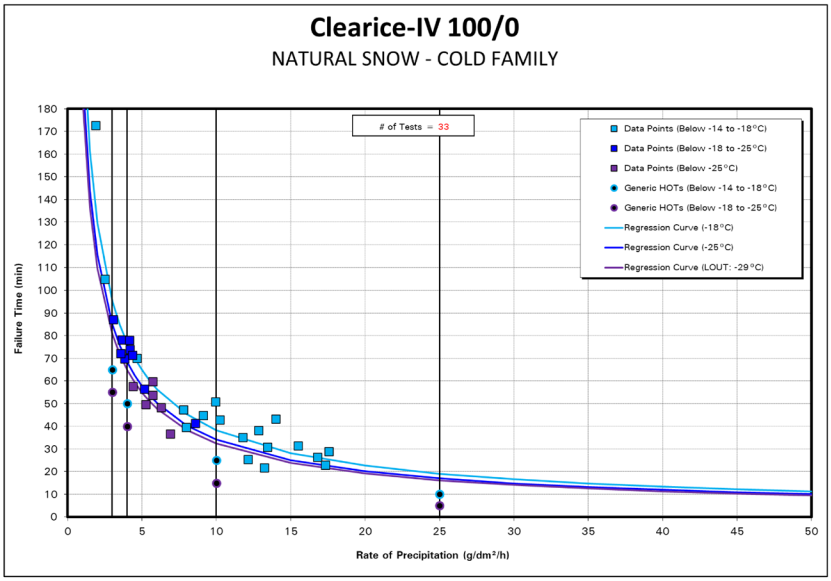


Figure 4.6: Type IV 100/0 – Very Cold Snow

Table 4.1: Regression Equation Coefficients for Clearice-IV

Natural Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Clearice-IV	100/0	≥ -14°C	92%	2.8289	-0.8073	-0.2979	55

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

Simulated Freezing Fog

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clearice-IV	100/0	-3°C	100%	2.5730	-0.5808	4
Clearice-IV	100/0	-14°C	100%	2.2665	-0.5145	4
Clearice-IV	100/0	-25°C	98%	2.0127	-0.8043	4

General Equation $t = 10^{I} R^{A}$

Simulated Freezing Drizzle

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clearice-IV	100/0	-3°C	100%	2.4973	-0.6147	4
Clearice-IV	100/0	-10°C	94%	2.3766	-0.5674	4

General Equation $t = 10^{I} R^{A}$

Simulated Light Freezing Rain

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clearice-IV	100/0	-3°C	98%	2.5684	-0.7275	4
Clearice-IV	100/0	-10°C	91%	2.3770	-0.6003	4

General Equation $t = 10^{I} R^{A}$

Simulated Rain on Cold-Soaked Wing

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Total Pts.
Clearice-IV	100/0	+1°C	100%	2.4579	-0.7134	4

General Equation $t = 10^{I} R^{A}$

Very Cold Snow

Fluid	Dil.	Temp.	R^2	Intercept (I)	Coeff. Rate (A)	Coeff. Temp. (B)	Total Pts.
Clearice-IV	100/0	< -14°C	89%	2.8366	-0.7581	-0.3811	33

General Equation $t = 10^{I} R^{A} (2\text{-}T)^{B}$

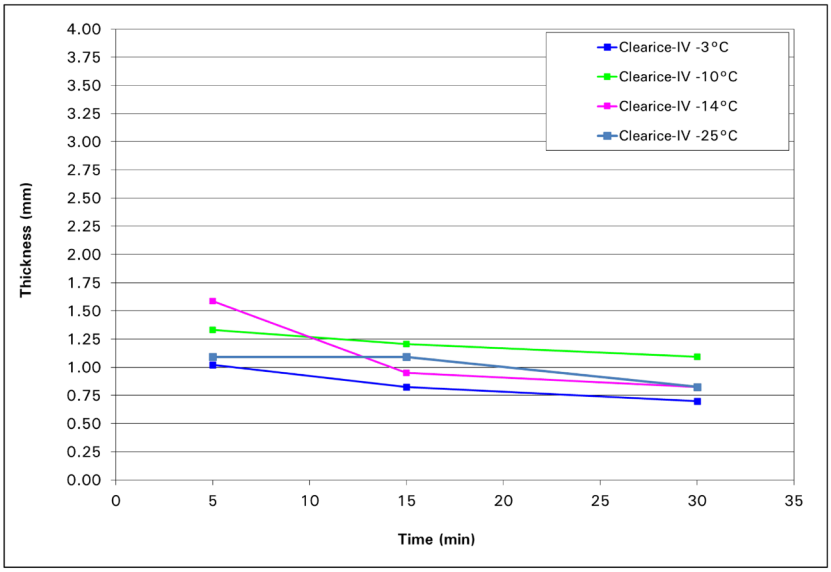


Figure 4.7: Fluid Thickness Profiles of Clearice-IV

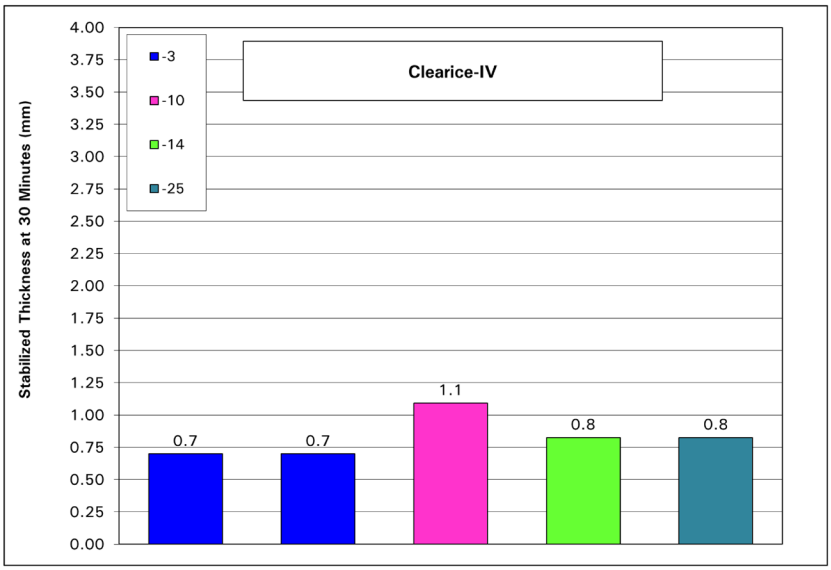


Figure 4.8: Final Fluid Thickness of Clearice-IV

4.2 Discussion

4.2.1 Holdover Time Table

The holdover times described in Subsection 4.1 were used to populate a fluid-specific HOT table for Clearice-IV. The HOT table is shown in both the TC format (Table 4.2) and FAA format (Table 4.3) at the end of this section.

4.2.2 Holdover Times in Frost

It should be noted that frost holdover times are not included in the fluid-specific HOT tables. This is due to a decision made by TC and the FAA in May 2009 to move frost holdover times from the generic and fluid-specific HOT tables to a separate frost HOT table. Accordingly, frost holdover times have not been included in the Clearice-IV fluid-specific HOT table.

4.2.3 Fluid Viscosity

The viscosities of the fluid samples used in this testing were measured using both the Aerospace Standard (AS) 9968 method and the manufacturer's designated method. The APS-measured viscosities appear at the beginning of this document and will be published as the lowest on-wing viscosity (LOWV) values for the fluid. For the fluid-specific holdover times provided in this document to be valid, operators must ensure that the viscosity of the fluid being used is equal to or greater than the published LOWV.

4.2.4 Lowest Operational Use Temperatures

The lowest operational use temperature (LOUT) for Type II/III/IV fluids is determined by the higher of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type;

b) The actual freezing point of the fluid plus its freezing point buffer of 7°C; and

c) For fluid dilutions, the LOUT may also be limited by the coldest temperature for which holdover times are published (-3°C for 50/50; -14°C for 75/25).

The aerodynamic acceptance and freezing point information for this fluid is provided at the beginning of this document. The aerodynamic LOUT for Clearice-IV is -30°C (-22°F); however, as the fluid did not undergo the additional LOUT testing to support a LOUT below -29°C, the fluid's LOUT will be capped at -29°C (-20°F).

4.2.5 Lowest and Highest Usable Precipitation Rates in Snow

4.2.5.1 Natural Snow

The lowest usable precipitation rate (LUPR) and highest usable precipitation rate (HUPR) for Clearice-IV were determined by analysing the natural snow data sets using the analysis methodology described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report. The resulting statistics are shown in Table 4.4 (LUPR statistics) and Table 4.5 (HUPR statistics).

The analysis determined the LUPR for Clearice-IV is:

- 100/0 = 3 g/dm²/h.

The analysis determined the HUPR for Clearice-IV is:

- 100/0 = 50 g/dm²/h.

4.2.5.2 Very Cold Snow

The LUPR and HUPR for Clearice-IV in very cold snow conditions were set at 3 g/dm²/h and 25 g/dm²/h, respectively. The LUPR represents the lower boundary of very light snow, while the HUPR represents the upper boundary of moderate snow. The reasoning behind selecting these values is described in the report *Methodology for Endurance Time Testing of Type II, Type III, and Type IV Fluids*, which is provided as an annex to this report.

4.2.6 Publication of Holdover Times

As Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd. intends to commercialize Clearice-IV, TC and the FAA will publish its fluid-specific HOT table in their 2025-26 HOT Guidelines. The guidelines will also include the LOWV and LOUT information; the regression and LUPR/HUPR data will be published in the related TC and FAA Regression Information documents.

Table 4.2: Fluid-Specific Holdover Time Guidelines – Clearice-IV (TC Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:25 - 4:00	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:05 - 1:55	0:35 - 0:55	0:09 - 0:09	0:15 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:20 - 2:10	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:55 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:20 - 2:10	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:55 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:00	0:15 - 0:30	1:15 - 1:35	0:40 - 1:15	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:00	0:15 - 0:25	1:10 - 1:25	0:35 - 1:10	0:15 - 0:35					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:00	0:10 - 0:25	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32.

Table 4.3: Fluid-Specific Holdover Time Guidelines – Clearice-IV (FAA Format)

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:25 - 4:00	0:25 - 0:50	2:15 - 2:50	1:05 - 2:15	0:30 - 1:05	1:05 - 1:55	0:35 - 0:55	0:09 - 0:09	0:15 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 2:10	0:20 - 0:40	1:50 - 2:20	0:55 - 1:50	0:25 - 0:55	0:55 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 2:10	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:55 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:00	0:15 - 0:30	1:15 - 1:35	0:40 - 1:15	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:00	0:15 - 0:25	1:10 - 1:25	0:35 - 1:10	0:15 - 0:35					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:00	0:10 - 0:25	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 56) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 32

Table 4.4: LUPR Statistics – Clearice-IV

Data Measure	100/0	
	Stat.	Rating
Data Points ≤ 10.0 g	22	40
Data Points ≤ 9.5 g	21	40
Data Points ≤ 8.5 g	20	40
Data Points ≤ 7.5 g	16	40
Data Points ≤ 6.5 g	13	40
Data Points ≤ 5.5 g	9	40
Data Points ≤ 4.5 g	7	40
Data Points ≤ 3.5 g	5	40
Data Points ≤ 2.5 g	2	30
Negative Scatter 0-10 g	-8%	40

Rate	100/0	
	Score	Pass/Fail
9 g/dm²/h	40	pass
8 g/dm²/h	40	pass
7 g/dm²/h	40	pass
6 g/dm²/h	40	pass
5 g/dm²/h	40	pass
4 g/dm²/h	40	pass
3 g/dm²/h	40	pass

LUPR	100/0
	3 g/dm²/h

Table 4.5: HUPR Statistics – Clearice-IV

Data Measure	100/0	
	Stat.	Rating
Data Points > 20 g	12	40
Data Points ≥ 15 g	18	40
Data Points ≥ 20 g	12	40
Data Points ≥ 25 g	9	40
Data Points ≥ 30 g	5	40
Data Points ≥ 35 g	3	40
Data Points ≥ 40 g	3	40
Negative Scatter > 25 g	-4%	40

Rate	100/0	
	Score	Pass/Fail
25 g/dm²/h	40	pass
30 g/dm²/h	40	pass
35 g/dm²/h	40	pass
40 g/dm²/h	40	pass
45 g/dm²/h	40	pass
50 g/dm²/h	40	pass

HUPR	100/0
	50 g/dm²/h

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APPENDIX J

TRANSPORT CANADA AND FEDERAL AVIATION ADMINISTRATION
HOLDOVER TIME GUIDELINES
WINTER 2025-2026

TRANSPORT CANADA
HOLDOVER TIME (HOT) GUIDELINES
WINTER 2025-2026

Transport Canada
Holdover Time (HOT) Guidelines
Winter 2025-2026

Original Issue: August 12, 2025

This document should be used in conjunction with the most recent version of the TP 14052E - *Guidelines for Aircraft Ground Icing Operations*. These two documents complement each other and should be used together for a thorough understanding of the subject matter.

Questions or comments on the content of the holdover time guidelines should be addressed to Transport Canada - Commercial Flight Standards by e-mail at AARTFInfo-InfoAARTF@tc.gc.ca.

To receive notification of HOT Guideline updates, subscribe to or update your e-news subscription at the following Transport Canada Web site: http://wwwapps.tc.gc.ca/Comm/5/ListServ/menu.aspx.
Subscribing to e-news will require an email address and selecting Holdover Time (HOT) Guidelines under Publications / Air Transportation / Aviation Safety / Safety Information.

CHANGE CONTROL RECORDS

This page indicates any changes made to individual pages within the document. Changed pages have sidebars to assist in identifying where significant changes have been made on these pages.

It is the responsibility of the end user to periodically check the following website for updates: https://tc.canada.ca/en/aviation/general-operating-flight-rules/holdover-time-hot-guidelines-icing-anti-icing-aircraft.

REVISION	*DATE*	*DESCRIPTION OF CHANGES*	*AFFECTED PAGES*	*AUTHOR*

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HOW TO USE THIS DOCUMENT

Complementary Documents

This document should be used in conjunction with the most recent version of the TP 14052E - Guidelines for Aircraft Ground Icing Operations. These two documents complement each other and should be used together for a thorough understanding of the subject matter.

Beginning in the winter of 2021-22, Transport Canada has published an annual database of degree-specific holdover times (DSHOTs) for snow and snow-related precipitation conditions (including snow, snow grains, and snow pellets). The DSHOT database contains an expanded set of snow precipitation HOTs for all undiluted Type II, III and IV anti icing fluids listed in the Transport Canada HOT Guidelines. This database can be found at https://tc.canada.ca/en/aviation/general-operating-flight-rules/holdover-time-hot-guidelines-icing-anti-icing-aircraft. Guidance and conditions on the use of DSHOT data can be found in Advisory Circular (AC) 700-061 at https://tc.canada.ca/en/aviation/reference-centre/advisory-circulars/advisory-circular-ac-no-ac-700-061.

Applicability

A new version of this document is published for each winter operating season, typically in early August preceding the winter operating season. Updates to the winter's document may be published at any time after the Original Issue document is published. When a new document is published, either mid-season or each new season, the previous document becomes obsolete. It is the responsibility of the end user to periodically check for document updates on the following website: https://tc.canada.ca/en/aviation/general-operating-flight-rules/holdover-time-hot-guidelines-icing-anti-icing-aircraft.

Main Document Structure and Content

This document is divided into several sections.

- Change Control Records: Provides details of any changes made to the document in mid-season document updates.
- Table of Contents: Provides a list of sections, tables, and appendices in the document.
- How to Use This Document: Provides top-level guidance on how to use the document.
- Highlights and Changes for Winter 2025-2026: Describes key changes made to the document for the current winter operating season.
- Holdover Time Guidelines: Series of tables that provide estimated holdover times (in hh:mm). Fluids are divided by fluid type (Type I, II, III, and IV), aircraft construction materials (Type I only), fluid brand (Type II, III, IV), aircraft rotation speed (Type III only), and fluid application temperature (Type III only). Columns in the tables divide the information by precipitation type; rows in the tables divide the information by temperature and fluid dilution. Notes in the tables refer to additional information on the specific HOTs. Cautions that apply to all tables in a section are located on the flysheets before each section.
- Allowance Times Tables: Tables that provide allowance times (in minutes) for Type III and Type IV fluids. Rows in the tables divide the information by precipitation type; columns in the tables divide the information by temperature. Notes in the tables refer to additional information on the specific allowance times. Cautions that apply to all allowance times tables are located on the flysheet before the section. Use of these tables must be validated by first confirming that fluid being used is listed in the "List of Fluids Validated for Use with Allowance Times".
- Supplementary Guidance: Series of tables that provide supplementary information for using the holdover time guidelines and allowance times tables. Includes a table for estimating snowfall intensity from prevailing visibility, tables of fluid information (one table per fluid type), and tables of fluid application guidance (by fluid type).

Appendices

The appendices contain complementary content.

- Appendix A: Provides adjusted holdover time guidelines (holdover time guidelines and allowance times tables) for operations when flaps and slats are deployed prior to de/anti-icing.
- Appendix B: Provides information on laboratories involved in testing de/anti-icing fluids.
- Appendix C: Provides the latest de/anti-icing fluid manufacturer contact information at the time of publication.

HIGHLIGHTS AND CHANGES FOR WINTER 2025-2026

CHANGED THIS YEAR

The principal changes from this year are briefly indicated herein.

Holdover Time Tables

- Fluid-specific HOT guidelines tables have been created for six new fluids:
  - ESSPO CHEMICALS D.O.O Nordwing PG2 (Type II)
  - AFLRUS LLC Green Flo Type 4 (Type IV)
  - AllClear Systems Clear IV Flight (Type IV)
  - ESSPO CHEMICALS D.O.O Nordwing PG4 (Type IV)
  - Newave Aerochemical, FCY-EGIV PLUS (Type IV)
  - Xinjiang Zhongtian Liyang Aviation Clearice-IV (Type IV)
- Further testing in very cold snow conditions has enabled fluid-specific holdover times to be provided in natural snow (below -14°C) for three existing fluids:
  - MKS DevO Chemicals COREICEPHOB TYPE II (Type II)
  - ALAB International PROFLIGHT EG4 (Type IV)
  - ALAB International PROFLIGHT PG4 (Type IV)
- The 75/25 and 50/50 dilutions for Newave Aerochemical FCY-2 (Type II) have been removed.
- Several increases have been made to the Type II generic holdover times as a result of removed fluid data.
- Several decreases have been made to the Type IV generic holdover times as a result of the newly added fluids.
- The holdover times for Type I Aluminum and Composite fluids in the “Snow mixed with Freezing Fog” column have been increased.
- A new “Moderate Snow mixed with Rain” column has been added to all Type I, II, III, and IV HOT tables with fluid-specific values.
- Editorial changes have been made to several notes to improve clarity and reduce redundancy.

Allowance Times Tables

- The table “List of Fluid Validated for Use with Allowance Times” has been updated indicating which Type III and Type IV fluids are validated for use with which allowance times.
- Increases have been made to the condition “Moderate Ice Pellets Mixed with Moderate Snow” in the Type IV EG and Type IV PG allowance time tables.
- Additional intensity references have been added to the allowance time tables for conditions regarding Light or Moderate Ice Pellets mixed with Drizzle or Freezing Drizzle.
- Editorial changes have been made to the note regarding small hail reporting, to add clarity on how the METAR indicates small hail in various parts of the world.
- Minor editorial changes have been made to the 'Above 0°C' column to clarify the Fahrenheit values.

Supplemental Guidance

- The list of fluids (Tables 55, 56, 57 and 58) has been updated to reflect the latest information available on all de/anti-icing fluids.

Transport Canada Holdover Time Guidelines Winter 2025-2026

UNCHANGED FROM PREVIOUS YEAR

Holdover Time Tables

- The Active Frost HOTs are unchanged.

Supplemental Guidance

- The fluid application tables are unchanged.

ACTIVE FROST HOLDOVER TIME (HOT) GUIDELINES
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

TABLE 1: ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I Aluminum	Type I Composite
-1°C and above (30°F and above)	0:45	0:35
below -1 to -3°C (below 30 to 27°F)		
below -3 to -10°C (below 27 to 14°F)		
below -10 to -14°C (below 14 to 7°F)		
below -14 to -21°C (below 7 to -6°F)		
below -21 to -25°C (below -6 to -13°F)		
below -25°C (below -13°F)		

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1°C and above (30°F and above)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	2:00	0:30	3:00
below -1 to -3°C (below 30 to 27°F)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	1:30	0:30	3:00
below -3 to -10°C (below 27 to 14°F)	100/0	8:00	2:00	10:00
	75/25	4:00	1:00	5:00
below -10 to -14°C (below 14 to 7°F)	100/0	6:00	2:00	6:00
	75/25	1:00	1:00	1:00
below -14 to -21°C (below 7 to -6°F)	100/0	3:00	2:00	6:00
below -21 to -25°C (below -6 to -13°F)	100/0	2:00	2:00	4:00
below -25°C (below -13°F)	100/0	No Holdover Time Guidelines Exist		

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 55 - Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 9.

HOLDOVER TIME (HOT) GUIDELINES FOR SAE TYPE I FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

TABLE 2: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM[1]

Outside Air Temperature[2,3]	Freezing Fog, Freezing Mist[4], or Ice Crystals[5]	Snow mixed with Freezing Fog[6]	Very Light Snow, Snow Grains or Snow Pellets[7,8]	Light Snow, Snow Grains or Snow Pellets[7,8]	Moderate Snow, Snow Grains or Snow Pellets[7,8]	Freezing Drizzle[9]	Light Freezing Rain	Moderate Snow mixed with Rain[10,11]	Rain on Cold-Soaked Wing[11]	Other[12]
-3°C and above (27°F and above)	0:11 - 0:17	0:06 - 0:11	0:18 - 0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:04 - 0:06	0:02 - 0:02	0:02 - 0:05	
below -3 to -6°C (below 27 to 21°F)	0:08 - 0:13	0:05 - 0:08	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:04 - 0:06	CAUTION: No holdover time guidelines exist		
below -6 to -10°C (below 21 to 14°F)	0:06 - 0:10	0:04 - 0:06	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05			
below -10°C (below 14°F)	0:05 - 0:09	0:02 - 0:04	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04					

NOTES

1 These holdover times apply to aircraft with critical surfaces constructed predominantly or entirely of aluminum materials that have demonstrated satisfactory use of these holdover times. Takeoff after the longest applicable holdover time has been exceeded is not permitted for Type I fluids.
2 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
5 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
6 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
7 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
11 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
12 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 11.

TABLE 3: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES[1]

Outside Air Temperature[2,3]	Freezing Fog, Freezing Mist[4], or Ice Crystals[5]	Snow mixed with Freezing Fog[6]	Very Light Snow, Snow Grains or Snow Pellets[7,8]	Light Snow, Snow Grains or Snow Pellets[7,8]	Moderate Snow, Snow Grains or Snow Pellets[7,8]	Freezing Drizzle[9]	Light Freezing Rain	Moderate Snow mixed with Rain[10,11]	Rain on Cold-Soaked Wing[11]	Other[12]
-3°C and above (27°F and above)	0:09 - 0:16	0:03 - 0:06	0:12 - 0:15	0:06 - 0:12	0:03 - 0:06	0:08 - 0:13	0:04 - 0:06	0:01 - 0:01	0:01 - 0:05	
below -3 to -6°C (below 27 to 21°F)	0:06 - 0:08	0:02 - 0:05	0:11 - 0:13	0:05 - 0:11	0:02 - 0:05	0:05 - 0:09	0:04 - 0:06	CAUTION: No holdover time guidelines exist		
below -6 to -10°C (below 21 to 14°F)	0:04 - 0:08	0:02 - 0:05	0:09 - 0:12	0:05 - 0:09	0:02 - 0:05	0:04 - 0:07	0:02 - 0:05			
below -10°C (below 14°F)	0:04 - 0:07	0:02 - 0:04	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04					

NOTES

1 These holdover times apply to newer aircraft with critical surfaces constructed predominantly or entirely of composite materials. Takeoff after the longest applicable holdover time has been exceeded is not permitted for Type I fluids.
2 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
5 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
6 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
7 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
11 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
12 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 11.

HOLDOVER TIME (HOT) GUIDELINES FOR SAE TYPE II FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE 4: GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:55 - 1:50	0:20 - 0:40	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:05 - 0:05	0:07 - 0:45	
	75/25	0:40 - 1:10	0:15 - 0:25	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:03 - 0:03	0:04 - 0:25	
	50/50	0:15 - 0:30	0:05 - 0:10	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:30 - 0:45	0:15 - 0:30	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20			
	75/25	0:25 - 0:55	0:09 - 0:15	0:10 - 0:25	0:15 - 0:30	0:09 - 0:20			
below -8 to -14°C (below 18 to 7°F)	100/0	0:30 - 0:45	0:10 - 0:25	0:15 - 0:30	0:20 - 0:45[12]	0:15 - 0:20[12]			
	75/25	0:25 - 0:55	0:07 - 0:15	0:09 - 0:20	0:15 - 0:30[12]	0:09 - 0:20[12]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:20	0:01 - 0:05	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:20	0:00 - 0:02	0:01 - 0:03					
below -25°C (below -13°F)	100/0	0:15 - 0:20	0:00 - 0:00	0:00 - 0:01					

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 56). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
12 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 5: TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:20 - 3:00	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:40 - 1:15	0:40 - 1:40	0:30 - 0:45	0:07 - 0:07	0:09 - 1:25	
	75/25	1:15 - 1:25	0:20 - 0:40	1:45 - 2:00	0:55 - 1:45	0:25 - 0:55	0:35 - 1:05	0:20 - 0:30	0:03 - 0:03	0:04 - 0:50	
	50/50	0:15 - 0:30	0:05 - 0:10	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:45 - 2:30	0:25 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:25 - 1:10	0:20 - 0:30			
	75/25	0:35 - 1:55	0:20 - 0:35	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:15 - 0:55	0:20 - 0:35			
below -8 to -14°C (below 18 to 7°F)	100/0	0:45 - 2:30	0:20 - 0:40	1:45 - 2:00	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10[11]	0:20 - 0:30[11]			
	75/25	0:35 - 1:55	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:15 - 0:55[11]	0:20 - 0:35[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:40	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:40	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -27°C (below -13 to -17°F)	100/0	0:15 - 0:40	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 6: TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:55 - 1:50	0:20 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:07 - 0:07	0:10 - 0:55	
	75/25	0:50 - 1:20	0:20 - 0:35	1:20 - 1:40	0:45 - 1:20	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30	0:05 - 0:05	0:07 - 0:50	
	50/50	0:35 - 1:00	0:10 - 0:20	0:50 - 1:05	0:25 - 0:50	0:15 - 0:25	0:20 - 0:40	0:10 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:45 - 1:50	0:15 - 0:30	1:20 - 1:35	0:40 - 1:20	0:25 - 0:40	0:30 - 0:55	0:20 - 0:25			
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40	0:20 - 0:25			
below -8 to -14°C (below 18 to 7°F)	100/0	0:45 - 1:50	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:20 - 0:35	0:30 - 0:55[11]	0:20 - 0:25[11]			
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40[11]	0:20 - 0:25[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:20 - 0:50	0:09 - 0:20	0:45 - 1:00	0:25 - 0:45	0:15 - 0:25					
below -18 to -25°C (below 0 to -13°F)	100/0	0:20 - 0:50	0:05 - 0:10	0:30 - 0:35	0:15 - 0:30	0:07 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 7: TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:30 - 4:00	0:45 - 1:10	2:00 - 2:00	1:35 - 2:00	1:00 - 1:35	1:20 - 2:00	0:45 - 1:25	0:08 - 0:08	0:10 - 1:30	
	75/25	1:50 - 2:45	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:10 - 1:30	0:30 - 0:55	0:04 - 0:04	0:06 - 0:50	
	50/50	0:55 - 1:45	0:09 - 0:20	0:45 - 0:55	0:25 - 0:45	0:10 - 0:25	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 1:45	0:35 - 1:00	2:00 - 2:00	1:15 - 2:00	0:45 - 1:15	0:35 - 1:30	0:25 - 0:45			
	75/25	0:25 - 1:05	0:20 - 0:40	1:45 - 2:00	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10	0:20 - 0:35			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 1:45	0:30 - 0:50	1:50 - 2:00	1:05 - 1:50	0:40 - 1:05	0:35 - 1:30[11]	0:25 - 0:45[11]			
	75/25	0:25 - 1:05	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 1:10[11]	0:20 - 0:35[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:50	0:06 - 0:20	1:10 - 1:40	0:25 - 1:10	0:08 - 0:25					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:50	0:02 - 0:07	0:30 - 0:40	0:10 - 0:30	0:03 - 0:10					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 0:50	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 8: TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:50 - 4:00	0:50 - 1:25	2:00 - 2:00	1:55 - 2:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:10 - 0:10	0:15 - 2:00	
	75/25	2:30 - 4:00	0:30 - 1:05	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:07 - 0:07	0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:30	0:35 - 1:05	2:00 - 2:00	1:25 - 2:00	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45			
	75/25	0:40 - 1:30	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:00	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[11]	0:35 - 0:45[11]			
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[11]	0:35 - 0:45[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:50	0:08 - 0:25	1:35 - 2:00	0:35 - 1:35	0:10 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:50	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15					
below -25 to -30.5°C (below -13 to -23°F)	100/0	0:25 - 0:50	0:02 - 0:05	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 9: TYPE II HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:40 - 3:10	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:05 - 1:50	0:50 - 1:05	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:20	0:25 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:20	0:20 - 0:40	1:45 - 2:00	0:50 - 1:45	0:25 - 0:50	0:50 - 1:30[11]	0:25 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:20 - 0:35	0:10 - 0:25	1:15 - 1:40	0:30 - 1:15	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:20 - 0:35	0:06 - 0:15	0:50 - 1:05	0:20 - 0:50	0:08 - 0:20					
below -25 to -30°C (below -13 to -22°F)	100/0	0:20 - 0:30	0:03 - 0:07	0:25 - 0:30	0:09 - 0:25	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 10: TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:15 - 3:45	0:45 - 1:15	1:00 - 1:40	1:50 - 2:00	1:00 - 1:25	0:15 - 0:15	0:20 - 2:00	
	75/25	1:40 - 2:30	0:25 - 0:50	0:35 - 1:10	1:25 - 2:00	0:50 - 1:10	0:10 - 0:10	0:15 - 2:00	
	50/50	0:35 - 1:05	0:05 - 0:10	0:07 - 0:15	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:30 - 1:05	0:40 - 1:10	0:55 - 1:30	0:25 - 1:00	0:15 - 0:35			
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05	0:20 - 0:55	0:09 - 0:30			
below -8 to -14°C (below 18 to 7°F)	100/0	0:30 - 1:05	0:40 - 1:05	0:50 - 1:25	0:25 - 1:00[11]	0:15 - 0:35[11]			
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05	0:20 - 0:55[11]	0:09 - 0:30[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:55	0:01 - 0:05	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:55	0:00 - 0:02	0:01 - 0:03					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 0:55	0:00 - 0:00	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 11: TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:25 - 2:25	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:00 - 1:35	0:40 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:35	0:30 - 0:50	2:00 - 2:00	1:10 - 2:00	0:40 - 1:10	0:30 - 1:15	0:35 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:35	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:35 - 1:05	0:30 - 1:15[11]	0:35 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 0:45	0:10 - 0:20	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 0:45	0:06 - 0:10	0:30 - 0:35	0:15 - 0:30	0:08 - 0:15					
below -25 to -28°C (below -13 to -18°F)	100/0	0:35 - 0:45	0:05 - 0:09	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 12: TYPE II HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:55 - 2:45	0:30 - 1:00	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:10 - 2:00	0:45 - 1:00	0:09 - 0:09	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	1:05 - 1:45	0:15 - 0:35	1:35 - 1:55	0:45 - 1:35	0:25 - 0:45	0:50 - 1:15	0:25 - 0:30	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:45 - 1:25	0:25 - 0:45	1:50 - 2:00	1:00 - 1:50	0:30 - 1:00	0:30 - 1:10	0:25 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:45 - 1:25	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:30 - 1:10[11]	0:25 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:25	0:08 - 0:15	0:35 - 0:40	0:20 - 0:35	0:10 - 0:20					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:25	0:03 - 0:05	0:15 - 0:15	0:07 - 0:15	0:04 - 0:07					
below -25 to -27°C (below -13 to -17°F)	100/0	0:15 - 0:25	0:02 - 0:04	0:10 - 0:10	0:05 - 0:10	0:03 - 0:05					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 13: TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:15 - 2:25	0:25 - 0:40	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:06 - 0:06	0:08 - 0:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:45 - 1:30	0:15 - 0:30	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:45 - 1:30	0:10 - 0:25	0:15 - 0:30	0:20 - 0:45[11]	0:15 - 0:20[11]			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:35	0:01 - 0:05	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:35	0:00 - 0:02	0:01 - 0:03					
below -25 to -28°C (below -13 to -18°F)	100/0	0:25 - 0:35	0:00 - 0:00	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 14: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:10 - 2:25	0:25 - 0:55	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	0:50 - 1:20	0:35 - 0:50	0:05 - 0:05	0:07 - 1:10	
	75/25	1:00 - 1:50	0:20 - 0:40	1:55 - 2:00	0:55 - 1:55	0:25 - 0:55	0:40 - 1:15	0:25 - 0:40	0:05 - 0:05	0:07 - 0:55	
	50/50	0:25 - 0:55	0:10 - 0:20	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30	0:20 - 0:35	0:10 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 1:35	0:20 - 0:40	1:50 - 2:00	0:50 - 1:50	0:25 - 0:50	0:35 - 1:10	0:25 - 0:35			
	75/25	0:55 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40	0:25 - 1:05	0:20 - 0:30			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 1:35	0:15 - 0:30	1:25 - 1:50	0:40 - 1:25	0:20 - 0:40	0:35 - 1:10[11]	0:25 - 0:35[11]			
	75/25	0:55 - 1:25	0:10 - 0:25	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30	0:25 - 1:05[11]	0:20 - 0:30[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:20	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:20	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -28°C (below -13 to -18°F)	100/0	0:15 - 0:20	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 15: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:40 - 3:30	0:20 - 0:45	1:55 - 2:00	1:00 - 1:55	0:30 - 1:00	0:40 - 1:35	0:25 - 0:45	0:06 - 0:06	0:09 - 0:50	
	75/25	0:40 - 1:10	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:04 - 0:04	0:05 - 0:25	
	50/50	0:20 - 0:35	0:07 - 0:15	0:30 - 0:35	0:15 - 0:30	0:09 - 0:15	0:10 - 0:30	0:08 - 0:10	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:30 - 0:45	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 0:50	0:20 - 0:30			
	75/25	0:30 - 0:55	0:09 - 0:15	0:40 - 0:50	0:25 - 0:40	0:10 - 0:25	0:20 - 0:30	0:15 - 0:20			
below -8 to -14°C (below 18 to 7°F)	100/0	0:30 - 0:45	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35	0:25 - 0:50[11]	0:20 - 0:30[11]			
	75/25	0:30 - 0:55	0:07 - 0:15	0:35 - 0:40	0:20 - 0:35	0:09 - 0:20	0:20 - 0:30[11]	0:15 - 0:20[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:25	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:25	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -28°C (below -13 to -18°F)	100/0	0:15 - 0:25	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

HOLDOVER TIME (HOT) GUIDELINES FOR SAE TYPE III FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

TABLE 16: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10°C (below 27 to 14°F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -16°C (below 14 to 3°F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

TABLE 17: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10°C (below 27 to 14°F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -20.5°C (below 14 to -5°F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

TABLE 18: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -10°C (below 27 to 14°F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -25°C (below 14 to -13°F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					
below -25 to -35°C (below -13 to -31°F)	100/0	0:25 - 1:00	0:07 - 0:16	0:45 - 1:00	0:20 - 0:45	0:10 - 0:20					

CAUTION: No holdover time guidelines exist

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 51 provides allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

HOLDOVER TIME (HOT) GUIDELINES FOR SAE TYPE IV FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE 19: GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	1:15 - 2:15	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:05	
	75/25	1:25 - 2:40	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:40 - 1:15	1:00 - 1:20	0:30 - 0:50	0:07 - 0:07	0:09 - 1:20	
	50/50	0:30 - 0:55	0:07 - 0:20	1:00 - 1:10	0:25 - 1:00	0:10 - 0:25	0:15 - 0:40	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:15 - 0:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:25 - 1:00	0:20 - 0:25			
	75/25	0:40 - 1:20	0:25 - 0:50	1:50 - 2:00	1:05 - 1:50	0:30 - 1:05	0:20 - 1:05	0:15 - 0:25			
below -8 to -14°C (below 18 to 7°F)	100/0	0:15 - 0:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:25 - 1:00[12]	0:20 - 0:25[12]			
	75/25	0:40 - 1:20	0:20 - 0:45	1:45 - 2:00	0:55 - 1:45	0:25 - 0:55	0:20 - 1:05[12]	0:15 - 0:25[12]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25°C (below -13°F)	100/0	0:15 - 0:30	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids and Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail.
12 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 20: TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:20 - 4:00	0:45 - 1:25	2:00 - 2:00	1:55 - 2:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:08 - 0:08	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:20 - 1:35	0:35 - 1:05	2:00 - 2:00	1:30 - 2:00	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:20 - 1:35	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:40 - 1:15	0:25 - 1:25[11]	0:20 - 0:25[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:40	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:40	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -26°C (below -13 to -15°F)	100/0	0:25 - 0:40	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 21: TYPE IV HOLDOVER TIMES FOR AFLRUS LLC GREEN FLO TYPE 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:15 - 2:30	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:50 - 2:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:50 - 2:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:35 - 1:00[11]	0:20 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:10	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:10	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					
below -25 to -30°C (below -13 to -22°F)	100/0	0:25 - 1:00	0:04 - 0:10	0:35 - 0:40	0:15 - 0:35	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 22: TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:05 - 4:00	0:45 - 1:25	2:00 - 2:00	1:50 - 2:00	1:00 - 1:50	1:25 - 2:00	0:40 - 1:00	0:08 - 0:08	0:10 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	2:30 - 3:55	0:45 - 1:25	2:00 - 2:00	1:50 - 2:00	1:00 - 1:50	1:05 - 2:00	0:50 - 1:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	2:30 - 3:55	0:45 - 1:25	2:00 - 2:00	1:50 - 2:00	1:00 - 1:50	1:05 - 2:00[11]	0:50 - 1:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:35	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:35	0:15 - 0:35	1:30 - 1:55	0:45 - 1:30	0:20 - 0:45					
below -25 to -26°C (below -13 to -15°F)	100/0	0:35 - 1:35	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 23: TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:25 - 2:15	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:05 - 1:25	0:40 - 0:50	0:10 - 0:10	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:20	0:25 - 0:50	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	0:45 - 1:10	0:35 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:20	0:20 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:45 - 1:10[11]	0:35 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 0:50	0:10 - 0:25	1:15 - 1:40	0:35 - 1:15	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 0:50	0:07 - 0:15	0:50 - 1:00	0:20 - 0:50	0:09 - 0:20					
below -25 to -29°C (below -13 to -20°F)	100/0	0:35 - 0:50	0:05 - 0:15	0:40 - 0:50	0:15 - 0:40	0:07 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 24: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEAR IV FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 2:50	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:05 - 1:45	0:50 - 1:10	0:15 - 0:15	0:20 - 1:15	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:50 - 1:55	0:25 - 0:45	1:55 - 2:00	1:00 - 1:55	0:30 - 1:00	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:50 - 1:55	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:50 - 1:25[11]	0:40 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:45	0:10 - 0:20	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30					
below -18 to -23°C (below 0 to -9°F)	100/0	0:25 - 0:45	0:08 - 0:15	0:40 - 0:50	0:20 - 0:40	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 25: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:50 - 3:15	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:10 - 1:35	0:30 - 1:00	0:08 - 0:08	0:10 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:35 - 3:45	0:25 - 0:55	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	1:05 - 1:30	0:30 - 1:00			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:35 - 3:45	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:05 - 1:30[11]	0:30 - 1:00[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:55 - 2:00	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45					
below -18 to -25°C (below 0 to -13°F)	100/0	0:55 - 2:00	0:09 - 0:20	0:55 - 1:10	0:25 - 0:55	0:15 - 0:25					
below -25 to -29°C (below -13 to -20°F)	100/0	0:55 - 2:00	0:07 - 0:15	0:45 - 0:55	0:20 - 0:45	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 26: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 3:15	0:25 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:40 - 1:10	0:20 - 0:35	0:06 - 0:06	0:08 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8°C (below 27 to 18°F)	100/0	1:25 - 2:45	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:40 - 1:10	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:25 - 2:45	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:40 - 1:10[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:50 - 1:25	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45					
below -18 to -25°C (below 0 to -13°F)	100/0	0:50 - 1:25	0:15 - 0:30	1:20 - 1:40	0:35 - 1:20	0:20 - 0:35					
below -25 to -30°C (below -13 to -22°F)	100/0	0:30 - 1:05	0:09 - 0:20	0:55 - 1:05	0:25 - 0:55	0:10 - 0:25					

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 27: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:50 - 3:15	0:40 - 1:10	2:00 - 2:00	1:35 - 2:00	0:50 - 1:35	1:10 - 1:35	0:45 - 1:05	0:15 - 0:15	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 1:55	0:30 - 0:50	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	0:55 - 1:10	0:35 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 1:55	0:20 - 0:40	1:40 - 2:00	0:55 - 1:40	0:30 - 0:55	0:55 - 1:10[11]	0:35 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:45	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:45	0:07 - 0:15	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20					
below -25 to -26°C (below -13 to -15°F)	100/0	0:30 - 0:45	0:06 - 0:15	0:35 - 0:45	0:20 - 0:35	0:08 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 28: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:30 - 3:05	0:30 - 0:50	1:55 - 2:00	1:10 - 1:55	0:40 - 1:10	1:05 - 2:00	0:30 - 0:50	0:09 - 0:09	0:10 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:20 - 3:00	0:25 - 0:45	1:45 - 2:00	1:00 - 1:45	0:35 - 1:00	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:20 - 3:00	0:25 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:45	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:45	0:15 - 0:30	1:20 - 1:35	0:40 - 1:20	0:20 - 0:40					
below -25 to -31°C (below -13 to -24°F)	100/0	0:35 - 1:05	0:07 - 0:15	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 29: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:15 - 4:00	0:40 - 1:15	2:00 - 2:00	1:40 - 2:00	0:55 - 1:40	2:00 - 2:00	1:10 - 1:55	0:15 - 0:15	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:10	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:35 - 1:05	0:35 - 1:55	0:45 - 1:05			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:10	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:35 - 1:55[11]	0:45 - 1:05[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:20 - 0:35	0:10 - 0:20	0:50 - 1:00	0:25 - 0:50	0:15 - 0:25					
below -18 to -25°C (below 0 to -13°F)	100/0	0:20 - 0:35	0:05 - 0:09	0:25 - 0:30	0:15 - 0:25	0:06 - 0:15					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:20 - 0:35	0:05 - 0:09	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 30: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:05 - 3:35	0:25 - 1:00	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	0:45 - 1:40	0:25 - 0:40	0:07 - 0:07	0:09 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:25 - 3:40	0:25 - 1:00	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	1:00 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:25 - 3:40	0:25 - 1:00	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	1:00 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					
below -25 to -27°C (below -13 to -17°F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 31: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:15 - 4:00	0:40 - 1:20	2:00 - 2:00	1:45 - 2:00	0:55 - 1:45	1:20 - 2:00	0:55 - 1:20	0:15 - 0:15	0:25 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:50 - 4:00	0:40 - 1:20	2:00 - 2:00	1:45 - 2:00	0:55 - 1:45	1:15 - 2:00	0:45 - 1:20			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:50 - 4:00	0:40 - 1:20	2:00 - 2:00	1:45 - 2:00	0:55 - 1:45	1:15 - 2:00[11]	0:45 - 1:20[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:40 - 1:30	0:35 - 1:10	2:00 - 2:00	1:35 - 2:00	0:50 - 1:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:40 - 1:30	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:35 - 1:05					
below -25 to -29°C (below -13 to -20°F)	100/0	0:40 - 1:30	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:30 - 0:55					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 32: TYPE IV HOLDOVER TIMES FOR CHONGQING JOBA CHEMICAL FW-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:15 - 4:00	0:35 - 1:15	2:00 - 2:00	1:40 - 2:00	0:50 - 1:40	1:30 - 2:00	0:45 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	2:30 - 4:00	0:30 - 1:00	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	0:50 - 2:00	0:35 - 1:10			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	2:30 - 4:00	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	0:50 - 2:00[11]	0:35 - 1:10[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:40	0:20 - 0:40	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:40	0:15 - 0:30	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -25 to -29°C (below -13 to -20°F)	100/0	0:35 - 1:40	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 33: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	4:00 - 4:00	0:50 - 1:20	2:00 - 2:00	1:45 - 2:00	1:05 - 1:45	1:30 - 2:00	1:00 - 1:40	0:10 - 0:10	0:15 - 1:40	
	75/25	3:40 - 4:00	0:45 - 1:20	2:00 - 2:00	1:45 - 2:00	1:00 - 1:45	1:40 - 2:00	0:45 - 1:15	0:08 - 0:08	0:10 - 1:45	
	50/50	1:25 - 2:45	0:20 - 0:35	1:25 - 1:40	0:45 - 1:25	0:25 - 0:45	0:30 - 0:50	0:20 - 0:25	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:00 - 1:55	0:40 - 1:05	2:00 - 2:00	1:30 - 2:00	0:55 - 1:30	0:35 - 1:40	0:25 - 0:45			
	75/25	0:40 - 1:20	0:40 - 1:10	2:00 - 2:00	1:30 - 2:00	0:50 - 1:30	0:25 - 1:10	0:25 - 0:45			
below -8 to -14°C (below 18 to 7°F)	100/0	1:00 - 1:55	0:35 - 1:00	2:00 - 2:00	1:20 - 2:00	0:50 - 1:20	0:35 - 1:40[11]	0:25 - 0:45[11]			
	75/25	0:40 - 1:20	0:35 - 1:00	2:00 - 2:00	1:25 - 2:00	0:45 - 1:25	0:25 - 1:10[11]	0:25 - 0:45[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:50	0:05 - 0:15	1:15 - 1:45	0:20 - 1:15	0:06 - 0:20					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:50	0:02 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -25 to -28.5°C (below -13 to -19°F)	100/0	0:30 - 0:50	0:01 - 0:04	0:20 - 0:30	0:06 - 0:20	0:01 - 0:06					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 34: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:55 - 4:00	0:40 - 1:35	2:00 - 2:00	2:00 - 2:00	0:55 - 2:00	2:00 - 2:00	1:00 - 2:00	0:15 - 0:15	0:20 - 2:00	
	75/25	3:55 - 4:00	0:35 - 1:25	2:00 - 2:00	1:55 - 2:00	0:50 - 1:55	2:00 - 2:00	1:20 - 1:25	0:15 - 0:15	0:20 - 1:50	
	50/50	1:15 - 1:50	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:25 - 1:00	0:15 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:15	0:35 - 1:15	2:00 - 2:00	1:40 - 2:00	0:45 - 1:40	0:25 - 1:35	0:25 - 0:40			
	75/25	0:40 - 2:00	0:30 - 1:05	2:00 - 2:00	1:30 - 2:00	0:35 - 1:30	0:20 - 1:05	0:20 - 0:30			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:15	0:30 - 1:05	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	0:25 - 1:35[11]	0:25 - 0:40[11]			
	75/25	0:40 - 2:00	0:25 - 0:55	2:00 - 2:00	1:15 - 2:00	0:30 - 1:15	0:20 - 1:05[11]	0:20 - 0:30[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:50	0:05 - 0:20	1:15 - 1:50	0:25 - 1:15	0:07 - 0:25					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:50	0:02 - 0:07	0:30 - 0:45	0:09 - 0:30	0:03 - 0:09					
below -25 to -29°C (below -13 to -20°F)	100/0	0:25 - 0:50	0:01 - 0:04	0:20 - 0:30	0:06 - 0:20	0:02 - 0:06					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 35: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:50 - 4:00	0:50 - 1:25	2:00 - 2:00	1:55 - 2:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:10 - 0:10	0:15 - 2:00	
	75/25	2:30 - 4:00	0:30 - 1:05	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:07 - 0:07	0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:30	0:35 - 1:05	2:00 - 2:00	1:25 - 2:00	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45			
	75/25	0:40 - 1:30	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:00	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[11]	0:35 - 0:45[11]			
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[11]	0:35 - 0:45[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:50	0:08 - 0:25	1:35 - 2:00	0:35 - 1:35	0:10 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:50	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15					
below -25 to -30.5°C (below -13 to -23°F)	100/0	0:25 - 0:50	0:02 - 0:05	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 36: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:30 - 4:00	0:50 - 1:30	2:00 - 2:00	2:00 - 2:00	1:05 - 2:00	2:00 - 2:00	1:00 - 1:50	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:00 - 1:50	0:40 - 1:10	2:00 - 2:00	1:35 - 2:00	0:50 - 1:35	0:35 - 1:40	0:50 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:00 - 1:50	0:35 - 1:00	2:00 - 2:00	1:20 - 2:00	0:45 - 1:20	0:35 - 1:40[11]	0:50 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:40	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:40	0:05 - 0:10	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15					
below -25 to -29°C (below -13 to -20°F)	100/0	0:25 - 0:40	0:03 - 0:06	0:20 - 0:25	0:09 - 0:20	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 37: TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR ENDURANCE™ EG106 ADF/AAF

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:05 - 3:10	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:10 - 2:00	0:50 - 1:15	0:15 - 0:15	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:50 - 3:20	0:25 - 0:50	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	0:55 - 1:50	0:45 - 1:10			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:50 - 3:20	0:25 - 0:45	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:55 - 1:50[11]	0:45 - 1:10[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:05	0:15 - 0:35	1:45 - 2:00	0:50 - 1:45	0:25 - 0:50					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:05	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:05	0:15 - 0:30	1:20 - 1:45	0:40 - 1:20	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 38: TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:20 - 4:00	0:45 - 1:25	2:00 - 2:00	1:55 - 2:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:08 - 0:08	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:20 - 1:35	0:35 - 1:05	2:00 - 2:00	1:30 - 2:00	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:20 - 1:35	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:40 - 1:15	0:25 - 1:25[11]	0:20 - 0:25[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:40	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:40	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -26°C (below -13 to -15°F)	100/0	0:25 - 0:40	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 39: TYPE IV HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 3:10	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	1:05 - 1:45	0:50 - 1:00	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:25	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:25	0:20 - 0:45	1:55 - 2:00	0:55 - 1:55	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:45	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:45	0:06 - 0:15	0:50 - 1:10	0:20 - 0:50	0:09 - 0:20					
below -25 to -30°C (below -13 to -22°F)	100/0	0:20 - 0:35	0:04 - 0:09	0:30 - 0:40	0:15 - 0:30	0:05 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 40: TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:15 - 2:40	0:35 - 1:00	2:00 - 2:00	1:20 - 2:00	0:45 - 1:20	0:40 - 1:30	0:35 - 0:40	0:09 - 0:09	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:10 - 2:35	0:30 - 0:55	2:00 - 2:00	1:10 - 2:00	0:40 - 1:10	0:50 - 1:25	0:30 - 0:40			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:10 - 2:35	0:25 - 0:50	1:55 - 2:00	1:05 - 1:55	0:35 - 1:05	0:50 - 1:25[11]	0:30 - 0:40[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:00	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:00	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:30 - 1:00	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 41: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:30 - 2:40	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:35 - 1:15	1:05 - 1:30	0:40 - 1:05	0:10 - 0:10	0:15 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:35	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:35 - 1:05	0:50 - 1:20	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:35	0:25 - 0:45	2:00 - 2:00	1:00 - 2:00	0:30 - 1:00	0:50 - 1:20[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:50	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:50	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:30 - 0:50	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 42: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:10 - 4:00	0:30 - 1:00	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:05 - 2:00	0:30 - 0:50	0:06 - 0:06	0:09 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	2:40 - 4:00	0:30 - 1:00	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:05 - 2:00	0:40 - 1:00			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	2:40 - 4:00	0:30 - 1:00	2:00 - 2:00	1:25 - 2:00	0:40 - 1:25	1:05 - 2:00[11]	0:40 - 1:00[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:45 - 1:55	0:07 - 0:20	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25					
below -18 to -25°C (below 0 to -13°F)	100/0	0:45 - 1:55	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15					
below -25 to -26°C (below -13 to -15°F)	100/0	0:45 - 1:55	0:01 - 0:06	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 43: TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:10 - 4:00	0:55 - 1:35	2:00 - 2:00	2:00 - 2:00	1:15 - 2:00	1:50 - 2:00	1:05 - 2:00	0:15 - 0:15	0:25 - 2:00	
	75/25	1:25 - 2:40	0:30 - 0:55	2:00 - 2:00	1:15 - 2:00	0:45 - 1:15	1:00 - 1:20	0:30 - 0:50	0:08 - 0:08	0:10 - 1:20	
	50/50	0:30 - 0:55	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30	0:15 - 0:40	0:15 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 3:30	0:50 - 1:25	2:00 - 2:00	1:50 - 2:00	1:05 - 1:50	0:25 - 1:35	0:20 - 0:30			
	75/25	0:45 - 1:50	0:30 - 0:50	1:50 - 2:00	1:05 - 1:50	0:40 - 1:05	0:20 - 1:10	0:15 - 0:25			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 3:30	0:45 - 1:15	2:00 - 2:00	1:45 - 2:00	1:00 - 1:45	0:25 - 1:35[11]	0:20 - 0:30[11]			
	75/25	0:45 - 1:50	0:25 - 0:45	1:45 - 2:00	1:00 - 1:45	0:35 - 1:00	0:20 - 1:10[11]	0:15 - 0:25[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:40 - 1:00	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:40 - 1:00	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -28°C (below -13 to -18°F)	100/0	0:40 - 1:00	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 44: TYPE IV HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE-IV PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:20 - 3:50	0:35 - 1:15	2:00 - 2:00	1:40 - 2:00	0:45 - 1:40	1:25 - 2:00	0:50 - 1:20	0:09 - 0:09	0:10 - 1:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:15 - 0:35	0:25 - 0:55	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	0:40 - 1:30	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:15 - 0:35	0:20 - 0:45	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55	0:40 - 1:30[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -29°C (below -13 to -20°F)	100/0	0:15 - 0:30	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 45: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:55 - 4:00	0:25 - 0:55	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	1:10 - 2:00	0:40 - 1:05	0:09 - 0:09	0:15 - 1:25	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:35 - 2:05	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:30 - 0:55	0:35 - 1:20	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:35 - 2:05	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:35 - 1:20[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:55	0:10 - 0:20	1:00 - 1:15	0:30 - 1:00	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:55	0:05 - 0:10	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15					
below -25 to -29.5°C (below -13 to -21°F)	100/0	0:30 - 0:55	0:05 - 0:10	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 46: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:35 - 4:00	0:25 - 0:55	2:00 - 2:00	1:10 - 2:00	0:35 - 1:10	1:20 - 2:00	0:40 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:25 - 3:25	0:20 - 0:45	2:00 - 2:00	1:00 - 2:00	0:25 - 1:00	0:50 - 2:00	0:45 - 1:05			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:25 - 3:25	0:20 - 0:40	1:55 - 2:00	0:50 - 1:55	0:25 - 0:50	0:50 - 2:00[11]	0:45 - 1:05[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:35 - 1:55	0:15 - 0:30	1:35 - 2:00	0:40 - 1:35	0:15 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:35 - 1:55	0:09 - 0:20	1:10 - 1:35	0:30 - 1:10	0:15 - 0:30					
below -25 to -29°C (below -13 to -20°F)	100/0	0:35 - 1:55	0:08 - 0:20	1:00 - 1:20	0:25 - 1:00	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 47: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:05 - 4:00	0:30 - 1:00	2:00 - 2:00	1:20 - 2:00	0:40 - 1:20	1:15 - 2:00	0:40 - 0:55	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:35 - 3:15	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:35 - 3:15	0:20 - 0:40	2:00 - 2:00	0:55 - 2:00	0:25 - 0:55	1:15 - 2:00[11]	0:30 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:10	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:10	0:09 - 0:20	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:10	0:08 - 0:20	1:00 - 1:15	0:25 - 1:00	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 48: TYPE IV HOLDOVER TIMES FOR SHAANXI CLEANWAY CLEANSURFACE IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:30 - 4:00	0:30 - 1:15	2:00 - 2:00	1:40 - 2:00	0:40 - 1:40	1:20 - 2:00	0:40 - 1:10	0:09 - 0:09	0:15 - 1:50	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 2:05	0:20 - 0:45	2:00 - 2:00	1:00 - 2:00	0:25 - 1:00	0:30 - 1:30	0:25 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 2:05	0:15 - 0:35	1:45 - 2:00	0:45 - 1:45	0:20 - 0:45	0:30 - 1:30[11]	0:25 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:25 - 0:35	0:10 - 0:20	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:25 - 0:35	0:05 - 0:10	0:35 - 0:45	0:15 - 0:35	0:07 - 0:15					
below -25 to -30°C (below -13 to -22°F)	100/0	0:20 - 0:30	0:04 - 0:09	0:30 - 0:35	0:15 - 0:30	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 49: TYPE IV HOLDOVER TIMES FOR XINJIANG ZHONGTIAN LIYANG AVIATION CLEARICE-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:25 - 4:00	0:25 - 0:50	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:05 - 1:55	0:35 - 0:55	0:09 - 0:09	0:15 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:20 - 2:10	0:20 - 0:40	1:50 - 2:00	0:55 - 1:50	0:25 - 0:55	0:55 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:20 - 2:10	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:55 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:00	0:15 - 0:30	1:15 - 1:35	0:40 - 1:15	0:20 - 0:40					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:00	0:15 - 0:25	1:10 - 1:25	0:35 - 1:10	0:15 - 0:35					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:00	0:10 - 0:25	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

ALLOWANCE TIMES TABLES FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.

TABLE 50: LIST OF FLUIDS VALIDATED FOR USE WITH ALLOWANCE TIMES[1]

Manufacturer	Fluid Name	Applicable Allowance Times (ATs)
Type III Fluids		
AllClear Systems LLC	AeroClear MAX	ATs for Type III Fluids
Type IV EG Fluids		
AFLRUS LLC	Green Flo Type 4	Fluid has not been validated[2]
ALAB International	PROFLIGHT EG4	Fluid has not been validated[2]
AllClear Systems LLC	ClearWing EG	ATs for Type IV EG Fluids
ASGlobal	4Flite EG	Fluid has not been validated[2]
AVIAFLUID International Ltd	AVIAFlight EG	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR EG IV	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR Nordik IV	ATs for Type IV EG Fluids
Chongqing Joba Chemical Co., Ltd	FW-IV	ATs for Type IV EG Fluids
Dow Inc.	UCAR ENDURANCE™ EG106 ADF/AAF	ATs for Type IV EG Fluids
JSC RCP Nordix	Defrost NORTH 4	ATs for Type IV EG Fluids
Newave Aerochemical Co. Ltd.	FCY-EGIV	ATs for Type IV EG Fluids
Newave Aerochemical Co. Ltd.	FCY-EGIV PLUS	Fluid has not been validated[2]
Xinjiang Zhongtian Liyang Aviation	Clearice-IV	Fluid has not been validated[2]
Type IV PG Fluids		
ABAX Industries	ECOWING AD-49	ATs for Type IV PG Fluids
ALAB International	PROFLIGHT PG4	Fluid has not been validated[2]
AllClear Systems LLC	Clear IV Flight	Fluid has not been validated[2]
ASGlobal	4Flite PG	ATs for Type IV PG Fluids
AVIAFLUID International Ltd	AVIAFlight PG	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH PLUS	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Advance	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Xtend	ATs for Type IV PG Fluids
Dow Inc.	UCAR™ FLIGHTGUARD™ AD-49	ATs for Type IV PG Fluids
ESSPO CHEMICALS D.O.O	Nordwing PG4	Fluid has not been validated[2]
Inland Technologies Inc.	ECO-SHIELD®	ATs for Type IV PG Fluids
JSC RCP Nordix	Defrost ECO 4	ATs for Type IV PG Fluids
Kilfrost Limited	ABC-S Plus	ATs for Type IV PG Fluids
MKS DevO Chemicals	COREICEPHOB TYPE-IV PG	Fluid has not been validated[2]
Newave Aerochemical Co. Ltd.	FCY 9311	ATs for Type IV PG Fluids
Shaanxi Cleanway Aviation Chemical Co., Ltd	Cleansurface IV	Fluid has not been validated[2]

NOTES

1 Allowance times are for use with undiluted (100/0) Type III, Type IV EG, and Type IV PG fluids only. No allowance times exist for Type II fluids.
2 No allowance times exist for this fluid at the time of publication as the allowance times have not yet been validated.

TABLE 51: ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[4]	Outside Air Temperature			
	Above 0°C (Above 32°F)	0 to -5°C (32 to 23°F)	Below -5 to -10°C (Below 23 to 14°F)	Below -10°C[3] (Below 14°F)
Light Ice Pellets (or Small Hail[5,6]) -PL	10 minutes	10 minutes	10 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Snow -PLSN, -SNPL	10 minutes	10 minutes	10 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		7 minutes	5 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	7 minutes			
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		7 minutes	5 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Rain -PLRA, -RAPL	7 minutes			
Moderate Ice Pellets (or Small Hail[5,6]) PL	5 minutes	5 minutes	5 minutes	

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; or light rain.

3 Ensure that the lowest operational use temperature (LOUT) is respected.

4 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

5 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

6 If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 52: ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[5]	Outside Air Temperature				
	Above 0°C[3] (Above 32°F)	0 to -5°C[3] (32 to 23°F)	Below -5 to -10°C[3] (Below 23 to 14°F)	Below -10 to -16°C[3] (Below 14 to 3°F)	Below -16 to -22°C[3,4] (Below 3 to -8°F)
Light Ice Pellets (or Small Hail[6,7]) -PL	70 minutes	70 minutes	70 minutes	50 minutes	30 minutes
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Snow -PLSN, -SNPL	50 minutes	50 minutes	30 minutes	25 minutes	
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		40 minutes	30 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	40 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		40 minutes	30 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain -PLRA, -RAPL	40 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		20 minutes			
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	20 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) PL	35 minutes	35 minutes	35 minutes	15 minutes	10 minutes
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Snow PLSN, SNPL	25 minutes	25 minutes	15 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		20 minutes	10 minutes		
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	20 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Rain PLRA, RAPL	15 minutes				

Caution: No allowance times currently exist

Caution: No allowance times currently exist

NOTES

- The notes that apply to the allowance times in the table above can be found on page 67.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 52 (CONT'D): ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) EG-based fluids. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for EG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 Ensure that the lowest operational use temperature (LOUT) is respected.

5 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

6 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

7 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

TABLE 53: ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[6]	Outside Air Temperature				
	Above 0°C[3] (Above 32°F)	0 to -5°C[3] (32 to 23°F)	Below -5 to -10°C[3] (Below 23 to 14°F)	Below -10 to -16°C[4] (Below 14 to 3°F)	Below -16 to -22°C[4,5] (Below 3 to -8°F)
Light Ice Pellets (or Small Hail[7,8]) -PL	50 minutes	50 minutes	30 minutes	30 minutes	20 minutes
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Snow -PLSN, -SNPL	40 minutes	40 minutes	15 minutes	15 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		25 minutes	10 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	25 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		25 minutes	10 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain -PLRA, -RAPL	25 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		20 minutes			
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	20 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) PL	15 minutes	15 minutes	10 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Snow PLSN, SNPL	15 minutes	15 minutes	5 minutes	5 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		10 minutes	7 minutes		
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	10 minutes	**Caution: No allowance times currently exist**			
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Rain PLRA, RAPL	10 minutes				

NOTES

- The notes that apply to the allowance times in the table above can be found on page 69.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 53 (CONT'D): ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) PG-based fluids applied on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 115 knots.

5 Ensure that the lowest operational use temperature (LOUT) is respected.

6 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

7 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

8 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

SUPPLEMENTAL GUIDANCE FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

TABLE 54: SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Visibility		Day		Night	
Statute Miles	Meters	Below -1°C Below 30°F	-1°C and above 30°F and above	Below -1°C Below 30°F	-1°C and above 30°F and above
≤1/4 (≤3/8)	≤400 (≤600)	Heavy	Heavy	Heavy	Heavy
1/2 (>3/8 to ≤5/8)	800 (>600 to ≤1000)	Moderate	Heavy	Heavy	Heavy
3/4 (>5/8 to ≤7/8)	1200 (>1000 to ≤1400)	Moderate	Moderate	Heavy	Heavy
1 (>7/8 to ≤1 1/8)	1600 (>1400 to ≤1800)	Light	Light	Moderate	Heavy
1 ¼ (>1 1/8 to ≤1 3/8)	2000 (>1800 to ≤2200)	Light	Light	Moderate	Moderate
1 ½ (>1 3/8 to ≤1 5/8)	2400 (>2200 to ≤2600)	Light	Light	Moderate	Moderate
1 ¾ (>1 5/8 to ≤1 7/8)	2800 (>2600 to ≤3000)	Light	Light	Light	Light
2 (>1 7/8 to ≤2 ¼)	3200 (>3000 to ≤3600)	Very Light	Very Light	Light	Light
2 ½ (>2 ¼ to ≤2 ¾)	4000 (>3600 to ≤4400)	Very Light	Very Light	Light	Light
3 (>2 ¾ to ≤3 ¼)	4800 (>4400 to ≤5200)	Very Light	Very Light	Very Light	Light
≥3 ½ (>3 ¼)	≥5600 (>5200)	Very Light	Very Light	Very Light	Very Light

NOTES

- The METAR/SPECI reported visibility or flight crew observed visibility will be used with this visibility table to establish snowfall intensity for Type I, II, III and IV holdover time guidelines, during snow, snow grain, or snow pellet precipitation conditions. This visibility table will also be used when snow, snow grains, or snow pellets are accompanied by blowing or drifting snow, or when snow is mixed with ice crystals, freezing fog, rain or drizzle in the METAR/SPECI.
- The use of Runway Visual Range (RVR) is not permitted for determining visibility used with the holdover tables.
- Some METARs contain tower visibility as well as surface visibility. Whenever surface visibility is available from an official source, such as a METAR, in either the main body of the METAR or in the Remarks ("RMK") section, the preferred action is to use the surface visibility value.
- If the visibility is being reduced by snow along with form(s) of obscuration such as fog, haze, smoke, etc., use of the table above may overestimate the actual snowfall intensity. However, use of the snowfall intensity being reported in accordance with the Environment and Climate Change Canada Manual of Surface Weather Observations (MANOBS), may underestimate the actual snowfall intensity as it does not directly correlate to the snowfall intensities used when determining holdover times. Use of the visibility table in all snow conditions with or without obscuration is recommended.

Example for how to read and use the table: `CYVO 160200Z 15011G17KT 1SM -SN DRSN OVC009 M06/M08 A2948`

In the above METAR the snowfall intensity is reported as light. However, based upon the "Snowfall Intensities as a Function of Prevailing Visibility" table, with a visibility of 1 statute mile, at night and a temperature of -6°C, the snowfall intensity is classified as moderate. The snowfall intensity of moderate - not the METAR reported intensity of light - will be used to determine which holdover time guideline value is appropriate for the fluid in use.

TABLE 55:
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]						
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
ABAX Industries									
DE-950	PG	26-06-01	71/29	-26	-15	Not tested[11]		-31	-24
Aéro Mag 2000									
DeiceX PG ADF Concentrate (Multiple Location)	PG	Y-M-D[12]	65/35	-25	-13	Not tested[11]		-31.5	-25
AFLRUS LLC									
Orange Flo Type 1	EG	26-11-15	70/30	-42	-44	Not tested[11]		-40	-40
ALAB Industries[10]									
WDF 1	*EG*	*22-03-02[9]*	*70/30*	*-40*	*-40*	*Not tested[11]*		*-45*	*-49*
ALAB International									
PROFLIGHT EG1	*EG*	*25-06-01[9]*	*70/30*	*-43.5*	*-46*	*Not tested[11]*		*-44*	*-47*
AllClear Systems LLC									
Lift-Off E-188	EG	26-06-01	70/30	-40	-40	Not tested[11]		-41.5	-43
Lift-Off P-88	PG	26-06-01	70/30	-24.5	-12	Not tested[11]		-29.5	-21
Arcton Ltd.[10]									
Arctica DG ready-to-use	*DEG*	*22-03-26[9]*	*as supplied*	*-26*	*-15*	*Not tested[11]*		*-26*	*-15*
ASGlobal									
Sky-Go EG	EG	26-09-23	70/30	*-31[14]*	*-24[14]*	Not tested[11]		-44	-47
Sky-Go PG	PG	26-07-27	70/30	*-21.5[14]*	*-7[14]*	Not tested[11]		-30.5	-23
Sky-Go PG 80	PG	27-08-07	70/30	*-25[14]*	*-13[14]*	Not tested[11]		-31.5	-25
AVIAFLUID International Ltd.									
AVIAFLO EG	*EG*	*25-03-23[9]*	*70/30*	*-40.5*	*-41*	*Not tested[11]*		*-41*	*-42*
AVIAFLO PG	*PG*	*22-02-10[9]*	*70/30*	*Not tested[11]*		*Not tested[11]*		*-30*	*-22*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.									
Cleanwing I	PG	27-06-08	75/25	Not tested[11]		Not tested[11]		-39.5	-39
Cleanwing E	EG	28-06-01	75/25	-37	-35	Not tested[11]		-37	-35
Cleanwing S-92	EG	28-06-01	75/25	-35	-31	Not tested[11]		-40	-40
KHF-1	PG	27-06-08	75/25	Not tested[11]		Not tested[11]		-38.5	-37

TABLE 55 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]					
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]
				°C	°F	°C	°F	°C	°F
Beijing Wangye Aviation Chemical Product Co Ltd.[10]									
KLA-1A	*EG*	*22-05-22[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-32*	*-26*
Beijing Yadilite Aviation Advanced Materials Corporation[10]									
YD-101A Type I	*EG*	*25-02-26[9]*	*70/30*	*Not tested[11]*		*Not tested[11]*		*-38*	*-36*
CHEMCO Inc.									
CHEMR EG I	EG	28-06-01	70/30	-37	-35	Not tested[11]		-43	-45
CHEMR REG I	EG	26-06-01	75/25	-36.5	-34	Not tested[11]		-43.5	-46
Chongqing Joba Chemical Co.,Ltd									
FW-I	EG	25-11-07	75/25	-43	-45	Not tested[11]		-46	-51
Clariant Produkte (Deutschland) GmbH									
Octaflo EF Concentrate	*PG*	*22-03-28[9]*	*65/35*	*-25*	*-13*	*Not tested[11]*		*-33*	*-27*
Safewing EG I Arctic	EG	26-08-23	70/30	-43.5	-46	Not tested[11]		-46	-51
Safewing MP I 1938 ECO (80)	PG	28-06-19	71/29	-25	-13	Not tested[11]		-32.5	-27
Safewing MP I ECO PLUS (80)	PG	27-06-01	71/29	-25	-13	Not tested[11]		-33	-27
Safewing MP I LFD 80	PG	29-06-01	71/29	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD 80 Pre-Mix 55%	PG	29-06-01	as supplied	Not tested[11]		Not tested[11]		-17	1
Safewing MP I LFD 88	PG	27-06-01	65/35	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD PLUS 88	PG	26-06-01	65/35	-25	-13	Not tested[11]		-34	-29
Cryotech Deicing Technology									
Polar Plus® LT	PG	28-06-01	63/37	-27	-17	Not tested[11]		-33	-27
Polar Plus® LT (80)	PG	28-06-01	70/30	-27	-17	Not tested[11]		-33	-27
Dow Inc.									
UCAR™ ADF Concentrate	EG	27-06-01	75/25	-36	-33	Not tested[11]		-45	-49
UCAR™ ADF XL54[15]	EG	27-06-01	as supplied	-33	-27	Not tested[11]		-33	-27
UCAR™ PG ADF Concentrate	PG	27-06-01	65/35	-25	-13	Not tested[11]		-32	-26
UCAR™ PG ADF Dilute 55/45[16]	PG	27-06-01	as supplied	-24	-11	Not tested[11]		-25	-13

TABLE 55 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution[4,5] (fluid/water)	Lowest Operational Use Temperature[3]					
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
ESSPO CHEMICALS D.O.O									
Nordwing EG1	EG	27-06-01	70/30	-42	-44	Not tested[11]		-48	-54
Nordwing PG1	PG	27-06-01	70/30	-25	-13	Not tested[11]		-29	-20
HOC Industries									
SafeTemp® ES Plus	PG	28-07-04	65/35	-25.5	-14	Not tested[11]		-29	-20
Inland Technologies Inc.									
DuraGly-E Type I ADF Concentrate	*EG*	*23-02-08[9]*	*60/40*	*-33*	*-27*	*Not tested[11]*		*-33*	*-27*
Inland ADF Concentrate (Multiple Location)	EG	Y-M-D[17]	75/25	-36	-33	Not tested[11]		-42.5	-45
SafeTemp® ES Plus (Multiple Location)	PG	Y-M-D[18]	65/35	-25.5	-14	Not tested[11]		-31	-24
JSC RCP Nordix									
DEFROST EG 88.1	*EG*	*25-04-13[9]*	*70/30*	*-40.5*	*-41*	*Not tested[11]*		*-44.5*	*-48*
DEFROST PG 1	*PG*	*23-11-21[9]*	*70/30*	*-24.5*	*-12*	*Not tested[11]*		*-31.5*	*-25*
Kilfrost Limited									
Kilfrost DF Plus	PG	27-06-01	69/31	-25.5	-14	Not tested[11]		-32	-26
Kilfrost DF Plus (80)	*PG*	*24-07-14[9]*	*69/31*	*-26*	*-15*	*Not tested[11]*		*-31.5*	*-25*
Kilfrost DF Plus (88)	*PG*	*23-06-05[9]*	*63/37*	*-25.5*	*-14*	*Not tested[11]*		*-32*	*-26*
Kilfrost Ice Clear I	PG	27-06-01	70/30	-26	-15	Not tested[11]		-33	-27
LNT Solutions[10]									
LNT E188	EG	25-08-13	70/30	-30.5	-23	Not tested[11]		-41	-42
LNT P180	PG	26-11-10	69/31	-26	-15	Not tested[11]		-32	-26
MKS DevO Chemicals									
COREICEPHOB TYPE I	PG	26-06-01	71/29	Not tested[11]		Not tested[11]		-32.5	-27

TABLE 55 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution[4,5] (fluid/water)	Lowest Operational Use Temperature[3]					
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
Newave Aerochemical Co. Ltd.									
FCY-1A	EG	27-06-01	75/25	*-40[14]*	*-40[14]*	Not tested[11]		-40	-40
FCY-1Bio+	EG	29-06-01	75/25	-40.5	-41	Not tested[11]		-40.5	-41
FCY-1Bio+ (R)	EG	25-12-01	75/25	Not tested[11]		Not tested[11]		-46	-51
ROMCHIM PROTECT SRL[10]									
ADD-PROTECT NG Type I	EG	26-06-01	60/40	-22	-8	Not tested[11]		-22	-8
ADD-PROTECT Type I	PG	27-06-01	70/30	-25.5	-14	Not tested[11]		-31	-24
Shaanxi Cleanway Aviation Chemical Co., Ltd									
Cleansurface I	*EG*	*25-06-07[13]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-40.5*	*-41*
Cleansurface I-BIO	*EG*	*22-05-02[9]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-37*	*-35*
Topan LLP[10]									
TOPAN TYPE I	*EG*	*24-07-13[9]*	*75/25*	*-35.5*	*-32*	*Not tested[11]*		*-42*	*-44*
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.									
Clearice-I	EG	29-06-01	60/40	Not tested[11]		Not tested[11]		-30	-22
Clearice-IB	EG	29-06-01	75/25	Not tested[11]		Not tested[11]		-43.5	-46

TABLE 56:
TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-2	PG	27-06-01	100/0	Not tested[11]		-27	-17	5 750 (a)	Not Available[19]	17 200 (a)	14 000 (h)
			75/25	Not tested[11]		-15	5	12 000 (c)	Not Available[19]	30 200 (c)	32 000 (h)
			50/50[9]	*Not tested[11]*		*-3*	*27*	*7 500 (a)*	*Not Available[19]*	*26 900 (c)*	*36 800 (h)*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.											
Cleanwing II	*PG*	*25-07-06[13]*	*100/0*	*Not tested[11]*		*-25*	*-13*	*4 650 (e)*	*4 500 (a)*	*13 500 (a)*	*11 100 (i)*
			75/25	*Not tested[11]*		*-15*	*5*	*9 450 (e)*	*10 000 (a)*	*14 600 (i)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-4.5*	*24*	*10 150 (e)*	*10 200 (a)*	*12 900 (i)*	*Not Available[19]*
Clariant Produkte (Deutschland) GmbH											
Safewing MP II FLIGHT	PG	26-06-01	100/0	Not tested[11]		-29	-20	3 340 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	12 900 (c)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	11 500 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Cryotech Deicing Technology											
Polar Guard® II	PG	27-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	9 750 (a)	38 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	80 (a)	Not Available[19]	48 000 (c)	Not Available[19]
ESSPO CHEMICALS D.O.O.											
Nordwing PG2	PG	27-06-01	100/0	Not tested[11]		-30	-22	11 450 (a)	9 500 (h)	20 500 (c)	18,100 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Kilfrost Limited											
ABC-K Plus	*PG*	*25-06-01[13]*	*100/0*	*Not tested[11]*		*-29*	*-20*	*2 850 (e)*	*2 640 (a)*	*13 400 (a)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*12 650 (e)*	*12 650 (c)*	*29 000 (c)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3.5*	*26*	*4 200 (e)*	*5 260 (a)*	*15 000 (a)*	*Not Available[19]*
Ice Clear II	PG	26-06-01	100/0	Not tested[11]		-28	-18	4 100 (a)	18 000 (m)	26 000 (c)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

TABLE 56 (CONT'D): TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
MKS DevO Chemicals											
COREICEPHOB TYPE II	PG	26-06-01	100/0	Not tested[11]		-27	-17	34 400 (i)	Not Available[19]	50 200 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Not tested[11]		-3.5	26	20 700 (i)	Not Available[19]	30 700 (i)	Not Available[19]
Newave Aerochemical Co. Ltd.											
FCY-2	PG	27-06-01	100/0	Not tested[11]		-28	-18	7 000 (e)	8 920 (a)	24 800 (c)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ROMCHIM PROTECT SRL[10]											
ADD-PROTECT NG Type II	*PG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*5 200 (a)*	*Not Available[19]*	*12 400 (a)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*8 250 (a)*	*Not Available[19]*	*43 800 (i)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3*	*27*	*5 850 (a)*	*Not Available[19]*	*38 900 (i)*	*Not Available[19]*
ADD-PROTECT Type II	*PG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*4 000 (a)*	*Not Available[19]*	*18 250 (a)*	*12 900 (i)*
			75/25	*Not tested[11]*		*-14*	*7*	*7 700 (a)*	*Not Available[19]*	*23 300 (c)*	*23 200 (i)*
			50/50	*Not tested[11]*		*-3*	*27*	*14 500 (a)*	*Not Available[19]*	*31 400 (c)*	*22 600 (i)*

TABLE 57:
TYPE III FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]						AS 9968 Viscosity[7] (mPa.s)			
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
AllClear Systems LLC													
AeroClear MAX	EG	27-06-01	100/0	-16	3	-20.5	-5	-35	-31	7 800 (o)	Not Available[19]	15 000 (o)	Not Available[19]
			75/25	Dilution Not Applicable						Dilution Not Applicable			
			50/50	Dilution Not Applicable						Dilution Not Applicable			

TABLE 58:
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-49	PG	26-06-01	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	25 900 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AFLRUS LLC											
Green Flo Type 4	EG	26-11-25	100/0	Not tested[11]		-30	-22	6 550 (a)	Not Available[19]	13 400 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ALAB International											
PROFLIGHT EG4	*EG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*1 840 (a)*	*Not Available[19]*	*6 180 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
PROFLIGHT PG4	PG	26-06-01	100/0	Not tested[11]		-29	-20	10 600 (a)	Not Available[19]	17 800 (h)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AllClear Systems LLC											
Clear IV Flight	PG	27-06-01	100/0	Not tested[11]		-23	-9	22 300 (m)	21 900 (l)	31 700 (m)	29 400 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ClearWing EG	EG	27-06-01	100/0	Not tested[11]		-29	-20	35 500 (n)	13 350 (a)	51 800 (k)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ASGlobal											
4Flite EG	EG	26-09-24	100/0	Not tested[11]		-30	-22	6 600 (a)	Not Available[19]	17 300 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
4Flite PG	*PG*	*25-08-04[13]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*26 100 (c)*	*Not Available[19]*	*36 500 (c)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

TABLE 58 (CONT'D): TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
AVIAFLUID International Ltd											
AVIAFlight EG	*EG*	*22-04-28[9]*	*100/0*	*Not tested[11]*		*-31*	*-24*	*5 600 (a)*	*Not Available[19]*	*12 800 (a)*	*11 200 (i)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
AVIAFlight PG	*PG*	*23-07-01[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*28 600 (c)*	*Not Available[19]*	*35 900 (c)*	*22 200 (i)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
CHEMCO Inc.											
ChemR EG IV	*EG*	*23-04-07[9]*	*100/0*	*Not tested[11]*		*-27*	*-17*	*46 400 (m)*	*19 450 (c)*	*67 000 (m)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
ChemR Nordik IV	EG	27-06-01	100/0	Not tested[11]		-29	-20	60 800 (n)	43 100 (c)	87 100 (n)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Chongqing Joba Chemical Co.,Ltd											
FW-IV	EG	25-11-01	100/0	Not tested[11]		-29	-20	32 600 (j)	Not Available[19]	66 200 (j)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Clariant Produkte (Deutschland) GmbH											
Safewing MP IV LAUNCH	PG	26-06-01	100/0	Not tested[11]		-28.5	-19	7 550 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	18 000 (a)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	17 800 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Safewing MP IV LAUNCH PLUS	PG	27-06-01	100/0	Not tested[11]		-29	-20	8 700 (p)	8 450 (a)	21 000 (q)	21 000 (c)
			75/25	Not tested[11]		-14	7	18 800 (q)	17 200 (c)	51 600 (q)	51 600 (c)
			50/50	Not tested[11]		-3.5	26	9 700 (p)	12 150 (a)	65 700 (q)	65 700 (c)

TABLE 58 (CONT'D): TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
Cryotech Deicing Technology											
Polar Guard® Advance	PG	27-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	9 750 (a)	38 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	80 (a)	Not Available[19]	48 000 (c)	Not Available[19]
Polar Guard® Xtend	PG	27-06-01	100/0	Not tested[11]		-29	-20	6 000 (f)	6 350 (a)	23 500 (f)	23 200 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Dow Inc.											
UCAR ENDURANCE™ EG106 ADF/AAF	EG	27-06-01	100/0	Not tested[11]		-29	-20	24 850 (j)	2 230 (a)	47 800 (j)	5 900 (a)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
UCAR™ FLIGHTGUARD™ AD-49	PG	27-06-01	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	25 900 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ESSPO CHEMICALS D.O.O.											
Nordwing PG4	PG	27-06-01	100/0	Not tested[11]		-30	-22	11 550 (a)	9 800 (h)	20 000 (c)	20 300 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Inland Technologies Inc.											
ECO-SHIELD®	*PG*	*24-10-28[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*11 050 (a)*	*Not Available[19]*	*25 800 (i)*	*34 500 (c)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
JSC RCP Nordix											
Defrost ECO 4	*PG*	*23-08-12[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*9 800 (h)*	*12 350 (a)*	*14 800 (i)*	*17 340 (a)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Defrost NORTH 4	*EG*	*23-06-01[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*2 500 (a)*	*Not Available[19]*	*5 350 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

TABLE 58 (CONT'D): TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
								Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
				°C	°F	°C	°F				
Kilfrost Limited											
ABC-S Plus	*PG*	*25-06-15[13]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*17 900 (e)*	*17 900 (c)*	*43 800 (c)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*18 300 (e)*	*18 300 (c)*	*58 000 (c)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3.5*	*26*	*7 500 (e)*	*7 500 (a)*	*27 000 (c)*	*Not Available[19]*
MKS DevO Chemicals											
COREICEPHOB TYPE-IV PG	PG	26-06-01	100/0	Not tested[11]		-29	-20	50 200 (i)	Not Available[19]	60 900 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Newave Aerochemical Co. Ltd.											
FCY 9311	PG	26-06-01	100/0	Not tested[11]		-29.5	-21	14 100 (c)	Not Available[19]	27 600 (c)	25 700 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV	EG	26-06-01	100/0	Not tested[11]		-29	-20	24 800 (g)	6 300 (a)	43 700 (k)	78 000 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV PLUS	EG	27-06-01	100/0	Not tested[11]		-29	-20	27 400 (k)	Not Available[19]	66 900 (k)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Shaanxi Cleanway Aviation Chemical Co., Ltd											
Cleansurface IV	PG	25-11-28	100/0	Not tested[11]		-30	-22	16 750 (a)	14 800 (h)	29 700 (d)	21 100 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.											
Clearice-IV	EG	26-11-11	100/0	Not tested[11]		-29	-20	35 600 (d)	Not Available[19]	75 100 (d)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

CAUTIONS AND NOTES FOR TABLES 55, 56, 57, 58

CAUTIONS

- These tables list fluids that have been tested with respect to endurance time performance (Holdover Times), anti-icing performance (Water Spray Endurance Testing/High Humidity Endurance Testing) and aerodynamic acceptance (Type I: SAE ARP6207 §3.4.1, AMS1424 §3.5.2 and §3.5.3; Type II/ III/ IV: SAE ARP5718 §FOREWARD, AMS1428 §3.2.4 and §3.2.5) only. These tests were conducted by APS Aviation Inc. (www.apsaviation.ca) and Anti-icing Materials International Laboratory (AMIL) (www.uqac.ca/amil). The end user is responsible for contacting the fluid manufacturer to confirm all other SAE AMS1424/1428 technical requirement tests, such as fluid stability, toxicity, materials compatibility, etc. have been conducted. These technical requirement tests are typically conducted by Scientific Material International (SMI) (www.smiinc.com) and AMIL, or any acceptable source.
- LOUT data provided in these tables is based strictly on the manufacturer's data; the end user is responsible for verifying the validity of this data.
- Type I fluids supplied in concentrated form must not be used in that form and must be diluted.

NOTES

1 PG = conventional glycol (propylene glycol); EG = conventional glycol (ethylene glycol); DEG = conventional glycol (diethylene glycol); NCG = non-conventional glycol (organic non-ionic diols and triols, e.g. 1,3-propanediol, glycerine) and mixtures of non-conventional glycol and conventional glycol; NG = non-glycol (e.g. organic salts) and mixtures of non-glycol and glycol.

2 Expiry date is the earlier expiry date of the Aerodynamic Test(s) or Water Spray Endurance Test. Fluids that are tested after the issuance of this list will appear in a later update.

3 The values in this table were determined using test results from pre-production fluid samples when available. In some cases, the fluid manufacturer requested the publication of a more conservative value than the pre-production test value. The lowest operational use temperature (LOUT) for a given fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer (Type I = 10°C/18°F; Type II/III/IV = 7°C/13°F).

Note: LOUTs are rounded to the nearest half degree Celsius and the values in degrees Fahrenheit are calculated to the nearest whole degree.

4 The LOUT for Type I fluids that are intended to be diluted is derived from a dilution that provides the lowest operational use temperature. For other Type I dilutions, determine the freezing point of the fluid and add a 10°C freezing point buffer, as a dilution will usually yield a higher and more restrictive operational use temperature. Consult the fluid manufacturer or fluid documentation for further clarification and guidance on establishing the appropriate operational use temperature of a diluted fluid.

5 Type I concentrate fluids have also been tested at 50/50 (glycol/water) dilution.

6 If uncertain whether the aircraft to be treated conforms to the low speed, the middle speed, or the high speed aerodynamic test, consult the aircraft manufacturer. The aerodynamic test is defined in SAE AS5900 (latest version).

7 The Alternate viscosity method should only be used for field verification and auditing purposes; when in doubt as to which method is appropriate, use the manufacturer method. Viscosity measurement methods are indicated as letters (in parentheses) beside each viscosity value. Details of each measurement method are shown in Table 59 on the following page. The exact measurement method (spindle, container, fluid volume, temperature, speed, duration) must be used to compare the viscosity of a sample to a viscosity given in this table.

8 The lowest on-wing viscosity (LOWV), and highest on-wing viscosity (HOWV) values in this table are those of the fluids provided by the manufacturers for holdover time testing, and initial qualification aerodynamic testing. For the holdover times and lowest operation use temperature to be valid, the viscosity of the fluid on the wing shall not be lower than the LOWV value in this table and higher than the HOWV value in this table. The user should periodically ensure that the viscosity of a fluid sample taken from the wing surface complies with these limits.

9 Aerodynamic Performance and Anti-Icing Performance test data has expired; fluids listed in italics will be removed from this listing four years after expiry.

10 Manufacturer has not provided fluid information as required in SAE ARP5718B; fluid may be removed from this listing in subsequent revisions.

11 Manufacturer has indicated fluid was not tested.

12 Dow UCAR™ PG ADF Concentrate, sold under the product name DeiceX PG ADF Concentrate, qualified from 2023-06-15.

13 Currently in the test/re-test process. Contact the fluid manufacturer for latest information (see Appendix C for latest available contact information).

14 Fluid was not retested for low speed aerodynamics. This data will be removed four years after the expiry of the last low speed test.

15 For UCAR™ ADF XL54, refer to primary site qualification of UCAR™ ADF Concentrate.

16 For UCAR™ PG ADF Dilute 55/45, refer to primary site qualification of UCAR™ PG ADF Concentrate.

17 Dow UCAR™ ADF Concentrate, sold under the product name Inland ADF Concentrate, qualified from 2015-09-04.

18 Refer to preproduction qualification of SafeTemp® ES Plus submitted by HOC Industries, qualified from 2017-11-20.

19 Manufacturer has not provided an alternate method for measuring viscosity. Please use the Manufacturer Method.

TABLE 59:
VISCOSITY MEASUREMENT METHODS FOR TYPE II, III, AND IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

Method	Brookfield Spindle*	Container	Fluid Volume	Temp.**	Speed	Duration
a	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20°C	0.3 rpm	10.0 minutes
b	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20°C	0.3 rpm	33.3 minutes
c	LV2-disc (with guard leg)	600 mL low form (Griffin) beaker	425 mL***	20°C	0.3 rpm	10.0 minutes
d	LV2-disc (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20°C	0.3 rpm	10.0 minutes
e	LV2-disc (with guard leg)	150 mL tall form (Berzelius) beaker	135 mL***	20°C	0.3 rpm	10.0 minutes
f	SC4-34/13R	small sample adapter	10 mL	20°C	0.3 rpm	10.0 minutes
g	SC4-34/13R	small sample adapter	10 mL	0°C	0.3 rpm	30.0 minutes
h	SC4-31/13R	small sample adapter	10 mL	20°C	0.3 rpm	10.0 minutes
i	SC4-31/13R	small sample adapter	10 mL	20°C	0.3 rpm	30.0 minutes
j	SC4-31/13R	small sample adapter	10 mL	0°C	0.3 rpm	10.0 minutes
k	SC4-31/13R	small sample adapter	10 mL	0°C	0.3 rpm	30.0 minutes
l	SC4-31/13R	small sample adapter	9 mL	20°C	0.3 rpm	15.0 minutes
m	SC4-31/13R	small sample adapter	9 mL	0°C	0.3 rpm	10.0 minutes
n	SC4-31/13R	small sample adapter	9 mL	0°C	0.3 rpm	30.0 minutes
o	SC4-31/13R	small sample adapter	9 mL	0°C	0.3 rpm	65.0 minutes
p	LV1	big sample adapter	55 mL	20°C	0.3 rpm	10.0 minutes
q	LV2-disc	big sample adapter	60 mL	20°C	0.3 rpm	10.0 minutes

* Spindle must be attached to a Brookfield viscometer model equipped with an LV spring.

** Sample temperature will affect readings; ensure sufficient time is allowed for sample to reach thermal equilibrium before starting test. Use of a cooling bath strongly recommended.

*** If necessary, adjust fluid volume to ensure fluid is level with notch on the spindle shaft.

TABLE 60: GUIDELINES FOR THE APPLICATION OF SAE TYPE I FLUID

Outside Air Temperature (OAT)[1]	One-Step Procedure Deicing Only[2]	One-Step Procedure Anti-icing Only[3]	Two-Step Procedure	
			First Step: Deicing[2]	Second Step: Anti-icing[4,5]
0°C (32°F) and above	Heated Type I fluid/water mixture with a freezing point of at least 10°C (18°F) below OAT	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle	Heated water or a heated fluid/water mixture	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT
Below 0°C (32°F)			Heated fluid/water mixture with a freezing point at OAT or below	

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. The LOUT for a given Type I fluid is the higher (warmer) of:
   a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
   b) The actual freezing point of the fluid plus its freezing point buffer of 10°C (18°F).

2 When deicing, there is no minimum fluid quantity required, use as much fluid as necessary to ensure the aircraft is free of frozen contamination. A fluid temperature of at least 60°C (140°F) at the nozzle is desirable. Deicing is complete after all contamination is removed. There is no holdover time for a "deicing only" operation.

3 One-step anti-icing only procedure is only possible on a clean aircraft. If deicing and anti-icing are required, a two-step procedure should be followed.

4 To be applied before first step fluid freezes, typically within 3 minutes. This time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

5 When anti-icing, a minimum quantity of 1 litre/m^2 (~2 gal./100 sq. ft.) of Type I fluid mixture heated to at least 60°C (140°F). This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times.

CAUTIONS

- For heated fluids, the upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage, etc. Consult the appropriate guidance (HOT Tables and TP 14052) for the contaminant in question.

TABLE 61: GUIDELINES FOR THE APPLICATION OF SAE TYPE II AND IV FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	One-Step Procedure Deicing Only[2]	One-Step Procedure Anti-icing Only[3]	Two-Step Procedure	
			First Step: Deicing[2]	Second Step: Anti-icing[4]
0°C (32°F) and above	Heated Type II or IV fluid/water mixture	100/0, 75/25, or 50/50 Heated or Unheated Type II or IV fluid/water mixture	Heated water or a heated fluid/water mixture	100/0, 75/25, or 50/50 Heated or Unheated Type II or IV fluid/water mixture
Below 0°C (32°F) to -3°C (27°F)		100/0, 75/25, or 50/50 Heated or Unheated Type II or IV fluid/water mixture	Heated fluid/water mixture with a freezing point at OAT or below	100/0, 75/25, or 50/50 Heated or Unheated Type II or IV fluid/water mixture
Below -3°C (27°F) to -14°C (7°F)		100/0 or 75/25 Heated or Unheated Type II or IV fluid/water mixture		100/0 or 75/25 Heated or Unheated Type II or IV fluid/water mixture
Below -14°C (7°F)		100/0 Heated or Unheated Type II or IV fluid		100/0 Heated or Unheated Type II or IV fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consider the use of Type I/III fluid when Type II/IV fluid cannot be used due to LOUT limitations (see Table 56 and Table 58). The LOUT for a given Type II/IV fluid is the higher (warmer) of:

   a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
   b) The actual freezing point of the fluid plus its freezing point buffer of 7°C (13°F).

   Some diluted fluids have LOUTs that are below the coldest temperature for which holdover times are provided. Holdover times do not apply when anti-icing at temperatures for which holdover times are not provided.

2 When deicing, there is no minimum fluid quantity required, use as much fluid as necessary to ensure the aircraft is free of frozen contamination. A fluid temperature of at least 60°C (140°F) at the nozzle is desirable. Deicing is complete after all contamination is removed. There is no holdover time for a “deicing only” operation.

3 One-step anti-icing only procedure is only possible on a clean aircraft. If deicing and anti-icing are required, a two-step procedure should be followed.

4 To be applied before first step fluid freezes, typically within 3 minutes. This time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, in colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- For heated fluids, the upper temperature limit shall not exceed fluid and aircraft manufacturers’ recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage, etc. Consult the appropriate guidance (HOT Tables and TP 14052) for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.

TABLE 62: GUIDELINES FOR THE APPLICATION OF UNHEATED SAE TYPE III FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	One-Step Procedure Deicing Only[2]	One-Step Procedure Anti-icing Only[3]	Two-Step Procedure	
			First Step: Deicing[2]	Second Step: Anti-icing[4]
0°C (32°F) and above	Heated Type III fluid/water mixture	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated water or a heated fluid/water mixture	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below 0°C (32°F) to -3°C (27°F)		100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below -3°C (27°F) to -10°C (14°F)		100/0 or 75/25 Unheated Type III fluid/water mixture		100/0 or 75/25 Unheated Type III fluid/water mixture
Below -10°C (14°F)		100/0 Unheated Type III fluid/water mixture		100/0 Unheated Type III fluid/water mixture

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consider the use of Type I when Type III fluid cannot be used due to LOUT limitations (see Table 57). The LOUT for a given Type III fluid is the higher (warmer) of:

   a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
   b) The actual freezing point of the fluid plus its freezing point buffer of 7°C (13°F).

   Some diluted fluids have LOUTs that are below the coldest temperature for which holdover times are provided. Holdover times do not apply when anti-icing at temperatures for which holdover times are not provided.

2 When deicing, there is no minimum fluid quantity required, use as much fluid as necessary to ensure the aircraft is free of frozen contamination. Deicing is complete after all contamination is removed. There is no holdover time for a “deicing only” operation.

3 One-step anti-icing only procedure is only possible on a clean aircraft. If deicing and anti-icing are required, a two-step procedure should be followed.

4 To be applied before first step fluid freezes, typically within 3 minutes. This time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, in colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- For heated fluids, a fluid temperature not less than 60°C (140°F) at the nozzle is desirable. Upper temperature limit shall not exceed fluid and aircraft manufacturers’ recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage, etc. Consult the appropriate guidance (HOT Tables and TP 14052) for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type III is not to be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.

APPENDIX A:
ADJUSTED HOLDOVER TIME (HOT) GUIDELINES

These tables are for use when flaps/slats are deployed prior to de/anti-icing. Holdover and allowance times have been adjusted to 76 percent of standard times. Standard holdover and allowance times can be used if flaps and slats are deployed as close to departure as safety allows.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED HOLDOVER TIME (HOT) GUIDELINES FOR WINTER 2025-2026

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Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED ACTIVE FROST HOT GUIDELINES
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-1: ADJUSTED ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I Aluminum	Type I Composite
-1°C and above (30°F and above)	0:34	0:27
below -1 to -3°C (below 30 to 27°F)		
below -3 to -10°C (below 27 to 14°F)		
below -10 to -14°C (below 14 to 7°F)		
below -14 to -21°C (below 7 to -6°F)		
below -21 to -25°C (below -6 to -13°F)		
below -25°C (below -13°F)		

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1°C and above (30°F and above)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:31	0:23	2:17
below -1 to -3°C (below 30 to 27°F)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:08	0:23	2:17
below -3 to -10°C (below 27 to 14°F)	100/0	6:05	1:31	7:36
	75/25	3:02	0:46	3:48
below -10 to -14°C (below 14 to 7°F)	100/0	4:34	1:31	4:34
	75/25	0:46	0:46	0:46
below -14 to -21°C (below 7 to -6°F)	100/0	2:17	1:31	4:34
below -21 to -25°C (below -6 to -13°F)	100/0	1:31	1:31	3:02
below -25°C (below -13°F)	100/0	No Holdover Time Guidelines Exist		

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 55 - Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-4.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED HOT GUIDELINES FOR SAE TYPE I FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

TABLE ADJ-2: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM[1]

Outside Air Temperature[2,3]	Freezing Fog, Freezing Mist[4], or Ice Crystals[5]	Snow mixed with Freezing Fog[6]	Very Light Snow, Snow Grains or Snow Pellets[7,8]	Light Snow, Snow Grains or Snow Pellets[7,8]	Moderate Snow, Snow Grains or Snow Pellets[7,8]	Freezing Drizzle[9]	Light Freezing Rain	Moderate Snow mixed with Rain[10,11]	Rain on Cold-Soaked Wing[11]	Other[12]
-3°C and above (27°F and above)	0:08 - 0:13	0:05 - 0:08	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:07 - 0:10	0:03 - 0:05	0:02 - 0:02	0:02 - 0:04	
below -3 to -6°C (below 27 to 21°F)	0:06 - 0:10	0:04 - 0:06	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:03 - 0:05	CAUTION: No holdover time guidelines exist		
below -6 to -10°C (below 21 to 14°F)	0:05 - 0:08	0:03 - 0:05	0:08 - 0:10	0:05 - 0:08	0:03 - 0:05	0:03 - 0:05	0:02 - 0:04			
below -10°C (below 14°F)	0:04 - 0:07	0:02 - 0:03	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times apply to aircraft with critical surfaces constructed predominantly or entirely of aluminum materials that have demonstrated satisfactory use of these holdover times. Takeoff after the longest applicable holdover time has been exceeded is not permitted for Type I fluids.
2 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
5 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
6 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
7 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
11 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
12 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

TABLE ADJ-3: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES[1]

Outside Air Temperature[2,3]	Freezing Fog, Freezing Mist[4], or Ice Crystals[5]	Snow mixed with Freezing Fog[6]	Very Light Snow, Snow Grains or Snow Pellets[7,8]	Light Snow, Snow Grains or Snow Pellets[7,8]	Moderate Snow, Snow Grains or Snow Pellets[7,8]	Freezing Drizzle[9]	Light Freezing Rain	Moderate Snow mixed with Rain[10,11]	Rain on Cold-Soaked Wing[11]	Other[12]
-3°C and above (27°F and above)	0:07 - 0:12	0:02 - 0:05	0:09 - 0:11	0:05 - 0:09	0:02 - 0:05	0:06 - 0:10	0:03 - 0:05	0:01 - 0:01	0:01 - 0:04	
below -3 to -6°C (below 27 to 21°F)	0:05 - 0:06	0:02 - 0:04	0:08 - 0:10	0:04 - 0:08	0:02 - 0:04	0:04 - 0:07	0:03 - 0:05	CAUTION: No holdover time guidelines exist		
below -6 to -10°C (below 21 to 14°F)	0:03 - 0:06	0:02 - 0:04	0:07 - 0:09	0:04 - 0:07	0:02 - 0:04	0:03 - 0:05	0:02 - 0:04			
below -10°C (below 14°F)	0:03 - 0:05	0:02 - 0:03	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times apply to newer aircraft with critical surfaces constructed predominantly or entirely of composite materials. Takeoff after the longest applicable holdover time has been exceeded is not permitted for Type I fluids.
2 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10°C (18°F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
5 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
6 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
7 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
11 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
12 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED HOT GUIDELINES FOR SAE TYPE II FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE ADJ-4: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:42 - 1:24	0:15 - 0:30	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:04 - 0:04	0:05 - 0:34	
	75/25	0:30 - 0:53	0:11 - 0:19	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:02 - 0:02	0:03 - 0:19	
	50/50	0:11 - 0:23	0:04 - 0:08	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07			
below -3 to -8°C (below 27 to 18°F)	100/0	0:23 - 0:34	0:11 - 0:23	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15			
	75/25	0:19 - 0:42	0:07 - 0:11	0:08 - 0:19	0:11 - 0:23	0:07 - 0:15			
below -8 to -14°C (below 18 to 7°F)	100/0	0:23 - 0:34	0:08 - 0:19	0:11 - 0:23	0:15 - 0:34[12]	0:11 - 0:15[12]			
	75/25	0:19 - 0:42	0:05 - 0:11	0:07 - 0:15	0:11 - 0:23[12]	0:07 - 0:15[12]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:15	0:01 - 0:04	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:15	0:00 - 0:02	0:01 - 0:02					
below -25°C (below -13°F)	100/0	0:11 - 0:15	0:00 - 0:00	0:00 - 0:01					

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 56). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
12 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-5: ADJUSTED TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:01 - 2:17	0:23 - 0:42	1:50 - 2:00	0:57 - 1:50	0:30 - 0:57	0:30 - 1:16	0:23 - 0:34	0:05 - 0:05	0:07 - 1:05	
	75/25	0:57 - 1:05	0:15 - 0:30	1:20 - 1:39	0:42 - 1:20	0:19 - 0:42	0:27 - 0:49	0:15 - 0:23	0:02 - 0:02	0:03 - 0:38	
	50/50	0:11 - 0:23	0:04 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:34 - 1:54	0:19 - 0:34	1:31 - 1:50	0:46 - 1:31	0:23 - 0:46	0:19 - 0:53	0:15 - 0:23			
	75/25	0:27 - 1:27	0:15 - 0:27	1:16 - 1:35	0:38 - 1:16	0:19 - 0:38	0:11 - 0:42	0:15 - 0:27			
below -8 to -14°C (below 18 to 7°F)	100/0	0:34 - 1:54	0:15 - 0:30	1:20 - 1:35	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53[11]	0:15 - 0:23[11]			
	75/25	0:27 - 1:27	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:11 - 0:42[11]	0:15 - 0:27[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:30	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:30	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -27°C (below -13 to -17°F)	100/0	0:11 - 0:30	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-6: ADJUSTED TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:42 - 1:24	0:15 - 0:30	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:05 - 0:05	0:08 - 0:42	
	75/25	0:38 - 1:01	0:15 - 0:27	1:01 - 1:16	0:34 - 1:01	0:19 - 0:34	0:27 - 0:46	0:15 - 0:23	0:04 - 0:04	0:05 - 0:38	
	50/50	0:27 - 0:46	0:08 - 0:15	0:38 - 0:49	0:19 - 0:38	0:11 - 0:19	0:15 - 0:30	0:08 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:34 - 1:24	0:11 - 0:23	1:01 - 1:12	0:30 - 1:01	0:19 - 0:30	0:23 - 0:42	0:15 - 0:19			
	75/25	0:30 - 1:20	0:15 - 0:27	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30	0:15 - 0:19			
below -8 to -14°C (below 18 to 7°F)	100/0	0:34 - 1:24	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:15 - 0:27	0:23 - 0:42[11]	0:15 - 0:19[11]			
	75/25	0:30 - 1:20	0:15 - 0:27	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30[11]	0:15 - 0:19[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:38	0:07 - 0:15	0:34 - 0:46	0:19 - 0:34	0:11 - 0:19					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:38	0:04 - 0:08	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-7: ADJUSTED TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:40 - 3:02	0:34 - 0:53	1:58 - 2:00	1:12 - 1:58	0:46 - 1:12	1:01 - 1:31	0:34 - 1:05	0:06 - 0:06	0:08 - 1:08	
	75/25	1:24 - 2:05	0:23 - 0:46	1:58 - 2:00	1:01 - 1:58	0:30 - 1:01	0:53 - 1:08	0:23 - 0:42	0:03 - 0:03	0:05 - 0:38	
	50/50	0:42 - 1:20	0:07 - 0:15	0:34 - 0:42	0:19 - 0:34	0:08 - 0:19	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:20	0:27 - 0:46	1:35 - 1:54	0:57 - 1:35	0:34 - 0:57	0:27 - 1:08	0:19 - 0:34			
	75/25	0:19 - 0:49	0:15 - 0:30	1:20 - 1:39	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53	0:15 - 0:27			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:20	0:23 - 0:38	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:27 - 1:08[11]	0:19 - 0:34[11]			
	75/25	0:19 - 0:49	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:53[11]	0:15 - 0:27[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:38	0:05 - 0:15	0:53 - 1:16	0:19 - 0:53	0:06 - 0:19					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:38	0:02 - 0:05	0:23 - 0:30	0:08 - 0:23	0:02 - 0:08					
below -25 to -29°C (below -13 to -20°F)	100/0	0:23 - 0:38	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-8: ADJUSTED TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:09 - 3:02	0:38 - 1:05	2:00 - 2:00	1:27 - 2:00	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:08 - 0:08	0:11 - 1:31	
	75/25	1:54 - 3:02	0:23 - 0:49	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:05 - 0:05	0:07 - 1:16	
	50/50	0:38 - 1:05	0:05 - 0:15	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:54	0:27 - 0:49	1:50 - 2:00	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34			
	75/25	0:30 - 1:08	0:19 - 0:38	1:46 - 2:00	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:54	0:23 - 0:38	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[11]	0:27 - 0:34[11]			
	75/25	0:30 - 1:08	0:15 - 0:34	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[11]	0:27 - 0:34[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:38	0:06 - 0:19	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:38	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11					
below -25 to -30.5°C (below -13 to -23°F)	100/0	0:19 - 0:38	0:02 - 0:04	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-9: ADJUSTED TYPE II HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:16 - 2:24	0:23 - 0:46	1:58 - 2:00	1:01 - 1:58	0:30 - 1:01	0:49 - 1:24	0:38 - 0:49	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:49 - 1:46	0:19 - 0:34	1:31 - 1:54	0:46 - 1:31	0:23 - 0:46	0:38 - 1:08	0:19 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:49 - 1:46	0:15 - 0:30	1:20 - 1:39	0:38 - 1:20	0:19 - 0:38	0:38 - 1:08[11]	0:19 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:27	0:08 - 0:19	0:57 - 1:16	0:23 - 0:57	0:11 - 0:23					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:27	0:05 - 0:11	0:38 - 0:49	0:15 - 0:38	0:06 - 0:15					
below -25 to -30°C (below -13 to -22°F)	100/0	0:15 - 0:23	0:02 - 0:05	0:19 - 0:23	0:07 - 0:19	0:03 - 0:07					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-10: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:43 - 2:51	0:34 - 0:57	0:46 - 1:16	1:24 - 1:31	0:46 - 1:05	0:11 - 0:11	0:15 - 1:31	
	75/25	1:16 - 1:54	0:19 - 0:38	0:27 - 0:53	1:05 - 1:31	0:38 - 0:53	0:08 - 0:08	0:11 - 1:31	
	50/50	0:27 - 0:49	0:04 - 0:08	0:05 - 0:11	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:23 - 0:49	0:30 - 0:53	0:42 - 1:08	0:19 - 0:46	0:11 - 0:27			
	75/25	0:19 - 1:05	0:19 - 0:38	0:27 - 0:49	0:15 - 0:42	0:07 - 0:23			
below -8 to -14°C (below 18 to 7°F)	100/0	0:23 - 0:49	0:30 - 0:49	0:38 - 1:05	0:19 - 0:46[11]	0:11 - 0:27[11]			
	75/25	0:19 - 1:05	0:19 - 0:38	0:27 - 0:49	0:15 - 0:42[11]	0:07 - 0:23[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:42	0:01 - 0:04	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:42	0:00 - 0:02	0:01 - 0:02					
below -25 to -29°C (below -13 to -20°F)	100/0	0:23 - 0:42	0:00 - 0:00	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-11: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:05 - 1:50	0:23 - 0:46	1:50 - 2:00	1:01 - 1:50	0:30 - 1:01	0:46 - 1:12	0:30 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:49 - 1:58	0:23 - 0:38	1:39 - 1:58	0:53 - 1:39	0:30 - 0:53	0:23 - 0:57	0:27 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:49 - 1:58	0:19 - 0:38	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:23 - 0:57[11]	0:27 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 0:34	0:08 - 0:15	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 0:34	0:05 - 0:08	0:23 - 0:27	0:11 - 0:23	0:06 - 0:11					
below -25 to -28°C (below -13 to -18°F)	100/0	0:27 - 0:34	0:04 - 0:07	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-12: ADJUSTED TYPE II HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:27 - 2:05	0:23 - 0:46	1:58 - 2:00	1:05 - 1:58	0:30 - 1:05	0:53 - 1:31	0:34 - 0:46	0:07 - 0:07	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	0:49 - 1:20	0:11 - 0:27	1:12 - 1:27	0:34 - 1:12	0:19 - 0:34	0:38 - 0:57	0:19 - 0:23	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:34 - 1:05	0:19 - 0:34	1:24 - 1:43	0:46 - 1:24	0:23 - 0:46	0:23 - 0:53	0:19 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:34 - 1:05	0:15 - 0:27	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:23 - 0:53[11]	0:19 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:19	0:06 - 0:11	0:27 - 0:30	0:15 - 0:27	0:08 - 0:15					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:19	0:02 - 0:04	0:11 - 0:11	0:05 - 0:11	0:03 - 0:05					
below -25 to -27°C (below -13 to -17°F)	100/0	0:11 - 0:19	0:02 - 0:03	0:08 - 0:08	0:04 - 0:08	0:02 - 0:04					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-13: ADJUSTED TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:57 - 1:50	0:19 - 0:30	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:05 - 0:05	0:06 - 0:34	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:34 - 1:08	0:11 - 0:23	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:34 - 1:08	0:08 - 0:19	0:11 - 0:23	0:15 - 0:34[11]	0:11 - 0:15[11]			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:27	0:01 - 0:04	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:27	0:00 - 0:02	0:01 - 0:02					
below -25 to -28°C (below -13 to -18°F)	100/0	0:19 - 0:27	0:00 - 0:00	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-14: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:53 - 1:50	0:19 - 0:42	1:58 - 2:00	0:53 - 1:58	0:27 - 0:53	0:38 - 1:01	0:27 - 0:38	0:04 - 0:04	0:05 - 0:53	
	75/25	0:46 - 1:24	0:15 - 0:30	1:27 - 1:50	0:42 - 1:27	0:19 - 0:42	0:30 - 0:57	0:19 - 0:30	0:04 - 0:04	0:05 - 0:42	
	50/50	0:19 - 0:42	0:08 - 0:15	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23	0:15 - 0:27	0:08 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:12	0:15 - 0:30	1:24 - 1:46	0:38 - 1:24	0:19 - 0:38	0:27 - 0:53	0:19 - 0:27			
	75/25	0:42 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30	0:19 - 0:49	0:15 - 0:23			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:12	0:11 - 0:23	1:05 - 1:24	0:30 - 1:05	0:15 - 0:30	0:27 - 0:53[11]	0:19 - 0:27[11]			
	75/25	0:42 - 1:05	0:08 - 0:19	0:49 - 1:05	0:23 - 0:49	0:11 - 0:23	0:19 - 0:49[11]	0:15 - 0:23[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:15	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:15	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -28°C (below -13 to -18°F)	100/0	0:11 - 0:15	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-15: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:16 - 2:40	0:15 - 0:34	1:27 - 1:50	0:46 - 1:27	0:23 - 0:46	0:30 - 1:12	0:19 - 0:34	0:05 - 0:05	0:07 - 0:38	
	75/25	0:30 - 0:53	0:11 - 0:19	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:03 - 0:03	0:04 - 0:19	
	50/50	0:15 - 0:27	0:05 - 0:11	0:23 - 0:27	0:11 - 0:23	0:07 - 0:11	0:08 - 0:23	0:06 - 0:08	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:23 - 0:34	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:38	0:15 - 0:23			
	75/25	0:23 - 0:42	0:07 - 0:11	0:30 - 0:38	0:19 - 0:30	0:08 - 0:19	0:15 - 0:23	0:11 - 0:15			
below -8 to -14°C (below 18 to 7°F)	100/0	0:23 - 0:34	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27	0:19 - 0:38[11]	0:15 - 0:23[11]			
	75/25	0:23 - 0:42	0:05 - 0:11	0:27 - 0:30	0:15 - 0:27	0:07 - 0:15	0:15 - 0:23[11]	0:11 - 0:15[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:19	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:19	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -28°C (below -13 to -18°F)	100/0	0:11 - 0:19	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED HOT GUIDELINES FOR SAE TYPE III FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.

TABLE ADJ-16: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10°C (below 27 to 14°F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -16°C (below 14 to 3°F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

TABLE ADJ-17: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10°C (below 27 to 14°F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -20.5°C (below 14 to -5°F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

TABLE ADJ-18: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10°C (below 27 to 14°F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -25°C (below 14 to -13°F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					
below -25 to -35°C (below -13 to -31°F)	100/0	0:19 - 0:46	0:05 - 0:12	0:34 - 0:46	0:15 - 0:34	0:08 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-50 provides adjusted allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

ADJUSTED HOT GUIDELINES FOR SAE TYPE IV FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The only acceptable decision-making criterion, for takeoff without a pre-takeoff contamination inspection, is the shorter time within the applicable table cell.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates, or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE ADJ-19: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3°C and above (27°F and above)	100/0	0:57 - 1:43	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:27 - 0:53	0:11 - 0:23	0:05 - 0:05	0:06 - 0:49	
	75/25	1:05 - 2:02	0:23 - 0:42	1:35 - 1:50	0:57 - 1:35	0:30 - 0:57	0:46 - 1:01	0:23 - 0:38	0:05 - 0:05	0:07 - 1:01	
	50/50	0:23 - 0:42	0:05 - 0:15	0:46 - 0:53	0:19 - 0:46	0:08 - 0:19	0:11 - 0:30	0:07 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:11 - 0:27	0:15 - 0:27	1:12 - 1:31	0:34 - 1:12	0:19 - 0:34	0:19 - 0:46	0:15 - 0:19			
	75/25	0:30 - 1:01	0:19 - 0:38	1:24 - 1:39	0:49 - 1:24	0:23 - 0:49	0:15 - 0:49	0:11 - 0:19			
below -8 to -14°C (below 18 to 7°F)	100/0	0:11 - 0:27	0:11 - 0:23	1:05 - 1:24	0:34 - 1:05	0:15 - 0:34	0:19 - 0:46[12]	0:15 - 0:19[12]			
	75/25	0:30 - 1:01	0:15 - 0:34	1:20 - 1:31	0:42 - 1:20	0:19 - 0:42	0:15 - 0:49[12]	0:11 - 0:19[12]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:23	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:23	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25°C (below -13°F)	100/0	0:11 - 0:23	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids and Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail.
12 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-20: ADJUSTED TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:32 - 3:02	0:34 - 1:05	2:00 - 2:00	1:27 - 2:00	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:06 - 0:06	0:08 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:15 - 1:12	0:27 - 0:49	2:00 - 2:00	1:08 - 2:00	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:15 - 1:12	0:23 - 0:42	1:50 - 2:00	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[11]	0:15 - 0:19[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:30	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:30	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -26°C (below -13 to -15°F)	100/0	0:19 - 0:30	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-21: ADJUSTED TYPE IV HOLDOVER TIMES FOR AFLRUS LLC GREEN FLO TYPE 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:57 - 1:54	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:27 - 0:53	0:11 - 0:23	0:05 - 0:05	0:06 - 0:53	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:38 - 1:58	0:15 - 0:27	1:12 - 1:31	0:34 - 1:12	0:19 - 0:34	0:27 - 0:46	0:15 - 0:23			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:38 - 1:58	0:11 - 0:23	1:05 - 1:24	0:34 - 1:05	0:15 - 0:34	0:27 - 0:46[11]	0:15 - 0:23[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 0:53	0:08 - 0:19	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 0:53	0:08 - 0:19	0:53 - 1:08	0:23 - 0:53	0:11 - 0:23					
below -25 to -30°C (below -13 to -22°F)	100/0	0:19 - 0:46	0:03 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-22: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:21 - 3:02	0:34 - 1:05	2:00 - 2:00	1:24 - 2:00	0:46 - 1:24	1:05 - 1:31	0:30 - 0:46	0:06 - 0:06	0:08 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:54 - 2:59	0:34 - 1:05	2:00 - 2:00	1:24 - 2:00	0:46 - 1:24	0:49 - 1:31	0:38 - 1:12			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:54 - 2:59	0:34 - 1:05	2:00 - 2:00	1:24 - 2:00	0:46 - 1:24	0:49 - 1:31[11]	0:38 - 1:12[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 1:12	0:23 - 0:46	2:00 - 2:00	1:01 - 2:00	0:30 - 1:01					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 1:12	0:11 - 0:27	1:08 - 1:27	0:34 - 1:08	0:15 - 0:34					
below -25 to -26°C (below -13 to -15°F)	100/0	0:27 - 1:12	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-23: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:05 - 1:43	0:23 - 0:46	2:00 - 2:00	1:01 - 2:00	0:30 - 1:01	0:49 - 1:05	0:30 - 0:38	0:08 - 0:08	0:11 - 1:01	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:49 - 1:46	0:19 - 0:38	1:46 - 2:00	0:53 - 1:46	0:27 - 0:53	0:34 - 0:53	0:27 - 0:34			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:49 - 1:46	0:15 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:34 - 0:53[11]	0:27 - 0:34[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 0:38	0:08 - 0:19	0:57 - 1:16	0:27 - 0:57	0:11 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 0:38	0:05 - 0:11	0:38 - 0:46	0:15 - 0:38	0:07 - 0:15					
below -25 to -29°C (below -13 to -20°F)	100/0	0:27 - 0:38	0:04 - 0:11	0:30 - 0:38	0:11 - 0:30	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-24: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEAR IV FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:12 - 2:09	0:23 - 0:46	1:54 - 2:00	1:01 - 1:54	0:30 - 1:01	0:49 - 1:20	0:38 - 0:53	0:11 - 0:11	0:15 - 0:57	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:38 - 1:27	0:19 - 0:34	1:27 - 1:50	0:46 - 1:27	0:23 - 0:46	0:38 - 1:05	0:30 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:38 - 1:27	0:15 - 0:30	1:16 - 1:31	0:38 - 1:16	0:19 - 0:38	0:38 - 1:05[11]	0:30 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:34	0:08 - 0:15	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23					
below -18 to -23°C (below 0 to -9°F)	100/0	0:19 - 0:34	0:06 - 0:11	0:30 - 0:38	0:15 - 0:30	0:08 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-25: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:24 - 2:28	0:23 - 0:46	2:00 - 2:00	1:01 - 2:00	0:30 - 1:01	0:53 - 1:12	0:23 - 0:46	0:06 - 0:06	0:08 - 1:08	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:12 - 2:51	0:19 - 0:42	1:50 - 2:00	0:53 - 1:50	0:27 - 0:53	0:49 - 1:08	0:23 - 0:46			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:12 - 2:51	0:19 - 0:38	1:43 - 2:00	0:49 - 1:43	0:23 - 0:49	0:49 - 1:08[11]	0:23 - 0:46[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:42 - 1:31	0:11 - 0:27	1:12 - 1:35	0:34 - 1:12	0:15 - 0:34					
below -18 to -25°C (below 0 to -13°F)	100/0	0:42 - 1:31	0:07 - 0:15	0:42 - 0:53	0:19 - 0:42	0:11 - 0:19					
below -25 to -29°C (below -13 to -20°F)	100/0	0:42 - 1:31	0:05 - 0:11	0:34 - 0:42	0:15 - 0:34	0:08 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-26: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:12 - 2:28	0:19 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:30 - 0:53	0:15 - 0:27	0:05 - 0:05	0:06 - 0:49	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:05	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:30 - 0:53	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:05	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:30 - 0:53[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:38 - 1:05	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34					
below -18 to -25°C (below 0 to -13°F)	100/0	0:38 - 1:05	0:11 - 0:23	1:01 - 1:16	0:27 - 1:01	0:15 - 0:27					
below -25 to -30°C (below -13 to -22°F)	100/0	0:23 - 0:49	0:07 - 0:15	0:42 - 0:49	0:19 - 0:42	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-27: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:24 - 2:28	0:30 - 0:53	2:00 - 2:00	1:12 - 2:00	0:38 - 1:12	0:53 - 1:12	0:34 - 0:49	0:11 - 0:11	0:11 - 1:01	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:49 - 1:27	0:23 - 0:38	1:35 - 1:54	0:53 - 1:35	0:27 - 0:53	0:42 - 0:53	0:27 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:49 - 1:27	0:15 - 0:30	1:16 - 1:31	0:42 - 1:16	0:23 - 0:42	0:42 - 0:53[11]	0:27 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:34	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:34	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15					
below -25 to -26°C (below -13 to -15°F)	100/0	0:23 - 0:34	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:06 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-28: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:08 - 2:21	0:23 - 0:38	1:27 - 1:46	0:53 - 1:27	0:30 - 0:53	0:49 - 1:31	0:23 - 0:38	0:07 - 0:07	0:08 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:01 - 2:17	0:19 - 0:34	1:20 - 1:35	0:46 - 1:20	0:27 - 0:46	0:42 - 1:08	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:01 - 2:17	0:19 - 0:30	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:42 - 1:08[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 1:20	0:15 - 0:30	1:16 - 1:31	0:38 - 1:16	0:19 - 0:38					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 1:20	0:11 - 0:23	1:01 - 1:12	0:30 - 1:01	0:15 - 0:30					
below -25 to -31°C (below -13 to -24°F)	100/0	0:27 - 0:49	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-29: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:43 - 3:02	0:30 - 0:57	2:00 - 2:00	1:16 - 2:00	0:42 - 1:16	1:31 - 1:31	0:53 - 1:27	0:11 - 0:11	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:49 - 1:39	0:19 - 0:38	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:27 - 1:27	0:34 - 0:49			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:49 - 1:39	0:15 - 0:27	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:27 - 1:27[11]	0:34 - 0:49[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:15 - 0:27	0:08 - 0:15	0:38 - 0:46	0:19 - 0:38	0:11 - 0:19					
below -18 to -25°C (below 0 to -13°F)	100/0	0:15 - 0:27	0:04 - 0:07	0:19 - 0:23	0:11 - 0:19	0:05 - 0:11					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:15 - 0:27	0:04 - 0:07	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-30: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 2:43	0:19 - 0:46	2:00 - 2:00	0:57 - 2:00	0:27 - 0:57	0:34 - 1:16	0:19 - 0:30	0:05 - 0:05	0:07 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:47	0:19 - 0:46	2:00 - 2:00	0:57 - 2:00	0:27 - 0:57	0:46 - 1:12	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:47	0:19 - 0:46	2:00 - 2:00	0:57 - 2:00	0:27 - 0:57	0:46 - 1:12[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -25 to -27°C (below -13 to -17°F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-31: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:43 - 3:02	0:30 - 1:01	2:00 - 2:00	1:20 - 2:00	0:42 - 1:20	1:01 - 1:31	0:42 - 1:01	0:11 - 0:11	0:19 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:24 - 3:02	0:30 - 1:01	2:00 - 2:00	1:20 - 2:00	0:42 - 1:20	0:57 - 1:31	0:34 - 1:01			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:24 - 3:02	0:30 - 1:01	2:00 - 2:00	1:20 - 2:00	0:42 - 1:20	0:57 - 1:31[11]	0:34 - 1:01[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 1:08	0:27 - 0:53	2:00 - 2:00	1:12 - 2:00	0:38 - 1:12					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 1:08	0:19 - 0:38	1:39 - 2:00	0:49 - 1:39	0:27 - 0:49					
below -25 to -29°C (below -13 to -20°F)	100/0	0:30 - 1:08	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:23 - 0:42					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-32: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHONGQING JOBA CHEMICAL FW-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:28 - 3:02	0:27 - 0:57	2:00 - 2:00	1:16 - 2:00	0:38 - 1:16	1:08 - 1:31	0:34 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:54 - 3:02	0:23 - 0:46	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:38 - 1:31	0:27 - 0:53			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:54 - 3:02	0:23 - 0:42	1:50 - 2:00	0:57 - 1:50	0:27 - 0:57	0:38 - 1:31[11]	0:27 - 0:53[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 1:16	0:15 - 0:30	1:31 - 1:58	0:42 - 1:31	0:19 - 0:42					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 1:16	0:11 - 0:23	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -25 to -29°C (below -13 to -20°F)	100/0	0:27 - 1:16	0:08 - 0:19	0:53 - 1:08	0:23 - 0:53	0:11 - 0:23					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-33: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	3:02 - 3:02	0:38 - 1:01	2:00 - 2:00	1:20 - 2:00	0:49 - 1:20	1:08 - 1:31	0:46 - 1:16	0:08 - 0:08	0:11 - 1:16	
	75/25	2:47 - 3:02	0:34 - 1:01	2:00 - 2:00	1:20 - 2:00	0:46 - 1:20	1:16 - 1:31	0:34 - 0:57	0:06 - 0:06	0:08 - 1:20	
	50/50	1:05 - 2:05	0:15 - 0:27	1:05 - 1:16	0:34 - 1:05	0:19 - 0:34	0:23 - 0:38	0:15 - 0:19	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:46 - 1:27	0:30 - 0:49	1:50 - 2:00	1:08 - 1:50	0:42 - 1:08	0:27 - 1:16	0:19 - 0:34			
	75/25	0:30 - 1:01	0:30 - 0:53	2:00 - 2:00	1:08 - 2:00	0:38 - 1:08	0:19 - 0:53	0:19 - 0:34			
below -8 to -14°C (below 18 to 7°F)	100/0	0:46 - 1:27	0:27 - 0:46	1:39 - 1:54	1:01 - 1:39	0:38 - 1:01	0:27 - 1:16[11]	0:19 - 0:34[11]			
	75/25	0:30 - 1:01	0:27 - 0:46	1:50 - 2:00	1:05 - 1:50	0:34 - 1:05	0:19 - 0:53[11]	0:19 - 0:34[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:38	0:04 - 0:11	0:57 - 1:20	0:15 - 0:57	0:05 - 0:15					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:38	0:02 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -25 to -28.5°C (below -13 to -19°F)	100/0	0:23 - 0:38	0:01 - 0:03	0:15 - 0:23	0:05 - 0:15	0:01 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-34: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:59 - 3:02	0:30 - 1:12	2:00 - 2:00	1:35 - 2:00	0:42 - 1:35	1:31 - 1:31	0:46 - 1:31	0:11 - 0:11	0:15 - 1:31	
	75/25	2:59 - 3:02	0:27 - 1:05	2:00 - 2:00	1:27 - 2:00	0:38 - 1:27	1:31 - 1:31	1:01 - 1:05	0:11 - 0:11	0:15 - 1:24	
	50/50	0:57 - 1:24	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34	0:19 - 0:46	0:11 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:43	0:27 - 0:57	2:00 - 2:00	1:16 - 2:00	0:34 - 1:16	0:19 - 1:12	0:19 - 0:30			
	75/25	0:30 - 1:31	0:23 - 0:49	2:00 - 2:00	1:08 - 2:00	0:27 - 1:08	0:15 - 0:49	0:15 - 0:23			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:43	0:23 - 0:49	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:19 - 1:12[11]	0:19 - 0:30[11]			
	75/25	0:30 - 1:31	0:19 - 0:42	2:00 - 2:00	0:57 - 2:00	0:23 - 0:57	0:15 - 0:49[11]	0:15 - 0:23[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:38	0:04 - 0:15	0:57 - 1:24	0:19 - 0:57	0:05 - 0:19					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:38	0:02 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -25 to -29°C (below -13 to -20°F)	100/0	0:19 - 0:38	0:01 - 0:03	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-35: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:09 - 3:02	0:38 - 1:05	2:00 - 2:00	1:27 - 2:00	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:08 - 0:08	0:11 - 1:31	
	75/25	1:54 - 3:02	0:23 - 0:49	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:05 - 0:05	0:07 - 1:16	
	50/50	0:38 - 1:05	0:05 - 0:15	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:54	0:27 - 0:49	1:50 - 2:00	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34			
	75/25	0:30 - 1:08	0:19 - 0:38	1:46 - 2:00	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:54	0:23 - 0:38	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[11]	0:27 - 0:34[11]			
	75/25	0:30 - 1:08	0:15 - 0:34	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[11]	0:27 - 0:34[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:38	0:06 - 0:19	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:38	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11					
below -25 to -30.5°C (below -13 to -23°F)	100/0	0:19 - 0:38	0:02 - 0:04	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-36: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:54 - 3:02	0:38 - 1:08	2:00 - 2:00	1:31 - 2:00	0:49 - 1:31	1:31 - 1:31	0:46 - 1:24	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:46 - 1:24	0:30 - 0:53	2:00 - 2:00	1:12 - 2:00	0:38 - 1:12	0:27 - 1:16	0:38 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:46 - 1:24	0:27 - 0:46	1:50 - 2:00	1:01 - 1:50	0:34 - 1:01	0:27 - 1:16[11]	0:38 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:30	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:30	0:04 - 0:08	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11					
below -25 to -29°C (below -13 to -20°F)	100/0	0:19 - 0:30	0:02 - 0:05	0:15 - 0:19	0:07 - 0:15	0:03 - 0:07					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-37: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR ENDURANCE™ EG106 ADF/AAF

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:35 - 2:24	0:23 - 0:46	2:00 - 2:00	1:01 - 2:00	0:30 - 1:01	0:53 - 1:31	0:38 - 0:57	0:11 - 0:11	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8°C (below 27 to 18°F)	100/0	1:24 - 2:32	0:19 - 0:38	1:50 - 2:00	0:53 - 1:50	0:27 - 0:53	0:42 - 1:24	0:34 - 0:53			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:24 - 2:32	0:19 - 0:34	1:39 - 2:00	0:49 - 1:39	0:23 - 0:49	0:42 - 1:24[11]	0:34 - 0:53[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:49	0:11 - 0:27	1:20 - 1:43	0:38 - 1:20	0:19 - 0:38					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:49	0:11 - 0:23	1:08 - 1:27	0:30 - 1:08	0:15 - 0:30					
below -25 to -29°C (below -13 to -20°F)	100/0	0:23 - 0:49	0:11 - 0:23	1:01 - 1:20	0:30 - 1:01	0:15 - 0:30					

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-38: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:32 - 3:02	0:34 - 1:05	2:00 - 2:00	1:27 - 2:00	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:06 - 0:06	0:08 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:15 - 1:12	0:27 - 0:49	2:00 - 2:00	1:08 - 2:00	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:15 - 1:12	0:23 - 0:42	1:50 - 2:00	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[11]	0:15 - 0:19[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:30	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:30	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -26°C (below -13 to -15°F)	100/0	0:19 - 0:30	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-39: ADJUSTED TYPE IV HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:12 - 2:24	0:23 - 0:42	1:58 - 2:00	0:57 - 1:58	0:27 - 0:57	0:49 - 1:20	0:38 - 0:46	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:50	0:19 - 0:38	1:39 - 2:00	0:49 - 1:39	0:23 - 0:49	0:42 - 1:08	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:50	0:15 - 0:34	1:27 - 1:50	0:42 - 1:27	0:23 - 0:42	0:42 - 1:08[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:34	0:08 - 0:19	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:34	0:05 - 0:11	0:38 - 0:53	0:15 - 0:38	0:07 - 0:15					
below -25 to -30°C (below -13 to -22°F)	100/0	0:15 - 0:27	0:03 - 0:07	0:23 - 0:30	0:11 - 0:23	0:04 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-40: ADJUSTED TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	0:57 - 2:02	0:27 - 0:46	1:50 - 2:00	1:01 - 1:50	0:34 - 1:01	0:30 - 1:08	0:27 - 0:30	0:07 - 0:07	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:53 - 1:58	0:23 - 0:42	1:35 - 1:54	0:53 - 1:35	0:30 - 0:53	0:38 - 1:05	0:23 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:53 - 1:58	0:19 - 0:38	1:27 - 1:43	0:49 - 1:27	0:27 - 0:49	0:38 - 1:05[11]	0:23 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:46	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:46	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:23 - 0:46	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-41: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:08 - 2:02	0:23 - 0:42	1:54 - 2:00	0:57 - 1:54	0:27 - 0:57	0:49 - 1:08	0:30 - 0:49	0:08 - 0:08	0:11 - 0:53	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:58	0:19 - 0:38	1:43 - 2:00	0:49 - 1:43	0:27 - 0:49	0:38 - 1:01	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:58	0:19 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:38 - 1:01[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:38	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:38	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -25.5°C (below -13 to -14°F)	100/0	0:23 - 0:38	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-42: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:39 - 3:02	0:23 - 0:46	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:49 - 1:31	0:23 - 0:38	0:05 - 0:05	0:07 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	2:02 - 3:02	0:23 - 0:46	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:49 - 1:31	0:30 - 0:46			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	2:02 - 3:02	0:23 - 0:46	2:00 - 2:00	1:05 - 2:00	0:30 - 1:05	0:49 - 1:31[11]	0:30 - 0:46[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:34 - 1:27	0:05 - 0:15	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19					
below -18 to -25°C (below 0 to -13°F)	100/0	0:34 - 1:27	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11					
below -25 to -26°C (below -13 to -15°F)	100/0	0:34 - 1:27	0:01 - 0:05	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-43: ADJUSTED TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:39 - 3:02	0:42 - 1:12	2:00 - 2:00	1:35 - 2:00	0:57 - 1:35	1:24 - 1:31	0:49 - 1:31	0:11 - 0:11	0:19 - 1:31	
	75/25	1:05 - 2:02	0:23 - 0:42	1:35 - 1:50	0:57 - 1:35	0:34 - 0:57	0:46 - 1:01	0:23 - 0:38	0:06 - 0:06	0:08 - 1:01	
	50/50	0:23 - 0:42	0:11 - 0:19	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:11 - 0:30	0:11 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 2:40	0:38 - 1:05	2:00 - 2:00	1:24 - 2:00	0:49 - 1:24	0:19 - 1:12	0:15 - 0:23			
	75/25	0:34 - 1:24	0:23 - 0:38	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:15 - 0:53	0:11 - 0:19			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 2:40	0:34 - 0:57	2:00 - 2:00	1:20 - 2:00	0:46 - 1:20	0:19 - 1:12[11]	0:15 - 0:23[11]			
	75/25	0:34 - 1:24	0:19 - 0:34	1:20 - 1:31	0:46 - 1:20	0:27 - 0:46	0:15 - 0:53[11]	0:11 - 0:19[11]			
below -14 to -18°C (below 7 to 0°F)	100/0	0:30 - 0:46	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:30 - 0:46	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -28°C (below -13 to -18°F)	100/0	0:30 - 0:46	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-44: ADJUSTED TYPE IV HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE-IV PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:46 - 2:55	0:27 - 0:57	2:00 - 2:00	1:16 - 2:00	0:34 - 1:16	1:05 - 1:31	0:38 - 1:01	0:07 - 0:07	0:08 - 1:16	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:11 - 0:27	0:19 - 0:42	1:58 - 2:00	0:53 - 1:58	0:27 - 0:53	0:30 - 1:08	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:11 - 0:27	0:15 - 0:34	1:35 - 2:00	0:42 - 1:35	0:19 - 0:42	0:30 - 1:08[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:11 - 0:23	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25°C (below 0 to -13°F)	100/0	0:11 - 0:23	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -29°C (below -13 to -20°F)	100/0	0:11 - 0:23	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-45: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:27 - 3:02	0:19 - 0:42	1:46 - 2:00	0:53 - 1:46	0:27 - 0:53	0:53 - 1:31	0:30 - 0:49	0:07 - 0:07	0:11 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:27 - 1:35	0:15 - 0:30	1:24 - 1:46	0:42 - 1:24	0:23 - 0:42	0:27 - 1:01	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:27 - 1:35	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:27 - 1:01[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:42	0:08 - 0:15	0:46 - 0:57	0:23 - 0:46	0:11 - 0:23					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:42	0:04 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11					
below -25 to -29.5°C (below -13 to -21°F)	100/0	0:23 - 0:42	0:04 - 0:08	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines — Winter 2025-2026

TABLE ADJ-46: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:58 - 3:02	0:19 - 0:42	1:58 - 2:00	0:53 - 1:58	0:27 - 0:53	1:01 - 1:31	0:30 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:05 - 2:36	0:15 - 0:34	1:39 - 2:00	0:46 - 1:39	0:19 - 0:46	0:38 - 1:31	0:34 - 0:49			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:05 - 2:36	0:15 - 0:30	1:27 - 1:50	0:38 - 1:27	0:19 - 0:38	0:38 - 1:31[11]	0:34 - 0:49[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:27 - 1:27	0:11 - 0:23	1:12 - 1:35	0:30 - 1:12	0:11 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:27 - 1:27	0:07 - 0:15	0:53 - 1:12	0:23 - 0:53	0:11 - 0:23					
below -25 to -29°C (below -13 to -20°F)	100/0	0:27 - 1:27	0:06 - 0:15	0:46 - 1:01	0:19 - 0:46	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-47: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	2:21 - 3:02	0:23 - 0:46	2:00 - 2:00	1:01 - 2:00	0:30 - 1:01	0:57 - 1:31	0:30 - 0:42	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:12 - 2:28	0:19 - 0:38	1:43 - 2:00	0:49 - 1:43	0:23 - 0:49	0:57 - 1:31	0:23 - 0:34			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:12 - 2:28	0:15 - 0:30	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:57 - 1:31[11]	0:23 - 0:34[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:53	0:11 - 0:23	1:08 - 1:27	0:30 - 1:08	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:53	0:07 - 0:15	0:49 - 1:05	0:23 - 0:49	0:11 - 0:23					
below -25 to -29°C (below -13 to -20°F)	100/0	0:23 - 0:53	0:06 - 0:15	0:46 - 0:57	0:19 - 0:46	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-48: ADJUSTED TYPE IV HOLDOVER TIMES FOR SHAANXI CLEANWAY CLEANSURFACE IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:54 - 3:02	0:23 - 0:57	2:00 - 2:00	1:16 - 2:00	0:30 - 1:16	1:01 - 1:31	0:30 - 0:53	0:07 - 0:07	0:11 - 1:24	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	0:42 - 1:35	0:15 - 0:34	1:50 - 2:00	0:46 - 1:50	0:19 - 0:46	0:23 - 1:08	0:19 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	0:42 - 1:35	0:11 - 0:27	1:20 - 1:43	0:34 - 1:20	0:15 - 0:34	0:23 - 1:08[11]	0:19 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:19 - 0:27	0:08 - 0:15	0:49 - 1:01	0:23 - 0:49	0:11 - 0:23					
below -18 to -25°C (below 0 to -13°F)	100/0	0:19 - 0:27	0:04 - 0:08	0:27 - 0:34	0:11 - 0:27	0:05 - 0:11					
below -25 to -30°C (below -13 to -22°F)	100/0	0:15 - 0:23	0:03 - 0:07	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-49: ADJUSTED TYPE IV HOLDOVER TIMES FOR XINJIANG ZHONGTIAN LIYANG AVIATION CLEARICE-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3°C and above (27°F and above)	100/0	1:50 - 3:02	0:19 - 0:38	1:43 - 2:00	0:49 - 1:43	0:23 - 0:49	0:49 - 1:27	0:27 - 0:42	0:07 - 0:07	0:11 - 1:08	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8°C (below 27 to 18°F)	100/0	1:01 - 1:39	0:15 - 0:30	1:24 - 1:46	0:42 - 1:24	0:19 - 0:42	0:42 - 1:12	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14°C (below 18 to 7°F)	100/0	1:01 - 1:39	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34	0:42 - 1:12[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18°C (below 7 to 0°F)	100/0	0:23 - 0:46	0:11 - 0:23	0:57 - 1:12	0:30 - 0:57	0:15 - 0:30					
below -18 to -25°C (below 0 to -13°F)	100/0	0:23 - 0:46	0:11 - 0:19	0:53 - 1:05	0:27 - 0:53	0:11 - 0:27					
below -25 to -29°C (below -13 to -20°F)	100/0	0:23 - 0:46	0:08 - 0:19	0:49 - 1:01	0:23 - 0:49	0:11 - 0:23					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0°C (32°F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

ADJUSTED ALLOWANCE TIMES TABLES FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.

TABLE ADJ-50: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[4]	Outside Air Temperature			
	Above 0°C (Above 32°F)	0 to -5°C (32 to 23°F)	Below -5 to -10°C (Below 23 to 14°F)	Below -10°C[3] (Below 14°F)
Light Ice Pellets (or Small Hail[5,6]) -PL	8 minutes	8 minutes	8 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Snow -PLSN, -SNPL	8 minutes	8 minutes	8 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		5 minutes	4 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	5 minutes			
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		5 minutes	4 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Rain -PLRA, -RAPL	5 minutes			
Moderate Ice Pellets (or Small Hail[5,6]) PL	4 minutes	4 minutes	4 minutes	

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; or light rain.

3 Ensure that the lowest operational use temperature (LOUT) is respected.

4 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

5 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

6 If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

TABLE ADJ-51: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[5]	Outside Air Temperature				
	Above 0°C[3] (Above 32°F)	0 to -5°C[3] (32 to 23°F)	Below -5 to -10°C[3] (Below 23 to 14°F)	Below -10 to -16°C[3] (Below 14 to 3°F)	Below -16 to -22°C[3,4] (Below 3 to -8°F)
Light Ice Pellets (or Small Hail[6,7]) -PL	53 minutes	53 minutes	53 minutes	38 minutes	23 minutes
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Snow -PLSN, -SNPL	38 minutes	38 minutes	23 minutes	19 minutes	
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		30 minutes	23 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	30 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		30 minutes	23 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain -PLRA, -RAPL	30 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		15 minutes			
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	15 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) PL	27 minutes	27 minutes	27 minutes	11 minutes	8 minutes
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Snow PLSN, SNPL	19 minutes	19 minutes	11 minutes	8 minutes	
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		15 minutes	8 minutes		
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	15 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Rain PLRA, RAPL	11 minutes				

Caution: No allowance times currently exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

- The notes that apply to the allowance times in the table above can be found on page A-61.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

TABLE ADJ-51 (CONT'D): ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) EG-based fluids. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for EG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 Ensure that the lowest operational use temperature (LOUT) is respected.

5 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

6 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

7 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

Appendix A: Transport Canada Adjusted HOT Guidelines Winter 2025-2026

TABLE ADJ-52: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[6]	Outside Air Temperature				
	Above 0°C[3] (Above 32°F)	0 to -5°C[3] (32 to 23°F)	Below -5 to -10°C[3] (Below 23 to 14°F)	Below -10 to -16°C[4] (Below 14 to 3°F)	Below -16 to -22°C[4,5] (Below 3 to -8°F)
Light Ice Pellets (or Small Hail[7,8]) -PL	38 minutes	38 minutes	23 minutes	23 minutes	15 minutes
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Snow -PLSN, -SNPL	30 minutes	30 minutes	11 minutes	11 minutes	
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		19 minutes	8 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	19 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		19 minutes	8 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain -PLRA, -RAPL	19 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		15 minutes			
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	15 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) PL	11 minutes	11 minutes	8 minutes	8 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Snow PLSN, SNPL	11 minutes	11 minutes	4 minutes	4 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		8 minutes	5 minutes		
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	8 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Rain PLRA, RAPL	8 minutes				

Caution: No allowance times currently exist

Caution: No allowance times currently exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

- The notes that apply to the allowance times in the table above can be found on page A-63.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

TABLE ADJ-52 (CONT'D): ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) PG-based fluids applied on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 115 knots.

5 Ensure that the lowest operational use temperature (LOUT) is respected.

6 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

7 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the section regarding Hail, Small Hail, Ice Pellets, Snow Grains and Snow Pellets in TP 14052E - *Guidelines for Aircraft Ground Icing Operations*.

8 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

APPENDIX B:
TESTING LABORATORIES

TESTING LABORATORIES

The following laboratories are known to provide testing for de/anti-icing fluids given they verifiably adhere to internationally accepted standards and recommended practices that are associated with the holdover times published by Transport Canada.

Please enquire directly with the laboratories for a full list of testing available.

- **Anti-icing Materials International Laboratory (AMIL):** 555, boulevard de l'Université, Chicoutimi, Québec, G7H 2B1, Canada, 418-545-5011 ext. 2406, www.amillaboratory.ca. Provides testing for anti-icing performance (described in AMS1424, AMS1428, and AS5901), aerodynamic acceptance (described in AMS1424, AMS1428 and AS5900), physical properties including fluid stability (described in AMS1424 and AMS1428), environmental information (described in AMS1424 and AMS1428) and most of tests to evaluate materials compatibility (described in AMS1424 and AMS1428).

- **APS Aviation Inc.:** 6700, chemin de la Côte-de-Liesse, Suite 102, Saint-Laurent, Quebec, H4T 2B5, Canada, 514-878-4388, www.apsaviation.ca. Provides endurance time testing (described in ARP5485B and ARP5945A).

- **Scientific Material International (SMI):** 12219 SW 131st Avenue, Miami, Florida, USA 33186-6401; 305-971-7047, www.smiinc.com. Provides testing for physical properties including fluid stability (described in AMS1424 and AMS1428), environmental information (described in AMS1424 and AMS1428) and most of tests to evaluate materials compatibility (described in AMS1424 and AMS1428).

APPENDIX C:
AIRCRAFT DEICING FLUID (ADF)/AIRCRAFT ANTI-ICING FLUID (AAF) MANUFACTURERS

Appendix C: ADF/AAF Manufacturers — Winter 2025-2026

TABLE C-1: ADF/AAF MANUFACTURERS CONTACT INFORMATION[1]

Fluid Manufacturer	Primary contact	Email Address
ABAX Industries	Alejandra Villa Rodriguez	a.rodriguez@abax.eu
ADDCON EUROPE GmbH	Norman Kilian	norman.kilian@addcon.com
Aero Mag 2000 SYR LLC	Mark Vilcek	m.vilcek@aeromag2000.com
AFLRUS LLC	Olga Tengeri	office@aflrus.qa
ALAB Industries	Marat Zhazbek	info@alab.kz
Alab International	Kuanyshbay Bissenov	deicing@alab.kz
AllClear Systems LLC	Steve Szafara	SSzafara@allclearsys.com
Arcton Ltd.	Bulat Hamitov	bulathamitov@yandex.ru
ASGlobal	Paulo de Oliveira	paulo@asglobal.biz
AVIAFLUID International Ltd	Igor Derbasov	iderbasov@aviafluid.ru
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.	Arella	xiangaokelihua@163.com
Beijing Wangye Aviation Chemical Product Co Ltd.	Sina Gong	hswgyh@sina.com
Beijing Yadilite Aviation Advanced Materials Corporation	Kewei Wang	wangkewei@yadilite.com
CHEMCO Inc.	Claude Grenon	claude.grenon@chemco-inc.com
Chongqing Joba Chemical Co,.Ltd.	Cherry Wang	info@changfengchem.com
Clariant Produkte (Deutschland) GmbH	Andreas Brueck	andreas.brueck@clariant.com
Cryotech Deicing Technology	Melissa Copeland	melissa.copeland@cryotech.com
ESSPO CHEMICALS D.O.O	Lukas Pakeltis	lukas@esspo.lt
Dow Inc.	Arash Nowbahar	ARNowbahar@dow.com
HOC Industries	Jeremy Wilcoxson	jwilcoxson@hocindustries.com
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JSC RCP Nordix	Ruslan Ukraintsev	defrost@nordway.ru
Kilfrost Limited	Lee Stokes	lee.stokes@kilfrost.com
LNT Solutions	Philip Newton	philip.newton@lntsolutions.com
MKS DevO Chemicals	Efe Dikergil	efe.dikergil@mksdevo.com
Newave Aerochemical Co. Ltd.	Peng Aiqun	lwgs@newave.cn
ROMCHIM PROTECT SRL	Eugenia Hongu	contact@romchimprotect.ro
Shaanxi Cleanway Aviation Chemical Co., Ltd	Arella	xiangaokelihua@163.com
Topan LLP	Almat Kurmanov	almat.kurmanov@topan.kz
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd	Huang Liang	heima.54@foxmail.com

1 Contact information provided above is the latest information as of the time of publication, August 12, 2025.

FAA
HOLDOVER TIME GUIDELINES
WINTER 2025-2026

FAA
HOLDOVER TIME GUIDELINES

WINTER 2025-2026
ORIGINAL ISSUE: AUGUST 12, 2025

The information contained in this document serves as the official FAA guidance, Holdover Times and Allowance Times for use during the 2025-2026 winter season.

Direct questions or comments concerning FAA aircraft ground de/anti-icing requirements and policies, technical content of the holdover time tables and allowance time tables or access issues to 9-AFS-200-Correspondence@faa.gov with HOT25/26 in the subject line.

The Holdover Times Tables and related information can be found at the FAA's Aircraft Ground Deicing website. To receive notifications on updates to the Holdover Times Tables and related information, subscribe to the Aircraft Ground Deicing website by clicking on this link.

This document is intended to be used in conjunction with the FAA Ground Deicing Program General Information Document, Winter 2025-2026, located on the FAA's Aircraft Ground Deicing website.

This is a guidance document. Its content is not legally binding in its own right and will not be relied upon by the Department as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with the guidance document is voluntary only. Nonconformity will not affect rights and obligations under existing statutes and regulations.

CHANGE CONTROL RECORDS

This page indicates any changes made to individual pages within the document. Changed pages have the appropriate revision date in the footer. Sidebars are shown to assist in identifying where significant changes have been made on these pages.

It is the responsibility of the end user to periodically check the following website for updates:
https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/.

REVISION	*DATE*	*DESCRIPTION OF CHANGES*	*AFFECTED PAGES*	*AUTHOR*

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HOW TO USE THIS DOCUMENT

Complementary Documents

This document is designed to be used in conjunction with the FAA N 8900 series notice "Revised FAA-Approved Deicing Program Updates, Winter 2025-2026" and the latest FAA General Information Ground Deicing Program. These documents complement each other and should be used together for a thorough understanding of the subject matter.

Beginning in the winter of 2021-22, the FAA has published an annual database of degree-specific holdover times (DSHOTs) for snow and snow-related precipitation conditions (including snow, snow grains, and snow pellets). The DSHOT database contains an expanded set of snow precipitation HOTs for all undiluted Type II, III and IV anti-icing fluids listed in the FAA HOT Guidelines. This database can be found at the following website:
https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/.
Guidance and conditions on the use of DSHOT data can be found in the latest FAA General Information Ground Deicing Program document.

Applicability

A new version of this document is published for each winter operating season, typically in early August preceding the winter operating season. Updates to the winter's document may be published at any time after the Original Issue document is published. When a new document is published, either mid-season or each new season, the previous document becomes obsolete. It is the responsibility of the end user to periodically check for document updates on the following website:
https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/.

Main Document Structure and Content

This document is divided into several sections.

- Change Control Records: Provides details of any changes made to the document in mid-season document updates.
- Table of Contents: Provides a list of sections, tables, and appendices in the document.
- How to Use This Document: Provides top-level guidance on how to use the document.
- Highlights and Changes for Winter 2025-2026: Describes key changes made to the document for the current winter operating season.
- Holdover Time Guidelines: Series of tables that provide estimated holdover times (in hh:mm). Fluids are divided by fluid type (Type I, II, III, and IV), aircraft construction materials (Type I only), fluid brand (Type II, III, IV), aircraft rotation speed (Type III only), and fluid application temperature (Type III only). Columns in the tables divide the information by precipitation type; rows in the tables divide the information by temperature and fluid dilution. Notes in the tables refer to additional information on the specific HOTs. Cautions that apply to all tables in a section are located on the flysheets before each section.
- Allowance Times Tables: Tables that provide allowance times (in minutes) for Type III and Type IV fluids. Rows in the tables divide the information by precipitation type; columns in the tables divide the information by temperature. Notes in the tables refer to additional information on the specific allowance times. Cautions that apply to all allowance times tables are located on the flysheet before the section. Use of these tables must be validated by first confirming that fluid being used is listed in the "List of Fluids Validated for Use with Allowance Times".
- Supplementary Guidance: Series of tables that provide supplementary information for using the holdover time guidelines and allowance times tables. Includes a table for estimating snowfall intensity from prevailing visibility, tables of fluid information (one table per fluid type), and tables of fluid application guidance (by fluid type).

Appendices

The appendices contain complementary content.

- Appendix A: Provides adjusted holdover time guidelines (holdover time guidelines and allowance times tables) for operations when flaps and slats are deployed prior to de/anti-icing.
- Appendix B: Provides information on laboratories involved in testing de/anti-icing fluids.
- Appendix C: Provides the latest de/anti-icing fluid manufacturer contact information at the time of publication.

HIGHLIGHTS AND CHANGES FOR WINTER 2025-2026

CHANGED THIS YEAR

The principal changes from this year are briefly indicated herein.

Holdover Time Tables

- Fluid-specific HOT guidelines tables have been created for six new fluids:
  - ESSPO CHEMICALS D.O.O Nordwing PG2 (Type II)
  - AFLRUS LLC Green Flo Type 4 (Type IV)
  - AllClear Systems Clear IV Flight (Type IV)
  - ESSPO CHEMICALS D.O.O Nordwing PG4 (Type IV)
  - Newave Aerochemical, FCY-EGIV PLUS (Type IV)
  - Xinjiang Zhongtian Liyang Aviation Clearice-IV (Type IV)
- Further testing in very cold snow conditions has enabled fluid-specific holdover times to be provided in natural snow (below -14 °C) for three existing fluids:
  - MKS DevO Chemicals COREICEPHOB TYPE II (Type II)
  - ALAB International PROFLIGHT EG4 (Type IV)
  - ALAB International PROFLIGHT PG4 (Type IV)
- The 75/25 and 50/50 dilutions for Newave Aerochemical FCY-2 (Type II) have been removed.
- Several increases have been made to the Type II generic holdover times as a result of removed fluid data.
- Several decreases have been made to the Type IV generic holdover times as a result of the newly added fluids.
- The holdover times for Type I Aluminum and Composite fluids in the “Snow mixed with Freezing Fog” column have been increased.
- A new “Moderate Snow mixed with Rain” column has been added to all Type I, II, III, and IV HOT tables with fluid-specific values.
- Editorial changes have been made to several notes to improve clarity and reduce redundancy.

Allowance Times Tables

- The table “List of Fluid Validated for Use with Allowance Times” has been updated indicating which Type III and Type IV fluids are validated for use with which allowance times.
- Increases have been made to the condition “Moderate Ice Pellets Mixed with Moderate Snow” in the Type IV EG and Type IV PG allowance time tables.
- Additional intensity references have been added to the allowance time tables for conditions regarding Light or Moderate Ice Pellets mixed with Drizzle or Freezing Drizzle.
- Editorial changes have been made to the note regarding small hail reporting, to add clarity on how the METAR indicates small hail in various parts of the world.
- Minor editorial changes have been made to the 'Above 0 °C' column to clarify the Fahrenheit values.

Supplemental Guidance

- The list of fluids (Tables 55, 56, 57 and 58) has been updated to reflect the latest information available on all de/anti-icing fluids.

FAA Holdover Time Guidelines — Winter 2025-2026

UNCHANGED FROM PREVIOUS YEAR

Holdover Time Tables

- The Active Frost HOTs are unchanged.

Supplemental Guidance

- The fluid application tables are unchanged.

ACTIVE FROST HOLDOVER TIME (HOT) GUIDELINES
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

TABLE 1: ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I Aluminum	Type I Composite
-1 °C and above (30 °F and above)	0:45	0:35
below -1 to -3 °C (below 30 to 27 °F)		
below -3 to -10 °C (below 27 to 14 °F)		
below -10 to -14 °C (below 14 to 7 °F)		
below -14 to -21 °C (below 7 to -6 °F)		
below -21 to -25 °C (below -6 to -13 °F)		
below -25 °C (below -13 °F)		

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1 °C and above (30 °F and above)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	2:00	0:30	3:00
below -1 to -3 °C (below 30 to 27 °F)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	1:30	0:30	3:00
below -3 to -10 °C (below 27 to 14 °F)	100/0	8:00	2:00	10:00
	75/25	4:00	1:00	5:00
below -10 to -14 °C (below 14 to 7 °F)	100/0	6:00	2:00	6:00
	75/25	1:00	1:00	1:00
below -14 to -21 °C (below 7 to -6 °F)	100/0	3:00	2:00	6:00
below -21 to -25 °C (below -6 to -13 °F)	100/0	2:00	2:00	4:00
below -25 °C (below -13 °F)	100/0	No Holdover Time Guidelines Exist		

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 55 - Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 9.

HOT GUIDELINES FOR SAE TYPE I FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

TABLE 2: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:11 - 0:17	0:06 - 0:11	0:18 - 0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:02 - 0:05	0:02 - 0:02	0:02 - 0:05	
below -3 to -6 °C (below 27 to 21 °F)	0:08 - 0:13	0:05 - 0:08	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:02 - 0:05	CAUTION: No holdover time guidelines exist		
below -6 to -10 °C (below 21 to 14 °F)	0:06 - 0:10	0:04 - 0:06	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05			
below -10 °C (below 14 °F)	0:05 - 0:09	0:02 - 0:04	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04					

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 11.

TABLE 3: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:09 - 0:16	0:03 - 0:06	0:12 - 0:15	0:06 - 0:12	0:03 - 0:06	0:08 - 0:13	0:02 - 0:05	0:01 - 0:01	0:01 - 0:05	
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:08	0:02 - 0:05	0:11 - 0:13	0:05 - 0:11	0:02 - 0:05	0:05 - 0:09	0:02 - 0:05	CAUTION: No holdover time guidelines exist		
below -6 to -10 °C (below 21 to 14 °F)	0:04 - 0:08	0:02 - 0:05	0:09 - 0:12	0:05 - 0:09	0:02 - 0:05	0:04 - 0:07	0:02 - 0:05			
below -10 °C (below 14 °F)	0:04 - 0:07	0:02 - 0:04	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04					

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 11.

HOT GUIDELINES FOR SAE TYPE II FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE 4: GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	0:20 - 0:40	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:05 - 0:05	0:07 - 0:45	
	75/25	0:40 - 1:10	0:15 - 0:25	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:03 - 0:03	0:04 - 0:25	
	50/50	0:15 - 0:30	0:05 - 0:10	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:15 - 0:30	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20			
	75/25	0:25 - 0:55	0:09 - 0:15	0:10 - 0:25	0:15 - 0:30	0:09 - 0:20			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:10 - 0:25	0:15 - 0:30	0:20 - 0:45[12]	0:15 - 0:20[12]			
	75/25	0:25 - 0:55	0:07 - 0:15	0:09 - 0:20	0:15 - 0:30[12]	0:09 - 0:20[12]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:01 - 0:05	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:20	0:00 - 0:02	0:01 - 0:03					
below -25 °C (below -13 °F)	100/0	0:15 - 0:20	0:00 - 0:00	0:00 - 0:01					

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 56). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
12 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 5: TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:20 - 3:00	0:30 - 0:55	2:25 - 2:55	1:15 - 2:25	0:40 - 1:15	0:40 - 1:40	0:30 - 0:45	0:07 - 0:07	0:09 - 1:25	
	75/25	1:15 - 1:25	0:20 - 0:40	1:45 - 2:10	0:55 - 1:45	0:25 - 0:55	0:35 - 1:05	0:20 - 0:30	0:03 - 0:03	0:04 - 0:50	
	50/50	0:15 - 0:30	0:05 - 0:10	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 2:30	0:25 - 0:45	2:00 - 2:25	1:00 - 2:00	0:30 - 1:00	0:25 - 1:10	0:20 - 0:30			
	75/25	0:35 - 1:55	0:20 - 0:35	1:40 - 2:05	0:50 - 1:40	0:25 - 0:50	0:15 - 0:55	0:20 - 0:35			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 2:30	0:20 - 0:40	1:45 - 2:05	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10[11]	0:20 - 0:30[11]			
	75/25	0:35 - 1:55	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:15 - 0:55[11]	0:20 - 0:35[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:40	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:40	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:15 - 0:40	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 6: TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	0:20 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:07 - 0:07	0:10 - 0:55	
	75/25	0:50 - 1:20	0:20 - 0:35	1:20 - 1:40	0:45 - 1:20	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30	0:05 - 0:05	0:07 - 0:50	
	50/50	0:35 - 1:00	0:10 - 0:20	0:50 - 1:05	0:25 - 0:50	0:15 - 0:25	0:20 - 0:40	0:10 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:50	0:15 - 0:30	1:20 - 1:35	0:40 - 1:20	0:25 - 0:40	0:30 - 0:55	0:20 - 0:25			
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40	0:20 - 0:25			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:50	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:20 - 0:35	0:30 - 0:55[11]	0:20 - 0:25[11]			
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40[11]	0:20 - 0:25[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:50	0:09 - 0:20	0:45 - 1:00	0:25 - 0:45	0:15 - 0:25					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:50	0:05 - 0:10	0:30 - 0:35	0:15 - 0:30	0:07 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 7: TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:30 - 4:00	0:45 - 1:10	2:35 - 3:00	1:35 - 2:35	1:00 - 1:35	1:20 - 2:00	0:45 - 1:25	0:08 - 0:08	0:10 - 1:30	
	75/25	1:50 - 2:45	0:30 - 1:00	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20	1:10 - 1:30	0:30 - 0:55	0:04 - 0:04	0:06 - 0:50	
	50/50	0:55 - 1:45	0:09 - 0:20	0:45 - 0:55	0:25 - 0:45	0:10 - 0:25	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:45	0:35 - 1:00	2:05 - 2:30	1:15 - 2:05	0:45 - 1:15	0:35 - 1:30	0:25 - 0:45			
	75/25	0:25 - 1:05	0:20 - 0:40	1:45 - 2:10	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10	0:20 - 0:35			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:45	0:30 - 0:50	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05	0:35 - 1:30[11]	0:25 - 0:45[11]			
	75/25	0:25 - 1:05	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 1:10[11]	0:20 - 0:35[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:06 - 0:20	1:10 - 1:40	0:25 - 1:10	0:08 - 0:25					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:02 - 0:07	0:30 - 0:40	0:10 - 0:30	0:03 - 0:10					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 0:50	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 8: TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:50 - 4:00	0:50 - 1:25	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:10 - 0:10	0:15 - 2:00	
	75/25	2:30 - 4:00	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:07 - 0:07	0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	0:35 - 1:05	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45			
	75/25	0:40 - 1:30	0:25 - 0:50	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[11]	0:35 - 0:45[11]			
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[11]	0:35 - 0:45[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:08 - 0:25	1:35 - 2:15	0:35 - 1:35	0:10 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15					
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:25 - 0:50	0:02 - 0:05	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 9: TYPE II HOLDOVER TIMES FOR FOR ESSPO CHEMICALS D.O.O NORDWING PG2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:40 - 3:10	0:30 - 1:00	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20	1:05 - 1:50	0:50 - 1:05	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:20	0:25 - 0:45	2:00 - 2:30	1:00 - 2:00	0:30 - 1:00	0:50 - 1:30	0:25 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:20	0:20 - 0:40	1:45 - 2:10	0:50 - 1:45	0:25 - 0:50	0:50 - 1:30[11]	0:25 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:10 - 0:25	1:15 - 1:40	0:30 - 1:15	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:35	0:06 - 0:15	0:50 - 1:05	0:20 - 0:50	0:08 - 0:20					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:30	0:03 - 0:07	0:25 - 0:30	0:09 - 0:25	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 10: TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:15 - 3:45	0:45 - 1:15	1:00 - 1:40	1:50 - 2:00	1:00 - 1:25	0:15 - 0:15	0:20 - 2:00	
	75/25	1:40 - 2:30	0:25 - 0:50	0:35 - 1:10	1:25 - 2:00	0:50 - 1:10	0:10 - 0:10	0:15 - 2:00	
	50/50	0:35 - 1:05	0:05 - 0:10	0:07 - 0:15	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 1:05	0:40 - 1:10	0:55 - 1:30	0:25 - 1:00	0:15 - 0:35			
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05	0:20 - 0:55	0:09 - 0:30			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 1:05	0:40 - 1:05	0:50 - 1:25	0:25 - 1:00[11]	0:15 - 0:35[11]			
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05	0:20 - 0:55[11]	0:09 - 0:30[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:55	0:01 - 0:05	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:55	0:00 - 0:02	0:01 - 0:03					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 0:55	0:00 - 0:00	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 11: TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:25 - 2:25	0:30 - 1:00	2:25 - 2:55	1:20 - 2:25	0:40 - 1:20	1:00 - 1:35	0:40 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:35	0:30 - 0:50	2:10 - 2:35	1:10 - 2:10	0:40 - 1:10	0:30 - 1:15	0:35 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:35	0:25 - 0:50	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05	0:30 - 1:15[11]	0:35 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 0:45	0:10 - 0:20	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 0:45	0:06 - 0:10	0:30 - 0:35	0:15 - 0:30	0:08 - 0:15					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:35 - 0:45	0:05 - 0:09	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 12: TYPE II HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:55 - 2:45	0:30 - 1:00	2:35 - 3:00	1:25 - 2:35	0:40 - 1:25	1:10 - 2:00	0:45 - 1:00	0:09 - 0:09	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	1:05 - 1:45	0:15 - 0:35	1:35 - 1:55	0:45 - 1:35	0:25 - 0:45	0:50 - 1:15	0:25 - 0:30	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:25	0:25 - 0:45	1:50 - 2:15	1:00 - 1:50	0:30 - 1:00	0:30 - 1:10	0:25 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:25	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:30 - 1:10[11]	0:25 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:25	0:08 - 0:15	0:35 - 0:40	0:20 - 0:35	0:10 - 0:20					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:25	0:03 - 0:05	0:15 - 0:15	0:07 - 0:15	0:04 - 0:07					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:15 - 0:25	0:02 - 0:04	0:10 - 0:10	0:05 - 0:10	0:03 - 0:05					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 13: TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:25	0:25 - 0:40	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:06 - 0:06	0:08 - 0:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:30	0:15 - 0:30	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:30	0:10 - 0:25	0:15 - 0:30	0:20 - 0:45[11]	0:15 - 0:20[11]			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:35	0:01 - 0:05	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:35	0:00 - 0:02	0:01 - 0:03					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:25 - 0:35	0:00 - 0:00	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 14: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:10 - 2:25	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	0:50 - 1:20	0:35 - 0:50	0:05 - 0:05	0:07 - 1:10	
	75/25	1:00 - 1:50	0:20 - 0:40	1:55 - 2:25	0:55 - 1:55	0:25 - 0:55	0:40 - 1:15	0:25 - 0:40	0:05 - 0:05	0:07 - 0:55	
	50/50	0:25 - 0:55	0:10 - 0:20	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30	0:20 - 0:35	0:10 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:35	0:20 - 0:40	1:50 - 2:20	0:50 - 1:50	0:25 - 0:50	0:35 - 1:10	0:25 - 0:35			
	75/25	0:55 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40	0:25 - 1:05	0:20 - 0:30			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:35	0:15 - 0:30	1:25 - 1:50	0:40 - 1:25	0:20 - 0:40	0:35 - 1:10[11]	0:25 - 0:35[11]			
	75/25	0:55 - 1:25	0:10 - 0:25	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30	0:25 - 1:05[11]	0:20 - 0:30[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:20	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:15 - 0:20	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

TABLE 15: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:40 - 3:30	0:20 - 0:45	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	0:40 - 1:35	0:25 - 0:45	0:06 - 0:06	0:09 - 0:50	
	75/25	0:40 - 1:10	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:04 - 0:04	0:05 - 0:25	
	50/50	0:20 - 0:35	0:07 - 0:15	0:30 - 0:35	0:15 - 0:30	0:09 - 0:15	0:10 - 0:30	0:08 - 0:10	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 0:50	0:20 - 0:30			
	75/25	0:30 - 0:55	0:09 - 0:15	0:40 - 0:50	0:25 - 0:40	0:10 - 0:25	0:20 - 0:30	0:15 - 0:20			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35	0:25 - 0:50[11]	0:20 - 0:30[11]			
	75/25	0:30 - 0:55	0:07 - 0:15	0:35 - 0:40	0:20 - 0:35	0:09 - 0:20	0:20 - 0:30[11]	0:15 - 0:20[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:25	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:25	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:15 - 0:25	0:00 - 0:00	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 14.

HOT GUIDELINES FOR SAE TYPE III FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

TABLE 16: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -16 °C (below 14 to 3 °F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

TABLE 17: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -20.5 °C (below 14 to -5 °F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

TABLE 18: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:04 - 0:04	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -25 °C (below 14 to -13 °F)	100/0	0:40 - 1:45	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40					
below -25 to -35 °C (below -13 to -31 °F)	100/0	0:25 - 1:00	0:07 - 0:16	0:45 - 1:00	0:20 - 0:45	0:10 - 0:20					

CAUTION: No holdover time guidelines exist

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 51 provides allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

HOT GUIDELINES FOR SAE TYPE IV FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend, or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE 19: GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:15	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:05	
	75/25	1:25 - 2:40	0:30 - 0:55	2:05 - 2:25	1:15 - 2:05	0:40 - 1:15	1:00 - 1:20	0:30 - 0:50	0:07 - 0:07	0:09 - 1:20	
	50/50	0:30 - 0:55	0:07 - 0:20	1:00 - 1:10	0:25 - 1:00	0:10 - 0:25	0:15 - 0:40	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 0:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:25 - 1:00	0:20 - 0:25			
	75/25	0:40 - 1:20	0:25 - 0:50	1:50 - 2:10	1:05 - 1:50	0:30 - 1:05	0:20 - 1:05	0:15 - 0:25			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 0:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:25 - 1:00[12]	0:20 - 0:25[12]			
	75/25	0:40 - 1:20	0:20 - 0:45	1:45 - 2:00	0:55 - 1:45	0:25 - 0:55	0:20 - 1:05[12]	0:15 - 0:25[12]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 °C (below -13 °F)	100/0	0:15 - 0:30	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids and Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
12 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 20: TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:20 - 4:00	0:45 - 1:25	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:08 - 0:08	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	0:35 - 1:05	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15	0:25 - 1:25[11]	0:20 - 0:25[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:25 - 0:40	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 21: TYPE IV HOLDOVER TIMES FOR AFLRUS LLC GREEN FLO TYPE 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:30	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:35 - 1:10	0:15 - 0:30	0:06 - 0:06	0:08 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:50 - 2:35	0:20 - 0:35	1:35 - 2:00	0:45 - 1:35	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:50 - 2:35	0:15 - 0:30	1:25 - 1:50	0:45 - 1:25	0:20 - 0:45	0:35 - 1:00[11]	0:20 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:10	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:10	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:25 - 1:00	0:04 - 0:10	0:35 - 0:40	0:15 - 0:35	0:06 - 0:15					

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 22: TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:05 - 4:00	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50	1:25 - 2:00	0:40 - 1:00	0:08 - 0:08	0:10 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:30 - 3:55	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50	1:05 - 2:00	0:50 - 1:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:30 - 3:55	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50	1:05 - 2:00[11]	0:50 - 1:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:35	0:30 - 1:00	2:45 - 3:00	1:20 - 2:45	0:40 - 1:20					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:35	0:15 - 0:35	1:30 - 1:55	0:45 - 1:30	0:20 - 0:45					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:35 - 1:35	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 23: TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:25 - 2:15	0:30 - 1:00	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	1:05 - 1:25	0:40 - 0:50	0:10 - 0:10	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:20	0:25 - 0:50	2:20 - 2:55	1:10 - 2:20	0:35 - 1:10	0:45 - 1:10	0:35 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:20	0:20 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	0:45 - 1:10[11]	0:35 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 0:50	0:10 - 0:25	1:15 - 1:40	0:35 - 1:15	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 0:50	0:07 - 0:15	0:50 - 1:00	0:20 - 0:50	0:09 - 0:20					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:35 - 0:50	0:05 - 0:15	0:40 - 0:50	0:15 - 0:40	0:07 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 24: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEAR IV FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:50	0:30 - 1:00	2:30 - 3:00	1:20 - 2:30	0:40 - 1:20	1:05 - 1:45	0:50 - 1:10	0:15 - 0:15	0:20 - 1:15	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:50 - 1:55	0:25 - 0:45	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	0:50 - 1:25	0:40 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:50 - 1:55	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50	0:50 - 1:25[11]	0:40 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:45	0:10 - 0:20	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30					
below -18 to -23 °C (below 0 to -9 °F)	100/0	0:25 - 0:45	0:08 - 0:15	0:40 - 0:50	0:20 - 0:40	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 25: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:15	0:30 - 1:00	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	1:10 - 1:35	0:30 - 1:00	0:08 - 0:08	0:10 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 3:45	0:25 - 0:55	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10	1:05 - 1:30	0:30 - 1:00			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:35 - 3:45	0:25 - 0:50	2:15 - 2:45	1:05 - 2:15	0:30 - 1:05	1:05 - 1:30[11]	0:30 - 1:00[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:55 - 2:00	0:15 - 0:35	1:35 - 2:05	0:45 - 1:35	0:20 - 0:45					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:55 - 2:00	0:09 - 0:20	0:55 - 1:10	0:25 - 0:55	0:15 - 0:25					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:55 - 2:00	0:07 - 0:15	0:45 - 0:55	0:20 - 0:45	0:10 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 26: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 3:15	0:25 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	0:40 - 1:10	0:20 - 0:35	0:06 - 0:06	0:08 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 2:45	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:40 - 1:10	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 2:45	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:40 - 1:10[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:50 - 1:25	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:50 - 1:25	0:15 - 0:30	1:20 - 1:40	0:35 - 1:20	0:20 - 0:35					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:30 - 1:05	0:09 - 0:20	0:55 - 1:05	0:25 - 0:55	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 27: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:15	0:40 - 1:10	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35	1:10 - 1:35	0:45 - 1:05	0:15 - 0:15	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 1:55	0:30 - 0:50	2:05 - 2:30	1:10 - 2:05	0:35 - 1:10	0:55 - 1:10	0:35 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 1:55	0:20 - 0:40	1:40 - 2:00	0:55 - 1:40	0:30 - 0:55	0:55 - 1:10[11]	0:35 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:45	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:45	0:07 - 0:15	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:30 - 0:45	0:06 - 0:15	0:35 - 0:45	0:20 - 0:35	0:08 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 28: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:30 - 3:05	0:30 - 0:50	1:55 - 2:20	1:10 - 1:55	0:40 - 1:10	1:05 - 2:00	0:30 - 0:50	0:09 - 0:09	0:10 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 3:00	0:25 - 0:45	1:45 - 2:05	1:00 - 1:45	0:35 - 1:00	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 3:00	0:25 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:45	0:20 - 0:40	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:45	0:15 - 0:30	1:20 - 1:35	0:40 - 1:20	0:20 - 0:40					
below -25 to -31 °C (below -13 to -24 °F)	100/0	0:35 - 1:05	0:07 - 0:15	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 29: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:15 - 4:00	0:40 - 1:15	3:00 - 3:00	1:40 - 3:00	0:55 - 1:40	2:00 - 2:00	1:10 - 1:55	0:15 - 0:15	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:10	0:25 - 0:50	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05	0:35 - 1:55	0:45 - 1:05			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:10	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:35 - 1:55[11]	0:45 - 1:05[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:10 - 0:20	0:50 - 1:00	0:25 - 0:50	0:15 - 0:25					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:35	0:05 - 0:09	0:25 - 0:30	0:15 - 0:25	0:06 - 0:15					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:20 - 0:35	0:05 - 0:09	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 30: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:05 - 3:35	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	0:45 - 1:40	0:25 - 0:40	0:07 - 0:07	0:09 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:40	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	1:00 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 3:40	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	1:00 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:40 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.,
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 31: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:15 - 4:00	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:20 - 2:00	0:55 - 1:20	0:15 - 0:15	0:25 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 4:00	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:15 - 2:00	0:45 - 1:20			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:50 - 4:00	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:15 - 2:00[11]	0:45 - 1:20[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:30	0:35 - 1:10	3:00 - 3:00	1:35 - 3:00	0:50 - 1:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:30	0:25 - 0:50	2:10 - 2:40	1:05 - 2:10	0:35 - 1:05					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:40 - 1:30	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:30 - 0:55					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 32: TYPE IV HOLDOVER TIMES FOR CHONGQING JOBA CHEMICAL FW-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:15 - 4:00	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:50 - 1:40	1:30 - 2:00	0:45 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:30 - 4:00	0:30 - 1:00	2:45 - 3:00	1:25 - 2:45	0:40 - 1:25	0:50 - 2:00	0:35 - 1:10			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:30 - 4:00	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:35 - 1:15	0:50 - 2:00[11]	0:35 - 1:10[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:40	0:20 - 0:40	2:00 - 2:35	0:55 - 2:00	0:25 - 0:55					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:40	0:15 - 0:30	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:35 - 1:40	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 33: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	4:00 - 4:00	0:50 - 1:20	2:50 - 3:00	1:45 - 2:50	1:05 - 1:45	1:30 - 2:00	1:00 - 1:40	0:10 - 0:10	0:15 - 1:40	
	75/25	3:40 - 4:00	0:45 - 1:20	3:00 - 3:00	1:45 - 3:00	1:00 - 1:45	1:40 - 2:00	0:45 - 1:15	0:08 - 0:08	0:10 - 1:45	
	50/50	1:25 - 2:45	0:20 - 0:35	1:25 - 1:40	0:45 - 1:25	0:25 - 0:45	0:30 - 0:50	0:20 - 0:25	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:55	0:40 - 1:05	2:25 - 2:50	1:30 - 2:25	0:55 - 1:30	0:35 - 1:40	0:25 - 0:45			
	75/25	0:40 - 1:20	0:40 - 1:10	2:40 - 3:00	1:30 - 2:40	0:50 - 1:30	0:25 - 1:10	0:25 - 0:45			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 1:55	0:35 - 1:00	2:10 - 2:30	1:20 - 2:10	0:50 - 1:20	0:35 - 1:40[11]	0:25 - 0:45[11]			
	75/25	0:40 - 1:20	0:35 - 1:00	2:25 - 2:55	1:25 - 2:25	0:45 - 1:25	0:25 - 1:10[11]	0:25 - 0:45[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:05 - 0:15	1:15 - 1:45	0:20 - 1:15	0:06 - 0:20					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:02 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:30 - 0:50	0:01 - 0:04	0:20 - 0:30	0:06 - 0:20	0:01 - 0:06					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 34: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:55 - 4:00	0:40 - 1:35	3:00 - 3:00	2:05 - 3:00	0:55 - 2:05	2:00 - 2:00	1:00 - 2:00	0:15 - 0:15	0:20 - 2:00	
	75/25	3:55 - 4:00	0:35 - 1:25	3:00 - 3:00	1:55 - 3:00	0:50 - 1:55	2:00 - 2:00	1:20 - 1:25	0:15 - 0:15	0:20 - 1:50	
	50/50	1:15 - 1:50	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:25 - 1:00	0:15 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:15	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:45 - 1:40	0:25 - 1:35	0:25 - 0:40			
	75/25	0:40 - 2:00	0:30 - 1:05	3:00 - 3:00	1:30 - 3:00	0:35 - 1:30	0:20 - 1:05	0:20 - 0:30			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:15	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	0:25 - 1:35[11]	0:25 - 0:40[11]			
	75/25	0:40 - 2:00	0:25 - 0:55	2:55 - 3:00	1:15 - 2:55	0:30 - 1:15	0:20 - 1:05[11]	0:20 - 0:30[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:05 - 0:20	1:15 - 1:50	0:25 - 1:15	0:07 - 0:25					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:02 - 0:07	0:30 - 0:45	0:09 - 0:30	0:03 - 0:09					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:25 - 0:50	0:01 - 0:04	0:20 - 0:30	0:06 - 0:20	0:02 - 0:06					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 35: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:50 - 4:00	0:50 - 1:25	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:10 - 0:10	0:15 - 2:00	
	75/25	2:30 - 4:00	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:07 - 0:07	0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	0:35 - 1:05	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45			
	75/25	0:40 - 1:30	0:25 - 0:50	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[11]	0:35 - 0:45[11]			
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[11]	0:35 - 0:45[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:08 - 0:25	1:35 - 2:15	0:35 - 1:35	0:10 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15					
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:25 - 0:50	0:02 - 0:05	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 36: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:30 - 4:00	0:50 - 1:30	3:00 - 3:00	2:00 - 3:00	1:05 - 2:00	2:00 - 2:00	1:00 - 1:50	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:50	0:40 - 1:10	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35	0:35 - 1:40	0:50 - 0:55			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 1:50	0:35 - 1:00	2:25 - 2:55	1:20 - 2:25	0:45 - 1:20	0:35 - 1:40[11]	0:50 - 0:55[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:05 - 0:10	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:25 - 0:40	0:03 - 0:06	0:20 - 0:25	0:09 - 0:20	0:04 - 0:09					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 37: TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR ENDURANCE™ EG106 ADF/AAF

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:05 - 3:10	0:30 - 1:00	2:45 - 3:00	1:20 - 2:45	0:40 - 1:20	1:10 - 2:00	0:50 - 1:15	0:15 - 0:15	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 3:20	0:25 - 0:50	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10	0:55 - 1:50	0:45 - 1:10			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:50 - 3:20	0:25 - 0:45	2:10 - 2:45	1:05 - 2:10	0:30 - 1:05	0:55 - 1:50[11]	0:45 - 1:10[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:05	0:15 - 0:35	1:45 - 2:15	0:50 - 1:45	0:25 - 0:50					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:05	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:05	0:15 - 0:30	1:20 - 1:45	0:40 - 1:20	0:20 - 0:40					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 38: TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:20 - 4:00	0:45 - 1:25	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:08 - 0:08	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	0:35 - 1:05	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15	0:25 - 1:25[11]	0:20 - 0:25[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:25 - 0:40	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 39: TYPE IV HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 3:10	0:30 - 0:55	2:35 - 3:00	1:15 - 2:35	0:35 - 1:15	1:05 - 1:45	0:50 - 1:00	0:15 - 0:15	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:25	0:25 - 0:50	2:10 - 2:40	1:05 - 2:10	0:30 - 1:05	0:55 - 1:30	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:25	0:20 - 0:45	1:55 - 2:25	0:55 - 1:55	0:30 - 0:55	0:55 - 1:30[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:45	0:10 - 0:25	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:45	0:06 - 0:15	0:50 - 1:10	0:20 - 0:50	0:09 - 0:20					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:35	0:04 - 0:09	0:30 - 0:40	0:15 - 0:30	0:05 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 40: TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:40	0:35 - 1:00	2:25 - 2:50	1:20 - 2:25	0:45 - 1:20	0:40 - 1:30	0:35 - 0:40	0:09 - 0:09	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:10 - 2:35	0:30 - 0:55	2:05 - 2:30	1:10 - 2:05	0:40 - 1:10	0:50 - 1:25	0:30 - 0:40			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:10 - 2:35	0:25 - 0:50	1:55 - 2:15	1:05 - 1:55	0:35 - 1:05	0:50 - 1:25[11]	0:30 - 0:40[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:00	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:00	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:30 - 1:00	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 41: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:30 - 2:40	0:30 - 0:55	2:30 - 3:00	1:15 - 2:30	0:35 - 1:15	1:05 - 1:30	0:40 - 1:05	0:10 - 0:10	0:15 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:35	0:25 - 0:50	2:15 - 2:45	1:05 - 2:15	0:35 - 1:05	0:50 - 1:20	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:35	0:25 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	0:50 - 1:20[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:30 - 0:50	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 42: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:10 - 4:00	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00	0:30 - 0:50	0:06 - 0:06	0:09 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:40 - 4:00	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00	0:40 - 1:00			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:40 - 4:00	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00[11]	0:40 - 1:00[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:45 - 1:55	0:07 - 0:20	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:45 - 1:55	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:45 - 1:55	0:01 - 0:06	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 43: TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:10 - 4:00	0:55 - 1:35	3:00 - 3:00	2:05 - 3:00	1:15 - 2:05	1:50 - 2:00	1:05 - 2:00	0:15 - 0:15	0:25 - 2:00	
	75/25	1:25 - 2:40	0:30 - 0:55	2:05 - 2:25	1:15 - 2:05	0:45 - 1:15	1:00 - 1:20	0:30 - 0:50	0:08 - 0:08	0:10 - 1:20	
	50/50	0:30 - 0:55	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30	0:15 - 0:40	0:15 - 0:20	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 3:30	0:50 - 1:25	3:00 - 3:00	1:50 - 3:00	1:05 - 1:50	0:25 - 1:35	0:20 - 0:30			
	75/25	0:45 - 1:50	0:30 - 0:50	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05	0:20 - 1:10	0:15 - 0:25			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 3:30	0:45 - 1:15	2:55 - 3:00	1:45 - 2:55	1:00 - 1:45	0:25 - 1:35[11]	0:20 - 0:30[11]			
	75/25	0:45 - 1:50	0:25 - 0:45	1:45 - 2:00	1:00 - 1:45	0:35 - 1:00	0:20 - 1:10[11]	0:15 - 0:25[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:00	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:00	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:40 - 1:00	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 44: TYPE IV HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE-IV PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:20 - 3:50	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:45 - 1:40	1:25 - 2:00	0:50 - 1:20	0:09 - 0:09	0:10 - 1:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 0:35	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	0:40 - 1:30	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 0:35	0:20 - 0:45	2:05 - 2:40	0:55 - 2:05	0:25 - 0:55	0:40 - 1:30[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:15 - 0:30	0:00 - 0:01	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 45: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:55 - 4:00	0:25 - 0:55	2:20 - 2:55	1:10 - 2:20	0:35 - 1:10	1:10 - 2:00	0:40 - 1:05	0:09 - 0:09	0:15 - 1:25	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:35 - 2:05	0:20 - 0:40	1:50 - 2:20	0:55 - 1:50	0:30 - 0:55	0:35 - 1:20	0:20 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:35 - 2:05	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:35 - 1:20[11]	0:20 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:55	0:10 - 0:20	1:00 - 1:15	0:30 - 1:00	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:55	0:05 - 0:10	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15					
below -25 to -29.5 °C (below -13 to -21 °F)	100/0	0:30 - 0:55	0:05 - 0:10	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 53 provides allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 46: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:35 - 4:00	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	1:20 - 2:00	0:40 - 1:05	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:25	0:20 - 0:45	2:10 - 2:45	1:00 - 2:10	0:25 - 1:00	0:50 - 2:00	0:45 - 1:05			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 3:25	0:20 - 0:40	1:55 - 2:25	0:50 - 1:55	0:25 - 0:50	0:50 - 2:00[11]	0:45 - 1:05[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:55	0:15 - 0:30	1:35 - 2:05	0:40 - 1:35	0:15 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:55	0:09 - 0:20	1:10 - 1:35	0:30 - 1:10	0:15 - 0:30					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:35 - 1:55	0:08 - 0:20	1:00 - 1:20	0:25 - 1:00	0:10 - 0:25					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 52 provides allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 47: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:05 - 4:00	0:30 - 1:00	2:50 - 3:00	1:20 - 2:50	0:40 - 1:20	1:15 - 2:00	0:40 - 0:55	0:10 - 0:10	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 3:15	0:25 - 0:50	2:15 - 2:55	1:05 - 2:15	0:30 - 1:05	1:15 - 2:00	0:30 - 0:45			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:35 - 3:15	0:20 - 0:40	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	1:15 - 2:00[11]	0:30 - 0:45[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:10	0:15 - 0:30	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:10	0:09 - 0:20	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:10	0:08 - 0:20	1:00 - 1:15	0:25 - 1:00	0:10 - 0:25					

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 48: TYPE IV HOLDOVER TIMES FOR SHAANXI CLEANWAY CLEANSURFACE IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:30 - 4:00	0:30 - 1:15	3:00 - 3:00	1:40 - 3:00	0:40 - 1:40	1:20 - 2:00	0:40 - 1:10	0:09 - 0:09	0:15 - 1:50	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:05	0:20 - 0:45	2:25 - 3:00	1:00 - 2:25	0:25 - 1:00	0:30 - 1:30	0:25 - 0:35			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:05	0:15 - 0:35	1:45 - 2:15	0:45 - 1:45	0:20 - 0:45	0:30 - 1:30[11]	0:25 - 0:35[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:35	0:10 - 0:20	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:35	0:05 - 0:10	0:35 - 0:45	0:15 - 0:35	0:07 - 0:15					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:30	0:04 - 0:09	0:30 - 0:35	0:15 - 0:30	0:06 - 0:15					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 49: TYPE IV HOLDOVER TIMES FOR XINJIANG ZHONGTIAN LIYANG AVIATION CLEARICE-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:25 - 4:00	0:25 - 0:50	2:15 - 2:50	1:05 - 2:15	0:30 - 1:05	1:05 - 1:55	0:35 - 0:55	0:09 - 0:09	0:15 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 2:10	0:20 - 0:40	1:50 - 2:20	0:55 - 1:50	0:25 - 0:55	0:55 - 1:35	0:35 - 0:50			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 2:10	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:55 - 1:35[11]	0:35 - 0:50[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:00	0:15 - 0:30	1:15 - 1:35	0:40 - 1:15	0:20 - 0:40					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:00	0:15 - 0:25	1:10 - 1:25	0:35 - 1:10	0:15 - 0:35					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:00	0:10 - 0:25	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm that the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

ALLOWANCE TIMES TABLES FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.

TABLE 50: LIST OF FLUIDS VALIDATED FOR USE WITH ALLOWANCE TIMES[1]

Manufacturer	Fluid Name	Applicable Allowance Times (ATs)
Type III Fluids		
AllClear Systems LLC	AeroClear MAX	ATs for Type III Fluids
Type IV EG Fluids		
AFLRUS LLC	Green Flo Type 4	Fluid has not been validated[2]
ALAB International	PROFLIGHT EG4	Fluid has not been validated[2]
AllClear Systems LLC	ClearWing EG	ATs for Type IV EG Fluids
ASGlobal	4Flite EG	Fluid has not been validated[2]
AVIAFLUID International Ltd	AVIAFlight EG	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR EG IV	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR Nordik IV	ATs for Type IV EG Fluids
Chongqing Joba Chemical Co,.Ltd	FW-IV	ATs for Type IV EG Fluids
Dow Inc.	UCAR ENDURANCE™ EG106 ADF/AAF	ATs for Type IV EG Fluids
JSC RCP Nordix	Defrost NORTH 4	ATs for Type IV EG Fluids
Newave Aerochemical Co. Ltd.	FCY-EGIV	ATs for Type IV EG Fluids
Newave Aerochemical Co. Ltd.	FCY-EGIV PLUS	Fluid has not been validated[2]
Xinjiang Zhongtian Liyang Aviation	Clearice-IV	Fluid has not been validated[2]
Type IV PG Fluids		
ABAX Industries	ECOWING AD-49	ATs for Type IV PG Fluids
ALAB International	PROFLIGHT PG4	Fluid has not been validated[2]
AllClear Systems LLC	Clear IV Flight	Fluid has not been validated[2]
ASGlobal	4Flite PG	ATs for Type IV PG Fluids
AVIAFLUID International Ltd	AVIAFlight PG	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH PLUS	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Advance	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Xtend	ATs for Type IV PG Fluids
Dow Inc.	UCAR™ FLIGHTGUARD™ AD-49	ATs for Type IV PG Fluids
ESSPO CHEMICALS D.O.O	Nordwing PG4	Fluid has not been validated[2]
Inland Technologies Inc.	ECO-SHIELD®	ATs for Type IV PG Fluids
JSC RCP Nordix	Defrost ECO 4	ATs for Type IV PG Fluids
Kilfrost Limited	ABC-S Plus	ATs for Type IV PG Fluids
MKS DevO Chemicals	COREICEPHOB TYPE-IV PG	Fluid has not been validated[2]
Newave Aerochemical Co. Ltd.	FCY 9311	ATs for Type IV PG Fluids
Shaanxi Cleanway Aviation Chemical Co., Ltd	Cleansurface IV	Fluid has not been validated[2]

NOTES

1 Allowance times are for use with undiluted (100/0) Type III, Type IV EG, and Type IV PG fluids only. No allowance times exist for Type II fluids.
2 No allowance times exist for this fluid at the time of publication as the allowance times have not yet been validated.

TABLE 51: ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[4]	Outside Air Temperature			
	Above 0 °C (Above 32 °F)	0 to -5 °C (32 to 23 °F)	Below -5 to -10 °C (Below 23 to 14 °F)	Below -10 °C[3] (Below 14 °F)
Light Ice Pellets (or Small Hail[5,6]) -PL	10 minutes	10 minutes	10 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Snow -PLSN, -SNPL	10 minutes	10 minutes	10 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		7 minutes	5 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	7 minutes			
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		7 minutes	5 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Rain -PLRA, -RAPL	7 minutes			
Moderate Ice Pellets (or Small Hail[5,6]) PL	5 minutes	5 minutes	5 minutes	

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; or light rain.

3 Ensure that the lowest operational use temperature (LOUT) is respected.

4 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

5 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.

6 If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 52: ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[5]	Outside Air Temperature				
	Above 0 °C[3] (Above 32 °F)	0 to -5 °C[3] (32 to 23 °F)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[3] (Below 14 to 3 °F)	Below -16 to -22 °C[3,4] (Below 3 to -8 °F)
Light Ice Pellets (or Small Hail[6,7]) -PL	70 minutes	70 minutes	70 minutes	50 minutes	30 minutes
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Snow -PLSN, -SNPL	50 minutes	50 minutes	30 minutes	25 minutes	
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		40 minutes	30 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	40 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		40 minutes	30 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain -PLRA, -RAPL	40 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		20 minutes			
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	20 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) PL	35 minutes	35 minutes	35 minutes	15 minutes	10 minutes
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Snow PLSN, SNPL	25 minutes	25 minutes	15 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		20 minutes	10 minutes		
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	20 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Rain PLRA, RAPL	15 minutes				

Caution: No allowance times currently exist

Caution: No allowance times currently exist

NOTES

- The notes that apply to the allowance times in the table above can be found on page 67.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 52 (CONT'D): ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) EG-based fluids. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).
2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.
3 No allowance times exist for EG-based fluids when used on aircraft with rotation speeds less than 100 knots.
4 Ensure that the lowest operational use temperature (LOUT) is respected.
5 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.
6 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.
7 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

TABLE 53: ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[6]	Outside Air Temperature				
	Above 0 °C[3] (Above 32 °F)	0 to -5 °C[3] (32 to 23 °F)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[4] (Below 14 to 3 °F)	Below -16 to -22 °C[4,5] (Below 3 to -8 °F)
Light Ice Pellets (or Small Hail[7,8]) -PL	50 minutes	50 minutes	30 minutes	30 minutes	20 minutes
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Snow -PLSN, -SNPL	40 minutes	40 minutes	15 minutes	15 minutes	
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		25 minutes	10 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	25 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		25 minutes	10 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain -PLRA, -RAPL	25 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		20 minutes			
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	20 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) PL	15 minutes	15 minutes	10 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Snow PLSN, SNPL	15 minutes	15 minutes	5 minutes	5 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		10 minutes	7 minutes		
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	10 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Rain PLRA, RAPL	10 minutes				

Caution: No allowance times currently exist

NOTES

- The notes that apply to the allowance times in the table above can be found on page 69.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 63.

TABLE 53 (CONT'D): ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) PG-based fluids applied on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 115 knots.

5 Ensure that the lowest operational use temperature (LOUT) is respected.

6 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

7 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.

8 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

SUPPLEMENTAL GUIDANCE FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

TABLE 54: SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Visibility		Day		Night	
Statute Miles	Meters	-1 °C and below 30 °F and below	Above -1 °C Above 30 °F	-1 °C and Below 30 °F and below	Above -1 °C Above 30 °F
≤1/4 (≤3/8)	**≤400** (≤600)	Heavy	Heavy	Heavy	Heavy
1/2 (>3/8 to ≤5/8)	**800** (>600 to ≤1000)	Moderate	Heavy	Heavy	Heavy
3/4 (>5/8 to ≤7/8)	**1200** (>1000 to ≤1400)	Moderate	Moderate	Moderate	Heavy
1 (>7/8 to ≤1 1/8)	**1600** (>1400 to ≤1800)	Light	Light	Moderate	Moderate
1 ¼ (>1 1/8 to ≤1 3/8)	**2000** (>1800 to ≤2200)	Light	Light	Moderate	Moderate
1 ½ (>1 3/8 to ≤1 5/8)	**2400** (>2200 to ≤2600)	Light	Light	Moderate	Moderate
1 ¾ (>1 5/8 to ≤1 7/8)	**2800** (>2600 to ≤3000)	Very Light	Light	Light	Light
2 (>1 7/8 to ≤2 ¼)	**3200** (>3000 to ≤3600)	Very Light	Very Light	Light	Light
2 ½ (>2 ¼ to ≤2 ¾)	**4000** (>3600 to ≤4400)	Very Light	Very Light	Very Light	Very Light
3 (>2 ¾ to ≤3 ¼)	**4800** (>4400 to ≤5200)	Very Light	Very Light	Very Light	Very Light
≥3 ½ (>3 ¼)	**≥5600** (>5200)	Very Light	Very Light	Very Light	Very Light

NOTES

- The METAR/SPECI reported visibility or flight crew observed visibility will be used with this visibility table to establish snowfall intensity for Type I, II, III and IV holdover time guidelines, during snow, snow grain, or snow pellet precipitation conditions. This visibility table will also be used when snow, snow grains, or snow pellets are accompanied by blowing or drifting snow, or when snow is mixed with ice crystals, freezing fog, rain or drizzle in the METAR/SPECI.
- The use of Runway Visual Range (RVR) is not permitted for determining visibility used with the holdover tables.
- Some METARs contain tower visibility as well as surface visibility. Whenever surface visibility is available from an official source, such as a METAR, in either the main body of the METAR or in the Remarks ("RMK") section, the preferred action is to use the surface visibility value.
- If the visibility is being reduced by snow along with form(s) of obscuration such as fog, haze, smoke, etc., use of the table above may overestimate the actual snowfall intensity. However, use of the snowfall intensity being reported by the weather observer or automated surface observing system (ASOS), from the FMH-1 Table, may underestimate the actual snowfall intensity as it does not directly correlate to the snowfall intensities used when determining holdover times. Use of the visibility table in all snow conditions with or without obscurations is recommended.

Example for how to read and use the table: `CYVO 160200Z 15011G17KT 1SM -SN DRSN OVC009 M06/M08 A2948`

In the above METAR the snowfall intensity is reported as light. However, based upon the "Snowfall Intensities as a Function of Prevailing Visibility" table, with a visibility of 1 statute mile, at night and a temperature of -6 °C, the snowfall intensity is classified as moderate. The snowfall intensity of moderate - not the METAR reported intensity of light - will be used to determine which holdover time guideline value is appropriate for the fluid in use.

TABLE 55:
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]						
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
ABAX Industries									
DE-950	PG	26-06-01	71/29	-26	-15	Not tested[11]		-31	-24
Aéro Mag 2000									
DeiceX PG ADF Concentrate (Multiple Location)	PG	Y-M-D[12]	65/35	-25	-13	Not tested[11]		-31.5	-25
AFLRUS LLC									
Orange Flo Type 1	EG	26-11-15	70/30	-42	-44	Not tested[11]		-40	-40
ALAB Industries[10]									
WDF 1	*EG*	*22-03-02[9]*	*70/30*	*-40*	*-40*	*Not tested[11]*		*-45*	*-49*
ALAB International									
PROFLIGHT EG1	*EG*	*25-06-01[9]*	*70/30*	*-43.5*	*-46*	*Not tested[11]*		*-44*	*-47*
AllClear Systems LLC									
Lift-Off E-188	EG	26-06-01	70/30	-40	-40	Not tested[11]		-41.5	-43
Lift-Off P-88	PG	26-06-01	70/30	-24.5	-12	Not tested[11]		-29.5	-21
Arcton Ltd.[10]									
Arctica DG ready-to-use	*DEG*	*22-03-26[9]*	*as supplied*	*-26*	*-15*	*Not tested[11]*		*-26*	*-15*
ASGlobal									
Sky-Go EG	EG	26-09-23	70/30	*-31[14]*	*-24[14]*	Not tested[11]		-44	-47
Sky-Go PG	PG	26-07-27	70/30	*-21.5[14]*	*-7[14]*	Not tested[11]		-30.5	-23
Sky-Go PG 80	PG	27-08-07	70/30	*-25[14]*	*-13[14]*	Not tested[11]		-31.5	-25
AVIAFLUID International Ltd.									
AVIAFLO EG	*EG*	*25-03-23[9]*	*70/30*	*-40.5*	*-41*	*Not tested[11]*		*-41*	*-42*
AVIAFLO PG	*PG*	*22-02-10[9]*	*70/30*	*Not tested[11]*		*Not tested[11]*		*-30*	*-22*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.									
Cleanwing I	PG	27-06-08	75/25	Not tested[11]		Not tested[11]		-39.5	-39
Cleanwing E	EG	28-06-01	75/25	-37	-35	Not tested[11]		-37	-35
Cleanwing S-92	EG	28-06-01	75/25	-35	-31	Not tested[11]		-40	-40
KHF-1	PG	27-06-08	75/25	Not tested[11]		Not tested[11]		-38.5	-37

TABLE 55 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]					
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]
				°C	°F	°C	°F	°C	°F
Beijing Wangye Aviation Chemical Product Co Ltd.[10]									
KLA-1A	*EG*	*22-05-22[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-32*	*-26*
Beijing Yadilite Aviation Advanced Materials Corporation[10]									
YD-101A Type I	*EG*	*25-02-26[9]*	*70/30*	*Not tested[11]*		*Not tested[11]*		*-38*	*-36*
CHEMCO Inc.									
CHEMR EG I	EG	28-06-01	70/30	-37	-35	Not tested[11]		-43	-45
CHEMR REG I	EG	26-06-01	75/25	-36.5	-34	Not tested[11]		-43.5	-46
Chongqing Joba Chemical Co.,Ltd									
FW-I	EG	25-11-07	75/25	-43	-45	Not tested[11]		-46	-51
Clariant Produkte (Deutschland) GmbH									
Octaflo EF Concentrate	*PG*	*22-03-28[9]*	*65/35*	*-25*	*-13*	*Not tested[11]*		*-33*	*-27*
Safewing EG I Arctic	EG	26-08-23	70/30	-43.5	-46	Not tested[11]		-46	-51
Safewing MP I 1938 ECO (80)	PG	28-06-19	71/29	-25	-13	Not tested[11]		-32.5	-27
Safewing MP I ECO PLUS (80)	PG	27-06-01	71/29	-25	-13	Not tested[11]		-33	-27
Safewing MP I LFD 80	PG	29-06-01	71/29	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD 80 Pre-Mix 55%	PG	29-06-01	as supplied	Not tested[11]		Not tested[11]		-17	1
Safewing MP I LFD 88	PG	27-06-01	65/35	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD PLUS 88	PG	26-06-01	65/35	-25	-13	Not tested[11]		-34	-29
Cryotech Deicing Technology									
Polar Plus® LT	PG	28-06-01	63/37	-27	-17	Not tested[11]		-33	-27
Polar Plus® LT (80)	PG	28-06-01	70/30	-27	-17	Not tested[11]		-33	-27
Dow Inc.									
UCAR™ ADF Concentrate	EG	27-06-01	75/25	-36	-33	Not tested[11]		-45	-49
UCAR™ ADF XL54[15]	EG	27-06-01	as supplied	-33	-27	Not tested[11]		-33	-27
UCAR™ PG ADF Concentrate	PG	27-06-01	65/35	-25	-13	Not tested[11]		-32	-26
UCAR™ PG ADF Dilute 55/45[16]	PG	27-06-01	as supplied	-24	-11	Not tested[11]		-25	-13

TABLE 55 (CONT'D):
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution[4,5] (fluid/water)	Lowest Operational Use Temperature[3]					
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
ESSPO CHEMICALS D.O.O									
Nordwing EG1	EG	27-06-01	70/30	-42	-44	Not tested[11]		-48	-54
Nordwing PG1	PG	27-06-01	70/30	-25	-13	Not tested[11]		-29	-20
HOC Industries									
SafeTemp® ES Plus	PG	28-07-04	65/35	-25.5	-14	Not tested[11]		-29	-20
Inland Technologies Inc.									
DuraGly-E Type I ADF Concentrate	*EG*	*23-02-08[9]*	*60/40*	*-33*	*-27*	*Not tested[11]*		*-33*	*-27*
Inland ADF Concentrate (Multiple Location)	EG	Y-M-D[17]	75/25	-36	-33	Not tested[11]		-42.5	-45
SafeTemp® ES Plus (Multiple Location)	PG	Y-M-D[18]	65/35	-25.5	-14	Not tested[11]		-31	-24
JSC RCP Nordix									
DEFROST EG 88.1	*EG*	*25-04-13[9]*	*70/30*	*-40.5*	*-41*	*Not tested[11]*		*-44.5*	*-48*
DEFROST PG 1	*PG*	*23-11-21[9]*	*70/30*	*-24.5*	*-12*	*Not tested[11]*		*-31.5*	*-25*
Kilfrost Limited									
Kilfrost DF Plus	PG	27-06-01	69/31	-25.5	-14	Not tested[11]		-32	-26
Kilfrost DF Plus (80)	*PG*	*24-07-14[9]*	*69/31*	*-26*	*-15*	*Not tested[11]*		*-31.5*	*-25*
Kilfrost DF Plus (88)	*PG*	*23-06-05[9]*	*63/37*	*-25.5*	*-14*	*Not tested[11]*		*-32*	*-26*
Kilfrost Ice Clear I	PG	27-06-01	70/30	-26	-15	Not tested[11]		-33	-27
LNT Solutions[10]									
LNT E188	EG	25-08-13	70/30	-30.5	-23	Not tested[11]		-41	-42
LNT P180	PG	26-11-10	69/31	-26	-15	Not tested[11]		-32	-26
MKS DevO Chemicals									
COREICEPHOB TYPE I	PG	26-06-01	71/29	Not tested[11]		Not tested[11]		-32.5	-27

TABLE 55 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]						
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
Newave Aerochemical Co. Ltd.									
FCY-1A	EG	27-06-01	75/25	*-40*[14]	*-40*[14]	Not tested[11]		-40	-40
FCY-1Bio+	EG	29-06-01	75/25	-40.5	-41	Not tested[11]		-40.5	-41
FCY-1Bio+ (R)	EG	25-12-01	75/25	Not tested[11]		Not tested[11]		-46	-51
ROMCHIM PROTECT SRL[10]									
ADD-PROTECT NG Type I	EG	26-06-01	60/40	-22	-8	Not tested[11]		-22	-8
ADD-PROTECT Type I	PG	27-06-01	70/30	-25.5	-14	Not tested[11]		-31	-24
Shaanxi Cleanway Aviation Chemical Co., Ltd									
Cleansurface I	*EG*	*25-06-07*[13]	*75/25*	*Not tested*[11]		*Not tested*[11]		*-40.5*	*-41*
Cleansurface I-BIO	*EG*	*22-05-02*[9]	*75/25*	*Not tested*[11]		*Not tested*[11]		*-37*	*-35*
Topan LLP[10]									
TOPAN TYPE I	*EG*	*24-07-13*[9]	*75/25*	*-35.5*	*-32*	*Not tested*[11]		*-42*	*-44*
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.									
Clearice-I	EG	29-06-01	60/40	Not tested[11]		Not tested[11]		-30	-22
Clearice-IB	EG	29-06-01	75/25	Not tested[11]		Not tested[11]		-43.5	-46

TABLE 56:
TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-2	PG	27-06-01	100/0	Not tested[11]		-27	-17	5 750 (a)	Not Available[19]	17 200 (a)	14 000 (h)
			75/25	Not tested[11]		-15	5	12 000 (c)	Not Available[19]	30 200 (c)	32 000 (h)
			50/50[9]	*Not tested[11]*		*-3*	*27*	*7 500 (a)*	*Not Available[19]*	*26 900 (c)*	*36 800 (h)*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.											
Cleanwing II	*PG*	*25-07-06[13]*	*100/0*	*Not tested[11]*		*-25*	*-13*	*4 650 (e)*	*4 500 (a)*	*13 500 (a)*	*11 100 (i)*
			75/25	*Not tested[11]*		*-15*	*5*	*9 450 (e)*	*10 000 (a)*	*14 600 (i)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-4.5*	*24*	*10 150 (e)*	*10 200 (a)*	*12 900 (i)*	*Not Available[19]*
Clariant Produkte (Deutschland) GmbH											
Safewing MP II FLIGHT	PG	26-06-01	100/0	Not tested[11]		-29	-20	3 340 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	12 900 (c)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	11 500 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Cryotech Deicing Technology											
Polar Guard® II	PG	27-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	9 750 (a)	38 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	80 (a)	Not Available[19]	48 000 (c)	Not Available[19]
ESSPO CHEMICALS D.O.O.											
Nordwing PG2	PG	27-06-01	100/0	Not tested[11]		-30	-22	11 450 (a)	9 500 (h)	20 500 (c)	18,100 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Kilfrost Limited											
ABC-K Plus	*PG*	*25-06-01[13]*	*100/0*	*Not tested[11]*		*-29*	*-20*	*2 850 (e)*	*2 640 (a)*	*13 400 (a)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*12 650 (e)*	*12 650 (c)*	*29 000 (c)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3.5*	*26*	*4 200 (e)*	*5 260 (a)*	*15 000 (a)*	*Not Available[19]*
Ice Clear II	PG	26-06-01	100/0	Not tested[11]		-28	-18	4 100 (a)	18 000 (m)	26 000 (c)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

TABLE 56 (CONT'D):
TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
MKS DevO Chemicals											
COREICEPHOB TYPE II	PG	26-06-01	100/0	Not tested[11]		-27	-17	34 400 (i)	Not Available[19]	50 200 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Not tested[11]		-3.5	26	20 700 (i)	Not Available[19]	30 700 (i)	Not Available[19]
Newave Aerochemical Co. Ltd.											
FCY-2	PG	27-06-01	100/0	Not tested[11]		-28	-18	7 000 (e)	8 920 (a)	24 800 (c)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ROMCHIM PROTECT SRL[10]											
ADD-PROTECT NG Type II	*PG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*5 200 (a)*	*Not Available[19]*	*12 400 (a)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*8 250 (a)*	*Not Available[19]*	*43 800 (i)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3*	*27*	*5 850 (a)*	*Not Available[19]*	*38 900 (i)*	*Not Available[19]*
ADD-PROTECT Type II	*PG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*4 000 (a)*	*Not Available[19]*	*18 250 (a)*	*12 900 (i)*
			75/25	*Not tested[11]*		*-14*	*7*	*7 700 (a)*	*Not Available[19]*	*23 300 (c)*	*23 200 (i)*
			50/50	*Not tested[11]*		*-3*	*27*	*14 500 (a)*	*Not Available[19]*	*31 400 (c)*	*22 600 (i)*

TABLE 57:
TYPE III FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]						AS 9968 Viscosity[7] (mPa.s)			
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
AllClear Systems LLC													
AeroClear MAX	EG	27-06-01	100/0	-16	3	-20.5	-5	-35	-31	7 800 (o)	Not Available[19]	15 000 (o)	Not Available[19]
			75/25	Dilution Not Applicable						Dilution Not Applicable			
			50/50	Dilution Not Applicable						Dilution Not Applicable			

TABLE 58:
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-49	PG	26-06-01	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	25 900 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AFLRUS LLC											
Green Flo Type 4	EG	26-11-25	100/0	Not tested[11]		-30	-22	6 550 (a)	Not Available[19]	13 400 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ALAB International											
PROFLIGHT EG4	*EG*	*25-06-01[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*1 840 (a)*	*Not Available[19]*	*6 180 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
PROFLIGHT PG4	PG	26-06-01	100/0	Not tested[11]		-29	-20	10 600 (a)	Not Available[19]	17 800 (h)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AllClear Systems LLC											
Clear IV Flight	PG	27-06-01	100/0	Not tested[11]		-23	-9	22 300 (m)	21 900 (l)	31 700 (m)	29 400 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ClearWing EG	EG	27-06-01	100/0	Not tested[11]		-29	-20	35 500 (n)	13 350 (a)	51 800 (k)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ASGlobal											
4Flite EG	EG	26-09-24	100/0	Not tested[11]		-30	-22	6 600 (a)	Not Available[19]	17 300 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
4Flite PG	*PG*	*25-08-04[13]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*26 100 (c)*	*Not Available[19]*	*36 500 (c)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

TABLE 58 (CONT'D): TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
AVIAFLUID International Ltd											
AVIAFlight EG	*EG*	*22-04-28[9]*	*100/0*	*Not tested[11]*		*-31*	*-24*	*5 600 (a)*	*Not Available[19]*	*12 800 (a)*	*11 200 (i)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
AVIAFlight PG	*PG*	*23-07-01[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*28 600 (c)*	*Not Available[19]*	*35 900 (c)*	*22 200 (i)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
CHEMCO Inc.											
ChemR EG IV	*EG*	*23-04-07[9]*	*100/0*	*Not tested[11]*		*-27*	*-17*	*46 400 (m)*	*19 450 (c)*	*67 000 (m)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
ChemR Nordik IV	EG	27-06-01	100/0	Not tested[11]		-29	-20	60 800 (n)	43 100 (c)	87 100 (n)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Chongqing Joba Chemical Co.,Ltd											
FW-IV	EG	25-11-01	100/0	Not tested[11]		-29	-20	32 600 (j)	Not Available[19]	66 200 (j)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Clariant Produkte (Deutschland) GmbH											
Safewing MP IV LAUNCH	PG	26-06-01	100/0	Not tested[11]		-28.5	-19	7 550 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	18 000 (a)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	17 800 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Safewing MP IV LAUNCH PLUS	PG	27-06-01	100/0	Not tested[11]		-29	-20	8 700 (p)	8 450 (a)	21 000 (q)	21 000 (c)
			75/25	Not tested[11]		-14	7	18 800 (q)	17 200 (c)	51 600 (q)	51 600 (c)
			50/50	Not tested[11]		-3.5	26	9 700 (p)	12 150 (a)	65 700 (q)	65 700 (c)

TABLE 58 (CONT'D): TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
Cryotech Deicing Technology											
Polar Guard® Advance	PG	27-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	9 750 (a)	38 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	80 (a)	Not Available[19]	48 000 (c)	Not Available[19]
Polar Guard® Xtend	PG	27-06-01	100/0	Not tested[11]		-29	-20	6 000 (f)	6 350 (a)	23 500 (f)	23 200 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Dow Inc.											
UCAR ENDURANCE™ EG106 ADF/AAF	EG	27-06-01	100/0	Not tested[11]		-29	-20	24 850 (j)	2 230 (a)	47 800 (j)	5 900 (a)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
UCAR™ FLIGHTGUARD™ AD-49	PG	27-06-01	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	25 900 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ESSPO CHEMICALS D.O.O.											
Nordwing PG4	PG	27-06-01	100/0	Not tested[11]		-30	-22	11 550 (a)	9 800 (h)	20 000 (c)	20 300 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Inland Technologies Inc.											
ECO-SHIELD®	*PG*	*24-10-28[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*11 050 (a)*	*Not Available[19]*	*25 800 (i)*	*34 500 (c)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
JSC RCP Nordix											
Defrost ECO 4	*PG*	*23-08-12[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*9 800 (h)*	*12 350 (a)*	*14 800 (i)*	*17 340 (a)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Defrost NORTH 4	*EG*	*23-06-01[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*2 500 (a)*	*Not Available[19]*	*5 350 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

TABLE 58 (CONT'D):
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 83 and 84)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
Kilfrost Limited											
ABC-S Plus	*PG*	*25-06-15[13]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*17 900 (e)*	*17 900 (c)*	*43 800 (c)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*18 300 (e)*	*18 300 (c)*	*58 000 (c)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3.5*	*26*	*7 500 (e)*	*7 500 (a)*	*27 000 (c)*	*Not Available[19]*
MKS DevO Chemicals											
COREICEPHOB TYPE-IV PG	PG	26-06-01	100/0	Not tested[11]		-29	-20	50 200 (i)	Not Available[19]	60 900 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Newave Aerochemical Co. Ltd.											
FCY 9311	PG	26-06-01	100/0	Not tested[11]		-29.5	-21	14 100 (c)	Not Available[19]	27 600 (c)	25 700 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV	EG	26-06-01	100/0	Not tested[11]		-29	-20	24 800 (g)	6 300 (a)	43 700 (k)	78 000 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV PLUS	EG	27-06-01	100/0	Not tested[11]		-29	-20	27 400 (k)	Not Available[19]	66 900 (k)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Shaanxi Cleanway Aviation Chemical Co., Ltd											
Cleansurface IV	PG	25-11-28	100/0	Not tested[11]		-30	-22	16 750 (a)	14 800 (h)	29 700 (d)	21 100 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.											
Clearice-IV	EG	26-11-11	100/0	Not tested[11]		-29	-20	35 600 (d)	Not Available[19]	75 100 (d)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

CAUTIONS AND NOTES FOR TABLES 55, 56, 57, 58

CAUTIONS

- These tables list fluids that have been tested with respect to endurance time performance (Holdover Times), anti-icing performance (Water Spray Endurance Testing/High Humidity Endurance Testing) and aerodynamic acceptance (Type I: SAE ARP6207 §3.4.1, AMS1424 §3.5.2 and §3.5.3; Type II/ III/ IV: SAE ARP5718 §FOREWARD, AMS1428 §3.2.4 and §3.2.5) only. These tests were conducted by APS Aviation Inc. (www.apsaviation.ca) and Anti-icing Materials International Laboratory (AMIL) (www.uqac.ca/amil). The end user is responsible for contacting the fluid manufacturer to confirm all other SAE AMS1424/1428 technical requirement tests, such as fluid stability, toxicity, materials compatibility, etc. have been conducted. These technical requirement tests are typically conducted by Scientific Material International (SMI) (www.smiinc.com) and AMIL, or any acceptable source.
- LOUT data provided in these tables is based strictly on the manufacturer's data; the end user is responsible for verifying the validity of this data.
- Type I fluids supplied in concentrated form must not be used in that form and must be diluted.

NOTES

1 PG = conventional glycol (propylene glycol); EG = conventional glycol (ethylene glycol); DEG = conventional glycol (diethylene glycol); NCG = non-conventional glycol (organic non-ionic diols and triols, e.g. 1,3-propanediol, glycerine) and mixtures of non-conventional glycol and conventional glycol; NG = non-glycol (e.g. organic salts) and mixtures of non-glycol and glycol.

2 Expiry date is the earlier expiry date of the Aerodynamic Test(s) or Water Spray Endurance Test. Fluids that are tested after the issuance of this list will appear in a later update.

3 The values in this table were determined using test results from pre-production fluid samples when available. In some cases, the fluid manufacturer requested the publication of a more conservative value than the pre-production test value. The lowest operational use temperature (LOUT) for a given fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer (Type I = 10 °C/18 °F; Type II/III/IV = 7 °C/13 °F).

Note: LOUTs are rounded to the nearest half degree Celsius and the values in degrees Fahrenheit are calculated to the nearest whole degree.

4 The LOUT for Type I fluids that are intended to be diluted is derived from a dilution that provides the lowest operational use temperature. For other Type I dilutions, determine the freezing point of the fluid and add a 10 °C freezing point buffer, as a dilution will usually yield a higher and more restrictive operational use temperature. Consult the fluid manufacturer or fluid documentation for further clarification and guidance on establishing the appropriate operational use temperature of a diluted fluid.

5 Type I concentrate fluids have also been tested at 50/50 (glycol/water) dilution.

6 If uncertain whether the aircraft to be treated conforms to the low speed, the middle speed, or the high speed aerodynamic test, consult the aircraft manufacturer. The aerodynamic test is defined in SAE AS5900 (latest version).

7 The Alternate viscosity method should only be used for field verification and auditing purposes; when in doubt as to which method is appropriate, use the manufacturer method. Viscosity measurement methods are indicated as letters (in parentheses) beside each viscosity value. Details of each measurement method are shown in Table 59 on the following page. The exact measurement method (spindle, container, fluid volume, temperature, speed, duration) must be used to compare the viscosity of a sample to a viscosity given in this table.

8 The lowest on-wing viscosity (LOWV), and highest on-wing viscosity (HOWV) values in this table are those of the fluids provided by the manufacturers for holdover time testing, and initial qualification aerodynamic testing. For the holdover times and lowest operation use temperature to be valid, the viscosity of the fluid on the wing shall not be lower than the LOWV value in this table and higher than the HOWV value in this table. The user should periodically ensure that the viscosity of a fluid sample taken from the wing surface complies with these limits.

9 Aerodynamic Performance and Anti-Icing Performance test data has expired; fluids listed in italics will be removed from this listing four years after expiry.

10 Manufacturer has not provided fluid information as required in SAE ARP5718B; fluid may be removed from this listing in subsequent revisions.

11 Manufacturer has indicated fluid was not tested.

12 Dow UCAR™ PG ADF Concentrate, sold under the product name DeiceX PG ADF Concentrate, qualified from 2023-06-15.

13 Currently in the test/re-test process. Contact the fluid manufacturer for latest information (see Appendix C for latest available contact information).

14 Fluid was not retested for low speed aerodynamics. This data will be removed four years after the expiry of the last low speed test.

15 For UCAR™ ADF XL54, refer to primary site qualification of UCAR™ ADF Concentrate.

16 For UCAR™ PG ADF Dilute 55/45, refer to primary site qualification of UCAR™ PG ADF Concentrate.

17 Dow UCAR™ ADF Concentrate, sold under the product name Inland ADF Concentrate, qualified from 2015-09-04.

18 Refer to preproduction qualification of SafeTemp® ES Plus submitted by HOC Industries, qualified from 2017-11-20.

19 Manufacturer has not provided an alternate method for measuring viscosity. Please use the Manufacturer Method.

TABLE 59:
VISCOSITY MEASUREMENT METHODS FOR TYPE II, III, AND IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

Method	Brookfield Spindle*	Container	Fluid Volume	Temp.**	Speed	Duration
a	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	10.0 minutes
b	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	33.3 minutes
c	LV2-disc (with guard leg)	600 mL low form (Griffin) beaker	425 mL***	20 °C	0.3 rpm	10.0 minutes
d	LV2-disc (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	10.0 minutes
e	LV2-disc (with guard leg)	150 mL tall form (Berzelius) beaker	135 mL***	20 °C	0.3 rpm	10.0 minutes
f	SC4-34/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
g	SC4-34/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
h	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
i	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	30.0 minutes
j	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	10.0 minutes
k	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
l	SC4-31/13R	small sample adapter	9 mL	20 °C	0.3 rpm	15.0 minutes
m	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	10.0 minutes
n	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	30.0 minutes
o	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	65.0 minutes
p	LV1	big sample adapter	55 mL	20 °C	0.3 rpm	10.0 minutes
q	LV2-disc	big sample adapter	60 mL	20 °C	0.3 rpm	10.0 minutes

* Spindle must be attached to a Brookfield viscometer model equipped with an LV spring.

** Sample temperature will affect readings; ensure sufficient time is allowed for sample to reach thermal equilibrium before starting test. Use of a cooling bath strongly recommended.

*** If necessary, adjust fluid volume to ensure fluid is level with notch on the spindle shaft.

TABLE 60: GUIDELINES FOR THE APPLICATION OF SAE TYPE I FLUID

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing[2]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[3]
0 °C (32 °F) and above	Fluid/water mixture heated to at least 60 °C (140 °F) at the nozzle with a freezing point of at least 10° C (18 °F) below OAT	Heated water or a heated fluid/water mixture	Fluid/water mixture heated to at least 60 °C (140 °F) at the nozzle with a freezing point of at least 10 °C (18 °F) below OAT
Below 0 °C (32 °F)		Heated fluid/water mixture with a freezing point at OAT or below	

NOTES

1 Fluids must not be used at temperatures below their lowest operational use temperature (LOUT).

2 When anti-icing using the one-step procedure, a minimum quantity of 1 liter/m^2 (~2 gal./100 sq. ft.) of Type I fluid mixture heated to at least 60 °C (140 °F) is required after all frozen contamination is removed. This is achieved using a continuous process. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times.

3 To be applied before first-step fluid freezes, typically within 3 minutes. This time may be higher than 3 minutes in some conditions, but potentially lower in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- This table is applicable for the use of Type I holdover time guidelines in all conditions, including active frost. If holdover times are not required, a temperature of 60 °C (140 °F) at the nozzle is desirable.
- If holdover times are required, the temperature of water or fluid/water mixtures shall be at least 60 °C (140 °F) at the nozzle. Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- To use Type I Holdover Times Guidelines in all conditions including active frost, an additional minimum of 1 liter/m^2 (~2 gal./100 sq. ft.) of heated Type I fluid mixture must be applied to the surfaces after all frozen contamination is removed. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times. The required protection can be provided using a 1-step method by applying more fluid than is strictly needed to just remove all of the frozen contamination (the same additional amount stated above is required).
- The lowest operational use temperature (LOUT) for a given Type I fluid is the higher (warmer) of:
  a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
  b) The actual freezing point of the fluid plus a freezing point buffer of 10 °C (18 °F).
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2025-2026) for the contaminant in question.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

TABLE 61: GUIDELINES FOR THE APPLICATION OF SAE TYPE II AND IV FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[2]
0 °C (32 °F) and above	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated water or a heated Type I, II, III, or IV fluid/water mixture	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below 0 °C (32 °F) to -3 °C (27 °F)	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below -3 °C (27 °F) to -14 °C (7 °F)	100/0 or 75/25 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 or 75/25 Heated or unheated Type II or IV fluid/water mixture
Below -14 °C (7 °F)	100/0 Heated[3] Type II or IV fluid	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 Heated or unheated Type II or IV fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consideration should be given to the use of Type I/III fluid when Type II/IV fluid cannot be used due to LOUT limitations (see Table 56 and Table 58). The LOUT for a given Type II/IV fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer of 7 °C (13 °F).

Although some LOUTs are lower than the temperatures stated in the HOT table, holdover times do not apply when anti-icing below the lowest temperature stated in the band.

2 To be applied before first step fluid freezes, typically within 3 minutes. Time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

3 Clean aircraft may be anti-iced with unheated fluid.

CAUTIONS

- For heated fluids, a fluid temperature not less than 60 °C (140 °F) at the nozzle is desirable.
- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2025-2026") for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

TABLE 62: GUIDELINES FOR THE APPLICATION OF UNHEATED SAE TYPE III FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	Anti-icing Only[4]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[2]
0 °C (32 °F) and above	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated[3] water or a heated[3] Type I, II, III, or IV fluid/water mixture	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below 0 °C (32 °F) to -3 °C (27 °F)	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below -3 °C (27 °F) to -10 °C (14 °F)	100/0 or 75/25 Unheated Type III fluid/water mixture	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 or 75/25 Unheated Type III fluid/water mixture
Below -10 °C (14 °F)	100/0 Unheated Type III fluid	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 Unheated Type III fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consider the use of Type I when Type III fluid cannot be used (see Table 57). The LOUT for a given Type III fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer of 7 °C (13 °F).

Although the LOUTs may be lower than the temperatures stated in the HOT table, holdover times do not apply when anti-icing below the lowest temperature stated in the band.

2 To be applied before first step fluid freezes, typically within 3 minutes. This time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

3 For heated fluids, a fluid temperature not less than 60 °C (140 °F) at the nozzle is desirable.

4 Anti-icing only with unheated Type III fluid is only possible on a clean aircraft. If deicing is required, a two-step procedure must be used.

CAUTIONS

- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2025-2026") for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type III is not to be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

APPENDIX A:
ADJUSTED HOLDOVER TIME (HOT) GUIDELINES

These tables are for use when flaps/slats are deployed prior to de/anti-icing. Holdover and allowance times have been adjusted to 76 percent of standard times. Standard holdover and allowance times can be used if flaps and slats are deployed as close to departure as safety allows.

Note: Industry data indicates the possibility of increased takeoff misconfigurations when the selection of takeoff flaps is delayed later in the taxi regime. If an air carrier chooses to select the flaps/slats to the takeoff configuration prior to beginning the anti-icing process, operators should have robust procedures in place to ensure that the aircraft is properly configured prior to takeoff. Air Carriers should follow the airframe manufacturer's recommended procedures regarding anti-icing operations and the configuration of flaps/slats while taxiing.

Appendix A: FAA Adjusted Holdover Time Guidelines Winter 2025-2026

ADJUSTED HOLDOVER TIME (HOT) GUIDELINES FOR WINTER 2025-2026

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Appendix A: FAA Adjusted Holdover Time Guidelines Winter 2025-2026

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ADJUSTED ACTIVE FROST HOT GUIDELINES
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-1: ADJUSTED ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I Aluminum	Type I Composite
-1 °C and above (30 °F and above)	0:34	0:27
below -1 to -3 °C (below 30 to 27 °F)		
below -3 to -10 °C (below 27 to 14 °F)		
below -10 to -14 °C (below 14 to 7 °F)		
below -14 to -21 °C (below 7 to -6 °F)		
below -21 to -25 °C (below -6 to -13 °F)		
below -25 °C (below -13 °F)		

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1 °C and above (30 °F and above)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:31	0:23	2:17
below -1 to -3 °C (below 30 to 27 °F)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:08	0:23	2:17
below -3 to -10 °C (below 27 to 14 °F)	100/0	6:05	1:31	7:36
	75/25	3:02	0:46	3:48
below -10 to -14 °C (below 14 to 7 °F)	100/0	4:34	1:31	4:34
	75/25	0:46	0:46	0:46
below -14 to -21 °C (below 7 to -6 °F)	100/0	2:17	1:31	4:34
below -21 to -25 °C (below -6 to -13 °F)	100/0	1:31	1:31	3:02
below -25 °C (below -13 °F)	100/0	No Holdover Time Guidelines Exist		

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 55 - Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-4.

ADJUSTED HOT GUIDELINES FOR SAE TYPE I FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

TABLE ADJ-2: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:08 - 0:13	0:05 - 0:08	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:07 - 0:10	0:02 - 0:04	0:02 - 0:02	0:02 - 0:04	
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:10	0:04 - 0:06	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:04	CAUTION: No holdover time guidelines exist		
below -6 to -10 °C (below 21 to 14 °F)	0:05 - 0:08	0:03 - 0:05	0:08 - 0:10	0:05 - 0:08	0:03 - 0:05	0:03 - 0:05	0:02 - 0:04			
below -10 °C (below 14 °F)	0:04 - 0:07	0:02 - 0:03	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

TABLE ADJ-3: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:07 - 0:12	0:02 - 0:05	0:09 - 0:11	0:05 - 0:09	0:02 - 0:05	0:06 - 0:10	0:02 - 0:04	0:01 - 0:01	0:01 - 0:04	
below -3 to -6 °C (below 27 to 21 °F)	0:05 - 0:06	0:02 - 0:04	0:08 - 0:10	0:04 - 0:08	0:02 - 0:04	0:04 - 0:07	0:02 - 0:04	CAUTION: No holdover time guidelines exist		
below -6 to -10 °C (below 21 to 14 °F)	0:03 - 0:06	0:02 - 0:04	0:07 - 0:09	0:04 - 0:07	0:02 - 0:04	0:03 - 0:05	0:02 - 0:04			
below -10 °C (below 14 °F)	0:03 - 0:05	0:02 - 0:03	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

ADJUSTED HOT GUIDELINES FOR SAE TYPE II FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

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CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE ADJ-4: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:42 - 1:24	0:15 - 0:30	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:04 - 0:04	0:05 - 0:34	
	75/25	0:30 - 0:53	0:11 - 0:19	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:02 - 0:02	0:03 - 0:19	
	50/50	0:11 - 0:23	0:04 - 0:08	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:34	0:11 - 0:23	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15			
	75/25	0:19 - 0:42	0:07 - 0:11	0:08 - 0:19	0:11 - 0:23	0:07 - 0:15			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:34	0:08 - 0:19	0:11 - 0:23	0:15 - 0:34[12]	0:11 - 0:15[12]			
	75/25	0:19 - 0:42	0:05 - 0:11	0:07 - 0:15	0:11 - 0:23[12]	0:07 - 0:15[12]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:15	0:01 - 0:04	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:15	0:00 - 0:02	0:01 - 0:02					
below -25 °C (below -13 °F)	100/0	0:11 - 0:15	0:00 - 0:00	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 56). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
12 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-5: ADJUSTED TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:01 - 2:17	0:23 - 0:42	1:50 - 2:13	0:57 - 1:50	0:30 - 0:57	0:30 - 1:16	0:23 - 0:34	0:05 - 0:05	0:07 - 1:05	
	75/25	0:57 - 1:05	0:15 - 0:30	1:20 - 1:39	0:42 - 1:20	0:19 - 0:42	0:27 - 0:49	0:15 - 0:23	0:02 - 0:02	0:03 - 0:38	
	50/50	0:11 - 0:23	0:04 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:54	0:19 - 0:34	1:31 - 1:50	0:46 - 1:31	0:23 - 0:46	0:19 - 0:53	0:15 - 0:23			
	75/25	0:27 - 1:27	0:15 - 0:27	1:16 - 1:35	0:38 - 1:16	0:19 - 0:38	0:11 - 0:42	0:15 - 0:27			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:54	0:15 - 0:30	1:20 - 1:35	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53[11]	0:15 - 0:23[11]			
	75/25	0:27 - 1:27	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:11 - 0:42[11]	0:15 - 0:27[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:30	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:30	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:11 - 0:30	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-6: ADJUSTED TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:42 - 1:24	0:15 - 0:30	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:05 - 0:05	0:08 - 0:42	
	75/25	0:38 - 1:01	0:15 - 0:27	1:01 - 1:16	0:34 - 1:01	0:19 - 0:34	0:27 - 0:46	0:15 - 0:23	0:04 - 0:04	0:05 - 0:38	
	50/50	0:27 - 0:46	0:08 - 0:15	0:38 - 0:49	0:19 - 0:38	0:11 - 0:19	0:15 - 0:30	0:08 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:24	0:11 - 0:23	1:01 - 1:12	0:30 - 1:01	0:19 - 0:30	0:23 - 0:42	0:15 - 0:19			
	75/25	0:30 - 1:20	0:15 - 0:27	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30	0:15 - 0:19			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:24	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:15 - 0:27	0:23 - 0:42[11]	0:15 - 0:19[11]			
	75/25	0:30 - 1:20	0:15 - 0:27	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30[11]	0:15 - 0:19[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:38	0:07 - 0:15	0:34 - 0:46	0:19 - 0:34	0:11 - 0:19					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:38	0:04 - 0:08	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than "moderate". No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of "moderate" precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a "heavy" precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-7: ADJUSTED TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:40 - 3:02	0:34 - 0:53	1:58 - 2:21	1:12 - 1:58	0:46 - 1:12	1:01 - 1:31	0:34 - 1:05	0:06 - 0:06	0:08 - 1:08	
	75/25	1:24 - 2:05	0:23 - 0:46	1:58 - 2:24	1:01 - 1:58	0:30 - 1:01	0:53 - 1:08	0:23 - 0:42	0:03 - 0:03	0:05 - 0:38	
	50/50	0:42 - 1:20	0:07 - 0:15	0:34 - 0:42	0:19 - 0:34	0:08 - 0:19	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:20	0:27 - 0:46	1:35 - 1:54	0:57 - 1:35	0:34 - 0:57	0:27 - 1:08	0:19 - 0:34			
	75/25	0:19 - 0:49	0:15 - 0:30	1:20 - 1:39	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53	0:15 - 0:27			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:20	0:23 - 0:38	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:27 - 1:08[11]	0:19 - 0:34[11]			
	75/25	0:19 - 0:49	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:53[11]	0:15 - 0:27[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:05 - 0:15	0:53 - 1:16	0:19 - 0:53	0:06 - 0:19					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:02 - 0:05	0:23 - 0:30	0:08 - 0:23	0:02 - 0:08					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:38	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-8: ADJUSTED TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:09 - 3:02	0:38 - 1:05	2:28 - 2:59	1:27 - 2:28	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:08 - 0:08	0:11 - 1:31	
	75/25	1:54 - 3:02	0:23 - 0:49	2:17 - 2:55	1:05 - 2:17	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:05 - 0:05	0:07 - 1:16	
	50/50	0:38 - 1:05	0:05 - 0:15	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:54	0:27 - 0:49	1:50 - 2:09	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34			
	75/25	0:30 - 1:08	0:19 - 0:38	1:46 - 2:17	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:54	0:23 - 0:38	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[11]	0:27 - 0:34[11]			
	75/25	0:30 - 1:08	0:15 - 0:34	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[11]	0:27 - 0:34[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	0:06 - 0:19	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11					
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:19 - 0:38	0:02 - 0:04	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-9: ADJUSTED TYPE II HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:16 - 2:24	0:23 - 0:46	1:58 - 2:28	1:01 - 1:58	0:30 - 1:01	0:49 - 1:24	0:38 - 0:49	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:46	0:19 - 0:34	1:31 - 1:54	0:46 - 1:31	0:23 - 0:46	0:38 - 1:08	0:19 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:46	0:15 - 0:30	1:20 - 1:39	0:38 - 1:20	0:19 - 0:38	0:38 - 1:08[11]	0:19 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:27	0:08 - 0:19	0:57 - 1:16	0:23 - 0:57	0:11 - 0:23					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:27	0:05 - 0:11	0:38 - 0:49	0:15 - 0:38	0:06 - 0:15					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:15 - 0:23	0:02 - 0:05	0:19 - 0:23	0:07 - 0:19	0:03 - 0:07					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-10: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:43 - 2:51	0:34 - 0:57	0:46 - 1:16	1:24 - 1:31	0:46 - 1:05	0:11 - 0:11	0:15 - 1:31	
	75/25	1:16 - 1:54	0:19 - 0:38	0:27 - 0:53	1:05 - 1:31	0:38 - 0:53	0:08 - 0:08	0:11 - 1:31	
	50/50	0:27 - 0:49	0:04 - 0:08	0:05 - 0:11	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:49	0:30 - 0:53	0:42 - 1:08	0:19 - 0:46	0:11 - 0:27			
	75/25	0:19 - 1:05	0:19 - 0:38	0:27 - 0:49	0:15 - 0:42	0:07 - 0:23			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:49	0:30 - 0:49	0:38 - 1:05	0:19 - 0:46[11]	0:11 - 0:27[11]			
	75/25	0:19 - 1:05	0:19 - 0:38	0:27 - 0:49	0:15 - 0:42[11]	0:07 - 0:23[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:42	0:01 - 0:04	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:42	0:00 - 0:02	0:01 - 0:02					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:42	0:00 - 0:00	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-11: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:05 - 1:50	0:23 - 0:46	1:50 - 2:13	1:01 - 1:50	0:30 - 1:01	0:46 - 1:12	0:30 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:58	0:23 - 0:38	1:39 - 1:58	0:53 - 1:39	0:30 - 0:53	0:23 - 0:57	0:27 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:58	0:19 - 0:38	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:23 - 0:57[11]	0:27 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 0:34	0:08 - 0:15	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 0:34	0:05 - 0:08	0:23 - 0:27	0:11 - 0:23	0:06 - 0:11					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:27 - 0:34	0:04 - 0:07	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-12: ADJUSTED TYPE II HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:27 - 2:05	0:23 - 0:46	1:58 - 2:24	1:05 - 1:58	0:30 - 1:05	0:53 - 1:31	0:34 - 0:46	0:07 - 0:07	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	0:49 - 1:20	0:11 - 0:27	1:12 - 1:27	0:34 - 1:12	0:19 - 0:34	0:38 - 0:57	0:19 - 0:23	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:05	0:19 - 0:34	1:24 - 1:43	0:46 - 1:24	0:23 - 0:46	0:23 - 0:53	0:19 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:05	0:15 - 0:27	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:23 - 0:53[11]	0:19 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:19	0:06 - 0:11	0:27 - 0:30	0:15 - 0:27	0:08 - 0:15					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:19	0:02 - 0:04	0:11 - 0:11	0:05 - 0:11	0:03 - 0:05					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:11 - 0:19	0:02 - 0:03	0:08 - 0:08	0:04 - 0:08	0:02 - 0:04					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-13: ADJUSTED TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:57 - 1:50	0:19 - 0:30	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:05 - 0:05	0:06 - 0:34	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:08	0:11 - 0:23	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:08	0:08 - 0:19	0:11 - 0:23	0:15 - 0:34[11]	0:11 - 0:15[11]			
	75/25	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:27	0:01 - 0:04	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:27	0:00 - 0:02	0:01 - 0:02					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:19 - 0:27	0:00 - 0:00	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-14: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:53 - 1:50	0:19 - 0:42	1:58 - 2:28	0:53 - 1:58	0:27 - 0:53	0:38 - 1:01	0:27 - 0:38	0:04 - 0:04	0:05 - 0:53	
	75/25	0:46 - 1:24	0:15 - 0:30	1:27 - 1:50	0:42 - 1:27	0:19 - 0:42	0:30 - 0:57	0:19 - 0:30	0:04 - 0:04	0:05 - 0:42	
	50/50	0:19 - 0:42	0:08 - 0:15	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23	0:15 - 0:27	0:08 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:12	0:15 - 0:30	1:24 - 1:46	0:38 - 1:24	0:19 - 0:38	0:27 - 0:53	0:19 - 0:27			
	75/25	0:42 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30	0:19 - 0:49	0:15 - 0:23			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:12	0:11 - 0:23	1:05 - 1:24	0:30 - 1:05	0:15 - 0:30	0:27 - 0:53[11]	0:19 - 0:27[11]			
	75/25	0:42 - 1:05	0:08 - 0:19	0:49 - 1:05	0:23 - 0:49	0:11 - 0:23	0:19 - 0:49[11]	0:15 - 0:23[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:15	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:15	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:11 - 0:15	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-15: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:16 - 2:40	0:15 - 0:34	1:27 - 1:50	0:46 - 1:27	0:23 - 0:46	0:30 - 1:12	0:19 - 0:34	0:05 - 0:05	0:07 - 0:38	
	75/25	0:30 - 0:53	0:11 - 0:19	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:03 - 0:03	0:04 - 0:19	
	50/50	0:15 - 0:27	0:05 - 0:11	0:23 - 0:27	0:11 - 0:23	0:07 - 0:11	0:08 - 0:23	0:06 - 0:08	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:34	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:38	0:15 - 0:23			
	75/25	0:23 - 0:42	0:07 - 0:11	0:30 - 0:38	0:19 - 0:30	0:08 - 0:19	0:15 - 0:23	0:11 - 0:15			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:34	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27	0:19 - 0:38[11]	0:15 - 0:23[11]			
	75/25	0:23 - 0:42	0:05 - 0:11	0:27 - 0:30	0:15 - 0:27	0:07 - 0:15	0:15 - 0:23[11]	0:11 - 0:15[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:19	0:01 - 0:04	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:19	0:00 - 0:02	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:11 - 0:19	0:00 - 0:00	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

ADJUSTED HOT GUIDELINES FOR SAE TYPE III FLUIDS WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.

TABLE ADJ-16: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -16 °C (below 14 to 3 °F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

TABLE ADJ-17: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -20.5 °C (below 14 to -5 °F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

TABLE ADJ-18: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:03 - 0:03	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -10 to -25 °C (below 14 to -13 °F)	100/0	0:30 - 1:20	0:10 - 0:23	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30					
below -25 to -35 °C (below -13 to -31 °F)	100/0	0:19 - 0:46	0:05 - 0:12	0:34 - 0:46	0:15 - 0:34	0:08 - 0:15					

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16 °C (3 °F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-50 provides adjusted allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-22.

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2025-2026**

ADJUSTED HOT GUIDELINES FOR SAE TYPE IV FLUIDS
WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content.
- High wind velocity, jet blast or blowing snow may reduce holdover time below the lowest time stated in the range.
- The holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilution of Type II or IV is not to be used for the anti-icing step because fluid freezing may occur.

TABLE ADJ-19: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7]	Light Snow, Snow Grains or Snow Pellets[6,7]	Moderate Snow, Snow Grains or Snow Pellets[6,7]	Freezing Drizzle[8]	Light Freezing Rain	Moderate Snow mixed with Rain[9,10]	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:57 - 1:43	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:27 - 0:53	0:11 - 0:23	0:05 - 0:05	0:06 - 0:49	
	75/25	1:05 - 2:02	0:23 - 0:42	1:35 - 1:50	0:57 - 1:35	0:30 - 0:57	0:46 - 1:01	0:23 - 0:38	0:05 - 0:05	0:07 - 1:01	
	50/50	0:23 - 0:42	0:05 - 0:15	0:46 - 0:53	0:19 - 0:46	0:08 - 0:19	0:11 - 0:30	0:07 - 0:15			
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:11 - 0:27	0:15 - 0:27	1:12 - 1:31	0:34 - 1:12	0:19 - 0:34	0:19 - 0:46	0:15 - 0:19			
	75/25	0:30 - 1:01	0:19 - 0:38	1:24 - 1:39	0:49 - 1:24	0:23 - 0:49	0:15 - 0:49	0:11 - 0:19			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:11 - 0:27	0:11 - 0:23	1:05 - 1:24	0:34 - 1:05	0:15 - 0:34	0:19 - 0:46[12]	0:15 - 0:19[12]			
	75/25	0:30 - 1:01	0:15 - 0:34	1:20 - 1:31	0:42 - 1:20	0:19 - 0:42	0:15 - 0:49[12]	0:11 - 0:19[12]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:23	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:23	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 °C (below -13 °F)	100/0	0:11 - 0:23	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 58). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
5 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids and Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
12 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-20: ADJUSTED TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:32 - 3:02	0:34 - 1:05	2:47 - 3:00	1:27 - 2:47	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:06 - 0:06	0:08 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 1:12	0:27 - 0:49	2:13 - 2:40	1:08 - 2:13	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 1:12	0:23 - 0:42	1:50 - 2:17	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[11]	0:15 - 0:19[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:19 - 0:30	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-21: ADJUSTED TYPE IV HOLDOVER TIMES FOR AFLRUS LLC GREEN FLO TYPE 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:57 - 1:54	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:27 - 0:53	0:11 - 0:23	0:05 - 0:05	0:06 - 0:53	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:38 - 1:58	0:15 - 0:27	1:12 - 1:31	0:34 - 1:12	0:19 - 0:34	0:27 - 0:46	0:15 - 0:23			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:38 - 1:58	0:11 - 0:23	1:05 - 1:24	0:34 - 1:05	0:15 - 0:34	0:27 - 0:46[11]	0:15 - 0:23[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 0:53	0:08 - 0:19	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 0:53	0:08 - 0:19	0:53 - 1:08	0:23 - 0:53	0:11 - 0:23					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:19 - 0:46	0:03 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-22: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:21 - 3:02	0:34 - 1:05	2:43 - 3:00	1:24 - 2:43	0:46 - 1:24	1:05 - 1:31	0:30 - 0:46	0:06 - 0:06	0:08 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:54 - 2:59	0:34 - 1:05	2:43 - 3:00	1:24 - 2:43	0:46 - 1:24	0:49 - 1:31	0:38 - 1:12			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:54 - 2:59	0:34 - 1:05	2:43 - 3:00	1:24 - 2:43	0:46 - 1:24	0:49 - 1:31[11]	0:38 - 1:12[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:12	0:23 - 0:46	2:05 - 2:40	1:01 - 2:05	0:30 - 1:01					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:12	0:11 - 0:27	1:08 - 1:27	0:34 - 1:08	0:15 - 0:34					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:27 - 1:12	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-23: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:05 - 1:43	0:23 - 0:46	2:02 - 2:32	1:01 - 2:02	0:30 - 1:01	0:49 - 1:05	0:30 - 0:38	0:08 - 0:08	0:11 - 1:01	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:46	0:19 - 0:38	1:46 - 2:13	0:53 - 1:46	0:27 - 0:53	0:34 - 0:53	0:27 - 0:34			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:46	0:15 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:34 - 0:53[11]	0:27 - 0:34[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 0:38	0:08 - 0:19	0:57 - 1:16	0:27 - 0:57	0:11 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 0:38	0:05 - 0:11	0:38 - 0:46	0:15 - 0:38	0:07 - 0:15					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:27 - 0:38	0:04 - 0:11	0:30 - 0:38	0:11 - 0:30	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-24: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEAR IV FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:12 - 2:09	0:23 - 0:46	1:54 - 2:21	1:01 - 1:54	0:30 - 1:01	0:49 - 1:20	0:38 - 0:53	0:11 - 0:11	0:15 - 0:57	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:38 - 1:27	0:19 - 0:34	1:27 - 1:50	0:46 - 1:27	0:23 - 0:46	0:38 - 1:05	0:30 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:38 - 1:27	0:15 - 0:30	1:16 - 1:31	0:38 - 1:16	0:19 - 0:38	0:38 - 1:05[11]	0:30 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:34	0:08 - 0:15	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23					
below -18 to -23 °C (below 0 to -9 °F)	100/0	0:19 - 0:34	0:06 - 0:11	0:30 - 0:38	0:15 - 0:30	0:08 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-25: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:24 - 2:28	0:23 - 0:46	2:02 - 2:32	1:01 - 2:02	0:30 - 1:01	0:53 - 1:12	0:23 - 0:46	0:06 - 0:06	0:08 - 1:08	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:12 - 2:51	0:19 - 0:42	1:50 - 2:17	0:53 - 1:50	0:27 - 0:53	0:49 - 1:08	0:23 - 0:46			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:12 - 2:51	0:19 - 0:38	1:43 - 2:05	0:49 - 1:43	0:23 - 0:49	0:49 - 1:08[11]	0:23 - 0:46[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:42 - 1:31	0:11 - 0:27	1:12 - 1:35	0:34 - 1:12	0:15 - 0:34					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:42 - 1:31	0:07 - 0:15	0:42 - 0:53	0:19 - 0:42	0:11 - 0:19					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:42 - 1:31	0:05 - 0:11	0:34 - 0:42	0:15 - 0:34	0:08 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-26: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:12 - 2:28	0:19 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:30 - 0:53	0:15 - 0:27	0:05 - 0:05	0:06 - 0:49	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:05	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:30 - 0:53	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:05	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:30 - 0:53[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:38 - 1:05	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:38 - 1:05	0:11 - 0:23	1:01 - 1:16	0:27 - 1:01	0:15 - 0:27					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:23 - 0:49	0:07 - 0:15	0:42 - 0:49	0:19 - 0:42	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-27: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:24 - 2:28	0:30 - 0:53	2:09 - 2:36	1:12 - 2:09	0:38 - 1:12	0:53 - 1:12	0:34 - 0:49	0:11 - 0:11	0:11 - 1:01	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:27	0:23 - 0:38	1:35 - 1:54	0:53 - 1:35	0:27 - 0:53	0:42 - 0:53	0:27 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:27	0:15 - 0:30	1:16 - 1:31	0:42 - 1:16	0:23 - 0:42	0:42 - 0:53[11]	0:27 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:34	0:11 - 0:19	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:34	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:23 - 0:34	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:06 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-28: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:08 - 2:21	0:23 - 0:38	1:27 - 1:46	0:53 - 1:27	0:30 - 0:53	0:49 - 1:31	0:23 - 0:38	0:07 - 0:07	0:08 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:01 - 2:17	0:19 - 0:34	1:20 - 1:35	0:46 - 1:20	0:27 - 0:46	0:42 - 1:08	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:01 - 2:17	0:19 - 0:30	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:42 - 1:08[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:20	0:15 - 0:30	1:16 - 1:31	0:38 - 1:16	0:19 - 0:38					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:20	0:11 - 0:23	1:01 - 1:12	0:30 - 1:01	0:15 - 0:30					
below -25 to -31 °C (below -13 to -24 °F)	100/0	0:27 - 0:49	0:05 - 0:11	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-29: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:43 - 3:02	0:30 - 0:57	2:17 - 2:47	1:16 - 2:17	0:42 - 1:16	1:31 - 1:31	0:53 - 1:27	0:11 - 0:11	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:39	0:19 - 0:38	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:27 - 1:27	0:34 - 0:49			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:39	0:15 - 0:27	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:27 - 1:27[11]	0:34 - 0:49[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:27	0:08 - 0:15	0:38 - 0:46	0:19 - 0:38	0:11 - 0:19					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:27	0:04 - 0:07	0:19 - 0:23	0:11 - 0:19	0:05 - 0:11					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:15 - 0:27	0:04 - 0:07	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-30: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:43	0:19 - 0:46	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:34 - 1:16	0:19 - 0:30	0:05 - 0:05	0:07 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:47	0:19 - 0:46	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:46 - 1:12	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:47	0:19 - 0:46	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:46 - 1:12[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:30 - 1:05	0:11 - 0:23	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30					

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-31: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:43 - 3:02	0:30 - 1:01	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	1:01 - 1:31	0:42 - 1:01	0:11 - 0:11	0:19 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:24 - 3:02	0:30 - 1:01	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	0:57 - 1:31	0:34 - 1:01			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:24 - 3:02	0:30 - 1:01	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	0:57 - 1:31[11]	0:34 - 1:01[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:08	0:27 - 0:53	2:21 - 2:51	1:12 - 2:21	0:38 - 1:12					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:08	0:19 - 0:38	1:39 - 2:02	0:49 - 1:39	0:27 - 0:49					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:08	0:15 - 0:30	1:24 - 1:43	0:42 - 1:24	0:23 - 0:42					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-32: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHONGQING JOBA CHEMICAL FW-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:28 - 3:02	0:27 - 0:57	2:28 - 3:00	1:16 - 2:28	0:38 - 1:16	1:08 - 1:31	0:34 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:54 - 3:02	0:23 - 0:46	2:05 - 2:36	1:05 - 2:05	0:30 - 1:05	0:38 - 1:31	0:27 - 0:53			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:54 - 3:02	0:23 - 0:42	1:50 - 2:17	0:57 - 1:50	0:27 - 0:57	0:38 - 1:31[11]	0:27 - 0:53[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:16	0:15 - 0:30	1:31 - 1:58	0:42 - 1:31	0:19 - 0:42					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:16	0:11 - 0:23	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:27 - 1:16	0:08 - 0:19	0:53 - 1:08	0:23 - 0:53	0:11 - 0:23					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-33: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	3:02 - 3:02	0:38 - 1:01	2:09 - 2:32	1:20 - 2:09	0:49 - 1:20	1:08 - 1:31	0:46 - 1:16	0:08 - 0:08	0:11 - 1:16	
	75/25	2:47 - 3:02	0:34 - 1:01	2:21 - 2:47	1:20 - 2:21	0:46 - 1:20	1:16 - 1:31	0:34 - 0:57	0:06 - 0:06	0:08 - 1:20	
	50/50	1:05 - 2:05	0:15 - 0:27	1:05 - 1:16	0:34 - 1:05	0:19 - 0:34	0:23 - 0:38	0:15 - 0:19	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:46 - 1:27	0:30 - 0:49	1:50 - 2:09	1:08 - 1:50	0:42 - 1:08	0:27 - 1:16	0:19 - 0:34			
	75/25	0:30 - 1:01	0:30 - 0:53	2:02 - 2:28	1:08 - 2:02	0:38 - 1:08	0:19 - 0:53	0:19 - 0:34			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:46 - 1:27	0:27 - 0:46	1:39 - 1:54	1:01 - 1:39	0:38 - 1:01	0:27 - 1:16[11]	0:19 - 0:34[11]			
	75/25	0:30 - 1:01	0:27 - 0:46	1:50 - 2:13	1:05 - 1:50	0:34 - 1:05	0:19 - 0:53[11]	0:19 - 0:34[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:04 - 0:11	0:57 - 1:20	0:15 - 0:57	0:05 - 0:15					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:02 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:23 - 0:38	0:01 - 0:03	0:15 - 0:23	0:05 - 0:15	0:01 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-34: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:59 - 3:02	0:30 - 1:12	3:00 - 3:00	1:35 - 3:00	0:42 - 1:35	1:31 - 1:31	0:46 - 1:31	0:11 - 0:11	0:15 - 1:31	
	75/25	2:59 - 3:02	0:27 - 1:05	3:00 - 3:00	1:27 - 3:00	0:38 - 1:27	1:31 - 1:31	1:01 - 1:05	0:11 - 0:11	0:15 - 1:24	
	50/50	0:57 - 1:24	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34	0:19 - 0:46	0:11 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:43	0:27 - 0:57	2:51 - 3:00	1:16 - 2:51	0:34 - 1:16	0:19 - 1:12	0:19 - 0:30			
	75/25	0:30 - 1:31	0:23 - 0:49	2:40 - 3:00	1:08 - 2:40	0:27 - 1:08	0:15 - 0:49	0:15 - 0:23			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:43	0:23 - 0:49	2:28 - 3:00	1:05 - 2:28	0:30 - 1:05	0:19 - 1:12[11]	0:19 - 0:30[11]			
	75/25	0:30 - 1:31	0:19 - 0:42	2:13 - 2:55	0:57 - 2:13	0:23 - 0:57	0:15 - 0:49[11]	0:15 - 0:23[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	0:04 - 0:15	0:57 - 1:24	0:19 - 0:57	0:05 - 0:19					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:02 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:19 - 0:38	0:01 - 0:03	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-35: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:09 - 3:02	0:38 - 1:05	2:28 - 2:59	1:27 - 2:28	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:08 - 0:08	0:11 - 1:31	
	75/25	1:54 - 3:02	0:23 - 0:49	2:17 - 2:55	1:05 - 2:17	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:05 - 0:05	0:07 - 1:16	
	50/50	0:38 - 1:05	0:05 - 0:15	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:54	0:27 - 0:49	1:50 - 2:09	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34			
	75/25	0:30 - 1:08	0:19 - 0:38	1:46 - 2:17	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:54	0:23 - 0:38	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[11]	0:27 - 0:34[11]			
	75/25	0:30 - 1:08	0:15 - 0:34	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[11]	0:27 - 0:34[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	0:06 - 0:19	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11					
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:19 - 0:38	0:02 - 0:04	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-36: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:54 - 3:02	0:38 - 1:08	2:43 - 3:00	1:31 - 2:43	0:49 - 1:31	1:31 - 1:31	0:46 - 1:24	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:46 - 1:24	0:30 - 0:53	2:09 - 2:36	1:12 - 2:09	0:38 - 1:12	0:27 - 1:16	0:38 - 0:42			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:46 - 1:24	0:27 - 0:46	1:50 - 2:13	1:01 - 1:50	0:34 - 1:01	0:27 - 1:16[11]	0:38 - 0:42[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	0:11 - 0:23	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:04 - 0:08	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:19 - 0:30	0:02 - 0:05	0:15 - 0:19	0:07 - 0:15	0:03 - 0:07					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-37: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR ENDURANCE™ EG106 ADF/AAF

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:24	0:23 - 0:46	2:05 - 2:40	1:01 - 2:05	0:30 - 1:01	0:53 - 1:31	0:38 - 0:57	0:11 - 0:11	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:24 - 2:32	0:19 - 0:38	1:50 - 2:17	0:53 - 1:50	0:27 - 0:53	0:42 - 1:24	0:34 - 0:53			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:24 - 2:32	0:19 - 0:34	1:39 - 2:05	0:49 - 1:39	0:23 - 0:49	0:42 - 1:24[11]	0:34 - 0:53[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:49	0:11 - 0:27	1:20 - 1:43	0:38 - 1:20	0:19 - 0:38					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:49	0:11 - 0:23	1:08 - 1:27	0:30 - 1:08	0:15 - 0:30					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:49	0:11 - 0:23	1:01 - 1:20	0:30 - 1:01	0:15 - 0:30					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-38: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW INC. UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:32 - 3:02	0:34 - 1:05	2:47 - 3:00	1:27 - 2:47	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:06 - 0:06	0:08 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 1:12	0:27 - 0:49	2:13 - 2:40	1:08 - 2:13	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 1:12	0:23 - 0:42	1:50 - 2:17	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[11]	0:15 - 0:19[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:19 - 0:30	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-39: ADJUSTED TYPE IV HOLDOVER TIMES FOR ESSPO CHEMICALS D.O.O NORDWING PG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:12 - 2:24	0:23 - 0:42	1:58 - 2:24	0:57 - 1:58	0:27 - 0:57	0:49 - 1:20	0:38 - 0:46	0:11 - 0:11	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:50	0:19 - 0:38	1:39 - 2:02	0:49 - 1:39	0:23 - 0:49	0:42 - 1:08	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:50	0:15 - 0:34	1:27 - 1:50	0:42 - 1:27	0:23 - 0:42	0:42 - 1:08[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:34	0:08 - 0:19	1:01 - 1:20	0:27 - 1:01	0:11 - 0:27					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:34	0:05 - 0:11	0:38 - 0:53	0:15 - 0:38	0:07 - 0:15					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:15 - 0:27	0:03 - 0:07	0:23 - 0:30	0:11 - 0:23	0:04 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-40: ADJUSTED TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:57 - 2:02	0:27 - 0:46	1:50 - 2:09	1:01 - 1:50	0:34 - 1:01	0:30 - 1:08	0:27 - 0:30	0:07 - 0:07	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:53 - 1:58	0:23 - 0:42	1:35 - 1:54	0:53 - 1:35	0:30 - 0:53	0:38 - 1:05	0:23 - 0:30			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:53 - 1:58	0:19 - 0:38	1:27 - 1:43	0:49 - 1:27	0:27 - 0:49	0:38 - 1:05[11]	0:23 - 0:30[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:46	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:46	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:23 - 0:46	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-41: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:08 - 2:02	0:23 - 0:42	1:54 - 2:24	0:57 - 1:54	0:27 - 0:57	0:49 - 1:08	0:30 - 0:49	0:08 - 0:08	0:11 - 0:53	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:58	0:19 - 0:38	1:43 - 2:05	0:49 - 1:43	0:27 - 0:49	0:38 - 1:01	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:58	0:19 - 0:34	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:38 - 1:01[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:23 - 0:38	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-42: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:39 - 3:02	0:23 - 0:46	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31	0:23 - 0:38	0:05 - 0:05	0:07 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:02 - 3:02	0:23 - 0:46	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31	0:30 - 0:46			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:02 - 3:02	0:23 - 0:46	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31[11]	0:30 - 0:46[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:34 - 1:27	0:05 - 0:15	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:34 - 1:27	0:02 - 0:08	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11					
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:34 - 1:27	0:01 - 0:05	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-43: ADJUSTED TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:39 - 3:02	0:42 - 1:12	2:43 - 3:00	1:35 - 2:43	0:57 - 1:35	1:24 - 1:31	0:49 - 1:31	0:11 - 0:11	0:19 - 1:31	
	75/25	1:05 - 2:02	0:23 - 0:42	1:35 - 1:50	0:57 - 1:35	0:34 - 0:57	0:46 - 1:01	0:23 - 0:38	0:06 - 0:06	0:08 - 1:01	
	50/50	0:23 - 0:42	0:11 - 0:19	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:11 - 0:30	0:11 - 0:15	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 2:40	0:38 - 1:05	2:24 - 2:51	1:24 - 2:24	0:49 - 1:24	0:19 - 1:12	0:15 - 0:23			
	75/25	0:34 - 1:24	0:23 - 0:38	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:15 - 0:53	0:11 - 0:19			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 2:40	0:34 - 0:57	2:13 - 2:40	1:20 - 2:13	0:46 - 1:20	0:19 - 1:12[11]	0:15 - 0:23[11]			
	75/25	0:34 - 1:24	0:19 - 0:34	1:20 - 1:31	0:46 - 1:20	0:27 - 0:46	0:15 - 0:53[11]	0:11 - 0:19[11]			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:46	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:46	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:30 - 0:46	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-44: ADJUSTED TYPE IV HOLDOVER TIMES FOR MKS DEVO CHEMICALS COREICEPHOB TYPE-IV PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:46 - 2:55	0:27 - 0:57	2:47 - 3:00	1:16 - 2:47	0:34 - 1:16	1:05 - 1:31	0:38 - 1:01	0:07 - 0:07	0:08 - 1:16	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:11 - 0:27	0:19 - 0:42	1:58 - 2:32	0:53 - 1:58	0:27 - 0:53	0:30 - 1:08	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:11 - 0:27	0:15 - 0:34	1:35 - 2:02	0:42 - 1:35	0:19 - 0:42	0:30 - 1:08[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:23	0:01 - 0:05	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:23	0:00 - 0:02	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:11 - 0:23	0:00 - 0:01	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines — Winter 2025-2026

TABLE ADJ-45: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:27 - 3:02	0:19 - 0:42	1:46 - 2:13	0:53 - 1:46	0:27 - 0:53	0:53 - 1:31	0:30 - 0:49	0:07 - 0:07	0:11 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:27 - 1:35	0:15 - 0:30	1:24 - 1:46	0:42 - 1:24	0:23 - 0:42	0:27 - 1:01	0:15 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:27 - 1:35	0:15 - 0:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:27 - 1:01[11]	0:15 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:42	0:08 - 0:15	0:46 - 0:57	0:23 - 0:46	0:11 - 0:23					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:42	0:04 - 0:08	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11					
below -25 to -29.5 °C (below -13 to -21 °F)	100/0	0:23 - 0:42	0:04 - 0:08	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-52 provides adjusted allowance times for Type IV PG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-46: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:58 - 3:02	0:19 - 0:42	1:58 - 2:32	0:53 - 1:58	0:27 - 0:53	1:01 - 1:31	0:30 - 0:49	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:36	0:15 - 0:34	1:39 - 2:05	0:46 - 1:39	0:19 - 0:46	0:38 - 1:31	0:34 - 0:49			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:36	0:15 - 0:30	1:27 - 1:50	0:38 - 1:27	0:19 - 0:38	0:38 - 1:31[11]	0:34 - 0:49[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:27	0:11 - 0:23	1:12 - 1:35	0:30 - 1:12	0:11 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:27	0:07 - 0:15	0:53 - 1:12	0:23 - 0:53	0:11 - 0:23					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:27 - 1:27	0:06 - 0:15	0:46 - 1:01	0:19 - 0:46	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-51 provides adjusted allowance times for Type IV EG fluids in ice pellets and small hail).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-47: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	2:21 - 3:02	0:23 - 0:46	2:09 - 2:43	1:01 - 2:09	0:30 - 1:01	0:57 - 1:31	0:30 - 0:42	0:08 - 0:08	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:12 - 2:28	0:19 - 0:38	1:43 - 2:13	0:49 - 1:43	0:23 - 0:49	0:57 - 1:31	0:23 - 0:34			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:12 - 2:28	0:15 - 0:30	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:57 - 1:31[11]	0:23 - 0:34[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:53	0:11 - 0:23	1:08 - 1:27	0:30 - 1:08	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:53	0:07 - 0:15	0:49 - 1:05	0:23 - 0:49	0:11 - 0:23					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:53	0:06 - 0:15	0:46 - 0:57	0:19 - 0:46	0:08 - 0:19					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-48: ADJUSTED TYPE IV HOLDOVER TIMES FOR SHAANXI CLEANWAY CLEANSURFACE IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:54 - 3:02	0:23 - 0:57	2:51 - 3:00	1:16 - 2:51	0:30 - 1:16	1:01 - 1:31	0:30 - 0:53	0:07 - 0:07	0:11 - 1:24	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:35	0:15 - 0:34	1:50 - 2:21	0:46 - 1:50	0:19 - 0:46	0:23 - 1:08	0:19 - 0:27			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:35	0:11 - 0:27	1:20 - 1:43	0:34 - 1:20	0:15 - 0:34	0:23 - 1:08[11]	0:19 - 0:27[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:27	0:08 - 0:15	0:49 - 1:01	0:23 - 0:49	0:11 - 0:23					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:27	0:04 - 0:08	0:27 - 0:34	0:11 - 0:27	0:05 - 0:11					
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:15 - 0:23	0:03 - 0:07	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

TABLE ADJ-49: ADJUSTED TYPE IV HOLDOVER TIMES FOR XINJIANG ZHONGTIAN LIYANG AVIATION CLEARICE-IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6]	Light Snow, Snow Grains or Snow Pellets[5,6]	Moderate Snow, Snow Grains or Snow Pellets[5,6]	Freezing Drizzle[7]	Light Freezing Rain	Moderate Snow mixed with Rain[8,9]	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:02	0:19 - 0:38	1:43 - 2:09	0:49 - 1:43	0:23 - 0:49	0:49 - 1:27	0:27 - 0:42	0:07 - 0:07	0:11 - 1:08	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:01 - 1:39	0:15 - 0:30	1:24 - 1:46	0:42 - 1:24	0:19 - 0:42	0:42 - 1:12	0:27 - 0:38			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:01 - 1:39	0:11 - 0:27	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34	0:42 - 1:12[11]	0:27 - 0:38[11]			
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:46	0:11 - 0:23	0:57 - 1:12	0:30 - 0:57	0:15 - 0:30					
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:46	0:11 - 0:19	0:53 - 1:05	0:27 - 0:53	0:11 - 0:27					
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:46	0:08 - 0:19	0:49 - 1:01	0:23 - 0:49	0:11 - 0:23					

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR; however, it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or freezing mist.
4 The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 These holdover times apply to conditions of “moderate” precipitation intensity. In cases of very light or light snow mixed with light rain or drizzle, use light freezing rain holdover times. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 54) is required to confirm the precipitation intensity. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-26.

Appendix A: FAA Adjusted Holdover Time Guidelines Winter 2025-2026

ADJUSTED ALLOWANCE TIMES TABLES FOR WINTER 2025-2026

The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pre-takeoff check procedures.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.

Appendix A: FAA Adjusted Holdover Time Guidelines Winter 2025-2026

TABLE ADJ-50: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[4]	Outside Air Temperature			
	Above 0 °C (Above 32 °F)	0 to -5 °C (32 to 23 °F)	Below -5 to -10 °C (Below 23 to 14 °F)	Below -10 °C[3] (Below 14 °F)
Light Ice Pellets (or Small Hail[5,6]) -PL	8 minutes	8 minutes	8 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Snow -PLSN, -SNPL	8 minutes	8 minutes	8 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		5 minutes	4 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	5 minutes			
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		5 minutes	4 minutes	
Light Ice Pellets (or Small Hail[5,6]) Mixed with Light Rain -PLRA, -RAPL	5 minutes			
Moderate Ice Pellets (or Small Hail[5,6]) PL	4 minutes	4 minutes	4 minutes	

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; or light rain.

3 Ensure that the lowest operational use temperature (LOUT) is respected.

4 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

5 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.

6 If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

TABLE ADJ-51: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[5]	Outside Air Temperature				
	Above 0 °C[3] (Above 32 °F)	0 to -5 °C[3] (32 to 23 °F)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[3] (Below 14 to 3 °F)	Below -16 to -22 °C[3,4] (Below 3 to -8 °F)
Light Ice Pellets (or Small Hail[6,7]) -PL	53 minutes	53 minutes	53 minutes	38 minutes	23 minutes
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Snow -PLSN, -SNPL	38 minutes	38 minutes	23 minutes	19 minutes	
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		30 minutes	23 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	30 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		30 minutes	23 minutes		
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain -PLRA, -RAPL	30 minutes				
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		15 minutes			
Light Ice Pellets (or Small Hail[6,7]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	15 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) PL	27 minutes	27 minutes	27 minutes	11 minutes	8 minutes
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Snow PLSN, SNPL	19 minutes	19 minutes	11 minutes	8 minutes	
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		15 minutes	8 minutes		
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	15 minutes				
Moderate Ice Pellets (or Small Hail[6,7]) Mixed with Moderate Rain PLRA, RAPL	11 minutes				

Caution: No allowance times currently exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

- The notes that apply to the allowance times in the table above can be found on page A-61

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

TABLE ADJ-51 (CONT'D): ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) EG-based fluids. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for EG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 Ensure that the lowest operational use temperature (LOUT) is respected.

5 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

6 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.

7 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

TABLE ADJ-52: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[6]	Outside Air Temperature				
	Above 0 °C[3] (Above 32 °F)	0 to -5 °C[3] (32 to 23 °F)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[4] (Below 14 to 3 °F)	Below -16 to -22 °C[4,5] (Below 3 to -8 °F)
Light Ice Pellets (or Small Hail[7,8]) -PL	38 minutes	38 minutes	23 minutes	23 minutes	15 minutes
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Snow -PLSN, -SNPL	30 minutes	30 minutes	11 minutes	11 minutes	
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, +FZDZPL		19 minutes	8 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle -PLDZ, -DZPL, DZPL, +DZPL	19 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain -PLFZRA, -FZRAPL		19 minutes	8 minutes		
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain -PLRA, -RAPL	19 minutes				
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL		15 minutes			
Light Ice Pellets (or Small Hail[7,8]) Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL	15 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) PL	11 minutes	11 minutes	8 minutes	8 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Snow PLSN, SNPL	11 minutes	11 minutes	4 minutes	4 minutes	
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Freezing Drizzle PLFZDZ		8 minutes	5 minutes		
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Light, Moderate or Heavy Drizzle PLDZ	8 minutes				
Moderate Ice Pellets (or Small Hail[7,8]) Mixed with Moderate Rain PLRA, RAPL	8 minutes				

Caution: No allowance times currently exist

Caution: No allowance times currently exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

- The notes that apply to the allowance times in the table above can be found on page A-63.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-58.

TABLE ADJ-52 (CONT'D): ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS

NOTES

1 These allowance times are for use with undiluted (100/0) PG-based fluids applied on aircraft with rotation speeds of 100 knots or greater. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for Use with Allowance Times (Table 50).

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; light freezing rain; light rain; light rain and light snow; or light freezing rain and light snow, as well as in conditions of moderate ice pellets mixed with either: light, moderate or heavy freezing drizzle; light, moderate or heavy drizzle; or moderate rain.

3 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG-based fluids when used on aircraft with rotation speeds less than 115 knots.

5 Ensure that the lowest operational use temperature (LOUT) is respected.

6 Applicable METAR codes include only Ice Pellet conditions (i.e., PL). While allowance times can be used when Small Hail is reported instead of Ice Pellets, the corresponding METAR codes for Small Hail are not listed in the table.

7 The reporting of Small Hail by METAR varies by country, which can result in different HOTs or allowance times when the same METAR code is used in different regions. For details, refer to the *METAR Codes and Holdover or Allowance Times Used by Country* table in the FAA *Ground Deicing Program General Information* Document.

8 If the METAR does not report an intensity for small hail, use the "moderate ice pellets or small hail" allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

APPENDIX B:
TESTING LABORATORIES

TESTING LABORATORIES

The following laboratories are known to provide testing for de/anti-icing fluids given they verifiably adhere to internationally accepted standards and recommended practices that are associated with the holdover times published by the FAA.

Please enquire directly with the laboratories for a full list of testing available.

- **Anti-icing Materials International Laboratory (AMIL):** 555, boulevard de l'Université, Chicoutimi, Québec, G7H 2B1, Canada, 418-545-5011 ext. 2406, www.amillaboratory.ca. Provides testing for anti-icing performance (described in AMS1424, AMS1428, and AS5901), aerodynamic acceptance (described in AMS1424, AMS1428 and AS5900), physical properties including fluid stability (described in AMS1424 and AMS1428), environmental information (described in AMS1424 and AMS1428) and most of tests to evaluate materials compatibility (described in AMS1424 and AMS1428).

- **APS Aviation Inc.:** 6700, chemin de la Côte-de-Liesse, Suite 102, Saint-Laurent, Quebec, H4T 2B5, Canada, 514-878-4388 www.apsaviation.ca. Provides endurance time testing (described in ARP5485B and ARP5945A).

- **Scientific Material International (SMI):** 12219 SW 131st Avenue, Miami, Florida, USA 33186-6401; 305-971-7047, www.smiinc.com. Provides testing for physical properties including fluid stability (described in AMS1424 and AMS1428), environmental information (described in AMS1424 and AMS1428) and most of tests to evaluate materials compatibility (described in AMS1424 and AMS1428).

APPENDIX C:
AIRCRAFT DEICING FLUID (ADF)/AIRCRAFT ANTI-ICING FLUID (AAF) MANUFACTURERS

Appendix C: ADF/AAF Manufacturers — Winter 2025-2026

TABLE C-1: ADF/AAF MANUFACTURERS CONTACT INFORMATION[1]

Fluid Manufacturer	Primary contact	Email Address
ABAX Industries	Alejandra Villa Rodriguez	a.rodriguez@abax.eu
ADDCON EUROPE GmbH	Norman Kilian	norman.kilian@addcon.com
Aero Mag 2000 SYR LLC	Mark Vilcek	m.vilcek@aeromag2000.com
AFLRUS LLC	Olga Tengeri	office@aflrus.qa
ALAB Industries	Marat Zhazbek	info@alab.kz
Alab International	Kuanyshbay Bissenov	deicing@alab.kz
AllClear Systems LLC	Steve Szafara	SSzafara@allclearsys.com
Arcton Ltd.	Bulat Hamitov	bulathamitov@yandex.ru
ASGlobal	Paulo de Oliveira	paulo@asglobal.biz
AVIAFLUID International Ltd	Igor Derbasov	iderbasov@aviafluid.ru
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.	Arella	xiangaokelihua@163.com
Beijing Wangye Aviation Chemical Product Co Ltd.	Sina Gong	hswgyh@sina.com
Beijing Yadilite Aviation Advanced Materials Corporation	Kewei Wang	wangkewei@yadilite.com
CHEMCO Inc.	Claude Grenon	claude.grenon@chemco-inc.com
Chongqing Joba Chemical Co,.Ltd.	Cherry Wang	info@changfengchem.com
Clariant Produkte (Deutschland) GmbH	Andreas Brueck	andreas.brueck@clariant.com
Cryotech Deicing Technology	Melissa Copeland	melissa.copeland@cryotech.com
ESSPO CHEMICALS D.O.O	Lukas Pakeltis	lukas@esspo.lt
Dow Inc.	Arash Nowbahar	ARNowbahar@dow.com
HOC Industries	Jeremy Wilcoxson	jwilcoxson@hocindustries.com
Inland Technologies Inc.	Alex McLeod	amcleod@inlandgroup.ca
JSC RCP Nordix	Ruslan Ukraintsev	defrost@nordway.ru
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1 Contact information provided above is the latest information as of the time of publication, August 12, 2025.