TP 13826E

Aircraft Ground De/Anti-icing Fluid Holdover Time Development Program for the 2000-01 Winter

APPENDICES

APS AVIATION INC.

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APPENDIX A

EXCERPT FROM THE TRANSPORTATION DEVELOPMENT CENTRE WORK STATEMENT 2000-01

APPENDIX A

TRANSPORTATION DEVELOPMENT CENTRE

WORK STATEMENT
DC 187
AIRCRAFT & ANTI-ICING FLUID WINTER TESTING
2000-2001
(January 2001)

5.1 Holdover Time Testing

5.1.1 Holdover Time Testing and Evaluation of De/Anti-Icing Fluids for SAE

5.1.1.1 **Natural Snow Tests at Dorval**

5.1.1.1.1 The contractor shall prepare a test procedure.

5.1.1.1.2 Conduct flat plate tests under conditions of natural snow at the Dorval Airport test site to record fluid holdover times. All testing will be performed using the methodology developed in the conduct of similar tests for Transport Canada in past years.

5.1.1.1.3 Develop individual fluid holdover times for snow, based on samples of newly certified or re-certified Type I, Type II, Type III and Type IV fluids supplied by fluid manufacturers, under as wide a range of temperature, precipitation rate, precipitation type, and wind conditions as can be experienced. Testing is anticipated for two new Type IV fluids, two Type II fluids, as well as one Type I fluid.

5.1.1.1.4 Analyze the data collected and report the findings.

5.1.1.2 **Holdover Time Tests in Simulated Precipitation at NRC**

5.1.1.2.1 Prepare a test procedure for the conduct of holdover time tests in simulated precipitation at NRC.

5.1.1.2.2 Conduct flat plate tests under conditions of freezing drizzle, light freezing rain, freezing fog, and rain on a cold-soaked surface at the National Research Council Climatic Engineering Facility in Ottawa to record fluid holdover times. All testing will be performed using the methodology developed in the conduct of similar tests for Transport Canada in past years.

5.1.1.2.3 Develop individual fluid holdover times for all simulated precipitation conditions, based on samples of newly certified or re-certified fluids supplied by fluid manufacturers, under defined test parameters, such as temperature and precipitation rate. Two Type IV fluids, two Type II fluids, as well as one Type I fluid are anticipated for testing.

5.1.1.2.4 Analyze the data collected and report the findings.

5.1.2 Testing in Natural Snow for Comparison with Simulated Snow Tests

5.1.2.1 Prepare a test procedure for the conduct of Type I holdover time tests in natural precipitation.

5.1.2.2 Conduct further testing in natural snow conditions, using the same fluids as tested in simulated conditions during the last test season in order to compare the holdover times in natural and simulated conditions using the NCAR artificial snow generation system.

5.1.2.3 Re-evaluate Type I holdover times in natural snow with the new fluids using both the current test method and the newly proposed Type I fluid test protocol.

5.1.2.4 Conduct all holdover time trials in natural snow with Type I fluids at the Dorval test site at the same time as tests with new fluids to reduce costs.

5.1.2.5 Analyze the data collected and report the findings.

5.1.3 Holdover Time Testing in Simulated Frost at IREQ

The need to carry out frost testing has been expressed by several members of the SAE G-12 Holdover Time Subcommittee. During the 1999-2000 winter test season, APS conducted preliminary calibration tests in simulated frost conditions at the Institut de Recherche d'Hydro-Québec (IREQ) cold chamber in Varennes. Results of the calibration trials revealed that frost was producible at IREQ, and that the rates of deposition obtained at two temperatures (-3°C and -25°C) were similar to those proposed for use in future endurance time trials in simulated frost. Endurance time tests were conducted as part of these calibration trials with selected fluids, and in some cases, the endurance times obtained were significantly below the numbers approved for use in the various SAE holdover time tables.

5.1.3 1 Prepare a test procedure for the conduct of frost calibration and frost holdover time tests in simulated frost conditions.

5.1.3.2 Conduct additional frost calibration trials to fully determine the exact parameters required to perform holdover time tests in all the frost conditions. Trials will be performed to create a set of rate correction curves to relate the decreasing frost rate obtained on a bare surface during a long test, to the actual frost rate on the fluid covered surface. The required parameters will be identified and all the calibration trials will be performed as part of this set of trials. It is anticipated that two days of calibration is required at each of the five test temperatures, 0°C, -3°C, -10°C, -14°C, and -25°C, for a total of ten days.

5.1.3.3 Conduct holdover time testing in frost conditions at IREQ as part of the winter holdover time test program. Individual fluid holdover times for frost based on samples of newly certified or re-certified fluids supplied by the fluid manufacturers, will be obtained under defined test parameters, such as temperature, frost deposition rate, and relative humidity. Testing shall be conducted over a ten-day period at IREQ with three anti-icing fluids and two deicing fluids.

5.1.3.4 Analyze the data collected and report the findings.

5.1.4 Round Robin Holdover Time Testing

Tests conducted by TDC have provided holdover time guidelines to pilots and operators for several years. Round Robin testing of Type IV fluid must be performed to reconcile the differences in anti-icing fluid failure times in natural and simulated snow. Results of recent TDC holdover time tests using the NCAR artificial snow generation system indicate that the failure times for several Type IV fluids were up to 50% shorter than the times obtained from natural snow trials. Furthermore, the results of APS tests in natural and simulated snow are not in accordance with results obtained using AMIL's artificial snow method. In addition, APS and AMIL shall carry out testing under conditions of freezing rain and drizzle.

In 1998-99, a reference fluid (Fluid X) was proposed by the SAE to allow a comparison of different laboratory snowmaking methods. Unfortunately, the viscosity of Fluid X was found to be unstable, and use of the fluid was discontinued.

At the SAE G-12 Fluids Subcommittee meeting in Toulouse, it was proposed that certified fluids be used in the future to compare natural and simulated snow test data obtained from various sources.

5.1.4.1 Prepare a test procedure for the conduct of round-robin testing in snow and also for freezing rain and freezing drizzle.

5.1.4.2 Conduct natural snow tests in conjunction with outdoor testing of new fluids. Simulated snow testing will be completed using the NCAR system at one of several climatic chambers, including NRC, PMG Technologies, Centre du Recherche Industrielle du Québec (CRIQ) or IREQ. A total of 10 days of climatic chamber use will be planned for these trials. It is anticipated that tests will be conducted with three Type IV fluids (one ethylene and two propylene) of the same batch to obtain similar results in natural snow and using both artificial snow methods.

5.1.4.3 Collect a minimum of 20 data points per fluid dilution in natural snow under the widest possible range of temperatures, precipitation rates, precipitation types, and wind conditions.

5.1.4.4 Conduct a minimum of two tests in simulated snow for each fluid dilution, at each of the snow rate limits, for each cell of the snow column.

5.1.4.5 Travel to AMIL on two occasions during natural snow events to aid AMIL personnel in the determination of fluid failures in order to minimize the impact of the fluid failure call variable.

5.1.4.6 Conduct round robin testing in other simulated conditions covered by the various holdover time tables.

5.1.4.7 Aanalyze the data collected and report the findings.

5.1.5 Evaluation of the IREQ Chamber for Freezing Fog Holdover Time Testing

Aircraft de/anti-icing fluid holdover time testing in freezing fog has been conducted by APS at the National Research Council's Climatic Engineering Facility in Ottawa for several years. While the NRC facility has yielded good results for trials involving freezing fog, the daily calibration required for the conduct of tests in freezing fog is often excessive.

During the 1999-2000 test season, APS conducted preliminary calibration tests at the IREQ facility in Varennes. The results of these trials indicated that freezing fog could be produced at the facility, but several changes would need to be made to the current set-up in order to produce freezing fog with precipitation rates and rate distributions in the range required by the proposed Aerospace Standard 5485.

5.1.5.1 Establish the costs of conducting freezing fog holdover time testing at IREQ vs. NRC, and identify the benefits of such testing. Discus with IREQ their capabilities and charges..

5.1.5.2 Prepare a test procedure for the conduct of freezing fog testing at IREQ.

5.1.5.3 Obtain the approval of Transport Canada to conduct the freezing fog tests

5.1.5.4 Conduct the freezing fog tests at IREQ.

5.1.5.5 Analyze the data collected and report the findings.

5.1.6 Evaluation of Winter Weather Data

A study of the snow weather data has been undertaken since 1995 to ascertain the suitability of the precipitation rate ranges used for fluid holdover time evaluation in snow. Winter weather data will be collected and examined from Environment Canada for six weather stations within Quebec (Dorval, Quebec City, Rouyn, Pointe-au-Père, Frelighsburg, and High Falls).

During the 1999-2000 test season, APS collected one fog deposition measurement in an attempt to determine typical fog deposition rates that occur in natural conditions. The observed rate of fog deposition was below the current lower precipitation rate used in the evaluation of fluid holdover times in this condition.

5.1.6.1 Snow Rates

5.1.6.1.1 Examine the precipitation rate/temperature data from the different stations to determine the variance of the data in warmer and colder regions.

5.1.6.1.2 Examine the various temperature ranges used to establish holdover times to determine the frequency of precipitation that occurs within each temperature range.

5.1.6.1.3 Analyze the data collected and report the findings.

5.1.6.2 Fog Deposition Rates

5.1.6.2.1 Prepare a procedure for the collection of fog deposition rates in natural fog conditions.

5.1.6.2.2 Collect fog deposition measurements on at least two occasions.

5.1.6.2.3 Analyze the data collected and report the findings.

5.1.7 Documentation of Fluid Failure Characteristics

The objective of this study will be to document the appearance and properties of anti-icing fluids when they reach their operational limits.

Laboratory trials were conducted in past years under controlled conditions of ambient temperature and artificial precipitation; and natural snow trials were conducted in conditions selected for the desired precipitation rates and ambient air temperature. Documentation included photographic and videotape records, visual description, readings from various ice detection sensors, and measurements of physical characteristics such as adherence, viscosity, fluid concentration, and film thickness

5.1.7.1 Prepare a procedure for the conduct of trials to document the appearance of fluid failure characteristics.

5.1.7.2 Conduct trials outdoors during holdover time snow testing to collect missing data at temperatures of 0ºC to -5ºC. It is anticipated that one session will be sufficient to collect the information.

5.1.7.3 Analyze the data collected and report the findings.

APPENDIX B

EXPERIMENTAL PROGRAM
FOR DORVAL NATURAL PRECIPITATION FLAT PLATE TESTING
WINTER 2000-01

BM3833

EXPERIMENTAL PROGRAM
FOR DORVAL NATURAL PRECIPITATION FLAT PLATE TESTING

Winter 2000/2001

Prepared for

Transportation Development Centre
Transport Canada

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APS AVIATION INC.

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EXPERIMENTAL PROGRAM FOR DORVAL NATURAL PRECIPITATION FLAT PLATE TESTING 2000/2001

This document provides the detailed procedures and equipment required for the conduct of natural precipitation flat plate tests at Dorval for the 2000/2001 winter season.

1. OBJECTIVE

To conduct tests on standard flat plates to validate the current holdover time tables and develop holdover time tables for new fluids.

2. TEST REQUIREMENTS (PLAN)

Table B-1 provides the test plan for fluid types to be tested at the Dorval test site located adjacent to the Atmospheric Environment Services. These tests shall be conducted during natural snow conditions.

3. EQUIPMENT

Test equipment required for the flat plate tests was determined from previous winters in association with the Society of Automotive Engineers (SAE) working group. This equipment is listed in Attachment B-I.

4. PERSONNEL

The following personnel are required for the conduct of tests. The responsibility for each tester is provided in Attachment B-II.

For one stand	For two stands
1 x Test site Leader/video	1 x Test site leader/video
1 x End condition tester	2 x End condition tester
1 x Meteo tester	2 x Meteo tester

5. PROCEDURE

The modified test procedure is included in Attachment B-I. This procedure was developed several years ago and has been modified over the years to incorporate discussions at the SAE working group meetings. Attachment B-III contains a brief summary of the steps required to conduct a test.

6. DATA FORMS

The data forms are included at the end of this document. One data form was developed for the end-condition tester (Table B-3) and one data form for the Meteo/Video tester (Table B-4).

Table B-1

NATURAL SNOW PRECIPITATION TEST PLAN

NEW FLUIDS

Temperature Range	Type IV/II Neat	Type IV/II 75/25	Type IV/II 50/50	Type III	Type I Diluted
>0°C	YES	YES	YES	YES	YES
0 to -3°C	YES	YES	YES	YES	YES
-3 to -14°C	YES	YES	NO	YES	YES
-14 to -25°C	YES	NO	NO	NO	YES
below -25°C	YES	NO	NO	NO	YES

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ATTACHMENT B-I
FLAT PLATE FIELD TEST EQUIPMENT AND PROCEDURE
2000/2001

This field test procedure has been developed by the SAE G-12 Holdover Time Subcommittee working group on aircraft ground de/anti-icing as part of an overall testing program that includes laboratory tests, field tests and full-scale aircraft tests, which is aimed at substantiating the holdover time table entries for freezing point depressant fluids known as de/anti-icing fluids.

1. SCOPE

This procedure describes the equipment and generalized steps to follow in order to standardize the method to be used to establish the time period for which freezing point depressant fluids provide protection to test panels during inclement weather such as freezing rain or snow.

2. EQUIPMENT

Environment Canada's READAC (Automated Weather Station) is located within 50 metres of the Dorval test stands. Data from this station will be acquired on a one minute basis. Temperature, total precipitation, visibility, wind speed and direction are among a few of the parameters measured.

2.1 Precipitation Rate Measurement

The following equipment or equivalent are recommended:

2.1.1 Plate Pan (see Figure B-1)

A plate pan, placed at a 10º inclination on the test stand will be used to collect and weigh snow. The procedure for the collection of precipitation rates using this method is described in Attachment B-V. A schematic of the plate pan is provided in Figure B-1.

Note: When this method is used the bottom and sides of the pan MUST BE WETTED (before each pre-test weighing) with Type IV anti-icing fluid to prevent blowing snow from escaping the pan. The plate pans should be carefully rotated every 5 minutes to prevent accumulating snow from blowing away. The time of rotation should be reduced to 2 minutes during heavy precipitation or high wind conditions.

2.2 Plate Temperature Monitoring

Type T Kapton insulated thermocouple probes have been embedded within the test plates to monitor plate temperatures during a test. The accuracy of the thermocouples is 1.0ºC over the range +404 to -250ºC. Data from the thermocouples will be recorded with a logger.

2.3 Test Stand

A typical test stand is illustrated in Figure B-2; it may be altered to suit the location and facilities, but the angle for the panels, their arrangement and markings must all conform to Figures B-2 and B-3. There shall be no flanges or obstructions close to the edges of the panels that could interfere with the airflow over the panels.

2.4 Test Panels

2.4.1 Material and Dimensions

Alclad Aluminum 2024-T6 or 5052-H32 polished standard roll mill finish 30x50x0.32 cm (12x20x1/8"), for a working area of 25x40 cm (10x18"). Thicker aluminum stock may be needed when an instrument is mounted on the plate.

2.4.2 Markings

Each panel shall be marked as shown in Figure B-2 with lines at 2.5 and 15 cm (1 and 6") from the panel top edge, with 15 crosshair points and with vertical lines 2.5 cm (1") from each side; this marks off a working area of 25x40 cm (10x18") on each panel. All marks shall be made using a 0.3 cm (1/8") thick black marker or silk screen process, which does not come off with application of the test fluids or any of the cleaning agents. Re-marking of the plates will be required as the markings fade because of the cleaning actions.

2.4.3 Attachment

For attachment to the test stand, at least four holes shall be made, spaced along the two sides of each panel; the holes shall be within 2 cm (0.8") from the panel edge.

2.5 Fluid Application

The fluid should be poured onto the plates from a manageable container, until the entire test section surface is saturated and a consistent fluid thickness over the entire plate surface is obtained. Up to two litres of fluid may be applied to each panel for tests using anti-icing fluids. For Type I tests, 1 litre of fluid is sufficient.

Anti-icing fluids are applied to test surfaces at ambient outside air temperature. Type I fluids are applied at 20°C +/- 3°C, and diluted to a 10°C buffer. The mixing procedure for Type I fluids has been included in Attachment B-VII.

2.6 Film Thickness Gauge

Film thickness at the 15 cm (6") line can be evaluated (this is optional). Painter's wet paint film thickness gauge. 1-08 mil gauge or equivalent is available from Paul N. Gardner Company Inc., Pompano Beach, Florida.

2.7 Video Recording (Optional)

Tests may also be recorded with a hand-held video camera, in particular at the start of the test and when failures are being called. Care must be taken that the camera and any lighting do not interfere with the airflow or ambient temperatures.

2.8 Anemometer

Wind Minder Anemometer Model 2615 or equivalent. Available from Qualimetrics Inc., Princeton, New Jersey. To be mounted at 3 metres (10'). (For wind data and calibration sources, see TP12896E and TP12654E). Additional meteorological information is obtained from READAC.

2.9 Wind Vane

Model 2020 Qualimetrics or equivalent. To be mounted at 3 metres (10').
(For wind data and calibration sources, see TP12896E and TP12654E)

2.10 Relative Humidity Meter

Relative humidity will be provided by READAC on a minute-by-minute basis.

2.11 Ice Detection Sensors

Where feasible surface or remotely mounted ice detection sensors should be used during the tests.

3. DE/ANTI-ICING FLUIDS

3.1 Certification

Only fluids that have been certified will be included in tests. Fluid suppliers shall submit to the test coordinating organization proof of certification for the fluids they provide.

3.2 Test Fluids

Samples of deicing and anti-icing fluids for holdover time testing shall be prepared and delivered according to the sample selection procedures, intended for inclusion in Aerospace Standard 5485.

3.3 Dye

Fluids should be supplied for certification and for testing in the form to be used on aircraft.

4. PROCEDURE

Attachment B-III contains a summary of the major steps required for the conduct of flat plate tests. This should be mounted on the wall in the trailer at the site.

4.1 Start-up and Close-up

Attachment B-III provides a reference to enable testers to start the equipment at the beginning of a test session, and also provides reference on what should be closed at the end of a session.

4.2 Set-up

4.2.1 Panel Test Stand

If there is any wind, orient the test stand so that the test panels are facing into the wind direction at the beginning of the test and the wind is blowing up the panels,

i.e. ---->   /
wind   panel

If the wind shifts during the test do not move the stand; simply note it on the data sheet.

4.2.2 Plate Pan Method

Coat the bottom of the plate pan, as well as the inner sides of the pan, with about 0.6cm (¼") of anti-icing fluid (Type IV). Weigh the wetted pan prior to testing to the nearest gram. Weigh the pan at 10-minute intervals over the course of the test (see Table B-3). Replace the pans on the test stand as long as the duration of the last test panel. Do not remove the contents of the pan until the test is complete. Weigh again after test completion of each panel to determine the true water content reading of the precipitation.

When using plate pans to measure precipitation rate, two plate pans shall be used. Care must be taken to ensure that snow or ice does not fall into the pans when transporting them into the trailer. The complete description of this method is included in Attachment B-V.

4.3 Test Panel Preparation

4.3.1 Before the start of each day's testing, ensure the panels are clean.

4.3.2 Place the panels on the fixture and attach to the frame screws with flat bolts (wing nuts will make attaching and removal easier in poor weather).

4.3.3 Allow the panels to cool to outside air temperature.

4.4 Fluid Preparation and Application

4.4.1 Fluid Temperature

Anti-icing fluids should be placed outside (cold-soaked to ambient temperature conditions) prior to the start of the test session. Deicing fluids should be applied to test surfaces at 20°C +/- 5°C. Deicing fluids should be stored in the trailer at all times.

4.4.2 Cleaning Panels

Before applying test fluid to a panel, squeegee the surface to remove any precipitation or moisture. Fluid being used for the test could be used to help remove snow or ice from the test panel.

4.4.3 Order of Application

Apply the fluid to the panels, commencing at the upper edge of the test panel and working downwards to the lower edge. Ensure complete coverage by applying the fluid in a flooding manner. Start with the top left panel U, then cover panel X in the second row with the same fluid, then flood the second test fluid on panel V followed by panel Y, etc. (see Figure B-1).

4.5 Holdover Time Testing

4.5.1 Commence recording the test until the test reaches the END CONDITION. See Section 5 for definition of end condition.

4.5.2 Record the elapsed time (holdover time) required for the fluid to achieve the test END CONDITION.

4.6 Video Recording (not performed routinely)

Video record test (if required) with a hand-held camera in the following sequences:

1. General outdoor condition prior to test (get good view of snow falling).
2. Video record the data forms.
3. Video record pouring. Ensure that name of fluids are captured, testers faces, your voice, name and stand # (ensure date and time are available and synchronized).
4. Record pans being weighed and brought out.
5. Record establishing shot of test stand (all the plates).
6. Record establishing shot of each plate, followed by a close-up of the plate (scan the plate slowly), then returning to wide shot of the plate. Repeat this with each plate in sequence, beginning from left to right, top to bottom. Always follow the same sequence. Ensure that each plate has a tag marked with the type of fluid used on the plate and that the plate itself is marked with its corresponding letter (X, Y, Z...). Record the clock/timer often.
7. For each failure, record an overview of the plates, followed by a wide shot of the plate, zooming in into a close-up of the failure. Return to the establishing shot at the end of the procedure. Repeat this procedure for each failure.
8. Ensure that the lighting is appropriate for video purposes.
9. Ensure that the video camera is in fact recording. At the end of a test, rewind a few seconds and check that the test was recorded.

4.7 Plate Pan Measurements

Measure the quantity (rate) of precipitation using at least two plate pans mounted on the test stand. Record these measurements on the Form (Table B-4) at the following times:

- At the start of the test;
- Every 10 minutes;
- When there is a significant change in the rate (intensity) for more than one minute;
- After failure of each panel (measure only once if two panels fail at almost the same time); and
- At the end of the test.

4.8 Meteorological Observations

Meteorological observations must be recorded at the same times as in Subsection 4.7, and when there are changes in the type and category of precipitation. Significant changes in wind speed and direction should also be noted.

4.8.1 Type of Precipitation

Note the type of precipitation (refer to Figure B-5 for the codes). This is a subjective determination. If two or three forms of precipitation co-exist, then note all of these.

4.8.2 Classification of Precipitation

While many different classifications are available, a simple classification of ten forms of solid precipitation is shown in Figure B-4. Use of black velvet to collect the snow and inspect it, will facilitate the identification.

4.8.3 Determination of Wet or Dry Snow

While this is usually temperature and humidity level dependant, determination of wet or dry snow could be determined by collecting snow in a dry plate pan on a stand not being used. If in the course of a test, the snow in the pan can be combined and formed into a *snow-ball*, then this will be identified as wet snow. If the snow does not form into a *snow-ball* or if the snow does not even accumulate, then this is considered dry snow. Note that the time to form a *snow-ball*, when collecting with gloves, should be less then five seconds. One other method to determine whether the snow is wet or dry would be to measure the depth of the snow in the pan and compare it to the liquid equivalent depth. If the ratio is >10, then it would be dry snow.

4.8.4 Temperature and Wind Measurements

These are to be recorded from the computer monitor at the site at the start of the test. READAC information will also be used for data analysis.

4.9 Video Organization

The video equipment cassettes should be marked sequentially for the panning camera and the Hi 8 cameras. These numbers should be recorded on the data form at the time of testing. When these are full, then they should be marked as full.

5. END CONDITION

The plate failure time is that time required for the end conditions to be achieved. This occurs when the accumulating precipitation fails to be absorbed at any five of the crosshair marks on the panels or when 1/3 of the test panel is covered with accumulating precipitation.

A crosshair is considered failed if:

- There is a visible accumulation of snow (not slush, but white snow) on the fluid at the crosshair when viewed from the front (i.e. perpendicular to the plate). You are looking for an indication that the fluid can no longer accommodate or absorb the precipitation at this point.

OR

- When precipitation or frosting produces a *loss of gloss* (i.e. a dulling of the surface reflectivity) or a change in colour (dye) to grey or greyish appearance at any five crosshairs, or ice (or crusty snow) has formed on the crosshair (look for ice crystals). This condition is only applicable during freezing rain/drizzle, ice pellets, freezing fog or during a mixture of snow and freezing rain/drizzle and ice pellets.

As these determinations are subjective in nature, the following is **very important**:

- Whenever possible, have the same individual make the determination that a crosshair has failed.

- When making such a determination, ensure consistency in the criteria used to call the end of a test.

- Under light snow conditions or when the precipitation rate decreases, snow may sometimes build up on the fluid and then be absorbed later as the fluid accommodates (absorbs) it. If this occurs, record the first time snow builds up and note (in the comments sections) that there was an *un-failure* at a specific crosshair.

Updated definitions of fluid failure in natural snow conditions, along with photographs of the various failure conditions, have been included in Attachment B-VI.

6. REPORTING AND OBSERVATIONS

Calculate and record test data, observations and comments in the format of Tables B-3 and B-4. Each test must be conducted in duplicate. Detailed definitions and descriptions of meteorological phenomena are available in the Manual of Surface Weather Observation (MANOBS) - a copy is available at APS offices.

ATTACHMENT B-II
PERSONNEL RESPONSIBILITY

Test Site Leader

- Call personnel to conduct tests;
- Ensure test site is safe, functional and operational at all times;
- Supervise site personnel during the conduct of tests;
- Ensure site is opened and closed properly;
- Monitor weather forecasts on a daily basis and during test period;
- Report to project manager on site activities on daily basis;
- Review data forms upon completion of test for completeness and correctness;
- Decide what fluids should be tested;
- Ensure results are reasonable;
- Ensure all clocks are synchronized at all times;
- Ensure fluids are available and verify fluids being used for test are correct;
- Ensure computers are all operational;
- Ensure electronic data is being collected for all tests;
- Ensure proper documentation of tapes, diskettes, cassettes;
- Verify test procedure is correct (eg. stand into wind);
- Ensure all materials are available (pens, paper, batteries, etc.); and
- Fill in end of testing checklist for every session (see Attachment B-IV).

End Condition Tester

- Monitor the progression of failures on the plates;
- Record end condition times for each crosshair;
- Communicate to video operator the end condition times;
- Apply fluids onto test panels;
- Complete and sign Data Form (Table B-3); and
- Prepare fluids for each test.

Meteo Tester

- Record meteo for both stands;
- Rotate and measure plate pan weights;
- Squeegee plates prior the fluid application;
- Complete and sign Data Form (Table B-4);
- Assist end condition tester when failure times occur quickly; and
- Place stop-watch and start stop-watch on test stand.

Video Tester

- Sign and fill in cassette #'s, etc. in data form (Table B-4);
- Video all tests (see procedure);
- Verify all equipment is on;
- Document and mark all cassettes used for all electronic equipment;
- Ensure camera batteries are recharged and available;
- Ensure lighting is appropriate; and
- Video fluid application (capture fluid name on container).

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ATTACHMENT B-III
SUMMARY OF STEPS TO CONDUCT TESTS

The following are the major steps required to conduct flat plate tests at Dorval.

Upon Entering Trailer

1. Turn on lights (outside and inside) and sign-in.
2. Determine tests to be conducted and fluids (Type II, III, IV to be placed outdoors).
3. Remove snow and clear access to stands.
4. Turn on C/FIMS computers.
5. Synchronize all clocks on all equipment in 4) and stop watches.

For Each Test

1. Fill in general material on Tables 1 and 2 (Tables B-3 and B-4), and prepare plate pans for start of test.
2. Place fluids by stand.
3. Ensure stand is into wind.
4. Start logging C/FIMS computers.
5. Record end condition times of all panels **(care to be taken for the 5th crosshair of each panel)**.
6. Measure plate pan weights over the course of the test.
7. Video record start of test, progression of failures, and when the end condition (5 of 15 crosshairs) is being called on each panel.
8. Ensure forms are properly completed and signed.
9. Save C/FIMS data.
10. Start a new test.

To Close Trailer

1. Replenish fluids.
2. Log and document date, times, test #'s, etc. on all media
3. After major events (more than 10 tests), start new tapes for next occasion.
4. Place all media and test forms in large envelope for delivery to office.
5. Shut off the C/FIMS.
6. Clean trailer and all garbage.
7. Ensure outdoor is left clean and presentable.
8. Close lights and sign-out.

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ATTACHMENT B-IV

CHECKLIST FOR SITE LEADER FOR END OF TESTING

ITEM	ENTER DATE										
ALL FLUIDS BROUGHT IN											
ALL FLUIDS REPLENISHED											
WASTE FLUIDS BROUGHT IN											
HANDHELD CAMERAS BROUGHT IN											
OUTDOOR AND STAND LIGHTS TURNED OFF											
WRIST WATCHES HANDED IN											
ALL TEST MEDIA PROPERLY LABELED (HI 8, RVSI, C/FIMS)											
DATA FORMS CHECKED AND SIGNED											
ALL PERSONNEL SIGNED OUT											
TRAILER CLEANED UP											
TRAILER HEATER KEPT AT 20°C											
SITE LEADER INITIALS											

BM3833/procedures/holdover time/natural snow/checklist

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ATTACHMENT B-V
PROCEDURE FOR THE COLLECTION OF PRECIPITATION

GENERAL

1. Two large timepieces should be installed in the trailer (one above the rate station, the other in the window adjacent to the door), to insure that accurate collection times are recorded. Both timepieces should be synchronized;

2. Rates should be collected every 10 minutes in normal conditions and every 5 minutes in periods of high precipitation rates and high winds.

3. In the event of error (dropped pan, lost fluid...), the error and time should be recorded on the data form. When fluid has been lost from the plate pans, pans should be re-weighed prior to being placed on the test stand; and

4. The start time of the rate collection period is recorded from the timepiece above the rate station prior to exiting the trailer. The time required to get from the rate station to outside the trailer door should also be recorded. This value (in sec.) should be included in the buffer column in Table 3 (Table B-4), and eventually deducted from the rate collection time. When entering the trailer following a rate collection period, record the time from the timepiece in the window near the door.

PROCEDURE

1. Ensure that both plate pans are marked (*upper* and *lower*);

2. The bottom and sides of the pan must be wetted with Type IV anti-icing fluid to prevent blowing snow from escaping the pan;

3. Tare the scale, then weigh the wetted pan to the nearest gram;

4. Record the start time (hr/min/sec) from the timepiece located near the rate station before leaving the trailer to place the pans on the test stand, taking into consideration the time delay necessary to proceed outside from the rate station;

5. Ensure that the pans are placed in the proper location (upper and lower locations);

6. Prior to removing the plate pans from the test stand for re-weighing, carefully wipe away any accumulated precipitation from the lips of the plate pans (ensure that the precipitation does not fall into the plate pan). Carefully remove the plate pans from the stand and proceed **immediately** to the trailer to re-weigh the pans. Do not rest the pans on top of one another while transporting. Once inside the trailer, rest the pans on a clean dry table surface;

7. Upon entering the trailer, record the end time (hr/min/sec) from the timepiece in the window near the door;

8. Carefully wipe the bottom, sides and lips of the pans prior to weighing;

9. Weigh the plate pan. Plate pans should be re-weighed until consistent measurements are obtained;

10. Record the new weight (do not tare scale again), and bring the pans back outside;

11. Start time from the timepiece near the rate station; and

12. Continue this procedure until the final plate on the test stand has failed.

ATTACHMENT B-VI
UPDATED DEFINITIONS OF PLATE FAILURE IN NATURAL SNOW CONDITIONS

In all natural snow tests, regardless of the method of fluid failure, an accumulation of snow is apparent in the failed areas. Type IV fluid failures in natural snow tests normally occur when:

- The fluid has eroded due to dilution and snow begins to accumulate on the plate surface (dilution failure); and

- The fluid no longer absorbs the snow and it begins to rest on top of the fluid (snow-bridging failure).

A typical dilution-style failure is shown in Photo B-1. In this case, the fluid has been diluted due to ongoing precipitation and the fluid film has eroded substantially. Failures have reached just beyond the 3″ line on the plate (white snow is visible in the failed area). Dilution failures normally occur from top-to-bottom on the test surface, and are common at warm temperatures and low rates of precipitation. Ethylene-based Type IV fluids usually fail in this manner.

A snow-bridging failure is shown in Photo B-2. In this case, the fluid resists dilution and a thick film of fluid remains on the entire plate surface. Plate failure has occurred in this test because snow, resting on top of the fluid, covers more than 1/3 of the plate surface. Snow-bridging failures do not always occur in top-to-bottom fashion, and are common at cold temperatures and high rates of precipitation. Propylene-based Type IV fluids usually fail in this manner.

ATTACHMENT B-VII
UPDATED DEFINITIONS OF PLATE FAILURE IN NATURAL SNOW CONDITIONS

Photo B-1
Dilution Failure

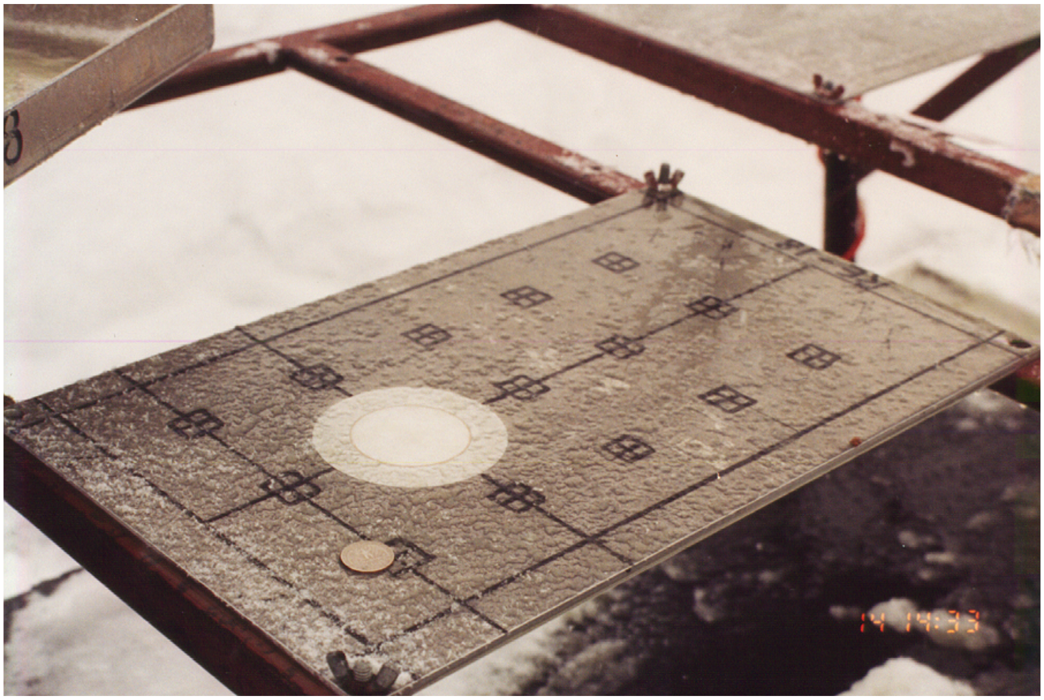

Photo B-2
Snow-bridging Failure

ATTACHMENT B-VII
TYPE I FLUID HOLDOVER TIME TEST MIXING PROCEDURE FOR NATURAL SNOW TESTS
Winter 2000/2001

In order to conduct Type I fluid holdover time tests, fluids must be pre-mixed to a 10°C buffer. This signifies that the fluid freeze point must be 10°C below the ambient air temperature. For example, if tests are conducted at an outside air temperature of -2°C, the fluid freeze point must be -22°C.

All Type I fluids must be diluted from their concentrated forms with HARD WATER. The procedure for the preparation of hard water is included in Attachment B-VIIA. Plastic containers (20-litre) of hard water will be pre-mixed and placed on the large shelf near the fluid mixing station.

The fluid dilutions and fluid freeze point measurements (°brix) for each Type I fluid at various temperatures are shown in Table B-2. Using the information in this table, Type I fluids should be prepared prior to the start of each test period. Fluid concentrations should also be adjusted using this information during any given test period if the ambient air temperature fluctuates by more than 1°C.

The following is an example of Type I fluid preparation for holdover time testing:

The ambient air temperature is -10°C. Type I fluids will be mixed to a freeze point of -20°C. In the case of Lyondell Arco+ Type I, the required glycol concentration of the -20°C freeze point fluid is 55%. Using a graduated cylinder, measure out the required amount of the Lyondell Arco+ concentrate. If mixing into an eight-litre container, the required amount of Lyondell Arco+ concentrate would be 4.4 litres. Add this amount to the container. The remainder of the eight-litre container will be filled with hard water (3.6 litres). The mixture should be shaken prior to measuring the refractive index (°Brix). The brix of the diluted fluid should be 26.5, based on the information in Table B-2. If the brix is below 26.5, additional concentrate should be added to the container. If the brix is above 26.5, hard water should be added. The mixture is deemed acceptable for testing when the refractive index of the fluid (°brix) is within 0.25 of the value stated in Table B-2. A summary for the testers is provided as Attachment B-VIIB.

Fluids for Type I testing should be applied to the test plates at 20°C +/-5°C. One litre of fluid is required for each individual test plate, and will be poured from one-litre containers. Prior to the start of each test run, the brix and temperature of each test fluid should be indicated on the End Condition Data Form (Table B-3).

In order to ensure that Type I fluids are sufficiently warm for holdover time testing, the containers of concentrated fluids should be replenished and stored in the trailer following each test period.

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ATTACHMENT B-VIIA
PROCEDURE FOR PREPARING HARD WATER

Hard water is required to dilute Type I fluids for holdover time testing. The following procedure outlines the steps required to produce 1 litre of hard water.

Hard Water =	Distilled (deionized) water	+	calcium acetate monohydrate or anhydrous calcium acetate	+	magnesium sulfate heptahydrate

In order to produce 1 liter of hard water:

1. Take 1 liter of Distilled Water.
2. Dissolve 400mg of the calcium acetate monohydrate or anhydrous calcium acetate.
3. Dissolve 280mg of the magnesium sulfate heptahydrate.

Requirements:

The distilled water must conform to specifications of Type IV water outlined in D 1193-91.

Electrical conductivity at 25°C = 5
Electrical resistance = 0.2
pH = 5.0 - 8.0
Total organic carbon = no limit
Sodium = 50 ug
Chlorides = 50 ug
Total silica = no limit

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ATTACHMENT B-VIIB
SUMMARY PROCEDURE FOR MIXING OF TYPE I FLUIDS FOR 10°C BUFFER

An example is included below in brackets using Lyondell Arco+:

1. Determine the outside air temperature (for example, -10°C).

2. Find the volume of the fluid and hard water (see below) to be mixed in Table A. (Mix 4.4 l glycol and 3.6 l hard water for Lyondell).

3. Shake the container and measure the refractive index in Brix and compare the value with that in Table A (for Safetemp, it should be 26.5).

4. If the Brix value is off by more than 0.25, adjust mixture by adding hard water to decrease Brix, or fluid to increase Brix. Redo Step 3.

As a general rule of thumb, add 150 ml of water or fluid for every 1 Brix value that the mixture is off (in the example, if the Brix was 28, then add 300 ml of water to reduce the Brix to about 26.5).

To produce 1 litre of hard water:

1. Take 1 litre of Distilled Water.

2. Dissolve 400 mg of the calcium acetate monohydrate or anhydrous calcium acetate.

3. Dissolve 280 mg of the magnesium sulfate heptahydrate.

TABLE B-2
FLUID DILUTION FOR TYPE I TESTING

OAT (°C)	FFP (°C)	Clariant EG I 1996				Clariant MPI 1938 TF (310)				Lyondell Arco Plus / Lyondell Arco Plus-ST				FCY-1A			
		% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres
5	-5																
1	-9	28	14	2.2	5.8	28.5	16.5	2.3	5.7	31.25	20.5	2.5	5.5	19.9	12.80	1.6	6.4
0	-10	29.5	14.75	2.4	5.6	31.5	18.5	2.5	5.5	32.25	21.25	2.6	5.4	22.0	14.01	1.8	6.2
-1	-11	31	15.5	2.5	5.5	34	19.75	2.7	5.3	33.25	21.8	2.7	5.3	23.7	15.18	1.9	6.1
-2	-12	33	16.5	2.6	5.4	37.5	21.5	3.0	5.0	34.25	22.5	2.7	5.3	26.0	16.50	2.1	5.9
-3	-13	35	17.5	2.8	5.2	39.25	22.5	3.1	4.9	35.25	23	2.8	5.2	27.2	17.37	2.2	5.8
-4	-14	36.5	18.25	2.9	5.1	40.5	23.5	3.2	4.8	36	23.5	2.9	5.1	29.0	18.90	2.3	5.7
-5	-15	38	19	3.0	5.0	42	24.25	3.4	4.6	37	24	3.0	5.0	30.5	19.38	2.4	5.6
-6	-16	39.5	19.75	3.2	4.8	43	24.75	3.4	4.6	38	24.75	3.0	5.0	32.0	20.10	2.6	5.4
-7	-17	41	20.5	3.3	4.7	44.25	25.5	3.5	4.5	39	25.5	3.1	4.9	33.5	21.22	2.7	5.3
-8	-18	42.5	21.25	3.4	4.6	45.5	26	3.6	4.4	40.25	26.25	3.2	4.8	35.0	22.50	2.8	5.2
-9	-19	44	22	3.5	4.5	46.5	26.5	3.7	4.3	41.25	26.75	3.3	4.7	36.4	22.91	2.9	5.1
-10	-20	45	22.5	3.6	4.4	47.75	27.5	3.8	4.2	42.5	27.5	3.4	4.6	38.0	23.60	3.0	5.0
-11	-21	46	23	3.7	4.3	49	28	3.9	4.1	43.5	28	3.5	4.5	39.0	24.44	3.1	4.9
-12	-22	47.5	23.75	3.8	4.2	50	28.75	4.0	4.0	44.5	28.5	3.6	4.4	40.3	25.16	3.2	4.8
-13	-23	48.5	24.25	3.9	4.1	51	29.25	4.1	3.9	45.5	29.25	3.6	4.4	41.5	25.84	3.3	4.7
-14	-24	50	25	4.0	4.0	52.25	29.75	4.2	3.8	46.5	30	3.7	4.3	42.6	26.48	3.4	4.6
-15	-25	50.5	25.25	4.0	4.0	53.5	30.25	4.3	3.7	47.5	30.5	3.8	4.2	44.0	27.10	3.5	4.5
-16	-26	52	26	4.2	3.8	54.5	30.75	4.4	3.6	48.75	31.25	3.9	4.1	44.8	27.69	3.6	4.4
-17	-27	53	26.5	4.2	3.8	55.5	31.25	4.4	3.6	50	32	4.0	4.0	45.9	28.24	3.7	4.3
-18	-28	54	27	4.3	3.7	56.5	31.75	4.5	3.5	50.75	32.5	4.1	3.9	46.9	28.77	3.8	4.2
-19	-29	55	27.5	4.4	3.6	57.75	32.25	4.6	3.4	51.75	33	4.1	3.9	47.9	29.27	3.8	4.2
-20	-30	56	28	4.5	3.5	58.75	32.75	4.7	3.3	52.75	33.5	4.2	3.8	49.0	30.50	3.9	4.1
-22	-32	58	29	4.6	3.4	61	33.75	4.9	3.1	55	34.5	4.4	3.6	50.6	30.64	4.0	4.0
-25	-35	61.5	30.75	4.9	3.1	64.5	35.25	5.2	2.8	56.75	35.75	4.5	3.5	53.5	32.70	4.3	3.7
-30	-40	66.5	33.25	5.3	2.7	70	37.75	5.6	2.4	60	37.25	4.8	3.2	58.0	34.90	4.6	3.4
Standard Mix																	

Bm3833/proc/hot/nat snw/Fcy-1a

FIGURE B-1
SCHEMATICS OF PLATE PAN AND TEST STAND

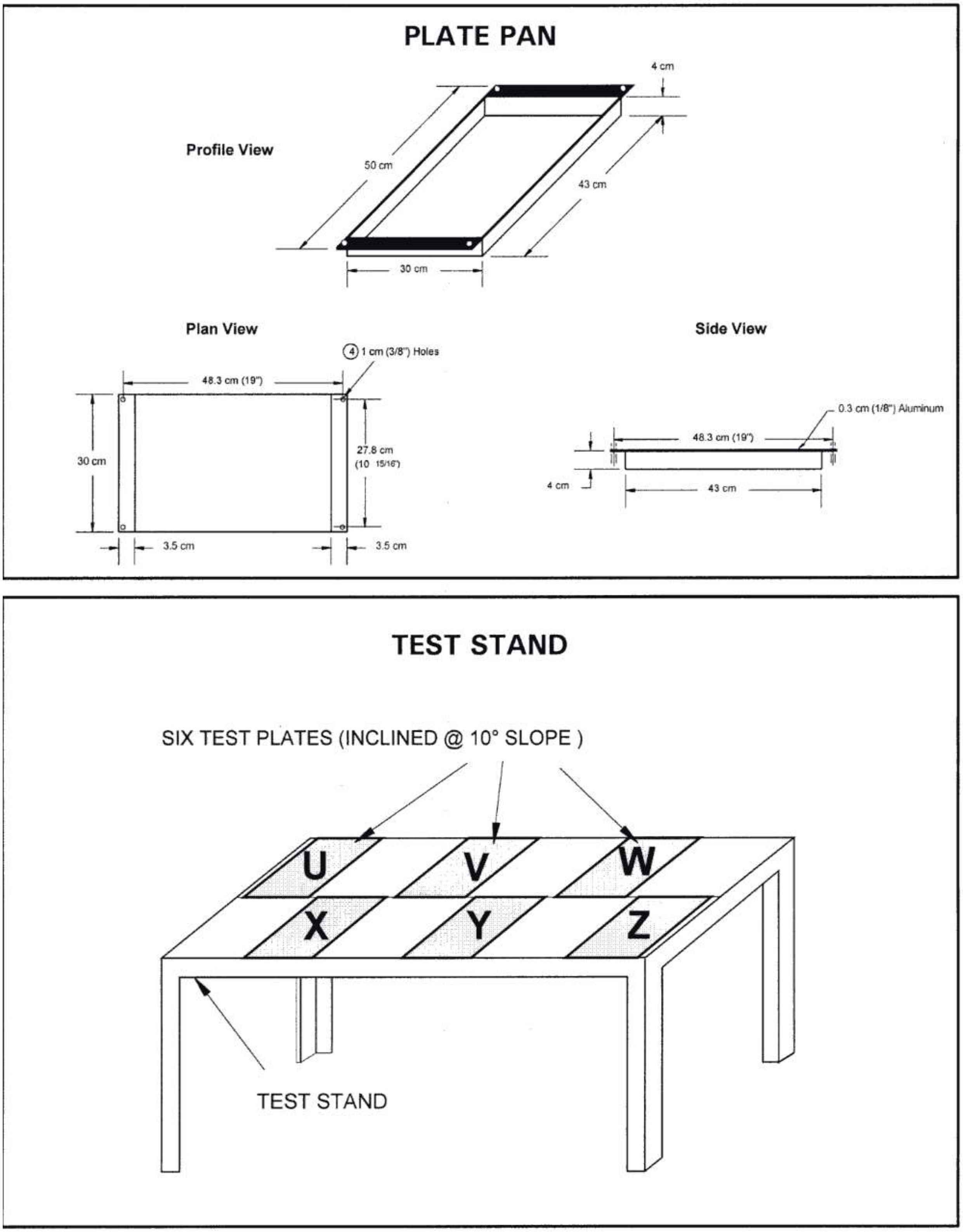


FIGURE B-2
TEST STAND

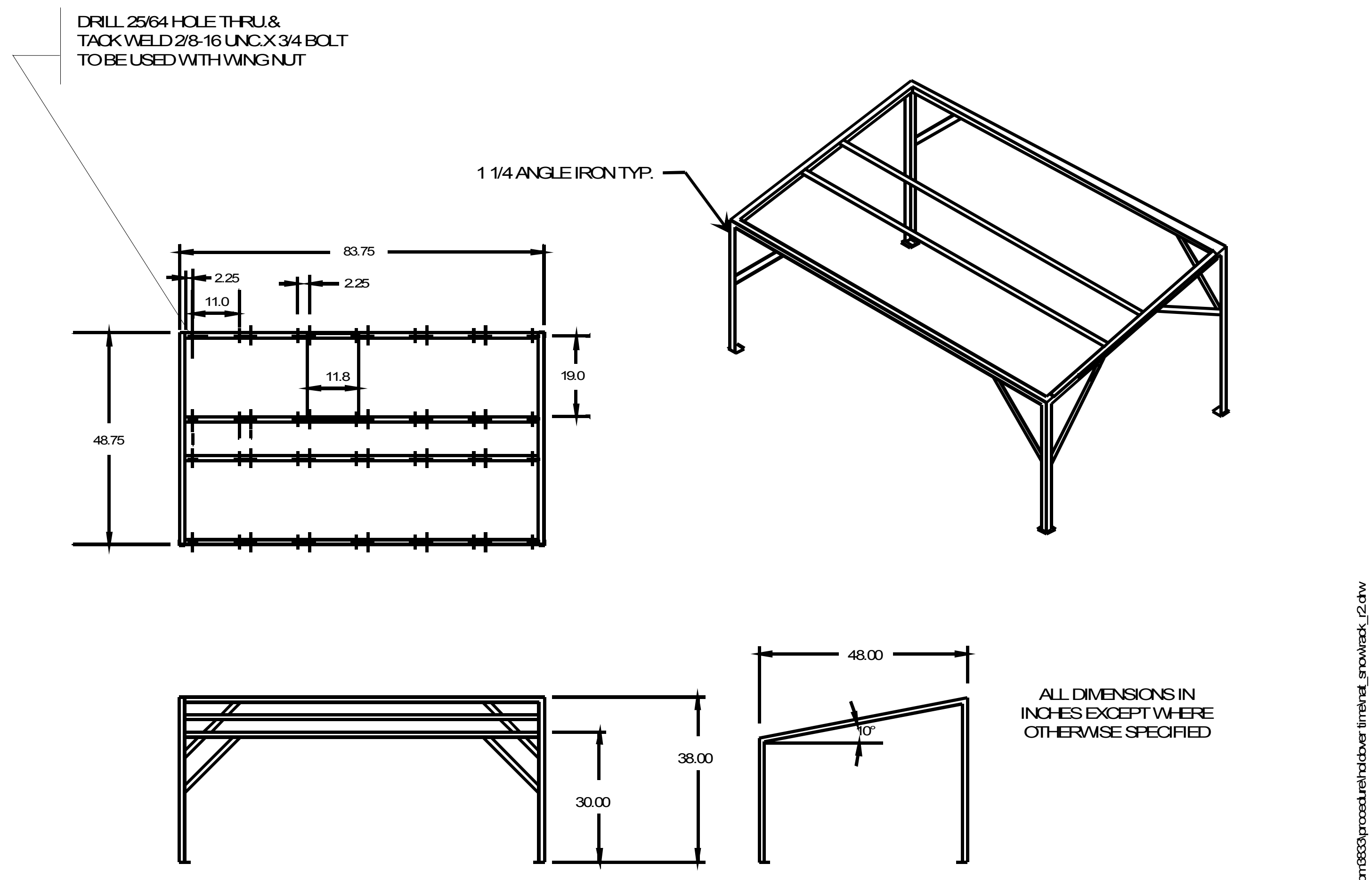


FIGURE B-3

TYPICAL ICE SENSOR
FLAT PLATE MARKINGS

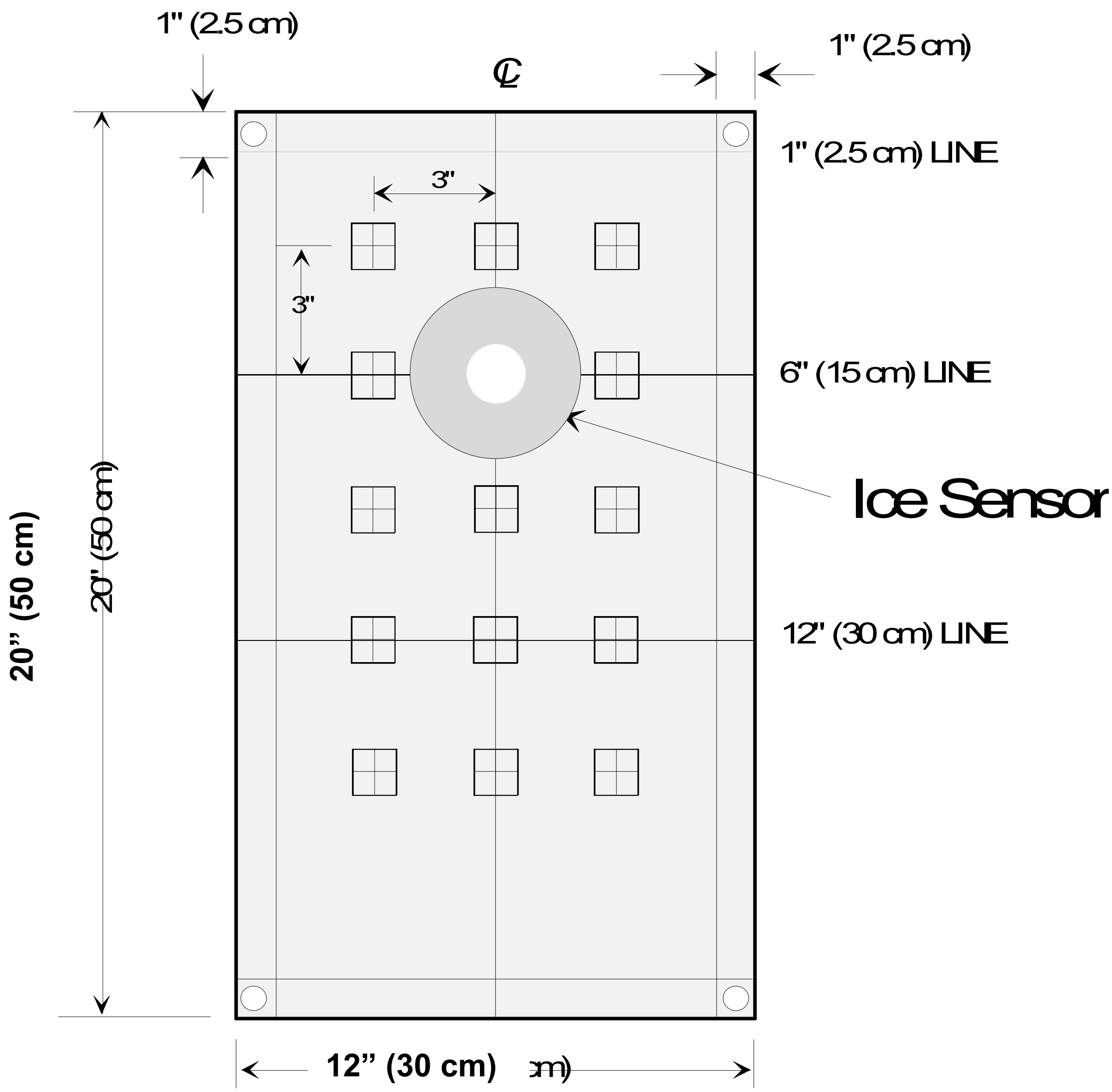
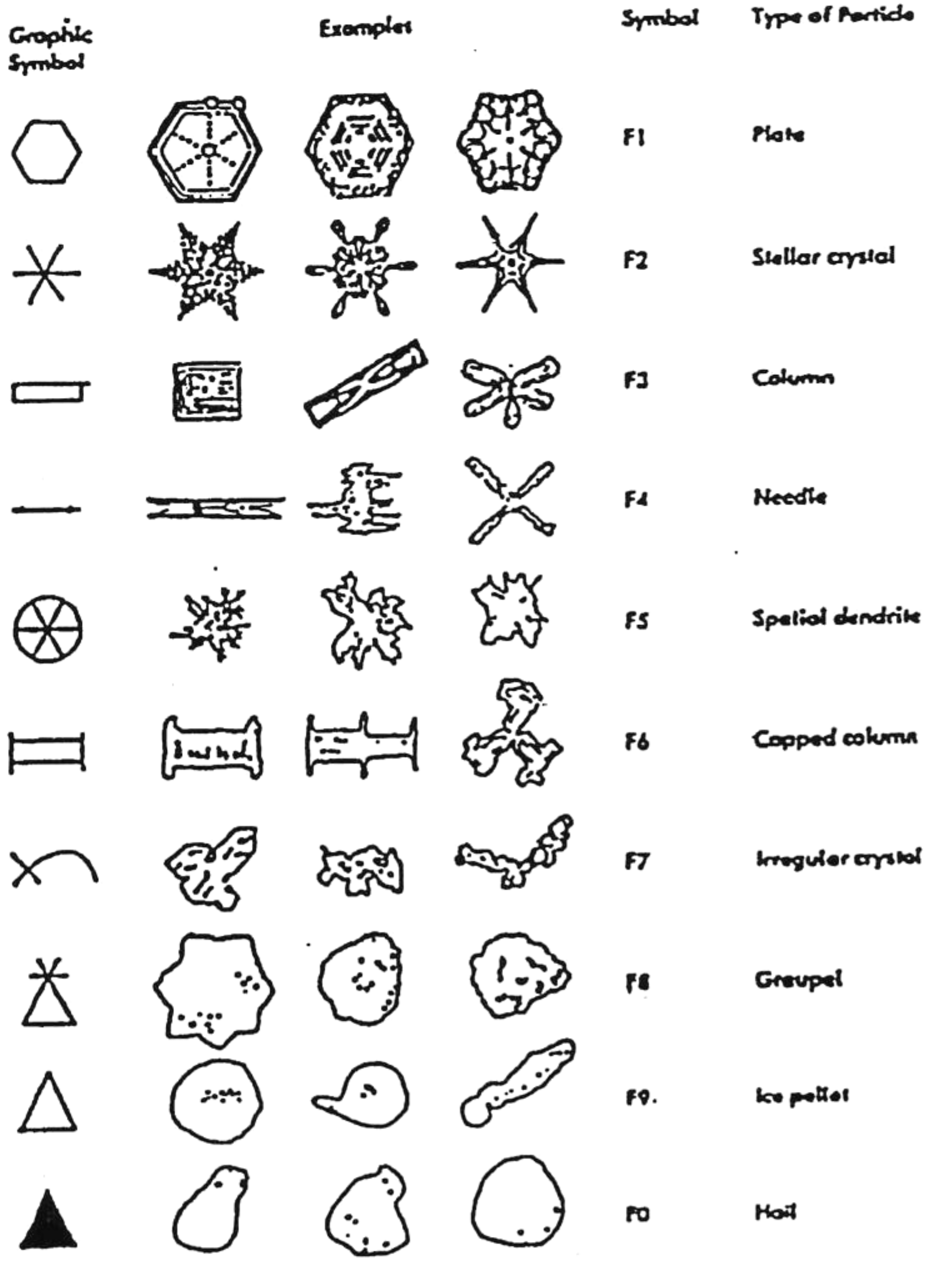


FIGURE B-4
INTERNATIONAL CLASSIFICATION FOR SOLID PRECIPITATION



4. A pictorial summary of the International Snow Classification for solid precipitation. This classification applies to falling snow.

Source: *International Commission on Snow and Ice, 1951*

FIGURE B-5
WEATHER PHENOMENA AND SYMBOLS

General Category	Specific Phenomena	Symbol
Tornadoes and Thunderstorms	Tornado	Tornado
	Waterspout	Waterspout
	Funnel Cloud	Funnel Cloud
	Thunderstorm	T, T+
Precipitation	Rain	R−−, R−, R, R+
	Rain Showers	RW−−, RW−, RW, RW+
	Drizzle	L−−, L−, L, L+
	Freezing Rain	ZR−−, ZR−, ZR, ZR+
	Freezing Drizzle	ZL−−, ZL−, ZL, ZL+
	Snow	S−−, S−, S, S+
	Snow Grains	SG−−, SG−, SG, SG+
	Ice Crystals	IC
	Ice Pellets	IP−−, IP−, IP, IP+
	Ice Pellet Showers	IPW−−, IPW−, IPW, IPW+
	Snow Showers	SW−−, SW−, SW, SW+
	Snow Pellets	SP−−, SP−, SP, SP+
	Hail	A−−, A−, A, A+
Obstructions to Vision (visibility 6 miles or less)	Fog	F
	Ice Fog	IF
	Haze	H
	Smoke	K
	Blowing Snow	BS
	Blowing Sand	BN
	Blowing Dust	BD
	Dust Haze	D

TABLE B-3
END CONDITION DATA FORM

REMEMBER TO SYNCHRONIZE TIME WITH AES - USE REAL TIME

VERSION 6.0 Winter 1999/2000

LOCATION:	DATE:	RUN # :	STAND # :

CIRCLE SENSOR PLATE: u v w x y z

SENSOR NUMBER: ___ ___ ___ ___ ___ ___

DIRECTION OF STAND: _____ °

OTHER COMMENTS (Fluid Batch, etc):

____

____

____

____

____

____

____

____

____

	PRINT	SIGN
FAILURES CALLED BY :		
HAND WRITTTEN BY :		
TEST SITE LEADER :		

*TIME (After Fluid Application) TO FAILURE FOR INDIVIDUAL CROSSHAIRS (hr:min)

Time of Fluid Application: ______ hr:min:ss ______ hr:min:ss ______ hr:min:ss

	Plate U			Plate V			Plate W		
FLUID NAME									
B1 B2 B3									
C1 C2 C3									
D1 D2 D3									
E1 E2 E3									
F1 F2 F3									
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA									
CALCULATED FAILURE TIME (MINUTES)									
BRIX / TEMPERATURE AT START	/			/			/		

Time of Fluid Application: ______ hr:min:ss ______ hr:min:ss ______ hr:min:ss

	Plate X			Plate Y			Plate Z		
FLUID NAME									
B1 B2 B3									
C1 C2 C3									
D1 D2 D3									
E1 E2 E3									
F1 F2 F3									
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA									
CALCULATED FAILURE TIME (MINUTES)									
BRIX / TEMPERATURE AT START	/			/			/		

Groups\CM1680 (exBM3833)\Procedures\Holdover Time\Natural snow\Data Form V6.xls

TABLE B-4
METEO/PLATE PAN DATA FORM

REMEMBER TO SYNCHRONIZE TIME WITH AES - USE REAL TIME | VERSION 6.0 | Winter 1999/2000

LOCATION: **DATE:** **RUN # :** **STAND # :**

HAND HELD VIDEO CASSETTE #:

PLATE PAN WEIGHT MEASUREMENTS *

PAN #	t TIME BEFORE (hh:mm:ss)	BUFFER TIME (Seconds)	t TIME AFTER (hh:mm:ss)	BUFFER TIME (Seconds)	w WEIGHT BEFORE (grams)	w WEIGHT AFTER (grams)	COMPUTE RATE (Δ w*4.7/ Δ t) (g/dm^2/h)

*measurements every 15 min. and at failure time of each test panel.

METEO OBSERVATIONS **

TIME (hr:min)	TYPE (Fig. 4) ZR, ZL,S, SG IP, IC, BS, SP	CLASSIF. (See Fig. 3)	If SNOW, WET or DRY

**observations at beginning, end, and every 10 min. intervals. Additional observations when there are significant changes.

TEMPERATURE AT START OF TEST ________ °C

WIND SPEED AT START OF TEST ________ kph

WIND DIRECTION AT START OF TEST ________ °

COMMENTS : ____

____

____

____

	PRINT	SIGN
WRITTEN & PERFORMED BY :	________	________
VIDEO BY :	________	________
TEST SITE LEADER :	________	________

Groups\CM1680 (cxBM3833)\Procedures\Holdover Time\Natural snow\Data Form V6.xls

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APPENDIX C

DETAILED PLAN OF NRC COLD CHAMBER TESTING WINTER 2000-01

BM3833.001

DETAILED PLAN OF
NRC COLD CHAMBER TESTING

Winter 2000/01

- Freezing Fog
- Freezing Drizzle and Light Freezing Rain
- Rain on a Cold-Soaked Surface

Prepared by: Michael Chaput

Reviewed by: John D'Avirro

April 2001
Version 1.0

APS AVIATION INC.

DETAILED PLAN OF NATIONAL RESEARCH COUNCIL COLD CHAMBER TESTING

Winter 2000/01

This document provides the detailed procedures and equipment required for the conduct of simulated freezing fog, freezing drizzle, light freezing rain and rain on a cold-soaked surface holdover time tests. Procedures for supplemental tests, such as the evaluation of an artificial snowmaking machine, are also provided in this document. These tests will be conducted at NRC's Climatic Engineering Facility (CEF) in Ottawa.

1. OBJECTIVES

The objective of the current holdover time test program is to establish holdover times for Type I deicing fluids and Type II and Type IV anti-icing fluids over the full range of HOT table conditions. Scheduling of the indoor tests will be coordinated with the NRC. Duration of tests will be 15 working days, including set-up time. Fluid failure will be determined by visual observation and supported by any ice detection instruments if these are made available.

The anticipated schedule of tests is provided in Attachment C-II

2. PERSONNEL

An indication of the personnel required is provided in Attachment C-IV.

HOT Manager: Overall management of HOT tests;
Determine test fluids and positioning of tests on stand; and
Determine failure times.

Spreadsheet 1/2: Management of rate spreadsheets;
Bring in / take out rate pans;
Measure droplet sizes (once per condition);
Measure rate distribution (once per condition);
Measure continuous rates (2 plates per stand);
Data entry / Chart preparation;
Fill in / modify recipe sheet; and
Printing of rate summaries.

Rate Manager: Manage rate pan entry / exit (rate management form); and
Bring in / take out rate pans (as required).

Fluids:	Ensure fluid temperature and brix are correct prior to testing; Pour fluids on test plates; Mark stand position in each condition; Ensure stand is level (10°); Ensure temperature loggers are operational; Ensure Type I fluids are mixed to proper freeze points; and Ensure video is operational.

3. PROCEDURES

- The procedures for indoor holdover time trials are shown in Attachment C-1;
- The detailed rate collection procedure appears in Attachment C-VI;
- The cold soak box preparation procedure appears in Attachment C-VII;
- The hard water preparation procedure for Type I tests in Attachment C-VIII.

4. TEST PLAN

Attachment C-II provides the test schedule for CEF tests while the detailed test plan is included in Attachment C-III.

5. EQUIPMENT

Test equipment required for the flat plate tests was determined from previous winters in association with the Society of Automotive Engineers (SAE) working group on ground deicing. A description of some important equipment appears in Attachment C-1. The complete equipment list for CEF tests is shown in Attachment C-V

6. DATA FORMS

The data forms for tests conducted in simulated conditions are as follows:

- De/anti-icing data form for freezing precipitation, Table C-2;
- De/anti-icing data form for cold-soak box, Table C-2A;
- Precipitation rate measurement, Table C-3;
- Detailed precipitation rate measurement form, Table C-3A;
- Continuous precipitation measurement form, Table C3B;
- Cold-soak precipitation rate measurement, Table C-4; and
- Rate management form, Table C-5.

ATTACHMENT C-1

INDOOR FLAT PLATE TEST EQUIPMENT AND PROCEDURE 2000/01

This indoor test procedure has been developed by the SAE G-12 Holdover Time Subcommittee working group on aircraft ground de/anti-icing as part of an overall testing program that includes laboratory tests, field tests and full-scale aircraft tests. The aim of this procedure is the development of holdover time table entries for freezing point depressant fluids known as de/anti-icing fluids.

1. SCOPE

This procedure describes the equipment and generalized steps to follow in order to standardize the method to be used to establish the time period for which freezing point depressant fluids provide protection to test panels during simulated winter conditions.

2. EQUIPMENT

The following equipment is required:

2.1 Plate Pans

Plate pans (27.7cm x 54cm), placed at a 10º inclination on the test stand, will be used to collect and weigh freezing precipitation. The procedure for the collection of precipitation rates using this method is described in 4.1 and in Attachment C-VI.

2.2 Temperature Gauge for Panels

Plate temperatures will be measured using thermocouples embedded within the test plate. All thermocouples are capable of measuring panel temperatures to an accuracy of 0.5ºC (1ºF) over the range +10 to -30ºC (+50 to -20ºF), and will be linked to an electronic data acquisition system.

2.3 Test Stand

A typical test stand is illustrated in Figure C-2; it may be altered to suit the location and facilities, but the angle for the panels, their arrangement and markings must all conform to Figure C-2. There shall be no flanges or obstructions close to the edges of the panels that could interfere with the airflow over the panels. Test panels should be positioned on the test stand at a 10° ± 0.2° angle from the horizontal.

2.4 Test Panels

2.4.1 Material and Dimensions

Test panels are made of Alclad Aluminum, 2024-T6 or 5052-H32, polished standard roll mill finish. The test panel dimensions are 300 x 500 x 3.2 mm, with a working area of 250 x 450 mm. Thicker aluminum stock may be needed when an instrument is mounted on the plate (CFIMS Sensor required 6.4 mm). Typical plate roughness used in APS Holdover time trials is 0.4 microns, measured parallel to the long axis of the plate.

2.4.2 Markings

Each panel shall be marked (as shown in Figure C-1) with lines at 25 and 150 mm from the panel top edge, with 15 crosshair points and with vertical lines 25 mm from each side; this marks off a working area of 250 x 450 mm on each panel. All marks shall be made using a 30 mm thick black marker or silkscreen process, which does not come off with application of the test fluids or any of the cleaning agents. Re-marking of the plates will be required as the markings fade because of the cleaning actions.

2.4.3 Attachment of Test Panels

For attachment to the test stand, at least four holes shall be made, spaced along the two sides of each panel; the holes shall be within 20 mm (0.8") from the panel edge.

2.5 Fluid Application

One litre of fluid per test should be poured onto the plates from one-litre pour containers, ensuring that the entire test section surface is saturated and a consistent fluid thickness over the entire plate surface is obtained.

2.6 Film Thickness Gauge

Film thickness at the 15 cm (6") line can be evaluated (this is optional). Painter's wet paint film thickness gauge. 1-08 mil gauge or equivalent is available from Paul N. Gardner Company Inc., Pompano Beach, Florida.

2.7 Video recording (optional)

Tests may also be recorded with a hand-held video camera, in particular at the start of the test and when failures are being called. Care must be taken that the camera and any lighting do not interfere with the airflow or ambient temperatures.

2.8 Relative Humidity Meter

Relative humidity in the test chamber will be recorded using a Vaisala RH Meter attached to an electronic data acquisition system.

2.9 Ice Detection Sensors

Where feasible, surface or remotely mounted ice detection sensors should be used during the tests.

2.10 Addition Equipment

- Squeegee/scraper
- Extension power cords
- Floodlights
- Watches/stopwatches

2.11 Test Chamber

Tests in simulated conditions will be conducted at the NRC, Climatic Engineering Facility in Ottawa. The chamber air temperature control is 0.5°C (+ standard deviation) based on the average air temperature measured at one-minute intervals. Temperature data is stored on the CEF data acquisition system. A minimum of three thermocouples are mounted in close proximity to the test stands and are monitored throughout the test set-up. The distance between nozzle and test plate is 6.5 to 6.7 meters, depending on the location of the plate on the test stand. The test chamber is equipped with artificial lighting arranged as such that it does not interfere with the precipitation nor with the air, fluid and plate temperatures

2.12 Spray Equipment

2.12.1 Characteristics of Precipitation Produced

The following is a point-form summary of the set of test conditions under which data for freezing drizzle, light freezing rain, rain on a cold-soaked surface, and freezing fog are collected:

- Freezing Drizzle:
  High precipitation rate: 12.7 g/dm²/hr;
  Droplet median volume diameter: 350 μm;
  Droplets produced with two # 23 hypodermic needles; and
  Air temperature: -3 and –10°C.

  Low Precipitation rate: 5 g/dm²/hr;
  Droplet median volume diameter: 250 μm;
  Droplets produced with two # 24 hypodermic needles; and
  Air temperature: -3 and –10°C.

- Light Freezing Rain:
  High precipitation rate: 25 g/dm²/hr;
  Droplet median volume diameter: 1 000 μm;
  Droplets produced with two # 20 hypodermic needles; and
  Air temperature: -3 and –10°C.

  Low precipitation rate: 12.7 g/dm²/hr;
  Droplet median volume diameter: 1 000 μm;
  Droplets produced with two # 20 hypodermic needles; and
  Air temperature: -3 and –10°C.

- Drizzle on Cold-Soaked Surface:
  Precipitation rate: 5 g/dm²/hr;
  Droplet median volume diameter: 250 μm;
  Droplets produced with two # 24 hypodermic needles; and
  Air temperature: +1°C.

- Moderate Rain on Cold-Soaked Surface:
  Precipitation rate: 76 g/dm²/hr;
  Droplet median volume diameter: 1 400 μm;
  Droplets produced with two # 17 hypodermic needles; and
  Air temperature: +1°C.

- Freezing Fog:
  Precipitation rate: 2 and 5 g/dm²/hr;
  Droplet median volume diameter: 30 μm; and
  Air temperature: -3°C, -14°C and -25°C.

2.12.2 Droplet Size Determination

The droplet size determination and distribution can be determined using the Dye Stain Method. The Dye Stain Method technique consists of dusting filter paper disks with water activated, very finely divided, powder form of methylene blue dye. The prepared disks are manually positioned under precipitation for a fixed time in order to acquire a droplet size pattern. A calibration curve is then used to convert from the measured diameter of the droplets ton the pattern to the experimental median volume diameter. This method of droplet size determination has been used for several years (see Transport Canada Reports TP 12654E, TP 12896E, TP 13131E, TP 13318E).

2.12.3 Spray Distribution

The water spray shall be evenly distributed over the entire area of each test plate. Even distribution is verified by exposing either a clean test plate or sheet of paper briefly to the spray. Drop distribution on the plate or paper is visually evaluated. Uneven distribution requires that the spray equipment be adjusted (step size and spray head speed) until even distribution is achieved.

2.13 Calibration of Test Equipment

All temperature sensors, humidity sensors, electronic balances, anemometers, and timing devices shall be maintained in a known state of calibration. Our experience indicates that a one-year calibration interval is sufficient.

3. DE/ANTI-ICING FLUIDS

3.1 Test Fluids

Only fluids that have been certified will be included in tests. Fluid suppliers shall submit to the test coordinating organization proof of certification for the fluids they provide.

3.2 Certification

Type IV fluids shall be pre-sheared by each manufacturer to a viscosity level selected by the manufacturer using the sample selection procedures outlined in the proposed Aerospace Standard 5485. Each manufacturer shall provide samples and a certificate of compliance showing the viscosity of their test sample of fluid before and after shearing, as well as information pertaining to the freeze point and refractive index of the fluid and other fluid parameters as usually provided to the end users. Viscosity and refractive index verifications of each fluid shall be made by the test organization upon receipt of fluid from the manufacturer.

3.3 Fluid Dye

Fluids should be supplied for certification and for holdover time testing in the form to be used on aircraft.

4. PROCEDURE

4.1 Rate Calculation Procedure

Rate calculation is performed by placing ice catch pans (27.7 cm x 54 cm) on the test plate support at each test location (maximum of 12 locations). Each pan is marked with a number identifying the collection location on the test plate support. The individual pans are weighed prior to exposure to precipitation and the weights are recorded. Prior to the start of the precipitation catch period, the exact time (hh:mm:ss) is recorded. The pans are then placed on the test plate support for a pre-determined period. The pans are re-weighed following this period and the precipitation rate for each pan is calculated (R1).

$R1 = (W_{a1}-W_{b1})/\text{Area-of-pan} * (T_{a1}-T_{b1})$
where,
W_{a1} = weight after of the 1st measurement
W_{b1} = weight before of the 1st measurement
T_{a1} = time after of the 1st measurement
T_{b1} = time before of the 1st measurement

The pans are then weighed and placed on the test plate support for a second collection period (R2). After the second collection period has expired, the pans are again re-weighed and the rates computed. A test may begin following the second rate collection period.

Following the failure of a test plate, a rate collection pan is weighed and placed at the plate location for a predetermined time interval (R3). It is then re-weighed and placed again (R4) on the stand in order to collect a minimum of two rates before and two rates after each test 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. In order for the test to be valid, the average rate must be within the set limits.

Water Spray Intensity Calculation

Average intensity: $$\frac{R1 + R2 + R3 + R4}{4}$$

The average intensity calculated must be within the specified tolerance.

The detailed rate procedure appears in Attachment F.

4.2 Continuous Rate Monitoring

During a test, rates will continuously be monitored in order to ensure that no rate fluctuations occur. One continuous monitoring pan is required when conducting 1 to 6 fluid tests, and two continuous monitoring pans are required for 7 to 12 tests. For this purpose, ice collection pans will be weighed and placed on each designated location. The continuous monitoring pans will be re-weighed at 15-minute intervals during the test.

4.3 Rate Distribution

Clean test plates are placed on the test stand, prior to the rate collection period, and are exposed to the precipitation in order to verify that even ice formation occurs over the surface of the test plates. If this visual inspection proves satisfactory, the rate collection period will begin. If this visual inspection proves unsatisfactory, the test stand is repositioned under the spray device.

In order to verify the rate distribution on the test stand, a continuous rate monitoring pan will be replaced with a detailed rate distribution pan, which consists of 4 small pans of equivalent size. The area of the 4 small pans combined is similar to that of a standard rate collection pan. The small pans will be weighed and placed at these locations and re-weighed at fixed intervals. The typical collection period for rate distribution is 60 minutes, however this interval may be shorter if all tests have completed within 60 minutes. The variation between the rate of any of the 4 small pans and that of the average rate of that location should not be greater than 10%.

4.4 Test Panel Preparation

4.4.1

Before the start of each day's testing, ensure the panels are clean using the procedure outlined in 4.5.4.

4.4.2

Place the panels on the fixture and attach to the frame screws with flat bolts (wing nuts will make attaching and removal easier in poor weather).

4.4.3

Allow the panels to cool to chamber temperature. The temperature may be verified using the thermistors attached to each plate.

4.5 Fluid Preparation and Application

4.5.1 Procedure for Type I Fluid Application

- Position plate covers over plates to protect from precipitation;
- Prepare 1 litre of test fluid and place it in a premarked pitcher. Fluid temperature must be 20°C ± 3°C. Measure and record Brix;
- Scrape up and squeegee any ice off the plate;
- Apply 1/3 litre to fully cleanse the plate and squeegee; and
- Apply remaining 2/3 litre on plate for test. Application should be consistent for each test to ensure consistent heat transfer to the plate,

4.5.2 Procedure for Anti-icing Fluid Application (Type II and IV)

Apply the fluids at ambient test temperature ±1.0°C to the panels, commencing at the upper edge of the test panel and working downwards to the lower edge. Ensure complete and consistent coverage by applying 1 litre of fluid from the prepared containers. Start time of the test begins immediately following completion of the fluid application.

4.5.3 Fluid Temperature

Except for Type I fluids, all fluids should be cold-soaked to ambient temperature conditions prior to the start of the test session.

4.5.4 Cleaning Panels

The test panels must be clean of all contamination prior to the start of any test. This is accomplished by scrapping off contamination, or when a different type of fluid is to be tested, a hot water wash is used to remove traces of the previous fluid. Before applying test fluid to any test panel, apply a small quantity of the fluid being used for the test and spread it over the entire test surface. Squeegee off any remaining fluid from the plate surface prior to the start of the test. Fluid for test is applied following procedure outlined in 4.5.1 and 4.5.2.

4.6 Holdover Time Testing

4.6.1

Record the elapsed time (holdover time) required for the fluid to achieve the test END CONDITION. See Section 5 for definition of end condition.

4.6.2 Fluid Holdover Time Determination

The test is dynamic by nature, and small variations can be expected. Each test condition shall be tested on at least two panels. Two tests will be conducted at the low rate limit and two tests will be conducted at the high rate limit, for each test temperature and precipitation type. If the variation of the anti-icing endurance time at one of the specified rate limits is more than 10%, repeat testing on two additional panels, for a total of 4 data points.

The holdover time values at the required precipitation rates are obtained by producing a "best fit" regression curve through the points using a power law transformation based on the test points collected at the lower and upper rate limits.

The equation used to treat the data is given by the expression below:

$$t = cR^a$$

where

t = Time (minutes)

R = Rate of precipitation (g/dm2/hr)

a,c = Coefficients determined from the regression

4.7 Video Recording (not performed routinely)

Video record test (if required) with a hand-held camera in the following sequences:

1) General laboratory conditions prior to test.
2) Video record the data forms.
3) Video record pouring. Ensure that name of fluids are captured, testers faces, your voice, name and stand # (ensure date and time are available and synchronized).
4) Record pans being weighed and brought out.
5) Record establishing shot of test stand (all the plates).
6) Record establishing shot of each plate, followed by a close-up of the plate (scan the plate slowly), then returning to wide shot of the plate. Repeat this with each plate in sequence. Record the clock/timer often.
7) For each failure, record an overview of the plates, followed by a wide shot of the plate, zooming in into a close-up of the failure. Return to the establishing shot at the end of the procedure. Repeat this procedure for each failure.
8) Ensure that the lighting is appropriate for video purposes.

9) Ensure that the video camera is in fact recording. At the end of a test, rewind a few seconds and check that the test was recorded.

5. END CONDITION

The plate failure time is that time required for the end conditions to be achieved. This occurs when precipitation fails to be absorbed at any five of the crosshair marks on the panels or when 1/3 of the test panel is covered with accumulating precipitation.

A crosshair is considered failed if:

- There is a visible accumulation of snow (not slush, but white snow) on the fluid at the crosshair when viewed from the front (i.e. perpendicular to the plate). You are looking for an indication that the fluid can no longer accommodate or absorb the precipitation at this point.

OR

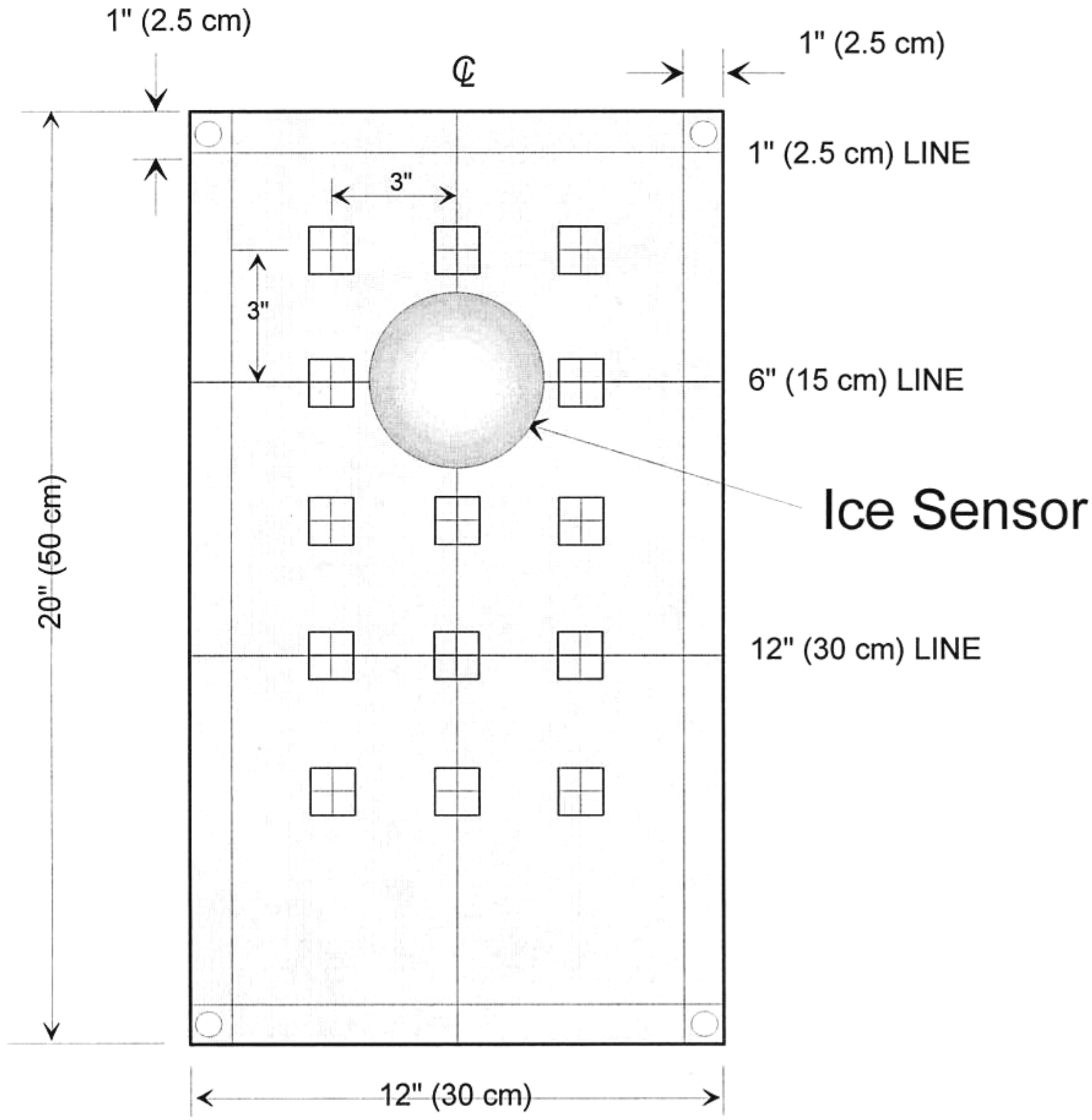
- When precipitation or frosting produces a loss of gloss (i.e. a dulling of the surface reflectivity) or a change in colour (dye) to grey or grayish appearance at any five crosshairs, or ice (or crusty snow) has formed on the crosshair (look for ice crystals). This condition is only applicable during freezing rain/drizzle, ice pellets, freezing fog or during a mixture of snow and freezing rain/drizzle and ice pellets.

As these determinations are subjective in nature, the following is very important:

- Whenever possible, have the same individual make the determination that a crosshair has failed.
- When making such a determination, ensure consistency in the criteria used to call the end of a test.

FIGURE C-1

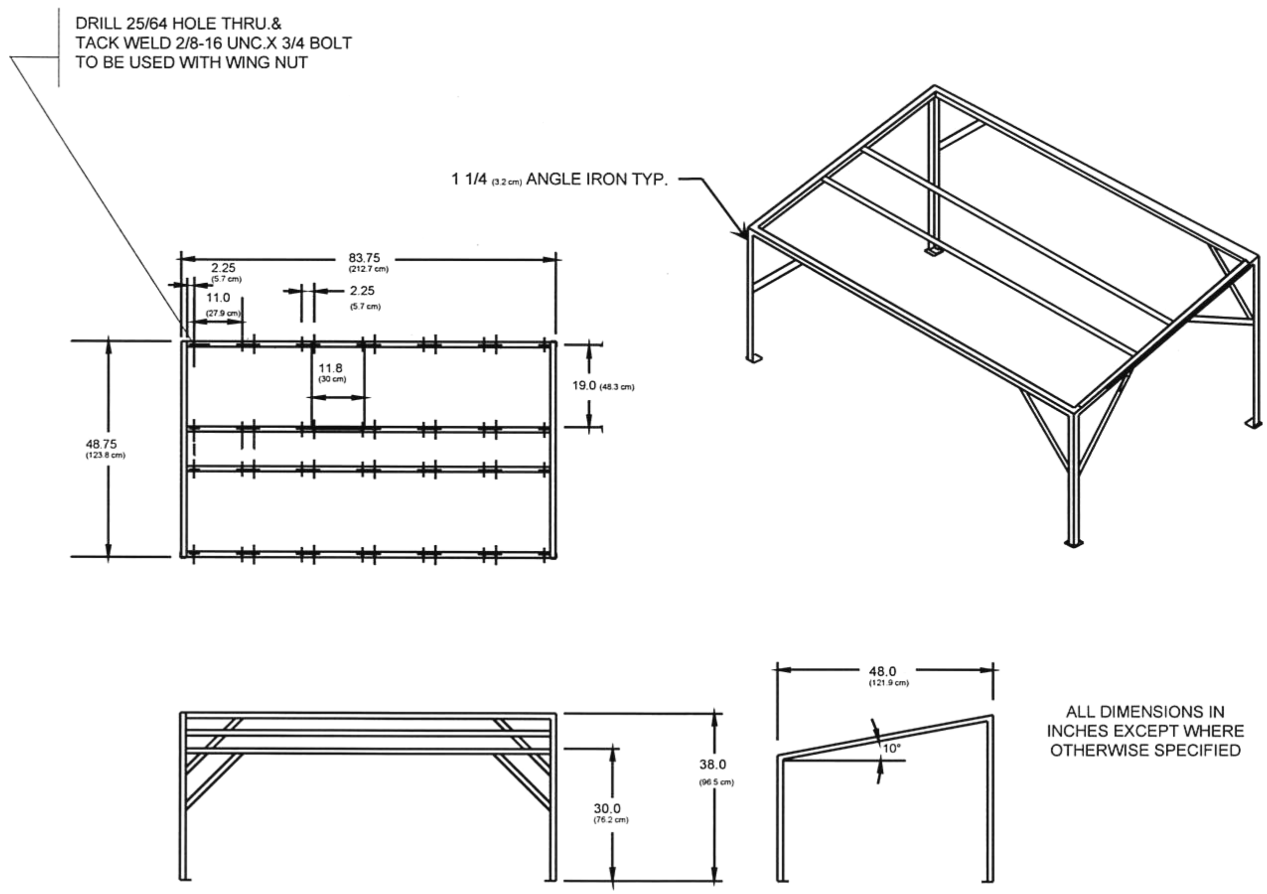
TYPICAL ICE SENSOR FLAT PLATE MARKINGS



1589\procedurlnat_snowplate.ch4

FIGURE C-2

TEST STAND



cm1589\proce\nat_snow\rack_r2.ch4

ATTACHMENT C-II

March 2001

March 2001

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

April 2001

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
			March 1 Memorial Day (Canada) Memorial Day (Canada)	2	3 / 4
5	6	7	8	9	10 / 11
12	13	14	15	16	17 Saint Patrick's Day (Canada) Saint Patrick's Day (Canada) / 18
19	20	21	22	23	24 / 25
26	27 ZD 3H (6H)	28 ZD 3L (7H)	29 ZFog 3L (13H)	30 ZFog 3H (10H)	31

Michael Chaput

03/21/2001

ATTACHMENT C-II

April 2001

April 2001

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

May 2001

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
Z Fog 10H (3) Z Fog 10L (3)	Z Fog 14L (9)	Z Fog 14H (6)	ZD 10L (6) ZD 10H (4)	ZR 10L (4) ZR 10H (3)	April 1
2	3	4	5	6	7
Z Fog 25H (4) Z Fog 25L (4)	ZR 3L (4) ZR 3H (3)	CSW L (7)	CSW H (5)		8
9	10	11	12	13 Good Friday (Canada) Good Friday (Canada)	14 15 Easter (Canada) Easter (Canada)
16 Easter Monday (Canada) Easter Monday (Canada)	17	18	19	20	21 22
23	24	25	26	27	28 29
30					

ATTACHMENT C-III

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	HOT	HOT Est.
1	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	100		60
2	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	100		60
3	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	75		60
4	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	75		60
5	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	50		15
6	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (TIV)	50		15
7	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	100		60
8	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	100		60
9	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	75		60
10	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	75		60
11	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	50		15
12	Light Freezing Rain	-3	13	CLAR SF MPIV 2015 TF (TIV)	50		15
13	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	100		70
14	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	100		70
15	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	75		50
16	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	75		50
17	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	50		25
18	Light Freezing Rain	-3	13	UCAR Dieth. (TIV)	50		25
19	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	100		30
20	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	100		30
21	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	75		25
22	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	75		25
23	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	50		10
24	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (COATED)	100		60
25	Light Freezing Rain	-3	13	CLAR SF PRO 2012 (COATED)	100		60
26	Light Freezing Rain	-3	13	SPCA Ecowing 26 (TII)	50		10
27	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	100		40
28	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	100		40
29	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	75		25
30	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	75		25
31	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	50		5
32	Light Freezing Rain	-3	25	CLAR SF PRO 2012 (TIV)	50		5
33	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	100		40
34	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	100		40
35	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	75		25
36	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	75		25
37	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	50		5
38	Light Freezing Rain	-3	25	CLAR SF MPIV 2015 TF (TIV)	50		5
39	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	100		50
40	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	100		50
41	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	75		35
42	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	75		35
43	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	50		10
44	Light Freezing Rain	-3	25	UCAR Dieth. (TIV)	50		10
45	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	100		15
46	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	100		15
47	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	75		10
48	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	75		10
49	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	50		5
50	Light Freezing Rain	-3	25	SPCA Ecowing 26 (TII)	50		5
51	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (TIV)	100		45
52	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (TIV)	100		45
53	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (COATED)	100		45
54	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (COATED)	100		45
55	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (TIV)	75		30
56	Light Freezing Rain	-10	13	CLAR SF PRO 2012 (TIV)	75		30
57	Light Freezing Rain	-10	13	CLAR SF MPIV 2015 TF (TIV)	100		45
58	Light Freezing Rain	-10	13	CLAR SF MPIV 2015 TF (TIV)	100		45

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	HOT	HOT Est.	
59	Light Freezing Rain	-10	13	CLAR SF MPIV 2015 TF (TIV)	75		30	
60	Light Freezing Rain	-10	13	CLAR SF MPIV 2015 TF (TIV)	75		30	
61	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100		40	
62	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100		40	
63	Light Freezing Rain	-10	13	UCAR Dieth. (COATED)	100		40	
64	Light Freezing Rain	-10	13	UCAR Dieth. (COATED)	100		40	
65	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	75		35	
66	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	75		35	
67	Light Freezing Rain	-10	13	SPCA Ecowing 26 (TII)	100		30	
68	Light Freezing Rain	-10	13	SPCA Ecowing 26 (TII)	100		30	
69	Light Freezing Rain	-10	13	SPCA Ecowing 26 (TII)	75		20	
70	Light Freezing Rain	-10	13	SPCA Ecowing 26 (TII)	75		20	
71	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100 / 25°C		40	
72	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100 / 25°C		40	
73	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100 / 15°C		40	
74	Light Freezing Rain	-10	13	UCAR Dieth. (TIV)	100 / 15°C		40	
75	Light Freezing Rain	-10	13	LYON. ARCO PLUS-ST. (TI)	10°		5	
76	Light Freezing Rain	-10	13	LYON. ARCO PLUS-ST. (TI)	10°		5	
77	Light Freezing Rain	-10	13	NEWAVE AEROCH. FCY-1A (TI)	10°		5	
78	Light Freezing Rain	-10	13	NEWAVE AEROCH. FCY-1A (TI)	10°		5	**15**
79	Light Freezing Rain	-10	25	CLAR SF PRO 2012 (TIV)	100		30	
80	Light Freezing Rain	-10	25	CLAR SF PRO 2012 (TIV)	100		30	
81	Light Freezing Rain	-10	25	CLAR SF PRO 2012 (TIV)	75		20	
82	Light Freezing Rain	-10	25	CLAR SF PRO 2012 (TIV)	75		20	
83	Light Freezing Rain	-10	25	CLAR SF MPIV 2015 TF (TIV)	100		30	
84	Light Freezing Rain	-10	25	CLAR SF MPIV 2015 TF (TIV)	100		30	
85	Light Freezing Rain	-10	25	CLAR SF MPIV 2015 TF (TIV)	75		20	
86	Light Freezing Rain	-10	25	CLAR SF MPIV 2015 TF (TIV)	75		20	
87	Light Freezing Rain	-10	25	UCAR Dieth. (TIV)	100		20	
88	Light Freezing Rain	-10	25	UCAR Dieth. (TIV)	100		20	
89	Light Freezing Rain	-10	25	UCAR Dieth. (TIV)	75		20	
90	Light Freezing Rain	-10	25	UCAR Dieth. (TIV)	75		20	
91	Light Freezing Rain	-10	25	UCAR Ultra+	100		20	
92	Light Freezing Rain	-10	25	UCAR Ultra+	100		20	
93	Light Freezing Rain	-10	25	SPCA AD-480	100		20	
94	Light Freezing Rain	-10	25	SPCA AD-480	100		20	
95	Light Freezing Rain	-10	25	SPCA AD-480	75		20	
96	Light Freezing Rain	-10	25	SPCA AD-480	75		20	
97	Light Freezing Rain	-10	25	Kilfrost ABC-S	100		20	
98	Light Freezing Rain	-10	25	Kilfrost ABC-S	100		20	
99	Light Freezing Rain	-10	25	Kilfrost ABC-S	75		20	
100	Light Freezing Rain	-10	25	Kilfrost ABC-S	75		20	
101	Light Freezing Rain	-10	25	SPCA Ecowing 26 (TII)	100		10	
102	Light Freezing Rain	-10	25	SPCA Ecowing 26 (TII)	100		10	
103	Light Freezing Rain	-10	25	SPCA Ecowing 26 (TII)	75		10	
104	Light Freezing Rain	-10	25	SPCA Ecowing 26 (TII)	75		10	
105	Light Freezing Rain	-10	25	LYON. ARCO PLUS-ST. (TI)	10°		2	
106	Light Freezing Rain	-10	25	LYON. ARCO PLUS-ST. (TI)	10°		2	
107	Light Freezing Rain	-10	25	NEWAVE AEROCH. FCY-1A (TI)	10°		2	
108	Light Freezing Rain	-10	25	NEWAVE AEROCH. FCY-1A (TI)	10°		2	**9**
							3038	
							51	

Rates: 156 Tests x 30 minutes = 78 hours
Hours required for testing = 155 hours (78 +77)
Total Chamber time required = 16 hours (155 hours /10 plates at a time)

Estimated time in chamber to complete Zr- tests = 2 days

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	HOT	HOT Est.
109	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	100		120
110	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	100		120
111	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	75		70
112	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	75		70
113	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	50		20
114	Freezing Drizzle	-3	5	CLAR SF PRO 2012 (TIV)	50		20
115	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	100		120
116	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	100		120
117	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	75		70
118	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	75		70
119	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	50		20
120	Freezing Drizzle	-3	5	CLAR SF MPIV 2015 TF (TIV)	50		20
121	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	100		120
122	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	100		120
123	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	75		80
124	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	75		80
125	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	50		35
126	Freezing Drizzle	-3	5	UCAR Dieth. (TIV)	50		35
127	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	100		60
128	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	100		60
129	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	75		45
130	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	75		45
131	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	50		20
132	Freezing Drizzle	-3	5	SPCA Ecowing 26 (TII)	50		20
133	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	100		55
134	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	100		55
135	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	75		55
136	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	75		55
137	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	50		10
138	Freezing Drizzle	-3	13	CLAR SF PRO 2012 (TIV)	50		10
139	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	100		55
140	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	100		55
141	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	75		55
142	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	75		55
143	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	50		10
144	Freezing Drizzle	-3	13	CLAR SF MPIV 2015 TF (TIV)	50		10
145	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	100		65
146	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	100		65
147	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	75		55
148	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	75		55
149	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	50		15
150	Freezing Drizzle	-3	13	UCAR Dieth. (TIV)	50		15
151	Freezing Drizzle	-3	13	UCAR Ultra+	100		65
152	Freezing Drizzle	-3	13	UCAR Ultra+	100		65
153	Freezing Drizzle	-3	13	SPCA AD-480	100		65
154	Freezing Drizzle	-3	13	SPCA AD-480	100		65
155	Freezing Drizzle	-3	13	SPCA AD-480	75		55
156	Freezing Drizzle	-3	13	SPCA AD-480	75		55
157	Freezing Drizzle	-3	13	SPCA AD-480	50		15
158	Freezing Drizzle	-3	13	SPCA AD-480	50		15
159	Freezing Drizzle	-3	13	Kilfrost ABC-S	100		65
160	Freezing Drizzle	-3	13	Kilfrost ABC-S	100		65
161	Freezing Drizzle	-3	13	Kilfrost ABC-S	75		55
162	Freezing Drizzle	-3	13	Kilfrost ABC-S	75		55
163	Freezing Drizzle	-3	13	Kilfrost ABC-S	50		15
164	Freezing Drizzle	-3	13	Kilfrost ABC-S	50		15
165	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	100		30
166	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	100		30

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm^2/hr	Fluid Brand	Dilution	HOT	HOT Est.	
167	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	75		20	
168	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	75		20	
169	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	50		5	
170	Freezing Drizzle	-3	13	SPCA Ecowing 26 (TII)	50		5	
171	Freezing Drizzle	-10	5	CLAR SF PRO 2012 (TIV)	100		95	
172	Freezing Drizzle	-10	5	CLAR SF PRO 2012 (TIV)	100		95	
173	Freezing Drizzle	-10	5	CLAR SF PRO 2012 (TIV)	75		70	
174	Freezing Drizzle	-10	5	CLAR SF PRO 2012 (TIV)	75		70	
175	Freezing Drizzle	-10	5	CLAR SF MPIV 2015 TF (TIV)	100		95	
176	Freezing Drizzle	-10	5	CLAR SF MPIV 2015 TF (TIV)	100		95	
177	Freezing Drizzle	-10	5	CLAR SF MPIV 2015 TF (TIV)	75		70	
178	Freezing Drizzle	-10	5	CLAR SF MPIV 2015 TF (TIV)	75		70	
179	Freezing Drizzle	-10	5	UCAR Dieth. (TIV)	100		80	
180	Freezing Drizzle	-10	5	UCAR Dieth. (TIV)	100		80	
181	Freezing Drizzle	-10	5	UCAR Dieth. (TIV)	75		75	
182	Freezing Drizzle	-10	5	UCAR Dieth. (TIV)	75		75	
183	Freezing Drizzle	-10	5	SPCA Ecowing 26 (TII)	100		45	
184	Freezing Drizzle	-10	5	SPCA Ecowing 26 (TII)	100		45	
185	Freezing Drizzle	-10	5	SPCA Ecowing 26 (TII)	75		30	
186	Freezing Drizzle	-10	5	SPCA Ecowing 26 (TII)	75		30	
187	Freezing Drizzle	-10	5	LYON. ARCO PLUS-ST. (TI)	10°		8	
188	Freezing Drizzle	-10	5	LYON. ARCO PLUS-ST. (TI)	10°		8	
189	Freezing Drizzle	-10	5	LYON. ARCO PLUS-ST. (COATED)	10°		8	
190	Freezing Drizzle	-10	5	LYON. ARCO PLUS-ST. (COATED)	10°		8	
191	Freezing Drizzle	-10	5	NEWAVE AEROCH. FCY-1A (TI)	10°		8	
192	Freezing Drizzle	-10	5	NEWAVE AEROCH. FCY-1A (TI)	10°		8	**19**
193	Freezing Drizzle	-10	13	CLAR SF PRO 2012 (TIV)	100		55	
194	Freezing Drizzle	-10	13	CLAR SF PRO 2012 (TIV)	100		55	
195	Freezing Drizzle	-10	13	CLAR SF PRO 2012 (TIV)	75		40	
196	Freezing Drizzle	-10	13	CLAR SF PRO 2012 (TIV)	75		40	
197	Freezing Drizzle	-10	13	CLAR SF MPIV 2015 TF (TIV)	100		55	
198	Freezing Drizzle	-10	13	CLAR SF MPIV 2015 TF (TIV)	100		55	
199	Freezing Drizzle	-10	13	CLAR SF MPIV 2015 TF (TIV)	75		40	
200	Freezing Drizzle	-10	13	CLAR SF MPIV 2015 TF (TIV)	75		40	
201	Freezing Drizzle	-10	13	UCAR Dieth. (TIV)	100		30	
202	Freezing Drizzle	-10	13	UCAR Dieth. (TIV)	100		30	
203	Freezing Drizzle	-10	13	UCAR Dieth. (TIV)	75		30	
204	Freezing Drizzle	-10	13	UCAR Dieth. (TIV)	75		30	
205	Freezing Drizzle	-10	13	SPCA Ecowing 26 (TII)	100		15	
206	Freezing Drizzle	-10	13	SPCA Ecowing 26 (TII)	100		15	
207	Freezing Drizzle	-10	13	SPCA Ecowing 26 (TII)	75		15	
208	Freezing Drizzle	-10	13	SPCA Ecowing 26 (TII)	75		15	
209	Freezing Drizzle	-10	13	LYON. ARCO PLUS-ST. (TI)	10°		5	
210	Freezing Drizzle	-10	13	LYON. ARCO PLUS-ST. (TI)	10°		5	
211	Freezing Drizzle	-10	13	NEWAVE AEROCH. FCY-1A (TI)	10°		5	
212	Freezing Drizzle	-10	13	NEWAVE AEROCH. FCY-1A (TI)	10°		5	**10**
							4838	
							81	

Rates: 136 Tests x 30 minutes = 68 hours
Hours required for testing = 167 hours (68 +99)
Total Chamber time required = 21 hours (167 hours /8 plates at a time)

Estimated time in chamber to complete Zd tests = 3 days

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	HOT	HOT Est.
213	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	100		240
214	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	100		240
215	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	75		180
216	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	75		180
217	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	50		35
218	Freezing Fog	-3	2	CLAR SF PRO 2012 (TIV)	50		35
219	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	100		240
220	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	100		240
221	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	75		180
222	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	75		180
223	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	50		35
224	Freezing Fog	-3	2	CLAR SF MPIV 2015 TF (TIV)	50		35
225	Freezing Fog	-3	2	UCAR Dieth. (TIV)	100		180
226	Freezing Fog	-3	2	UCAR Dieth. (TIV)	100		180
227	Freezing Fog	-3	2	UCAR Dieth. (TIV)	75		120
228	Freezing Fog	-3	2	UCAR Dieth. (TIV)	75		120
229	Freezing Fog	-3	2	UCAR Dieth. (TIV)	50		50
230	Freezing Fog	-3	2	UCAR Dieth. (TIV)	50		50
231	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	100		90
232	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	100		90
233	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	75		60
234	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	75		60
235	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	50		35
236	Freezing Fog	-3	2	SPCA Ecowing 26 (TII)	50		35
237	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	100		150
238	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	100		150
239	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	75		120
240	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	75		120
241	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	50		20
242	Freezing Fog	-3	5	CLAR SF PRO 2012 (TIV)	50		20
243	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	100		150
244	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	100		150
245	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	75		120
246	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	75		120
247	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	50		20
248	Freezing Fog	-3	5	CLAR SF MPIV 2015 TF (TIV)	50		20
249	Freezing Fog	-3	5	UCAR Dieth. (TIV)	100		180
250	Freezing Fog	-3	5	UCAR Dieth. (TIV)	100		180
251	Freezing Fog	-3	5	UCAR Dieth. (TIV)	75		120
252	Freezing Fog	-3	5	UCAR Dieth. (TIV)	75		120
253	Freezing Fog	-3	5	UCAR Dieth. (TIV)	50		20
254	Freezing Fog	-3	5	UCAR Dieth. (TIV)	50		20
255	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	100		35
256	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	100		35
257	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	75		25
258	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	75		25
259	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	50		15
260	Freezing Fog	-3	5	SPCA Ecowing 26 (TII)	50		15
261	Freezing Fog	-10	2	LYON. ARCO PLUS-ST. (TI)	10°		15
262	Freezing Fog	-10	2	LYON. ARCO PLUS-ST. (TI)	10°		15
263	Freezing Fog	-10	2	NEWAVE AEROCH. FCY-1A (TI)	10°		15
264	Freezing Fog	-10	2	NEWAVE AEROCH. FCY-1A (TI)	10°		15
265	Freezing Fog	-10	5	LYON. ARCO PLUS-ST. (TI)	10°		6
266	Freezing Fog	-10	5	LYON. ARCO PLUS-ST. (TI)	10°		6
267	Freezing Fog	-10	5	NEWAVE AEROCH. FCY-1A (TI)	10°		6
268	Freezing Fog	-10	5	NEWAVE AEROCH. FCY-1A (TI)	10°		6
269	Freezing Fog	-14	2	CLAR SF PRO 2012 (TIV)	100		120
270	Freezing Fog	-14	2	CLAR SF PRO 2012 (TIV)	100		120

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	HOT	HOT Est.	
271	Freezing Fog	-14	2	CLAR SF PRO 2012 (TIV)	75		70	
272	Freezing Fog	-14	2	CLAR SF PRO 2012 (TIV)	75		70	
273	Freezing Fog	-14	2	CLAR SF MPIV 2015 TF (TIV)	100		120	
274	Freezing Fog	-14	2	CLAR SF MPIV 2015 TF (TIV)	100		120	
275	Freezing Fog	-14	2	CLAR SF MPIV 2015 TF (TIV)	75		70	
276	Freezing Fog	-14	2	CLAR SF MPIV 2015 TF (TIV)	75		70	
277	Freezing Fog	-14	2	UCAR Dieth. (TIV)	100		120	
278	Freezing Fog	-14	2	UCAR Dieth. (TIV)	100		120	
279	Freezing Fog	-14	2	UCAR Dieth. (TIV)	75		70	
280	Freezing Fog	-14	2	UCAR Dieth. (TIV)	75		70	
281	Freezing Fog	-14	2	SPCA Ecowing 26 (TII)	100		65	
282	Freezing Fog	-14	2	SPCA Ecowing 26 (TII)	100		65	
283	Freezing Fog	-14	2	SPCA Ecowing 26 (TII)	75		55	
284	Freezing Fog	-14	2	SPCA Ecowing 26 (TII)	75		55	
285	Freezing Fog	-14	5	CLAR SF PRO 2012 (TIV)	100		45	
286	Freezing Fog	-14	5	CLAR SF PRO 2012 (TIV)	100		45	
287	Freezing Fog	-14	5	CLAR SF PRO 2012 (TIV)	75		30	
288	Freezing Fog	-14	5	CLAR SF PRO 2012 (TIV)	75		30	
289	Freezing Fog	-14	5	CLAR SF MPIV 2015 TF (TIV)	100		45	
290	Freezing Fog	-14	5	CLAR SF MPIV 2015 TF (TIV)	100		45	
291	Freezing Fog	-14	5	CLAR SF MPIV 2015 TF (TIV)	75		30	
292	Freezing Fog	-14	5	CLAR SF MPIV 2015 TF (TIV)	75		30	
293	Freezing Fog	-14	5	UCAR Dieth. (TIV)	100		45	
294	Freezing Fog	-14	5	UCAR Dieth. (TIV)	100		45	
295	Freezing Fog	-14	5	UCAR Dieth. (TIV)	75		30	
296	Freezing Fog	-14	5	UCAR Dieth. (TIV)	75		30	
297	Freezing Fog	-14	5	SPCA Ecowing 26 (TII)	100		30	
298	Freezing Fog	-14	5	SPCA Ecowing 26 (TII)	100		30	
299	Freezing Fog	-14	5	SPCA Ecowing 26 (TII)	75		20	
300	Freezing Fog	-14	5	SPCA Ecowing 26 (TII)	75		20	
301	Freezing Fog	-25	2	CLAR SF PRO 2012 (TIV)	100		40	
302	Freezing Fog	-25	2	CLAR SF PRO 2012 (TIV)	100		40	
303	Freezing Fog	-25	2	CLAR SF MPIV 2015 TF (TIV)	100		40	
304	Freezing Fog	-25	2	CLAR SF MPIV 2015 TF (TIV)	100		40	
305	Freezing Fog	-25	2	UCAR Dieth. (TIV)	100		40	
306	Freezing Fog	-25	2	UCAR Dieth. (TIV)	100		40	
307	Freezing Fog	-25	2	SPCA Ecowing 26 (TII)	100		20	
308	Freezing Fog	-25	2	SPCA Ecowing 26 (TII)	100		20	
309	Freezing Fog	-25	2	LYON. ARCO PLUS-ST. (TI)	10°		15	
310	Freezing Fog	-25	2	LYON. ARCO PLUS-ST. (TI)	10°		15	
311	Freezing Fog	-25	2	NEWAVE AEROCH. FCY-1A (TI)	10°		15	
312	Freezing Fog	-25	2	NEWAVE AEROCH. FCY-1A (TI)	10°		15	**6**
313	Freezing Fog	-25	5	CLAR SF PRO 2012 (TIV)	100		25	
314	Freezing Fog	-25	5	CLAR SF PRO 2012 (TIV)	100		25	
315	Freezing Fog	-25	5	CLAR SF MPIV 2015 TF (TIV)	100		25	
316	Freezing Fog	-25	5	CLAR SF MPIV 2015 TF (TIV)	100		25	
317	Freezing Fog	-25	5	UCAR Dieth. (TIV)	100		25	
318	Freezing Fog	-25	5	UCAR Dieth. (TIV)	100		25	
319	Freezing Fog	-25	5	SPCA Ecowing 26 (TII)	100		15	
320	Freezing Fog	-25	5	SPCA Ecowing 26 (TII)	100		15	
321	Freezing Fog	-25	5	LYON. ARCO PLUS-ST. (TI)	10°		6	
322	Freezing Fog	-25	5	LYON. ARCO PLUS-ST. (TI)	10°		6	
323	Freezing Fog	-25	5	NEWAVE AEROCH. FCY-1A (TI)	10°		6	
324	Freezing Fog	-25	5	NEWAVE AEROCH. FCY-1A (TI)	10°		6	**3**
							7398	
							123	

Rates: 200 Tests x 30 minutes = 100 hours
Hours required for testing = 311 hours (100 + 211)
Total Chamber time required = 39 hours (311 hours /8 plates at a time)

Estimated time in chamber to complete Zfog tests = 6 days

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate $g/dm^2/hr$	Fluid Brand	Dilution	HOT	HOT Est.	
325	Cold Soak Box	1	5	CLAR SF PRO 2012 (TIV)	100		115	
326	Cold Soak Box	1	5	CLAR SF PRO 2012 (TIV)	100		115	
327	Cold Soak Box	1	5	CLAR SF PRO 2012 (TIV)	75		55	
328	Cold Soak Box	1	5	CLAR SF PRO 2012 (TIV)	75		55	
329	Cold Soak Box	1	5	CLAR SF MPIV 2015 TF (TIV)	100		115	
330	Cold Soak Box	1	5	CLAR SF MPIV 2015 TF (TIV)	100		115	
331	Cold Soak Box	1	5	CLAR SF MPIV 2015 TF (TIV)	75		55	
332	Cold Soak Box	1	5	CLAR SF MPIV 2015 TF (TIV)	75		55	
333	Cold Soak Box	1	5	UCAR Dieth. (TIV)	100		70	
334	Cold Soak Box	1	5	UCAR Dieth. (TIV)	100		70	
335	Cold Soak Box	1	5	UCAR Dieth. (TIV)	75		60	
336	Cold Soak Box	1	5	UCAR Dieth. (TIV)	75		60	
337	Cold Soak Box	1	5	SPCA Ecowing 26 (TII)	100		40	
338	Cold Soak Box	1	5	SPCA Ecowing 26 (TII)	100		40	
339	Cold Soak Box	1	5	SPCA Ecowing 26 (TII)	75		25	
340	Cold Soak Box	1	5	SPCA Ecowing 26 (TII)	75		25	
341	Cold Soak Box	1	5	LYON. ARCO PLUS-ST. (TI)	10°		5	
342	Cold Soak Box	1	5	LYON. ARCO PLUS-ST. (TI)	10°		5	
343	Cold Soak Box	1	5	NEWAVE AEROCH. FCY-1A (TI)	10°		5	
344	Cold Soak Box	1	5	NEWAVE AEROCH. FCY-1A (TI)	10°		5	**18**
345	Cold Soak Box	1	75	CLAR SF PRO 2012 (TIV)	100		15	
346	Cold Soak Box	1	75	CLAR SF PRO 2012 (TIV)	100		15	
347	Cold Soak Box	1	75	CLAR SF PRO 2012 (TIV)	75		5	
348	Cold Soak Box	1	75	CLAR SF PRO 2012 (TIV)	75		5	
349	Cold Soak Box	1	75	CLAR SF MPIV 2015 TF (TIV)	100		15	
350	Cold Soak Box	1	75	CLAR SF MPIV 2015 TF (TIV)	100		15	
351	Cold Soak Box	1	75	CLAR SF MPIV 2015 TF (TIV)	75		5	
352	Cold Soak Box	1	75	CLAR SF MPIV 2015 TF (TIV)	75		5	
353	Cold Soak Box	1	75	UCAR Dieth. (TIV)	100		15	
354	Cold Soak Box	1	75	UCAR Dieth. (TIV)	100		15	
355	Cold Soak Box	1	75	UCAR Dieth. (TIV)	75		10	
356	Cold Soak Box	1	75	UCAR Dieth. (TIV)	75		10	
357	Cold Soak Box	1	75	SPCA Ecowing 26 (TII)	100		5	
358	Cold Soak Box	1	75	SPCA Ecowing 26 (TII)	100		5	
359	Cold Soak Box	1	75	SPCA Ecowing 26 (TII)	75		5	
360	Cold Soak Box	1	75	SPCA Ecowing 26 (TII)	75		5	
361	Cold Soak Box	1	75	LYON. ARCO PLUS-ST. (TI)	10°		2	
362	Cold Soak Box	1	75	LYON. ARCO PLUS-ST. (TI)	10°		2	
363	Cold Soak Box	1	75	NEWAVE AEROCH. FCY-1A (TI)	10°		2	
364	Cold Soak Box	1	75	NEWAVE AEROCH. FCY-1A (TI)	10°		2	**3**
							1248	
							21	

Rates: 56 Tests x 30 minutes = 28 hours
Hours required for testing = 58 hours (28 +30)
Total Chamber time required = 15 hours (58 hours /4 boxes at a time)
Estimated time in chamber to complete CSW tests = 2 days

ATTACHMENT C-IV

		ZR3H	ZR3L	ZR10H ZR10L	CSWL	CSWH	ZFOG25H ZFOG25L	ZFOG14H ZFOG14L	ZFOG14L ZFOG10H ZFOG10L	ZFOG3L	ZFOG3H	ZD10H	ZD10L	ZD3H	ZD3L	
		27-Mar	**28-Mar**	**29-Mar**	**30-Mar**	**31-Mar**	***3-Apr***	***4-Apr***	***5-Apr***	***6-Apr***	***7-Apr***	**10-Apr**	**11-Apr**	**12-Apr**	**13-Apr**	**14-Apr**
HOT MGR		MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	
Fluids Prep.		JM	JM	JM	JM	JM	JM	JM	JM	JM	JM	JM	JM	JM	JM	
Fluids / NCAR		MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	
Rate SS	Manage SS, change pans, detail rates, data entry, charts	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	Rob	
Rate SS	Manage SS, change pans, detail rates, data entry, charts	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	YOW2	
Rate Mgr	Manage/change pans	PL	PL	PL	PL	PL	PL	PL	PL	PL	PL	PL	PL	PL	PL	
CSW Mgr					JD	JD										
CSW box					RC	RC										
CSW box					?	?										
Procedure		YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	YOW3	
CHARTS		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	
NCAR		NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	

ATTACHMENT C-V

NRC COLD CHAMBER TESTS MARCH 2000

TEST EQUIPMENT CHECKLIST

TASK	*NRC Cold Chamber*	
	Resp.	**Status**
Logistics for Every Test		
Make Hotel reservations	CD	
Rent Mini-Van/Cube truck	CD	
Personnel Advances	All	
Personnel Transportation	MC	
Prior to Testing		
Install thermocouples on plates	NB	
Coordinate drop-off of truck in Ottawa	MC	
Install thermocouples in boxes	NB	
Follow-up on Kilfrost shipment	MC	
Mark crosshairs on all new plates	NB	
Order refrigerators	JD	
Test Equipment		
New Stand x 4 (individual stands)	MC	
2 x 3-plate stand	MC	
Desktop Computer x 1 (MC's computer)	MC	
Diskettes	MC	
Rags	MC	
Time Cards, Invoices, Expense forms	MC	
Video Tapes	JD	
Batteries AA, 9V	JD	
Laptop Computer x 2 Micron and IBM	NM	
Still Photo Camera and still digital camera	MC	
Fluid for cold-soak boxes	MC	
Digital Microscope + forensic scales	MC	
Weigh Scale x 2 (sartorius) + wiring	MC	
Digital Video camera	MC	
Time lapse video camera	MC / JM	
Boards for cold-soak test	MC	
Clamps x 12	MC	
VCR for time lapse	MC / JM	
Monitor for time lapse	MC / JM	
Reg. Plates (wing nuts) X 22 (with logging capability)	MC	
1 litre pour containers from office	MC	
Red containers	MC	
Data Forms for plates	MC	
Precipitation rate Data Forms	MC	
Insulation for weigh scale	MC	
Reports + HOT Tables	MC	
Dilution curves for Type I fluids	MC	
Large Precipitation Pans x 100	MC	
Metal cold-soak box covers	MC	
Microscope (with oil) for droplet sizes	MC	
Rate distribution pans	MC	
Large calculator	MC	
Fluids	MC	
Clipboards x 5	MC	
Pencils + pens	MC	
Paper Towels	MC	
Rubber squeegees x 4	MC	
Waste containers x 20	MC	
Plastic Refills(red containers) for Fluids and funnels	MC	
Electrical Extension Cords	MC	
Lighting x 3	MC	
Stop watches x 4	MC	
Storage bins for small equipment	MC	
Protective clothing (6)	MC	
Brixometer X 3	MC	
Tie wraps	MC	
Funnels	MC	
Hand-held Temperture Probes x 2 (Barnant and Wahl)	MC	
Thickness Gauges x 5 (both types)	MC	
Scrapers	MC	
RH meter	MC	

ATTACHMENT C-IV

AMENDED PROCEDURE FOR THE COLLECTION OF PRECIPITATION FOR HOLDOVER TIME TRIALS

The precipitation rate procedure outlined below is for use in 2000/01 holdover time trials. A concentrated effort has been made on an annual basis to improve this procedure based on the experiences gained through testing.

Below is an example of a typical test stand used for the conduct of holdover time tests. Each number represents a test location (plate location) on the test stand.

1	2	3	4	5	6
7	8	9	10	11	12

Prior to the start of the rate collection period, the proper needles and nozzles are installed in the spraying device, and the various pressure settings 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 collection period.

The pans are weighed prior to exposure to precipitation and the weights are recorded. Prior to the start of the precipitation catch period, the exact time (hh:mm:ss) is recorded. The pans are re-weighed following this 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 close to the precipitation rate required for the condition, then the pouring of fluids may begin at this location.

Rates will continuously be monitored at a minimum of two locations during a test in order 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 the course of 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 in order to collect a minimum of two 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.

The following is an example of a test run conducted in light freezing rain conditions. The desired rate of precipitation for this run is 25 g/dm^2/h.

Prior to the start of the test, collection pans are placed at each of the locations on the stand. Following a collection period, the pans are re-weighed. The following rates were recorded.

Rate collection #1

1 24.5 g/dm^2/hr	2 24.6 g/dm^2/hr	3 24.2 g/dm^2/hr	4 23.9 g/dm^2/hr	5 25.0 g/dm^2/hr	6 26.4 g/dm^2/hr
7 26.2 g/dm^2/hr	8 25.6 g/dm^2/hr	9 25.3 g/dm^2/hr	10 25.1 g/dm^2/hr	11 25.7 g/dm^2/hr	12 26.1 g/dm^2/hr

The rates are deemed to be acceptable, and therefore the pans are immediately returned to the test stand and a second rate collection period is initiated. Following the collection period, the pans are again re-weighed.

Rate collection #2

1 25.1 g/dm^2/hr	2 24.8 g/dm^2/hr	3 24.9 g/dm^2/hr	4 25.9 g/dm^2/hr	5 25.8 g/dm^2/hr	6 25.4 g/dm^2/hr
7 25.9 g/dm^2/hr	8 25.3 g/dm^2/hr	9 25.2 g/dm^2/hr	10 25.0 g/dm^2/hr	11 25.1 g/dm^2/hr	12 26.4 g/dm^2/hr

A calculation of the precipitation rates reveals that the rates are consistent As a result, holdover time tests will be conducted on plates 1, 2, 3, 4, 5, 6, 8, 9, 10 and 11. Collection pans will be re-weighed and placed on locations 7 and 12 in order to provide continuous monitoring of the rates during the test period.

Following the failure of the plates, the collection pans are weighed and once again placed on the test stand at their respective locations. Following the precipitation collection period, the pans are re-weighed.

Rate collection #3 (following plate failure)

1 25.4 g/dm^2/hr	2 24.9 g/dm^2/hr	3 25.5 g/dm^2/hr	4 26.7 g/dm^2/hr	5 25.2 g/dm^2/hr	6 26.5 g/dm^2/hr
7 26.3 g/dm^2/hr	8 25.4 g/dm^2/hr	9 24.6 g/dm^2/hr	10 25.5 g/dm^2/hr	11 24.3 g/dm^2/hr	12 26.3 g/dm^2/hr

The pans are returned to the stand. Following another collection period, they are re-weighed for the final time.

Rate collection #4 (following plate failure)

1 25.2 g/dm^2/hr	2 25.7 g/dm^2/hr	3 25.1 g/dm^2/hr	4 24.3 g/dm^2/hr	5 25.7 g/dm^2/hr	6 26.9 g/dm^2/hr
7 26.7 g/dm^2/hr	8 25.4 g/dm^2/hr	9 24.6 g/dm^2/hr	10 25.5 g/dm^2/hr	11 24.3 g/dm^2/hr	12 26.3 g/dm^2/hr

The rate of precipitation for any location on the stand may be calculated by averaging the four rates obtained for this location. Below are the calculated precipitation rates for the example run.

Average Precipitation Rates

1 25.1 $g/dm^2/hr$	2 25.0 $g/dm^2/hr$	3 24.9 $g/dm^2/hr$	4 25.2 $g/dm^2/hr$	5 25.4 $g/dm^2/hr$	6 26.3 $g/dm^2/hr$
7 26.3 $g/dm^2/hr$	8 25.4 $g/dm^2/hr$	9 24.9 $g/dm^2/hr$	10 25.3 $g/dm^2/hr$	11 24.9 $g/dm^2/hr$	12 26.3 $g/dm^2/hr$

The normal procedure is to conduct two tests at about 25 $g/dm^2/hr$ and two tests at about 13 $g/dm^2/hr$ for light freezing rain. Each of these tests are conducted at the same temperature (i.e. −3ºC). The average values obtained for precipitation rate at each position is used for each test. The HOT value at the required precipitation rate (for example at 25 $g/dm^2/hr$) is obtained by producing a "best fit" regression curve through the points using a "log-log" transformation based on the test points collected at around 13 $g/dm^2/hr$ and 25 $g/dm^2/hr$. Similarly, the HOT value at 13 $g/dm^2/h$ is obtained using the same curve. This method is repeated for all other conditions and associated temperatures described in 2.12.1., for each fluid.

ATTACHMENT C-VII

COLD SOAK BOX PREPARATION PROCEDURE

Winter 2000/01

1. Put six containers (20 L) of CSW box fluid (propylene 65/35) in cold (-30 ± 5ºC) freezer overnight. Freezers to be kept in large chamber.

2. Put all filled CSW boxes in warmer (-12 ± 1ºC) freezer overnight.

3. Next morning, if freezer in step (2) does not provide fluid and box temperature of -12 ± 1ºC, then empty boxes in pail and achieve fluid at -12 ± 1ºC in pail.

4. Prepare step (3) in corner of large chamber that is at +1ºC; ensure boxes are cooled to about -12ºC. 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 -12 ± 2ºC.

6. Prepare fluid to -12 ± 1ºC by mixing (use small amounts of hot water and/or cold fluid). Agitate fluid mixture frequently.

7. Fill boxes, ensure -12 ± 1ºC 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 to warm to -10 ± 0.5ºC. 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).

The process shall be managed as per the attached form (Figure C-3).

FIGURE C-3

CSW PROCESS MANAGEMENT FORM

1	*2*	*3*	*4*	*5*
6	*7*	*8*	*9*	*10*

1. A typical box position can be in one of the following stages:
- **Rate**
- **Not used**
- **Available for test (approx. Rate)**
- **Warming**
- **Test**

2. Denote the stage in the appropriate square

ATTACHMENT C-VIII

PROCEDURE FOR PREPARING HARD WATER

Hard water is required to dilute Type I fluids for holdover time testing. The following procedure outlines the steps required to produce 1 litre of hard water.

Hard Water =

Distilled (deionized) water + calcium acetate monohydrate or anhydrous calcium acetate + magnesium sulfate heptahydrate.

In order to produce 1 litre of hard water:

Take 1 litre of Distilled Water
Dissolve 400mg of the calcium acetate monohydrate or anhydrous calcium acetate
Dissolve 280mg of the magnesium sulfate heptahydrate

Requirements

The distilled water must conform to specifications of type IV water outlined in D 1193-91.

Electrical conductivity at 25°C = 5
Electrical resistance = 0.2
pH = 5.0 – 8.0
Total organic carbon = no limit
Sodium = 50 ug
Chlorides = 50 ug
Total silica = no limit

TABLE C-I

FLUID DILUTION FOR TYPE I TESTING

OAT (°C)	FFP (°C)	Clariant EG I 1996				Clariant MPI 1938 TF (310)				Lyondell Arco+				Inland Duragly-P			
		% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres
5	-5																
1	-9	28	14	2.2	5.8	28.5	16.5	2.3	5.7	31.25	20.5	2.5	5.5	30	21.25	2.4	5.6
0	-10	29.5	14.75	2.4	5.6	31.5	18.5	2.5	5.5	32.25	21.25	2.6	5.4	31	21.5	2.5	5.5
-1	-11	31	15.5	2.5	5.5	34	19.75	2.7	5.3	33.25	21.8	2.7	5.3	32	22	2.6	5.4
-2	-12	33	16.5	2.6	5.4	37.5	21.5	3.0	5.0	34.25	22.5	2.7	5.3	33	22.5	2.6	5.4
-3	-13	35	17.5	2.8	5.2	39.25	22.5	3.1	4.9	35.25	23	2.8	5.2	33	22.5	2.6	5.4
-4	-14	36.5	18.25	2.9	5.1	40.5	23.5	3.2	4.8	36	23.5	2.9	5.1	34	22.5	2.7	5.3
-5	-15	38	19	3.0	5.0	42	24.25	3.4	4.6	37	24	3.0	5.0	35	23	2.8	5.2
-6	-16	39.5	19.75	3.2	4.8	43	24.75	3.4	4.6	38	24.75	3.0	5.0	36	23.5	2.9	5.1
-7	-17	41	20.5	3.3	4.7	44.25	25.5	3.5	4.5	39	25.5	3.1	4.9	37	24	3.0	5.0
-8	-18	42.5	21.25	3.4	4.6	45.5	26	3.6	4.4	40.25	26.25	3.2	4.8	38.5	25	3.1	4.9
-9	-19	44	22	3.5	4.5	46.5	26.5	3.7	4.3	41.25	26.75	3.3	4.7	40	26	3.2	4.8
-10	-20	45	22.5	3.6	4.4	47.75	27.5	3.8	4.2	42.5	27.5	3.4	4.6	41.5	27	3.3	4.7
-11	-21	46	23	3.7	4.3	49	28	3.9	4.1	43.5	28	3.5	4.5	43.5	28	3.5	4.5
-12	-22	47.5	23.75	3.8	4.2	50	28.75	4.0	4.0	44.5	28.5	3.6	4.4	45	29	3.6	4.4
-13	-23	48.5	24.25	3.9	4.1	51	29.25	4.1	3.9	45.5	29.25	3.6	4.4	46	29.5	3.7	4.3
-14	-24	50	25	4.0	4.0	52.25	29.75	4.2	3.8	46.5	30	3.7	4.3	47	30	3.8	4.2
-15	-25	50.5	25.25	4.0	4.0	53.5	30.25	4.3	3.7	47.5	30.5	3.8	4.2	47.5	30.5	3.8	4.2
-16	-26	52	26	4.2	3.8	54.5	30.75	4.4	3.6	48.75	31.25	3.9	4.1	48.5	31	3.9	4.1
-17	-27	53	26.5	4.2	3.8	55.5	31.25	4.4	3.6	50	32	4.0	4.0	49	31.5	3.9	4.1
-18	-28	54	27	4.3	3.7	56.5	31.75	4.5	3.5	50.75	32.5	4.1	3.9	50	32	4.0	4.0
-19	-29	55	27.5	4.4	3.6	57.75	32.25	4.6	3.4	51.75	33	4.1	3.9	51	32.5	4.1	3.9
-20	-30	56	28	4.5	3.5	58.75	32.75	4.7	3.3	52.75	33.5	4.2	3.8	51.75	33	4.1	3.9
-22	-32	58	29	4.6	3.4	61	33.75	4.9	3.1	55	34.5	4.4	3.6	53	34	4.2	3.8
-25	-35	61.5	30.75	4.9	3.1	64.5	35.25	5.2	2.8	56.75	35.75	4.5	3.5	56	35.5	4.5	3.5
-30	-40	66.5	33.25	5.3	2.7	70	37.75	5.6	2.4	60	37.25	4.8	3.2	60	37	4.8	3.2
Standard Mix																	

TABLE C-2
DE/ANTI-ICING DATA FORM FOR FREEZING PRECIPIATION

REMEMBER TO SYNCHRONIZE TIME | VERSION 5.0 | 1997/98

LOCATION: CEF (Ottawa) **DATE:** **RUN NUMBER:** **STAND # :**

TIME TO FAILURE FOR INDIVIDUAL CROSSHAIRS (real time)

	Plate 1	Plate 2	Plate 3	Plate 4	Plate 5	Plate 6
Time of Fluid Application:						
Initial Brix						
Initial Fluid Temperatrure						
FLUID NAME/BATCH						
B1 B2 B3						
C1 C2 C3						
D1 D2 D3						
E1 E2 E3						
F1 F2 F3						
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA						
FAILURE CALL	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy
C/FIMS						

	Plate 7	Plate 8	Plate 9	Plate 10	Plate 11	Plate 12
Time of Fluid Application:						
Initial Brix						
Initial Fluid Temperatrure						
FLUID NAME/BATCH						
B1 B2 B3						
C1 C2 C3						
D1 D2 D3						
E1 E2 E3						
F1 F2 F3						
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA						
FAILURE CALL	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy	V. Difficult Difficult. Easy
C/FIMS						

PRECIP: ZF , ZD , ZR-, MOD **AMBIENT TEMPERATURE:** ________ °C

COMMENTS: ______________________

FAILURES CALLED BY : ______________________

HAND WRITTTEN BY : ______________________ **LEADER:** ______________

TABLE C-2A
DE/ANTI-ICING DATA FORM FOR COLD SOAK BOX

REMEMBER TO SYNCHRONIZE TIME

LOCATION: CEF (Ottawa) **DATE:** **RUN NUMBER:** **STAND # :**

TIME TO FAILURE FOR INDIVIDUAL CROSSHAIRS (real time)

Time of Fluid Application															
Initial Brix															
Fluid Temperature															
Intial Box Temperature															
Enter Box Number	Box #			Box #			Box #			Box #			Box #		
FLUID NAME/BATCH															
B1 B2 B3															
C1 C2 C3															
D1 D2 D3															
E1 E2 E3															
F1 F2 F3															
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA															
FAILURE CALL	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy
Final Box Temperature															

Time of Fluid Application															
Initial Brix															
Fluid Temperature															
Intial Box Temperature															
Enter Box Number	Box #			Box #			Box #			Box #			Box #		
FLUID NAME/BATCH															
B1 B2 B3															
C1 C2 C3															
D1 D2 D3															
E1 E2 E3															
F1 F2 F3															
TIME TO FIRST PLATE FAILURE WITHIN WORK AREA															
FAILURE CALL	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy	V. Difficult	Difficult.	Easy
Final Box Temperature															

AMBIENT TEMPERATURE: ________ °C

COMMENTS: ____________________

FAILURES CALLED BY : ____________

HAND WRITTTEN BY : ____________

TABLE C-3
PRECIPITATION RATE MEASUREMENT AT CEF IN OTTAWA

Date: ______________________ **Needles used:** __________

Start Time: ______________________ **Flow Rate of Water:** __________

Run # : ______________________ **Line Air Pressure:** __________

Stand: ______________________ **Line Air Temperature:** __________

Precip Type: ______________________ (ZD, ZR-, FZF, S) **Line Water Pressure:** __________

Line Water Temperature: __________

Pan Location:

1	**2**	**3**	**4**	**5**	**6**
7	**8**	**9**	**10**	**11**	**12**

Collection Pan:

Pan #	Area of Pan (dm²)	Location	Weight of Pan (g) Before	Weight of Pan (g) After	Collection Time (hr:mm:ss) Start	Collection Time (hr:mm:ss) End	Rate
1	14.56	1					
2	14.56	2					
3	14.56	3					
4	14.56	4					
5	14.56	5					
6	14.56	6					
7	14.56	7					
8	14.56	8					
9	14.56	9					
10	14.56	10					
11	14.56	11					
12	14.56	12					
13	14.56	13					
14	14.56	14					
15	14.56	15					
16	14.56	16					

Comments: ____

Handwritten by: ______________________

Measured by: ______________________

TABLE C-3A

DETAILED PRECIPITATION RATE MEASUREMENT AT CEF IN OTTAWA

PLATE

1	2
3	4

Date: ____________________

Start Time: ____________________

Run # : ____________________

Stand: ____________________

Precip Type: ____________________ (ZD, ZR-)

Pan Location (Circle):

1	2	3	4	5	6
7	8	9	10	11	12

Collection Pan:

Pan/ #	Area of Pan (dm^2)	Weight of Pan (g)		Collection Time (hr:mm:ss)		Rate
		Before	After	Start	End	
1						
2						
3						
4						

Comments: ____________________

____

____

____

Handwritten by: ____________________

Measured by: ____________________

TABLE C-3B

CONTINUOUS PRECIPITATION RATE MEASUREMENT AT CEF IN OTTAWA

Date: ____________________

Start Time: ____________________

Run # : ____________________

Stand: ____________________

Precip Type: ____________________ (ZD, ZR-, FZF, S, CS)

Pan Location:

1	2	3	4	5	6
7	8	9	10	11	12

Collection Pan:

Pan #	Area of Pan (dm²)	Location	Weight of Pan (g) Before	After	Collection Time (hr:mm:ss) Start	End	Rate
1	14.56						
2							
1							
2							
1							
2							
1							
2							
1							
2							
1							
2							
1							
2							
1							
2							
1							
2							
1							
2							

Comments: ____________________

Handwritten by: ____________________

Measured by: ____________________

TABLE C-4

COLD SOAK PRECIPITATION RATE MEASUREMENT AT CEF IN OTTAWA

Date: ____________________

Start Time: ____________________

Run # : ____________________

Precip Type: ____________________ (Drizzle, Light Rain, Moderate Rain, Heavy Rain)

Pan Location:

1	**2**	**3**	**4**	**5**
6	**7**	**8**	**9**	**10**

Collection Pan:

Pan #	Area of Pan (dm²)	Location		Weight of Pan (g) Before	After	Collection Time (hr:mm:ss) Start	End	RATE
1	14.56	1	=					
2	14.56	2	=					
3	14.56	3	=					
4	14.56	4	=					
5	14.56	5	=					
6	14.56	6	=					
7	14.56	7	=					
8	14.56	8	=					
9	14.56	9	=					
10	14.56	10	=					

Comments: ____

Handwritten by: ____________________

Measured by: ____________________

TABLE C-5

RATE MANAGEMENT FORM

DATE: ________________ **PERFORMED BY:** ________________

PAN #	TIME OUT	PAN #	TIME OUT	PAN #	TIME OUT

APPENDIX D

NRC TEST PROCEDURE OCTAGON MAXFLIGHT
JUNE 2001

NRC Test Procedure Octagon Max-Flight
June 2001

The detailed procedure and equipment list for these tests can be found in Appendix C. The following are the changes to the procedure found in Appendix C.

June 04 - June 10

June 2001						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

July 2001						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Monday, June 04

SETUP AT NRC

10:00- 14:00 **CSW +1° C**
14:00-19:00 **ZD -3° C**

SETUP NCAR MACHINE IN SMALL CHAMBER

Tuesday, June 05

8:00-12:00 **ZR – 10° C**
12:00-16:00 **ZD – 10° C**
16:00-20:00 **ZR – 3 ° C**

NCAR 8:00-10:30 TEST# 15,16

NCAR 16-19 :30 TEST# 9,10,11

Wednesday, June 06

8:00-14:00 **Zfog – 25° C**
14:00-18:00 **Zfog – 14° C**
AMIL 8:00-14:00
TEST# 9,11,33,35,57,59

NCAR 14:00-19:00 TEST# 17,18

AMIL ALTERNATES
TEST# 29,53, 5, 7

Thursday, June 07

8:00-18:00 **Zfog – 3° C**

NCAR 8:-12:45 TEST# 12,13,14

AMIL 13:00-20:00
TEST#1,13,17,21, 23,37,43,45,47

Friday, June 08

Saturday, June 09

Sunday, June 10

CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	Viscosity	HOT Est.
1	Cold Soak Box	1	5	O MaxF	100		50
2	Cold Soak Box	1	5	O MaxF	100		50
3	Cold Soak Box	1	5	O MaxF	75		40
4	Cold Soak Box	1	5	O MaxF	75		40
5	Cold Soak Box	1	75	O MaxF	100		10
6	Cold Soak Box	1	75	O MaxF	100		10
7	Cold Soak Box	1	75	O MaxF	75		10
8	Cold Soak Box	1	75	O MaxF	75		10
9	Freezing Drizzle	-10	5	O MaxF	100		70
10	Freezing Drizzle	-10	5	O MaxF	100		70
11	Freezing Drizzle	-10	5	O MaxF	75		60
12	Freezing Drizzle	-10	5	O MaxF	75		60
13	Freezing Drizzle	-10	13	O MaxF	100		30
14	Freezing Drizzle	-10	13	O MaxF	100		30
15	Freezing Drizzle	-10	13	O MaxF	75		30
16	Freezing Drizzle	-10	13	O MaxF	75		30
17	Freezing Drizzle	-3	5	O MaxF	100		120
18	Freezing Drizzle	-3	5	O MaxF	100		120
19	Freezing Drizzle	-3	5	O MaxF	75		120
20	Freezing Drizzle	-3	5	O MaxF	75		120
21	Freezing Drizzle	-3	5	O MaxF	50		60
22	Freezing Drizzle	-3	5	O MaxF	50		60
23	Freezing Drizzle	-3	13	O MaxF	100		60
24	Freezing Drizzle	-3	13	O MaxF	100		60
25	Freezing Drizzle	-3	13	O MaxF	75		80
26	Freezing Drizzle	-3	13	O MaxF	75		80
27	Freezing Drizzle	-3	13	O MaxF	50		30
28	Freezing Drizzle	-3	13	O MaxF	50		30
29	Light Freezing Rain	-10	13	O MaxF	100		40
30	Light Freezing Rain	-10	13	O MaxF	100		40
31	Light Freezing Rain	-10	13	O MaxF	75		30
32	Light Freezing Rain	-10	13	O MaxF	75		30
33	Light Freezing Rain	-10	25	O MaxF	100		20
34	Light Freezing Rain	-10	25	O MaxF	100		20
35	Light Freezing Rain	-10	25	O MaxF	75		20
36	Light Freezing Rain	-10	25	O MaxF	75		20
37	Light Freezing Rain	-3	13	O MaxF	100		60
38	Light Freezing Rain	-3	13	O MaxF	100		60
39	Light Freezing Rain	-3	13	O MaxF	75		70
40	Light Freezing Rain	-3	13	O MaxF	75		70
41	Light Freezing Rain	-3	13	O MaxF	50		30
42	Light Freezing Rain	-3	13	O MaxF	50		30
43	Light Freezing Rain	-3	25	O MaxF	100		40
44	Light Freezing Rain	-3	25	O MaxF	100		40
45	Light Freezing Rain	-3	25	O MaxF	75		40
46	Light Freezing Rain	-3	25	O MaxF	75		40
47	Light Freezing Rain	-3	25	O MaxF	50		20
48	Light Freezing Rain	-3	25	O MaxF	50		20
49	Freezing Fog	-25	2	O MaxF	100		120
50	Freezing Fog	-25	2	O MaxF	100		120
51	Freezing Fog	-25	5	O MaxF	100		20
52	Freezing Fog	-25	5	O MaxF	100		20
53	Freezing Fog	-14	2	O MaxF	100		180
54	Freezing Fog	-14	2	O MaxF	100		180

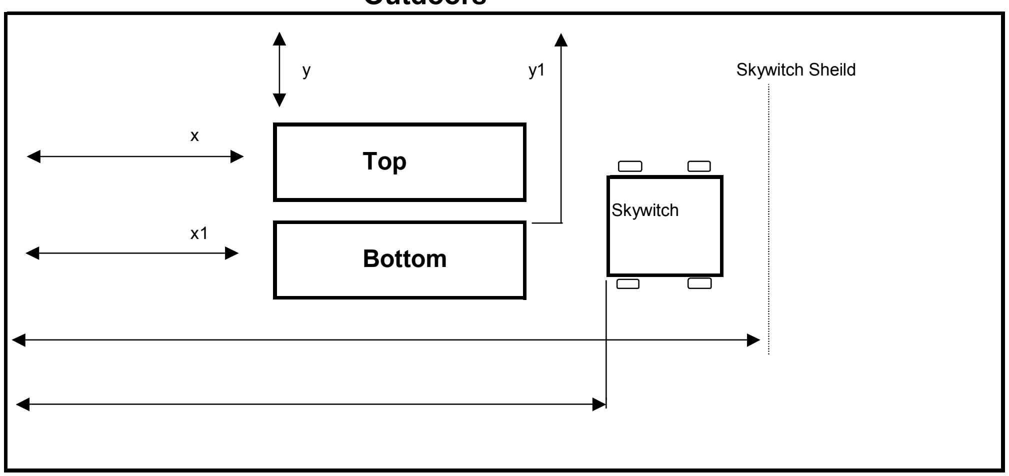
CEF DETAILED TEST PLAN

Test #	Precip Type	Temp. °C	Precip Rate g/dm²/hr	Fluid Brand	Dilution	Viscosity	HOT Est.
55	Freezing Fog	-14	2	O MaxF	75		120
56	Freezing Fog	-14	2	O MaxF	75		120
57	Freezing Fog	-14	5	O MaxF	100		40
58	Freezing Fog	-14	5	O MaxF	100		40
59	Freezing Fog	-14	5	O MaxF	75		30
60	Freezing Fog	-14	5	O MaxF	75		30
61	Freezing Fog	-3	2	O MaxF	100		180
62	Freezing Fog	-3	2	O MaxF	100		180
63	Freezing Fog	-3	2	O MaxF	75		120
64	Freezing Fog	-3	2	O MaxF	75		120
65	Freezing Fog	-3	2	O MaxF	50		50
66	Freezing Fog	-3	2	O MaxF	50		50
67	Freezing Fog	-3	5	O MaxF	100		120
68	Freezing Fog	-3	5	O MaxF	100		120
69	Freezing Fog	-3	5	O MaxF	75		70
70	Freezing Fog	-3	5	O MaxF	75		70
71	Freezing Fog	-3	5	O MaxF	50		20
72	Freezing Fog	-3	5	O MaxF	50		20

Test Stand Location at NRC Chamber

Test	Date of Final Position	Condition	Stand Position				Sky Witch Position	Skywitch Sheild Position	Nozzle Position	Rate	height	Comments
			x	x1	y	y1						
1	4-Apr-01	ZR3H	24' 2"	22' 7"	7'	9' 10"				Very Good		Top Stand 19' from snow fence
2	4-Apr-01	ZR3L	24' 2"	22' 7"	7'	9' 10"				Very Good		Top Stand 19' from snow fence
3	4/2/2001	ZR10H	24'	24' 5"	6' 9"	9' 6"				Very Good		Top stand is 20 ft. from snow fence
4	2-Apr-01	ZR10L	24'	24' 5"	6' 9"	9' 6"				Very Good		Top stand is 20 ft. from snow fence
5	27-Mar-01	ZD3H	24' 5"	22'	6'6"	10'4" to north wall				Very Good		
6	28-Mar-01	ZD3L	25' 3"	25' 3"	7'3"	9' 6" to north wall				Good		
7	2-Apr-01	ZD10H	24'	25' 3"	7'11"	9' 6"				Very Good		
8	2-Apr-01	ZD10L	24'	24' 7"	7' 7"	9' 11"				Good		20 ft. from Snow Fence
9	10-Apr-01	ZFog3H	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
10	10-Apr-01	ZFog3L	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
11	10-Apr-01	ZFog10H	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
12	10-Apr-01	ZFog10L	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
13	9-Apr-01	ZFog14H	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
14	9-Apr-01	ZFog14L	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
15	6-Apr-01	ZFog25H	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
16	6-Apr-01	ZFog25L	24'	21'11"	6'6"	8'10"	34' 2"from x	40'2" from x	top of 11	Good	144"	
17	29-Mar-01	CSWH	25'3"	25'3"		9' 6" to north wall						
18	29-Mar-01	CSWL	23'11"	25'3"	7'3"	9' 6" to north wall						

Outdoors



APPENDIX E

DILUTIONS FOR TYPE I FLUIDS

FLUID DILUTION FOR TYPE I TESTING

OAT (°C)	FFP (°C)	Clariant EG I 1996				Clariant MPI 1938 TF (310)				Lyondell Arco Plus / Lyondell Arco Plus-ST				FCY-1A			
		% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres	% Glycol	Brix	Glycol for 8 Litres	Water for 8 Litres
5	-5																
1	-9	28	14	2.2	5.8	28.5	16.5	2.3	5.7	31.25	20.5	2.5	5.5	19.9	12.80	1.6	6.4
0	-10	29.5	14.75	2.4	5.6	31.5	18.5	2.5	5.5	32.25	21.25	2.6	5.4	22.0	14.01	1.8	6.2
-1	-11	31	15.5	2.5	5.5	34	19.75	2.7	5.3	33.25	21.8	2.7	5.3	23.7	15.18	1.9	6.1
-2	-12	33	16.5	2.6	5.4	37.5	21.5	3.0	5.0	34.25	22.5	2.7	5.3	26.0	16.50	2.1	5.9
-3	-13	35	17.5	2.8	5.2	39.25	22.5	3.1	4.9	35.25	23	2.8	5.2	27.2	17.37	2.2	5.8
-4	-14	36.5	18.25	2.9	5.1	40.5	23.5	3.2	4.8	36	23.5	2.9	5.1	29.0	18.90	2.3	5.7
-5	-15	38	19	3.0	5.0	42	24.25	3.4	4.6	37	24	3.0	5.0	30.5	19.38	2.4	5.6
-6	-16	39.5	19.75	3.2	4.8	43	24.75	3.4	4.6	38	24.75	3.0	5.0	32.0	20.10	2.6	5.4
-7	-17	41	20.5	3.3	4.7	44.25	25.5	3.5	4.5	39	25.5	3.1	4.9	33.5	21.22	2.7	5.3
-8	-18	42.5	21.25	3.4	4.6	45.5	26	3.6	4.4	40.25	26.25	3.2	4.8	35.0	22.50	2.8	5.2
-9	-19	44	22	3.5	4.5	46.5	26.5	3.7	4.3	41.25	26.75	3.3	4.7	36.4	22.91	2.9	5.1
-10	-20	45	22.5	3.6	4.4	47.75	27.5	3.8	4.2	42.5	27.5	3.4	4.6	38.0	23.60	3.0	5.0
-11	-21	46	23	3.7	4.3	49	28	3.9	4.1	43.5	28	3.5	4.5	39.0	24.44	3.1	4.9
-12	-22	47.5	23.75	3.8	4.2	50	28.75	4.0	4.0	44.5	28.5	3.6	4.4	40.3	25.16	3.2	4.8
-13	-23	48.5	24.25	3.9	4.1	51	29.25	4.1	3.9	45.5	29.25	3.6	4.4	41.5	25.84	3.3	4.7
-14	-24	50	25	4.0	4.0	52.25	29.75	4.2	3.8	46.5	30	3.7	4.3	42.6	26.48	3.4	4.6
-15	-25	50.5	25.25	4.0	4.0	53.5	30.25	4.3	3.7	47.5	30.5	3.8	4.2	44.0	27.10	3.5	4.5
-16	-26	52	26	4.2	3.8	54.5	30.75	4.4	3.6	48.75	31.25	3.9	4.1	44.8	27.69	3.6	4.4
-17	-27	53	26.5	4.2	3.8	55.5	31.25	4.4	3.6	50	32	4.0	4.0	45.9	28.24	3.7	4.3
-18	-28	54	27	4.3	3.7	56.5	31.75	4.5	3.5	50.75	32.5	4.1	3.9	46.9	28.77	3.8	4.2
-19	-29	55	27.5	4.4	3.6	57.75	32.25	4.6	3.4	51.75	33	4.1	3.9	47.9	29.27	3.8	4.2
-20	-30	56	28	4.5	3.5	58.75	32.75	4.7	3.3	52.75	33.5	4.2	3.8	49.0	30.50	3.9	4.1
-22	-32	58	29	4.6	3.4	61	33.75	4.9	3.1	55	34.5	4.4	3.6	50.6	30.64	4.0	4.0
-25	-35	61.5	30.75	4.9	3.1	64.5	35.25	5.2	2.8	56.75	35.75	4.5	3.5	53.5	32.70	4.3	3.7
-30	-40	66.5	33.25	5.3	2.7	70	37.75	5.6	2.4	60	37.25	4.8	3.2	58.0	34.90	4.6	3.4
Standard Mix																	

APPENDIX F

REGRESSION ANALYSIS PERFORMED FOR ALL FLUIDS

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

Clariant Safewing Protect 2012 TYPE IV NEAT (#1)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.848609101
R Square	0.720137407
Adjusted R Square	0.704589485
Standard Error	0.11640313
Observations	39

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	1.255169372	0.627584686	46.31727732	1.10919E-10
Residual	36	0.487788791	0.013549689		
Total	38	1.742958163			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.92612771	0.138720318	21.09372118	7.45545E-22	2.644790235	3.207465184	2.644790235	3.207465184
X Variable 1	-0.672516229	0.069874323	-9.624654666	1.70911E-11	-0.814227738	-0.530804721	-0.814227738	-0.530804721
X Variable 2	-0.539913491	0.097964342	-5.511326651	3.12786E-06	-0.738594125	-0.341232858	-0.738594125	-0.341232858

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

Clariant Safewing Protect 2012 TYPE IV 75/25 (#2)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.897090785
R Square	0.804771876
Adjusted R Square	0.788502866
Standard Error	0.109595936
Observations	27

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	1.188312187	0.594156093	49.46655395	3.06555E-09
Residual	24	0.28827046	0.012011269		
Total	26	1.476582646			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.724035362	0.140721475	19.35763792	3.75207E-16	2.433600572	3.014470152	2.433600572	3.014470152
X Variable 1	-0.776760145	0.07815721	-9.938432407	5.5449E-10	-0.938068665	-0.615451626	-0.938068665	-0.615451626
X Variable 2	-0.301958715	0.117109401	-2.578432744	0.016487747	-0.543660589	-0.06025684	-0.543660589	-0.06025684

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

Clariant Safewing Protect 2012 TYPE IV 50/50 (#3)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.884860767
R Square	0.782978576
Adjusted R Square	0.762309869
Standard Error	0.078918004
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.471866071	0.235933035	37.88232018	1.07964E-07
Residual	21	0.130789078	0.006228051		
Total	23	0.602655149			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.960979108	0.1137476	17.23974046	7.14479E-14	1.724427983	2.197530233	1.724427983	2.197530233
X Variable 1	-0.606501552	0.070623486	-8.587816659	2.59435E-08	-0.753371157	-0.459631946	-0.753371157	-0.459631946
X Variable 2	0.007987971	0.141755097	0.056350503	0.955595303	-0.286807942	0.302783884	-0.286807942	0.302783884

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
OCTAGON MAXFLIGHT TYPE IV NEAT (#4)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.901416722
R Square	0.812552106
Adjusted R Square	0.793807317
Standard Error	0.105978918
Observations	23

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.973732379	0.48686619	43.34815884	5.35557E-08
Residual	20	0.22463062	0.011231531		
Total	22	1.198362999			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.46342965	0.197924849	17.49871062	1.36098E-13	3.050565842	3.876293458	3.050565842	3.876293458
X Variable 1	-0.740666821	0.079578545	-9.307368259	1.04298E-08	-0.906664679	-0.574668962	-0.906664679	-0.574668962
X Variable 2	-0.727451643	0.144566748	-5.031943065	6.38674E-05	-1.029012454	-0.425890832	-1.029012454	-0.425890832

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
OCTAGON MAXFLIGHT TYPE IV 75/25 (#5)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.950091225
R Square	0.902673336
Adjusted R Square	0.890507503
Standard Error	0.075209269
Observations	19

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.839385563	0.419692782	74.19741278	8.05109E-09
Residual	16	0.090502947	0.005656434		
Total	18	0.92988851			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.23189607	0.126578623	25.53271627	2.15248E-14	2.963561437	3.500230704	2.963561437	3.500230704
X Variable 1	-0.794605147	0.071462654	-11.11916646	6.15793E-09	-0.946099172	-0.643111122	-0.946099172	-0.643111122
X Variable 2	-0.432014864	0.11909428	-3.627503034	0.002263785	-0.684483403	-0.179546324	-0.684483403	-0.179546324

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
OCTAGON MAXFLIGHT TYPE IV 50/50 (#6)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.96627079
R Square	0.93367924
Adjusted R Square	0.91709905
Standard Error	0.062289884
Observations	11

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.436991753	0.218495877	56.31293983	1.93463E-05
Residual	8	0.031040237	0.00388003		
Total	10	0.46803199			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.415473277	0.384115609	8.891784649	2.0253E-05	2.529700521	4.301246032	2.529700521	4.301246032
X Variable 1	-1.178585299	0.154584248	-7.624226375	6.1636E-05	-1.535057444	-0.822113154	-1.535057444	-0.822113154
X Variable 2	-0.505766837	0.449389609	-1.125452894	0.293025887	-1.542061805	0.530528131	-1.542061805	0.530528131

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

SPCA Ecowing 26 TYPE II NEAT (#7)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.923362966
R Square	0.852599166
Adjusted R Square	0.841680586
Standard Error	0.079753992
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.993375822	0.496687911	78.08699891	5.95318E-12
Residual	27	0.171738878	0.006360699		
Total	29	1.165114701			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.359820524	0.103272698	22.85038117	3.38926E-19	2.147922591	2.571718456	2.147922591	2.571718456
X Variable 1	-0.509783809	0.051083643	-9.979394214	1.48406E-10	-0.614598716	-0.404968902	-0.614598716	-0.404968902
X Variable 2	-0.097821725	0.068495936	-1.428139118	0.164717855	-0.238363682	0.042720232	-0.238363682	0.042720232

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

SPCA Ecowing 26 TYPE II 75/25 (#8)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.875173255
R Square	0.765928226
Adjusted R Square	0.742521049
Standard Error	0.101698378
Observations	23

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.676857233	0.338428616	32.7219388	4.93731E-07
Residual	20	0.206851201	0.01034256		
Total	22	0.883708434			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.348508166	0.10813041	21.71921998	2.22466E-15	2.122952188	2.574064145	2.122952188	2.574064145
X Variable 1	-0.601564504	0.075656502	-7.951259814	1.28091E-07	-0.759381128	-0.443747879	-0.759381128	-0.443747879
X Variable 2	-0.104311588	0.088235312	-1.182197753	0.250992465	-0.288367138	0.079743963	-0.288367138	0.079743963

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
SPCA Ecowing 26 TYPE II 50/50 (#9)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.923123113
R Square	0.852156282
Adjusted R Square	0.839835972
Standard Error	0.089666887
Observations	27

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	1.112222804	0.556111402	69.1667897	1.09052E-10
Residual	24	0.192963613	0.008040151		
Total	26	1.305186417			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.017841297	0.115060376	17.53723885	3.45307E-15	1.780368401	2.255314193	1.780368401	2.255314193
X Variable 1	-0.69433267	0.059577645	-11.65424825	2.28376E-11	-0.817294861	-0.571370479	-0.817294861	-0.571370479
X Variable 2	0.029819409	0.164816418	0.18092499	0.857945645	-0.31034489	0.369983707	-0.31034489	0.369983707

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
Newave Aerochemical FCY-1A TYPE I (#10)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.884445599
R Square	0.782244018
Adjusted R Square	0.745951354
Standard Error	0.104941543
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.474731768	0.237365884	21.55377803	0.000106616
Residual	12	0.13215273	0.011012727		
Total	14	0.606884498			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.508199858	0.164300854	9.179501007	8.95823E-07	1.150219054	1.866180661	1.150219054	1.866180661
X Variable 1	-0.42661168	0.068017205	-6.27211421	4.11575E-05	-0.574808437	-0.278414923	-0.574808437	-0.278414923
X Variable 2	-0.384881843	0.134243224	-2.86704856	0.014167226	-0.677372698	-0.092390989	-0.677372698	-0.092390989

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
Clariant EG I 1996 TYPE I (#11)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.933229937
R Square	0.870918116
Adjusted R Square	0.853707198
Standard Error	0.065030908
Observations	18

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.427999167	0.213999583	50.60265347	2.14531E-07
Residual	15	0.063435285	0.004229019		
Total	17	0.491434452			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.748409892	0.114360548	15.28857566	1.48295E-10	1.504656004	1.99216378	1.504656004	1.99216378
X Variable 1	-0.660585464	0.069970722	-9.440883927	1.05946E-07	-0.80972462	-0.511446309	-0.80972462	-0.511446309
X Variable 2	-0.327220109	0.099679766	-3.282713461	0.0050342	-0.539682631	-0.114757587	-0.539682631	-0.114757587

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

Clariant MP I 1938 TYPE I (#12)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.936913575
R Square	0.877807047
Adjusted R Square	0.86035091
Standard Error	0.076520779
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.58889749	0.294448745	50.28644581	4.06746E-07
Residual	14	0.081976015	0.00585543		
Total	16	0.670873505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.799431607	0.106735396	16.85880851	1.07494E-10	1.570506746	2.028356468	1.570506746	2.028356468
X Variable 1	-0.632918803	0.083822908	-7.550666275	2.66627E-06	-0.812701219	-0.453136386	-0.812701219	-0.453136386
X Variable 2	-0.39185275	0.11912729	-3.289361741	0.005374859	-0.647355603	-0.136349897	-0.647355603	-0.136349897

MULTI-VARIABLE REGRESSION OUTPUT

NATURAL SNOW CONDITIONS

Lyondell Arco Plus TYPE I (#13)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.878956
R Square	0.77256365
Adjusted R Square	0.740072743
Standard Error	0.075783318
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	0.273117582	0.136558791	23.7778418	3.14789E-05
Residual	14	0.080403558	0.005743111		
Total	16	0.353521139			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.802033717	0.14977721	12.03142795	9.04445E-09	1.480793264	2.12327417	1.480793264	2.12327417
X Variable 1	-0.571039008	0.097767262	-5.84079983	4.28704E-05	-0.780729117	-0.361348899	-0.780729117	-0.361348899
X Variable 2	-0.468064116	0.108394917	-4.318137128	0.000708262	-0.700548299	-0.235579934	-0.700548299	-0.235579934

MULTI-VARIABLE REGRESSION OUTPUT
NATURAL SNOW CONDITIONS
Lyondell Arco Plus - ST TYPE I (#14)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.956225763
R Square	0.914367709
Adjusted R Square	0.903663673
Standard Error	0.087934934
Observations	19

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	1.321071089	0.660535544	85.42270185	2.89135E-09
Residual	16	0.123720843	0.007732553		
Total	18	1.444791932			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.901464038	0.102096043	18.62426777	2.86285E-12	1.685030145	2.117897931	1.685030145	2.117897931
X Variable 1	-0.634000683	0.048966358	-12.947679	6.7888E-10	-0.737804701	-0.530196665	-0.737804701	-0.530196665
X Variable 2	-0.48530765	0.088989525	-5.453536807	5.30725E-05	-0.673956972	-0.296658327	-0.673956972	-0.296658327

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN, T = -3 °C

Clariant Safewing Protect 2012 TYPE IV NEAT (#1)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998715349
R Square	0.997432348
Adjusted R Square	0.996148523
Standard Error	0.009810414
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.074774246	0.074774246	776.9218695	0.001284651
Residual	2	0.000192488	9.62442E-05		
Total	3	0.074966735			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.672758496	0.040597596	65.83538867	0.000230638	2.498081018	2.847435974	2.498081018	2.847435974
log_rate	-0.902431626	0.032376182	-27.87331824	0.001284651	-1.041735192	-0.763128061	-1.041735192	-0.763128061

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
Clariant Safewing Protect 2012 TYPE IV 75/25 (#2)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.88294821
R Square	0.779597541
Adjusted R Square	0.735517049
Standard Error	0.067399181
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.080340267	0.080340267	17.68577231	0.00844516
Residual	5	0.022713248	0.00454265		
Total	6	0.103053515			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.31049647	0.215194033	10.73680549	0.000121447	1.757323503	2.863669438	1.757323503	2.863669438
log_rate	-0.765860492	0.182111617	-4.205445555	0.00844516	-1.233992543	-0.297728441	-1.233992543	-0.297728441

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
Clariant Safewing Protect 2012 TYPE IV 50/50 (#3)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.973251642
R Square	0.947218759
Adjusted R Square	0.920828138
Standard Error	0.033323034
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.039855636	0.039855636	35.89225024	0.026748358
Residual	2	0.002220849	0.001110425		
Total	3	0.042076486			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.749854869	0.133867615	13.07153245	0.005801692	1.17386861	2.325841128	1.17386861	2.325841128
log_rate	-0.640335548	0.106882664	-5.991014124	0.026748358	-1.100214852	-0.180456243	-1.100214852	-0.180456243

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN, T = -10 °C

Clariant Safewing Protect 2012 TYPE IV NEAT (#4)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998114413
R Square	0.996232381
Adjusted R Square	0.994348571
Standard Error	0.008306707
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.036490632	0.036490632	528.8391828	0.001885587
Residual	2	0.000138003	6.90014E-05		
Total	3	0.036628635			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.121678557	0.034751335	61.05315326	0.000268169	1.972155529	2.271201586	1.972155529	2.271201586
log_rate	-0.637421547	0.027718194	-22.99650371	0.001885587	-0.756683392	-0.518159702	-0.756683392	-0.518159702

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -10 °C
Clariant Safewing Protect 2012 TYPE IV 75/25 (#5)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.962948304
R Square	0.927269436
Adjusted R Square	0.890904155
Standard Error	0.04541636
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.052594899	0.052594899	25.49875568	0.037051696
Residual	2	0.004125291	0.002062646		
Total	3	0.056720191			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.182453852	0.203271929	10.73662195	0.008563631	1.307844724	3.057062979	1.307844724	3.057062979
log_rate	-0.817806891	0.161953848	-5.049629261	0.037051696	-1.514638543	-0.120975239	-1.514638543	-0.120975239

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#6)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.991494984
R Square	0.983062304
Adjusted R Square	0.974593456
Standard Error	0.010789675
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.013513673	0.013513673	116.0798135	0.008505016
Residual	2	0.000232834	0.000116417		
Total	3	0.013746507			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.41169022	0.047815823	50.43707486	0.000392866	2.205955198	2.617425243	2.205955198	2.617425243
X Variable 1	-0.412418393	0.03827892	-10.77403423	0.008505016	-0.577119407	-0.247717379	-0.577119407	-0.247717379

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 75/25 (#7)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.978794615
R Square	0.958038898
Adjusted R Square	0.937058347
Standard Error	0.019197463
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.016828829	0.016828829	45.66319019	0.021205385
Residual	2	0.000737085	0.000368543		
Total	3	0.017565915			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.400992745	0.084365349	28.45946544	0.001232376	2.037997691	2.763987798	2.037997691	2.763987798
X Variable 1	-0.456050024	0.067488435	-6.757454416	0.021205385	-0.746429526	-0.165670522	-0.746429526	-0.165670522

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 50/50 (#8)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.989491156
R Square	0.979092747
Adjusted R Square	0.968639121
Standard Error	0.017269005
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.027931321	0.027931321	93.66058364	0.010508844
Residual	2	0.000596437	0.000298219		
Total	3	0.028527759			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.173350366	0.072014885	30.17918266	0.001096151	1.863495109	2.483205623	1.863495109	2.483205623
X Variable 1	-0.556450006	0.057497336	-9.677839823	0.010508844	-0.803841247	-0.309058765	-0.803841247	-0.309058765

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -10 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#9)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999354983
R Square	0.998710382
Adjusted R Square	0.998065573
Standard Error	0.008529739
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.112688605	0.112688605	1548.847078	0.000645017
Residual	2	0.000145513	7.27564E-05		
Total	3	0.112834118			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.852933031	0.036757383	77.61523772	0.000165958	2.694778666	3.011087396	2.694778666	3.011087396
X Variable 1	-1.142860392	0.029039485	-39.35539452	0.000645017	-1.267807299	-1.017913485	-1.267807299	-1.017913485

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -10 °C
OCTAGON MAXFLIGHT TYPE IV 75/25 (#10)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99977177
R Square	0.999543593
Adjusted R Square	0.999315389
Standard Error	0.00467568
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.095756627	0.095756627	4380.051562	0.00022823
Residual	2	4.3724E-05	2.1862E-05		
Total	3	0.095800351			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.609589157	0.019894479	131.1715275	5.81143E-05	2.523990064	2.69518825	2.523990064	2.69518825
X Variable 1	-1.039607209	0.015708317	-66.18195798	0.00022823	-1.107194691	-0.972019726	-1.107194691	-0.972019726

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
SPCA Ecowing 26 TYPE II NEAT (#11)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.962421873
R Square	0.926255862
Adjusted R Square	0.889383794
Standard Error	0.018225182
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.008344056	0.008344056	25.12079993	0.037578127
Residual	2	0.000664315	0.000332157		
Total	3	0.009008371			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.013091618	0.073725356	27.3052817	0.001338548	1.695876792	2.330306444	1.695876792	2.330306444
log_rate	-0.294594169	0.058777	-5.012065435	0.037578127	-0.547491364	-0.041696974	-0.547491364	-0.041696974

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
SPCA Ecowing 26 TYPE II 75/25 (#12)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.990836265
R Square	0.981756504
Adjusted R Square	0.972634756
Standard Error	0.014429436
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.0224091	0.0224091	107.6281107	0.009163735
Residual	2	0.000416417	0.000208209		
Total	3	0.022825518			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.048837841	0.058150595	35.23330815	0.000804579	1.798635849	2.299039832	1.798635849	2.299039832
log_rate	-0.480564854	0.046322197	-10.37439688	0.009163735	-0.679873319	-0.281256389	-0.679873319	-0.281256389

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -3 °C
SPCA Ecowing 26 TYPE II 50/50 (#13)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998345731
R Square	0.996694198
Adjusted R Square	0.995041297
Standard Error	0.006367583
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.024449179	0.024449179	602.9968724	0.001654269
Residual	2	8.10922E-05	4.05461E-05		
Total	3	0.024530271			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.61661094	0.025815537	62.62162722	0.000254909	1.505535571	1.727686308	1.505535571	1.727686308
log_rate	-0.505800365	0.020597837	-24.55599463	0.001654269	-0.594425764	-0.417174965	-0.594425764	-0.417174965

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN, T = -10 °C
SPCA Ecowing 26 TYPE II NEAT (#14)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99707024
R Square	0.994149063
Adjusted R Square	0.991223594
Standard Error	0.018161415
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.112087045	0.112087045	339.8255758	0.00292976
Residual	2	0.000659674	0.000329837		
Total	3	0.112746719			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.758664183	0.076155078	36.22429727	0.000761209	2.4309951	3.086333265	2.4309951	3.086333265
log_rate	-1.121716464	0.060849227	-18.43435857	0.00292976	-1.383529737	-0.85990319	-1.383529737	-0.85990319

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN, T = -10 °C

SPCA Ecowing 26 TYPE II 75/25 (#15)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99500397
R Square	0.990032899
Adjusted R Square	0.985049349
Standard Error	0.018388389
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.067173529	0.067173529	198.6601617	0.00499603
Residual	2	0.000676266	0.000338133		
Total	3	0.067849794			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.376026107	0.0781129	30.41784529	0.001079045	2.039933191	2.712119024	2.039933191	2.712119024
log_rate	-0.875870298	0.062141883	-14.09468559	0.00499603	-1.143245425	-0.608495171	-1.143245425	-0.608495171

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED LIGHT FREEZING RAIN
NEWAVE AEROCHEMICAL FCY-1A TYPE I (#16)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.990609794
R Square	0.981307764
Adjusted R Square	0.971961646
Standard Error	0.015772922
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.026121509	0.026121509	104.9962959	0.009390206
Residual	2	0.00049757	0.000248785		
Total	3	0.026619079			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.305183627	0.067880745	19.22759718	0.002693967	1.01311615	1.597251105	1.01311615	1.597251105
log_rate	-0.55441585	0.054106401	-10.24677003	0.009390206	-0.787217067	-0.321614633	-0.787217067	-0.321614633

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED LIGHT FREEZING RAIN
LYONDELL ARCO PLUS-ST TYPE I (#17)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.968204874
R Square	0.937420677
Adjusted R Square	0.906131016
Standard Error	0.019534386
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.011432289	0.011432289	29.95943835	0.031795126
Residual	2	0.000763184	0.000381592		
Total	3	0.012195473			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.108908349	0.082663126	13.41478838	0.005511003	0.753237374	1.464579323	0.753237374	1.464579323
log_rate	-0.358077536	0.065419955	-5.473521568	0.031795126	-0.63955708	-0.076597991	-0.63955708	-0.076597991

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -3 °C

Clariant Safewing Protect 2012 TYPE IV NEAT (#1)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.977724903
R Square	0.955945986
Adjusted R Square	0.941261315
Standard Error	0.034401221
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.077040103	0.077040103	65.09822192	0.003977469
Residual	3	0.003550332	0.001183444		
Total	4	0.080590435			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.261685449	0.071637594	31.57120896	6.98282E-05	2.033702439	2.489668459	2.033702439	2.489668459
log_rate	-0.605754981	0.075077954	-8.068346914	0.003977469	-0.844686764	-0.366823199	-0.844686764	-0.366823199

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -3 °C
Clariant Safewing Protect 2012 TYPE IV 75/25 (#2)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996522099
R Square	0.993056293
Adjusted R Square	0.98958444
Standard Error	0.009783697
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.027379056	0.027379056	286.0305972	0.003477901
Residual	2	0.000191441	9.57207E-05		
Total	3	0.027570497			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.013977772	0.023481406	85.76904391	0.00013591	1.912945365	2.11501018	1.912945365	2.11501018
log_rate	-0.425299666	0.025147151	-16.91243913	0.003477901	-0.533499201	-0.317100131	-0.533499201	-0.317100131

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -3 °C
Clariant Safewing Protect 2012 TYPE IV 50/50 (#3)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.957055542
R Square	0.915955311
Adjusted R Square	0.873932967
Standard Error	0.032836069
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.02350154	0.02350154	21.79686363	0.042944458
Residual	2	0.002156415	0.001078207		
Total	3	0.025657955			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.583825324	0.075692111	20.92457593	0.002276155	1.258148229	1.909502419	1.258148229	1.909502419
log_rate	-0.391334308	0.08382063	-4.668711132	0.042944458	-0.751985622	-0.030682995	-0.751985622	-0.030682995

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -10 °C

Clariant Safewing Protect 2012 TYPE IV NEAT (#4)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996648261
R Square	0.993307756
Adjusted R Square	0.989961634
Standard Error	0.014012416
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.058286519	0.058286519	296.853424	0.003351739
Residual	2	0.000392696	0.000196348		
Total	3	0.058679214			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.055905751	0.029608767	69.43570879	0.000207348	1.928509418	2.183302083	1.928509418	2.183302083
log_rate	-0.561898994	0.032612735	-17.22943481	0.003351739	-0.702220366	-0.421577622	-0.702220366	-0.421577622

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -10 °C
Clariant Safewing Protect 2012 TYPE IV 75/25 (#5)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.987499188
R Square	0.975154646
Adjusted R Square	0.962731969
Standard Error	0.035789522
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.100547228	0.100547228	78.49794662	0.012500812
Residual	2	0.00256178	0.00128089		
Total	3	0.103109008			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.04688673	0.082430766	24.83158678	0.001617842	1.692215521	2.401557939	1.692215521	2.401557939
log_rate	-0.803426755	0.090681176	-8.859906694	0.012500812	-1.193596634	-0.413256875	-1.193596634	-0.413256875

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#6)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.618919992
R Square	0.383061957
Adjusted R Square	0.177415942
Standard Error	0.007496994
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.000104694	0.000104694	1.862724923	0.265658995
Residual	3	0.000168615	5.62049E-05		
Total	4	0.000273309			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.094930354	0.014637075	143.1249294	7.52053E-07	2.048348605	2.141512104	2.048348605	2.141512104
X Variable 1	-0.022391758	0.01640642	-1.364816809	0.265658995	-0.074604359	0.029820843	-0.074604359	0.029820843

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 75/25 (#7)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995275754
R Square	0.990573826
Adjusted R Square	0.987431768
Standard Error	0.002040438
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001312561	0.001312561	315.2627328	0.000389515
Residual	3	1.24902E-05	4.16339E-06		
Total	4	0.001325051			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.137571439	0.004104394	520.8007821	1.56117E-08	2.124509415	2.150633464	2.124509415	2.150633464
X Variable 1	-0.081744565	0.004603865	-17.75563946	0.000389515	-0.096396132	-0.067092999	-0.096396132	-0.067092999

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 50/50 (#8)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.985671733
R Square	0.971548765
Adjusted R Square	0.962065021
Standard Error	0.031024005
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.098600807	0.098600807	102.4435789	0.002054418
Residual	3	0.002887467	0.000962489		
Total	4	0.101488273			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.309869722	0.059161894	39.04320082	3.69666E-05	2.121589993	2.498149451	2.121589993	2.498149451
X Variable 1	-0.673260777	0.06651827	-10.12144154	0.002054418	-0.884951796	-0.461569757	-0.884951796	-0.461569757

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -10 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#9)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999934506
R Square	0.999869017
Adjusted R Square	0.999803525
Standard Error	0.004668687
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.332771712	0.332771712	15267.114	6.54938E-05
Residual	2	4.35933E-05	2.17966E-05		
Total	3	0.332815306			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.895623796	0.010261685	282.1782031	1.25587E-05	2.851471299	2.939776293	2.851471299	2.939776293
X Variable 1	-1.345563336	0.010889945	-123.5601635	6.54938E-05	-1.392419018	-1.298707653	-1.392419018	-1.298707653

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -10 °C

OCTAGON MAXFLIGHT TYPE IV 75/25 (#10)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999441425
R Square	0.998883162
Adjusted R Square	0.998324742
Standard Error	0.011793489
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.248793455	0.248793455	1788.769254	0.000558575
Residual	2	0.000278173	0.000139086		
Total	3	0.249071628			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.576028581	0.024891378	103.4907988	9.33546E-05	2.468929552	2.683127611	2.468929552	2.683127611
X Variable 1	-1.128511161	0.026682634	-42.29384417	0.000558575	-1.243317349	-1.013704974	-1.243317349	-1.013704974

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -3 °C

SPCA Ecowing 26 TYPE II NEAT (#11)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997358295
R Square	0.994723569
Adjusted R Square	0.992085354
Standard Error	0.015261138
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.087814446	0.087814446	377.0441022	0.002641705
Residual	2	0.000465805	0.000232902		
Total	3	0.08828025			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.458913093	0.031978992	76.89151357	0.000169096	2.3213185	2.596507685	2.3213185	2.596507685
log_rate	-0.672327639	0.03462461	-19.4176235	0.002641705	-0.821305415	-0.523349863	-0.821305415	-0.523349863

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -3 °C
SPCA Ecowing 26 TYPE II 75/25 (#12)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999670666
R Square	0.99934144
Adjusted R Square	0.999012161
Standard Error	0.003002184
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.027354166	0.027354166	3034.931113	0.000329334
Residual	2	1.80262E-05	9.01311E-06		
Total	3	0.027372192			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.100885165	0.006714429	312.8911261	1.02143E-05	2.07199529	2.12977504	2.07199529	2.12977504
log_rate	-0.408507629	0.007415249	-55.09020887	0.000329334	-0.440412894	-0.376602364	-0.440412894	-0.376602364

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE, T = -3 °C
SPCA Ecowing 26 TYPE II 50/50 (#13)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.963002978
R Square	0.927374736
Adjusted R Square	0.903166315
Standard Error	0.040653924
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.063313122	0.063313122	38.30793936	0.008494916
Residual	3	0.004958225	0.001652742		
Total	4	0.068271347			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.732659897	0.074421302	23.28177359	0.000173598	1.495817879	1.969501916	1.495817879	1.969501916
log_rate	-0.541309632	0.087458366	-6.189340786	0.008494916	-0.819641447	-0.262977817	-0.819641447	-0.262977817

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -10 °C
SPCA Ecowing 26 TYPE II NEAT (#14)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999643236
R Square	0.999286599
Adjusted R Square	0.998929899
Standard Error	0.006313939
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.111683037	0.111683037	2801.47315	0.000356764
Residual	2	7.97316E-05	3.98658E-05		
Total	3	0.111762769			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.404392495	0.013941758	172.4597753	3.36204E-05	2.344405909	2.464379081	2.344405909	2.464379081
log_rate	-0.810087572	0.01530519	-52.92894435	0.000356764	-0.875940537	-0.744234606	-0.875940537	-0.744234606

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE, T = -10 °C
SPCA Ecowing 26 TYPE II 75/25 (#15)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999528371
R Square	0.999056964
Adjusted R Square	0.998585446
Standard Error	0.007351172
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.114499946	0.114499946	2118.810538	0.000471629
Residual	2	0.000108079	5.40397E-05		
Total	3	0.114608025			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.276825982	0.016824537	135.3277056	5.45998E-05	2.204435792	2.349216172	2.204435792	2.349216172
log_rate	-0.844528949	0.018347144	-46.03053919	0.000471629	-0.923470394	-0.765587503	-0.923470394	-0.765587503

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING DRIZZLE

NEWAVE AEROCHEMICAL FCY-1A TYPE I (#16)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99296812
R Square	0.985985688
Adjusted R Square	0.978978532
Standard Error	0.014121593
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.028060551	0.028060551	140.71125	0.00703188
Residual	2	0.000398839	0.000199419		
Total	3	0.02845939			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.101294018	0.030579022	36.01469104	0.000770085	0.969723015	1.232865021	0.969723015	1.232865021
log_rate	-0.400628254	0.033773585	-11.86217729	0.00703188	-0.545944363	-0.255312145	-0.545944363	-0.255312145

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING DRIZZLE
LYONDELL ARCO PLUS-ST TYPE I (#17)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.980154681
R Square	0.960703198
Adjusted R Square	0.941054797
Standard Error	0.018770575
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.017227298	0.017227298	48.8947268	0.019845319
Residual	2	0.000704669	0.000352334		
Total	3	0.017931966			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.094298827	0.04142552	26.41605504	0.001429986	0.916059075	1.27253858	0.916059075	1.27253858
log_rate	-0.318016327	0.045479785	-6.992476443	0.019845319	-0.513700185	-0.122332468	-0.513700185	-0.122332468

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C

CLARIANT SAFEWING PROTECT 2012 TYPE IV NEAT (#1)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997824364
R Square	0.995653461
Adjusted R Square	0.993480192
Standard Error	0.014141462
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.091618518	0.091618518	458.1362296	0.002175636
Residual	2	0.000399962	0.000199981		
Total	3	0.09201848			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.416213398	0.018828775	128.3255744	6.07203E-05	2.335199661	2.497227136	2.335199661	2.497227136
log_rate	-0.773950178	0.03615894	-21.40411712	0.002175636	-0.929529646	-0.618370709	-0.929529646	-0.618370709

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -3 °C
CLARIANT SAFEWING PROTECT 2012 TYPE IV 75/25 (#2)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.981555295
R Square	0.963450796
Adjusted R Square	0.945176194
Standard Error	0.033786144
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.060180927	0.060180927	52.72075429	0.018444705
Residual	2	0.002283007	0.001141504		
Total	3	0.062463934			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.281357703	0.044243294	51.56392059	0.000375892	2.09099404	2.471721366	2.09099404	2.471721366
log_rate	-0.603833243	0.083162246	-7.260905886	0.018444705	-0.961651758	-0.246014728	-0.961651758	-0.246014728

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C

CLARIANT SAFEWING PROTECT 2012 TYPE IV 50/50 (#3)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998889537
R Square	0.997780306
Adjusted R Square	0.996670459
Standard Error	0.01051126
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.099330232	0.099330232	899.0251777	0.001110463
Residual	2	0.000220973	0.000110487		
Total	3	0.099551205			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.879035045	0.013977377	134.4340242	5.53281E-05	1.818895203	1.939174886	1.818895203	1.939174886
log_rate	-0.741206823	0.024720285	-29.98374856	0.001110463	-0.847569701	-0.634843945	-0.847569701	-0.634843945

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -14 °C
CLARIANT SAFEWING PROTECT 2012 TYPE IV NEAT (#4)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999981716
R Square	0.999963432
Adjusted R Square	0.999945148
Standard Error	0.00197087
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.212436979	0.212436979	54690.77566	1.82841E-05
Residual	2	7.76866E-06	3.88433E-06		
Total	3	0.212444748			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.307042715	0.002256752	1022.284412	9.56877E-07	2.297332687	2.316752743	2.297332687	2.316752743
log_rate	-0.957719635	0.004095259	-233.8605902	1.82841E-05	-0.975340124	-0.940099147	-0.975340124	-0.940099147

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -14 °C
CLARIANT SAFEWING PROTECT 2012 TYPE IV 75/25 (#5)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998612911
R Square	0.997227747
Adjusted R Square	0.99584162
Standard Error	0.016083195
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.186095588	0.186095588	719.4347645	0.001387089
Residual	2	0.000517338	0.000258669		
Total	3	0.186612926			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.104451183	0.021386672	98.40012356	0.000103262	2.012431695	2.19647067	2.012431695	2.19647067
log_rate	-1.014534272	0.03782431	-26.82228112	0.001387089	-1.177279255	-0.851789288	-1.177279255	-0.851789288

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -25 °C
CLARIANT SAFEWING PROTECT 2012 TYPE IV NEAT (#6)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999042874
R Square	0.998086664
Adjusted R Square	0.997129996
Standard Error	0.007326884
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.056007439	0.056007439	1043.294791	0.000957126
Residual	2	0.000107366	5.36832E-05		
Total	3	0.056114806			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.872042332	0.012709754	147.2917834	4.60907E-05	1.817356636	1.926728027	1.817356636	1.926728027
log_rate	-0.760771199	0.023553234	-32.30007416	0.000957126	-0.862112655	-0.659429743	-0.862112655	-0.659429743

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#7)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997040199
R Square	0.994089158
Adjusted R Square	0.992611448
Standard Error	0.008257554
Observations	6

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.045871069	0.045871069	672.7225464	1.31277E-05
Residual	4	0.000272749	6.81872E-05		
Total	5	0.046143817			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.510208879	0.009041023	277.6465481	1.00959E-09	2.485106922	2.535310836	2.485106922	2.535310836
X Variable 1	-0.434325377	0.016745465	-25.93689547	1.31277E-05	-0.480818338	-0.387832417	-0.480818338	-0.387832417

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 75/25 (#8)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.95570471
R Square	0.913371492
Adjusted R Square	0.896045791
Standard Error	0.03655488
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.070444543	0.070444543	52.71772058	0.000774397
Residual	5	0.006681296	0.001336259		
Total	6	0.07712584			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.446900141	0.039339992	62.19879678	2.03326E-08	2.345773638	2.548026643	2.345773638	2.548026643
X Variable 1	-0.505129455	0.069570381	-7.260696976	0.000774397	-0.683965521	-0.32629339	-0.683965521	-0.32629339

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C
OCTAGON MAXFLIGHT TYPE IV 50/50 (#9)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.858010247
R Square	0.736181585
Adjusted R Square	0.692211849
Standard Error	0.080185422
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.107651957	0.107651957	16.74291577	0.006416183
Residual	6	0.038578211	0.006429702		
Total	7	0.146230168			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.224680352	0.089800649	24.77354424	2.84631E-07	2.004945919	2.444414785	2.004945919	2.444414785
X Variable 1	-0.708919744	0.173253304	-4.091810817	0.006416183	-1.132855617	-0.284983871	-1.132855617	-0.284983871

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -14 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#10)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998406661
R Square	0.996815862
Adjusted R Square	0.995223792
Standard Error	0.020431949
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.261380139	0.261380139	626.1133982	0.001593339
Residual	2	0.000834929	0.000417465		
Total	3	0.262215068			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.538539893	0.025314998	100.2780984	9.94313E-05	2.429618171	2.647461616	2.429618171	2.647461616
X Variable 1	-1.194543076	0.04773922	-25.02225806	0.001593339	-1.399948503	-0.989137648	-1.399948503	-0.989137648

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -14 °C
OCTAGON MAXFLIGHT TYPE IV 75/25 (#11)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99270612
R Square	0.98546544
Adjusted R Square	0.97819816
Standard Error	0.02455688
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.081774122	0.081774122	135.6030641	0.00729388
Residual	2	0.001206081	0.00060304		
Total	3	0.082980203			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.043983797	0.034466709	59.30313154	0.000284223	1.895685412	2.192282181	1.895685412	2.192282181
X Variable 1	-0.765330207	0.065722504	-11.64487287	0.00729388	-1.048111516	-0.482548898	-1.048111516	-0.482548898

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -25 °C
OCTAGON MAXFLIGHT TYPE IV NEAT (#12)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999713585
R Square	0.999427253
Adjusted R Square	0.999140879
Standard Error	0.005260179
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.096564892	0.096564892	3489.941558	0.000286415
Residual	2	5.5339E-05	2.76695E-05		
Total	3	0.096620231			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.88041016	0.006990198	269.0067124	1.38186E-05	1.850333745	1.910486575	1.850333745	1.910486575
X Variable 1	-0.784341671	0.013276886	-59.07572732	0.000286415	-0.841467539	-0.727215803	-0.841467539	-0.727215803

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C
SPCA Ecowing 26 TYPE II NEAT (#13)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998150916
R Square	0.996305251
Adjusted R Square	0.994457877
Standard Error	0.009400981
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.047663273	0.047663273	539.3087712	0.001849084
Residual	2	0.000176757	8.83784E-05		
Total	3	0.04784003			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.381038511	0.01424849	167.1081279	3.58081E-05	2.319732163	2.442344858	2.319732163	2.442344858
log_rate	-0.635181171	0.027351357	-23.22302244	0.001849084	-0.752864643	-0.517497699	-0.752864643	-0.517497699

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -3 °C
SPCA Ecowing 26 TYPE II 75/25 (#14)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.992089205
R Square	0.984240991
Adjusted R Square	0.976361486
Standard Error	0.022904699
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.065531744	0.065531744	124.9115316	0.007910795
Residual	2	0.001049251	0.000524625		
Total	3	0.066580994			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.243926018	0.029393745	76.34025661	0.000171546	2.117454854	2.370397183	2.117454854	2.370397183
log_rate	-0.60734785	0.054342077	-11.17638276	0.007910795	-0.841163097	-0.373532602	-0.841163097	-0.373532602

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -3 °C

SPCA Ecowing 26 TYPE II 50/50 (#15)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.977903983
R Square	0.9562962
Adjusted R Square	0.934444299
Standard Error	0.030694974
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.04123232	0.04123232	43.7626106	0.022096017
Residual	2	0.001884363	0.000942181		
Total	3	0.043116683			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.795517899	0.040084242	44.79360989	0.000498016	1.623049206	1.967986593	1.623049206	1.967986593
log_rate	-0.509001701	0.076942736	-6.615331481	0.022096017	-0.840059803	-0.177943599	-0.840059803	-0.177943599

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -14 °C

SPCA Ecowing 26 TYPE II NEAT (#16)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999694258
R Square	0.999388609
Adjusted R Square	0.999082914
Standard Error	0.009065247
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.268661239	0.268661239	3269.231562	0.000305742
Residual	2	0.000164357	8.21787E-05		
Total	3	0.268825597			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.500620912	0.011478909	217.8448208	2.10713E-05	2.451231118	2.550010706	2.451231118	2.550010706
log_rate	-1.233472597	0.021572807	-57.17719442	0.000305742	-1.326292959	-1.140652234	-1.326292959	-1.140652234

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -14 °C
SPCA Ecowing 26 TYPE II 75/25 (#17)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998555307
R Square	0.997112701
Adjusted R Square	0.995669051
Standard Error	0.013674799
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.129158902	0.129158902	690.6888088	0.001444693
Residual	2	0.000374	0.000187		
Total	3	0.129532902			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.137950723	0.018184101	117.5725248	7.23338E-05	2.059710794	2.216190651	2.059710794	2.216190651
log_rate	-0.845202663	0.032160267	-26.28095905	0.001444693	-0.98357722	-0.706828105	-0.98357722	-0.706828105

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -25 °C
SPCA Ecowing 26 TYPE II NEAT (#18)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999688674
R Square	0.999377445
Adjusted R Square	0.999066167
Standard Error	0.004715618
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.071393547	0.071393547	3210.567544	0.000311326
Residual	2	4.44741E-05	2.2237E-05		
Total	3	0.071438021			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.868227936	0.005982548	312.279614	1.02543E-05	1.842487089	1.893968782	1.842487089	1.893968782
log_rate	-0.697178224	0.012304187	-56.66187028	0.000311326	-0.750118903	-0.644237545	-0.750118903	-0.644237545

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -10 °C
NEWAVE AEROCHEMICAL FCY-1A TYPE I (#19)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.982591177
R Square	0.965485421
Adjusted R Square	0.948228131
Standard Error	0.019862073
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.022071013	0.022071013	55.94652675	0.017408823
Residual	2	0.000789004	0.000394502		
Total	3	0.022860017			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.09978255	0.024110376	45.61449172	0.000480265	0.996043902	1.203521197	0.996043902	1.203521197
log_rate	-0.354657868	0.047415795	-7.479741089	0.017408823	-0.558671709	-0.150644028	-0.558671709	-0.150644028

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -25 °C

NEWAVE AEROCHEMICAL FCY-1A TYPE I (#20)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999886263
R Square	0.999772538
Adjusted R Square	0.999658807
Standard Error	0.003007976
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.079537391	0.079537391	8790.684526	0.000113737
Residual	2	1.80958E-05	9.04792E-06		
Total	3	0.079555487			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.093793921	0.003139798	348.3644381	8.24E-06	1.080284451	1.10730339	1.080284451	1.10730339
log_rate	-0.578839905	0.006173723	-93.75865041	0.000113737	-0.605403308	-0.552276502	-0.605403308	-0.552276502

MULTI-VARIABLE REGRESSION OUTPUT

SIMULATED FREEZING FOG, T = -10 °C
LYONDELL ARCO PLUS-ST TYPE I (#21)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999427111
R Square	0.998854549
Adjusted R Square	0.998281824
Standard Error	0.004950332
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.042739019	0.042739019	1744.037664	0.000572889
Residual	2	4.90116E-05	2.45058E-05		
Total	3	0.042788031			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.233216758	0.00558299	220.8882305	2.04947E-05	1.209195075	1.257238442	1.209195075	1.257238442
log_rate	-0.458512938	0.010979275	-41.76167698	0.000572889	-0.505752979	-0.411272898	-0.505752979	-0.411272898

MULTI-VARIABLE REGRESSION OUTPUT
SIMULATED FREEZING FOG, T = -25 °C
LYONDELL ARCO PLUS-ST TYPE I (#22)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997408721
R Square	0.994824156
Adjusted R Square	0.992236234
Standard Error	0.016383177
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.103179014	0.103179014	384.410412	0.002591279
Residual	2	0.000536817	0.000268408		
Total	3	0.103715831			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.317262223	0.017656677	74.60419919	0.000179621	1.241291622	1.393232824	1.241291622	1.393232824
log_rate	-0.676961036	0.034527577	-19.60638702	0.002591279	-0.825521313	-0.52840076	-0.825521313	-0.52840076

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MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
CLARIANT SAFEWING PROTECT 2012 TYPE IV NEAT (#1)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999354523
R Square	0.998709462
Adjusted R Square	0.998064194
Standard Error	0.018634964
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.537471762	0.537471762	1547.741854	0.000645477
Residual	2	0.000694524	0.000347262		
Total	3	0.538166286			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.226036756	0.022133213	100.5744952	9.88462E-05	2.13080516	2.321268353	2.13080516	2.321268353
log_rate	-0.613263647	0.015588271	-39.34135044	0.000645477	-0.680334612	-0.546192682	-0.680334612	-0.546192682

MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
CLARIANT SAFEWING PROTECT 2012 TYPE IV 75/25 (#2)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999056532
R Square	0.998113953
Adjusted R Square	0.997485271
Standard Error	0.021708771
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.748203044	0.748203044	1587.628862	3.47827E-05
Residual	3	0.001413812	0.000471271		
Total	4	0.749616856			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.078860602	0.021609127	96.20289718	2.47592E-06	2.010090652	2.147630552	2.010090652	2.147630552
log_rate	-0.656075452	0.016465666	-39.8450607	3.47827E-05	-0.708476598	-0.603674305	-0.708476598	-0.603674305

MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
OCTAGON MAXFLIGHT TYPE IV NEAT (#3)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.998390663
R Square	0.996783917
Adjusted R Square	0.995175875
Standard Error	0.031261772
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.605802286	0.605802286	619.874433	0.001609337
Residual	2	0.001954597	0.000977298		
Total	3	0.607756883			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.642041685	0.03926962	67.27953219	0.000220846	2.473078029	2.811005342	2.473078029	2.811005342
X Variable 1	-0.695585658	0.027938222	-24.89727762	0.001609337	-0.815794206	-0.575377109	-0.815794206	-0.575377109

MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
OCTAGON MAXFLIGHT TYPE IV 75/25 (#4)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999966813
R Square	0.999933628
Adjusted R Square	0.999900442
Standard Error	0.004860923
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.711955918	0.711955918	30131.1393	3.31866E-05
Residual	2	4.72572E-05	2.36286E-05		
Total	3	0.712003176			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.664526635	0.005997686	444.2591042	5.06669E-06	2.638720657	2.690332613	2.638720657	2.690332613
X Variable 1	-0.741173564	0.004269845	-173.5832345	3.31866E-05	-0.759545239	-0.72280189	-0.759545239	-0.72280189

MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
SPCA Ecowing 26 TYPE II NEAT (#5)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999356744
R Square	0.998713902
Adjusted R Square	0.998070853
Standard Error	0.017459275
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.473423158	0.473423158	1553.091611	0.000643256
Residual	2	0.000609653	0.000304826		
Total	3	0.47403281			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.322404321	0.019855396	116.9659015	7.30859E-05	2.236973386	2.407835255	2.236973386	2.407835255
log_rate	-0.553495277	0.014044794	-39.40928331	0.000643256	-0.613925191	-0.493065362	-0.613925191	-0.493065362

MULTI-VARIABLE REGRESSION OUTPUT

COLD-SOAKED BOXES

SPCA Ecowing 26 TYPE II 75/25 (#6)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999933319
R Square	0.999866643
Adjusted R Square	0.999799964
Standard Error	0.00612832
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.563169242	0.563169242	14995.33251	6.66807E-05
Residual	2	7.51126E-05	3.75563E-05		
Total	3	0.563244355			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.203204191	0.00698666	315.344406	1.0056E-05	2.173142998	2.233265384	2.173142998	2.233265384
log_rate	-0.607199385	0.004958534	-122.4554307	6.66807E-05	-0.628534249	-0.585864522	-0.628534249	-0.585864522

MULTI-VARIABLE REGRESSION OUTPUT
COLD-SOAKED BOXES
NEWAVE AEROCHEMICAL FCY-1A TYPE I (#7)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99953689
R Square	0.999073995
Adjusted R Square	0.998610993
Standard Error	0.014037251
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.425185614	0.425185614	2157.8161	0.00046311
Residual	2	0.000394089	0.000197044		
Total	3	0.425579702			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.267140651	0.016387809	77.3221503	0.000167218	1.196629549	1.337651752	1.196629549	1.337651752
log_rate	-0.534993384	0.011517049	-46.45229919	0.00046311	-0.584547279	-0.485439489	-0.584547279	-0.485439489

MULTI-VARIABLE REGRESSION OUTPUT

COLD-SOAKED BOXES

LYONDELL ARCO PLUS-ST TYPE I (#8)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999397343
R Square	0.998795049
Adjusted R Square	0.998192574
Standard Error	0.015911564
Observations	4

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.419723033	0.419723033	1657.818739	0.000602657
Residual	2	0.000506356	0.000253178		
Total	3	0.420229389			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.311128095	0.018254003	71.82688106	0.000193776	1.232587405	1.389668785	1.232587405	1.389668785
log_rate	-0.524567691	0.012883475	-40.71632031	0.000602657	-0.580000848	-0.469134534	-0.580000848	-0.469134534

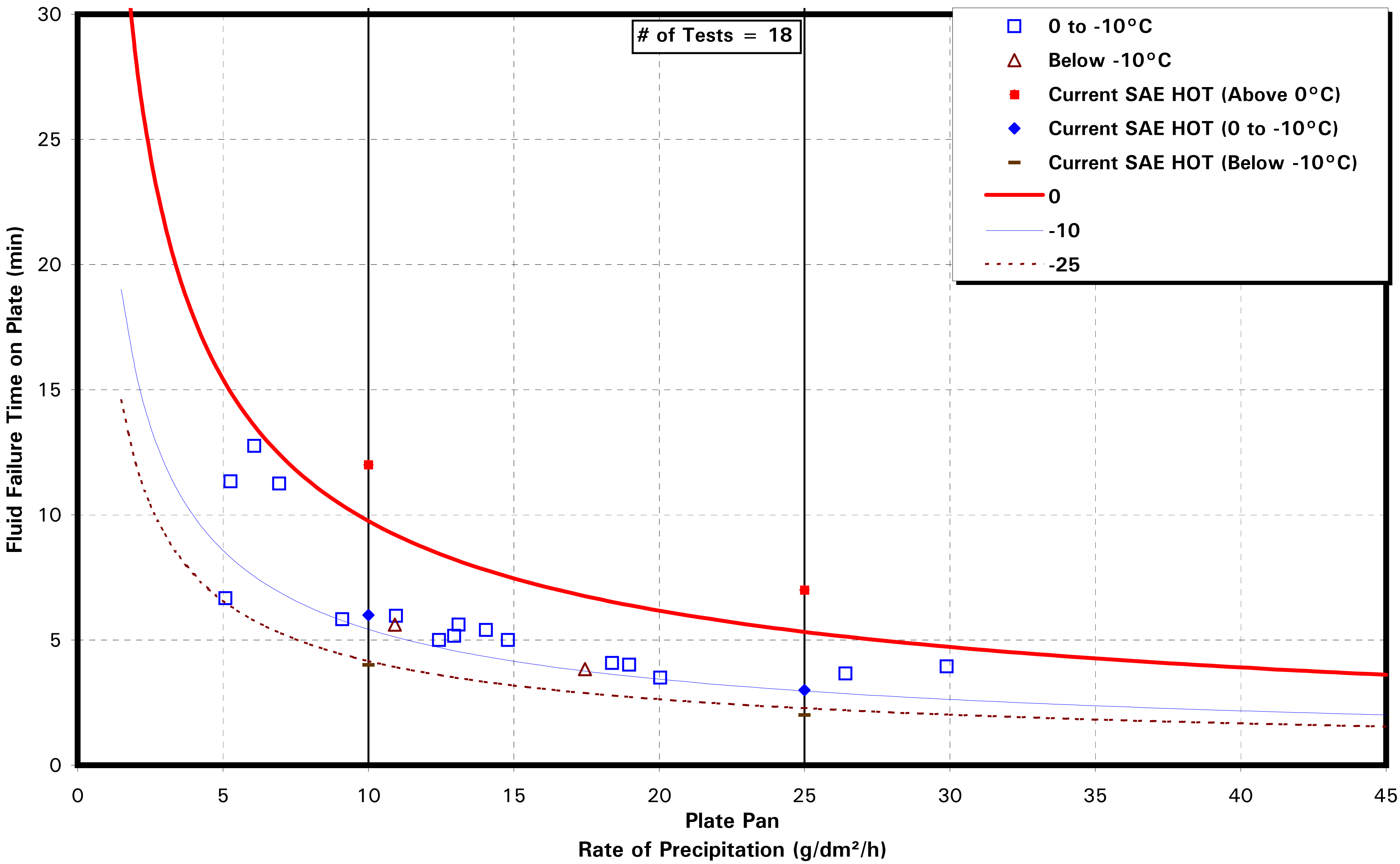
APPENDIX G

EFFECT OF FLUID BRAND AND RATE OF PRECIPITATION ON HOLDOVER TIME
WINTER 2000-01

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

TYPE I - Clariant EG I 1996 (Diluted)

NATURAL SNOW CONDITIONS

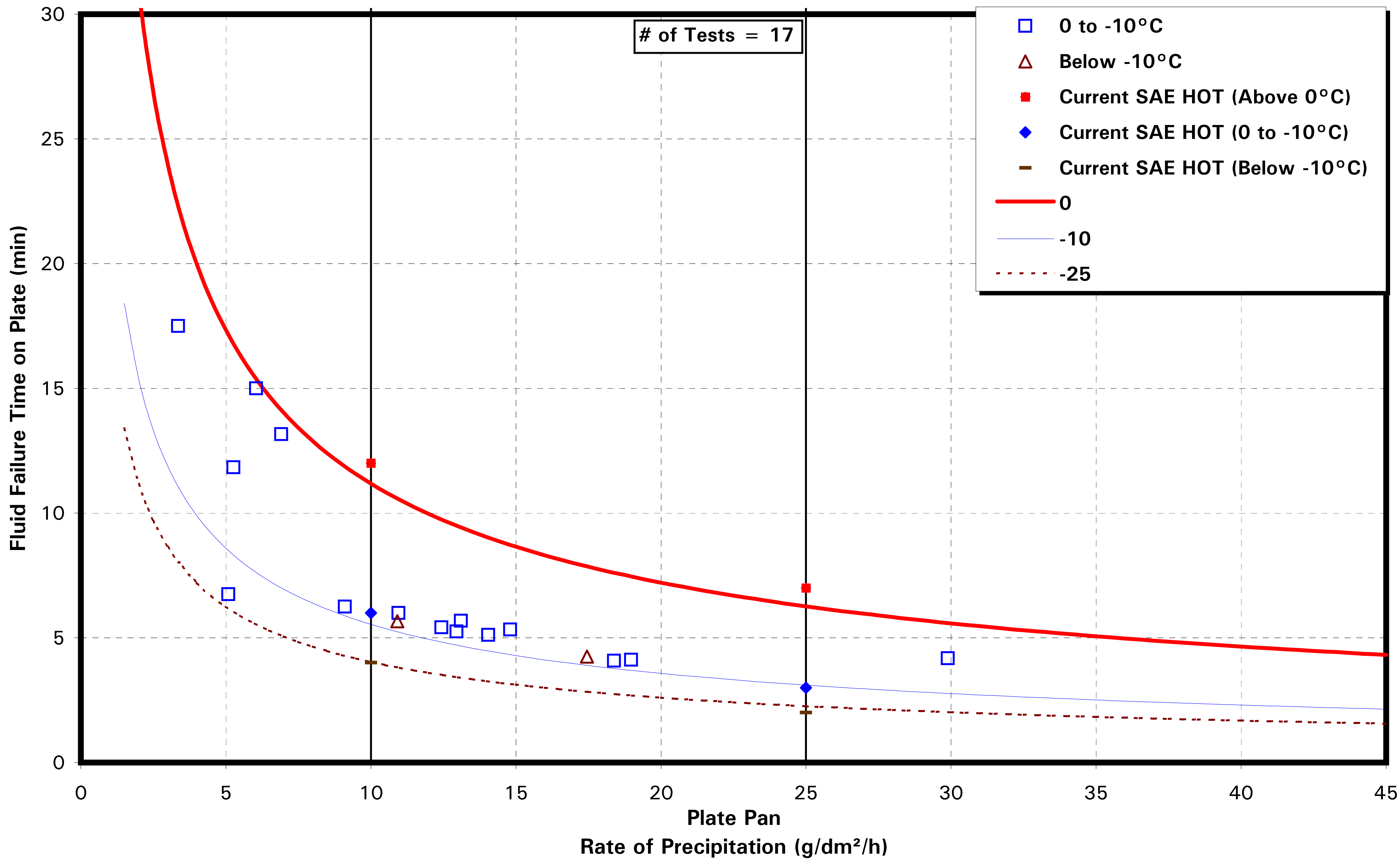


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : C1996

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

TYPE I - Clariant EG I 1938 (Diluted)

NATURAL SNOW CONDITIONS

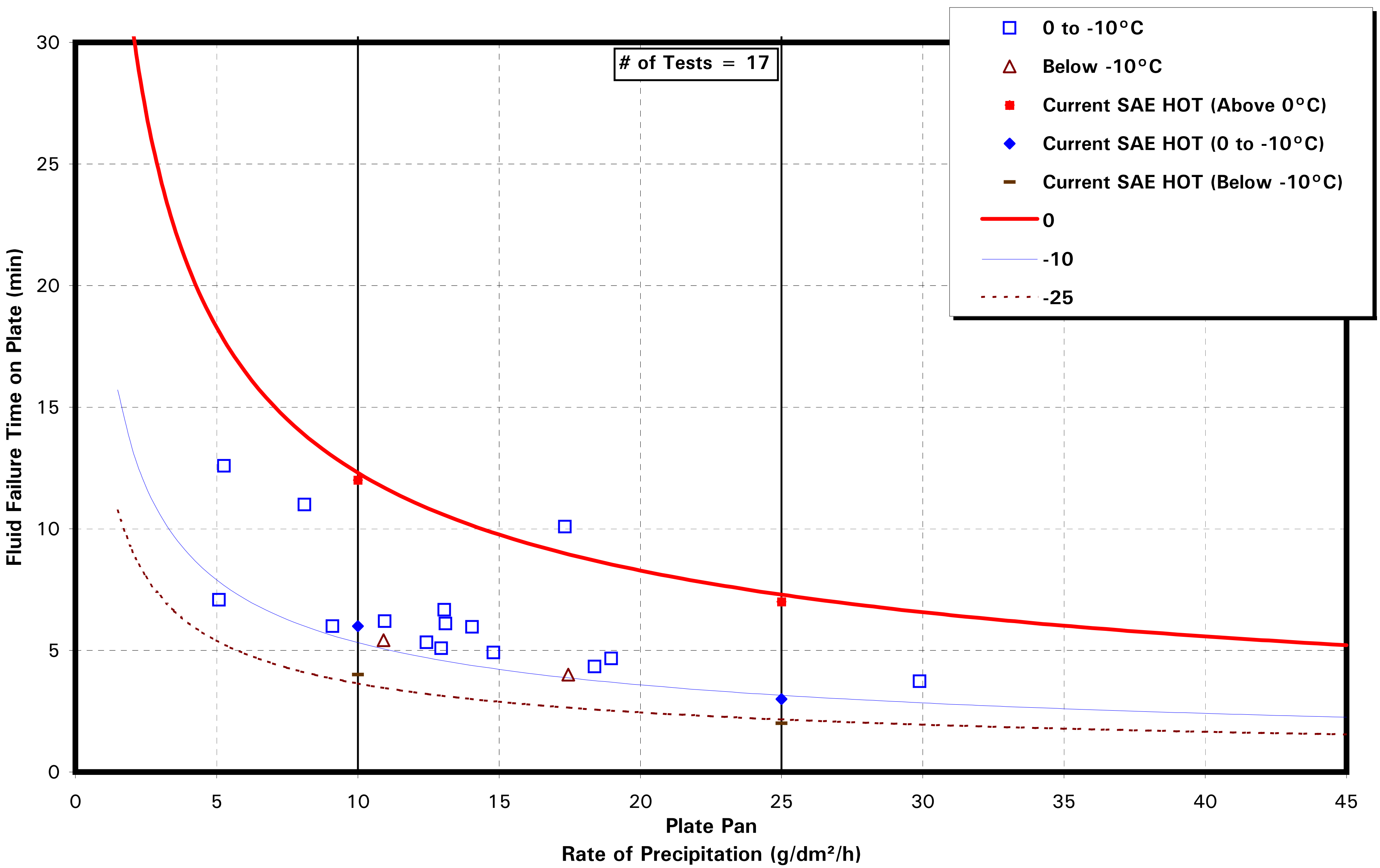


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : C1938

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

TYPE I - Lyondell Arco Plus (Diluted)

NATURAL SNOW CONDITIONS

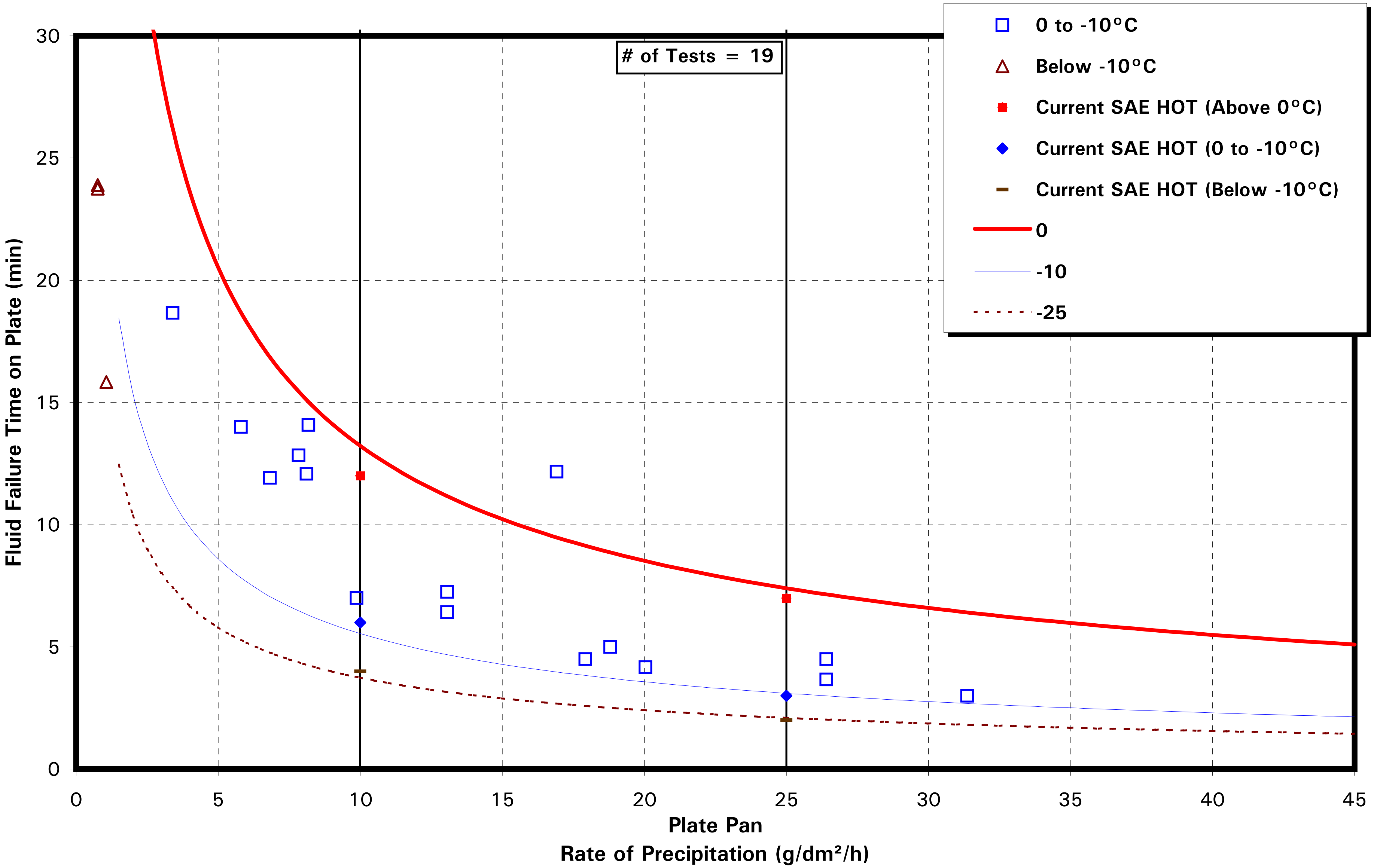


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : Lyondell

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

TYPE I - Lyondell Arco Plus-ST (Diluted)

NATURAL SNOW CONDITIONS

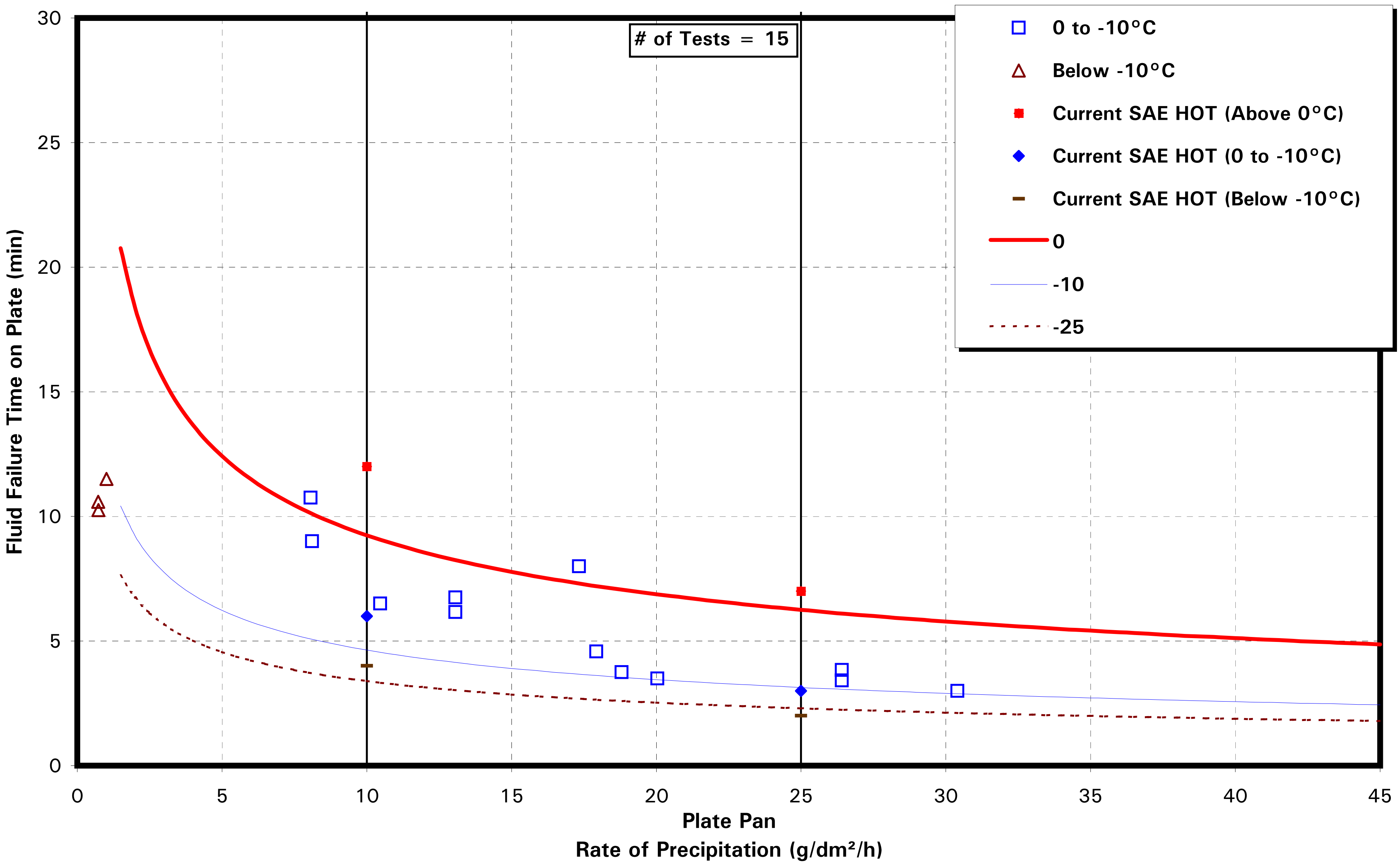


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : Lyondell-ST

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

TYPE I - Newave Aerochemical FCY-1A (Diluted)

NATURAL SNOW CONDITIONS

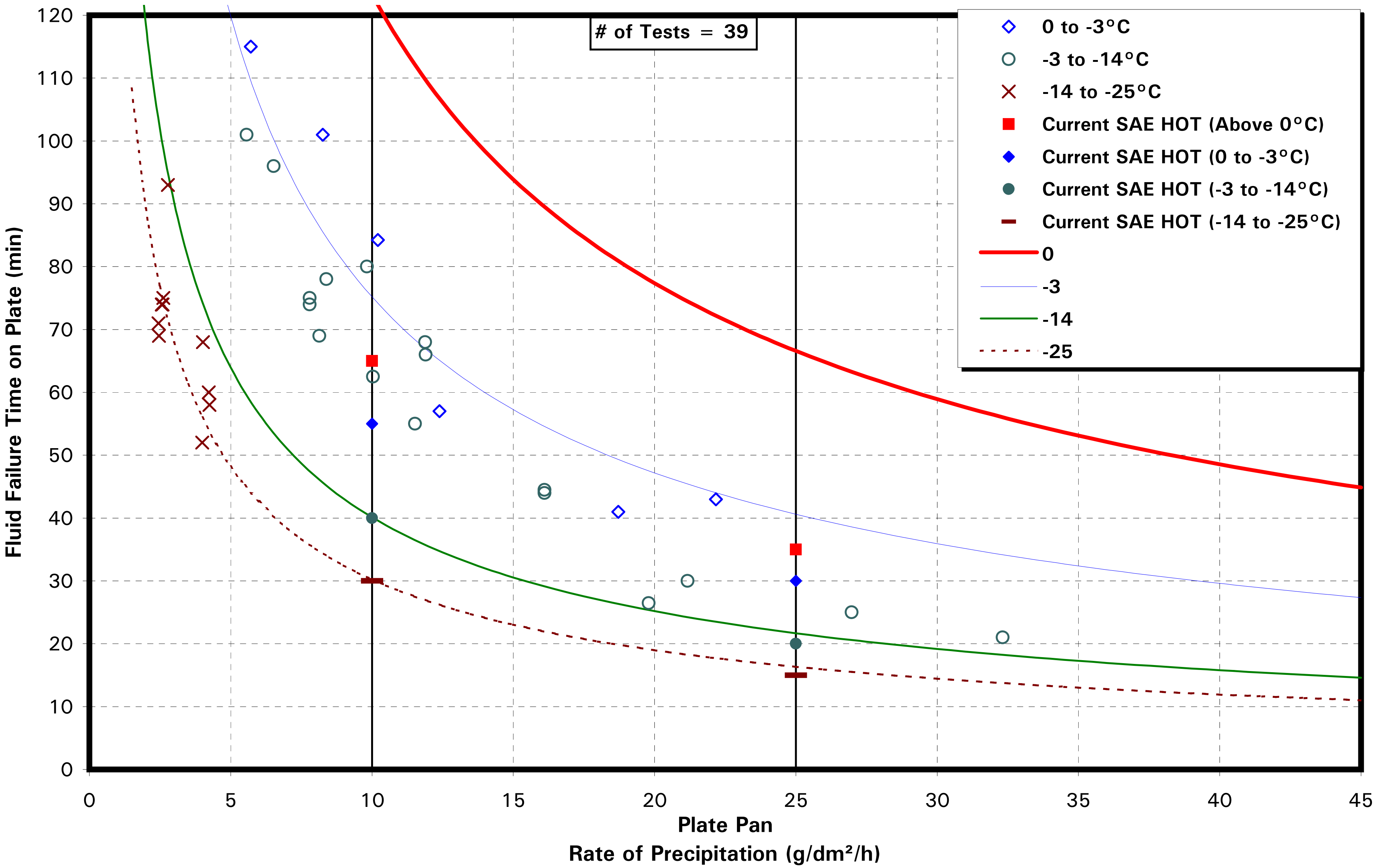


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : FCY-1A

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (NEAT)

NATURAL SNOW

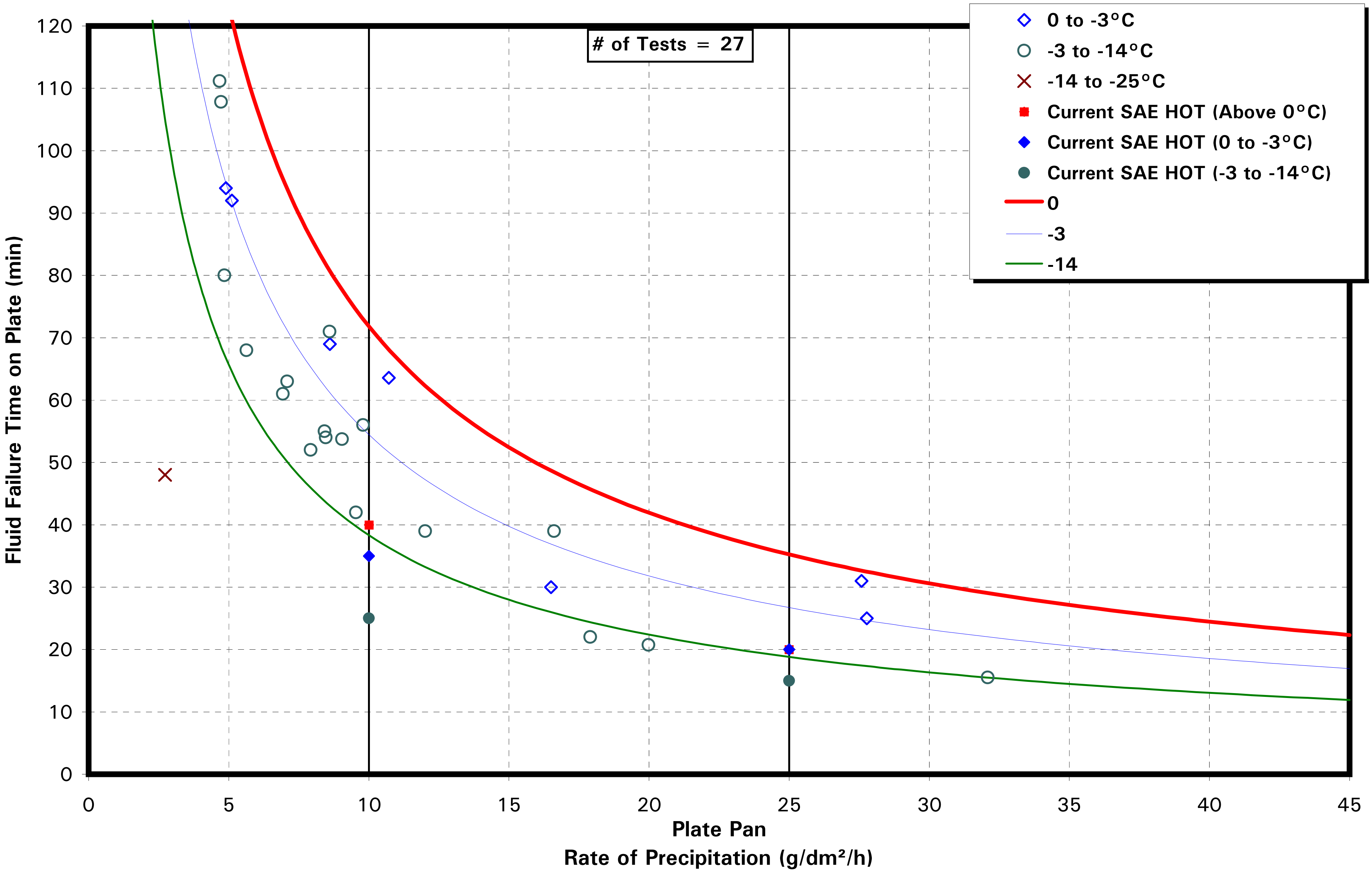


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : C2012-Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (75/25)

NATURAL SNOW

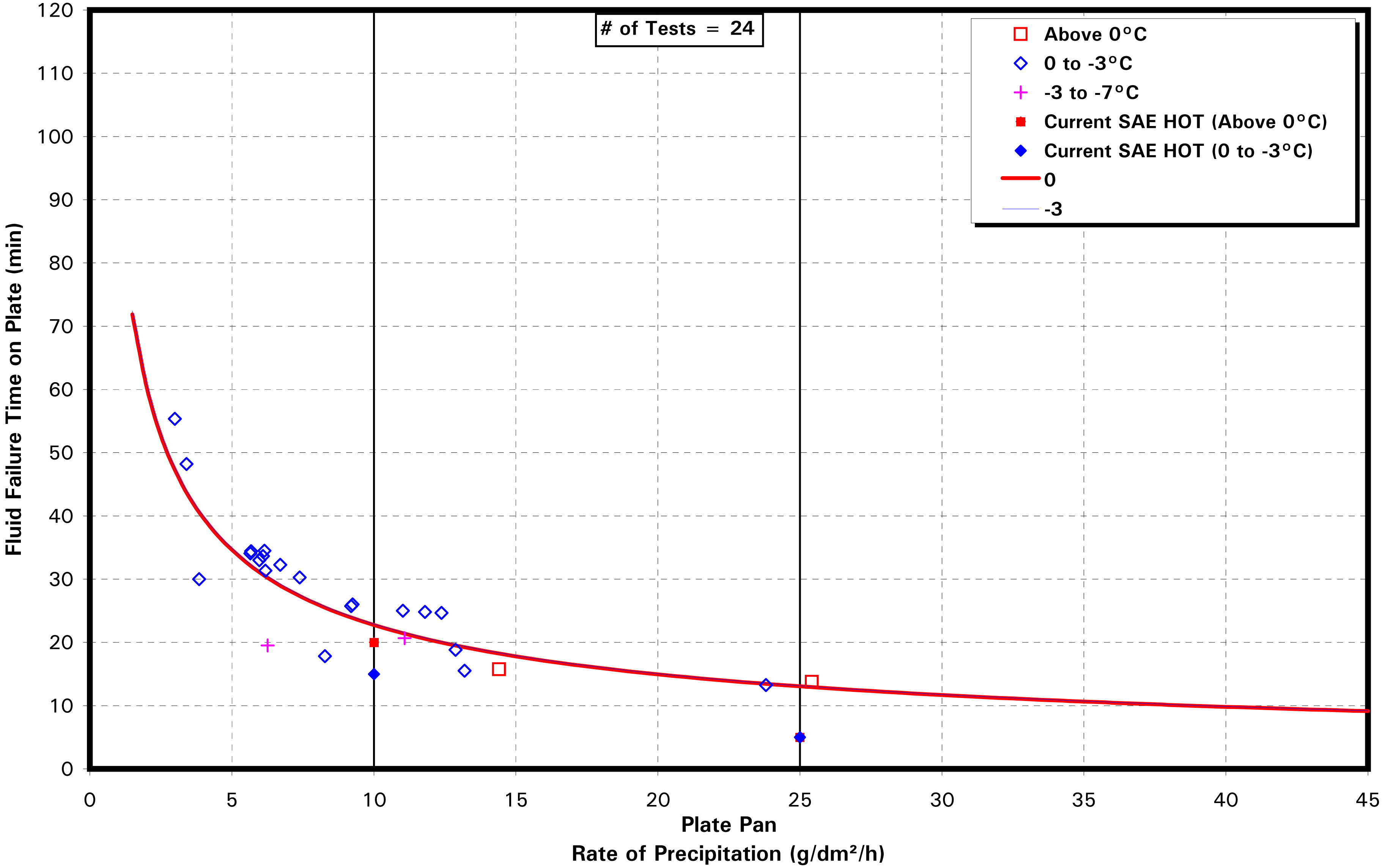


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : C2012-75%

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (50/50)

NATURAL SNOW

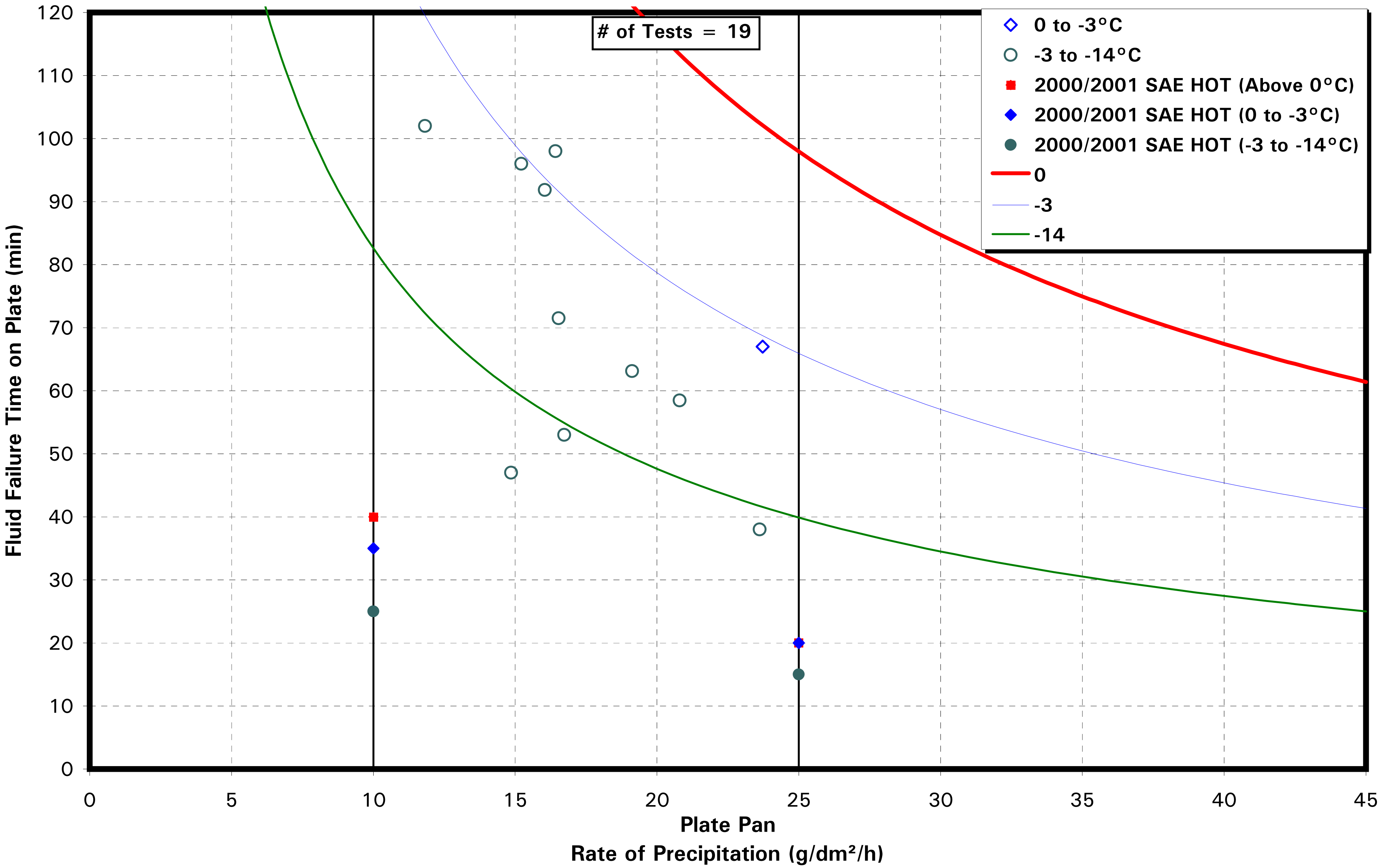


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT : C2012-50%

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (75/25)

BEFORE 28 FEBRUARY (VISCOSITY = 5990 cP) NATURAL SNOW

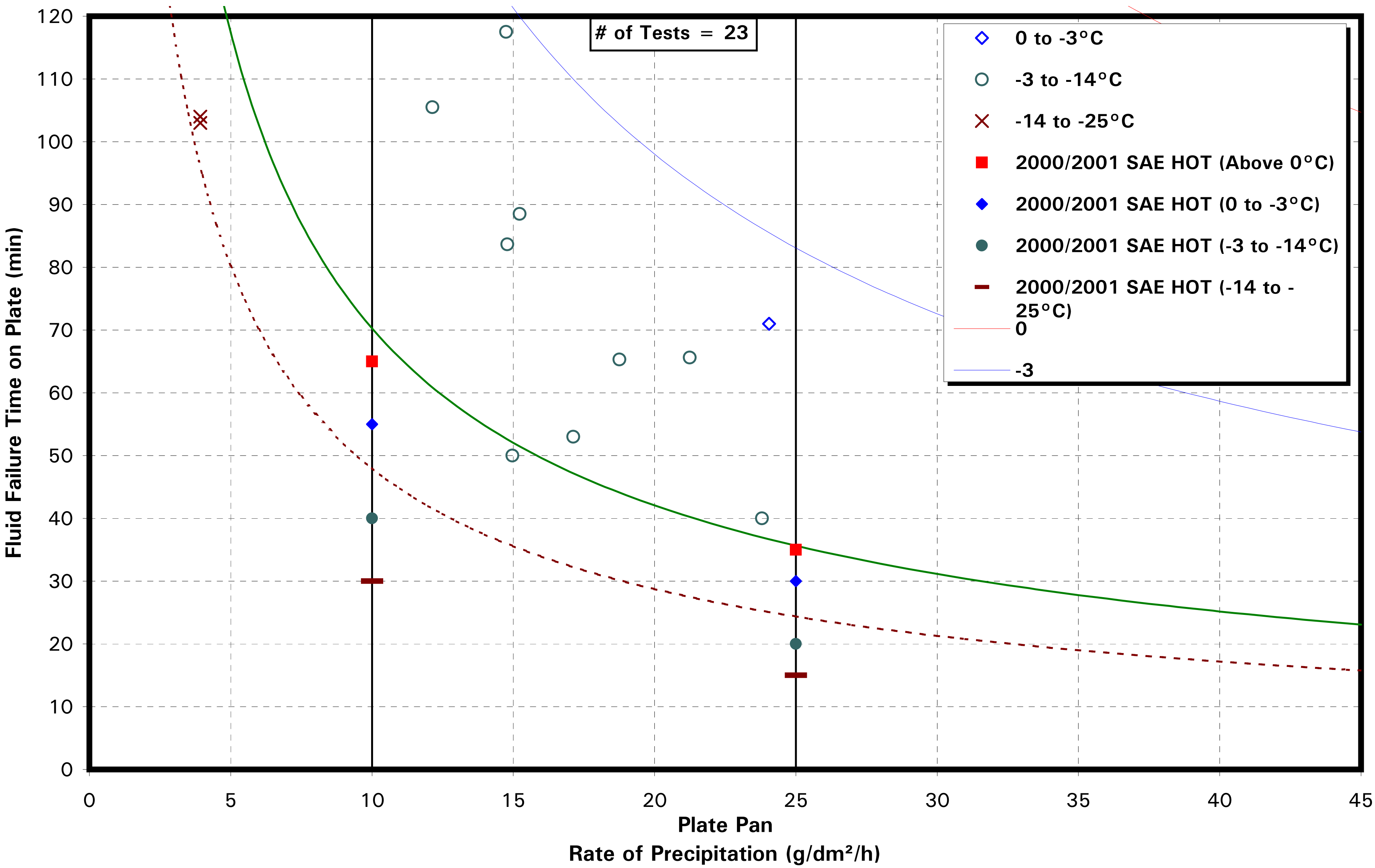


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS (OCTOGON)
AT: 75%(before)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (NEAT)

BEFORE 28 FEBRUARY (VISCOSITY = 5990 cP) NATURAL SNOW

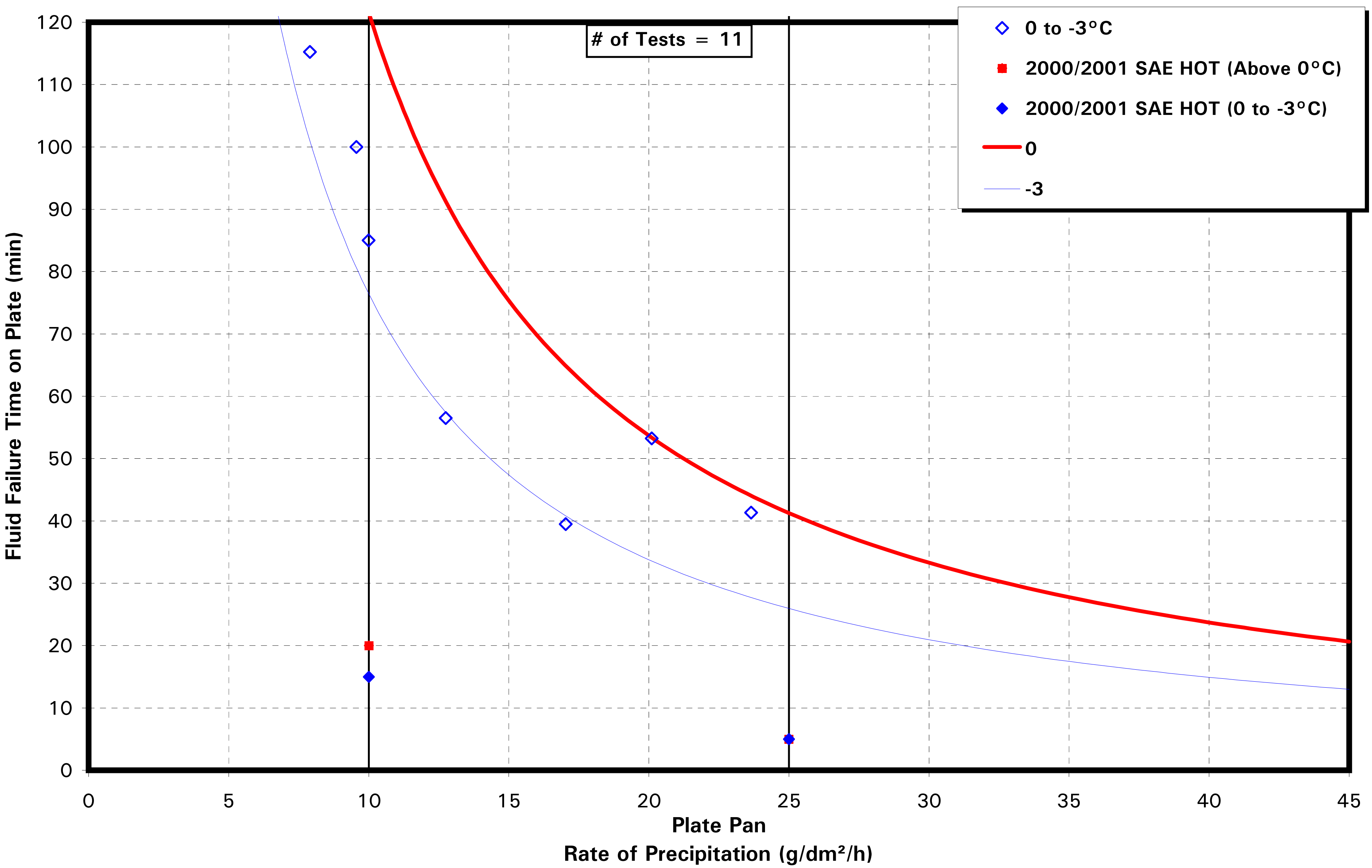


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS (OCTOGON)
AT: Neat(before)

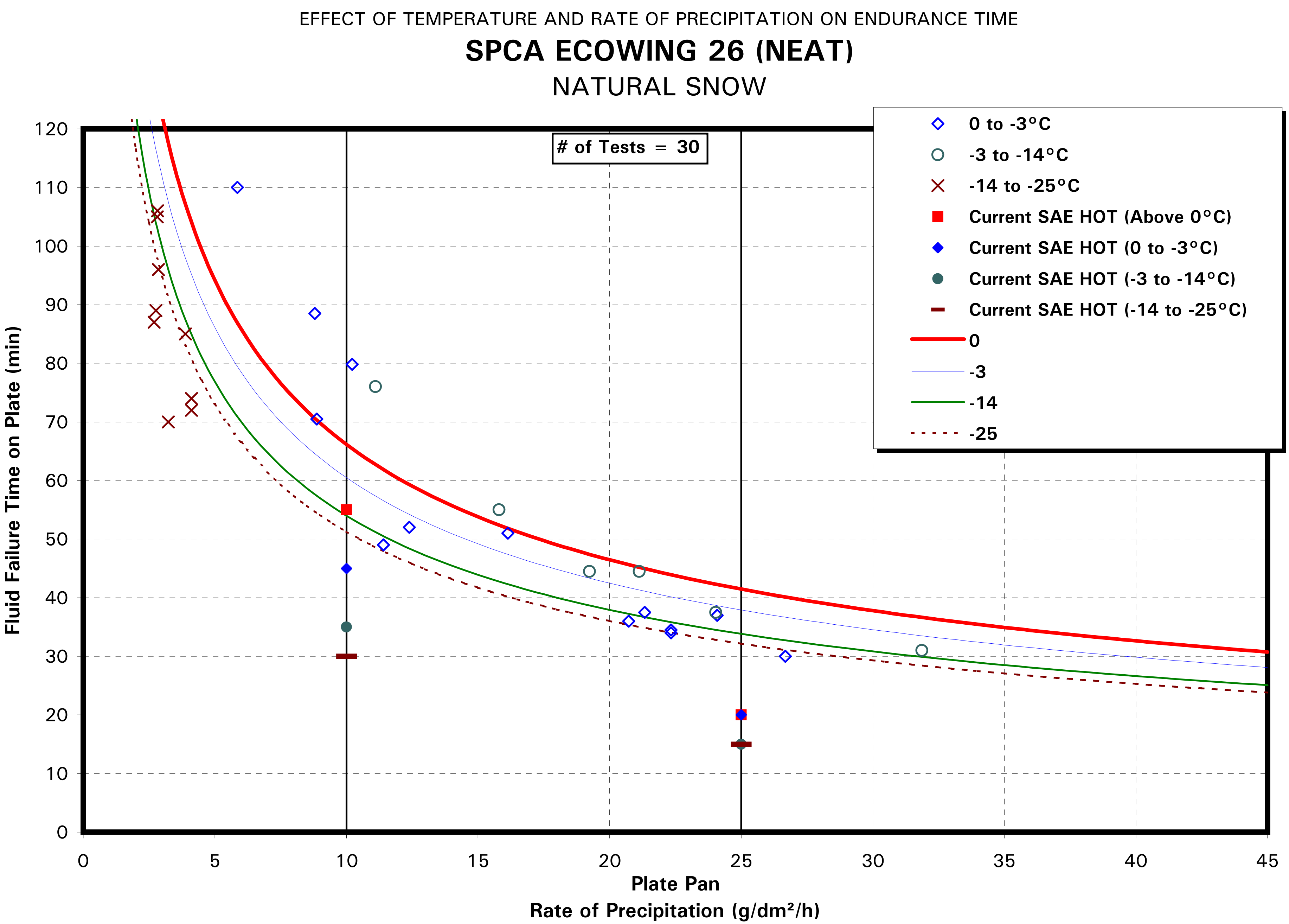
EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (50/50)

NATURAL SNOW



M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS (OCTOGON)
AT: 50%

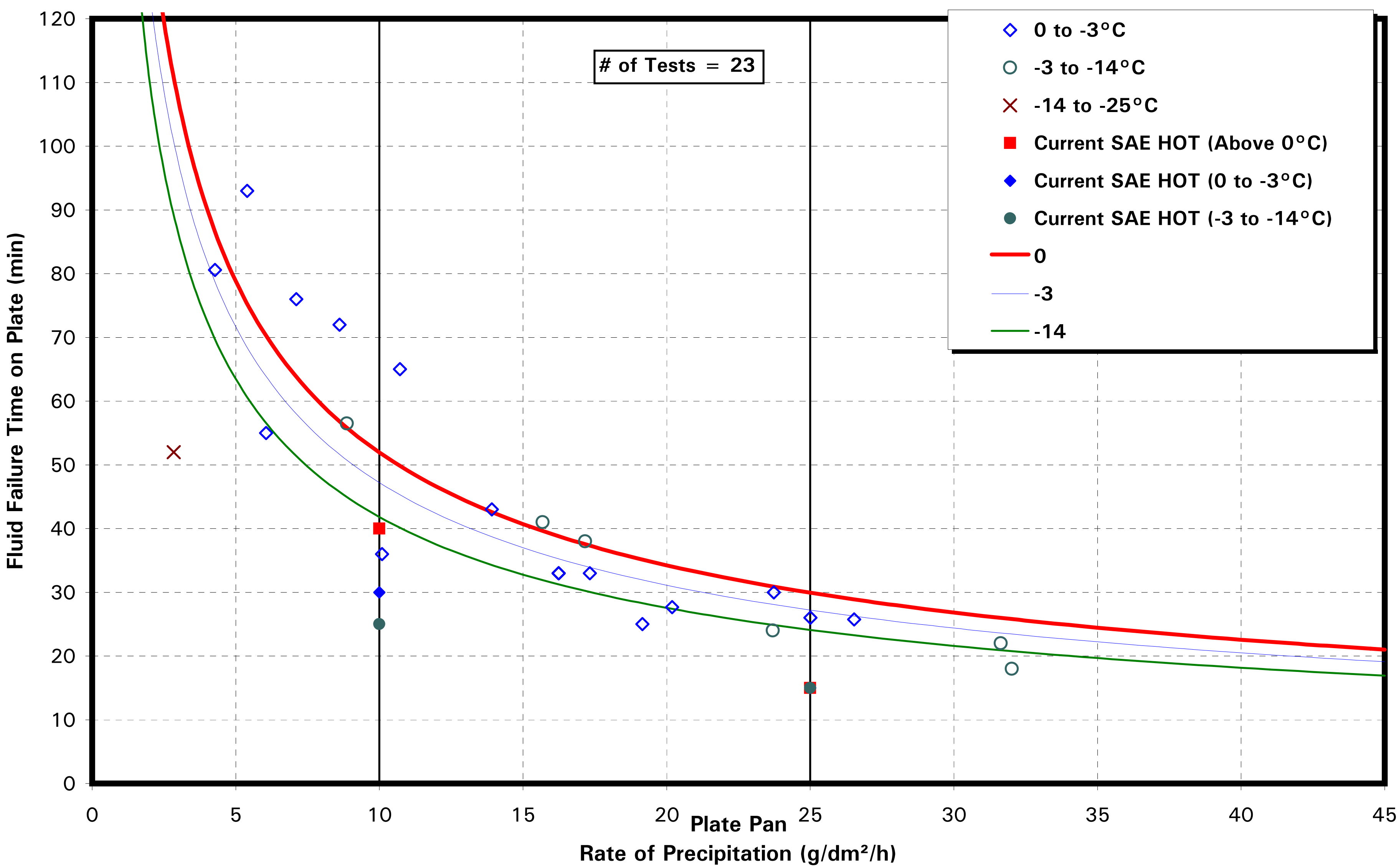


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT: SPCA E26-Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA ECOWING 26 (75/25)

NATURAL SNOW

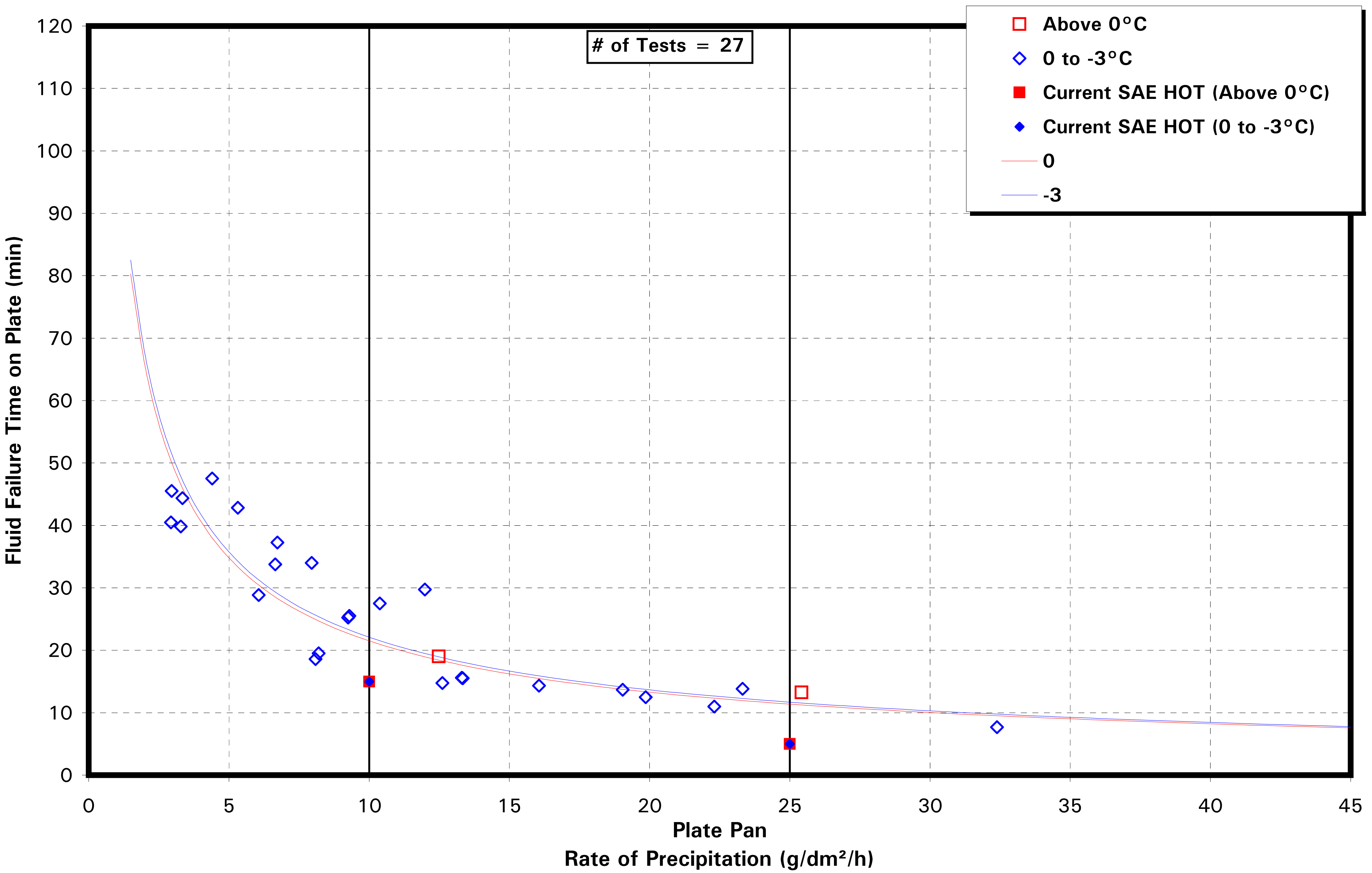


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT: SPCA E26-75%

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA ECOWING 26 (50/50)

NATURAL SNOW

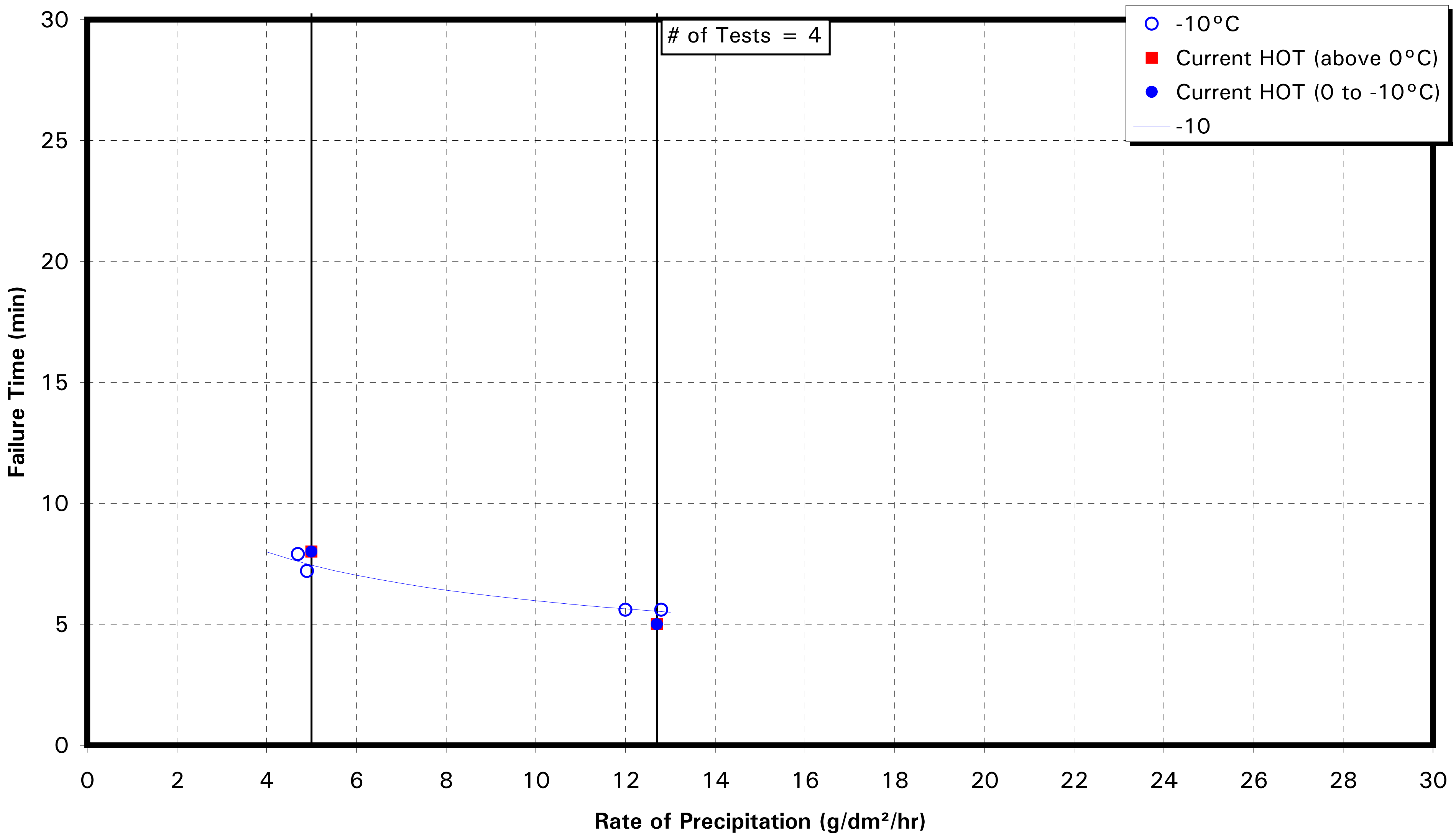


M\Groups\CM1680 (exBM3833)\Analysis\HOT\Snow\Fluid Rates CHARTS new
AT: SPCA E26-50%

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

LYONDELL ARCO PLUS - ST (10°)

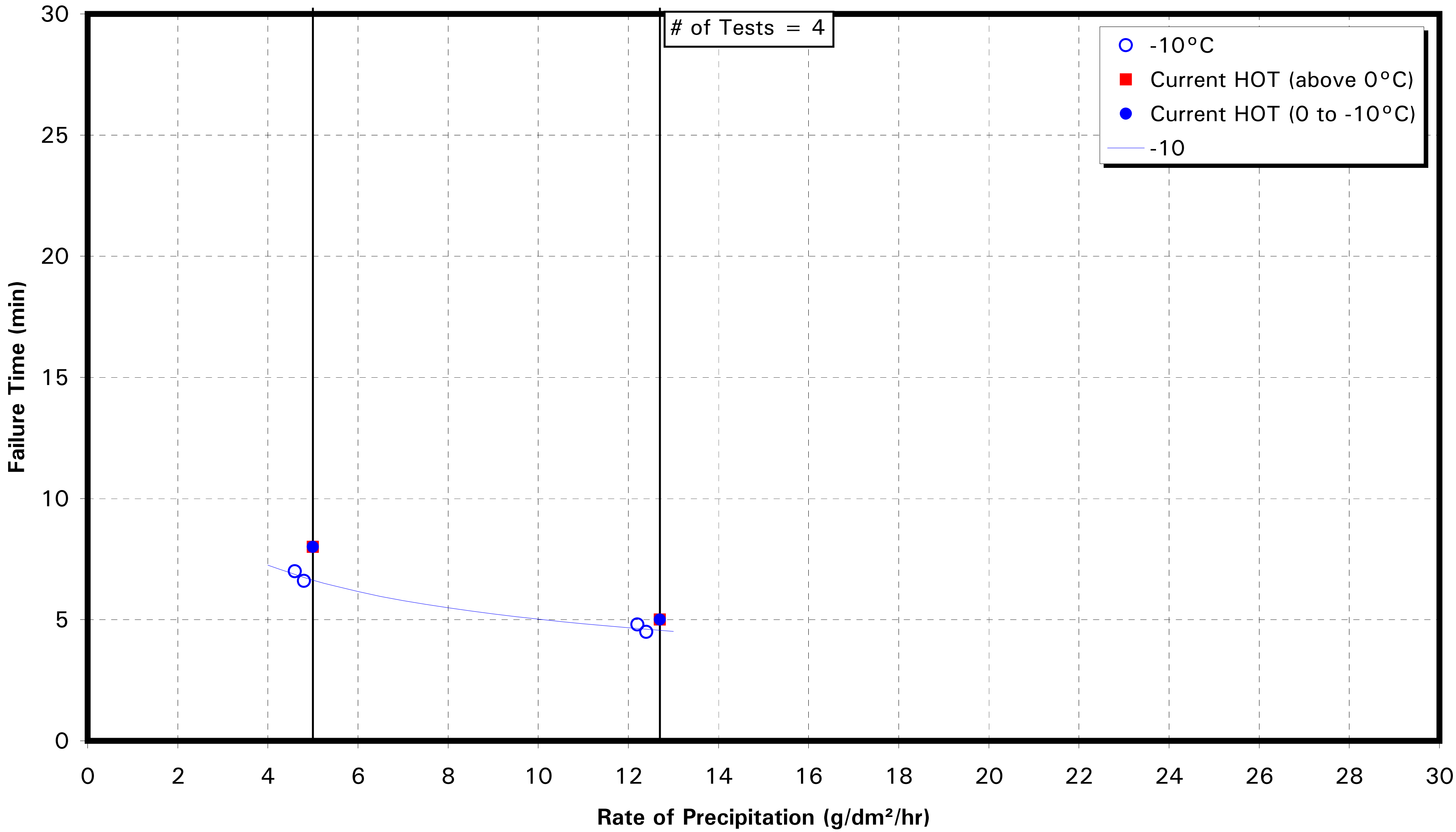
FREEZING DRIZZLE



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

NEWAVE AEROCH. FCY-1A (10°)

FREEZING DRIZZLE

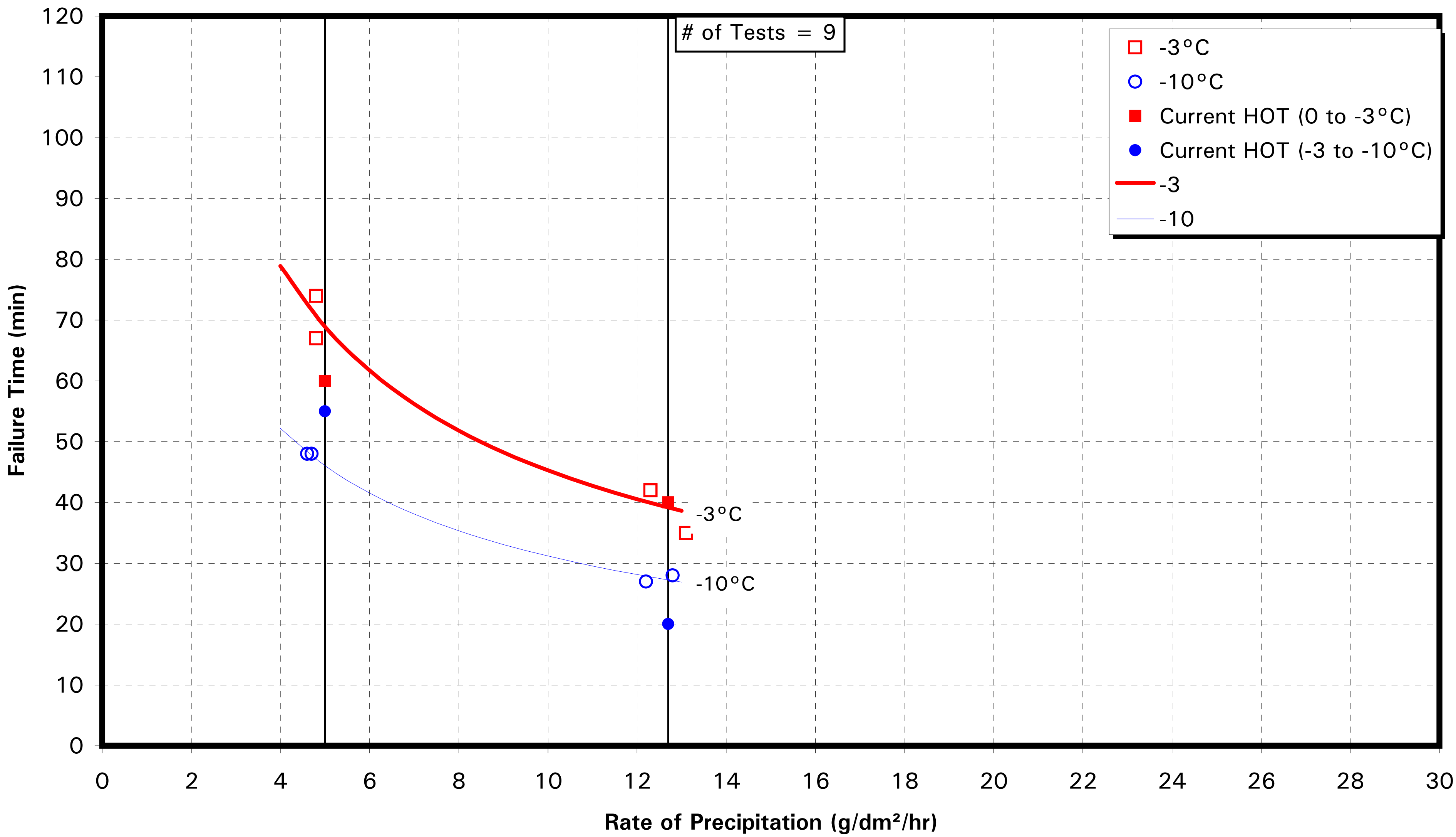


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - NEWAVE AEROCH FCY-1A
AT: 10° (2)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (NEAT)

FREEZING DRIZZLE

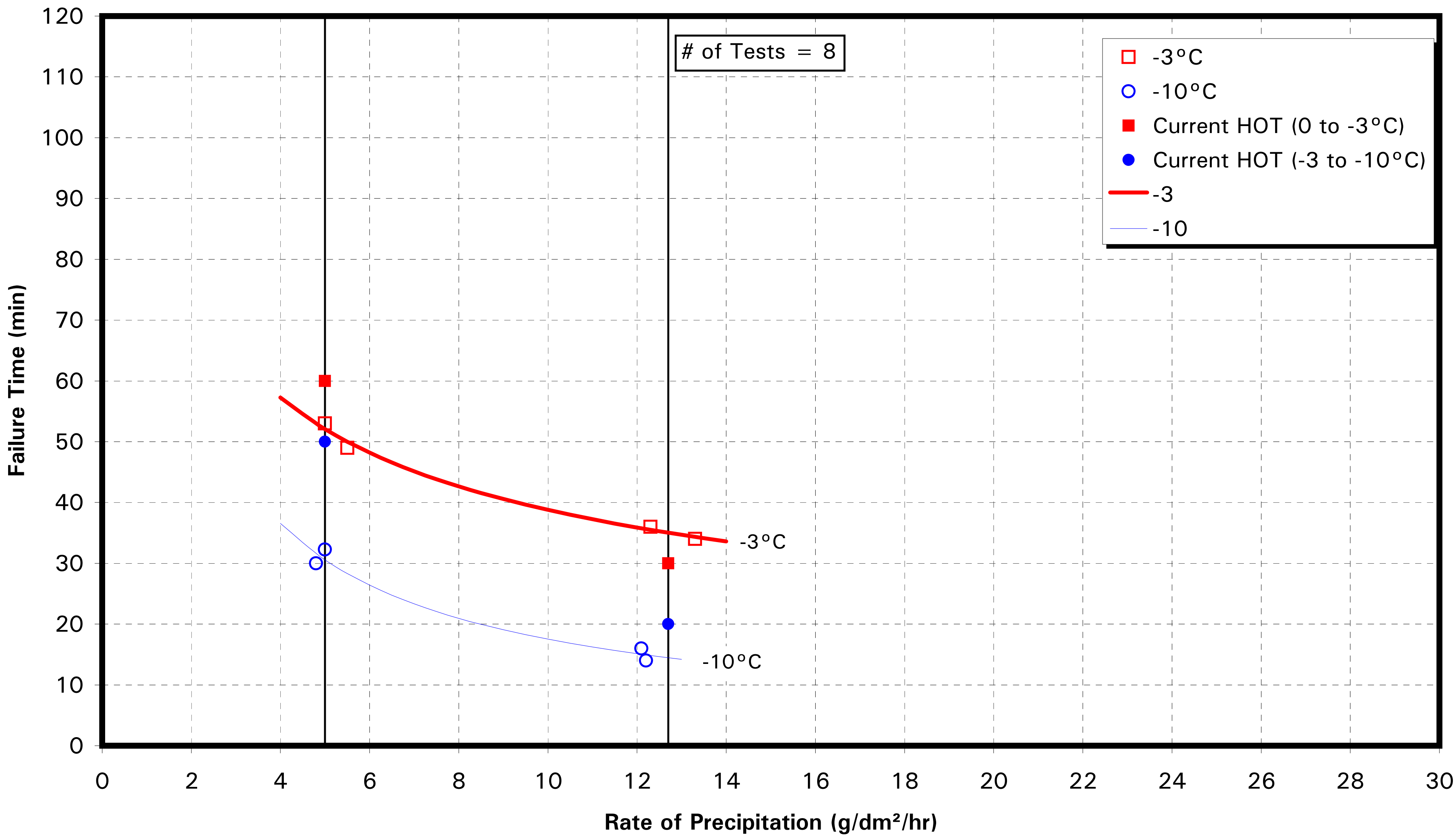


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - C2012
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (75/25)

FREEZING DRIZZLE

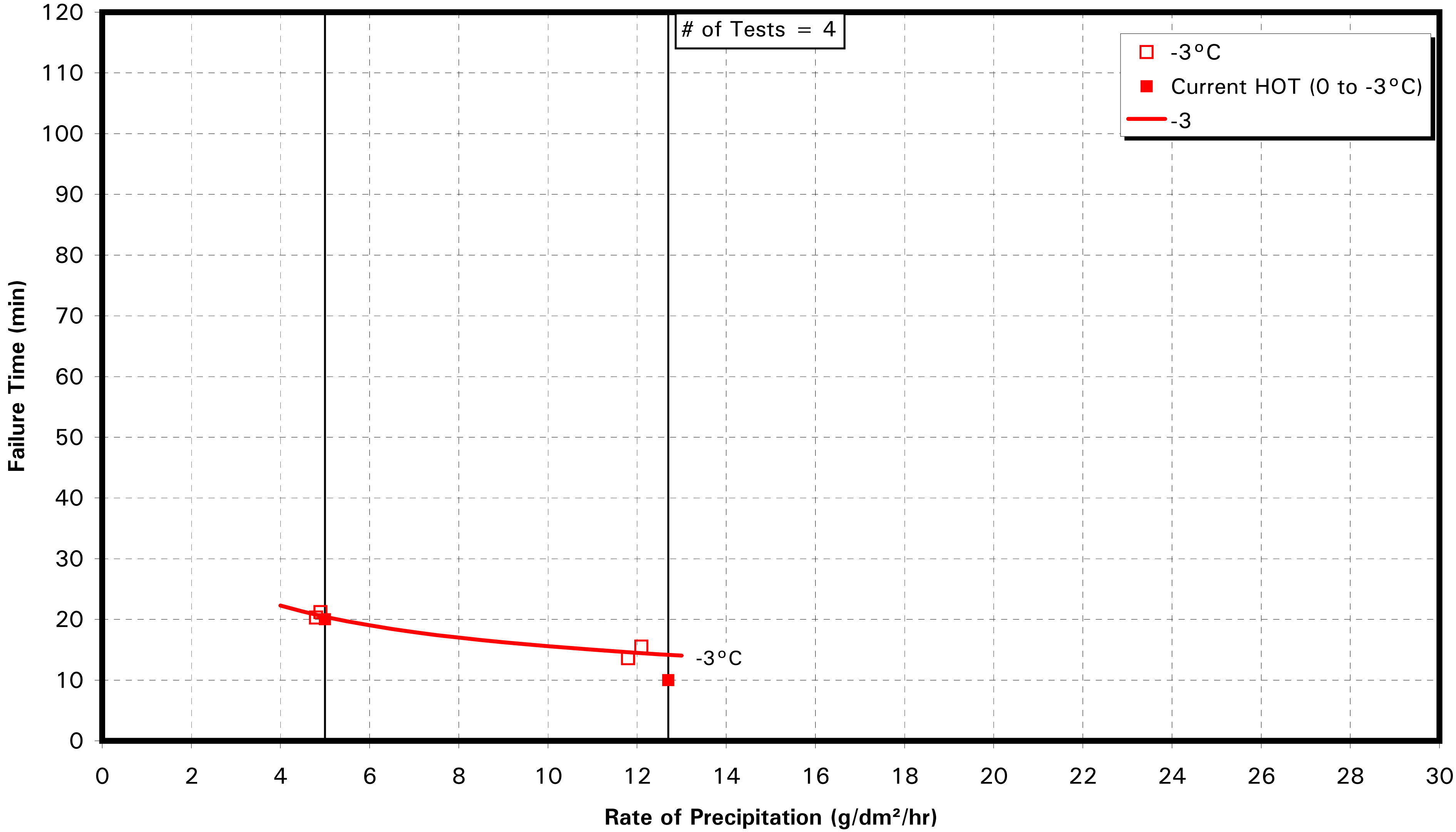


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - C2012
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT SAFEWING PROTECT 2012 (50/50)

FREEZING DRIZZLE

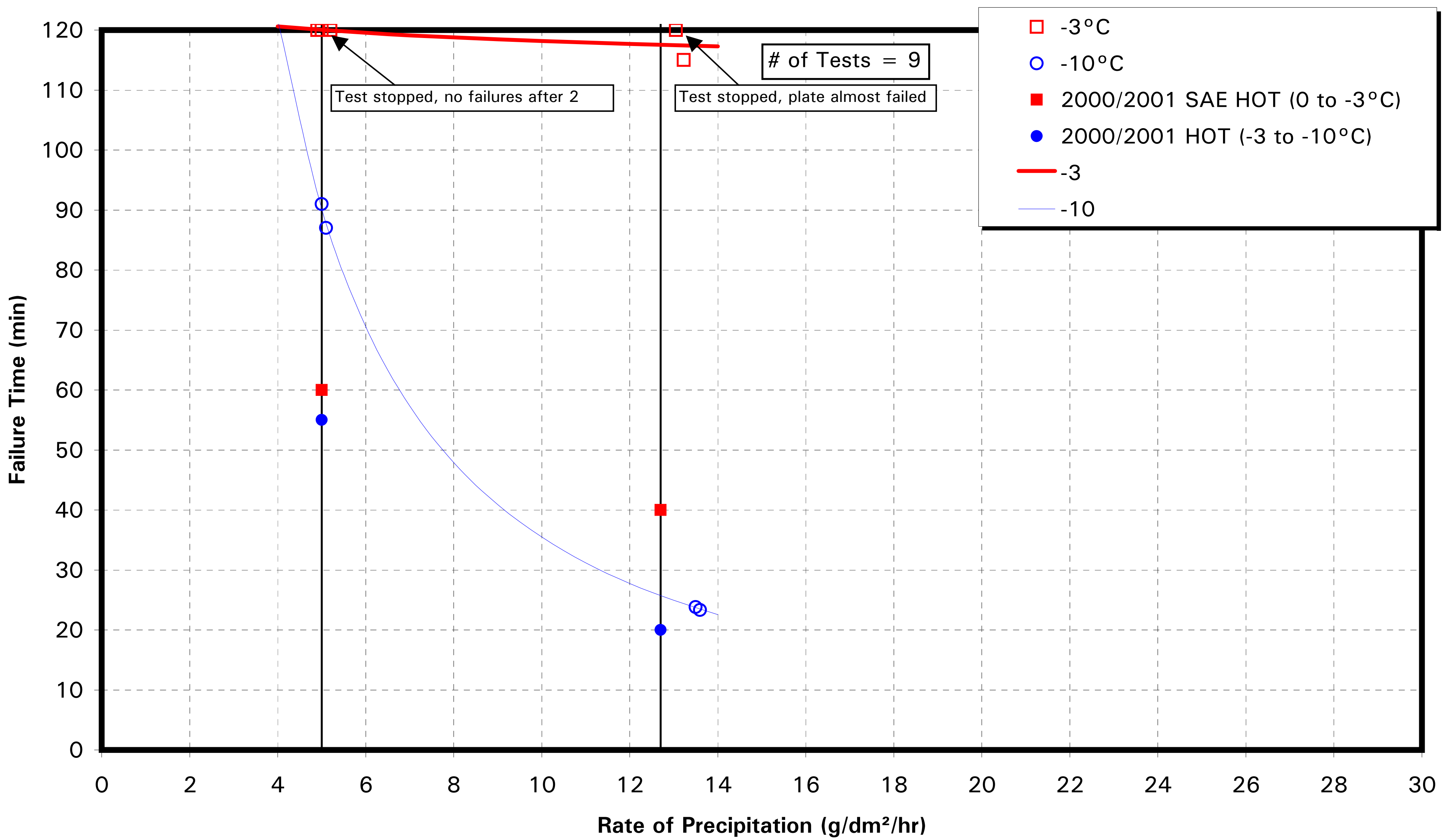


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - C2012
AT: 50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (NEAT)

FREEZING DRIZZLE

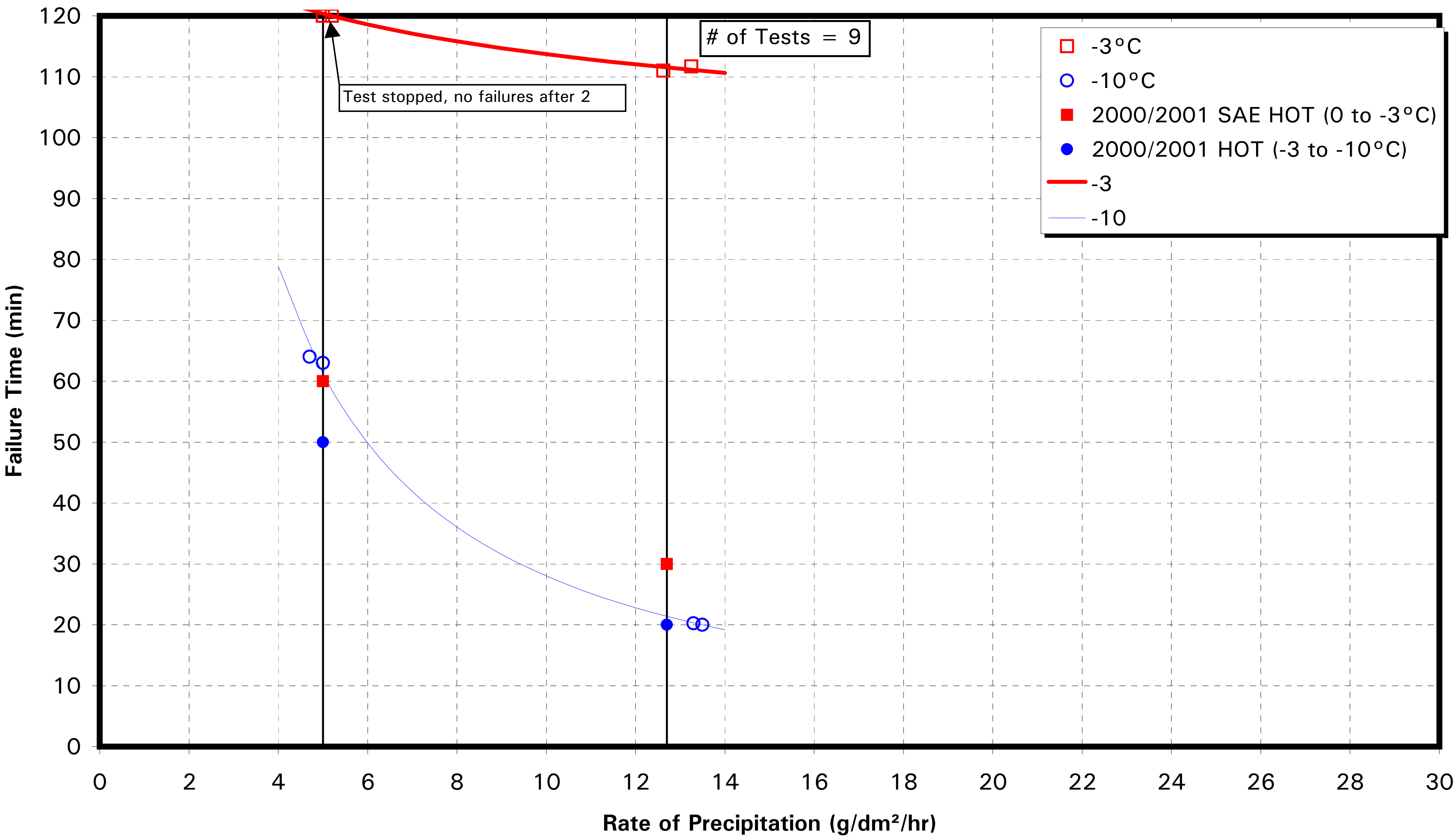


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZD
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (75/25)

FREEZING DRIZZLE

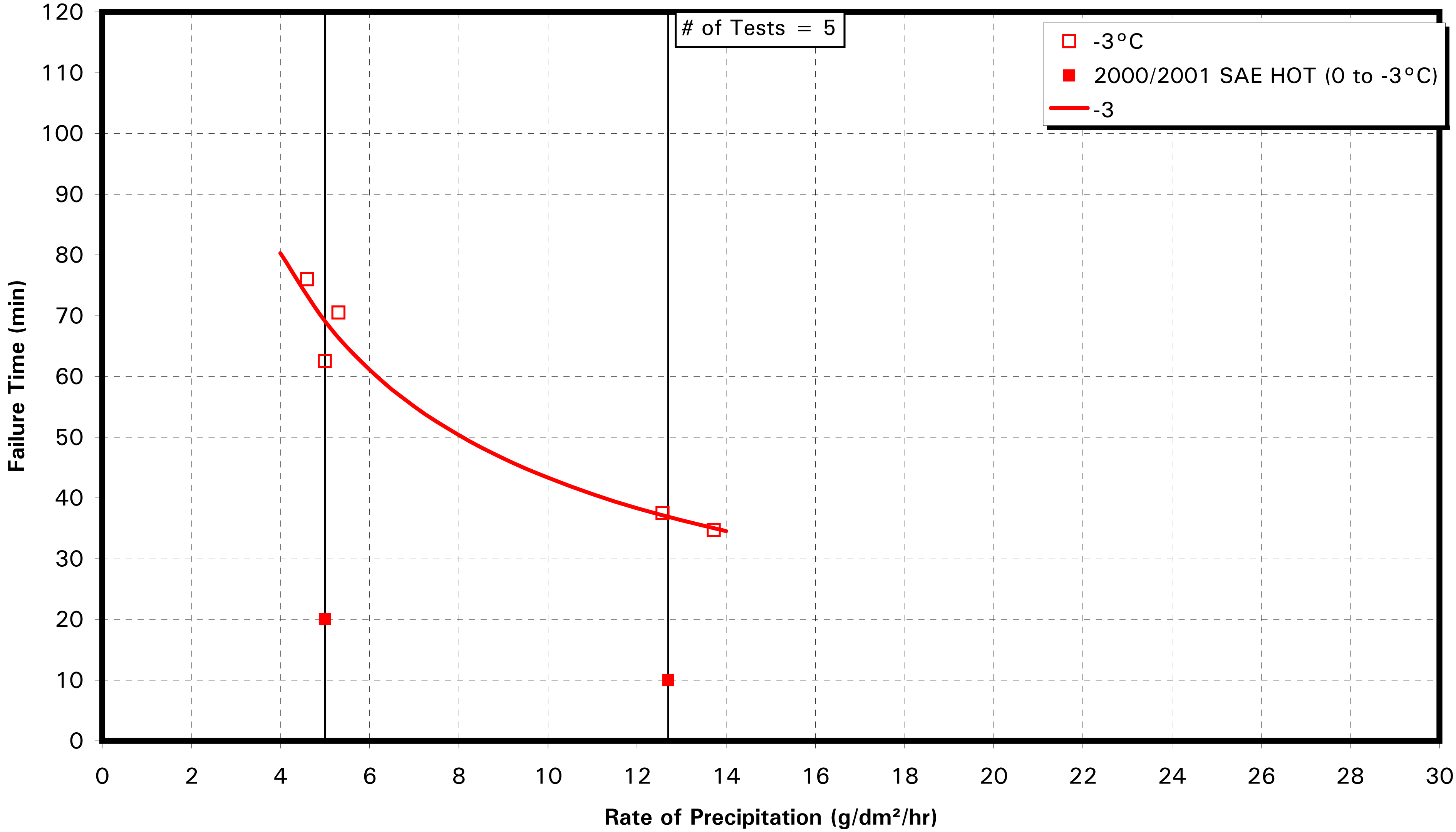


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZD
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (50/50)

FREEZING DRIZZLE

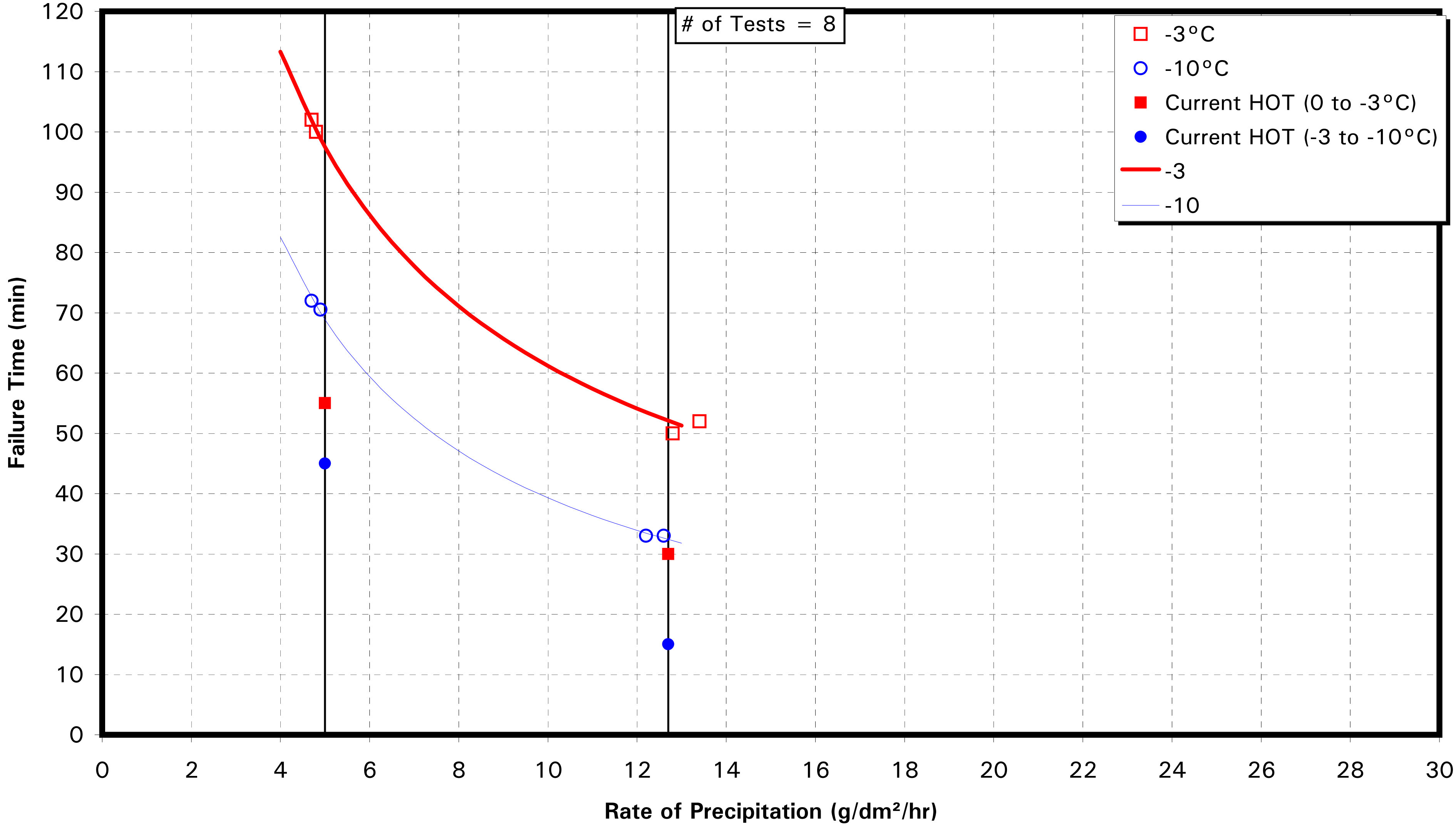


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZD
AT: 50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (NEAT)

FREEZING DRIZZLE

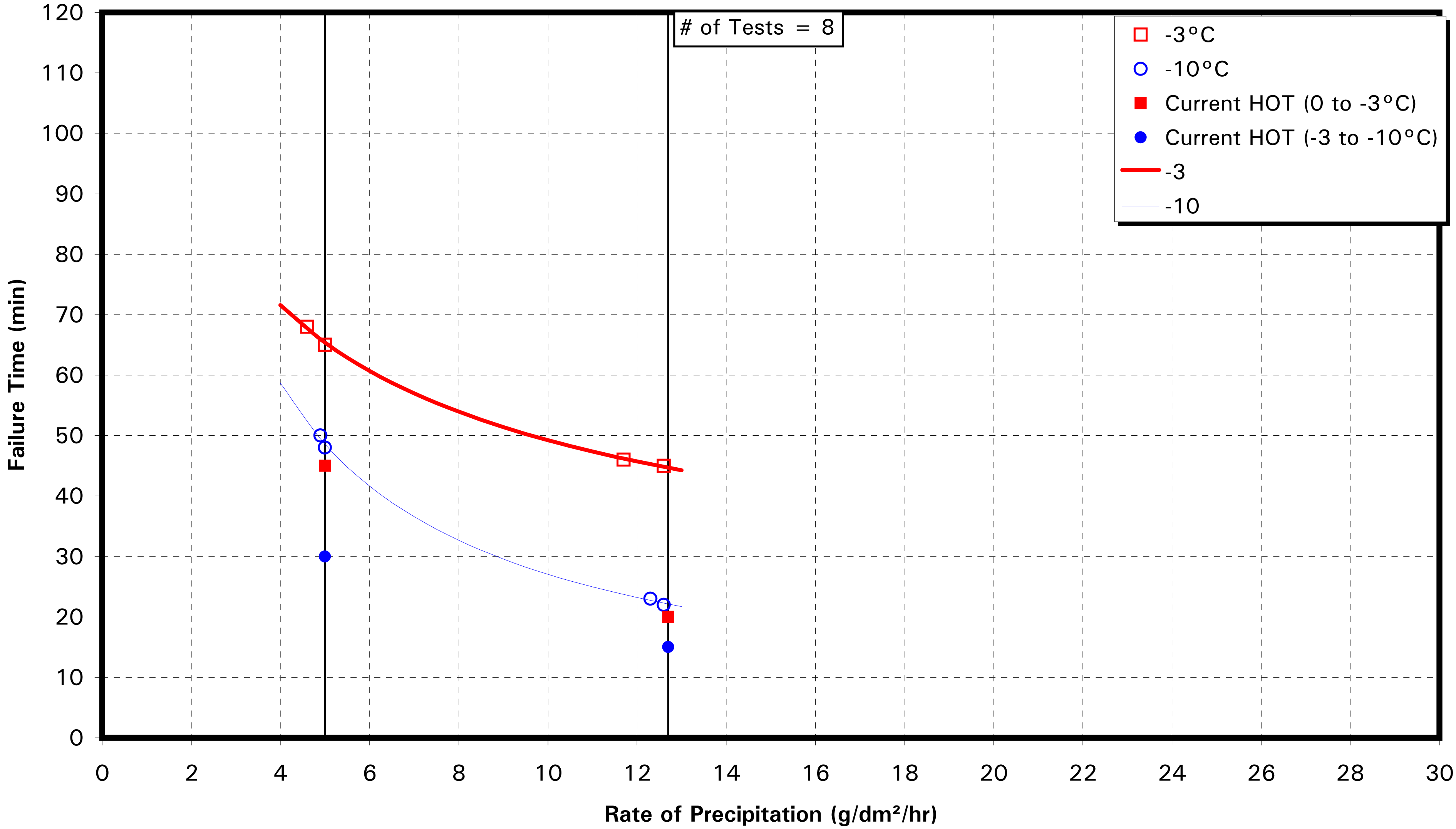


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - SPCA E26
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (75/25)

FREEZING DRIZZLE

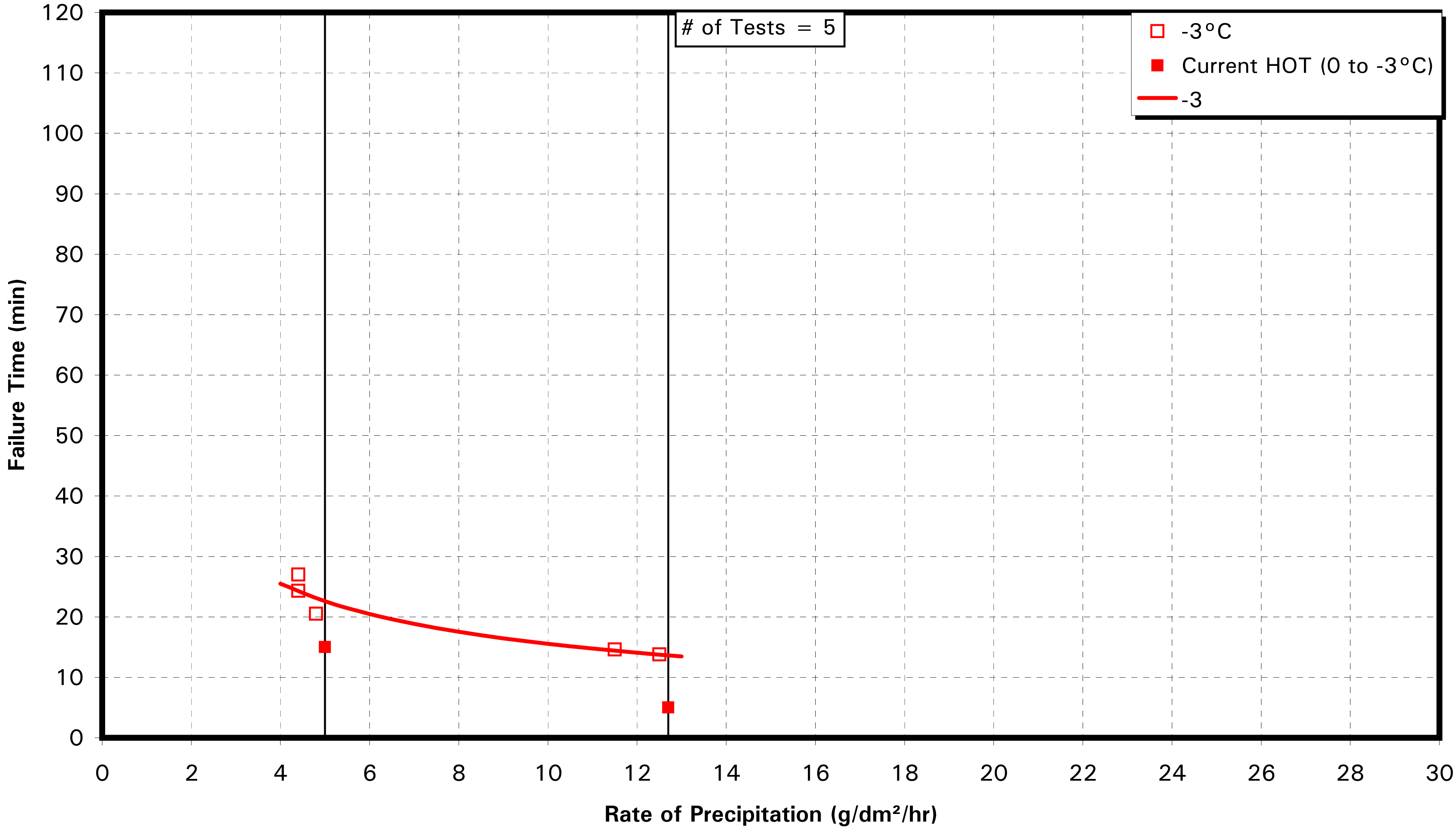


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - SPCA E26
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (50/50)

FREEZING DRIZZLE

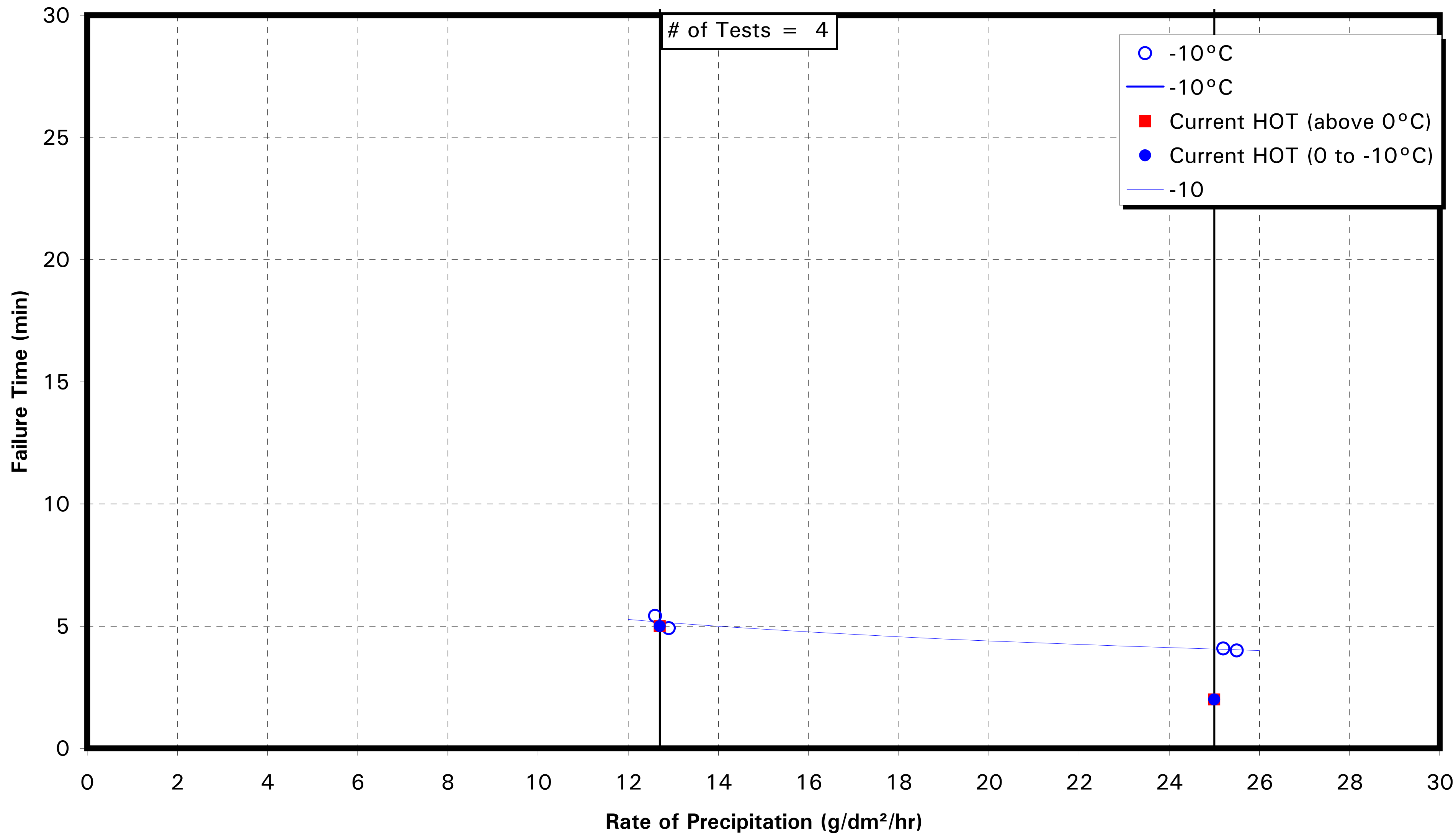


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZD - SPCA E26
AT: 50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

LYONDELL ARCO PLUS - ST (10°)

LIGHT FREEZING RAIN

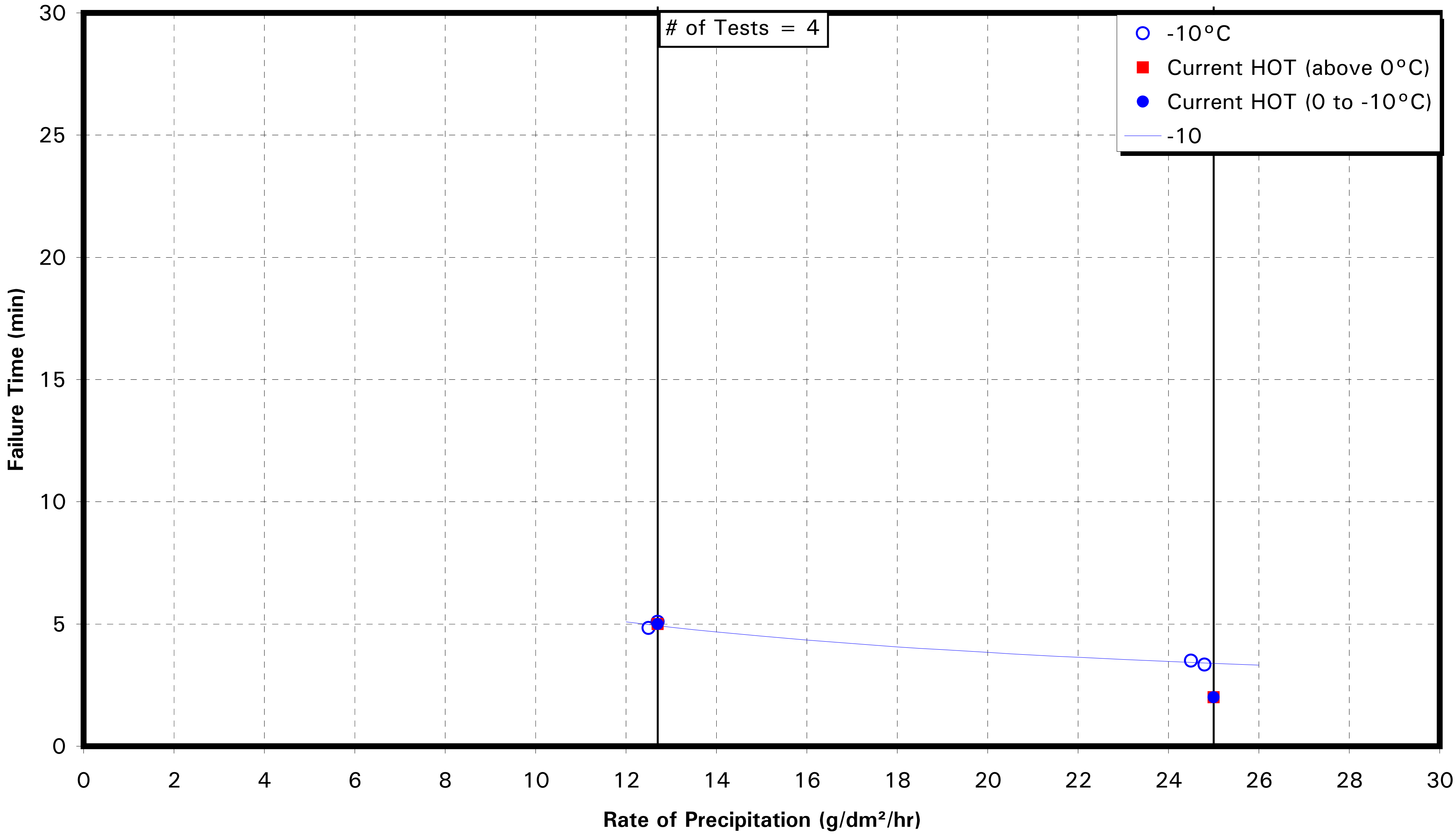


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - LYONDELL ARCO+ AT: 10° (2)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

NEWAVE AEROCH. FCY-1A (10°)

LIGHT FREEZING RAIN

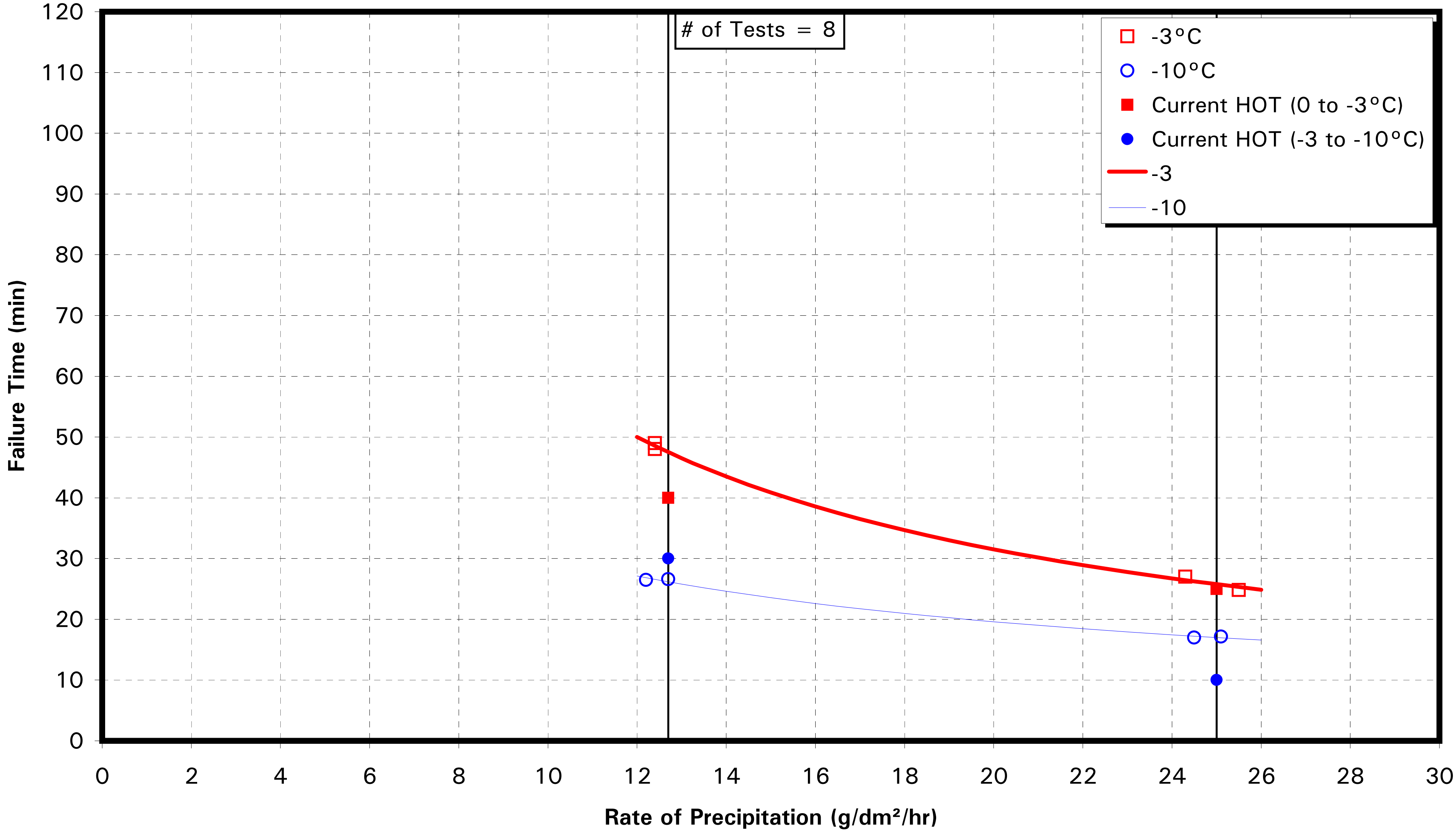


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - NEWAVE AEROCH FCY-1A
AT: 10° (2)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (NEAT)

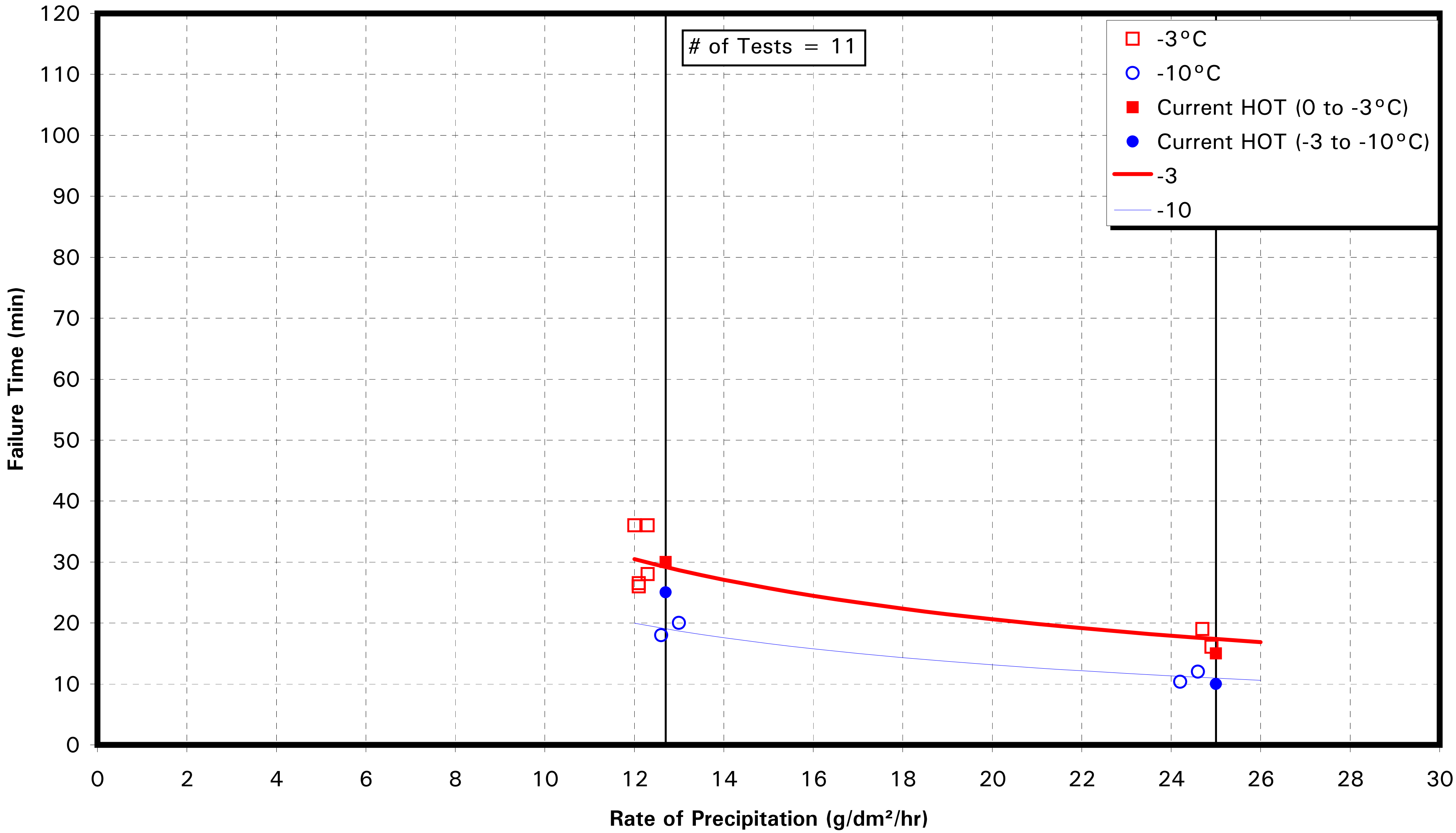
LIGHT FREEZING RAIN



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (75/25)

LIGHT FREEZING RAIN

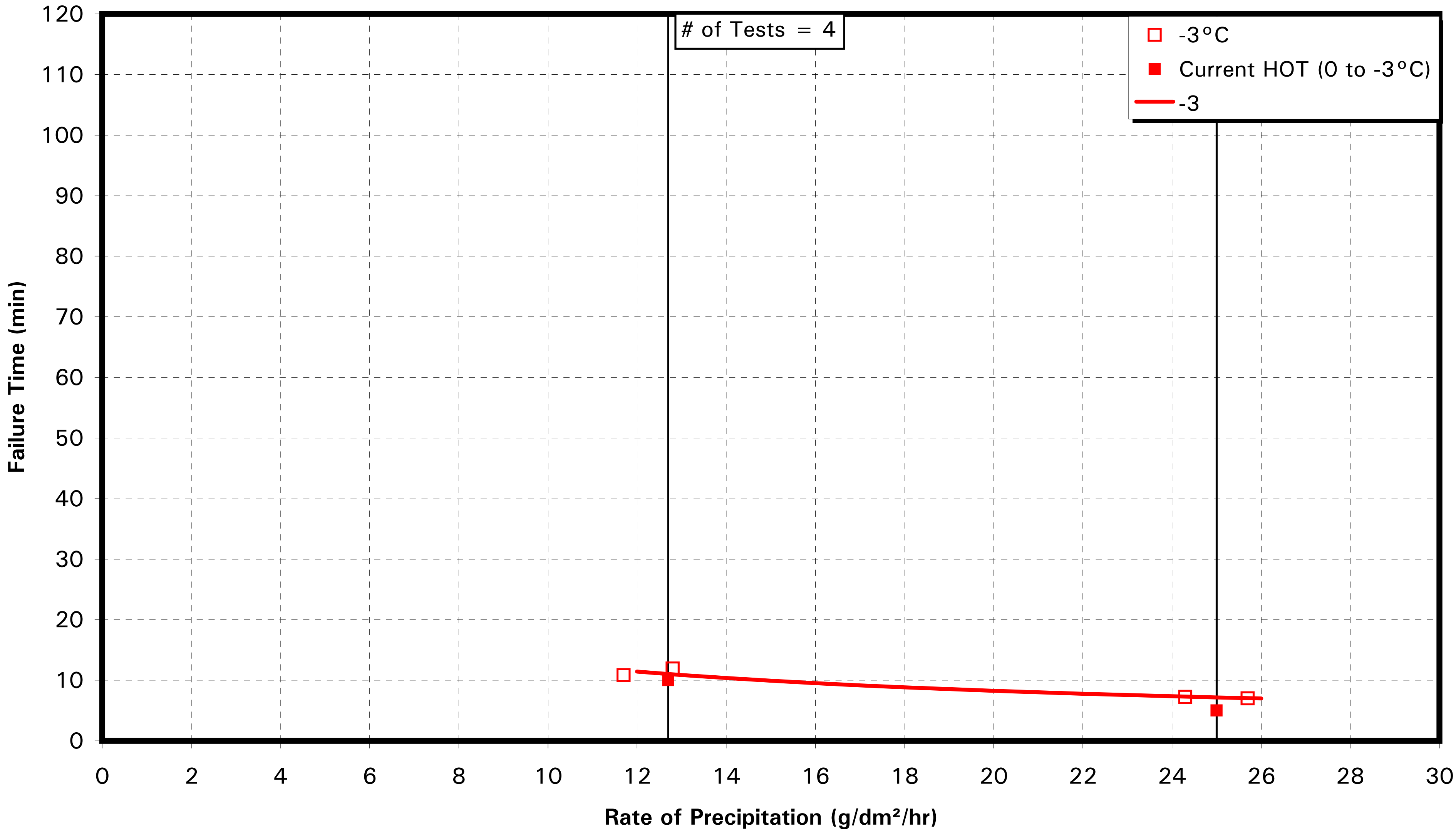


M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - C2012
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (50/50)

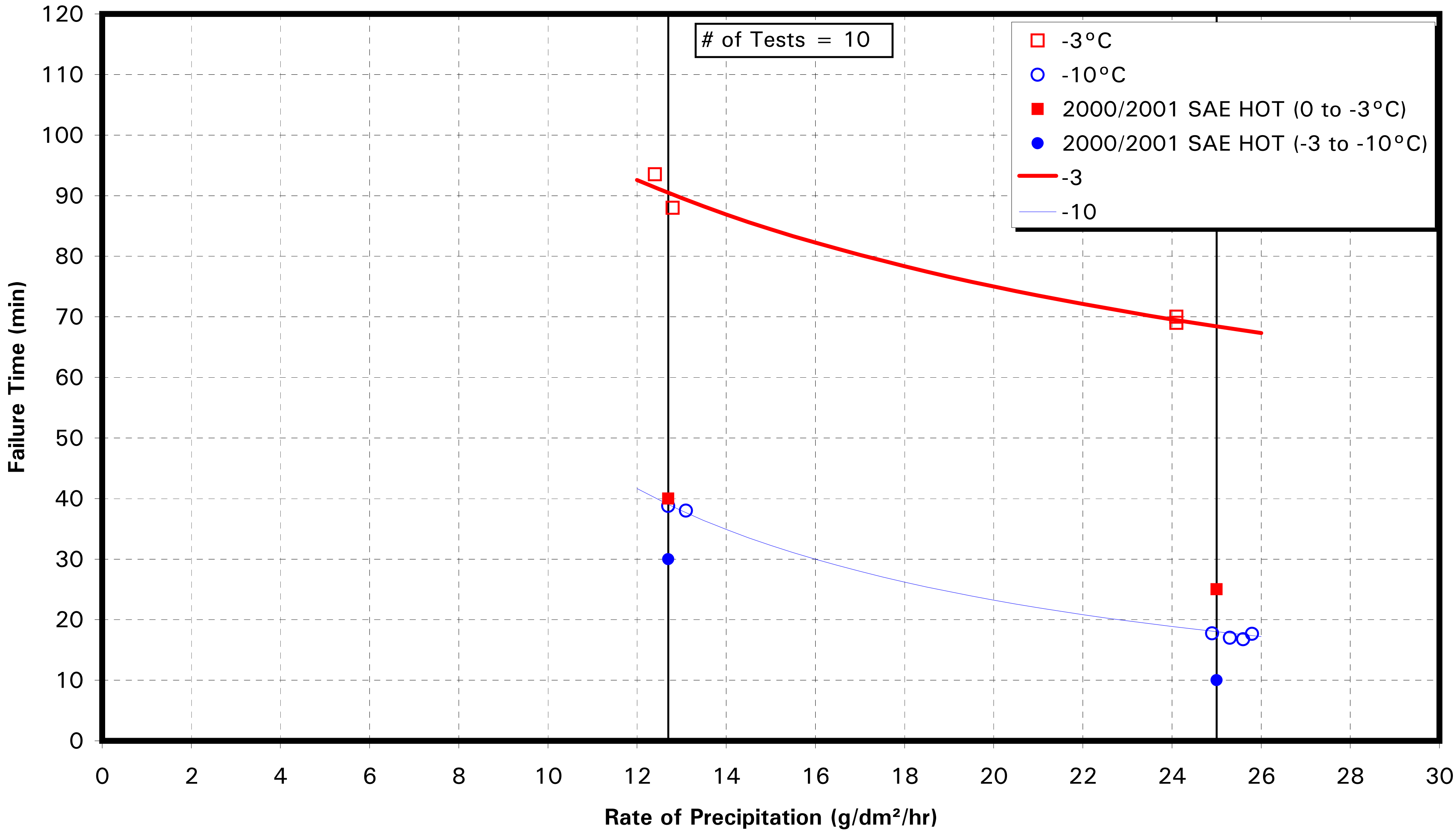
LIGHT FREEZING RAIN



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (NEAT)

LIGHT FREEZING RAIN

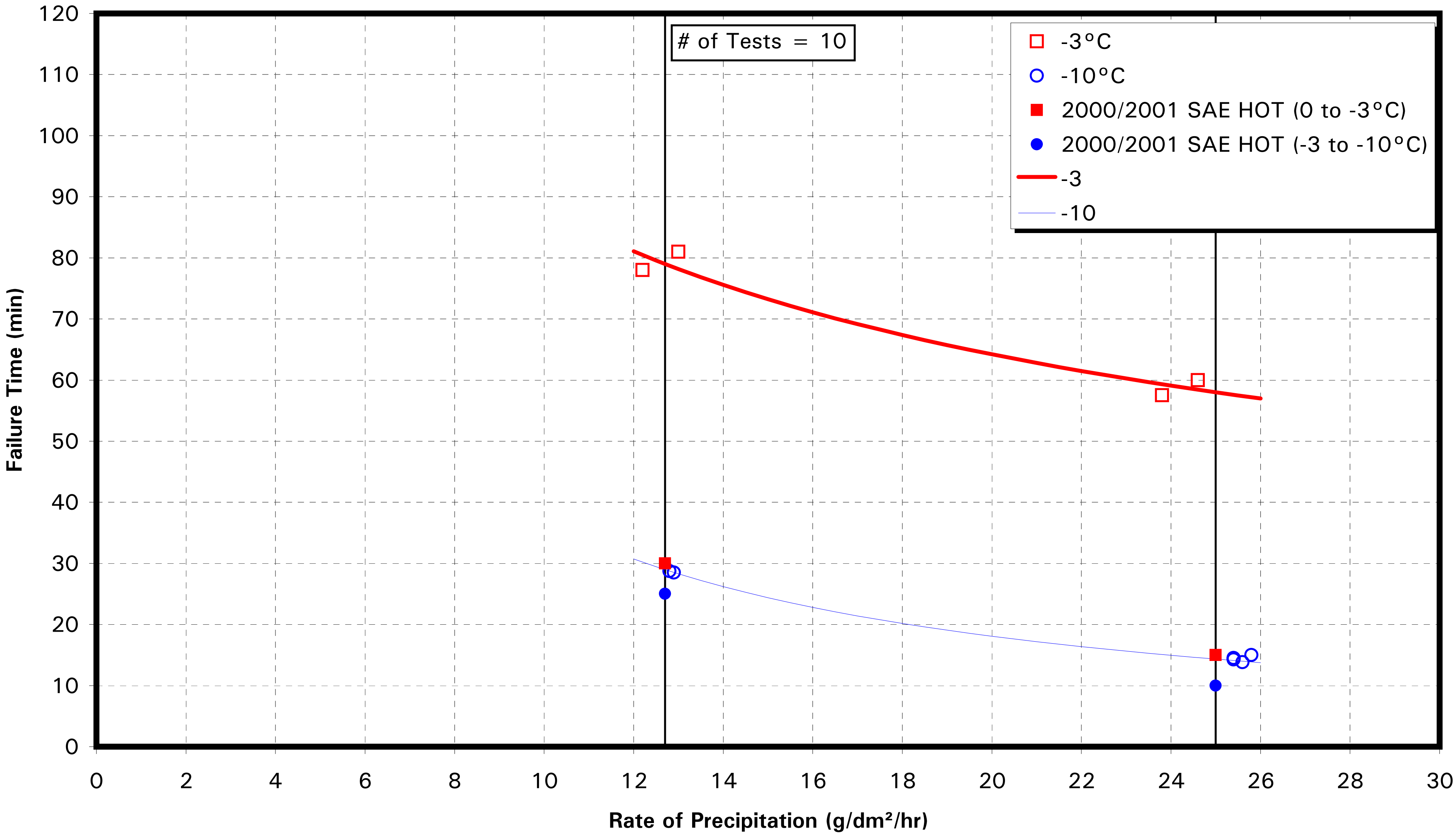


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZR
AT:Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (75/25)

LIGHT FREEZING RAIN

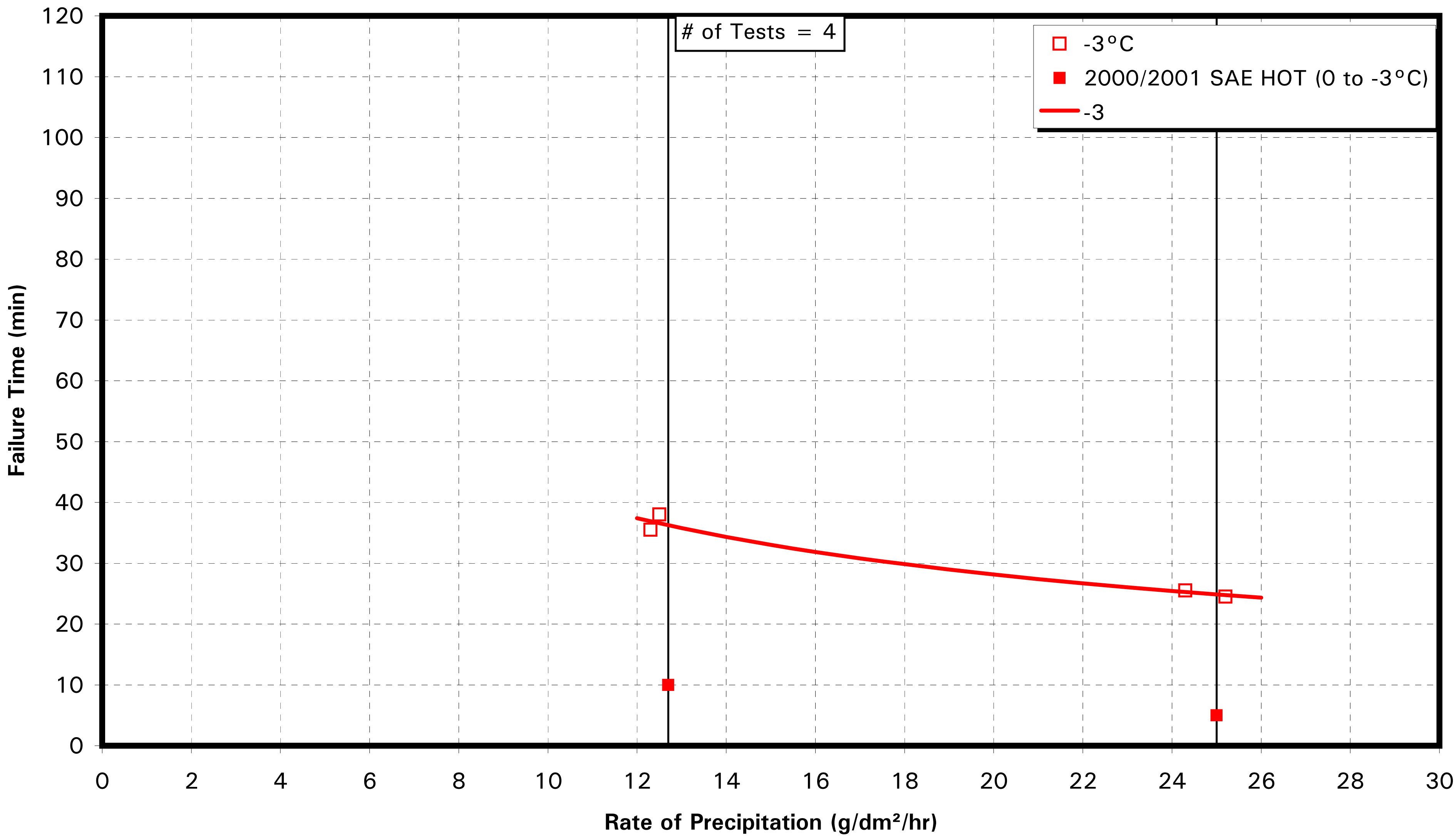


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZR
AT:75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (50/50)

LIGHT FREEZING RAIN

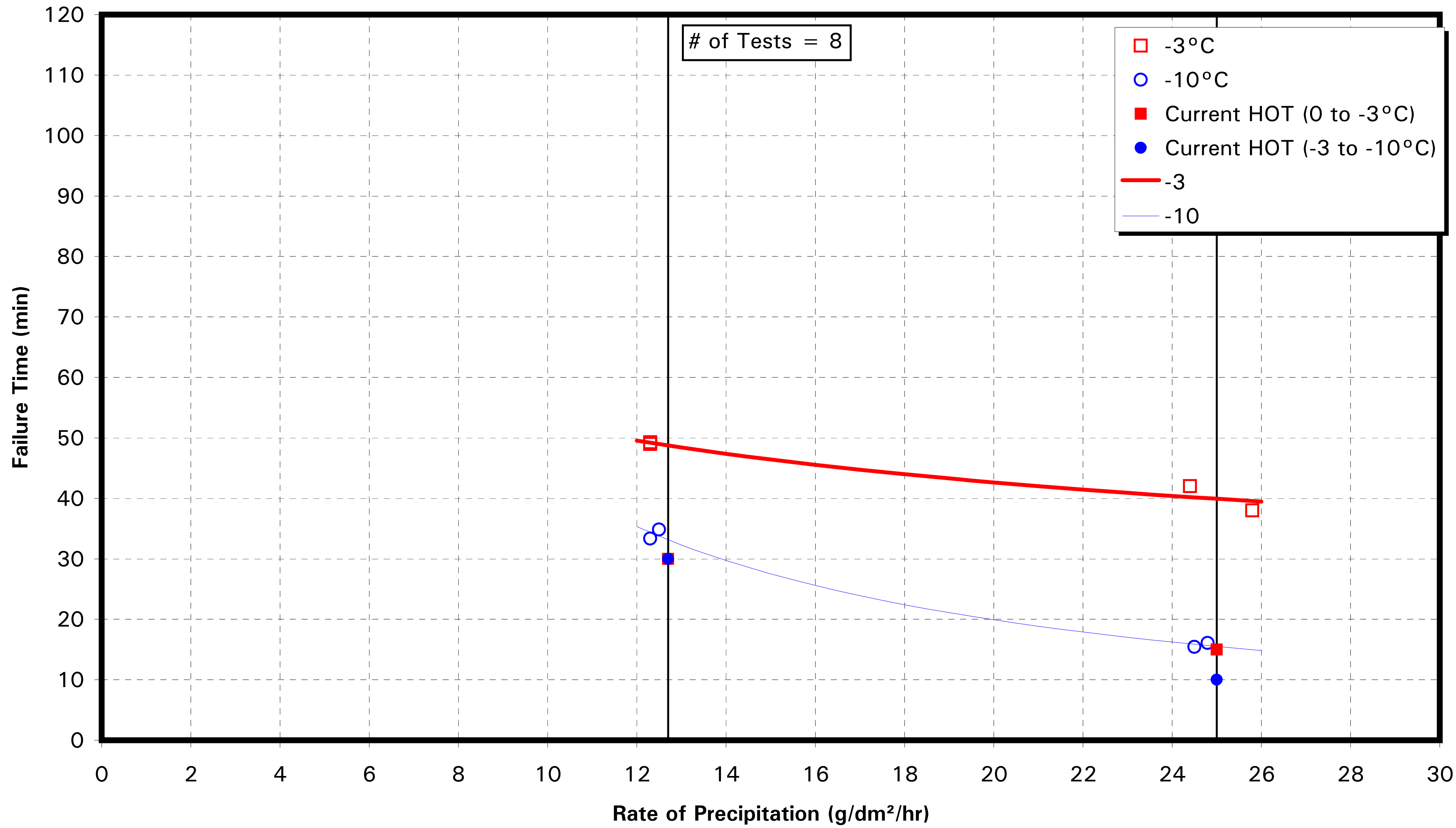


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZR
AT:50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (NEAT)

LIGHT FREEZING RAIN

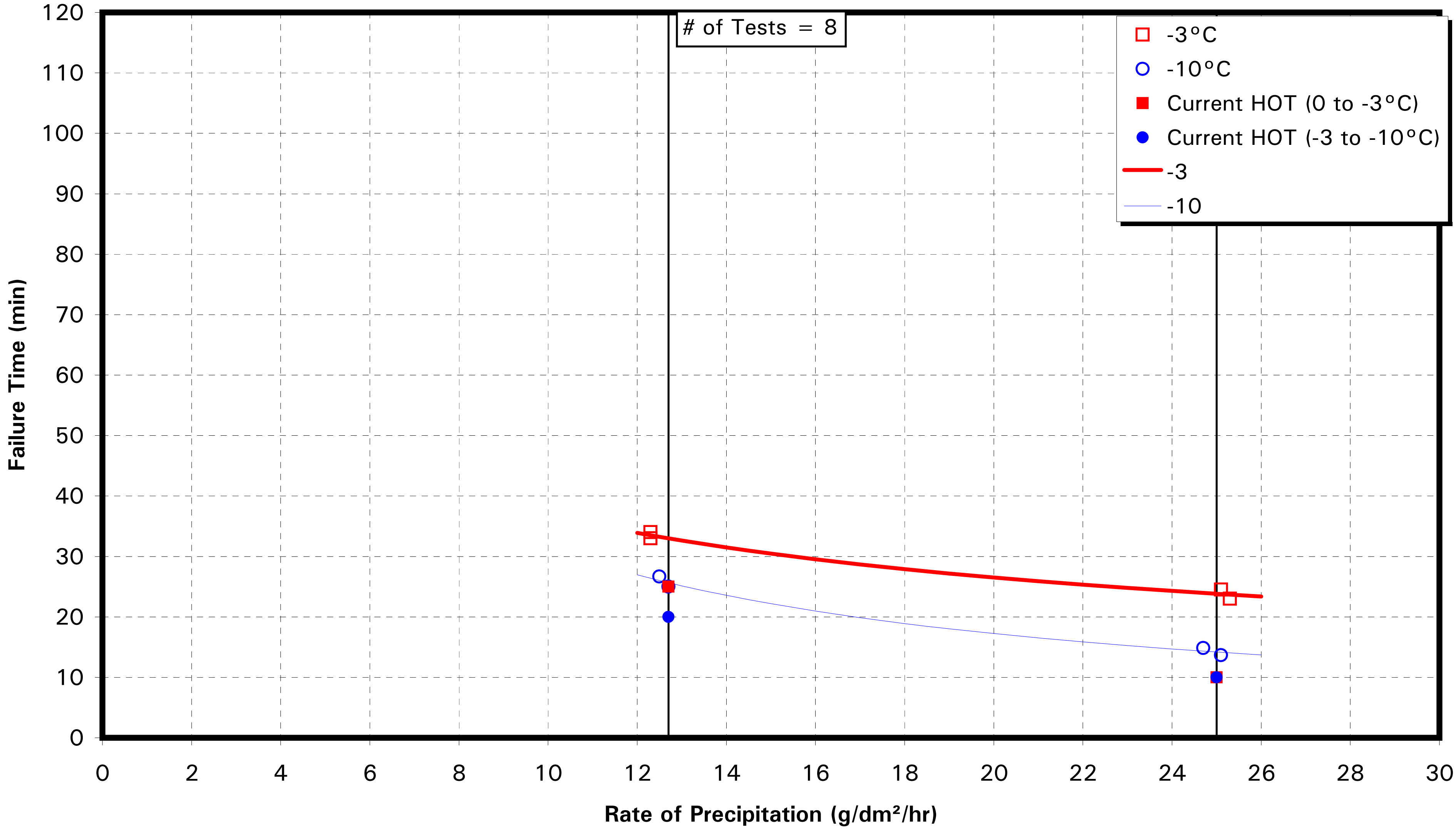


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - SPCA E26
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (75/25)

LIGHT FREEZING RAIN

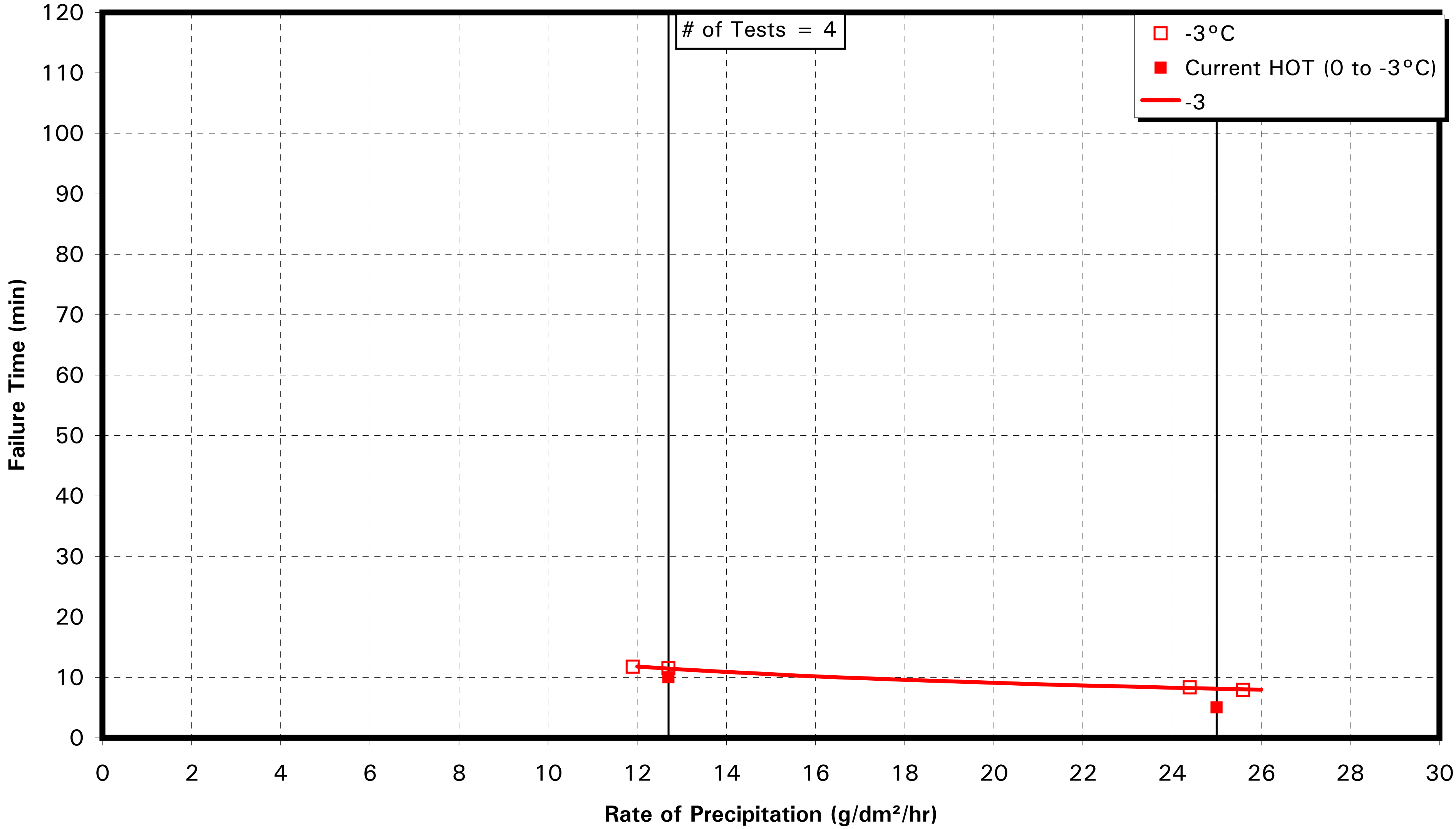


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - SPCA E26
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (50/50)

LIGHT FREEZING RAIN

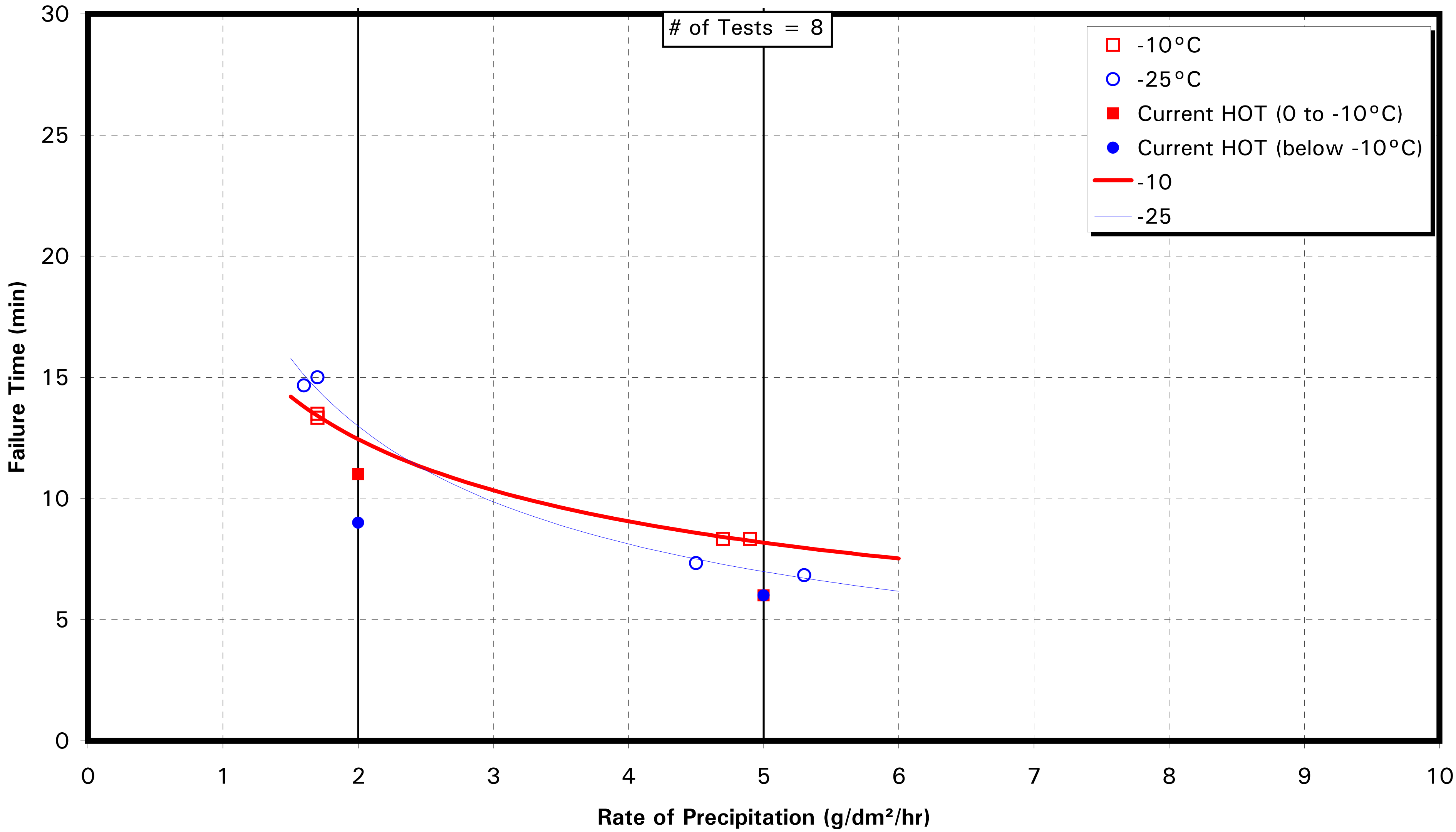


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZR - SPCA E26
AT: 50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

LYONDELL ARCO PLUS - ST (10°)

FREEZING FOG

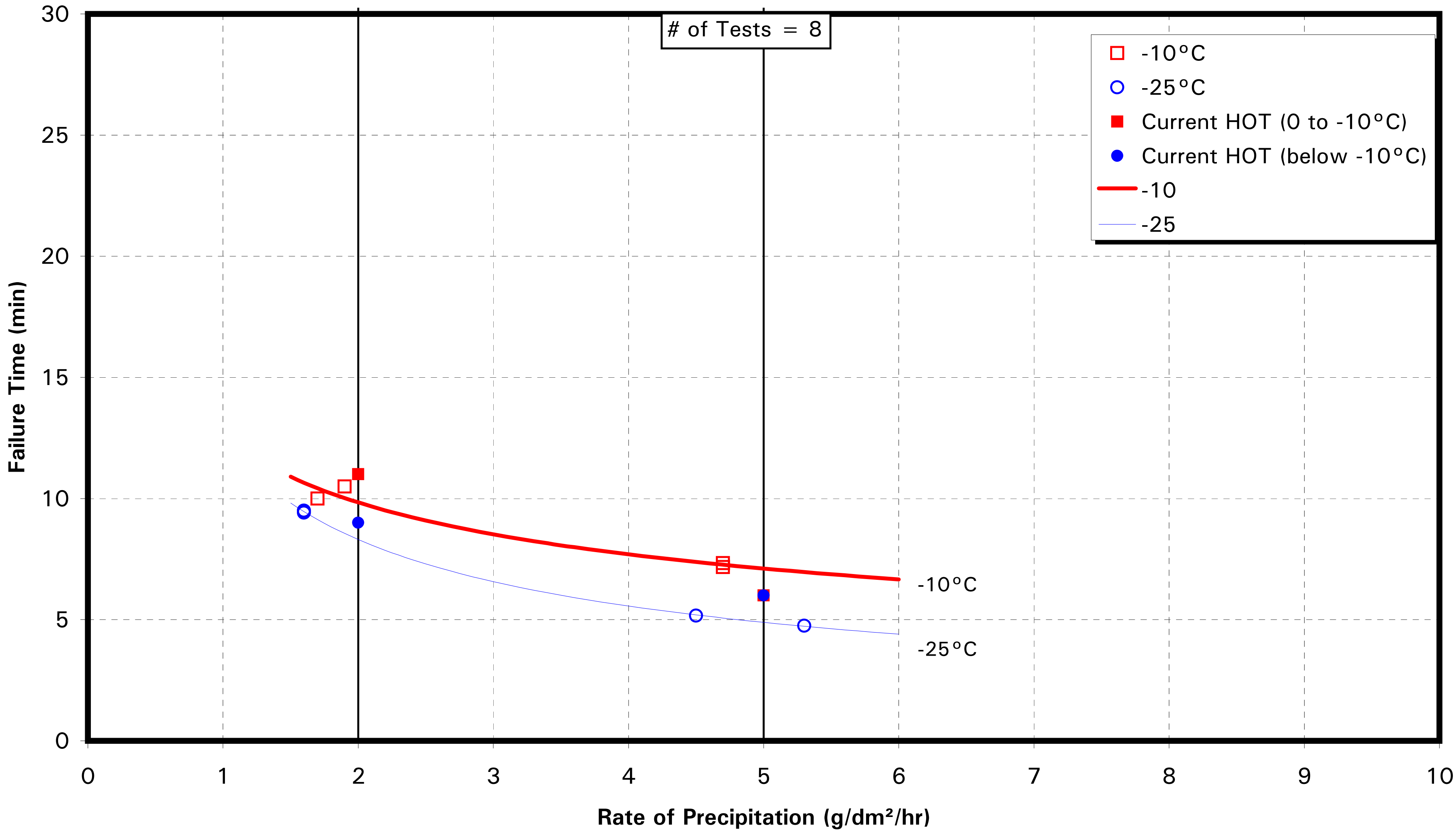


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - LYONDELL ARCO + AT: 10° (2)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

NEWAVE AEROCH. FCY-1A (10°)

FREEZING FOG

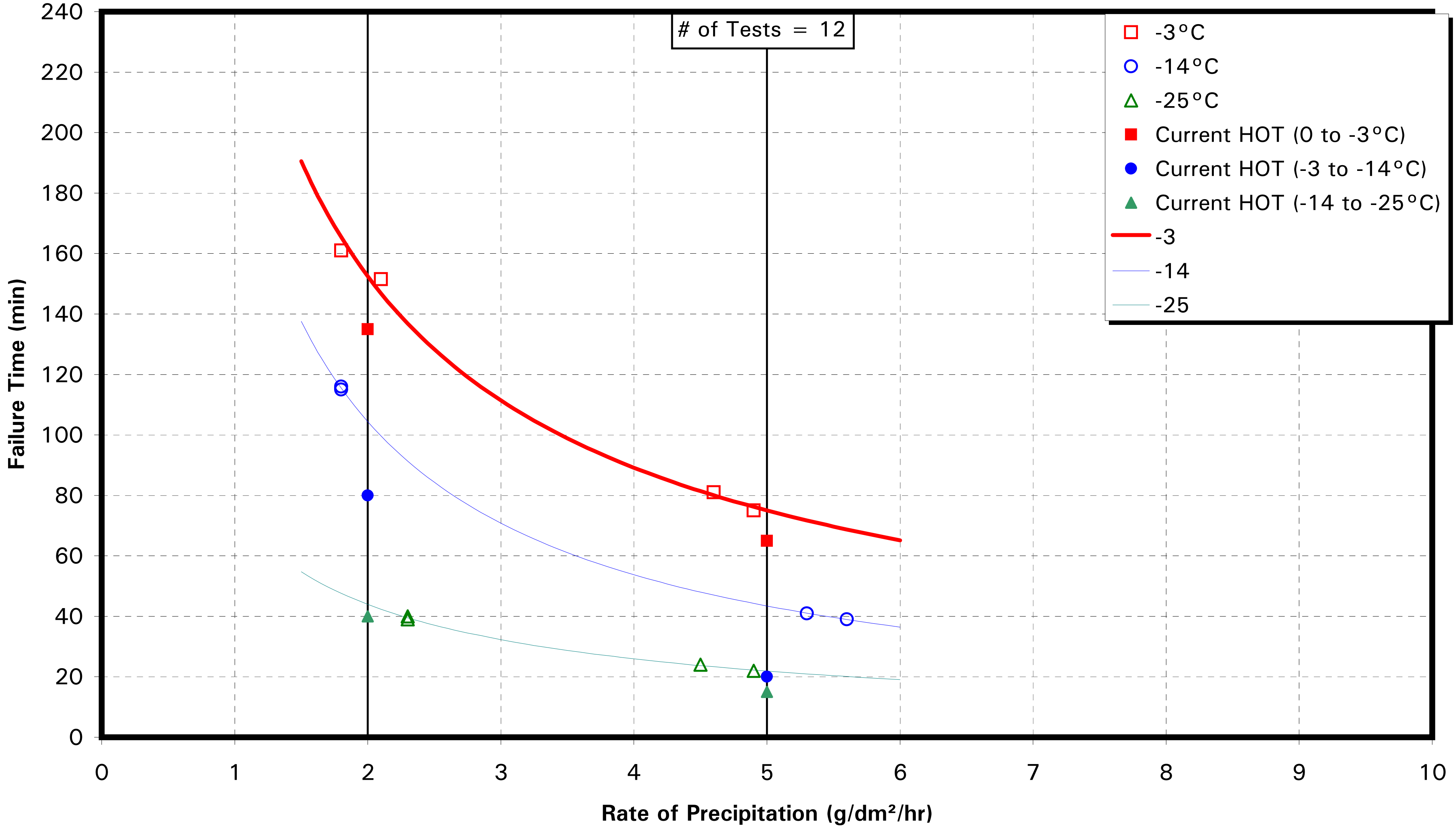


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - NEWAVE AEROCH. FCY-1A
AT: 10° (2)

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (NEAT)

FREEZING FOG

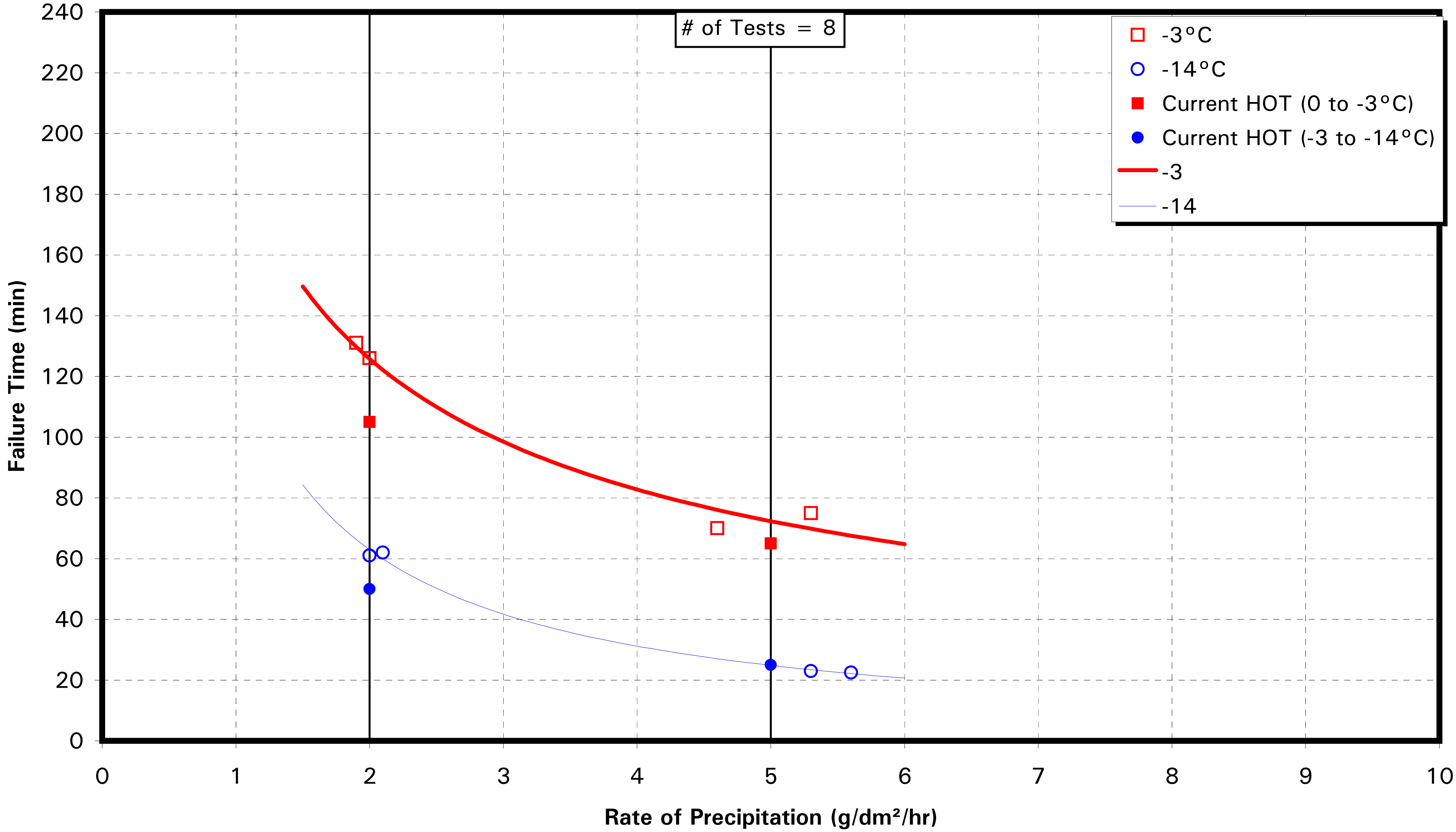


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - C2012
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (75/25)

FREEZING FOG

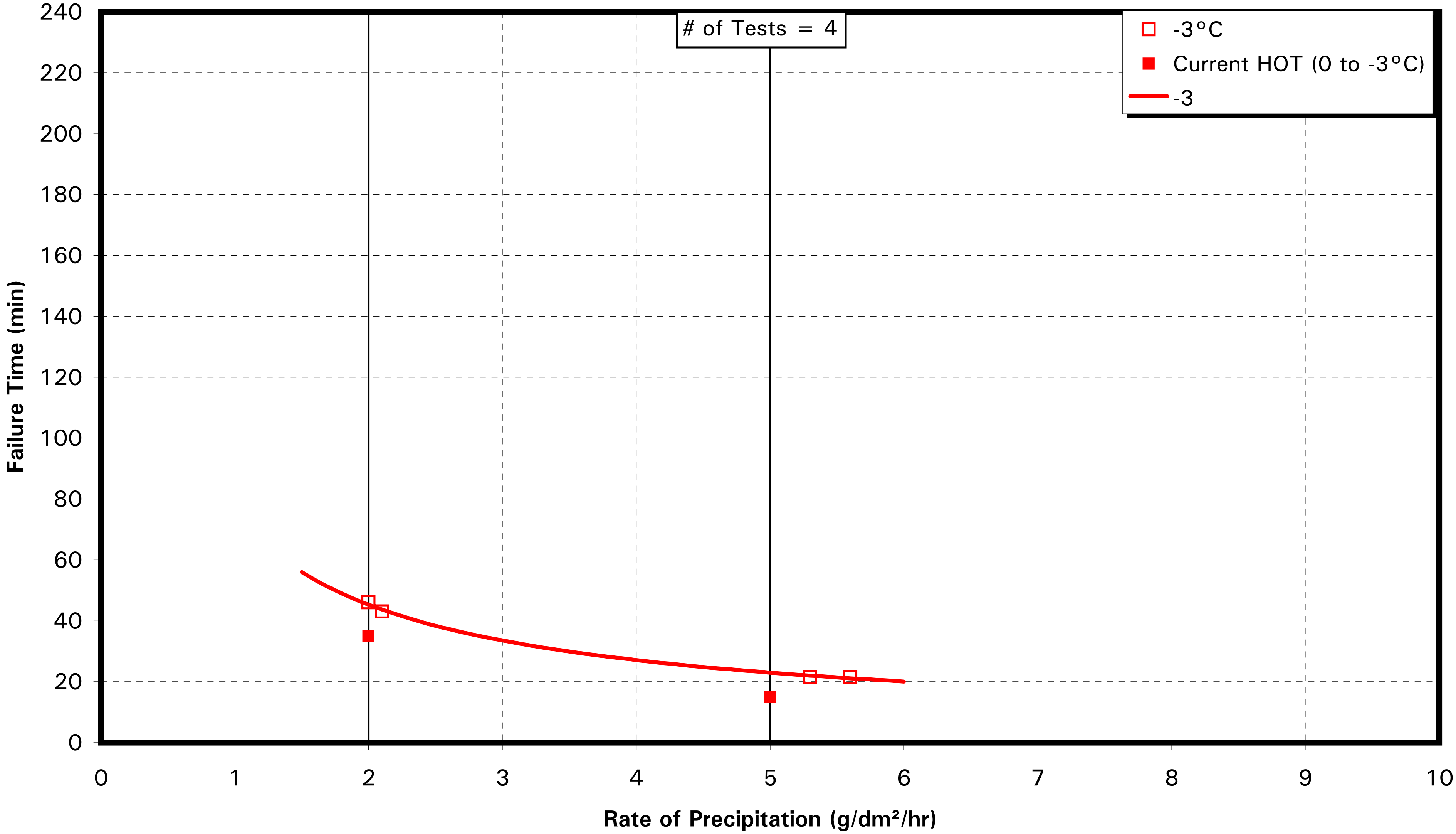


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - C2012
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (50/50)

FREEZING FOG

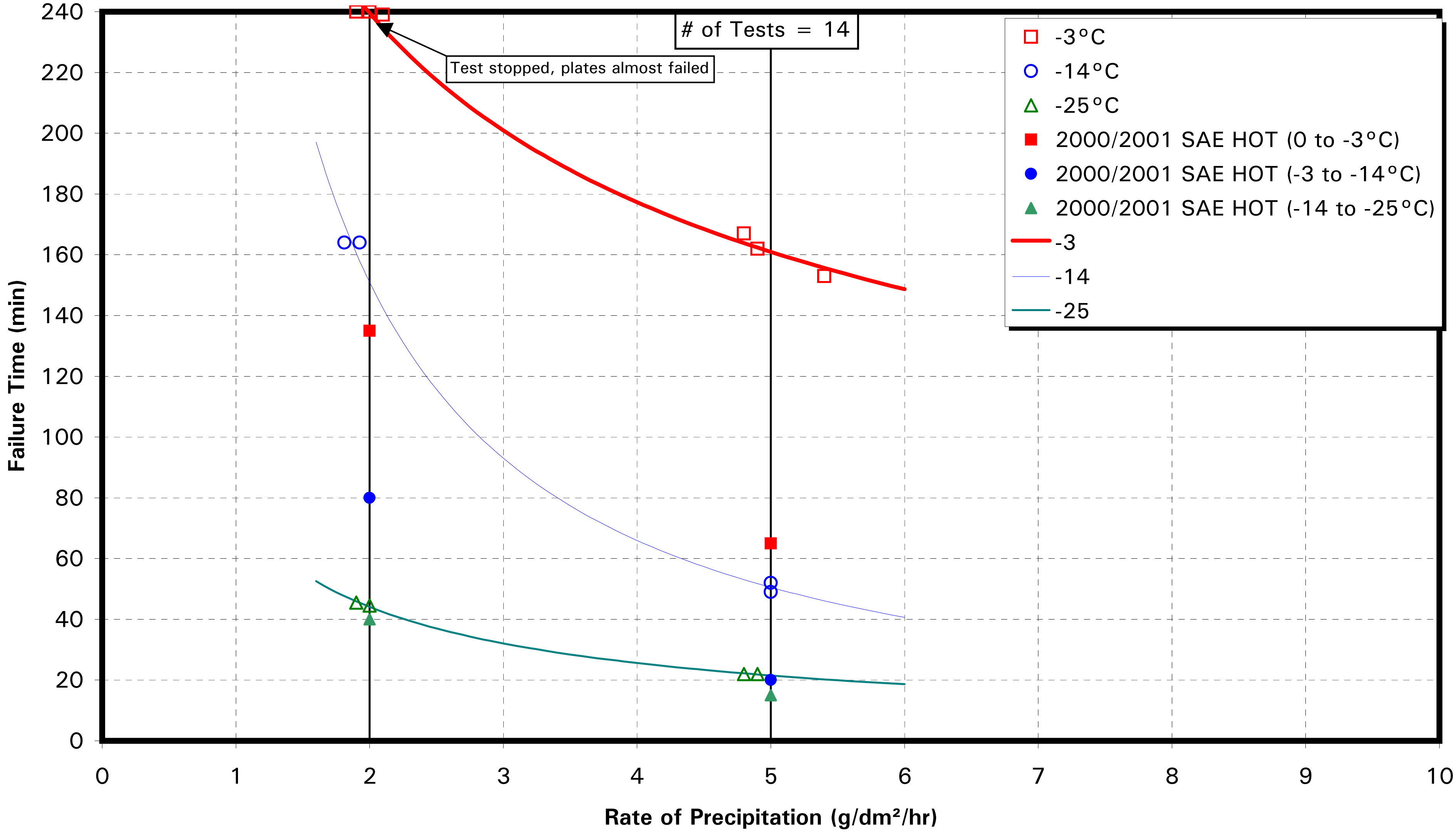


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - C2012
AT: 50-50

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (NEAT)

FREEZING FOG

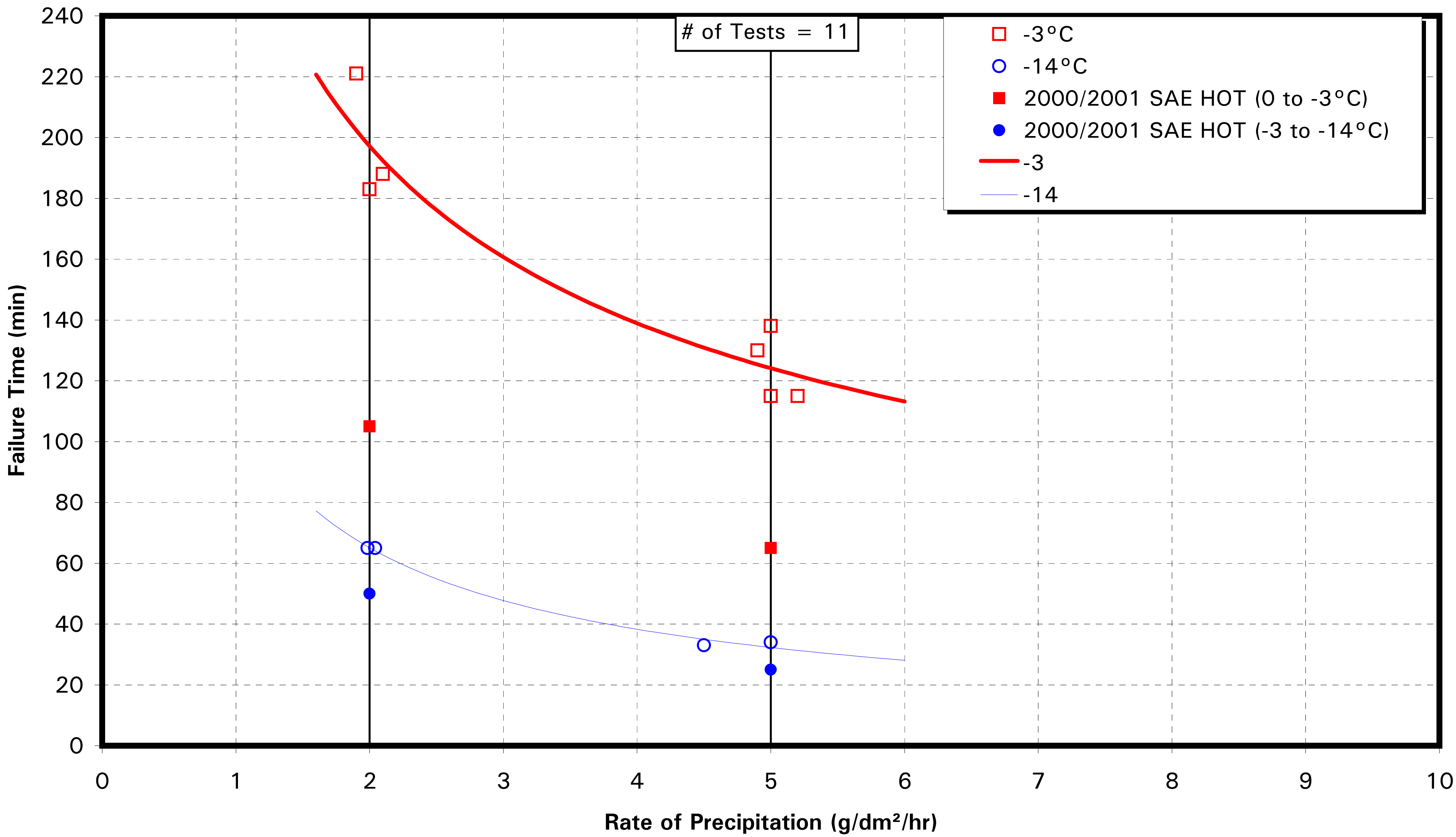


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZF
AT:Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (75/25)

FREEZING FOG

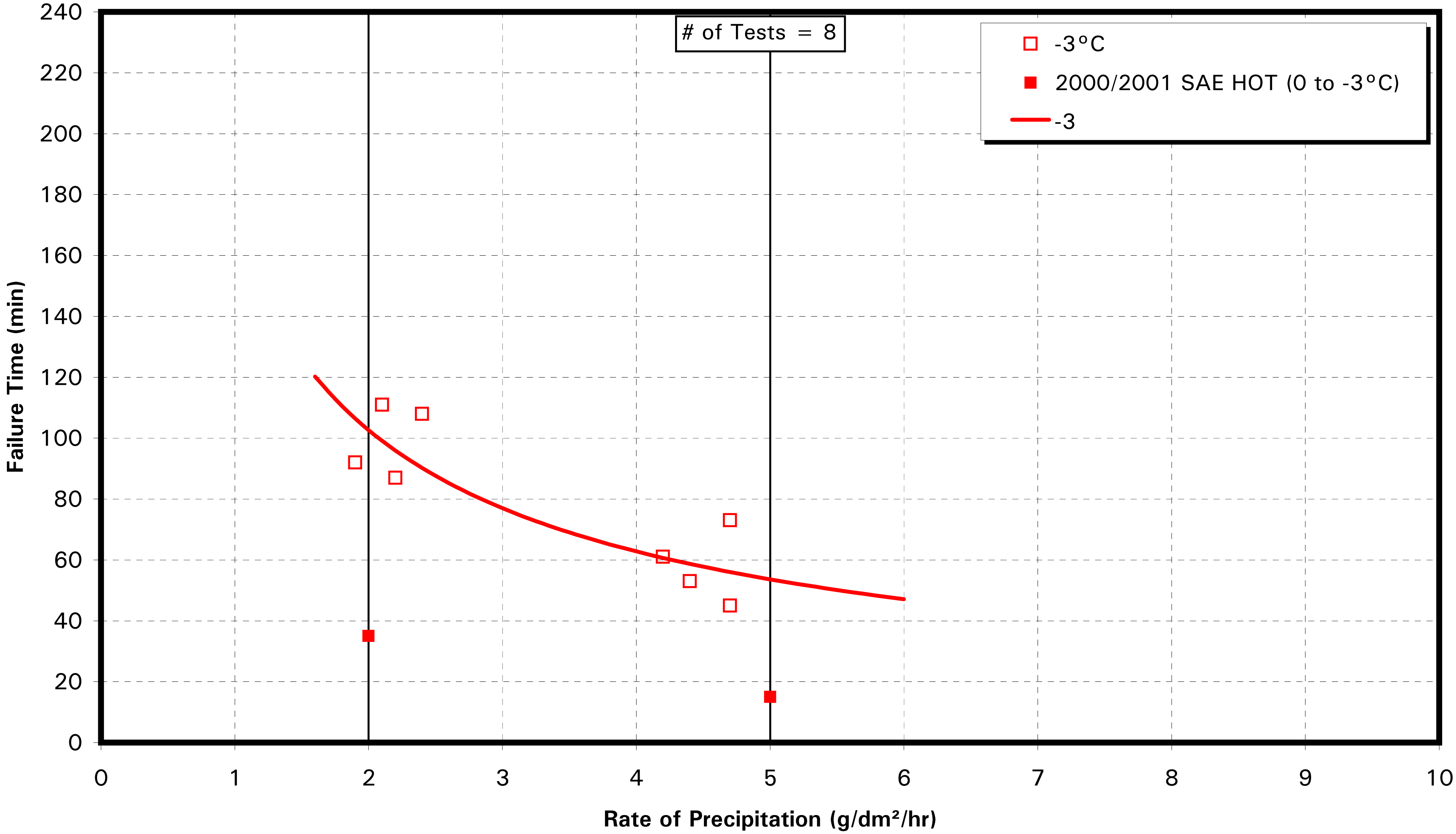


M\Groups\CM1680 (exBM3833)\Analysis\NRC 2001 JUNE\Charts\ZF
AT:75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (50/50)

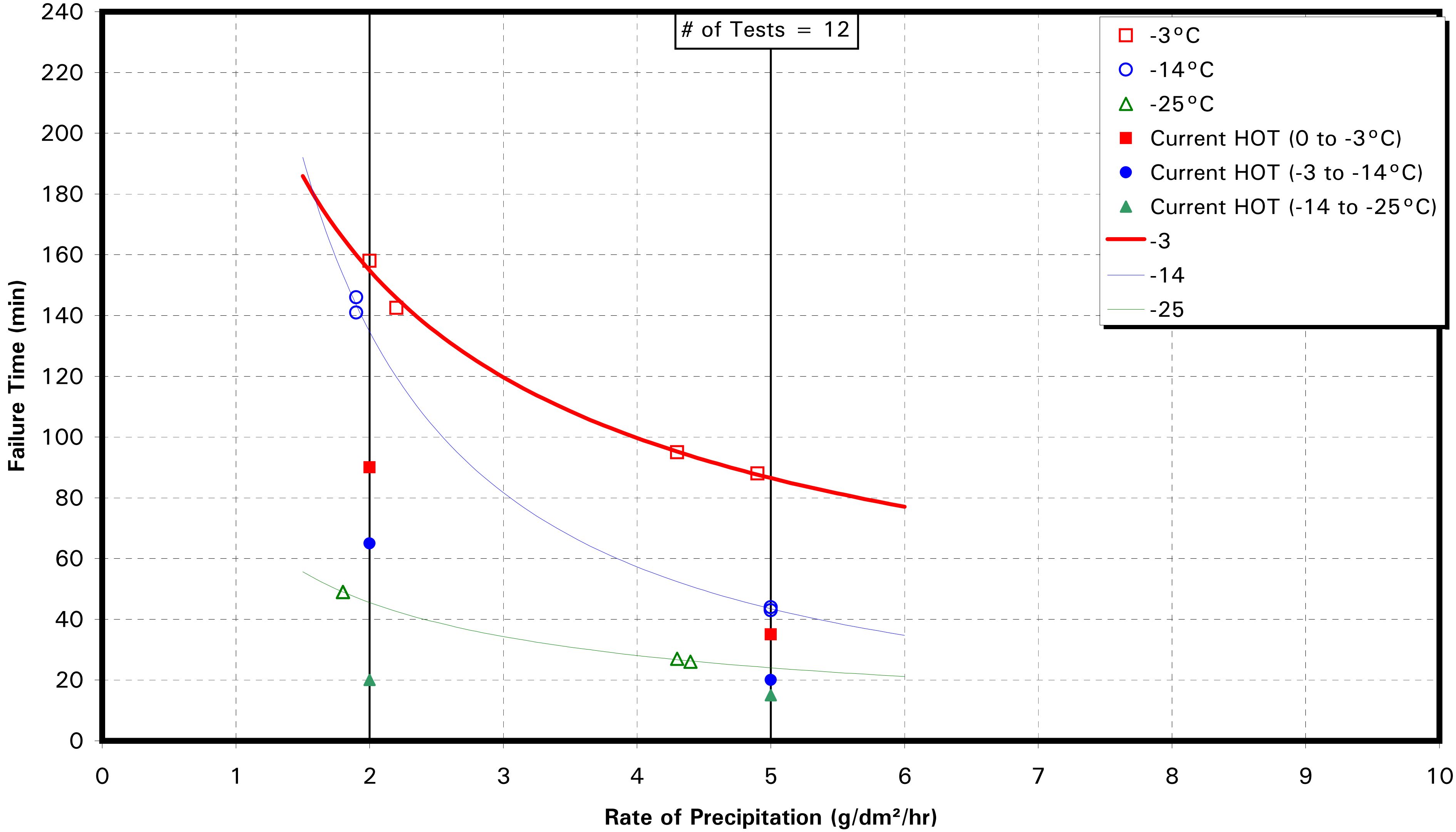
FREEZING FOG



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (NEAT)

FREEZING FOG

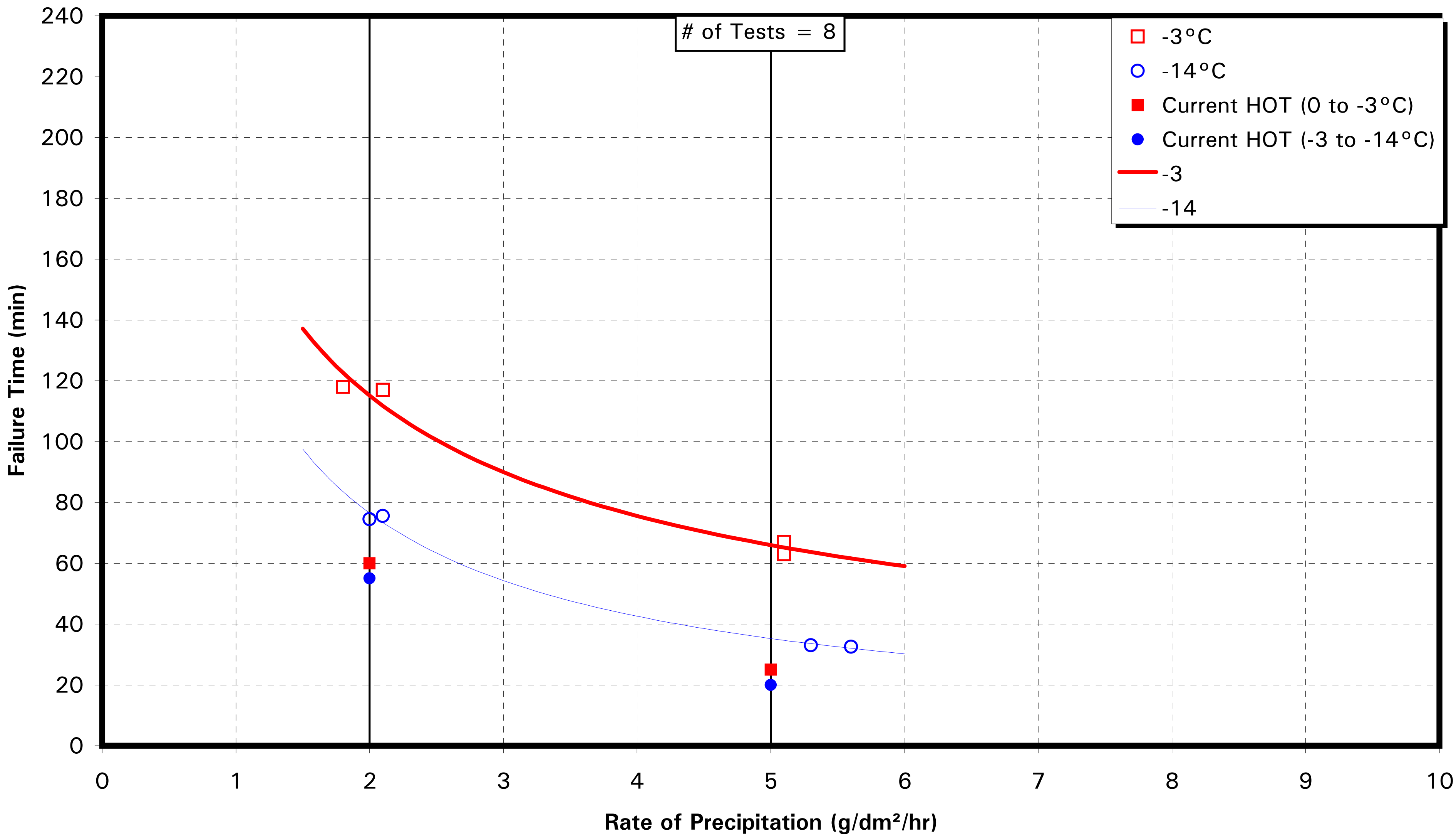


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - SPCA E26
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (75/25)

FREEZING FOG

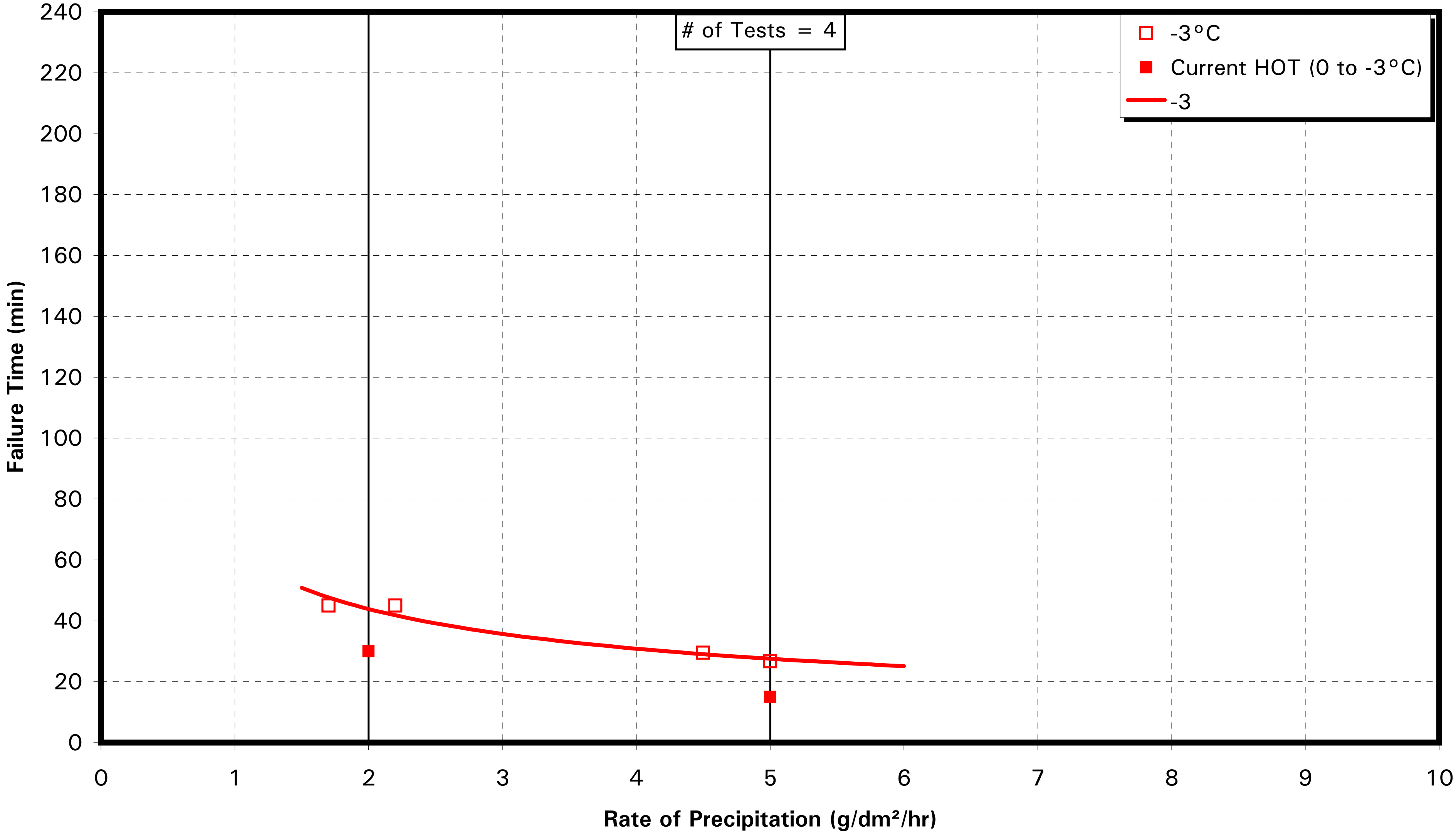


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\ZF - SPCA E26
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (50/50)

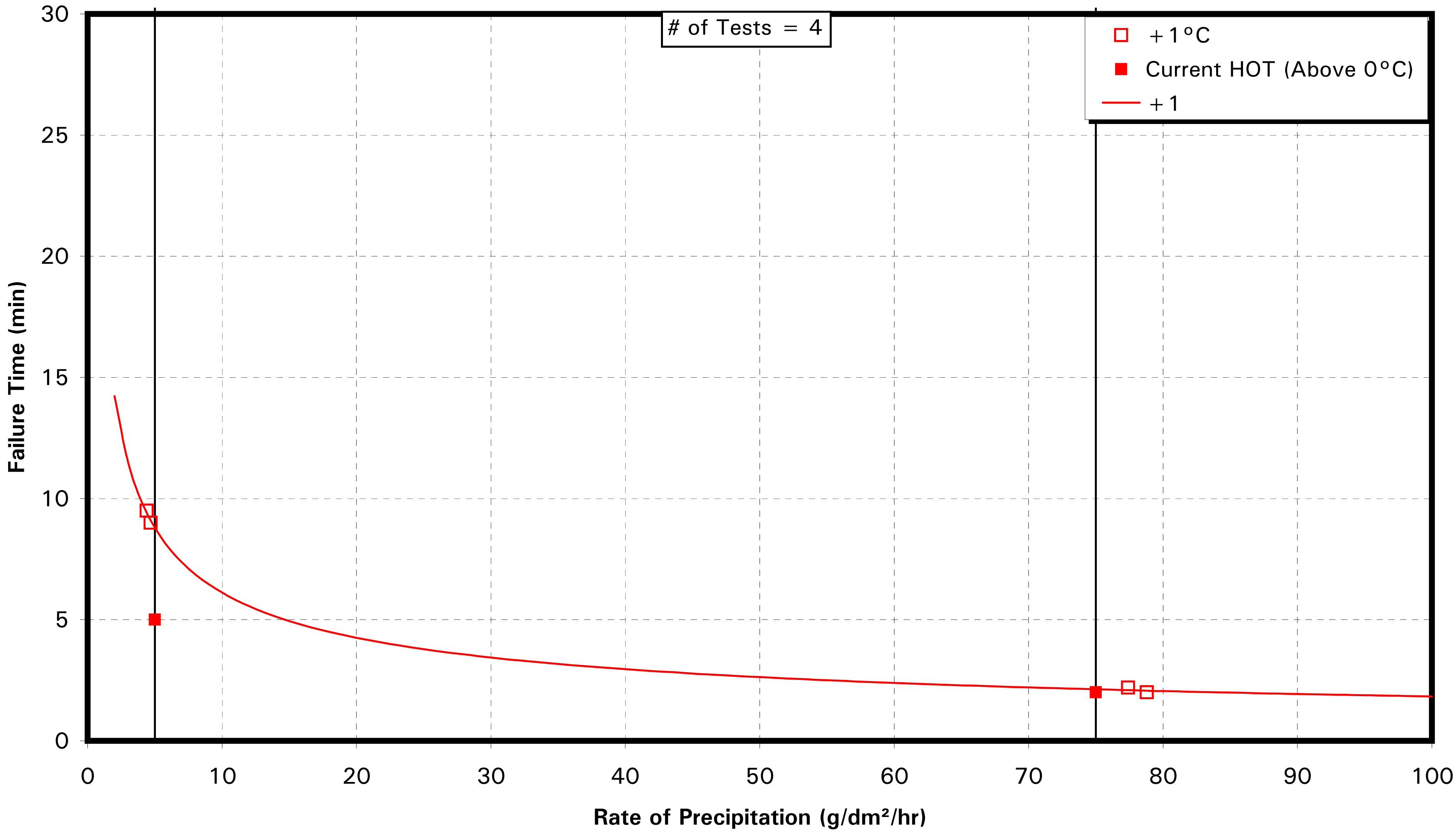
FREEZING FOG



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

LYONDELL ARCO PLUS - ST (10°)

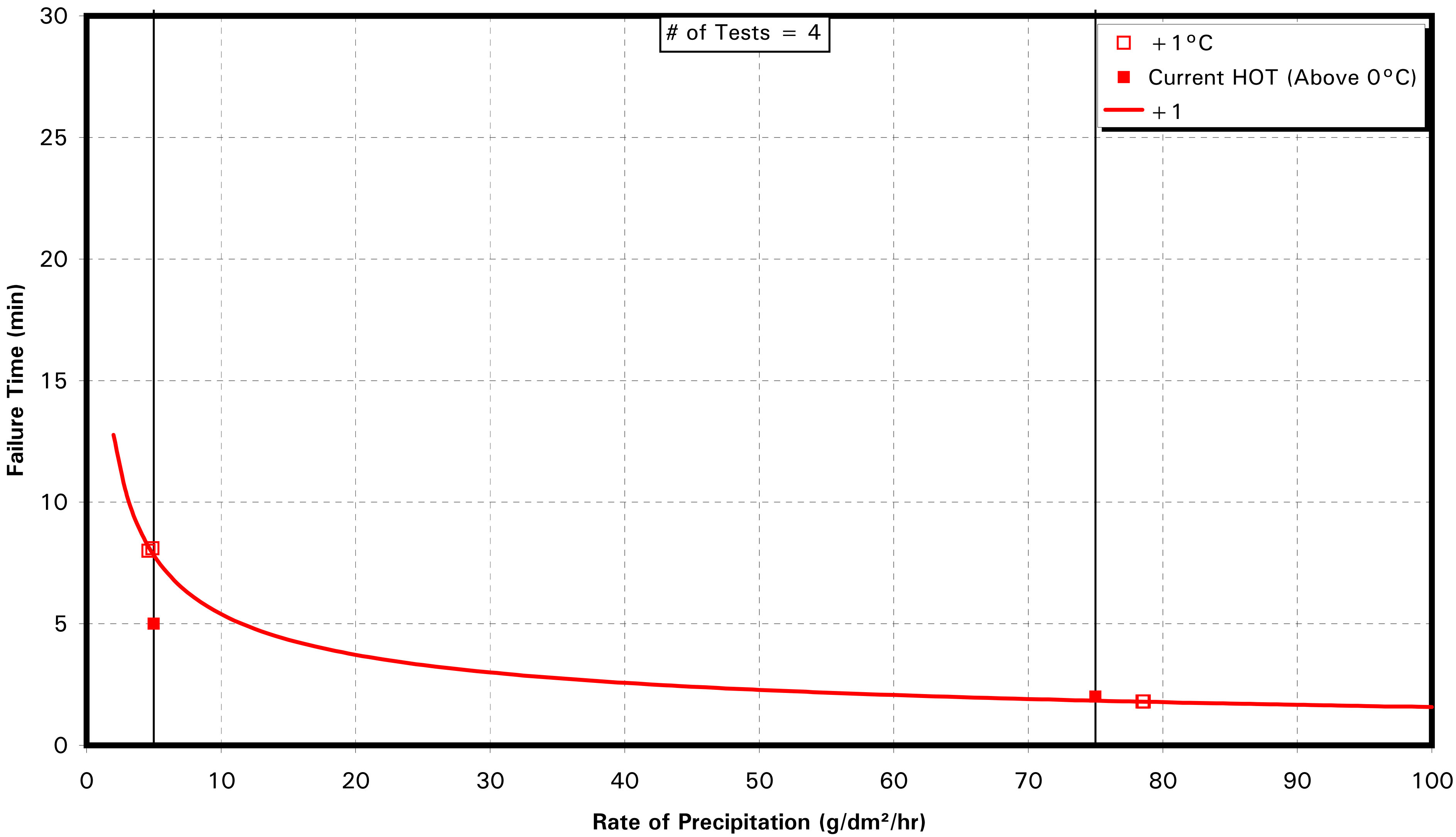
RAIN ON COLD-SOAKED SURFACE



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

NEWAVE AEROCH. FCY-1A (10°)

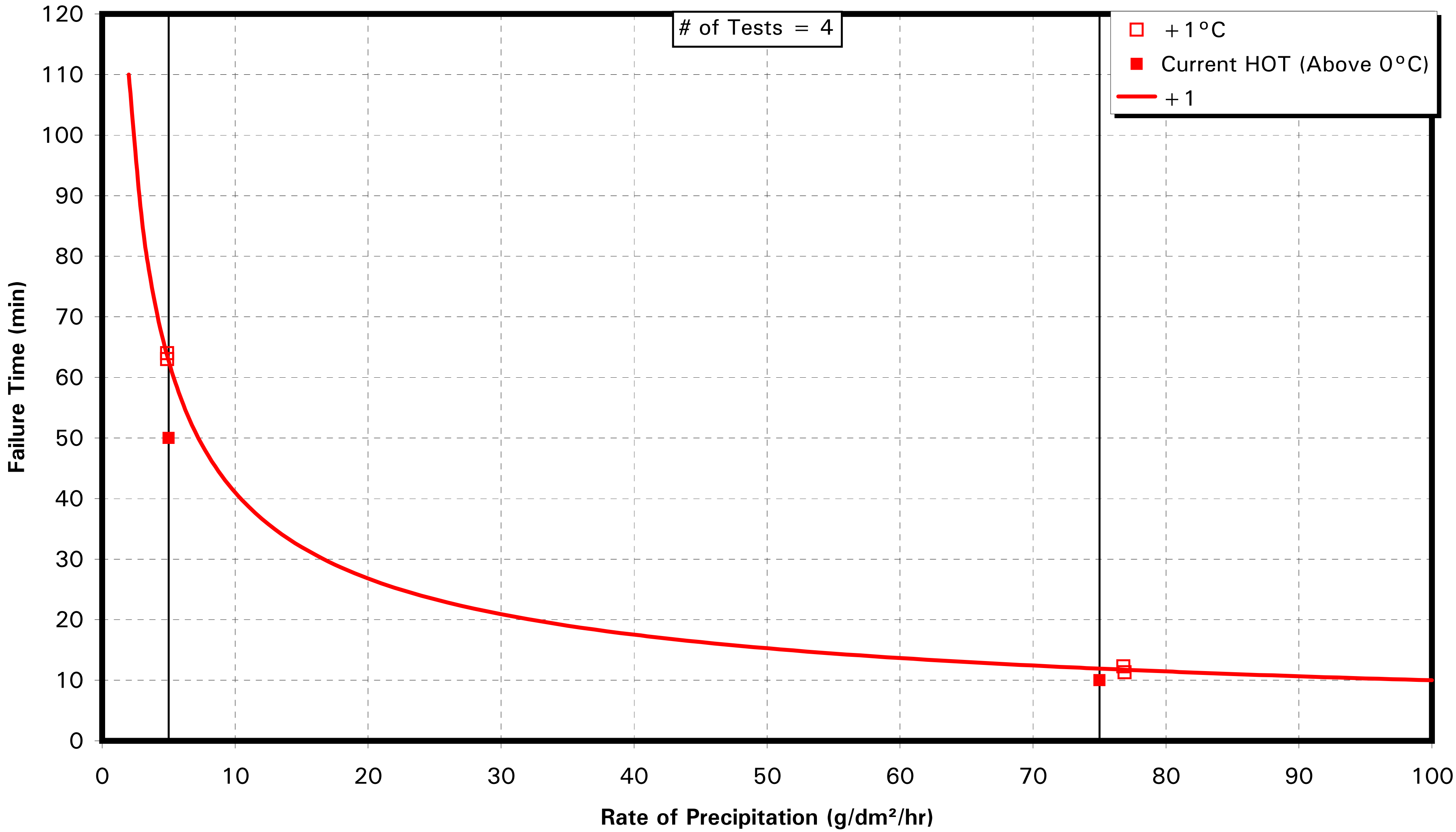
RAIN ON COLD-SOAKED SURFACE



EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (NEAT)

RAIN ON COLD-SOAKED SURFACE

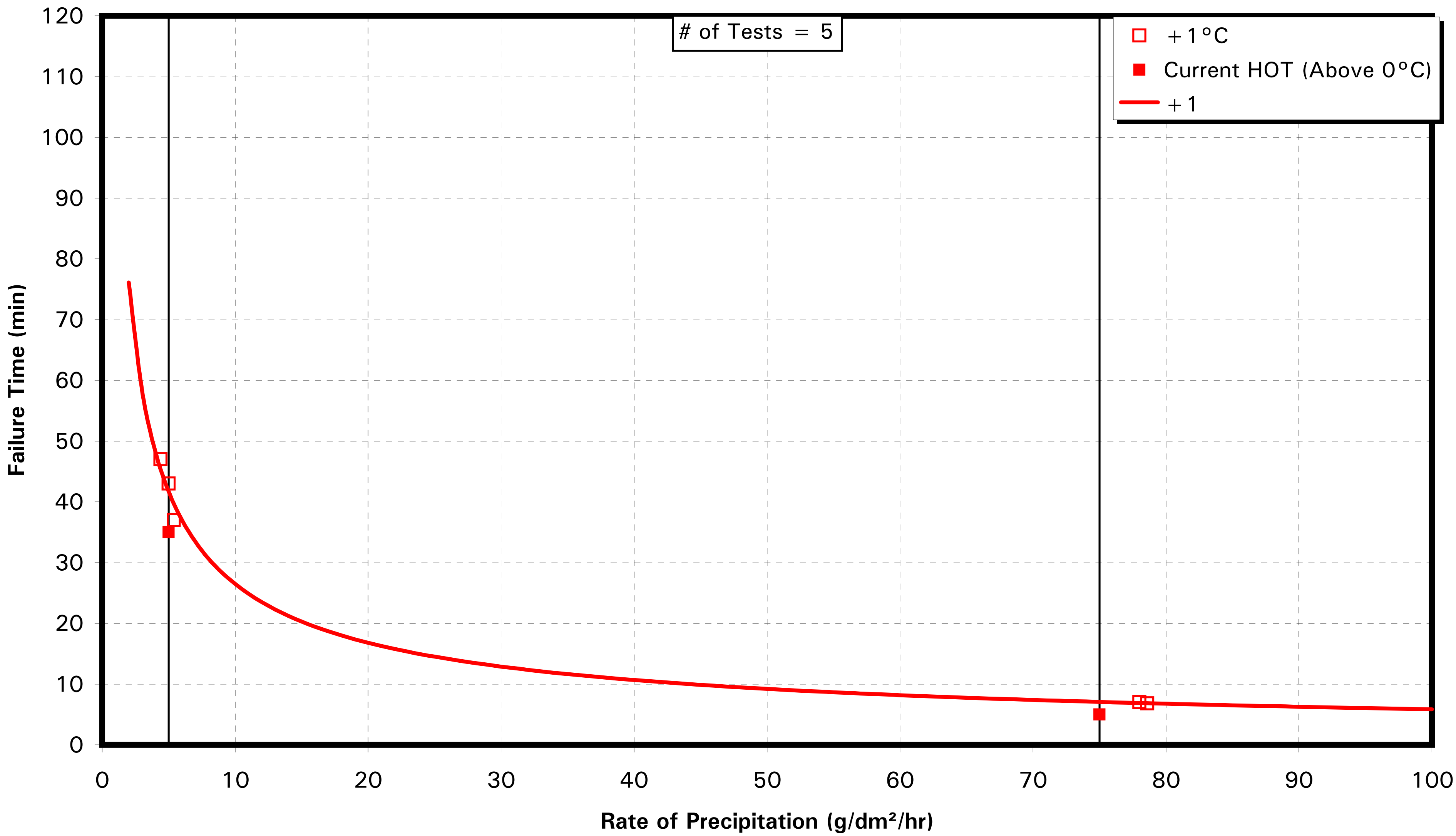


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\CS - C2012
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

CLARIANT 2012 (75/25)

RAIN ON COLD-SOAKED SURFACE

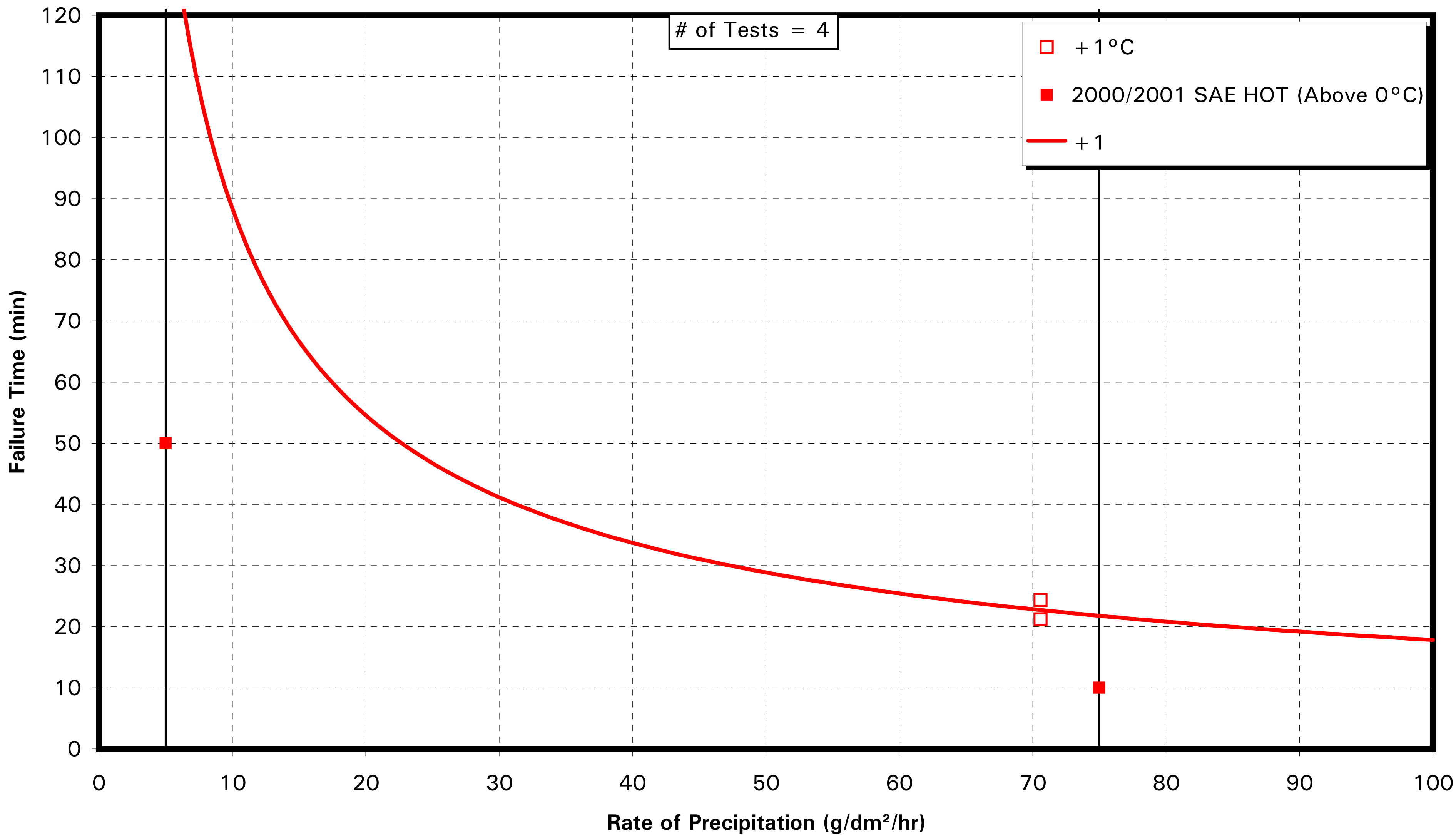


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\CS - C2012
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (NEAT)

RAIN ON COLD-SOAKED SURFACE

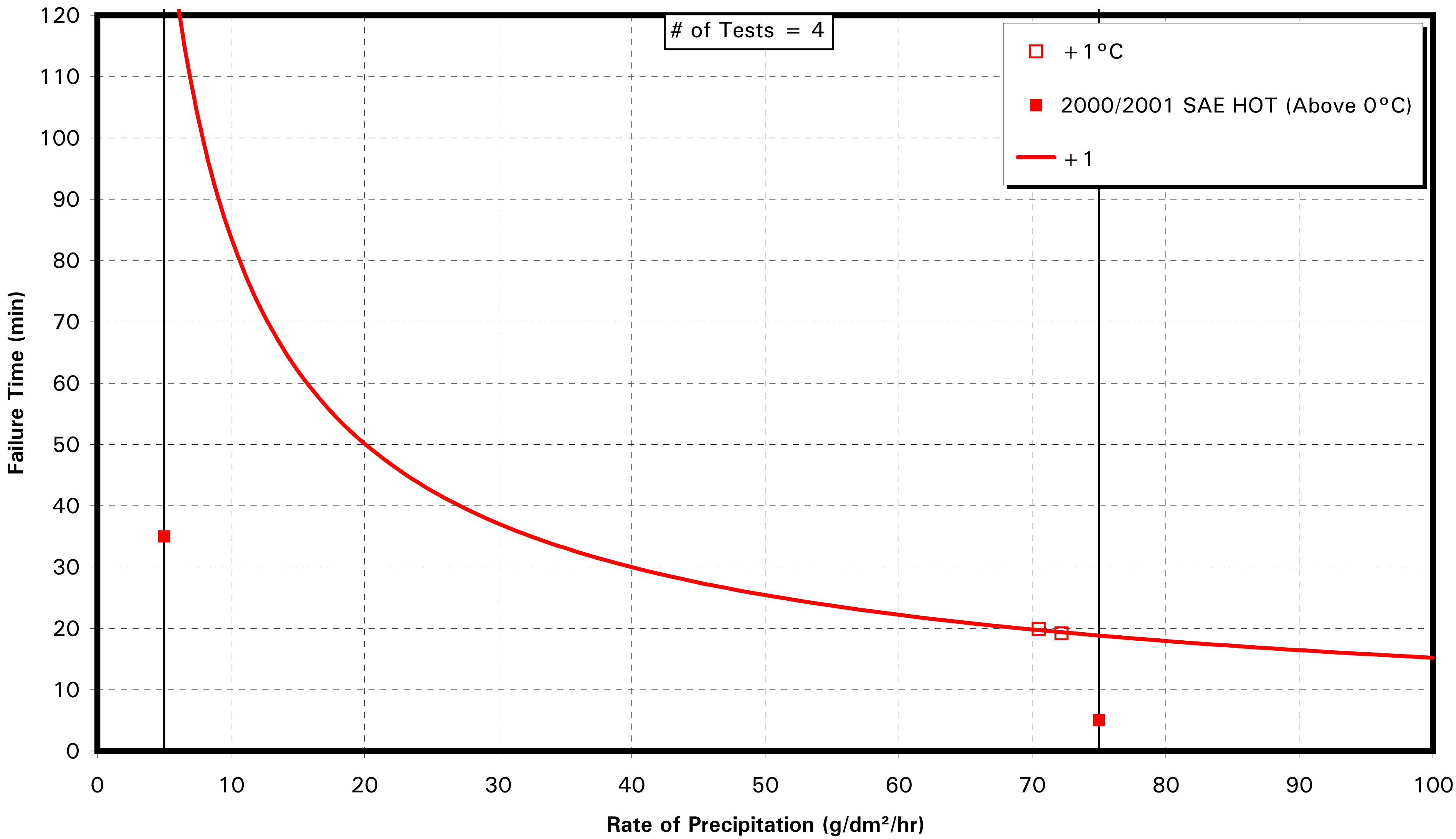


Groups\CM1680(exBM3833)\Analysis\NRC 2001 JUNE\Charts\CS
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

OCTAGON MAXFLIGHT (75/25)

RAIN ON COLD-SOAKED SURFACE

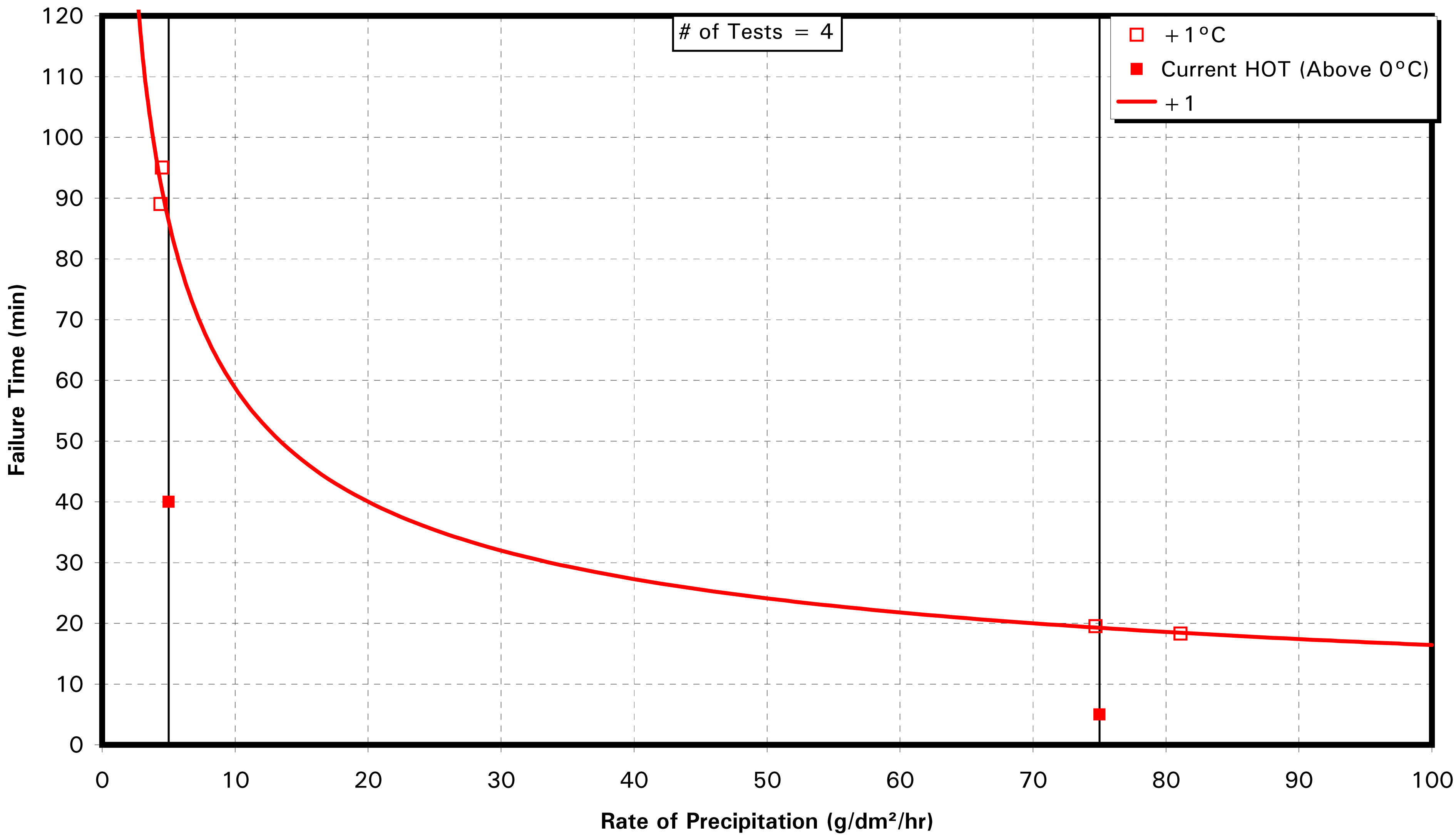


Groups\CM1680(exBM3833)\Analysis\NRC 2001 JUNE\Charts\CS
AT: 75-25

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (NEAT)

RAIN ON COLD-SOAKED SURFACE

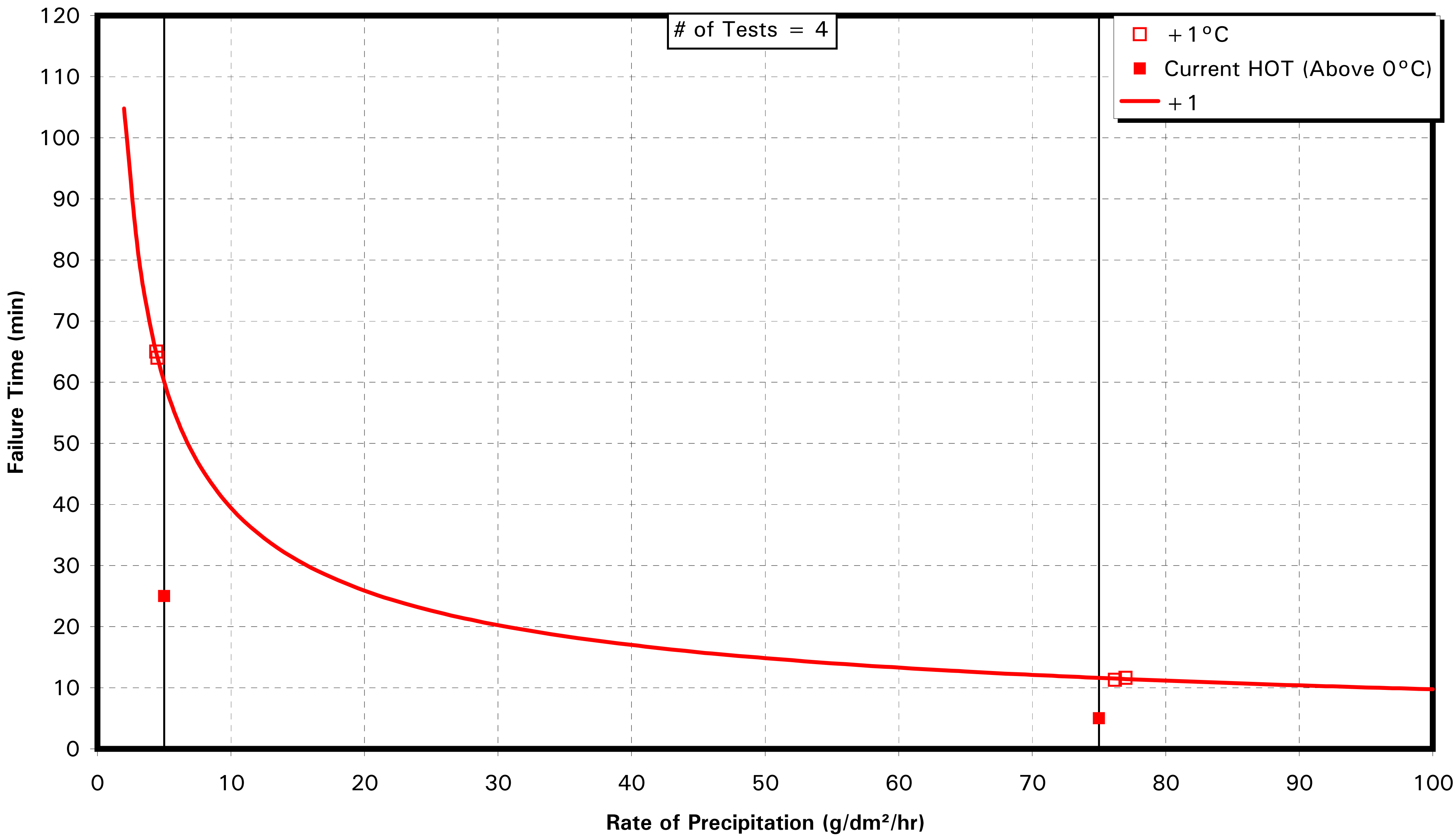


Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\CS - SPCA E26
AT: Neat

EFFECT OF TEMPERATURE AND RATE OF PRECIPITATION ON ENDURANCE TIME

SPCA Ecowing 26 (75/25)

RAIN ON COLD-SOAKED SURFACE



Groups\CM1680(exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\CS - SPCA E26
AT: 75-25

APPENDIX H

RATE PROGRAM SPREADSHEET GUIDE

PRECIPITATION RATE PROGRAM SPREADSHEET GUIDE

The spreadsheet contains several macros. When run, these macros will create a summary page listing the tests run, the plate number, the four relevant rates, the average and standard deviation of the four rates as well as a calculation of the most extreme rate from the mean value. Space will be available for entering the fluid type and any comments but these will not be entered automatically.

The program is set up so that the main program is run in a normal version of Excel with macros added to perform certain repetitive tasks. As such, since page protection cannot be enabled when a macro is run, any portion of the program can be changed. This allows for new calculations and corrections to be made at any time. It also allows formatting to be changed that would affect the ability of the macro to run. It is important that aspects such as cell locations and page names be kept constant, particularly on the 'output' page.

In order to use the summary macros, a letter "t" (case insensitive) must be entered in the appropriate row in the column titled "RATE" on the individual forms. An individual rate would appear here. A sample location is marked with a comment on each form. The summary page can be updated at any time during the day or at the end, after all the results are in.

The macros copy the values from the summary sheets and copy them to an area of hidden cells at the top of the "output" page. They then search for occurrences of the letter "t" in this area. Due to limitations on the acceptable length of macros within Excel, each macro deals with only four forms with the first two forms (used for calibration) are omitted. When an instance of "t" is found, the plate number, as well as the two previous and two subsequent rates are pasted into the next row of the summary page. Formulas in the page then calculate the average, standard deviation, and most extreme value from the average rate. Links in the page update the date and chamber conditions provided those facts are changed on other pages. If new calculations are to be added, they should be inserted into additional columns of the output table.

Correcting errors

There are two possible types of errors:

1. The first involves a miscalculation or typing error that causes a single rate value to be in error. If this happens, the value should be changed

at the location of the error either immediately or later when the error is found. The next time the summary macros are run, the error will be corrected on the summary sheet. When the macros are run, they review all the values; if the macro for a certain form is run twice, some tests could be entered in duplicate. It is suggested that while the page can be updated throughout the day for use with other projects, at the end of the day, the page should be cleared using 'clear page' and then the values should be re-entered. This is estimated to take less more than a minute at the end of the day.

2. The second error concerns an abnormal number of rates being run between tests. If less than two previous and two following rates are performed, the macros will paste the value in the previous and following cells to the summary sheet. If the space is blank or contains another test, the statistics will ignore them in the calculations. If more than 4 rates are completed, the macros will only account for the closest four. An area has been provided at the bottom of the "output" page for values to be entered manually. If an account is to taken for more than four rates, the values should be entered here.

Instructions for use have been included as a comment in cell B1 on the "output" page.

Also included is an average and standard deviation calculation to the summary pages and each form that will be printed each time a set of tests is run.

APPENDIX I

OFFICIAL TRANSPORT CANADA HOLDOVER TIME TABLES

TABLE 1-S1C

SAE TYPE I[5] FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F	FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[3]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[4]
above 0	above 32	0:45	0:12-0:30	0:06-0:15[1] *0:07-0:12*	0:05-0:08	0:02-0:05	0:02-0:05	
0 to -10	32 to 14	0:45	0:06-0:15[1] *0:06-0:11*	0:06-0:15[1] *0:03-0:16*	0:05-0:08	0:02-0:05	**CAUTION:**	
below -10	below 14	0:45	0:06-0:15[1] *0:06-0:09*	0:06-0:15[1] *0:02-0:04*	**No holdover time guidelines exist**			

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **FP = Freezing Point**

NOTES

1 To use these times, the fluid must be heated to a minimum temperature providing 60°C (140°F) at the nozzle and an average rate of at least 1 litre/m^2 (2 gals/100ft^2) must be applied to deiced surfaces, OTHERWISE THE ITALICISED TIMES MUST BE USED.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
4 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.
5 Type I Fluid / Water Mixture is selected so that the FP of the mixture is at least 10°C (18°F) below OAT.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

TRANSPORT CANADA , JULY 2001

TABLE 2-SAE

SAE TYPE II FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type II Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	12:00	0:35-1:30	0:20-0:55	0:30-0:55	0:15-0:30	0:05-0:40	
		75/25	6:00	0:25-1:00	0:15-0:40	0:20-0:45	0:10-0:25	0:05-0:25	
		50/50	4:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	8:00	0:35-1:30	0:20-0:45	0:30-0:55	0:15-0:30		
		75/25	5:00	0:25-1:00	0:15-0:30	0:20-0:45	0:10-0:25		
		50/50	3:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:20-1:05	0:15-0:35	0:15-0:45[3]	0:10-0:25[3]		
		75/25	5:00	0:20-0:55	0:15-0:25	0:15-0:30[3]	0:10-0:20[3]		
below -14 to -25	below 7 to -13	100/0	8:00	0:15-0:20	0:15-0:30				
below -25	below -13	100/0	Type II fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type II fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Based on tests of neat fluids with the lowest viscosity deliverable on the aircraft, yet meeting Type II WSET and HHET.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

TRANSPORT CANADA , JULY 2001

TABLE 2C

CLARIANT TYPE II FLUID HOLDOVER TABLE
SAFEWING MPII 1951 (8,700 mPa.s viscosity) (8,700 mPa.s viscosity)[1]

Guideline for Holdover Times Anticipated for Type II Fluid Concentrations as a Function of Weather Conditions and OAT

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type II Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	MODERATE SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	12:00	0:55-1:40	0:30-0:55	0:35-0:55	0:20-0:30	0:10-0:50	
		75/25	6:00	0:45-1:15	0:20-0:40	0:25-0:45	0:15-0:25	0:05-0:40	
		50/50	4:00	0:20-0:30	0:05-0:20	0:05-0:15	0:05-0:10	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	8:00	0:55-1:40	0:25-0:45	0:35-0:55	0:20-0:30		
		75/25	5:00	0:45-1:15	0:15-0:35	0:25-0:45	0:15-0:25		
		50/50	3:00	0:20-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:45-1:25	0:20-0:40	0:25-0:50[3]	0:15-0:30[3]		
		75/25	5:00	0:35-1:00	0:15-0:25	0:20-0:35[3]	0:15-0:20[3]		
below -14 to -25	below 7 to -13	100/0	8:00	0:20-0:40	0:20-0:35				
below -25	below -13	100/0	Type II fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type II fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, at 20°C, 0.3rpm, for 15 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

TRANSPORT CANADA , JULY 2001

TABLE 2K

KILFROST TYPE II FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
ABC-II PLUS (3,600 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type II Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	12:00	1:10-2:25	0:35-1:20	0:35-1:10	0:30-0:40	0:05-1:00	
		75/25	6:00	1:10-2:25	0:35-1:10	0:30-1:00	0:20-0:40	0:05-0:50	
		50/50	4:00	0:15-0:45	0:20-0:40	0:05-0:25	0:05-0:15	**CAUTION:** **No holdover time guidelines exist**	
0 to -3	32 to 27	100/0	8:00	1:10-2:25	0:25-0:55	0:35-1:10	0:30-0:40		
		75/25	5:00	1:10-2:25	0:25-0:50	0:30-1:00	0:20-0:40		
		50/50	3:00	0:15-0:45	0:15-0:35	0:05-0:25	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	8:00	0:30-1:05	0:15-0:35	0:15-0:45[3]	0:10-0:30[3]		
		75/25	5:00	0:20-0:55	0:15-0:35	0:15-0:30[3]	0:10-0:20[3]		
below -14 to -25	below 7 to -13	100/0	8:00	0:15-0:20	0:15-0:30				
below -25	below -13	100/0	Type II fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type II fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES
1 Lowest on-wing viscosity - Brookfield Spindle LV2 with guard leg, 150ml of neat fluid, at 20°C, 0.3rpm, 10 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 2S-26

SPCA TYPE II FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
ECOWING 26 (4,900 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type II Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	12:00	1:25-2:35	0:40-1:05	0:50-1:35	0:40-0:50	0:20-1:20	
		75/25	6:00	1:05-1:55	0:30-0:50	0:45-1:05	0:25-0:35	0:10-1:00	
		50/50	4:00	0:30-0:45	0:10-0:20	0:15-0:20	0:05-0:10	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:25-2:35	0:40-1:00	0:50-1:35	0:40-0:50		
		75/25	5:00	1:05-1:55	0:25-0:35	0:45-1:05	0:25-0:35		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:45-2:15	0:35-0:55	0:30-1:10[3]	0:15-0:35[3]		
		75/25	5:00	0:35-1:15	0:25-0:40	0:20-0:50[3]	0:15-0:25[3]		
below -14 to -25	below 7 to -13	100/0	8:00	0:25-0:45	0:30-0:50				
below -25	below -13	100/0	Type II fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type II fluid cannot be used.						

° C = Degrees Celsius
° F = Degrees Fahrenheit
OAT = Outside Air Temperature
VOL = Volume

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, at 20°C, 0.3rpm, for 30 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4-SAE

SAE TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		Frost[2]	Freezing Fog	Snow	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing	Other[5]
above 0°	above 32°	100/0	18:00	1:05-2:15	0:35-1:05	0:40-1:10	0:25-0:45	0:10-0:50	
		75/25	6:00	1:05-1:45	0:30-1:05	0:35-0:50	0:15-0:30	0:05-0:35	
		50/50	4:00	0:15-0:35	0:05-0:20	0:10-0:20	0:05-0:10	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:05-2:15	0:30-0:55	0:40-1:10	0:25-0:45		
		75/25	5:00	1:05-1:45	0:25-0:50	0:35-0:50	0:15-0:30		
		50/50	3:00	0:15-0:35	0:05-0:15	0:10-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:20-1:20	0:20-0:40	0:20-0:45[3]	0:10-0:25[3]		
		75/25	5:00	0:25-0:50	0:15-0:25	0:15-0:30[3]	0:10-0:20[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:15-0:40	0:15-0:30				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius
° F = Degrees Fahrenheit
OAT = Outside Air Temperature
VOL = Volume

NOTES

1 Based on tests of neat fluids with the lowest viscosity deliverable on the aircraft, yet meeting Type IV WSET and HHET.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

TRANSPORT CANADA, JULY 2001

TABLE 4C-a

CLARIANT TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
SAFEWING MPIV 1957 (16,200 mPa.s viscosity) (16,200 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		Frost[2]	Freezing Fog	Snow	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing	Other[5]
above 0°	above 32°	100/0	18:00	1:05-2:15	0:35-1:05	0:40-1:10	0:30-0:45	0:15-1:10	
		75/25	6:00	1:10-2:10	0:35-1:05	0:35-1:05	0:25-0:40	0:10-1:00	
		50/50	4:00	0:25-0:50	0:15-0:30	0:15-0:25	0:05-0:15	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:05-2:15	0:30-0:55	0:40-1:10	0:30-0:45		
		75/25	5:00	1:10-2:10	0:30-0:50	0:35-1:05	0:25-0:40		
		50/50	3:00	0:25-0:50	0:10-0:20	0:15-0:25	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:30	0:30-0:50	0:35-0:55[3]	0:20-0:35[3]		
		75/25	5:00	0:25-1:10	0:20-0:40	0:25-0:55[3]	0:15-0:30[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:25-0:40	0:25-0:45				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, at 20°C, 0.3rpm, for 15 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4C-b

CLARIANT TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
SAFEWING MPIV 2001 (18,000 mPa.s viscosity) (18,000 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT °C	OAT °F	Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Frost[2]	Freezing Fog	Snow	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing	Other[5]
above 0°	above 32°	100/0	18:00	1:20-3:20	1:55-2:00	0:55-1:55	0:40-1:00	0:15-2:00	
		75/25	6:00	1:20-2:00	0:50-1:25	0:35-1:10	0:25-0:35	0:10-1:25	
		50/50	4:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15	**CAUTION:** **No holdover time guidelines exist**	
0 to -3	32 to 27	100/0	12:00	1:20-3:20	1:00-1:55	0:55-1:55	0:40-1:00		
		75/25	5:00	1:20-2:00	0:35-1:00	0:35-1:10	0:25-0:35		
		50/50	3:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:35	0:30-0:50	0:55-1:35[3]	0:30-0:45[3]		
		75/25	5:00	0:30-1:00	0:20-0:35	0:40-1:10[3]	0:20-0:30[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:20-0:35				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius
° F = Degrees Fahrenheit

OAT = Outside Air Temperature
VOL = Volume

NOTES

1. Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, 10ml fluid, at 20°C, 0.3rpm, for 15 minutes 0 seconds.
2. During conditions that apply to aircraft protection for ACTIVE FROST.
3. The lowest use temperature is limited to -10°C (14°F).
4. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5. Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4C-c

CLARIANT TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
SAFEWING FOUR (6,400 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	18:00	1:50-2:45	0:45-1:45	1:05-1:45	0:50-1:05	0:10-1:20	
		75/25	6:00	1:45-2:25	0:40-1:25	0:50-1:30	0:30-0:45	0:15-1:25	
		50/50	4:00	0:30-0:45	0:15-0:25	0:15-0:25	0:10-0:15	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:50-2:45	0:35-1:20	1:05-1:45	0:50-1:05		
		75/25	5:00	1:45-2:25	0:30-1:05	0:50-1:30	0:30-0:45		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:10-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:30-1:30	0:25-0:55	0:25-1:05[3]	0:15-0:30[3]		
		75/25	5:00	0:30-1:05	0:20-0:45	0:20-0:50[3]	0:15-0:25[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:20-0:45				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, 10ml fluid, at 20°C, 0.3rpm, for 15 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4C-d

CLARIANT TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
SAFEWING MP IV 2012 PROTECT (7,800 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	18:00	1:15-2:30	1:10-2:00	0:40-1:10	0:25-0:45	0:10-1:05	
		75/25	6:00	1:10-2:05	0:35-1:10	0:35-0:50	0:15-0:30	0:05-0:40	
		50/50	4:00	0:25-0:45	0:15-0:25	0:15-0:20	0:05-0:10	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:15-2:30	0:40-1:15	0:40-1:10	0:25-0:45		
		75/25	5:00	1:10-2:05	0:25-0:55	0:35-0:50	0:15-0:30		
		50/50	3:00	0:25-0:45	0:15-0:25	0:15-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:35	0:20-0:40	0:25-0:45[3]	0:15-0:25[3]		
		75/25	5:00	0:25-1:05	0:20-0:40	0:15-0:30[3]	0:10-0:20[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:15-0:30				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, 10ml fluid, at 20°C, 0.3rpm, for 15 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4K

KILFROST TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
ABC-S (17,000 mPa.s viscosity) (17,000 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		Frost[2]	Freezing Fog	Snow	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing	Other[5]
above 0°	above 32°	100/0	18:00	2:35-4:00	1:10-2:00	1:20-1:50	1:00-1:25	0:20-1:15	
		75/25	6:00	1:05-1:45	0:30-1:05	0:45-1:10	0:35-0:50	0:10-0:50	
		50/50	4:00	0:20-0:35	0:05-0:20	0:15-0:20	0:05-0:10	**CAUTION:** **No holdover time guidelines exist**	
0 to -3	32 to 27	100/0	12:00	2:35-4:00	1:00-1:40	1:20-1:50	1:00-1:25		
		75/25	5:00	1:05-1:45	0:30-0:55	0:45-1:10	0:35-0:50		
		50/50	3:00	0:20-0:35	0:05-0:15	0:15-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-2:05	0:45-1:20	0:20-1:00[3]	0:10-0:30[3]		
		75/25	5:00	0:25-1:00	0:25-0:50	0:20-1:10[3]	0:10-0:35[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:40	0:40-1:10				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1. Lowest on-wing viscosity - Brookfield Spindle LV2 with guard leg, 150ml of neat fluid, at 20°C, 0.3rpm, for 10 minutes 0 seconds.
2. During conditions that apply to aircraft protection for ACTIVE FROST.
3. The lowest use temperature is limited to -10°C (14°F).
4. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5. Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 4S

SPCA TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002

AD-480 (15,200 mPa.s viscosity) (15,200 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		Frost[2]	Freezing Fog	Snow	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing	Other[5]
above 0°	above 32°	100/0	18:00	2:00-3:30	0:55-1:50	0:50-1:30	0:35-0:55	0:15-1:35	
		75/25	6:00	1:30-2:45	0:40-1:20	0:50-1:15	0:30-0:45	0:10-1:15	
		50/50	4:00	0:30-0:45	0:15-0:30	0:15-0:25	0:05-0:15	CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	2:00-3:30	0:40-1:20	0:50-1:30	0:35-0:55		
		75/25	5:00	1:30-2:45	0:30-1:05	0:50-1:15	0:30-0:45		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:20-1:20	0:30-0:55	0:25-1:20[3]	0:15-0:30[3]		
		75/25	5:00	0:25-0:50	0:20-0:45	0:25-1:05[3]	0:15-0:30[3]		
below -14 to -25	below 7 to -13	100/0	12:00	0:15-0:40	0:25-0:40				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius
° F = Degrees Fahrenheit

OAT = Outside Air Temperature
VOL = Volume

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-34/13R, small sample adapter, at 20°C, 0.3rpm, for 30 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

TRANSPORT CANADA, JULY 2001

TABLE 4U

UNION CARBIDE TYPE IV FLUID HOLDOVER GUIDELINES FOR WINTER 2001-2002
ULTRA+ (36,000 mPa.s viscosity)[1]

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER

OAT		Type IV Fluid Concentration Neat Fluid/Water (Vol% / Vol%)	Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F		FROST[2]	FREEZING FOG	SNOW	FREEZING DRIZZLE[4]	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING	OTHER[5]
above 0°	above 32°	100/0	18:00	1:35-3:35	0:40-1:25	0:45-1:35	0:25-0:40	0:10-1:20	
		75/25							
		50/50						CAUTION: No holdover time guidelines exist	
0 to -3	32 to 27	100/0	12:00	1:35-3:35	0:35-1:15	0:45-1:35	0:25-0:40		
		75/25							
		50/50							
below -3 to -14	below 27 to 7	100/0	12:00	1:25-3:00	0:25-0:55	0:45-1:25[3]	0:30-0:45[3]		
		75/25							
below -14 to -25	below 7 to -13	100/0	12:00	0:40-2:10	0:20-0:45				
below -25	below -13	100/0	Type IV fluid may be used below -25°C (-13°F) provided the freezing point of the fluid is at least 7°C (13°F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when Type IV fluid cannot be used.						

° C = Degrees Celsius **OAT = Outside Air Temperature**
° F = Degrees Fahrenheit **VOL = Volume**

NOTES

1 Lowest on-wing viscosity - Brookfield Spindle SC4-31/13R, small sample adapter, at 0°C, 0.3rpm, for 10 minutes 0 seconds.
2 During conditions that apply to aircraft protection for ACTIVE FROST.
3 The lowest use temperature is limited to -10°C (14°F).
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain and hail.

CAUTIONS:

- **The time of protection will be shortened in heavy weather conditions, heavy precipitation rates or high moisture content. High wind velocity or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may also be reduced when aircraft skin temperature is lower than OAT.**
- **The only acceptable decision criteria time is the shortest time within the applicable holdover time table cell.**
- **Fluids used during ground deicing do not provide ice protection during flight.**

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TABLE 5

CURRENTLY QUALIFIED FLUIDS

Table 5-1: Qualified Type I De-icing Fluids**

#	COMPANY NAME	FLUID NAME	EXPIRY
1-1	Beijing Wangye Aviation Chemical Product Co. Ltd.	KLA-1	03-03-02
1-2	Clariant GmbH	Safewing DG I 1937	01-10-27
1-3	Clariant GmbH	Safewing MP I 1938	02-06-13
1-4	Clariant GmbH	Safewing MP I 1938 TF	02-08-23
1-5	Clariant GmbH	Safewing MP I 1938 PR-MIX	02-09-11
1-6	Clariant GmbH	Safewing EG I 1996	02-09-05
1-7	Cryotech Deicing Technology	DF Plus	02-07-07
1-8	Cryotech Deicing Technology	DF Plus (88)	03-07-03
1-9	Delta Rocky Mountain Petroleum Inc.	Ice Away	01-12-27
1-10	Dow Chemical Company	UCAR® ADF Concentrate	02-09-22
1-11	Dow Chemical Company	UCAR® DEGree ADF	02-09-13
1-12	Home Oil	SafeTemp	02-08-21
1-13	Inland Technologies Inc.	Duragly-P	02-12-15
1-14	Inland Technologies Inc.	Duragly-E	01-02-01
1-15	Jarchem Industries Inc.	JarKleer 1000TF	02-10-02
1-16	Kilfrost Limited	Kilfrost DF	01-10-22
1-17	Kilfrost Limited	Kilfrost DF PLUS	01-07-06
1-18	Kilfrost Limited	Kilfrost DF PLUS (80)	03-03-15
1-19	Lyondell Chemical Co.	ARCOPlus	02-06-26
1-20	Lyondell Chemical Co.	ARCOPlus-ST	03-03-15
1-21	Metss Corporation	ADF	02-12-04
1-22	Newave Aerochemical Co. Ltd.	FCY-1A	03-03-08
1-23	Octagon Process	Octaflo™ EF	03-05-18
1-24	Octagon Process	Octaflo™	01-09-28
1-25	Octagon Process	Octaflo™ (R) Dilute	01-07-06
1-26	Octagon Process	Octaflo™ EG	03-06-12
1-27	Oslo Airport	Oslo Airport Fluid	01-10-29
1-28	Sanshin Kagaku Kogyo Co.	San-Ai ADF Type 1-A	03-01-23
1-29	SPCA	SPCA DE-910	02-07-07

Table 5-2: Qualified Type II De-icing Fluids**

#	COMPANY NAME	FLUID NAME	EXPIRY
2-1	Clariant GmbH	Safewing MP II 1951	03-xx-xx*
2-2	Kilfrost Limited	Kilfrost ABC II PLUS	03-xx-xx*
2-3	Kilfrost Limited	Kilfrost ABC-3	02-02-18
2-4	Octagon Process	Forty Below	03-xx-xx*
2-5	SPCA	SPCA AD-104/N	*
2-6	SPCA	Ecowing 26	03-05-04

Table 5-3: Qualified Type III De-icing Fluids**

#	COMPANY NAME	FLUID NAME	EXPIRY

Table 5-4: Qualified Type IV De-icing Fluids**

#	COMPANY NAME	FLUID NAME	EXPIRY
4-1	Clariant GmbH	Safewing MP IV 1957	01-05-25
4-2	Clariant GmbH	Safewing MP IV 2001	02-02-16
4-3	Clariant GmbH	Safewing Four	02-06-13
4-4	Clariant GmbH	Safewing MP IV 2012 Protect	03-02-19
4-5	Cryotech Deicing Technology	ABC-S	02-07-11
4-6	Dow Chemical Company	UCAR® ADF/AAF ULTRA+	02-04-10
4-7	Ely Chemical Company	Max-Flight	02-10-17
4-8	Kilfrost Limited	ABC-S	02-10-17
4-9	Octagon Process	Max-Flight™	03-06-18
4-10	SPCA	SPCA AD-480	03-06-12

** Qualified solely with respect to anti-icing performance and aerodynamic acceptance by the Anti-icing Materials International Laboratory, Université du Quebec à Chicoutimi, **Web site: http://www.uqac.uquebec.ca/amil/**

For other specification requirements for Type I fluids, see SAE AMS 1424 (latest version). For other specification requirements for Type II, III or IV fluids, see SAE AMS 1428 (latest version).

* Qualification in progress.

TRANSPORT CANADA , SEPTEMBER 2001

TABLE 6

SAE TYPE I DE-ICING FLUID APPLICATION PROCEDURES

Guidelines for the application of SAE Type I fluid mixtures at minimum concentrations for the prevailing outside air temperature (OAT)

Outside Air Temperature (OAT)	**One-step Procedure De-icing/Anti-icing**	**Two-step Procedure**	
		First step: De-icing	**Second step: Anti-icing[1]**
-3°C (27°F) and above	FP of heated fluid mixture shall be at least 10°C (18°F) below OAT	Water heated to 60°C (140° F) minimum at the nozzle or a heated mix of fluid and water	FP of fluid mixture shall be at least 10°C (18°F) below OAT
Below -3°C (27° F)		FP of heated fluid mixture shall not be more than 3°C (5°F) above OAT	

Note: 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.

Caution: Wing skin temperatures may differ and in some cases may be lower than OAT; a stronger mix may be needed under these conditions.

1 To be applied before first step fluid freezes, typically within 3 minutes.

TRANSPORT CANADA , JULY 2001

TABLE 7

SAE TYPE II and TYPE IV ANTI-ICING FLUID APPLICATION PROCEDURES

Guidelines for the application of SAE Type II and IV fluid mixtures (minimum concentrations in % by volume) as a Function of Outside Air Temperature (OAT)

Outside Air Temperature (OAT)	One-step Procedure De-icing/Anti-icing	Two-step Procedure	
		First step: De-icing	Second step: Anti-icing[1]
-3°C (27°F) and above	50/50 Heated[2] Type II/IV	Heated water or a heated mix of Type I, II or IV with water	50/50 Type II/IV
Below -3°C (27° F) to -14°C (7°F)	75/25 Heated[2] Type II/IV	Heated suitable mix of Type I, Type II/IV and water with FP not more than 3°C (5°F) above actual OAT	75/25 Type II/IV
Below -14°C (7° F) to -25°C (-13° F)	100/0 Heated[2] Type II/IV	Heated suitable mix of Type I, Type II/IV and water with FP not more than 3°C (5°F) above actual OAT	100/0 Type II/IV
Below -25°C (-13°F)	SAE Type II/IV fluid may be used below -25°C (-13°F) provided that the freezing point of the fluid is at least a 7°C (13°F) below OAT and that aerodynamic acceptance criteria are met. Consider the use of SAE Type I when Type II/IV fluid cannot be used (see Table 6).		

Note: 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.

Caution: Wing skin temperatures may differ and in some cases may be lower than OAT; a stronger mix may be needed under these conditions.

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 should not be used for the anti-icing step because fluid freezing may occur.

An insufficient amount of anti-icing 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.

1 To be applied before first step fluid freezes, typically within 3 minutes.
2 Clean aircraft may be anti-iced with unheated fluid.

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TABLE 8

SNOW VISIBILITY VS SNOWFALL INTENSITY CHART[1]

Lighting	Temperature Range		Visibility in statute miles		
	°C	°F	Heavy[2]	Moderate[2]	Light[2]
Daylight	Above -1	Above 30	<1	1 - 2	>2
	-1 to -7	30 to 19	<½	½ - 1¼	>1¼
	Below -7	Below 19	<3/8	3/8 - 5/8	>5/8
Darkness	Above -1	Above 30	<2	2 - 4	>4
	-1 to -7	30 to 19	<1	1 - 2½	>2½
	Below -7	Below 19	<¾	¾ - 1¼	>1¼

1 Rasmussen et al., "The Estimation of Snowfall Rate Using Visibility", Journal of Applied Meteorology, Vol 38, No 10, October 1999.

2 Heavy snowfall intensity is defined as greater than **2.5 mm/hr equivalent liquid water precipitation**, moderate snow as **1 mm/hr to 2.5 mm/hr**, and light snow as than **1 mm/hr**.

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APPENDIX J

OFFICIAL FEDERAL AVIATION ADMINISTRATION HOLDOVER TIME TABLES

TABLE OF CONTENTS FOR HOT GUIDELINES

TABLE OF CONTENTS FOR HOT GUIDELINES
(Cont.)

TABLE **PAGE**

TABLE 1 - Guideline for Holdover Times Anticipated for SAE Type I Fluid Mixture as a Function of Weather Conditions and OAT.

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		Approximate Holdover Times Under Various Weather Conditions (hours:minutes)						
°C	°F	*Frost	Freezing Fog	Snow◆	**Freezing Drizzle	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0°	above 32°	0:45	0:12 - 0:30	0:06 - 0:15◆◆	0:05 - 0:08	0:02 - 0:05	0:02 - 0:05	CAUTION : No holdover time guidelines exist
0 to -10	32 to 14	0:45	0:06 - 0:15◆◆	0:06 - 0:15◆◆	0:05 - 0:08	0:02 - 0:05	CAUTION: Clear ice may require touch for confirmation	
below -10	below 14	0:45	0:06 - 0:15◆◆	0:06 - 0:15◆◆				

°C = Degrees Celsius
°F = Degrees Fahrenheit
OAT = Outside Air Temperature
FP = Freezing Point

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains
◆◆ TO USE THESE TIMES, THE FLUID MUST BE HEATED TO A MINIMUM TEMPERATURE OF 60 °C (140 °F) AT THE NOZZLE AND AT LEAST 1 LITER/M^2 (≈ 2 GALS/100FT^2) MUST BE APPLIED TO DEICED SURFACES

SAE Type I fluid/water mixture is selected so that the FP of the mixture is at least 10 ° C (18 ° F) below OAT.

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST WILL REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: SAE TYPE I FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 1A - Guidelines for the Application of SAE Type I Fluid Mixtures.
Minimum Concentrations as a Function of Outside Air Temperature (OAT).
Concentrations in % V/V

Outside Air Temperature OAT	One-step Procedure Deicing/anti-icing	Two-step Procedure	
		First step: Deicing	Second step Anti-icing [1]
-3 °C (27°F) and above	FP of heated fluid mixture shall be at least 10 °C (18 °F) below OAT	Water heated to 60 °C (140 °F) minimum at the nozzle or a heated mix of fluid and water	FP of fluid mixture shall be at least 10 °C (18 °F) below actual OAT
Below -3 °C (27 °F)		FP of heated fluid mixture shall not be more than 3 °C (5 °F) above OAT	

Note: 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.

Caution: Wing skin temperatures may differ and in some cases may be lower than OAT.
A stronger mix (more glycol) can be used under the latter conditions.

1) To be applied before first step fluid freezes, typically within 3 minutes.

Effective: October 1, 2001

TABLE 2 - Guideline for Holdover Times Anticipated for SAE Type II Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type II Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	12:00	0:35-1:30	0:20-0:55	0:30-0:55	0:15-0:30	0:05-0:40	CAUTION: No holdover time guidelines exist
		75/25	6:00	0:25-1:00	0:15-0:40	0:20-0:45	0:10-0:25	0:05-0:25	
		50/50	4:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	8:00	0:35-1:30	0:20-0:45	0:30-0:55	0:15-0:30		
		75/25	5:00	0:25-1:00	0:15-0:30	0:20-0:45	0:10-0:25		
		50/50	3:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:20-1:05	0:15-0:35	**0:15-0:45	**0:10-0:25		
		75/25	5:00	0:20-0:55	0:15-0:25	**0:15-0:30	**0:10-0:20		
below -14 to -25	below 7 to -13	100/0	8:00	0:15-0:20	0:15-0:30				
below -25	below -13	100/0	SAE Type II fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type II fluid cannot be used.						

°C = Degrees Celsius
°F = Degrees Fahrenheit
OAT = Outside Air Temperature
VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: SAE TYPE II FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October1, 2001

TABLE 2A - Guideline for Holdover Times Anticipated for KILFROST ABC-II PLUS Type II Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 3,600cP, 20 °C, 0.3 RPM, Spindle LV2, 250ml beaker, 150ml fluid, 10 min. grd. leg.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type II Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	12:00	1:10-2:25	0:35-1:20	0:35-1:10	0:30-0:40	0:05-1:00	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:10-2:25	0:35-1:10	0:30-1:00	0:20-0:40	0:05-0:50	
		50/50	4:00	0:15-0:45	0:20-0:40	0:05-0:25	0:05-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	8:00	1:10-2:25	0:25-0:55	0:35-1:10	0:30-0:40		
		75/25	5:00	1:10-2:25	0:25-0:50	0:30-1:00	0:20-0:40		
		50/50	3:00	0:15-0:45	0:15-0:35	0:05-0:25	0:05-0:15		
below -3 to -14	Below 27 to 7	100/0	8:00	0:30-1:05	0:15-0:35	**0:15-0:45	**0:10-0:30		
		75/25	5:00	0:20-0:55	0:15-0:35	**0:15-0:30	**0:10-0:20		
below -14 to -25	Below 7 to –13	100/0	8:00	0:15-0:20	0:15-0:30				
below -25	below –13	100/0	**Kilfrost ABC-II PLUS** Type II fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **Kilfrost ABC-II PLUS** Type II fluid cannot be used.						

°C = Degrees Celsius   OAT = Outside Air Temperature
°F = Degrees Fahrenheit   VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **Kilfrost ABC-II PLUS** TYPE II FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 2B - Guideline for Holdover Times Anticipated for Clariant Safewing MPII 1951 Type II Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 8,700cP, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type II Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	12:00	0:55-1:40	0:30-0:55	0:35-0:55	0:20-0:30	0:10-0:50	CAUTION: No holdover time guidelines exist
		75/25	6:00	0:45-1:15	0:20-0:40	0:25-0:45	0:15-0:25	0:05-0:40	
		50/50	4:00	0:20-0:30	0:05-0:20	0:05-0:15	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	8:00	0:55-1:40	0:25-0:45	0:35-0:55	0:20-0:30		
		75/25	5:00	0:45-1:15	0:15-0:35	0:25-0:45	0:15-0:25		
		50/50	3:00	0:20-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:45-1:25	0:20-0:40	**0:25-0:50	**0:15-0:30		
		75/25	5:00	0:35-1:00	0:15-0:25	**0:20-0:35	**0:15-0:20		
below -14 to -25	below 7 to -13	100/0	8:00	0:20-0:40	0:20-0:35				
below -25	below -13	100/0	**Clariant Safewing MP II 1951** Type II fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **Clariant Safewing MP II 1951** Type II fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **Clariant Safewing MP II 1951** TYPE II FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 2C – Guideline for Holdover Times Anticipated for SPCA ECOWING 26 Type II Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% fluid Tested 4,900cp, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 30 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	12:00	1:25-2:35	0:40-1:05	0:50-1:35	0:40-0:50	0:20-1:25	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:05-1:55	0:30-0:50	0:45-1:05	0:25-0:35	0:10-1:00	
		50/50	4:00	0:30-0:45	0:10-0:20	0:15-0:20	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	8:00	1:25-2:35	0:40-1:00	0:50-1:35	0:40-0:50		
		75/25	5:00	1:05-1:55	0:25-0:45	0:45-1:05	0:25-0:35		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:45-2:15	0:35-0:55	**0:30-1:10	**0:15-0:35		
		75/25	5:00	0:35-1:15	0:25-0:40	**0:20-0:50	**0:15-0:25		
below -14 to -25	below 7 to -13	100/0	8:00	0:25-0:45	0:30-0:50				
below -25	below -13	100/0	**SPCA ECOWING 26** Type II fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SPCA ECOWING 26** Type II fluid cannot be used.						

°C = Degrees Celsius
°F = Degrees Fahrenheit
OAT = Outside Air Temperature
VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: SPCA ECOWING 26 TYPE II FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

TABLE 4 - Guideline for Holdover Times Anticipated for SAE Type IV Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F	Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:05-2:15	0:35-1:05	0:40-1:10	0:25-0:40	0:10-0:50	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:05-1:45	0:30-1:05	0:35-0:50	0:15-0:30	0:05-0:35	
		50/50	4:00	0:15-0:35	0:05-0:20	0:10-0:20	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:05-2:15	0:30-0:55	0:40-1:10	0:25-0:40		
		75/25	5:00	1:05-1:45	0:25-0:50	0:35-0:50	0:15-0:30		
		50/50	3:00	0:15-0:35	0:05-0:15	0:10-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:20-1:20	0:20-0:40	**0:20-0:45	**0:10-0:25		
		75/25	5:00	0:25-0:50	0:15-0:25	**0:15-0:30	**0:10-0:20		
below -14 to -25	below 7 to -13	100/0	12:00	0:15-0:40	0:15-0:30				
below -25	below -13	100/0	SAE Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C(13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: SAE TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October1, 2001

TABLE 4A - Guideline for Holdover Times Anticipated for UCAR ULTRA+ Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 36,000cP, 0 °C, 0.3 RPM, Spindle SC4-31/13R, 10ml fluid, 10 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:35-3:35	0:40-1:25	0:45-1:35	0:25-0:40	0:10-1:20	CAUTION: No holdover time guidelines exist
		75/25							
		50/50						CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:35-3:35	0:35-1:15	0:45-1:35	0:25-0:40		
		75/25							
		50/50							
below -3 to -14	below 27 to 7	100/0	12:00	1:25-3:00	0:25-0:55	**0:45-1:25	**0:30-0:45		
		75/25							
below -14 to -24	below 7 to -12	100/0	12:00	0:40-2:10	0:20-0:45				
below -24	below -12	100/0	**UCAR ULTRA+** Type IV fluid may be used below –24 °C (-12 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **UCAR ULTRA+** Type IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **UCAR ULTRA+** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4B - Guideline for Holdover Times Anticipated for OCTAGON MAX-FLIGHT Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 5,540cP, 20 °C, 0.3 RPM, Spindle LV1, 600ml beaker, 500ml fluid, 33 min 20 sec, grd. leg.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	2:40-4:00	1:15-2:00	0:55-2:00	0:35-1:00	0:15-1:15	CAUTION: No holdover time guidelines exist
		75/25	6:00	2:05-3:15	1:20-2:00	1:15-2:00	0:35-1:10	0:10-0:40	
		50/50	4:00	0:55-1:45	0:40-1:20	0:35-1:00	0:15-0:30	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	2:40-4:00	0:50-1:35	0:55-2:00	0:35-1:00		
		75/25	5:00	2:05-3:15	0:45-1:45	1:15-2:00	0:35-1:10		
		50/50	3:00	0:55-1:45	0:25-1:15	0:35-1:00	0:15-0:30		
below -3 to -14	below 27 to 7	100/0	12:00	0:50-2:30	0:25-0:50	**0:25-1:10	**0:20-0:40		
		75/25	5:00	0:30-1:05	0:20-0:50	**0:20-1:00	**0:15-0:30		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:20-0:40				
below -25	below -13	100/0	**OCTAGON MAX-FLIGHT** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **OCTAGON MAX-FLIGHT** Type IV fluid cannot be used.						

°C = Degrees Celsius   OAT = Outside Air Temperature
°F = Degrees Fahrenheit   VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **OCTAGON MAX-FLIGHT** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4C - Guideline for Holdover Times Anticipated for KILFROST ABC-S Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested17,000cP, 20 °C, 0.3 RPM, Spindle LV2,250ml beaker,150ml fluid,10 min. grd. leg.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	2:35-4:00	1:10-2:00	1:20-1:50	1:00-1:25	0:20-1:15	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:05-1:45	0:30-1:05	0:45-1:10	0:35-0:50	0:10-0:50	
		50/50	4:00	0:20-0:35	0:05-0:20	0:15-0:20	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	2:35-4:00	1:00-1:40	1:20-1:50	1:00-1:25		
		75/25	5:00	1:05-1:45	0:30-0:55	0:45-1:10	0:35-0:50		
		50/50	3:00	0:20-0:35	0:05-0:15	0:15-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-2:05	0:45-1:20	**0:20-1:00	**0:10-0:30		
		75/25	5:00	0:25-1:00	0:25-0:50	**0:20-1:10	**0:10-0:35		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:40	0:40-1:10				
below -25	below -13	100/0	**KILFROST ABC-S** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **KILFROST ABC-S** Type IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **KILFROST ABC-S** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4D - Guideline for Holdover Times Anticipated for SAFEWING MP IV 1957 Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 16,200cP, 20°, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:05-2:15	0:35-1:05	0:40-1:10	0:30-0:45	0:15-1:10	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:10-2:10	0:35-1:05	0:35-1:05	0:25-0:40	0:10-1:00	
		50/50	4:00	0:25-0:50	0:15-0:30	0:15-0:25	0:05-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:05-2:15	0:30-0:55	0:40-1:10	0:30-0:45		
		75/25	5:00	1:10-2:10	0:30-0:50	0:35-1:05	0:25-0:40		
		50/50	3:00	0:25-0:50	0:10-0:20	0:15-0:25	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:30	0:30-0:50	**0:35-0:55	**0:20-0:35		
		75/25	5:00	0:25-1:10	0:20-0:40	**0:25-0:55	**0:15-0:30		
below -14 to -25	below 7 to -13	100/0	12:00	0:25-0:40	0:25-0:45				
below -25	below -13	100/0	**SAFEWING® MP IV 1957** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SAFEWING® MP IV 1957** Type IV fluid cannot be used.						

°C = Degrees Celsius   OAT = Outside Air Temperature
°F = Degrees Fahrenheit   VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **SAFEWING MP IV 1957** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4E - Guideline for Holdover Times Anticipated for SAFEWING MP IV 2001 Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 18,000cP, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:20-3:20	1:55-2:00	0:55-1:55	0:40-1:00	0:15-2:00	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:20-2:00	0:50-1:25	0:35-1:10	0:25-0:35	0:10-1:25	
		50/50	4:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:20-3:20	1:00-1:55	0:55-1:55	0:40-1:00		
		75/25	5:00	1:20-2:00	0:35-1:00	0:35-1:10	0:25-0:35		
		50/50	3:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:35	0:30-0:50	**0:55-1:35	**0:30-0:45		
		75/25	5:00	0:30-1:00	0:20-0:35	**0:40-1:10	**0:20-0:30		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:20-0:35				
below -25	below -13	100/0	**SAFEWING® MP IV 2001** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SAFEWING® MP IV 2001** Type IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **SAFEWING MP IV 2001** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4F – Guideline for Holdover Times Anticipated for CLARIANT SAFEWING MP IV 2012 PROTECT Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% fluid Tested 7,800cp, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:15-2:30	1:10-2:00	0:40-1:10	0:25-0:45	0:10-1:05	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:10-2:05	0:35-1:10	0:35-0:50	0:15-0:30	0:05-0:40	
		50/50	4:00	0:25-0:45	0:15-0:25	0:15-0:20	0:05-0:10	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:15-2:30	0:40-1:15	0:40-1:10	0:25-0:45		
		75/25	5:00	1:10-2:05	0:25-0:55	0:35-0:50	0:15-0:30		
		50/50	3:00	0:25-0:45	0:15-0:25	0:15-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:45	0:20-0:40	**0:25-0:45	**0:15-0:25		
		75/25	5:00	0:25-1:05	0:20-0:40	**0:15-0:30	**0:10-0:20		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:15-0:30				
below -25	below -13	100/0	**CLARIANT SAFEWING MP IV 2012 PROTECT** TYPE IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SAFEWING MP IV 2012 PROTECT** TYPE IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **SAFEWING MP IV** FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4G - Guideline for Holdover Times Anticipated for SAFEWING FOUR Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – *Viscosity of Neat 100% Fluid Tested 6,400cP, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.*

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:50-2:45	0:45-1:45	1:05-1:45	0:50-1:05	0:10-1:20	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:45-2:25	0:40-1:25	0:50-1:30	0:30-0:45	0:15-1:25	
		50/50	4:00	0:30-0:45	0:15-0:25	0:15-0:25	0:10-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:50-2:45	0:35-1:20	1:05-1:45	0:50-1:05		
		75/25	5:00	1:45-2:25	0:30-1:05	0:50-1:30	0:30-0:45		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:10-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:30-1:30	0:25-0:55	**0:25-1:05	**0:15-0:30		
		75/25	5:00	0:30-1:05	0:20-0:45	**0:20-0:50	**0:15-0:25		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:20-0:45				
below -25	below -13	100/0	**SAFEWING® FOUR** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SAFEWING® FOUR** Type IV fluid cannot be used.						

°C = Degrees Celsius   OAT = Outside Air Temperature
°F = Degrees Fahrenheit   VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **SAFEWING® FOUR** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 4H - Guideline for Holdover Times Anticipated for SPCA AD-480 Type IV Fluid Mixtures as a Function of Weather Conditions and OAT – ***Viscosity of Neat 100% Fluid Tested 15,200cP, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 30 min.***

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY, AND IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		SAE Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	2:00-3:30	0:55-1:50	0:50-1:30	0:35-0:55	0:15-1:35	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:30-2:45	0:40-1:20	0:50-1:15	0:30-0:45	0:10-1:15	
		50/50	4:00	0:30-0:45	0:15-0:30	0:15-0:25	0:05-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	2:00-3:30	0:40-1:20	0:50-1:30	0:35-0:55		
		75/25	5:00	1:30-2:45	0:30-1:05	0:50-1:15	0:30-0:45		
		50/50	3:00	0:30-0:45	0:10-0:20	0:15-0:25	0:05-0:15		
below -3 to -14	below 27 to 7	100/0	12:00	0:20-1:20	0:30-0:55	**0:25-1:20	**0:15-0:30		
		75/25	5:00	0:25-0:50	0:20-0:45	**0:25-1:05	**0:15-0:30		
below -14 to -25	below 7 to -13	100/0	12:00	0:15-0:40	0:25-0:40				
below -25	below -13	100/0	**SPCA AD-480** Type IV fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when **SPCA AD-480** Type IV fluid cannot be used.						

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
◆ Snow includes snow grains

CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.

CAUTION: **SPCA AD-480** TYPE IV FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2001

TABLE 5 - Guidelines for the Application of SAE Type II and Type IV Fluid Mixtures.
Minimum Concentrations as a Function of Outside Air Temperature (OAT).
Concentrations in % V/V

Outside Air Temperature OAT	One-step Procedure Deicing/anti-icing	Two-step Procedure	
		First step: Deicing	Second step: Anti-icing[1]
-3 °C (27 °F) and above	50/50 Heated [2] Type II/IV	Water heated or a heated mix of Type I, II, or IV with water	50/50 Type II/IV
Below –3 °C (27 °F) to –14 °C (7 °F)	75/25 Heated [2] Type II/IV	Heated suitable mix of Type I, Type II/IV, and water with FP not more than 3 °C (5 °F) above actual OAT	75/25 Type II/IV
Below –14 °C (7 °F) to –25 °C (-13 °F)	100/0 Heated [2] Type II/IV	Heated suitable mix of Type I, Type II/IV, and water with FP not more than 3 °C (5 °F) above actual OAT	100/0 Type II/IV
Below –25 °C (-13 °F)	SAE Type II/IV fluid may be used below –25 °C (-13 °F) provided that the freezing point of the fluid is at least a 7 °C (13 °F) below OAT and that aerodynamic acceptance criteria are met. Consider the use of SAE Type I when Type II/IV fluid cannot be used (see table 1).		

NOTE: 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.

CAUTION: Wing skin temperatures may differ and in some cases may be lower than OAT.
A stronger mix can be used under the latter conditions.

CAUTION: As fluid freezing may occur, 50/50 Type II or IV fluid shall not be used for the anti-icing step of a cold soaked wing as indicated by frost or ice on the lower surface of the wing in the area of the fuel tank.

1) To be applied before first step fluid freezes, typically within 3 minutes.

2) Clean aircraft may be anti-iced with unheated fluid.

CAUTION: An insufficient amount of anti-icing fluid, especially in the second step of a two-step procedure may cause a substantial loss of holdover time, particularly when using a Type I fluid mixture for the first step (deicing).

Effective: October 1, 2001

Table 6. List of Qualified [(1)] Deicing/Anti-Icing Fluids – Winter 2001-2002

Qualified Type I Deicing/Anti-Icing Fluids

Company Name	Fluid Name
Clariant	Safewing DGI 1937
Clariant	Safewing MPI 1938
Clariant	Safewing MP I 1938 TF
Clariant	Safewing EG I 1996
Delta Petroleum	Ice Away
Home Oil Inc.	SAFETEMP I PG 100
Inland	Duragly – P
Inland	Duragly – E
Jarchem	JarKleer 1000
Kilfrost	Kilfrost® DF
Kilfrost	Kilfrost® DF PLUS
Kilfrost	Kilfrost® DF PLUS (80)
Lyondell Chemical Worldwide, Inc	ARCOPlus Concentrate
Lyondell Chemical Worldwide, Inc	ARCOPlus Dilute
Lyondell Chemical Worldwide, Inc	ARCOPlus Canadian Dilute
Metss Corporation	ADF
Newwave Aerochemical Co. Ltd.	FCY-1A
Octagon Process, Inc	OCTAFLO
Octagon Process, Inc	OCTAFLO EG
Octagon Process, Inc	OCTAFLO EF
SPCA	SPCA DE-910
Union Carbide	UCAR® ADF Concentrate
Union Carbide	UCAR® ADF 50/50
Union Carbide	UCAR® XL 54
Union Carbide	UCAR®DEGree™

Table 6 – Continued.

Qualified Type II Deicing/Anti-Icing Fluids

Company Name	Fluid Name
Clariant	Safewing MP II 1951
Kilfrost	Kilfrost® ABC-II PLUS
Kilfrost	Kilfrost® ABC-3
Octagon Process, Inc	Forty Below
SPCA	SPCA AD-104/N(MPG)
SPCA	SPCA Ecowing 26

Qualified Type IV Deicing/Anti-Icing Fluids

Company Name	Fluid Name
Clariant	Safewing MP IV 1957
Clariant	Safewing MP IV 2001
Clariant	Safewing FOUR
Clariant	Safewing MP IV 2012 PROTECT
Kilfrost	Kilfrost ABC-S
Octagon Process, Inc.	Max Flight
SPCA	SPCA AD-480
Union Carbide	UCAR® ADF/AAF ULTRA+

(1) Qualified implies that the fluid has met the requirements of the applicable SAE AMS performance specifications as conducted by the Anti-Icing Materials International Laboratory at the University of Quebec at Chicoutimi, Canada, in effect at the time of certification; and has completed holdover time testing. Fluids that successfully qualify after the issuance of this list will appear in a later update.

APPENDIX K

LOG OF ENDURANCE TIME TESTS
2000-01

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	APS OBS temp [°C]	Snow Type	D angle (°)	comments
1	1	Dec-11-00	1	1	22:47:45	22:52:45	dil.	Clariant EG I 1996	1a	-14	19.25	16	U	5.0	12.4	11%	7.0	-4.8	29	44	0.6	-5.0	S	44	
8	3	Dec-11-00	3	1	23:08:25	23:14:15	dil.	Clariant EG I 1996	1a	-14	19	16	U	5.8	9.1	4%	8.4	-5.2	31	52	0.7	-6.0	S	52	
12	4	Dec-11-00	4	1	23:26:00	23:31:10	dil.	Clariant EG I 1996	1a	-14	19.25	16	V	5.2	12.9	5%	11.5	-5.4	34	49	0.8	-6.0	S	49	
15	5	Dec-11-00	5	1	23:58:13	0:02:10	dil.	Clariant EG I 1996	1a	-16	19.75	17	V	4.0	29.9	11%	19.0	-5.7	38	49	0.4	-6.0	S	49	
18	6	Dec-12-00	6	1	0:29:55	0:34:55	dil.	Clariant EG I 1996	1a	-16	20.25	16	V	5.0	14.8	5%	23.1	-5.8	37	46	0.4	-6.4	S	46	
21	7	Dec-12-00	7	1	0:47:15	0:51:20	dil.	Clariant EG I 1996	1a	-16	20.25	18	V	4.1	18.4	9%	12.0	-5.8	37	42	0.5	-6.0	S	42	
27	9	Dec-14-00	2	2	5:59:20	6:03:10	dil.	Clariant EG I 1996	1a	-22	24	23	U	3.8	17.4	13%	53.3	-11.8	24	41	0.3	-12.0	S	41	
32	11	Dec-14-00	4	1	7:56:33	8:02:10	dil.	Clariant EG I 1996	1a	-22	23.75	23	U	5.6	10.9	20%	12.4	-11.3	23	40	0.6	-12.0	S	40	
36	12	Dec-30-00	1	1	19:45:01	19:50:59	dil.	Clariant EG I 1996	1a		19.5	20	V	6.0	11.0	10%	4.7	-4.3	28	29	0.8	-5.0	S	29	
39	13	Dec-30-00	2	1	20:19:07	20:24:31	dil.	Clariant EG I 1996	1a		19.5	19	V	5.4	14.0	16%	15.0	-4.0	29	37	0.7	-5.0	S	37	
42	14	Dec-30-00	3	1	20:51:14	20:55:15	dil.	Clariant EG I 1996	1a		19.25	19	V	4.0	19.0	9%	15.8	-4.1	26	27	0.5	-5.0	S	27	
45	15	Dec-30-00	4	1	21:22:53	21:28:30	dil.	Clariant EG I 1996	1a		19	22	V	5.6	13.1	10%	10.3	-4.3	36	30	0.5	-5.0	S	30	
79	21	Jan-31-01	2	1	12:41:50	12:53:10	dil.	Clariant EG I 1996	1a	-18	21.0	17	2	11.3	5.3	13%	0.4	-7.6	35	36	0.7	-8.6	S	0	
91	23	Jan-31-01	4	1	16:18:00	16:24:40	dil.	Clariant EG I 1996	1a			21	2	6.7	5.1	31%	4.2	-8.5	20	20	0.7	-9.0	S	0	
179	37	Feb-19-01	4	1	16:01:50	16:05:30	dil.	Clariant EG I 1996	1a	-12	17	19	4	3.7	26.4	26%		-2.2	28.9	175	0.3	-3.0	S	0	
284	46	Mar-05-01	3C	2	23:23:55	23:35:10	dil.	Clariant EG I 1996	1a	-13			10	11.3	6.9	0%		-1.9	34.2	42	1.2	-2.5	S		
287	46	Mar-05-01	3D	2	23:58:15	0:11:00	dil.	Clariant EG I 1996	1a	-13			10	12.8	6.1	2%		-1.7	32.0	37	1.6	-2.5	S		
388	52	Mar-13-01	1D	1	5:41:00	5:44:30	dil.	Clariant EG I 1996	1a	-16			U	3.5	20.0	5%		-6.2	29.2	47	0.4	-6.5	S		
2	1	Dec-11-00	1	1	22:48:35	22:54:00	dil.	Clariant MP I 1938	1a	-14	23.25	17	V	5.4	12.4	11%	7.0	-4.8	28	43	0.6	-5.0	S	43	
9	3	Dec-11-00	3	1	23:09:00	23:15:15	dil.	Clariant MP I 1938	1a	-14	23.25	16	V	6.3	9.1	4%	8.1	-5.2	32	52	0.7	-6.0	S	52	
11	4	Dec-11-00	4	1	23:25:15	23:30:30	dil.	Clariant MP I 1938	1a	-14	23.25	18	U	5.3	12.9	5%	11.5	-5.4	34	48	0.8	-6.0	S	48	
14	5	Dec-11-00	5	1	23:57:29	0:01:40	dil.	Clariant MP I 1938	1a	-16	24.75	18	U	4.2	29.9	11%	14.3	-5.7	36	48	0.4	-6.0	S	48	
17	6	Dec-12-00	6	1	0:29:10	0:34:30	dil.	Clariant MP I 1938	1a	-16	24.75	20	U	5.3	14.8	5%	23.1	-5.8	37	46	0.4	-6.4	S	46	
22	7	Dec-12-00	7	1	0:48:00	0:52:05	dil.	Clariant MP I 1938	1a	-16	24.75	18	W	4.1	18.4	9%	12.0	-5.8	37	43	0.5	-6.0	S	43	
28	9	Dec-14-00	2	2	6:00:05	6:04:20	dil.	Clariant MP I 1938	1a	-22	28.5	25	V	4.3	17.4	13%	40.0	-11.8	24	41	0.3	-12.0	S	41	
33	11	Dec-14-00	4	1	7:57:27	8:03:07	dil.	Clariant MP I 1938	1a	-22	28.5	23	V	5.7	10.9	20%	12.4	-11.3	24	40	0.6	-12.0	S	40	
37	12	Dec-30-00	1	1	19:45:40	19:51:40	dil.	Clariant MP I 1938	1a		24.5	18	W	6.0	11.0	10%	4.7	-4.3	29	30	0.8	-5.0	S	30	
40	13	Dec-30-00	2	1	20:19:53	20:25:00	dil.	Clariant MP I 1938	1a		24.25	18	W	5.1	14.0	16%	18.0	-4.0	29	38	0.7	-5.0	S	38	
43	14	Dec-30-00	3	1	20:52:09	20:56:16	dil.	Clariant MP I 1938	1a		24.5	18	W	4.1	19.0	9%	16.7	-4.1	25	27	0.5	-5.0	S	27	
46	15	Dec-30-00	4	1	21:23:39	21:29:20	dil.	Clariant MP I 1938	1a		24.5	21	W	5.7	13.1	10%	10.3	-4.3	37	30	0.5	-5.0	S	30	
80	21	Jan-31-01	2	1	12:42:40	12:54:30	dil.	Clariant MP I 1938	1a	-18	26.0	18	3	11.8	5.3	13%	0.4	-7.6	36	36	0.7	-8.6	S	0	
92	23	Jan-31-01	4	1	16:18:45	16:25:30	dil.	Clariant MP I 1938	1a			20	3	6.8	5.1	31%	4.9	-8.5	20	21	0.8	-9.0	S	0	
283	46	Mar-05-01	3C	2	23:23:05	23:36:15	dil.	Clariant MP I 1938	1a	-13			5	13.2	6.9	1%		-1.9	34.1	42	1.2	-2.5	S		
286	46	Mar-05-01	3D	2	23:57:30	0:12:30	dil.	Clariant MP I 1938	1a	-13			5	15.0	6.0	2%		-1.7	32.1	37	1.6	-2.5	S		
307	48	Mar-09-01	1B	2	2:37:10	2:54:40	dil.	Clariant MP I 1938	1a	-12	28.75	19	U	17.5	3.4	2%		-1.3	3.5	105	0.9	-1.3	S		
52	17	Jan-15-01	1	2	20:39:30	22:46:00	Neat	Clariant Safewing Protect 2012	4				V	126.5	4.9	6%	4.4	-8.0	21	30	2.4	-8.6	S	30	
55	17	Jan-15-01	1	2	20:42:00	22:46:00	Neat	Clariant Safewing Protect 2012	4				Y	124.0	4.9	6%	4.3	-8.0	21	30	2.4	-8.6	S	30	
57	17.1	Jan-15-01	2	2	23:35:31	0:02:00	Neat	Clariant Safewing Protect 2012	4				V	26.5	19.8	2%	16.2	-7.7	17	27	0.5	-8.3	S	27	
63	18	Jan-30-01	1	2	17:46:00	18:16:00	Neat	Clariant Safewing Protect 2012	4				Y	30.0	21.2	2%	7.2	-3.7	37	38	0.7	-4.5	S	0	
68	19	Jan-30-01	2	2	20:05:00	22:00:00	Neat	Clariant Safewing Protect 2012	4				Y	115.0	5.7	10%	3.6	-2.9	29	23	1.3	-3.5	S	0	
70	20	Jan-31-01	1	2	11:30:00	13:11:00	Neat	Clariant Safewing Protect 2012	4				U	101.0	5.6	2%	0.4	-7.4	32	38	1.0	-8.0	S	0	
76	20	Jan-31-01	1A	2	13:12:00	14:32:00	Neat	Clariant Safewing Protect 2012	4				U	80.0	9.8	7%	4.3	-7.8	29	32	0.7	-9.0	S	0	
82	22	Jan-31-01	3	2	14:42:00	15:37:00	Neat	Clariant Safewing Protect 2012	4				U	55.0	11.5	6%	8.1	-8.4	26	31	0.5	-9.2	S	0	
88	22	Jan-31-01	3A	2	15:50:00	17:59:00	Neat	Clariant Safewing Protect 2012	4				U	129.0	3.7	13%	3.3	-8.7	23	22	1.7	-9.8	S	0	
101	27	Feb-05-01	1	2	9:29:00	10:38:00	Neat	Clariant Safewing Protect 2012	4				U	69.0	8.1	9%	10.6	-7.9	16	28	0.7	-9.0	S	0	
107	28	Feb-05-01	2	2	11:40:00	13:16:00	Neat	Clariant Safewing Protect 2012	4				U	96.0	6.5	3%	6.4	-6.2	17	41	0.8	-8.0	S	0	
110	29	Feb-05-01	3	2	16:28:00	17:46:00	Neat	Clariant Safewing Protect 2012	4				U	78.0	8.4	8%	5.2	-4.8	20	27	0.7	-6.0	S	0	
118	30	Feb-14-01	1	2	10:30:00	11:36:00	Neat	Clariant Safewing Protect 2012	4				W	66.0	11.9	3%		-6.8	14.9	28	0.6	-7.5	S	0	
120	30	Feb-14-01	1	2	10:30:00	11:38:00	Neat	Clariant Safewing Protect 2012	4				Y	68.0	11.9	3%		-6.8	15.0	28	0.6	-7.5	S	0	
125	31	Feb-14-01	2	2	13:29:30	14:14:00	Neat	Clariant Safewing Protect 2012	4				W	44.5	16.1	0%		-6.1	5.0	171	0.4	-7.0	S	0	
127	31	Feb-14-01	2	2	13:30:00	14:14:00	Neat	Clariant Safewing Protect 2012	4				Y	44.0	16.1	0%		-6.1	5.0	175	0.4	-7.0	S	0	

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	APS OBS temp [°C]	Snow Type	D angle (°)	comments
131	32	Feb-14-01	3	2	15:26:00	18:35:00	Neat	Clariant Safewing Protect 2012	4				W	189.0	3.2	2%		-4.5			0.6	-5.0	S	0	
133	32	Feb-14-01	3	2	15:26:00	18:42:00	Neat	Clariant Safewing Protect 2012	4				Y	196.0	3.2	2%		-4.5			0.6	-5.0	S	0	
135	33	Feb-14-01	4	2	20:52:00	22:07:00	Neat	Clariant Safewing Protect 2012	4				V	75.0	7.8	5%		-3.9	4	252	0.4	-3.0	S	0	
136	33	Feb-14-01	4	2	20:52:00	22:06:00	Neat	Clariant Safewing Protect 2012	4				W	74.0	7.8	5%		-3.9	4	255	0.4	-3.0	S	0	
168	36	Feb-19-01	3	2	15:08:00	15:51:00	Neat	Clariant Safewing Protect 2012	4				X	43.0	22.2	7%		-2.4	26.1	187	0.3	-2.8	S	0	
184	38	Feb-22-01	1	2	22:16:00	23:31:00	Neat	Clariant Safewing Protect 2012	4				W	75.0	2.6	4%		-15.1	20.7	39	2.3	-15.0	S	0	
187	38	Feb-22-01	1	2	22:16:00	23:30:00	Neat	Clariant Safewing Protect 2012	4				Z	74.0	2.6	5%		-15.1	20.7	39	2.3	-15.0	S	0	Rate increased at 23:20
191	38	Feb-22-01	1	2	22:33:00	0:06:00	Neat	Clariant Safewing Protect 2012	4				10	93.0	2.8	6%		-15.2	19.5	36	1.9	-15.0	S	0	Rate increased at 23:20
193	38	Feb-22-01	1A	2	23:49:00	0:57:00	Neat	Clariant Safewing Protect 2012	4				5	68.0	4.0	10%		-15.8			1.0	-15.0	S	0	
194	38	Feb-22-01	1A	2	23:34:00	0:26:00	Neat	Clariant Safewing Protect 2012	4				6	52.0	4.0	8%		-15.4			1.0	-15.0	S	0	
198	39	Feb-23-01	2	1	22:41:00	23:50:00	Neat	Clariant Safewing Protect 2012	4				4	69.0	2.5	2%		-15.2	19.2	34	2.1	-15.0	S	0	
200	39	Feb-23-01	2	1	22:42:00	23:53:00	Neat	Clariant Safewing Protect 2012	4				6	71.0	2.4	3%		-15.2	19.2	35	2.0	-15.0	S	0	
203	40	Feb-23-01	3	2	1:27:00	2:25:00	Neat	Clariant Safewing Protect 2012	4				W	58.0	4.3	1%		-16.4	18.3	22	1.1	-15.0	S	0	
206	40	Feb-23-01	3	2	1:27:00	2:27:00	Neat	Clariant Safewing Protect 2012	4				Z	60.0	4.2	2%		-16.4	18.3	22	1.1	-15.0	S	0	
209	41	Feb-23-01	4	2	3:27:00	4:41:00	Neat	Clariant Safewing Protect 2012	4				W	74.0	2.6	11%		-16.4	18.5	28	1.3	-17.0	S	0	
211	41	Feb-23-01	4	2	3:27:00	4:41:00	Neat	Clariant Safewing Protect 2012	4				Z	74.0	2.6	11%		-16.4	18.5	28	1.3	-17.0	S	0	
222	42	Feb-25-01	1	2	6:15:30	7:18:00	Neat	Clariant Safewing Protect 2012	4				Y	62.5	10.0	9%		-9.3	21	52	1.4	-11.3	S	0	
235	43	Feb-25-01	2	2	8:13:00	8:34:00	Neat	Clariant Safewing Protect 2012	4				Y	21.0	32.3	13%		-9.8	21	46	0.4	-10.7	S	0	
273	46	Mar-05-01	3	2	21:28:45	22:53:00	Neat	Clariant Safewing Protect 2012	4				Y	84.3	10.2	12%		-2.0	34.5	50	0.9	-2.5	S		
296	47	Mar-06-01	4	2	1:06:00	2:47:00	Neat	Clariant Safewing Protect 2012	4				Y	101.0	8.3	4%		-1.7	34.8	42	1.0	-2.6	S		
362	51	Mar-11-01	2	2	12:21:00	13:18:00	Neat	Clariant Safewing Protect 2012	4				1	57.0	12.4	2%		-0.7	14.2	172	0.8	-0.5	S		Plate temperatures are above 0 °C
384	52	Mar-13-01	1C	1	5:18:30	5:43:30	Neat	Clariant Safewing Protect 2012	4				W	25.0	27.0	1%		-6.1	26.1	51	0.4	-6.5	S		
435	55	Mar-13-01	4	1	21:55:00	22:36:00	Neat	Clariant Safewing Protect 2012	4				2	41.0	18.7	3%		-1.6	5	229	0.4	-2.0	S		
95	24	Feb-02-01	1	2	11:40:30	12:13:30	50%	Clariant Safewing Protect 2012	4a				W	33.0	6.0	6%		-2.4	14	130	0.9	-2.1	S	0	
97	24	Feb-02-01	1	2	11:41:00	12:14:40	50%	Clariant Safewing Protect 2012	4a				Z	33.7	6.1	6%		-2.4	14	130	0.9	-2.1	S	0	
98	26	Feb-02-01	3	2	16:44:50	17:19:15	50%	Clariant Safewing Protect 2012	4a				U	34.4	5.7	3%		-0.9	15	147	1.1	-1.1	S	0	
100	26	Feb-02-01	3	2	16:45:25	17:19:30	50%	Clariant Safewing Protect 2012	4a				X	34.1	5.7	3%		-0.9	15	148	1.1	-1.1	S	0	
139	33	Feb-14-01	4A	2	21:48:10	22:07:40	50%	Clariant Safewing Protect 2012	4a				Y	19.5	6.3	2%		-3.8	1	77	0.4	-3.0	S	0	
142	33	Feb-14-01	4	2	22:17:00	22:37:40	50%	Clariant Safewing Protect 2012	4a				W	20.7	11.1	3%		-3.6	7	310	0.4	-3.0	S	0	
148	34	Feb-19-01	1	2	13:21:00	13:38:50	50%	Clariant Safewing Protect 2012	4a				Z	17.8	8.3	2%		-2.5	25.6	210	0.7	-2.4	S	0	
151	34	Feb-19-01	1A	2	13:45:15	14:00:45	50%	Clariant Safewing Protect 2012	4a				Z	15.5	13.2	1%		-2.6	22.9	198	0.7	-2.4	S	0	
158	34	Feb-19-01	1C	2	14:22:45	14:36:00	50%	Clariant Safewing Protect 2012	4a				Y	13.3	23.8	8%		-2.4	24.2	190	0.4	-2.4	S	0	
249	44	Mar-05-01	1	2	18:27:45	19:02:15	50%	Clariant Safewing Protect 2012	4a				3	34.5	6.2	3%		-2.3				-2.7	S		
255	44	Mar-05-01	1A	2	19:31:00	20:01:15	50%	Clariant Safewing Protect 2012	4a				X	30.3	7.4	5%		-2.0				-2.7	S		
261	44	Mar-05-01	1B	2	20:17:00	20:49:15	50%	Clariant Safewing Protect 2012	4a				Y	32.3	6.7	0%		-1.8	34.6	48	1.1	-2.7	S		
263	45	Mar-05-01	2	1	21:06:15	21:32:00	50%	Clariant Safewing Protect 2012	4a				U	25.8	9.2	15%		-2.0	35.1	49	1.0	-2.5	S		
264	45	Mar-05-01	2	1	21:06:30	21:32:30	50%	Clariant Safewing Protect 2012	4a				V	26.0	9.3	15%		-2.0	35.1	49	1.0	-2.5	S		
278	46	Mar-05-01	3B	2	22:51:00	23:16:00	50%	Clariant Safewing Protect 2012	4a				V	25.0	11.0	6%		-2.0	33.0	45	0.9	-2.5	S		
288	46	Mar-06-01	3E	2	0:21:40	0:46:30	50%	Clariant Safewing Protect 2012	4a				U	24.8	11.8	5%		-1.9	34.0	38	0.9	-2.5	S		Sub Run
305	48	Mar-09-01	1	2	1:52:40	2:48:00	50%	Clariant Safewing Protect 2012	4a				Z	55.3	3.0	2%		-1.3	4.5	122	1.2	-1.3	S		
310	48	Mar-09-01	1C	2	2:44:00	3:14:00	50%	Clariant Safewing Protect 2012	4a				10	30.0	3.8	2%		-1.3	4.7	108	0.9	-1.3	S		
312	49	Mar-09-01	2	1	2:15:48	3:04:00	50%	Clariant Safewing Protect 2012	4a				U	48.2	3.4	3%		-1.3	4.0	111	1.0	-1.5	S		
316	49	Mar-09-01	2A	1	3:11:10	3:42:30	50%	Clariant Safewing Protect 2012	4a				U	31.3	6.2	2%		-1.2	3.6	94	0.8	-1.5	S		Sub Run
345	50	Mar-11-01	1D	2	10:44:10	11:03:00	50%	Clariant Safewing Protect 2012	4a				W	18.8	12.9	2%		-1.3	14.6	155	1.1	-1.2	S		
439	55	Mar-13-01	4A	1	22:37:00	23:01:40	50%	Clariant Safewing Protect 2012	4a				2	24.7	12.4	1%		-1.6	7	315	0.5	-2.0	S		
451	57	Mar-23-01	2	1	16:05:15	16:19:00	50%	Clariant Safewing Protect 2012	4a				W	13.8	25.4	6%		0.3	12	324	0.9	0.1	S		
460	57	Mar-23-01	2B	1	17:15:45	17:31:30	50%	Clariant Safewing Protect 2012	4a				U	15.8	14.4	3%		0.2	10	351	0.7	0.1	S		
53	17	Jan-15-01	1	2	20:40:10	22:28:00	75%	Clariant Safewing Protect 2012	4b				W	107.8	4.7	6%	4.6	-8.0	22	31	2.3	-8.6	S	31	
56	17	Jan-15-01	1	2	20:42:50	22:34:00	75%	Clariant Safewing Protect 2012	4b				Z	111.2	4.7	6%	4.5	-8.0	22	31	2.4	-8.6	S	31	
58	17.1	Jan-15-01	2	2	23:36:15	23:57:00	75%	Clariant Safewing Protect 2012	4b				W	20.8	20.0	2%	16.1	-7.7	17	27	0.5	-8.3	S	27	
64	18	Jan-30-01	1	2	17:45:00	18:07:00	75%	Clariant Safewing Protect 2012	4b				Z	22.0	17.9	1%	6.2	-3.7	36	39	0.9	-4.5	S	0	

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	APS OBS temp [°C]	Snow Type	D angle (°)	comments
69	19	Jan-30-01	2	2	20:06:00	21:38:00	75%	Clariant Safewing Protect 2012	4b				Z	92.0	5.1	11%	3.5	-2.9	29	24	1.4	-3.5	S	0	
71	20	Jan-31-01	1	2	11:31:00	12:39:00	75%	Clariant Safewing Protect 2012	4b				V	68.0	5.6	1%	0.4	-7.3	30	39	1.1	-8.0	S	0	
77	20	Jan-31-01	1A	2	12:48:00	13:49:00	75%	Clariant Safewing Protect 2012	4b				V	61.0	6.9	7%	0.4	-7.7	33	35	0.8	-9.0	S	0	
83	22	Jan-31-01	3	2	14:43:00	15:22:00	75%	Clariant Safewing Protect 2012	4b				V	39.0	12.0	5%	7.3	-8.3	26	33	0.5	-9.2	S	0	
89	22	Jan-31-01	3A	2	15:50:00	17:10:00	75%	Clariant Safewing Protect 2012	4b				V	80.0	4.8	13%	3.8	-8.6	23	23	1.1	-9.8	S	0	
104	27	Feb-05-01	1	2	9:31:00	10:23:00	75%	Clariant Safewing Protect 2012	4b				X	52.0	7.9	8%	11.7	-8.0	17	28	0.8	-9.0	S	0	
108	28	Feb-05-01	2	2	11:42:00	12:45:00	75%	Clariant Safewing Protect 2012	4b				X	63.0	7.1	3%	5.5	-6.3	16	39	0.8	-8.0	S	0	
113	29	Feb-05-01	3	2	16:27:00	17:38:00	75%	Clariant Safewing Protect 2012	4b				X	71.0	8.6	8%	5.3	-4.8	19	27	0.7	-6.0	S	0	
121	30	Feb-14-01	1	2	10:31:00	11:13:00	75%	Clariant Safewing Protect 2012	4b				Z	42.0	9.5	1%		-6.8	15.5	31	0.6	-7.5	S	0	
122	30	Feb-14-01	1A	2	11:20:00	12:16:00	75%	Clariant Safewing Protect 2012	4b				Z	56.0	9.8	3%		-6.7	12.2	70	0.6	-7.5	S	0	
128	31	Feb-14-01	2	2	13:31:00	14:10:00	75%	Clariant Safewing Protect 2012	4b				Z	39.0	16.6	0%		-6.1	5.0	153	0.4	-7.0	S	0	
134	32	Feb-14-01	3	2	15:27:00	17:57:00	75%	Clariant Safewing Protect 2012	4b				Z	150.0	3.1	1%		-4.6		129	0.7	-5.0	S	0	
137	33	Feb-14-01	4	2	20:48:00	21:43:00	75%	Clariant Safewing Protect 2012	4b				Y	55.0	8.4	6%		-3.9	5	315	0.4	-3.0	S	0	
138	33	Feb-14-01	4	2	20:48:00	21:42:00	75%	Clariant Safewing Protect 2012	4b				Z	54.0	8.5	6%		-3.9	5	315	0.4	-3.0	S	0	
170	36	Feb-19-01	3A	2	15:44:00	16:09:00	75%	Clariant Safewing Protect 2012	4b				U	25.0	27.8	11%		-2.3	27.6	177	0.3	-2.8	S	0	
172	36	Feb-19-01	3A	2	15:52:00	16:23:00	75%	Clariant Safewing Protect 2012	4b				X	31.0	27.6	7%		-2.4	29.1	171	0.3	-2.8	S	0	
189	38	Feb-22-01	1	2	22:49:00	23:37:00	75%	Clariant Safewing Protect 2012	4b				5	48.0	2.7	7%		-15.1	19.0	33	2.5	-15.0	S	0	
223	42	Feb-25-01	1	2	6:16:15	7:10:00	75%	Clariant Safewing Protect 2012	4b				Z	53.8	9.1	11%		-9.4	22	51	1.5	-11.3	S	0	
236	43	Feb-25-01	2	2	8:13:30	8:29:00	75%	Clariant Safewing Protect 2012	4b				Z	15.5	32.1	14%		-9.9	22	46	0.4	-10.7	S	0	
274	46	Mar-05-01	3	2	21:29:25	22:33:00	75%	Clariant Safewing Protect 2012	4b				Z	63.6	10.7	12%		-2.0	35.5	50	0.9	-2.5	S		
297	47	Mar-06-01	4	2	1:07:00	2:16:00	75%	Clariant Safewing Protect 2012	4b				Z	69.0	8.6	4%		-1.7	33.8	43	1.0	-2.6	S		
319	49	Mar-09-01	2A	1	2:18:00	3:52:00	75%	Clariant Safewing Protect 2012	4b				X	94.0	4.9	2%		-1.2	4.0	104	0.9	-1.5	S		
354	50	Mar-11-01	1F	2	11:26:00	11:56:00	75%	Clariant Safewing Protect 2012	4b				V	30.0	16.5	1%		-1.5	15.8	156	0.7	-1.2	S		
3	1	Dec-11-00	1	1	22:49:05	22:54:25	dil.	Lyondell Arco Plus.	1a	-13	21.25	17	W	5.3	12.4	11%	7.0	-4.8	28	43	0.6	-5.0	S	43	
10	3	Dec-11-00	3	1	23:09:40	23:15:40	dil.	Lyondell Arco Plus.	1a	-14	22.75	17	W	6.0	9.1	4%	7.0	-5.2	33	51	0.7	-6.0	S	51	
13	4	Dec-11-00	4	1	23:26:50	23:31:55	dil.	Lyondell Arco Plus.	1a	-12	22.75	17	W	5.1	12.9	5%	11.5	-5.4	34	49	0.8	-6.0	S	49	
16	5	Dec-11-00	5	1	23:59:01	0:02:45	dil.	Lyondell Arco Plus.	1a	-16	24.75	17	W	3.7	29.9	11%	14.3	-5.7	39	49	0.4	-6.0	S	49	
19	6	Dec-12-00	6	1	0:30:40	0:35:35	dil.	Lyondell Arco Plus.	1a	-10	24.75	17	W	4.9	14.8	5%	26.1	-5.8	38	47	0.4	-6.4	S	47	
20	7	Dec-12-00	7	1	0:46:30	0:50:50	dil.	Lyondell Arco Plus.	1a	-16	24.75	17	U	4.3	18.4	9%	12.0	-5.8	37	42	0.5	-6.0	S	42	
29	9	Dec-14-00	2	2	6:00:50	6:04:50	dil.	Lyondell Arco Plus.	1a	-22	28	25	W	4.0	17.4	13%	40.0	-11.8	24	41	0.3	-12.0	S	41	
34	11	Dec-14-00	4	1	7:58:17	8:03:42	dil.	Lyondell Arco Plus.	1a	-22	28	25	W	5.4	10.9	20%	10.3	-11.3	24	40	0.6	-12.0	S	40	
35	12	Dec-30-00	1	1	19:44:18	19:50:30	dil.	Lyondell Arco Plus.	1a		24.5	19	U	6.2	11.0	10%	4.7	-4.3	28	29	0.8	-5.0	S	29	
38	13	Dec-30-00	2	1	20:18:22	20:24:20	dil.	Lyondell Arco Plus.	1a		24	19	U	6.0	14.0	16%	18.0	-4.0	29	37	0.7	-5.0	S	37	
41	14	Dec-30-00	3	1	20:49:44	20:54:24	dil.	Lyondell Arco Plus.	1a		24.5	19	U	4.7	19.0	9%	18.1	-4.1	29	27	0.5	-5.0	S	27	
44	15	Dec-30-00	4	1	21:22:09	21:28:15	dil.	Lyondell Arco Plus.	1a		24.25	21	U	6.1	13.1	10%	8.6	-4.3	36	30	0.5	-5.0	S	30	
81	21	Jan-31-01	2	1	12:43:15	12:55:50	dil.	Lyondell Arco Plus.	1a	-18	26.0	22	4	12.6	5.3	13%	0.4	-7.6	36	36	0.7	-8.6	S	0	
93	23	Jan-31-01	4	1	16:19:25	16:26:30	dil.	Lyondell Arco Plus.	1a			20	4	7.1	5.1	31%	4.2	-8.5	20	21	0.8	-9.0	S	0	
162	35	Feb-19-01	2	1	13:43:40	13:50:20	dil.	Lyondell Arco Plus.	1a	-12	22	19	4	6.7	13.1	1%		-2.6	27.1	198	0.7	-3.0	S	0	
323	49	Mar-09-01	2B	1	3:41:20	3:52:20	dil.	Lyondell Arco Plus.	1a	-12			Y	11.0	8.1	2%		-1.1	2.8	86	0.6	-1.5	S		
359	50	Mar-11-01	1G	2	11:49:55	12:00:00	dil.	Lyondell Arco Plus.	1a	-12	28.50	21	7	10.1	17.3	2%		-1.4	15.3	154	0.7	-1.2	S		Sub Run
160	35	Feb-19-01	2	1	13:42:15	13:49:30	dil.	Lyondell Arco Plus-ST	1a	-12	23	26	2	7.3	13.1	1%		-2.6	27.8	197	0.7	-3.0	S	0	
163	35	Feb-19-01	2	1	13:44:15	13:50:40	dil.	Lyondell Arco Plus-ST	1a	-12	23	26	5	6.4	13.1	1%		-2.5	26.7	198	0.7	-3.0	S	0	
177	37	Feb-19-01	4	1	16:00:45	16:05:15	dil.	Lyondell Arco Plus-ST	1a	-12	23	19	2	4.5	26.4	26%		-2.2	28.7	175	0.3	-3.0	S	0	
180	37	Feb-19-01	4	1	16:02:20	16:06:00	dil.	Lyondell Arco Plus-ST	1a	-12	23	19	5	3.7	26.4	26%		-2.2	28.9	175	0.3	-3.0	S	0	
214	41	Feb-23-01	4A	2	4:58:30	5:22:15	dil.	Lyondell Arco Plus-ST	1a	-27			Y	23.8	0.8	19%		-16.1	15.3	30	2.9	-17.0	S	0	
215	41	Feb-23-01	4A	2	4:59:06	5:23:00	dil.	Lyondell Arco Plus-ST	1a	-27			Z	23.9	0.8	19%		-16.1	15.3	29	2.9	-17.0	S	0	
217	41	Feb-23-01	4B	2	5:46:30	6:02:20	dil.	Lyondell Arco Plus-ST	1a	-27			X	15.8	1.1	11%		-16.0	14.5	26	1.5	-17.0	S	0	
228	42	Feb-25-01	1B	2	7:25:00	7:29:30	dil.	Lyondell Arco Plus-ST	1a	-20	28	23	Z	4.5	17.9	3%		-7.6	15	63	0.6	-11.3	S	0	
230	42	Feb-25-01	1C	2	7:42:25	7:49:25	dil.	Lyondell Arco Plus-ST	1a	-20	28	22	Z	7.0	9.9	7%		-8.3	25	51	0.6	-11.3	S	0	
239	43	Feb-25-01	2B	2	8:33:15	8:36:15	dil.	Lyondell Arco Plus-ST	1a	-20	28	19	2	3.0	31.4	9%		-9.1	21	46	0.4	-10.0	S	0	
275	46	Mar-05-01	3A	2	21:57:10	22:10:00	dil.	Lyondell Arco Plus-ST	1a	-13			3	12.8	7.8	18%		-2.0	35.5	51	1.0	-2.5	S		Sub Run Brix 3.5 = 23

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	APS OBS temp [°C]	Snow Type	D angle (°)	comments
276	46	Mar-05-01	3A	2	21:58:10	22:12:15	dil.	Lyondell Arco Plus-ST	1a	-13			5	14.1	8.2	18%		-2.0	35.2	51	1.0	-2.5	S		brix 10= 17
282	46	Mar-05-01	3C	2	23:22:05	23:34:00	dil.	Lyondell Arco Plus-ST	1a	-13			3	11.9	6.8	1%		-1.9	34.3	42	1.2	-2.5	S		-3C OUT
285	46	Mar-05-01	3D	2	23:56:30	0:10:30	dil.	Lyondell Arco Plus-ST	1a	-13			3	14.0	5.8	2%		-1.7	31.9	37	1.6	-2.5	S		
308	48	Mar-09-01	1B	2	2:38:00	2:56:40	dil.	Lyondell Arco Plus-ST	1a	-12	25	19	Y	18.7	3.4	2%		-1.3	3.5	104	0.9	-1.3	S		
324	49	Mar-09-01	2B	1	3:42:15	3:54:20	dil.	Lyondell Arco Plus-ST	1a	-12			Z	12.1	8.1	2%		-1.1	3.1	96	0.5	-1.5	S		
360	50	Mar-11-01	1G	2	11:50:40	12:02:50	dil.	Lyondell Arco Plus-ST	1a	-12	28	21	10	12.2	16.9	1%		-1.3	14.8	154	0.7	-1.2	S		
389	52	Mar-13-01	1D	1	5:41:50	5:46:00	dil.	Lyondell Arco Plus-ST	1a	-16			V	4.2	20.0	5%		-6.3	28.7	48	0.4	-6.5	S		
429	54	Mar-13-01	3D	1	21:37:40	21:42:40	dil.	Lyondell Arco Plus-ST	1a	-12	28.5	19	U	5.0	18.8	2%		-1.3	8	173	0.4	-1.0	S		Sub Run
161	35	Feb-19-01	2	1	13:43:00	13:49:45	dil.	Newave Aerochemical FCY-1A	1a	-12	16	25	3	6.8	13.1	1%		-2.6	27.5	197	0.7	-3.0	S	0	
164	35	Feb-19-01	2	1	13:44:35	13:50:45	dil.	Newave Aerochemical FCY-1A	1a	-12	16	25	6	6.2	13.1	1%		-2.5	26.7	198	0.7	-3.0	S	0	
178	37	Feb-19-01	4	1	16:01:25	16:05:15	dil.	Newave Aerochemical FCY-1A	1a	-12	16	19	3	3.8	26.4	26%		-2.2	28.9	175	0.3	-3.0	S	0	
181	37	Feb-19-01	4	1	16:02:50	16:06:15	dil.	Newave Aerochemical FCY-1A	1a	-12	16	19	6	3.4	26.4	26%		-2.2	28.9	175	0.3	-3.0	S	0	
212	41	Feb-23-01	4A	2	4:56:55	5:07:30	dil.	Newave Aerochemical FCY-1A	1a	-27			V	10.6	0.7	27%		-16.0	16.5	34	2.6	-17.0	S	0	
213	41	Feb-23-01	4A	2	4:57:45	5:08:00	dil.	Newave Aerochemical FCY-1A	1a	-27			W	10.3	0.7	28%		-16.0	16.5	34	2.7	-17.0	S	0	
216	41	Feb-23-01	4B	2	5:45:50	5:57:20	dil.	Newave Aerochemical FCY-1A	1a	-27	21	18	U	11.5	1.0	9%		-16.0	14.4	24	1.3	-17.0	S	0	
227	42	Feb-25-01	1B	2	7:24:15	7:28:50	dil.	Newave Aerochemical FCY-1A	1a	-20	23	21	Y	4.6	17.9	3%		-7.5	15	66	0.6	-11.3	S	0	
229	42	Feb-25-01	1C	2	7:41:50	7:48:20	dil.	Newave Aerochemical FCY-1A	1a	-20	24	20	Y	6.5	10.5	7%		-8.2	25	51	0.6	-11.3	S	0	
240	43	Feb-25-01	2B	2	8:34:30	8:37:30	dil.	Newave Aerochemical FCY-1A	1a	-20	24	18	6	3.0	30.4	8%		-8.9	21	46	0.4	-10.0	S	0	
277	46	Mar-05-01	3A	2	21:59:15	22:10:00	dil.	Newave Aerochemical FCY-1A	1a	-13			10	10.8	8.1	18%		-2.0	35.5	51	1.0	-2.5	S		20 C +/- 5 fluid -3 C OUT
322	49	Mar-09-01	2B	1	3:40:15	3:49:15	dil.	Newave Aerochemical FCY-1A	1a	-12			W	9.0	8.1	2%		-1.1	2.2	71	0.6	-1.5	S		
361	50	Mar-11-01	1G	2	11:51:30	11:59:30	dil.	Newave Aerochemical FCY-1A	1a	-12	25	20.5	11	8.0	17.3	2%		-1.4	15.4	154	0.7	-1.2	S		
390	52	Mar-13-01	1D	1	5:42:45	5:46:15	dil.	Newave Aerochemical FCY-1A	1a	-16			W	3.5	20.0	5%		-6.3	28.5	48	0.4	-6.5	S		
430	54	Mar-13-01	3D	1	21:38:00	21:41:45	dil.	Newave Aerochemical FCY-1A	1a	-12				3.8	18.8	2%		-1.3	7	172	0.4	-1.0	S		
4	2	Dec-11-00	2	2	22:33:00	23:56:40	Neat	OCTAGON MAXFLIGHT	4				U	83.7	14.8	8%	9.6	-5.1	31	48	0.7	-5.0	S	48	
6	2	Dec-11-00	2	2	22:35:00	0:03:30	Neat	OCTAGON MAXFLIGHT	4				W	88.5	15.2	8%	10.1	-5.2	32	48	0.7	-5.0	S	48	
23	8	Dec-14-00	1	2	4:50:00	5:40:00	Neat	OCTAGON MAXFLIGHT	4				U	50.0	15.0	5%	11.0	-12.1	27	48	0.7	-12.5	S	48	
25	8	Dec-14-00	1	2	4:52:00	5:45:00	Neat	OCTAGON MAXFLIGHT	4				W	53.0	17.1	7%	11.5	-12.1	27	48	0.7	-12.5	S	48	
30	10	Dec-14-00	3	2	6:21:00	7:01:00	Neat	OCTAGON MAXFLIGHT	4				U	40.0	23.8	3%	16.7	-11.2	21	39	0.4	-12.0	S	39	
48	16	Dec-30-00	5	1	22:50:51	23:56:09	Neat	OCTAGON MAXFLIGHT	4				W	65.3	18.8	5%	6.8	-4.5	44	27	0.4	-5.0	S	27	
50	16	Dec-30-00	5	1	23:47:40	0:53:17	Neat	OCTAGON MAXFLIGHT	4				Z	65.6	21.2	4%	8.3	-4.7	42	27	0.3	-5.0	S	27	
51	17	Jan-15-01	1	2	20:38:37	23:16:10	Neat	OCTAGON MAXFLIGHT	4				U	157.6	7.2	3%	5.4	-7.9	21	30	2.2	-8.6	S	30	
61	18	Jan-30-01	1	2	17:44:00	19:54:00	Neat	OCTAGON MAXFLIGHT	4				W	130.0	11.0	3%	3.4	-3.7	37	36	0.6	-4.5	S	0	
74	20	Jan-31-01	1	2	11:33:00	14:28:00	Neat	OCTAGON MAXFLIGHT	4				Y	175.0	7.4	5%	2.1	-7.6	31	35	0.8	-8.0	S	0	
86	22	Jan-31-01	3	2	14:45:00	18:13:00	Neat	OCTAGON MAXFLIGHT	4				Y	208.0	5.9	9%	4.7	-8.6	24	24	1.3	-9.2	S	0	
103	27	Feb-05-01	1	2	9:30:30	11:28:00	Neat	OCTAGON MAXFLIGHT	4				W	117.5	14.7	4%	9.0	-7.5	16	32	0.7	-9.0	S	0	
112	29	Feb-05-01	3	2	16:28:00	19:30:00	Neat	OCTAGON MAXFLIGHT	4				W	182.0	6.5	8%	3.5	-4.9	20	27	0.9	-6.0	S	0	
116	30	Feb-14-01	1	2	10:28:00	13:13:00	Neat	OCTAGON MAXFLIGHT	4				U	165.0	9.1	2%		-6.6	12.0	79	0.6	-7.5	S	0	
129	32	Feb-14-01	3	2	15:23:00	20:25:00	Neat	OCTAGON MAXFLIGHT	4				U	302.0	3.1	3%		-4.5			0.6	-5.0	S	0	
173	36	Feb-19-01	3A	2	15:09:00	16:20:00	Neat	OCTAGON MAXFLIGHT	4				Y	71.0	24.1	8%		-2.4	27.2	181	0.3	-2.8	S	0	
182	38	Feb-22-01	1	2	22:18:00	0:25:00	Neat	OCTAGON MAXFLIGHT	4				U	127.0	3.2	6%		-15.3			1.8	-15.0	S	0	
185	38	Feb-22-01	1	2	22:18:00	0:28:00	Neat	OCTAGON MAXFLIGHT	4				X	130.0	3.2	6%		-15.3			1.7	-15.0	S	0	
197	39	Feb-23-01	2	1	22:44:00	0:56:00	Neat	OCTAGON MAXFLIGHT	4				3	132.0	2.9	6%		-15.5			1.5	-15.0	S	0	
202	40	Feb-23-01	3	2	1:25:00	3:09:00	Neat	OCTAGON MAXFLIGHT	4				V	104.0	3.9	8%		-16.5	19.0	23	1.1	-15.0	S	0	
205	40	Feb-23-01	3	2	1:26:00	3:09:00	Neat	OCTAGON MAXFLIGHT	4				Y	103.0	3.9	8%		-16.5	19.1	23	1.1	-15.0	S	0	
208	41	Feb-23-01	4	2	3:26:00	8:28:00	Neat	OCTAGON MAXFLIGHT	4				V	302.0	1.6	5%		-15.7	14.7	29	2.0	-17.0	S	0	
221	42	Feb-25-01	1	2	6:14:30	8:00:00	Neat	OCTAGON MAXFLIGHT	4				X	105.5	12.1	7%		-8.8	21	53	1.1	-11.3	S	0	
292	47	Mar-06-01	4	2	1:00:00	4:06:00	Neat	OCTAGON MAXFLIGHT	4				U	186.0	6.6	4%		-1.5	37.7	41	1.2	-2.6	S		
348	50	Mar-11-01	1E	2	9:47:00	11:57:00	Neat	OCTAGON MAXFLIGHT	4				3	130.0	11.4	1%		-1.4	14.5	153	0.9	-1.2	S		sub run
413	54	Mar-13-01	3A	1	20:20:00	21:48:00	Neat	OCTAGON MAXFLIGHT	4				2	88.0	19.5	1%		-0.9	8	212	0.5	-1.0	S		
147	34	Feb-19-01	1	2	13:20:30	14:17:00	50%	OCTAGON MAXFLIGHT	4a				Y	56.5	12.7	1%		-2.5	23.0	200	0.6	-2.4	S	0	
251	44	Mar-05-01	1	2	18:49:00	21:06:00	50%	OCTAGON MAXFLIGHT	4a				10	137.0	7.0	3%		-2.1				-2.7	S		

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	APS OBS temp [°C]	Snow Type	D angle (°)	comments
252	44	Mar-05-01	1	2	19:06:00	21:13:00	50%	OCTAGON MAXFLIGHT	4a				3	127.0	7.0	4%		-2.1				-2.7	S		
254	44	Mar-05-01	1A	2	18:21:00	20:43:00	50%	OCTAGON MAXFLIGHT	4a				W	142.0	6.8	1%		-2.1				-2.7	S		
280	46	Mar-05-01	3B	2	22:38:45	0:34:00	50%	OCTAGON MAXFLIGHT	4a				X	115.3	7.9	1%		-1.9	33.2	41	1.1	-2.5	S		
300	47	Mar-06-01	4A	2	1:06:30	3:22:00	50%	OCTAGON MAXFLIGHT	4a				10	135.5	7.3	4%		-1.6	35.8	41	1.1	-2.6	S		
332	50	Mar-11-01	1A	2	9:56:00	11:21:00	50%	OCTAGON MAXFLIGHT	4a				8	85.0	10.0	2%		-1.3	14.4	151	1.0	-1.2	S		
333	50	Mar-11-01	1A	2	9:41:00	11:21:00	50%	OCTAGON MAXFLIGHT	4a				10	100.0	9.6	1%		-1.3	13.9	153	1.0	-1.2	S		
405	54	Mar-13-01	3	1	20:06:40	20:48:00	50%	OCTAGON MAXFLIGHT	4a				5	41.3	23.7	3%		-0.9	10	80	0.5	-1.0	S		
412	54	Mar-13-01	3A	1	20:37:00	21:16:30	50%	OCTAGON MAXFLIGHT	4a				1	39.5	17.0	1%		-0.8	8	266	0.5	-1.0	S		
418	54	Mar-13-01	3A	1	20:16:00	21:09:15	50%	OCTAGON MAXFLIGHT	4a				2	53.3	20.1	1%		-0.8	9	167	0.5	-1.0	S		Sub Run
5	2	Dec-11-00	2	2	22:34:00	0:12:00	75%	OCTAGON MAXFLIGHT	4b				V	98.0	16.4	7%	10.6	-5.2	32	48	0.6	-5.0	S	48	
7	2	Dec-11-00	2	2	22:36:00	0:07:50	75%	OCTAGON MAXFLIGHT	4b				X	91.8	16.1	7%	10.4	-5.2	32	48	0.6	-5.0	S	48	
24	8	Dec-14-00	1	2	4:51:00	5:44:00	75%	OCTAGON MAXFLIGHT	4b				V	53.0	16.7	7%	11.4	-12.1	27	48	0.7	-12.5	S	48	
26	8	Dec-14-00	1	2	4:53:00	5:40:00	75%	OCTAGON MAXFLIGHT	4b				X	47.0	14.9	5%	10.3	-12.1	28	47	0.7	-12.5	S	47	
31	10	Dec-14-00	3	2	6:22:00	7:00:00	75%	OCTAGON MAXFLIGHT	4b				V	38.0	23.6	3%	17.1	-11.2	21	39	0.5	-12.0	S	39	
47	16	Dec-30-00	5	1	22:49:59	23:53:07	75%	OCTAGON MAXFLIGHT	4b				U	63.1	19.1	4%	6.8	-4.5	44	27	0.4	-5.0	S	27	
49	16	Dec-30-00	5	1	23:46:33	0:45:00	75%	OCTAGON MAXFLIGHT	4b				Y	58.5	20.8	4%	8.3	-4.6	43	28	0.3	-5.0	S	28	
54	17	Jan-15-01	1	2	20:41:05	23:05:00	75%	OCTAGON MAXFLIGHT	4b				X	143.9	6.4	3%	4.7	-7.9	21	30	2.3	-8.6	S	30	
62	18	Jan-30-01	1	2	17:47:00	19:53:00	75%	OCTAGON MAXFLIGHT	4b				X	126.0	11.1	3%	3.3	-3.6	37	36	0.6	-4.5	S	0	
67	19	Jan-30-01	2	2	20:05:00	23:13:00	75%	OCTAGON MAXFLIGHT	4b				X	188.0	6.7	5%	4.3	-2.8	26	26	1.0	-3.5	S	0	
75	20	Jan-31-01	1	2	11:34:00	14:04:00	75%	OCTAGON MAXFLIGHT	4b				Z	150.0	6.6	4%	1.1	-7.5	32	36	0.9	-8.0	S	0	
87	22	Jan-31-01	3	2	14:46:00	17:08:00	75%	OCTAGON MAXFLIGHT	4b				Z	142.0	7.6	9%	5.7	-8.5	25	26	0.8	-9.2	S	0	
106	27	Feb-05-01	1	2	9:33:00	11:09:00	75%	OCTAGON MAXFLIGHT	4b				Z	96.0	15.2	4%	9.9	-7.6	16	29	0.7	-9.0	S	0	
115	29	Feb-05-01	3	2	16:29:00	19:15:00	75%	OCTAGON MAXFLIGHT	4b				Z	166.0	6.2	8%	4.2	-4.9	20	27	0.9	-6.0	S	0	
119	30	Feb-14-01	1	2	10:29:00	12:35:00	75%	OCTAGON MAXFLIGHT	4b				X	126.0	10.5	3%		-6.7	12.9	46	0.6	-7.5	S	0	
126	31	Feb-14-01	2	2	13:27:30	14:39:00	75%	OCTAGON MAXFLIGHT	4b				X	71.5	16.5	0%		-6.0	4.8	204	0.4	-7.0	S	0	
132	32	Feb-14-01	3	2	15:24:00	20:05:00	75%	OCTAGON MAXFLIGHT	4b				X	281.0	2.7	1%		-4.5			0.6	-5.0	S	0	
167	36	Feb-19-01	3	2	15:07:00	16:14:00	75%	OCTAGON MAXFLIGHT	4b				W	67.0	23.7	8%		-2.3	26.8	183	0.3	-2.8	S	0	
220	42	Feb-25-01	1	2	6:14:00	7:56:00	75%	OCTAGON MAXFLIGHT	4b				W	102.0	11.8	7%		-8.8	21	53	1.1	-11.3	S	0	
293	47	Mar-06-01	4	2	1:01:30	4:06:00	75%	OCTAGON MAXFLIGHT	4b				V	184.5	6.6	4%		-1.5	37.7	41	1.2	-2.6	S		
385	52	Mar-13-01	1C	1	5:19:45	6:17:00	75%	OCTAGON MAXFLIGHT	4b				X	57.3	22.8	2%		-6.1		48	0.4	-6.5	S		
144	34	Feb-19-01	1	2	13:20:00	14:09:00	Neat	SPCA Ecowing 26	2				V	49.0	11.4	0%		-2.5	23.6	202	0.7	-2.4	S	0	
152	34	Feb-19-01	1B	2	14:05:00	14:39:00	Neat	SPCA Ecowing 26	2				U	34.0	22.3	6%		-2.5	21.6	190	0.4	-2.4	S	0	
153	34	Feb-19-01	1B	2	14:14:00	14:48:30	Neat	SPCA Ecowing 26	2				V	34.5	22.3	6%		-2.4	23.2	189	0.3	-2.4	S	0	
165	36	Feb-19-01	3	2	15:05:00	15:41:00	Neat	SPCA Ecowing 26	2				U	36.0	20.7	6%		-2.4	25.8	188	0.3	-2.8	S	0	
169	36	Feb-19-01	3	2	15:09:30	15:47:00	Neat	SPCA Ecowing 26	2				Z	37.5	21.3	7%		-2.4	26.0	188	0.3	-2.8	S	0	
174	36	Feb-19-01	3A	2	15:49:00	16:19:00	Neat	SPCA Ecowing 26	2				Z	30.0	26.7	9%		-2.4	28.5	173	0.3	-2.8	S	0	
183	38	Feb-22-01	1	2	22:17:00	0:03:00	Neat	SPCA Ecowing 26	2				V	106.0	2.8	4%		-15.2	20.0	37	1.9	-15.0	S	0	
186	38	Feb-22-01	1	2	22:17:00	0:02:00	Neat	SPCA Ecowing 26	2				Y	105.0	2.8	4%		-15.2	20.1	38	1.9	-15.0	S	0	
190	38	Feb-22-01	1	2	22:32:00	0:08:00	Neat	SPCA Ecowing 26	2				8	96.0	2.9	5%		-15.2	19.5	35	1.9	-15.0	S	0	
192	38	Feb-22-01	1A	2	23:50:00	1:00:00	Neat	SPCA Ecowing 26	2				3	70.0	3.2	10%		-15.8			1.0	-15.0	S	0	
195	38	Feb-22-01	1A	2	23:33:00	0:58:00	Neat	SPCA Ecowing 26	2				11	85.0	3.9	9%		-15.7			1.0	-15.0	S	0	
196	39	Feb-23-01	2	1	22:43:00	0:10:00	Neat	SPCA Ecowing 26	2				2	87.0	2.7	4%		-15.2	19.0	34	1.9	-15.0	S	0	
199	39	Feb-23-01	2	1	22:43:00	0:12:00	Neat	SPCA Ecowing 26	2				5	89.0	2.8	4%		-15.2			1.9	-15.0	S	0	
201	40	Feb-23-01	3	2	1:24:00	2:36:00	Neat	SPCA Ecowing 26	2				U	72.0	4.1	6%		-16.4	18.5	22	1.1	-15.0	S	0	
204	40	Feb-23-01	3	2	1:24:00	2:38:00	Neat	SPCA Ecowing 26	2				X	74.0	4.1	6%		-16.4	18.5	22	1.1	-15.0	S	0	
207	41	Feb-23-01	4	2	3:25:00	5:42:00	Neat	SPCA Ecowing 26	2				U	137.0	2.0	10%		-16.3	17.4	29	1.9	-17.0	S	0	
210	41	Feb-23-01	4	2	3:25:00	5:45:00	Neat	SPCA Ecowing 26	2				X	140.0	2.0	9%		-16.3	17.4	29	1.9	-17.0	S	0	
218	42	Feb-25-01	1	2	6:13:00	7:29:00	Neat	SPCA Ecowing 26	2				U	76.0	11.1	8%		-9.0	20	54	1.3	-11.3	S	0	
224	42	Feb-25-01	1A	2	7:03:00	7:58:00	Neat	SPCA Ecowing 26	2				3	55.0	15.8	4%		-8.1	20	56	0.7	-11.3	S	0	
231	43	Feb-25-01	2	2	8:10:00	8:41:00	Neat	SPCA Ecowing 26	2				U	31.0	31.9	12%		-9.6	22	46	0.4	-10.7	S	0	
244	44	Mar-05-01	1	2	17:41:00	19:31:00	Neat	SPCA Ecowing 26	2				X	110.0	5.9	1%		-2.2				-2.7	S		

NATURAL SNOW TESTS AT DORVAL 2000-01

Test	Form	Date	Run	Stand	Start	Fail	Fluid	Fluid	Fluid	FFP	Fluid	Fluid	Plate	Fail	AVG	Pan diff	READAC Data					APS OBS	Snow	D	comments
no.	no.		no.	no.	Time (Local)	Time (Local)	dilution	Name	Type	(°C)	Brix	Temp. (°C)	Locat'n	Time [min.]	PAN [g/dm²/h]	%	rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	temp [°C]	Type	angle (°)	
271	46	Mar-05-01	3	2	21:27:10	22:47:00	Neat	SPCA Ecowing 26	2				W	79.8	10.2	12%		-2.0	34.8	50	0.9	-2.5	S		
298	47	Mar-06-01	4A	2	1:03:30	2:32:00	Neat	SPCA Ecowing 26	2				3	88.5	8.8	4%		-1.7	34.3	42	1.0	-2.6	S		Additional Pplates
331	50	Mar-11-01	1A	2	9:48:00	10:58:30	Neat	SPCA Ecowing 26	2				5	70.5	8.9	3%		-1.3	13.5	152	1.2	-1.2	S		Sub Run
363	51	Mar-11-01	2	2	12:26:00	13:18:00	Neat	SPCA Ecowing 26	2				9	52.0	12.4	2%		-0.7	14.5	173	0.9	-0.5	S		Rate increased 13:15
372	52	Mar-13-01	1	1	3:12:30	3:57:00	Neat	SPCA Ecowing 26	2				Y	44.5	21.1	7%		-6.4	21.0	47	0.5	-6.5	S		
386	52	Mar-13-01	1C	1	5:20:30	5:58:00	Neat	SPCA Ecowing 26	2				Y	37.5	24.0	2%		-6.1	26.9	51	0.4	-6.5	S		
393	52	Mar-13-01	1E	1	5:51:30	6:36:00	Neat	SPCA Ecowing 26	2				W	44.5	19.2	5%		-6.0		47	0.4	-6.5	S		
406	54	Mar-13-01	3	1	20:09:00	20:46:00	Neat	SPCA Ecowing 26	2				6	37.0	24.1	3%		-0.9	10	67	0.5	-1.0	S		
438	55	Mar-13-01	4	1	22:01:00	22:52:00	Neat	SPCA Ecowing 26	2				6	51.0	16.1	2%		-1.6	5	242	0.4	-2.0	S		
143	34	Feb-19-01	1	2	13:19:00	13:38:30	50%	SPCA Ecowing 26	2a				U	19.5	8.2	2%		-2.5	25.9	210	0.8	-2.4	S	0	
146	34	Feb-19-01	1	2	13:19:15	13:37:50	50%	SPCA Ecowing 26	2a				X	18.6	8.1	2%		-2.5	25.9	210	0.8	-2.4	S	0	
149	34	Feb-19-01	1A	2	13:46:10	14:01:45	50%	SPCA Ecowing 26	2a				U	15.6	13.3	1%		-2.6	22.5	199	0.7	-2.4	S	0	
150	34	Feb-19-01	1A	2	13:46:30	14:02:00	50%	SPCA Ecowing 26	2a				X	15.5	13.3	1%		-2.6	22.1	199	0.6	-2.4	S	0	
157	34	Feb-19-01	1C	2	14:23:30	14:37:20	50%	SPCA Ecowing 26	2a				X	13.8	23.3	8%		-2.4	24.8	189	0.4	-2.4	S	0	
176	36	Feb-19-01	3B	2	16:15:30	16:23:10	50%	SPCA Ecowing 26	2a				W	7.7	32.4	4%		-2.8	31.3	163	0.3	-2.8	S	0	
246	44	Mar-05-01	1	2	17:42:30	18:30:00	50%	SPCA Ecowing 26	2a				Z	47.5	4.4	2%		-2.3				-2.7	S		
248	44	Mar-05-01	1	2	18:05:10	18:48:00	50%	SPCA Ecowing 26	2a				10	42.8	5.3	2%		-2.3				-2.7	S		
253	44	Mar-05-01	1A	2	19:22:00	19:56:00	50%	SPCA Ecowing 26	2a				V	34.0	8.0	3%		-2.0				-2.7	S		Sub Run
260	44	Mar-05-01	1B	2	20:16:15	20:50:00	50%	SPCA Ecowing 26	2a				X	33.8	6.7	0%		-1.9	34.6	48	1.1	-2.7	S		
262	44	Mar-05-01	1B	2	20:31:30	21:08:45	50%	SPCA Ecowing 26	2a				Z	37.3	6.7	3%		-1.9	35.0	49	1.0	-2.7	S		
265	45	Mar-05-01	2	1	21:07:15	21:32:30	50%	SPCA Ecowing 26	2a				W	25.3	9.3	15%		-2.0	35.1	50	1.0	-2.5	S		
266	45	Mar-05-01	2	1	21:07:30	21:33:00	50%	SPCA Ecowing 26	2a				X	25.5	9.3	15%		-2.0	35.1	50	1.0	-2.5	S		
279	46	Mar-05-01	3B	2	22:51:30	23:19:00	50%	SPCA Ecowing 26	2a				W	27.5	10.4	6%		-2.0	32.8	44	0.8	-2.5	S		
289	46	Mar-06-01	3E	2	0:22:15	0:52:00	50%	SPCA Ecowing 26	2a				V	29.8	12.0	6%		-1.9	33.8	38	0.9	-2.5	S		
302	48	Mar-09-01	1	2	1:51:30	2:37:00	50%	SPCA Ecowing 26	2a				W	45.5	3.0	2%		-1.3	4.8	126	1.4	-1.3	S		
306	48	Mar-09-01	1A	2	1:52:00	2:32:30	50%	SPCA Ecowing 26	2a	-12	29	19	10	40.5	2.9	2%		-1.3	4.9	127	1.4	-1.3	S		Sub Run
313	49	Mar-09-01	2	1	2:16:39	3:01:00	50%	SPCA Ecowing 26	2a				V	44.4	3.3	2%		-1.3	3.9	110	1.0	-1.5	S		
315	49	Mar-09-01	2	1	2:19:36	2:59:25	50%	SPCA Ecowing 26	2a				Z	39.8	3.3	2%		-1.3	3.8	110	1.0	-1.5	S		
317	49	Mar-09-01	2A	1	3:11:40	3:40:30	50%	SPCA Ecowing 26	2a				W	28.8	6.1	2%		-1.2	3.8	101	0.8	-1.5	S		
344	50	Mar-11-01	1D	2	10:43:30	10:58:15	50%	SPCA Ecowing 26	2a				4	14.8	12.6	3%		-1.3	14.6	155	1.2	-1.2	S		
355	50	Mar-11-01	1F	2	11:25:00	11:39:20	50%	SPCA Ecowing 26	2a				W	14.3	16.1	1%		-1.5	15.2	156	0.7	-1.2	S		
408	54	Mar-13-01	3	1	20:08:00	20:19:00	50%	SPCA Ecowing 26	2a				V	11.0	22.3	7%		-0.9	10	38	0.7	-1.0	S		
426	54	Mar-13-01	3B	1	21:13:30	21:27:10	50%	SPCA Ecowing 26	2a				3	13.7	19.0	0%		-0.9	7	236	0.4	-1.0	S		
434	55	Mar-13-01	4	1	22:05:45	22:18:15	50%	SPCA Ecowing 26	2a				4	12.5	19.9	2%		-1.6	5	34	0.4	-2.0	S		
452	57	Mar-23-01	2	1	16:05:45	16:19:00	50%	SPCA Ecowing 26	2a				X	13.3	25.4	6%		0.3	12	324	0.9	0.1	S		
456	57	Mar-23-01	2A	1	16:51:00	17:10:00	50%	SPCA Ecowing 26	2a				V	19.0	12.5	0%		0.2	9	97	0.8	0.1	S		
145	34	Feb-19-01	1	2	13:20:00	13:56:00	75%	SPCA Ecowing 26	2b				W	36.0	10.1	1%		-2.5	25.6	204	0.7	-2.4	S	0	
154	34	Feb-19-01	1B	2	13:58:00	14:23:00	75%	SPCA Ecowing 26	2b				W	25.0	19.2	4%		-2.5	18.8	193	0.4	-2.4	S	0	
166	36	Feb-19-01	3	2	15:06:20	15:34:00	75%	SPCA Ecowing 26	2b				V	27.7	20.2	6%		-2.4	25.5	189	0.3	-2.8	S	0	
171	36	Feb-19-01	3A	2	15:37:15	16:03:00	75%	SPCA Ecowing 26	2b				V	25.8	26.5	10%		-2.3	27.0	180	0.3	-2.8	S	0	
175	36	Feb-19-01	3B	2	16:11:00	16:41:00	75%	SPCA Ecowing 26	2b				U	30.0	23.7	2%		-2.7	30.2	166	0.3	-2.8	S	0	
188	38	Feb-22-01	1	2	22:49:00	23:41:00	75%	SPCA Ecowing 26	2b				3	52.0	2.8	6%		-15.1	18.9	33	2.4	-15.0	S	0	
219	42	Feb-25-01	1	2	6:13:30	7:10:00	75%	SPCA Ecowing 26	2b				V	56.5	8.9	12%		-9.5	22	51	1.6	-11.3	S	0	
225	42	Feb-25-01	1A	2	7:03:00	7:41:00	75%	SPCA Ecowing 26	2b				5	38.0	17.2	3%		-7.9	19	57	0.6	-11.3	S	0	
226	42	Feb-25-01	1A	2	7:10:00	7:51:00	75%	SPCA Ecowing 26	2b				4	41.0	15.7	3%		-7.9	20	56	0.6	-11.3	S	0	
232	43	Feb-25-01	2	2	8:10:00	8:28:00	75%	SPCA Ecowing 26	2b				V	18.0	32.0	14%		-9.9	21	46	0.4	-10.7	S	0	
238	43	Feb-25-01	2A	2	8:23:00	8:45:00	75%	SPCA Ecowing 26	2b				5	22.0	31.6	9%		-9.2	22	48	0.4	-10.7	S	0	8:50 wind shift
245	44	Mar-05-01	1	2	17:42:00	19:15:00	75%	SPCA Ecowing 26	2b				Y	93.0	5.4	2%		-2.2				-2.7	S		
257	44	Mar-05-01	1A	2	18:31:00	19:47:00	75%	SPCA Ecowing 26	2b				Z	76.0	7.1	0%		-2.0				-2.7	S		
272	46	Mar-05-01	3	2	21:28:00	22:33:00	75%	SPCA Ecowing 26	2b				X	65.0	10.7	12%		-2.0	35.6	50	0.9	-2.5	S		
299	47	Mar-06-01	4A	2	1:04:00	2:16:00	75%	SPCA Ecowing 26	2b				5	72.0	8.6	4%		-1.7	33.9	43	1.0	-2.6	S		

NATURAL SNOW TESTS AT DORVAL 2000-01

Test no.	Form no.	Date	Run no.	Stand no.	Start Time (Local)	Fail Time (Local)	Fluid dilution	Fluid Name	Fluid Type	FFP (°C)	Fluid Brix	Fluid Temp. (°C)	Plate Locat'n	Fail Time [min.]	AVG PAN [g/dm²/h]	Pan diff %	READAC Data				APS OBS		Snow Type	D angle (°)	comments
																	rate [g/dm²/h]	temp [°C]	Wind Sp [km/h]	wind dir	visibility (mi)	temp [°C]			
309	48	Mar-09-01	1C	2	3:03:00	3:58:00	75%	SPCA Ecowing 26	2b				9	55.0	6.1	0%		-1.2	3.9	100	0.7	-1.3	S		
318	49	Mar-09-01	2A	1	2:17:25	3:38:00	75%	SPCA Ecowing 26	2b				W	80.6	4.3	3%		-1.3	4.2	109	0.9	-1.5	S		
350	50	Mar-11-01	1E	2	11:22:00	11:55:00	75%	SPCA Ecowing 26	2b				8	33.0	16.2	1%		-1.5	15.9	156	0.7	-1.2	S		
353	50	Mar-11-01	1F	2	11:22:00	11:55:00	75%	SPCA Ecowing 26	2b				U	33.0	16.2	1%		-1.5	15.9	156	0.7	-1.2	S		
379	52	Mar-13-01	1B	1	4:48:00	5:12:00	75%	SPCA Ecowing 26	2b				W	24.0	23.7	2%		-6.1	25.3	52	0.4	-6.5	S		
407	54	Mar-13-01	3	1	20:10:00	20:36:00	75%	SPCA Ecowing 26	2b				U	26.0	25.0	4%		-0.9	10	34	0.5	-1.0	S		
433	55	Mar-13-01	4	1	22:05:00	22:38:00	75%	SPCA Ecowing 26	2b				3	33.0	17.3	2%		-1.6	5	209	0.4	-2.0	S		
441	55	Mar-13-01	4A	1	22:17:00	23:00:00	75%	SPCA Ecowing 26	2b				4	43.0	13.9	2%		-1.6	6	309	0.5	-2.0	S		

SIMULATED FREEZING PRECIPITATION AT CEF-NRC (OTTAWA) FOR 2000-01 SEASON

Test #	Form #	Date	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Fluid Name	Fluid Dilution	Fluid Type	Fail Time (min)	Actual Rate of Precip (g/dm²/h)	Ambient Temp (°C)	Precipitation (Type)	comments
137	3	27-Mar-01	16:55:00	17:10:30	CLAR SF PRO 2012 (TIV)	50	4a	15.5	12.1	-3	Freezing Drizzle	
138	3	27-Mar-01	16:57:15	17:10:50	CLAR SF PRO 2012 (TIV)	50	4a	13.6	11.8	-3	Freezing Drizzle	
113	1	28-Mar-01	11:03:15	11:23:30	CLAR SF PRO 2012 (TIV)	50	4a	20.3	4.8	-3	Freezing Drizzle	
114	2	28-Mar-01	12:38:10	12:59:20	CLAR SF PRO 2012 (TIV)	50	4a	21.2	4.9	-3	Freezing Drizzle	
31	1	4-Apr-01	9:43:45	9:51:00	CLAR SF PRO 2012 (TIV)	50	4a	7.3	24.3	-3	Light Freezing Rain	
32	1	4-Apr-01	9:48:45	9:55:45	CLAR SF PRO 2012 (TIV)	50	4a	7.0	25.7	-3	Light Freezing Rain	
5	3	4-Apr-01	14:08:20	14:20:15	CLAR SF PRO 2012 (TIV)	50	4a	11.9	12.8	-3	Light Freezing Rain	
6	4	4-Apr-01	15:23:40	15:34:30	CLAR SF PRO 2012 (TIV)	50	4a	10.8	11.7	-3	Light Freezing Rain	
217	1	5-Apr-01	11:51:00	12:37:00	CLAR SF PRO 2012 (TIV)	50	4a	46.0	2.0	-3	Freezing Fog	
218	2	5-Apr-01	13:06:00	13:49:00	CLAR SF PRO 2012 (TIV)	50	4a	43.0	2.1	-3	Freezing Fog	
241	1	10-Apr-01	11:10:15	11:31:50	CLAR SF PRO 2012 (TIV)	50	4a	21.6	5.3	-3	Freezing Fog	
242	2	10-Apr-01	13:17:30	13:39:00	CLAR SF PRO 2012 (TIV)	50	4a	21.5	5.6	-3	Freezing Fog	
135	2	27-Mar-01	15:42:00	16:18:00	CLAR SF PRO 2012 (TIV)	75	4b	36.0	12.3	-3	Freezing Drizzle	
136	2	27-Mar-01	16:28:00	17:02:00	CLAR SF PRO 2012 (TIV)	75	4b	34.0	13.3	-3	Freezing Drizzle	
112	3	28-Mar-01	13:56:00	14:49:00	CLAR SF PRO 2012 (TIV)	75	4b	53.0	5.0	-3	Freezing Drizzle	
367	4	28-Mar-01	14:59:00	15:48:00	CLAR SF PRO 2012 (TIV)	75	4b	49.0	5.5	-3	Freezing Drizzle	
327	1	29-Mar-01	11:44:00	12:21:00	CLAR SF PRO 2012 (TIV)	75	4b	37.0	5.4	1	Cold Soak Box	
371	2	29-Mar-01	13:48:00	14:35:00	CLAR SF PRO 2012 (TIV)	75	4b	47.0	4.4	1	Cold Soak Box	
328	2	29-Mar-01	12:56:00	13:39:00	CLAR SF PRO 2012 (TIV)	75	4b	43.0	5.0	1	Cold Soak Box	
347	1	30-Mar-01	9:49:45	9:56:30	CLAR SF PRO 2012 (TIV)	75	4b	6.8	78.6	1	Cold Soak Box	
348	2	30-Mar-01	10:21:30	10:28:30	CLAR SF PRO 2012 (TIV)	75	4b	7.0	78.0	1	Cold Soak Box	
195	1	2-Apr-01	11:56:00	12:10:00	CLAR SF PRO 2012 (TIV)	75	4b	14.0	12.2	-10	Freezing Drizzle	
196	2	2-Apr-01	12:38:00	12:54:00	CLAR SF PRO 2012 (TIV)	75	4b	16.0	12.1	-10	Freezing Drizzle	
173	3	2-Apr-01	15:51:00	16:21:00	CLAR SF PRO 2012 (TIV)	75	4b	30.0	4.8	-10	Freezing Drizzle	
174	3	2-Apr-01	15:51:45	16:24:00	CLAR SF PRO 2012 (TIV)	75	4b	32.3	5.0	-10	Freezing Drizzle	
81	1	3-Apr-01	11:12:40	11:23:00	CLAR SF PRO 2012 (TIV)	75	4b	10.3	24.2	-10	Light Freezing Rain	
82	1	3-Apr-01	11:19:40	11:31:40	CLAR SF PRO 2012 (TIV)	75	4b	12.0	24.6	-10	Light Freezing Rain	
55	4	3-Apr-01	15:21:00	15:39:00	CLAR SF PRO 2012 (TIV)	75	4b	18.0	12.6	-10	Light Freezing Rain	
56	4	3-Apr-01	15:27:00	15:47:00	CLAR SF PRO 2012 (TIV)	75	4b	20.0	13.0	-10	Light Freezing Rain	
29	1	4-Apr-01	9:43:00	10:02:00	CLAR SF PRO 2012 (TIV)	75	4b	19.0	24.7	-3	Light Freezing Rain	
30	1	4-Apr-01	9:47:55	10:04:00	CLAR SF PRO 2012 (TIV)	75	4b	16.1	24.9	-3	Light Freezing Rain	
3	3	4-Apr-01	14:07:00	14:43:00	CLAR SF PRO 2012 (TIV)	75	4b	36.0	12.3	-3	Light Freezing Rain	

SIMULATED FREEZING PRECIPITATION AT CEF-NRC (OTTAWA) FOR 2000-01 SEASON

Test #	Form #	Date	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Fluid Name	Fluid Dilution	Fluid Type	Fail Time (min)	Actual Rate of Precip (g/dm²/h)	Ambient Temp (°C)	Precipitation (Type)	comments
9	3	4-Apr-01	14:10:00	14:46:00	CLAR SF PRO 2012 (TIV)	75	4b	36.0	12.0	-3	Light Freezing Rain	
4	3	4-Apr-01	14:46:00	15:12:00	CLAR SF PRO 2012 (TIV)	75	4b	26.0	12.1	-3	Light Freezing Rain	
403	4	4-Apr-01	15:36:30	16:03:00	CLAR SF PRO 2012 (TIV)	75	4b	26.5	12.1	-3	Light Freezing Rain	
402	4	4-Apr-01	15:27:00	15:55:00	CLAR SF PRO 2012 (TIV)	75	4b	28.0	12.3	-3	Light Freezing Rain	
216	2	5-Apr-01	14:07:00	16:13:00	CLAR SF PRO 2012 (TIV)	75	4b	126.0	2.0	-3	Freezing Fog	
215	2	5-Apr-01	12:59:00	15:10:00	CLAR SF PRO 2012 (TIV)	75	4b	131.0	1.9	-3	Freezing Fog	
271	1	9-Apr-01	11:19:00	12:21:00	CLAR SF PRO 2012 (TIV)	75	4b	62.0	2.1	-14	Freezing Fog	
272	1	9-Apr-01	11:21:00	12:22:00	CLAR SF PRO 2012 (TIV)	75	4b	61.0	2.0	-14	Freezing Fog	
287	4	9-Apr-01	16:48:00	17:11:00	CLAR SF PRO 2012 (TIV)	75	4b	23.0	5.3	-14	Freezing Fog	
288	4	9-Apr-01	16:48:30	17:11:00	CLAR SF PRO 2012 (TIV)	75	4b	22.5	5.6	-14	Freezing Fog	
239	2	10-Apr-01	12:01:00	13:11:00	CLAR SF PRO 2012 (TIV)	75	4b	70.0	4.6	-3	Freezing Fog	
240	2	10-Apr-01	12:44:00	13:59:00	CLAR SF PRO 2012 (TIV)	75	4b	75.0	5.3	-3	Freezing Fog	
134	1	27-Mar-01	14:16:00	14:58:00	CLAR SF PRO 2012 (TIV)	100	4	42.0	12.3	-3	Freezing Drizzle	
133	1	27-Mar-01	14:20:00	14:55:00	CLAR SF PRO 2012 (TIV)	100	4	35.0	13.1	-3	Freezing Drizzle	
365	2	27-Mar-01	15:41:00	16:23:00	CLAR SF PRO 2012 (TIV)	100	4	42.0	12.3	-3	Freezing Drizzle	
109	1	28-Mar-01	11:04:00	12:11:00	CLAR SF PRO 2012 (TIV)	100	4	67.0	4.8	-3	Freezing Drizzle	
110	2	28-Mar-01	11:51:00	13:05:00	CLAR SF PRO 2012 (TIV)	100	4	74.0	4.8	-3	Freezing Drizzle	
325	1	29-Mar-01	11:31:00	12:35:00	CLAR SF PRO 2012 (TIV)	100	4	64.0	4.9	1	Cold Soak Box	
326	2	29-Mar-01	13:04:00	14:07:00	CLAR SF PRO 2012 (TIV)	100	4	63.0	4.9	1	Cold Soak Box	
345	1	30-Mar-01	9:48:45	10:00:00	CLAR SF PRO 2012 (TIV)	100	4	11.3	76.9	1	Cold Soak Box	
346	2	30-Mar-01	10:28:15	10:40:30	CLAR SF PRO 2012 (TIV)	100	4	12.3	76.8	1	Cold Soak Box	
193	1	2-Apr-01	11:52:00	12:20:00	CLAR SF PRO 2012 (TIV)	100	4	28.0	12.8	-10	Freezing Drizzle	
194	1	2-Apr-01	12:24:00	12:51:00	CLAR SF PRO 2012 (TIV)	100	4	27.0	12.2	-10	Freezing Drizzle	
171	3	2-Apr-01	15:43:00	16:31:00	CLAR SF PRO 2012 (TIV)	100	4	48.0	4.6	-10	Freezing Drizzle	
172	3	2-Apr-01	15:46:00	16:34:00	CLAR SF PRO 2012 (TIV)	100	4	48.0	4.7	-10	Freezing Drizzle	
79	1	3-Apr-01	11:11:45	11:28:45	CLAR SF PRO 2012 (TIV)	100	4	17.0	24.5	-10	Light Freezing Rain	
80	1	3-Apr-01	11:18:50	11:36:00	CLAR SF PRO 2012 (TIV)	100	4	17.2	25.1	-10	Light Freezing Rain	
51	4	3-Apr-01	15:20:00	15:46:30	CLAR SF PRO 2012 (TIV)	100	4	26.5	12.2	-10	Light Freezing Rain	
52	4	3-Apr-01	15:26:10	15:52:45	CLAR SF PRO 2012 (TIV)	100	4	26.6	12.7	-10	Light Freezing Rain	
27	1	4-Apr-01	9:42:00	10:09:00	CLAR SF PRO 2012 (TIV)	100	4	27.0	24.3	-3	Light Freezing Rain	
28	1	4-Apr-01	9:47:10	10:12:00	CLAR SF PRO 2012 (TIV)	100	4	24.8	25.5	-3	Light Freezing Rain	
1	3	4-Apr-01	14:06:00	14:55:00	CLAR SF PRO 2012 (TIV)	100	4	49.0	12.4	-3	Light Freezing Rain	

SIMULATED FREEZING PRECIPITATION AT CEF-NRC (OTTAWA) FOR 2000-01 SEASON

Test #	Form #	Date	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Fluid Name	Fluid Dilution	Fluid Type	Fail Time (min)	Actual Rate of Precip (g/dm²/h)	Ambient Temp (°C)	Precipitation (Type)	comments
2	4	4-Apr-01	15:09:00	15:57:00	CLAR SF PRO 2012 (TIV)	100	4	48.0	12.4	-3	Light Freezing Rain	
213	1	5-Apr-01	11:46:30	14:18:00	CLAR SF PRO 2012 (TIV)	100	4	151.5	2.1	-3	Freezing Fog	
214	1	5-Apr-01	11:49:00	14:30:00	CLAR SF PRO 2012 (TIV)	100	4	161.0	1.8	-3	Freezing Fog	
313	1	6-Apr-01	11:17:00	11:39:00	CLAR SF PRO 2012 (TIV)	100	4	22.0	4.9	-25	Freezing Fog	
314	1	6-Apr-01	11:23:00	11:47:00	CLAR SF PRO 2012 (TIV)	100	4	24.0	4.5	-25	Freezing Fog	
301	4	6-Apr-01	15:03:00	15:42:00	CLAR SF PRO 2012 (TIV)	100	4	39.0	2.3	-25	Freezing Fog	
302	4	6-Apr-01	15:04:00	15:44:00	CLAR SF PRO 2012 (TIV)	100	4	40.0	2.3	-25	Freezing Fog	
269	1	9-Apr-01	11:14:00	13:10:00	CLAR SF PRO 2012 (TIV)	100	4	116.0	1.8	-14	Freezing Fog	
270	1	9-Apr-01	11:15:00	13:10:00	CLAR SF PRO 2012 (TIV)	100	4	115.0	1.8	-14	Freezing Fog	
285	3	9-Apr-01	16:03:00	16:44:00	CLAR SF PRO 2012 (TIV)	100	4	41.0	5.3	-14	Freezing Fog	
286	3	9-Apr-01	16:05:00	16:44:00	CLAR SF PRO 2012 (TIV)	100	4	39.0	5.6	-14	Freezing Fog	
237	1	10-Apr-01	11:03:00	12:24:00	CLAR SF PRO 2012 (TIV)	100	4	81.0	4.6	-3	Freezing Fog	
238	1	10-Apr-01	11:09:00	12:24:00	CLAR SF PRO 2012 (TIV)	100	4	75.0	4.9	-3	Freezing Fog	
341	3	29-Mar-01	14:46:30	14:55:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	9.0	4.7	1	Cold Soak Box	
342	3	29-Mar-01	14:38:30	14:48:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	9.5	4.4	1	Cold Soak Box	
361	2	30-Mar-01	10:43:50	10:46:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	2.2	77.4	1	Cold Soak Box	
362	3	30-Mar-01	10:51:15	10:53:15	LYON. ARCO PLUS-ST. (TI)	10°	1a	2.0	78.8	1	Cold Soak Box	
209	2	2-Apr-01	12:50:20	12:55:55	LYON. ARCO PLUS-ST. (TI)	10°	1a	5.6	12.8	-10	Freezing Drizzle	
210	2	2-Apr-01	12:58:40	13:04:15	LYON. ARCO PLUS-ST. (TI)	10°	1a	5.6	12.0	-10	Freezing Drizzle	
188	4	2-Apr-01	16:58:45	17:06:40	LYON. ARCO PLUS-ST. (TI)	10°	1a	7.9	4.7	-10	Freezing Drizzle	
187	4	2-Apr-01	16:52:49	17:00:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	7.2	4.9	-10	Freezing Drizzle	
105	3	3-Apr-01	12:34:40	12:38:40	LYON. ARCO PLUS-ST. (TI)	10°	1a	4.0	25.5	-10	Light Freezing Rain	
106	3	3-Apr-01	12:35:30	12:39:35	LYON. ARCO PLUS-ST. (TI)	10°	1a	4.1	25.2	-10	Light Freezing Rain	
75	5	3-Apr-01	16:27:05	16:32:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	5.4	12.6	-10	Light Freezing Rain	
76	5	3-Apr-01	16:28:35	16:33:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	4.9	12.9	-10	Light Freezing Rain	
321	3	6-Apr-01	12:11:10	12:18:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	6.8	5.3	-25	Freezing Fog	
322	3	6-Apr-01	12:14:10	12:21:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	7.3	4.5	-25	Freezing Fog	
309	4	6-Apr-01	15:01:30	15:16:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	15.0	1.7	-25	Freezing Fog	
310	4	6-Apr-01	15:02:20	15:17:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	14.7	1.6	-25	Freezing Fog	
265	5	9-Apr-01	17:48:00	17:56:20	LYON. ARCO PLUS-ST. (TI)	10°	1a	8.3	4.7	-10	Freezing Fog	
266	5	9-Apr-01	17:48:40	17:57:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	8.3	4.9	-10	Freezing Fog	
261	6	9-Apr-01	18:48:30	19:02:00	LYON. ARCO PLUS-ST. (TI)	10°	1a	13.5	1.7	-10	Freezing Fog	

M\Groups\CM1680 (exBM3833)\Analysis\HOT\CS,ZD,ZF,ZR\Charts for all conditions\Table
AT: Log

SIMULATED FREEZING PRECIPITATION AT CEF-NRC (OTTAWA) FOR 2000-01 SEASON

Test #	Form #	Date	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Fluid Name	Fluid Dilution	Fluid Type	Fail Time (min)	Actual Rate of Precip (g/dm²/h)	Ambient Temp (°C)	Precipitation (Type)	comments
262	6	9-Apr-01	18:49:10	19:02:30	LYON. ARCO PLUS-ST. (TI)	10°	1a	13.3	1.7	-10	Freezing Fog	
343	3	29-Mar-01	14:33:00	14:41:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	8.0	4.6	1	Cold Soak Box	
344	3	29-Mar-01	14:54:25	15:02:30	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	8.1	4.9	1	Cold Soak Box	
363	2	30-Mar-01	10:46:10	10:48:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	1.8	78.6	1	Cold Soak Box	
364	3	30-Mar-01	11:07:00	11:08:45	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	1.8	78.5	1	Cold Soak Box	
212	2	2-Apr-01	13:13:30	13:18:15	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	4.8	12.2	-10	Freezing Drizzle	
211	2	2-Apr-01	12:59:30	13:04:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	4.5	12.4	-10	Freezing Drizzle	
192	4	2-Apr-01	16:57:45	17:04:45	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	7.0	4.6	-10	Freezing Drizzle	
191	4	2-Apr-01	16:51:50	16:58:25	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	6.6	4.8	-10	Freezing Drizzle	
108	3	3-Apr-01	12:33:50	12:37:20	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	3.5	24.5	-10	Light Freezing Rain	
107	3	3-Apr-01	12:30:40	12:34:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	3.3	24.8	-10	Light Freezing Rain	
77	5	3-Apr-01	16:20:15	16:25:05	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	4.8	12.5	-10	Light Freezing Rain	
78	5	3-Apr-01	16:20:50	16:25:55	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	5.1	12.7	-10	Light Freezing Rain	
323	2	6-Apr-01	12:05:00	12:09:45	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	4.8	5.3	-25	Freezing Fog	
324	2	6-Apr-01	12:07:40	12:12:50	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	5.2	4.5	-25	Freezing Fog	
311	4	6-Apr-01	14:59:30	15:09:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	9.5	1.6	-25	Freezing Fog	
312	4	6-Apr-01	15:00:35	15:10:00	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	9.4	1.6	-25	Freezing Fog	
267	5	9-Apr-01	17:46:20	17:53:30	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	7.2	4.7	-10	Freezing Fog	
268	5	9-Apr-01	17:47:10	17:54:30	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	7.3	4.7	-10	Freezing Fog	
263	6	9-Apr-01	18:47:30	18:57:30	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	10.0	1.7	-10	Freezing Fog	
264	6	9-Apr-01	18:48:00	18:58:30	NEWAVE AEROCH. FCY-1A (TI)	10°	1a	10.5	1.9	-10	Freezing Fog	
27	3	4-Jun-01	20:40:20	21:15:00	Otagon MAXFLIGHT	50	4a	34.7	13.7	-3	Freezing Drizzle	
28	3	4-Jun-01	20:42:00	21:19:30	Otagon MAXFLIGHT	50	4a	37.5	12.6	-3	Freezing Drizzle	
21	4	4-Jun-01	17:24:00	18:40:00	Otagon MAXFLIGHT	50	4a	76.0	4.6	-3	Freezing Drizzle	
22	4	4-Jun-01	17:24:30	18:27:00	Otagon MAXFLIGHT	50	4a	62.5	5.0	-3	Freezing Drizzle	
79	4	4-Jun-01	17:25:30	18:36:00	Otagon MAXFLIGHT	50	4a	70.5	5.3	-3	Freezing Drizzle	
71	11	6-Jun-01	15:59:00	17:00:00	Otagon MAXFLIGHT	50	4a	61.0	4.2	-3	Freezing Fog	
72	11	6-Jun-01	16:05:00	16:50:00	Otagon MAXFLIGHT	50	4a	45.0	4.7	-3	Freezing Fog	
91	11	6-Jun-01	16:21:00	17:34:00	Otagon MAXFLIGHT	50	4a	73.0	4.7	-3	Freezing Fog	
92	11	6-Jun-01	17:35:00	18:28:00	Otagon MAXFLIGHT	50	4a	53.0	4.4	-3	Freezing Fog	
65	12	6-Jun-01	10:39:00	12:30:00	Otagon MAXFLIGHT	50	4a	111.0	2.1	-3	Freezing Fog	
66	12	6-Jun-01	10:38:00	12:26:00	Otagon MAXFLIGHT	50	4a	108.0	2.4	-3	Freezing Fog	

SIMULATED FREEZING PRECIPITATION AT CEF-NRC (OTTAWA) FOR 2000-01 SEASON

Test #	Form #	Date	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Fluid Name	Fluid Dilution	Fluid Type	Fail Time (min)	Actual Rate of Precip (g/dm²/h)	Ambient Temp (°C)	Precipitation (Type)	comments
86	12	6-Jun-01	10:37:00	12:04:00	Otagon MAXFLIGHT	50	4a	87.0	2.2	-3	Freezing Fog	
87	12	6-Jun-01	12:04:00	13:36:00	Otagon MAXFLIGHT	50	4a	92.0	1.9	-3	Freezing Fog	
48	9	5-Jun-01	20:31:30	20:57:00	Otagon MAXFLIGHT	50	4a	25.5	24.3	-3	Freezing Rain	
47	9	5-Jun-01	20:30:30	20:55:00	Otagon MAXFLIGHT	50	4a	24.5	25.2	-3	Freezing Rain	
41	10	5-Jun-01	18:24:30	19:00:00	Otagon MAXFLIGHT	50	4a	35.5	12.3	-3	Freezing Rain	
42	10	5-Jun-01	18:27:00	19:05:00	Otagon MAXFLIGHT	50	4a	38.0	12.5	-3	Freezing Rain	
7	1	4-Jun-01	11:27:50	11:47:00	Otagon MAXFLIGHT	75	4b	19.2	72.2	1	Cold Soak Box	
8	1	4-Jun-01	11:28:50	11:48:45	Otagon MAXFLIGHT	75	4b	19.9	70.5	1	Cold Soak Box	
3	2	4-Jun-01	13:51:20	16:08:00	Otagon MAXFLIGHT	75	4b	136.7	5.2	1	Cold Soak Box	no failure after 2 hours
4	2	4-Jun-01	13:52:00	16:08:00	Otagon MAXFLIGHT	75	4b	136.0	5.2	1	Cold Soak Box	no failure after 2 hours
26	3	4-Jun-01	20:24:00	22:15:00	Otagon MAXFLIGHT	75	4b	111.0	12.6	-3	Freezing Drizzle	
25	3	4-Jun-01	20:24:30	22:16:10	Otagon MAXFLIGHT	75	4b	111.7	13.3	-3	Freezing Drizzle	
19	4	4-Jun-01	17:23:00	19:23:00	Otagon MAXFLIGHT	75	4b	120.0	5.0	-3	Freezing Drizzle	no failure after 2 hours
20	4	4-Jun-01	17:12:30	19:13:00	Otagon MAXFLIGHT	75	4b	120.5	5.1	-3	Freezing Drizzle	no failure after 2 hours
81	4	4-Jun-01	17:13:00	19:13:00	Otagon MAXFLIGHT	75	4b	120.0	5.2	-3	Freezing Drizzle	no failure after 2 hours
69	11	6-Jun-01	16:03:00	18:21:00	Otagon MAXFLIGHT	75	4b	138.0	5.0	-3	Freezing Fog	
70	11	6-Jun-01	16:04:00	17:59:00	Otagon MAXFLIGHT	75	4b	115.0	5.2	-3	Freezing Fog	
89	11	6-Jun-01	15:57:00	17:52:00	Otagon MAXFLIGHT	75	4b	115.0	5.0	-3	Freezing Fog	
90	11	6-Jun-01	15:58:00	18:08:00	Otagon MAXFLIGHT	75	4b	130.0	4.9	-3	Freezing Fog	
63	12	6-Jun-01	10:31:00	14:12:00	Otagon MAXFLIGHT	75	4b	221.0	1.9	-3	Freezing Fog	
64	12	6-Jun-01	10:32:00	13:35:00	Otagon MAXFLIGHT	75	4b	183.0	2.0	-3	Freezing Fog	
85	12	6-Jun-01	10:33:00	13:41:00	Otagon MAXFLIGHT	75	4b	188.0	2.1	-3	Freezing Fog	
59	13	7-Jun-01	14:18:00	14:52:00	Otagon MAXFLIGHT	75	4b	34.0	5.0	-14	Freezing Fog	
60	13	7-Jun-01	14:19:00	14:52:00	Otagon MAXFLIGHT	75	4b	33.0	4.5	-14	Freezing Fog	
55	14	7-Jun-01	16:39:00	17:44:00	Otagon MAXFLIGHT	75	4b	65.0	2.0	-14	Freezing Fog	

APPENDIX L

PRELIMINARY REPORT
METHODOLOGY TO RE-CATEGORIZE
FLUID HOLDOVER TIME TABLES

1. INTRODUCTION

Two sets of guidelines currently exist in the aviation industry for anti-icing purposes, the Fluid-Specific Fluid Holdover Time Guidelines and the Generic Fluid Holdover Time Guidelines. Fluid-Specific Fluid Holdover Time Guidelines are tables that provide holdover time guidance to aircraft operators as to the duration of time available after an aircraft is de/anti-iced with a specific fluid prior to takeoff. There exist fluid-specific tables for several fluids in the industry. Generic Fluid Holdover Time Guidelines are tables that encompass the entire range of fluids available in the market. These tables provide the lowest/most conservative time duration available for an aircraft operator.

Three types of de/anti-icing fluids currently exist in the industry. Type I fluids are used as deicing agents that remove the contaminant of the aircraft's surface. Type II and Type IV fluids are anti-icing fluids that protect the aircraft's surface from precipitation. This report will focus on Type II and Type IV fluids only.

As new products are constantly being introduced into the market, the number of fluid-specific tables continues to increase. This has caused some concern in the industry. In addition, the Generic Fluid Holdover Time Guidelines are annually changed to encompass the new fluids that are introduced into the market. This report will provide a method that would reduce the number of Holdover Time Guidelines that exist in the industry.

1.1 Types of Fluid Guidelines

The Generic HOT Guidelines provide guidance in cases where the pilot is not aware of the fluid being used. There are two generic tables for the two anti-icing fluid types that exist:

- Generic Type II Fluid Holdover Time Guidelines
- Generic Type IV Fluid Holdover Time Guidelines

The Generic HOT guidelines have been used in the industry for many years. The values that are represented in the Generic HOT Guidelines are based on the lowest value obtained when HOT tests are conducted on the various fluids that are being used in the market. Introduction of new fluids to the market could have an effect on the values represented in the Generic HOT guidelines.

Seasoned pilots and operators use Fluid-Specific Fluid Holdover Time Guidelines. If a pilot is aware of the fluid that is being used on the aircraft, utilizing the fluid-specific tables will extend the window of time available for takeoff since the fluid specific tables portray the true capability of a specific product rather than the minimum, most conservative estimate of a fluid's holdover time at a particular temperature under a specific condition. Major airlines view the fluid-specific tables as a cost-efficient tool. Nine Fluid-Specific Holdover Time Guidelines exist:

Type II Fluids
- Kilfrost ABC-II Plus
- Clariant Safewing MPII 1951

Type IV Fluids
- Clariant Safewing MPIV 1957
- Clariant Safewing MPIV 2001
- Clariant Safewing Four
- Kilfrost ABC-S
- Octagon Maxflight
- SPCA AD-480
- UCAR Ultra +

Two more fluid-specific tables have been developed this year (for use in winter 2001-2002) for the following fluids:
- Type II - SPCA Ecowing 26
- Type IV - Clariant Safewing MPIV Protect 2012

1.2 Issues with the Current Situation

Every year, typically two or three new products are introduced to the market. Every new product that is introduced undergoes a series of holdover time tests. This process produces a fluid-specific table that is added to the HOT tables used in the industry. In addition, if the product fails to generate values that are superior to those reported in the Generic HOT Guidelines, the times in the generic guidelines are reduced to include the new product. This practice has the effect of constantly reducing the values represented in the Generic HOT Guidelines.

The constant changes to the Generic HOT Guidelines have prompted a discussion within the aviation industry that suggested freezing the Generic HOT Guidelines. Freezing the Generic HOT Guidelines will lock the minimum HOT values and therefore create a situation in which any new fluid introduced to the market will not be represented in the generic tables if it fails to generate holdover times that are superior to all the generic values.

The current generic tables are almost identical (Type II and Type IV). Some fluids are bad performers that are making the Type IV almost identical to

Type II. This is the reason the fluid-specific tables exist. Seasoned pilots will not use the Generic HOT Guidelines because they are not cost efficient since they penalize the high performers.

To summarize:

- Too many tables exist and the number of tables that exist will continue to grow.
- Levels of performance should be determined in which the high and the low performing fluids are identified and distinguished.

1.3 OBJECTIVES

This report will attempt to address the issues outlined in Section 1.2 and suggest one comprehensive method that will:

- Reduce the number of HOT tables; and
- Identify/segregate the high performers and the low performers.

The product of this report will be a set of three tables that will address these two points.

2. METHODOLOGY AND DATA REVIEW

2.1 Data Identification

The format of the holdover timetables divides the weather conditions in which anti-icing operations are carried out into six distinct categories occurring in five temperature zones. This combination creates 19 precipitation conditions. Within each temperature zone fluid dilutions are further subdivided to provide a matrix comprising 45 cells. Within each cell, two numbers are indicated, an upper limit holdover time value and a lower limit holdover time value.

For the purpose of this report, the upper limit holdover time values and the lower limit holdover time values will be called a table's *attributes*. The basic idea behind this analysis is to plot a line graph of all the *attributes* in one fluid-specific table and then compare this line graph with the 12 other line graphs created from the other 10 fluid-specific tables and the two generic tables (there are 11 fluid-specific tables in total).

Only 36 of the 45 cells will be analysed. Nine cells will not be analysed because the values within those cells of each table are identical. These nine cells belong to the frost condition. Since each cell contains two values, an upper limit holdover time value and a lower limit holdover time value, 72 attributes could be analysed in each table.

Analysis of the 72 attributes of 11 fluids can be complex, and various methods can be used to reduce the number of attributes per table to simplify the clustering process.

2.2 Data Extraction

The main objective of this analysis is the creation of a small set of tables that will encompass all the tables that currently exist in the market while separating the high performers from the low performers.

Data was extracted from the following tables:

1. Generic Type II Fluid Holdover Time Guidelines;
2. Generic Type IV Fluid Holdover Time Guidelines;
3. Kilfrost ABC-II Plus;
4. Clariant Safewing MPII 1951;
5. SPCA Ecowing 26;
6. Clariant Safewing MPIV 1957;
7. Clariant Safewing MPIV 2001;
8. Clariant Safewing Four;
9. Clariant Safewing MP IV Protect 2012;
10. Kilfrost ABC-S;
11. Octagon Maxflight;
12. SPCA AD-480; and
13. UCAR Ultra +

The values displayed in the tables were extracted in the form of HH:MM and converted to minutes in a log that was developed. The log contains the 72 attributes of each of the 11 fluid-specific tables and the two generic tables.

2.3 Selection of Important Attributes

The important attributes were identified based on a survey of airlines, which analyses the distribution of deicing operations, i.e. how many times in a year does a *precipitation condition* re-occur that requires deicing operations. This is calculated as a percentage of the total number of operations and is displayed in each of the 19 *precipitation conditions* in the holdover time format. The responses from the survey provided a total of 17,517 anti-icing operations for 7 major hub locations (Table L-1).

The data reveals that the analysis should be focused on two cells: SNOW 0°C to -3°C and SNOW below -3°C to -14°C (Neat Fluid), which comprise about 50% of all operations. The frost condition (about 33% of all operations) is not part of the analysis because the values in the frost condition on all the fluid-specific tables and generic tables are identical. These two groups of precipitation conditions represent 76% of all operations that are relevant to this analysis.

Previously, an analysis was conducted using all five cells including dilutions contained in the two snow precipitation conditions identified. The grouping of fluids using all five cells was identical to the grouping that is recommended in this report. Therefore, this report will concentrate on the two cells that are of interest to North American airports, and these are the ones that utilize fluids in their NEAT form. These cells each contain two values:

- Snow 0º to -3º 100/0 U (upper limit)
- Snow 0º to -3º 100/0 L (lower limit)
- Snow below -3º to -14º 100/0 U (upper limit)
- Snow below -3º to -14º 100/0 L (lower limit)

This will reduce the number of attributes chosen to represent each holdover timetable to four essential attributes.

2.4 Data Selection

The four essential attributes identified were extracted from each holdover time table and plotted in a line graph. Once the graph was plotted, clusters where then identified and separated. A cluster is a group of holdover time tables that reveal, once plotted in line graphs, that they are closely related.

Once a cluster was identified, the minimum value of each of the 72 attributes in the cluster of tables was used as the defining value (holdover time) of the table that would be used to identify and describe the cluster.

TABLE L-1 (FOR TYPE II & IV FLUID)
DISTRIBUTION OF DEICING OPERATIONS IN THE FOLLOWING STATION (S)

SUMMARY OF ALL AIRPORTS

Total # of Deicing Operations: *17517* **Type I included** NO **All values are estimates:**

OAT °C	OAT °F	Type IV Fluid Concentration Neat-Fluid/Water (% by volume)	FROST	FREEZING FOG	SNOW	FREEZING DRIZZLE	LIGHT FRZ RAIN	RAIN ON COLD SOAKED WING	OTHER RIME ICE	Total
above 0º	above 32º	100/0, 75/25, 50/50	5.5%	0.0%	6.0%	0.3%	0.2%	0.5%	0.0%	12.6%
0 to -3	32 to 27	100/0, 75/25, 50/50	22.1%	1.1%	26.6%	1.0%	1.8%		0.2%	52.9%
below -3 to -14	below 27 to 7	100/0, 75/25	4.8%	0.6%	24.9%	2.0%	1.0%		0.0%	33.3%
below -14 to -25	below 7 to -13	100/0	0.1%	0.0%	1.1%				0.0%	1.2%
below -25	below -13	100/0	0.0%	0.0%	0.0%				0.0%	0.0%
Total			32.6%	1.7%	58.5%	3.3%	3.1%	0.5%	0.3%	

100.0% **of Operations**

M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT: Table L-1

3. ANALYSIS AND OBSERVATIONS

3.1 Phase 1 – Is There a Need to Conduct the Analysis?

As mentioned Section 1.2, the two generic fluid holdover time guidelines that currently exist are almost identical. This can be seen in Figure L-1, which plots the values of the four essential attributes that have been chosen for use in this analysis. As can be seen from the graph, the maximum duration difference that exists between the two line graphs is 10 minutes.

The need to conduct the analysis can be further justified when all Type II fluids, Type IV fluids and the generic fluid holdover guidelines are plotted in Figure L-2, which shows:

a) Type II fluids cannot be easily distinguished from Type IV fluids.

b) There is a significant spread between the fluids (minimum of 30 minutes and maximum of 70 minutes). Some of the fluids in the plot are better performers than other fluids of the same fluid type.

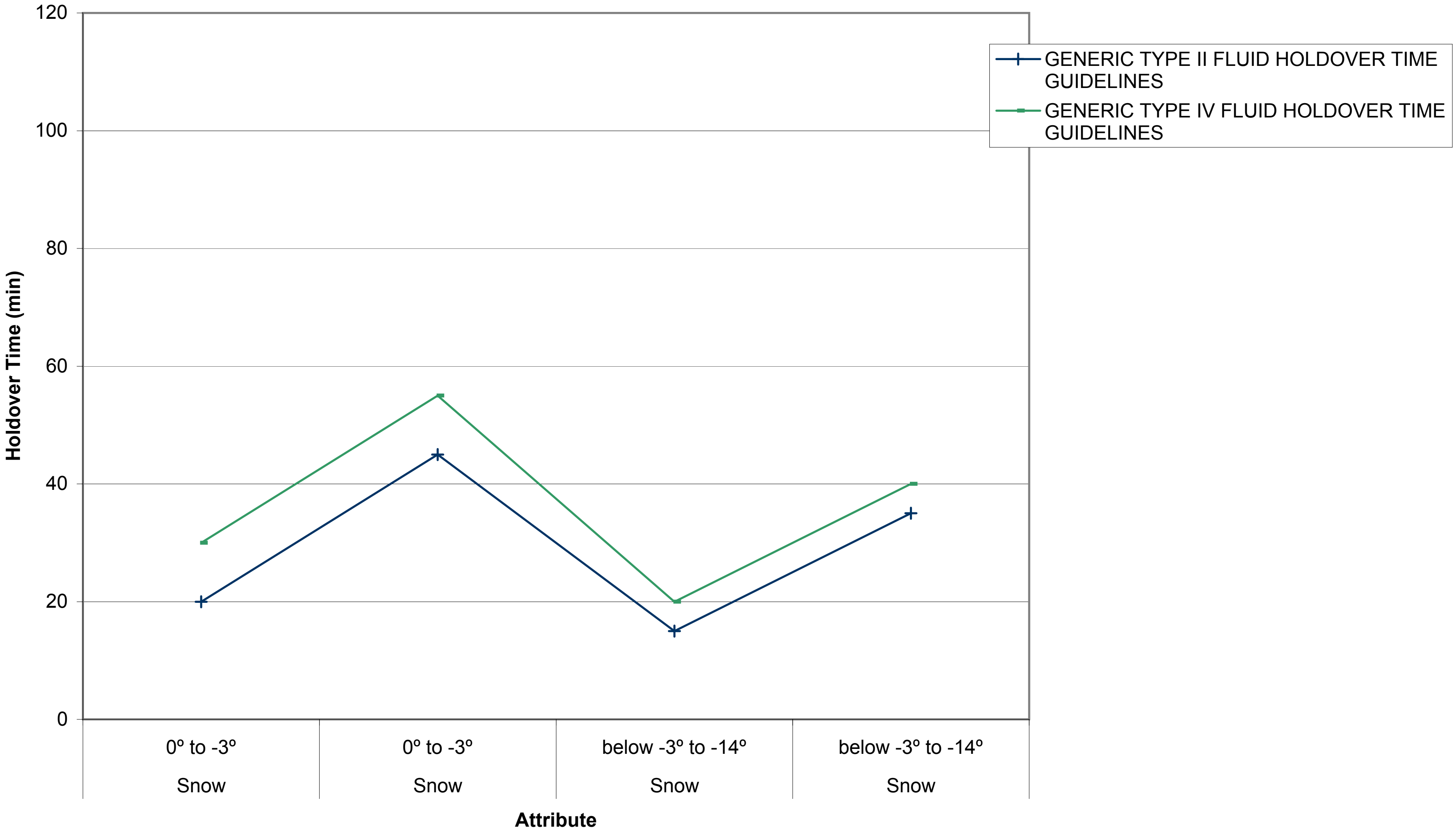
c) There is a significant difference in the performance of Kilfrost ABC-S when compared to the Generic Type IV Guidelines.

Figure L-3 is a plot of all Type II fluids and the generic Type II guideline. Figure L-4 is a plot of all Type IV fluids and the generic Type IV guideline. When comparing Figure L-3 to L-4, it can be seen that, while the Generic Type II Guideline may be an adequate representation of all Type II fluids under the four values being studied, there is a wide spread in the performance of the Type IV fluids.

3.2 Phase 2 – Identifying the Groups of Fluids

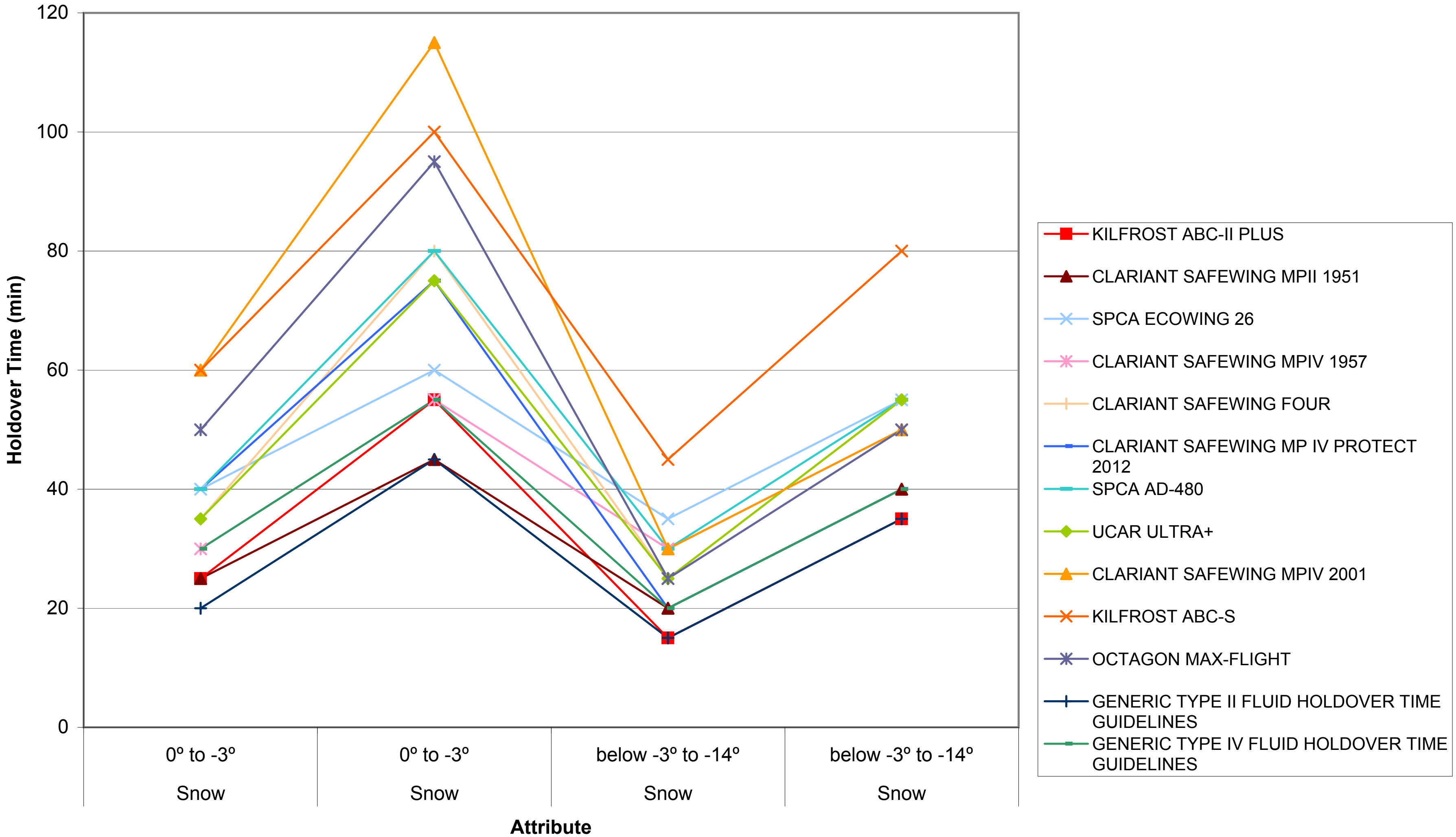
The analysis was then conducted while looking at all the fluids on one line graph and disregarding the type of fluid. Visually, the fluids where separated into three groups, low performers (Group A), medium performers (Group B) and high performers (Group C). Once the groups were formed, a line graph was generated to represent each group. This line graph was made up of the minimum value that exists under each essential attribute of the fluids that exist in the group (Figure L-5).

FIGURE L-1
GENERIC TYPE II AND TYPE IV FLUID HOLDOVER GUIDELINES



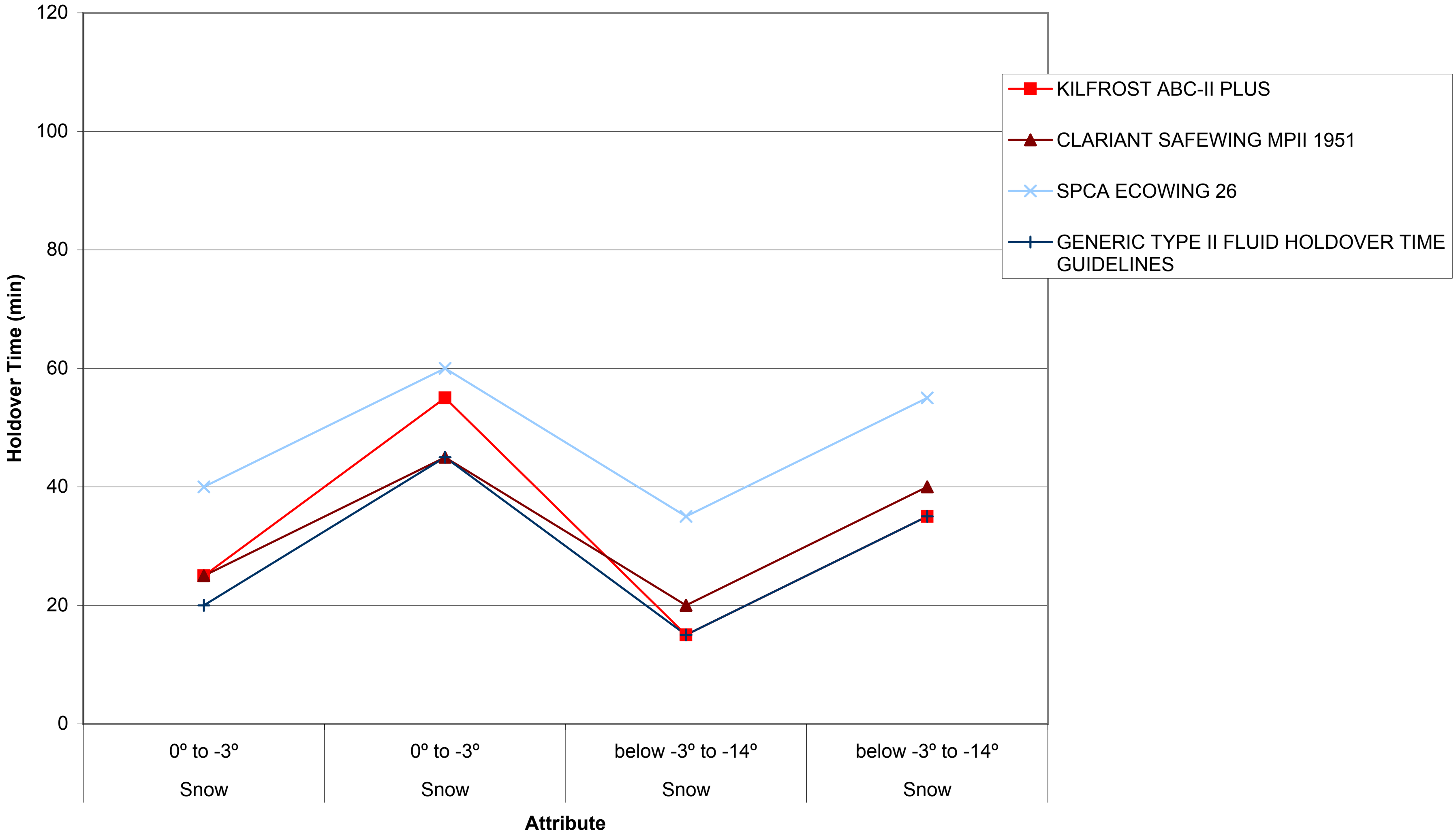
M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT: 1 -GEN Type II & GEN Type IV

FIGURE L-2
ALL FLUIDS AND GENERIC TYPE II AND TYPE IV FLUID HOLDOVER GUIDELINES



M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT: 2a-All Fluids & GEN Type II &IV

FIGURE L-3
TYPE II FLUIDS COMPARED TO GENERIC TYPE II FLUID HOLDOVER GUIDELINE



IM\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT: 3 -Type II Fluids & GEN TYPE II

FIGURE L-4
TYPE IV FLUIDS COMPARED TO GENERIC TYPE IV FLUID GUIDELINE

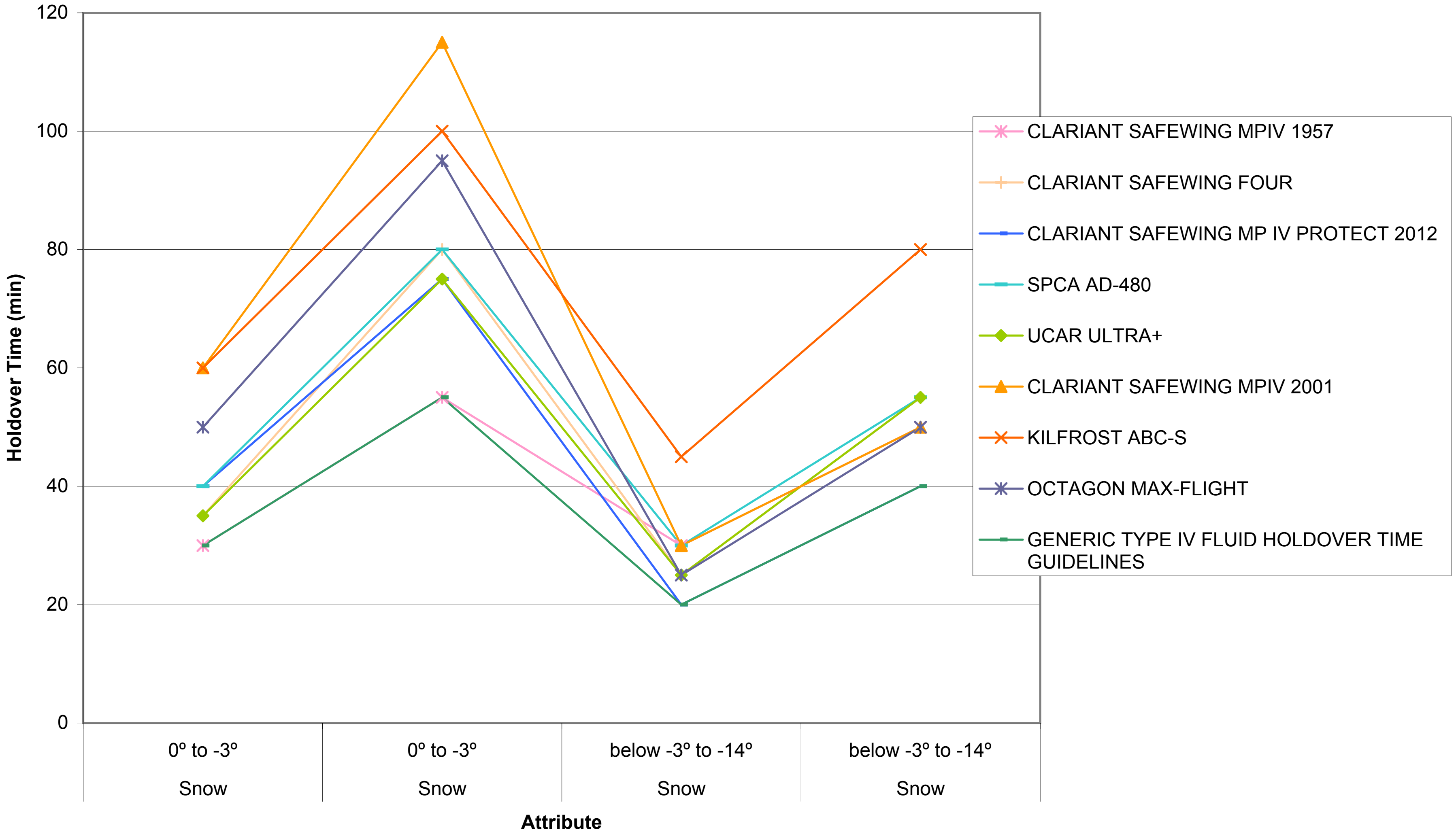
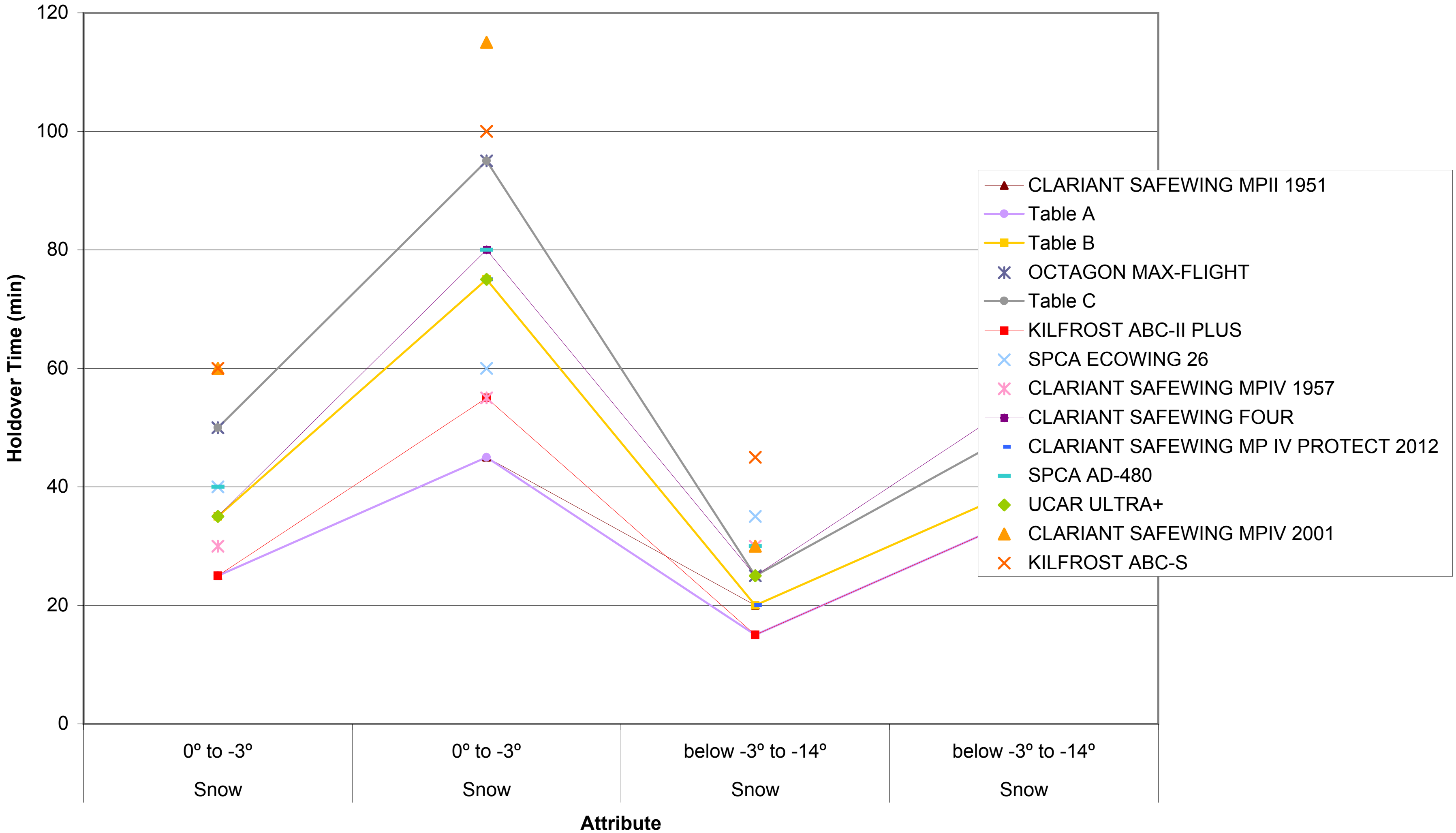


FIGURE L-5
ALL FLUIDS AND TABLES A, B, AND C



IM\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT: 5 -All Fluids & Tables A, B &C

It was observed that the following fluids are closely related in performance under the essential attributes that were chosen for this analysis:
Low Performers:

- Kilfrost ABC-II Plus
- Clariant Safewing MPII 1951
- SPCA Ecowing 26
- Clariant Safewing MPIV 1957

Table A was created and plotted to encompass and represent this group of fluids (Figure L-6)

Medium Performers

- Clariant Safewing Four
- Clariant Safewing MP IV Protect 2012
- SPCA AD-480
- UCAR Ultra +

Table B was created and plotted to encompass and represent this group of fluids (Figure L-7)

High Performers

- Clariant Safewing MPIV 2001
- Kilfrost ABC-S
- Octagon Maxflight

Table C was created and plotted to encompass and represent this group of fluids (Figure L-8)

3.3 Phase 3 – How Valid are These Groups?

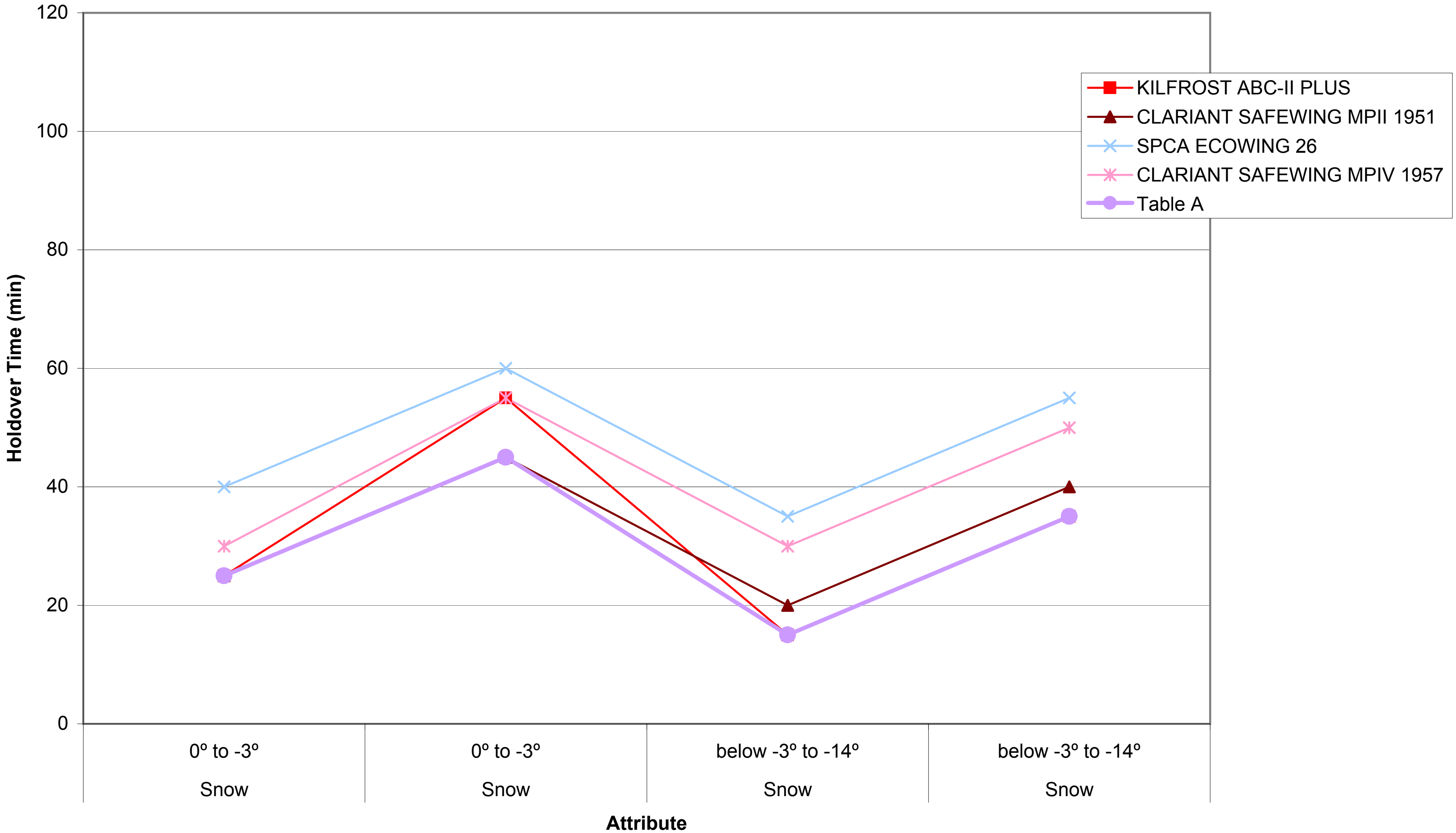
It can be seen that the three groupings that have been established are distinct from each other (Figure L-9). When the three groupings are compared to the two Generic Fluid Holdover Guidelines, a significant difference exists between the Generic Guidelines and the three grouping/tables (Figure L-10).

3.4 Phase 4 – Creation of the Tables

To create the new sets of tables that address the objectives of this report, attributes of a set of fluids in one specific group were compared to one another and the minimum value that exists within the set for a specific attribute was extracted and used to generate the table.

The three tables that were generated based on the lowest value of a set of fluids are represented in Section 3.5.

FIGURE L-6
FLUIDS AND TABLE A



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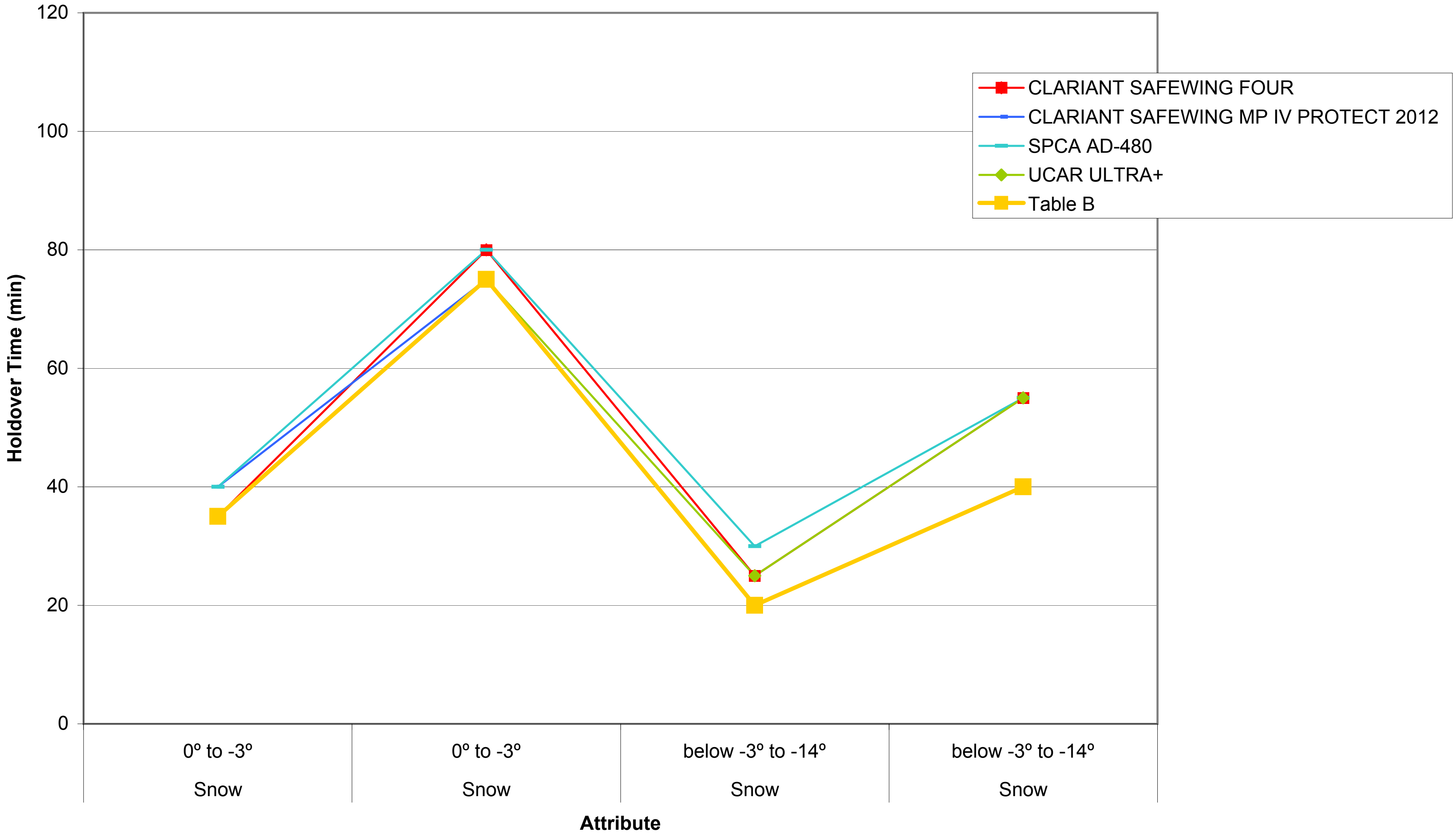
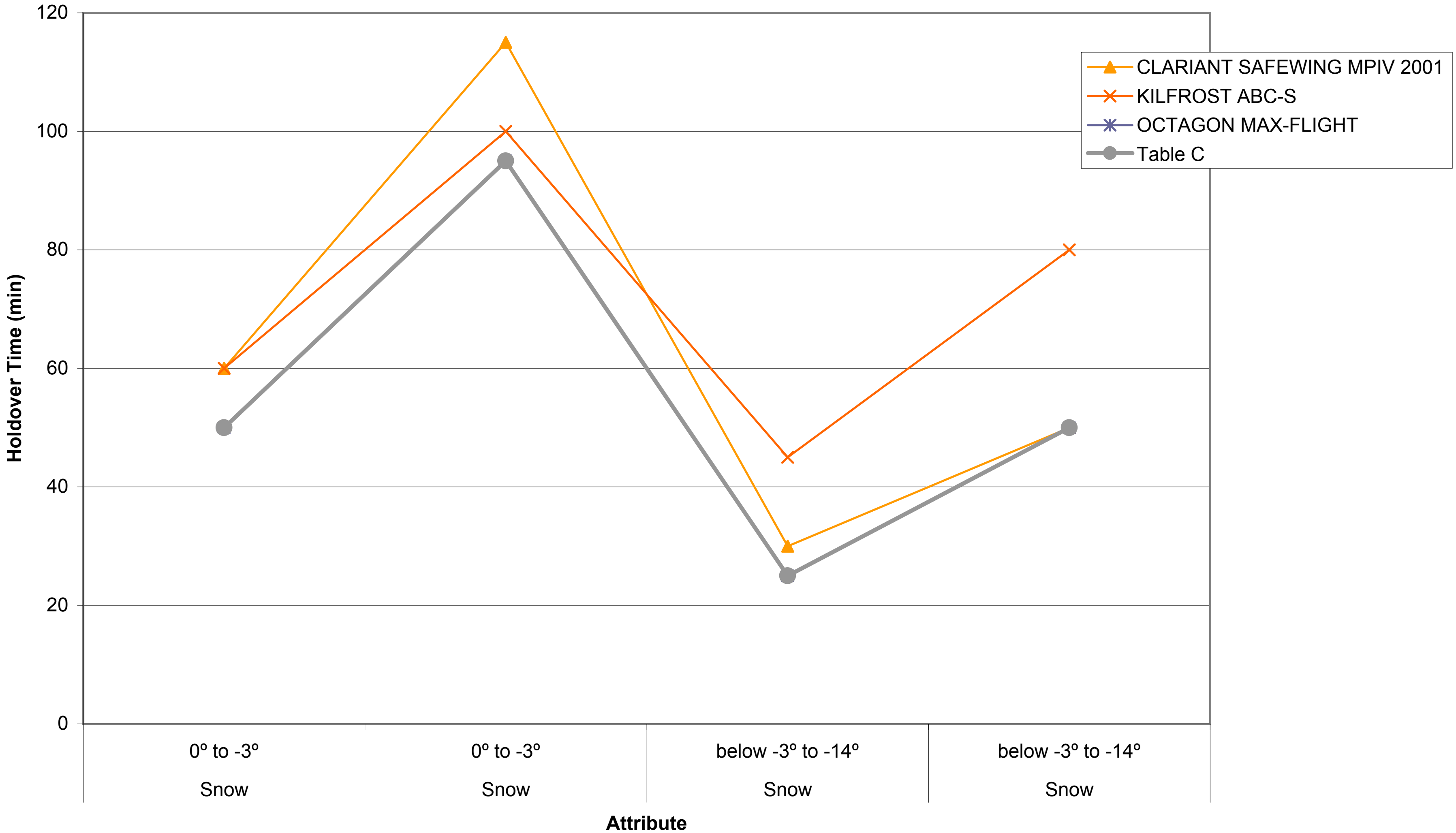
AT:6 -Fluids & Table A

FIGURE L-7
FLUIDS AND TABLE B



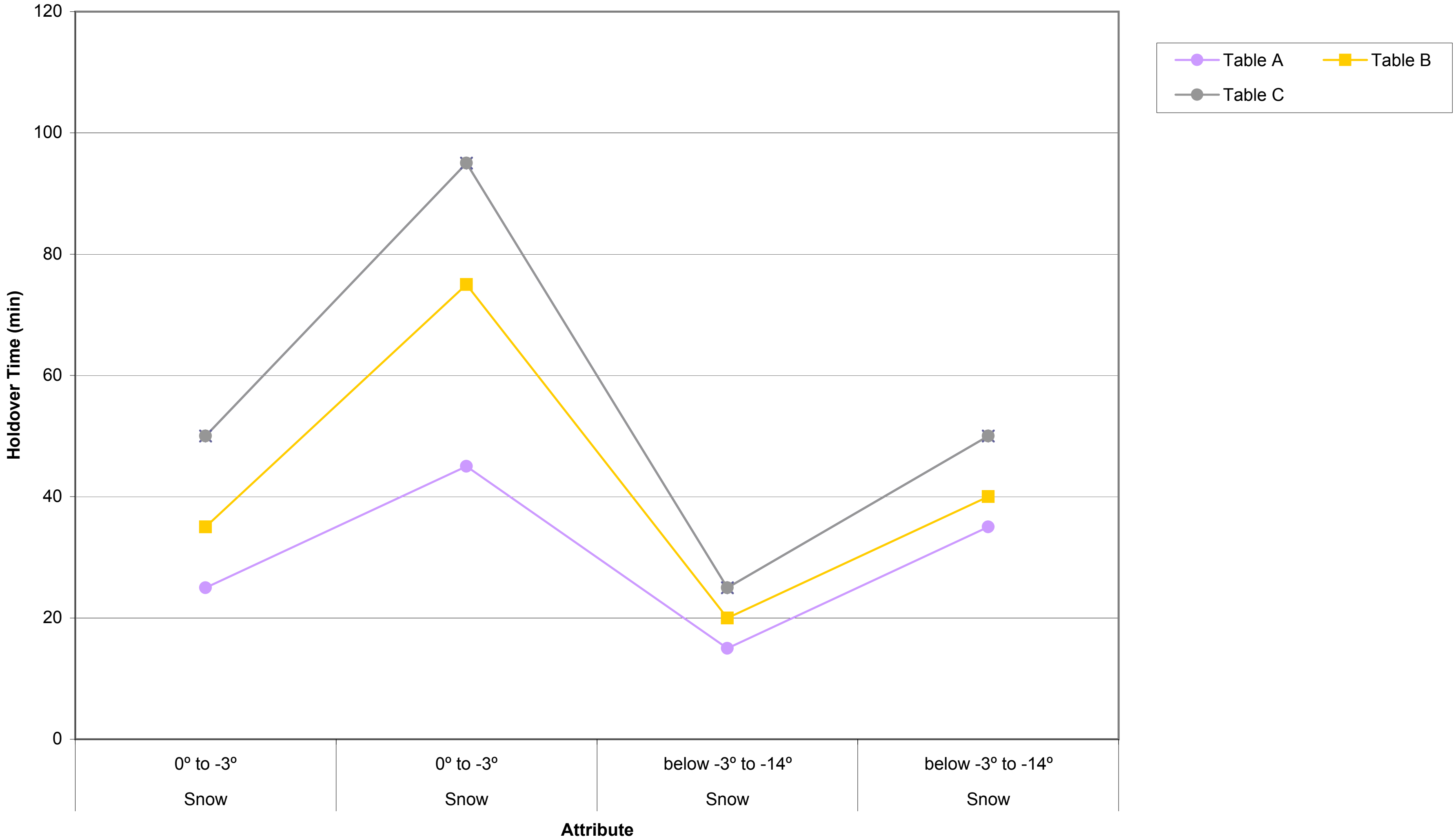
M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT:7- Fluids & Table B

FIGURE L-8
FLUIDS AND TABLE C



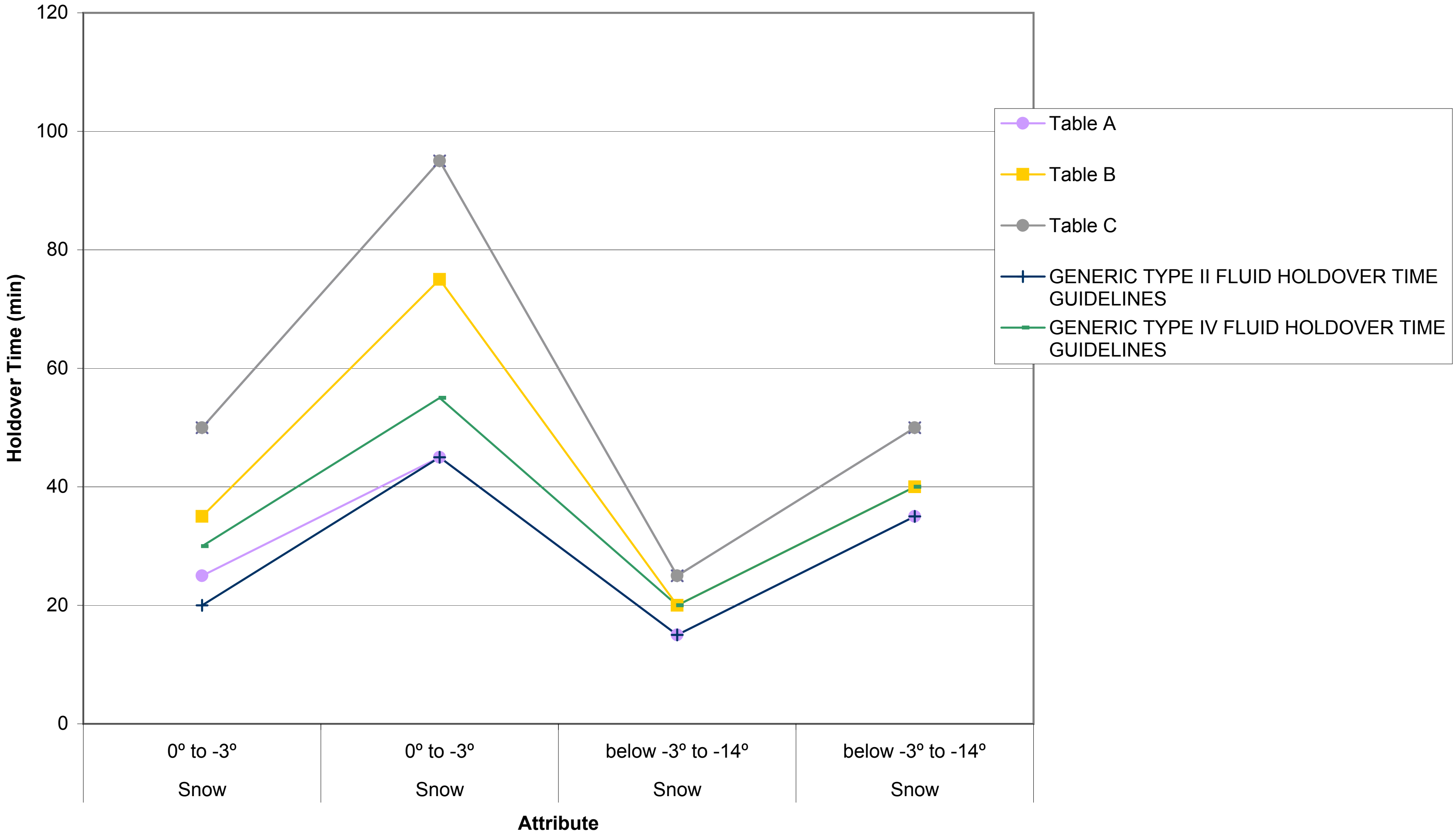
M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT:8 -Fluids & Table C

FIGURE L-9
TABLE A, B AND C



M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT:9 -Tables A, B, and C

FIGURE L-10
TABLE A, B, C COMPARED TO TYPE II AND TYPE IV FLUID HOLDOVER TIME GUIDLINES



M\Groups\CM1680 (exBM3833)\Reports\HOT\Appendices\Analysis
AT:10 -Table A, B, C & GEN II & IV

3.5 Summary of the Analysis

The three tables that were generated based on the lowest value of a set of fluids are represented in Table L-2, L-3, L-4. The three tables are the product of one method of analysis. Should the industry decide to adopt these tables, then the method of analysis would need further discussion to reach a unified and scientific approach.

3.6 Changes to the Analysis

This analysis can be conducted using different methods that will allow for better definition of how well fluids perform. Following are two suggestions that may bring forward a deeper appreciation for a system of tables that adequately represent the fluids that belong to each group.

- The method used to identify the essential attributes may be changed. This analysis focused on identifying a small set of critical cells through the analysis of the distribution of deicing operations under the various precipitation conditions. The cells identified as critical may be changed if more useful criteria are identified.
- Groups of fluids may be identified through analysis of all cells in the fluid-specific tables instead of identifying only two critical cells. The analysis would use statistical methods of analysis.

3.7 Advantages and Disadvantages to the Stakeholders

Following is a list of advantages and disadvantages that may be experienced by the various stakeholders should the industry and the regulating bodies proceed with this new approach (i.e., to address the existence of a large number of fluid specific holdover time tables and the constant changes that are occurring to the generic fluid tables).

Although this report puts forward a method that may or may not be adopted by the industry, the debate is ongoing and will require solutions that use advanced scientific methods to perform the analysis and produce a new set of tables. The advantages and disadvantages listed below will be experienced regardless of the methods used to segregate the better fluid performers from the average and low performers.

TABLE L-2

TABLE A COMPARED TO GENERIC TYPE II FLUID HOLDOVER TIME GUIDELINE

OAT °C	OAT °F	SAE Type II Fluid Concentration Neat-Fluid/Water (Vol%/Vol%)	*FROST	FREEZING FOG	SNOW ①	***FREEZING DRIZZLE	LIGHT FRZ RAIN	RAIN ON COLD SOAKED WING	OTHER****
above 0°	above 32°	100/0	12:00	0:35-1:30	0:20-0:55	0:30-0:55	0:15-0:30	0:05-0:40	
				0:55-1:40	0:30-0:55	0:35-0:55	0:20-0:30	0:05-0:50	
		75/25	6:00	0:25-1:00	0:15-0:40	0:20-0:45	0:10-0:25	0:05-0:25	
				0:45-1:15	0:20-0:40	0:25-0:45	0:15-0:25	0:05-0:40	
		50/50	4:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
				0:15-0:30	0:05-0:20	0:05-0:15	0:05-0:10		
0 to -3	32 to 27	100/0	8:00	0:35-1:30	0:20-0:45	0:30-0:55	0:15-0:30	CAUTION No holdover time guidelines exist	
				0:55-1:40	0:25-0:45	0:35-0:55	0:20-0:30		
		75/25	5:00	0:25-1:00	0:15-0:30	0:20-0:45	0:10-0:25		
				0:45-1:15	0:15-0:35	0:25-0:45	0:15-0:25		
		50/50	3:00	0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
				0:15-0:30	0:05-0:15	0:05-0:15	0:05-0:10		
below -3 to -14	below 27 to 7	100/0	8:00	0:20-1:05	0:15-0:35	**0:15-0:45	**0:10-0:30		
				0:30-1:05	0:15-0:35	**0:15-0:45	**0:10-0:30		
		75/25	5:00	0:20-0:55	0:15-0:25	**0:15-0:30	**0:10-0:20		
				0:20-0:55	0:15-0:25	**0:15-0:30	**0:10-0:20		
below -14 to -25	below 7 to -13	100/0	8:00	0:15-0:20	0:15-0:30				
				0:15-0:20	0:15-0:30				
below -25	below -13	100/0	SAE TYPE II fluid may be used below -25ºC (-13ºF) provided the freezing point of the fluid is at least 7ºC (13ºF) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type II fluid cannot be used.						

GENERIC TYPE II FLUID	0:15-0:30
Table A	0:15-0:30

Table A represents the following fluids:
KILFROST ABC-II PLUS
Viscosity of Neat 100% Fluid Tested 3,600 cP (20°C, 0.3 rpm, Spindle LV2, 250 mL beaker, 150 mL fluid, 10 min, grd.leg)
CLARIANT SAFEWING MPII 1951
Viscosity of Neat 100% Fluid Tested 8,700 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 15 min)
SPCA ECOWING 26
Viscosity of Neat 100% Fluid Tested 4,900 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 30 min)
CLARIANT SAFEWING MPIV 1957
Viscosity of Neat 100% Fluid Tested 16,200 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 15 min)

TABLE L-3

TABLE B COMPARED TO GENERIC TYPE IV FLUID HOLDOVER TIME GUIDELINE

OAT		Type IV Fluid Concentration Neat-Fluid/Water (% by volume)	Approximate Holdover Times Anticipated Under Various Weather Conditions (hours:minutes)						
°C	°F		*FROST	FREEZING FOG	SNOW ①	***FREEZING DRIZZLE	LIGHT FRZ RAIN	RAIN ON COLD SOAKED WING	OTHER****
above 0º	above 32º	**100/0**	18:00	1:05-2:15 1:15-2:30	0:35-1:05 0:40-1:25	0:40-1:00 0:40-1:10	0:25-0:40 0:25-0:40	0:10-0:50 0:10-1:05	
		75/25	6:00	1:05-1:45 1:10-2:05	0:20-0:40 0:35-1:10	0:30-1:00 0:35-0:50	0:15-0:30 0:15-0:30	0:05-0:35 0:15-0:40	
		50/50	4:00	0:15-0:35 0:25-0:45	0:05-0:20 0:15-0:25	0:10-0:20 0:15-0:20	0:05-0:10 0:05-0:10		
0 to -3	32 to 27	**100/0**	12:00	1:05-2:15 1:15-2:30	0:30-0:55 0:35-1:25	0:40-1:00 0:40-1:10	0:25-0:40 0:25-0:40	**CAUTION No holdover time guidelines exist**	
		75/25	5:00	1:05-1:45 1:10-2:05	0:20-0:35 0:25-0:55	0:30-1:00 0:35-0:50	0:15-0:30 0:15-0:30		
		50/50	3:00	0:15-0:35 0:25-0:45	0:05-0:15 0:10-0:20	0:10-0:20 0:15-0:20	0:05-0:10 0:05-0:10		
below -3 to -14	below 27 to 7	**100/0**	12:00	0:20-1:20 0:20-1:20	0:20-0:40 0:20-0:40	**0:20-0:55 0:25-0:45	**0:10-0:30 0:15-0:25		
		75/25	5:00	0:25-0:50 0:25-0:50	0:15-0:25 0:20-0:45	**0:20-0:50 0:15-0:30	**0:10-0:25 0:10-0:20		
below -14 to -25	below 7 to -13	**100/0**	12:00	0:15-0:40 0:15-0:40	0:15-0:30 0:15-0:30				
below -25	below -13	**100/0**	SAE TYPE IV fluid may be used below -25ºC (-13ºF) provided the freezing point of the fluid is at least 7ºC (13ºF) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type IV fluid cannot be used.						

GENERIC TYPE IV FLUID	0:15-0:30
Table B	0:15-0:30

Table B represents the following fluids:
CLARIANT SAFEWING FOUR
Viscosity of Neat 100% Fluid Tested 6,400 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 15 min)
CLARIANT SAFEWING MP IV PROTECT 2012
Viscosity of Neat 100% Fluid Tested 7,800 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 15 min)
SPCA AD-480
Viscosity of Neat 100% Fluid Tested 15,200 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 30 min)
UCAR ULTRA+
Viscosity of Neat 100% Fluid Tested 36,000 cP (0°C, 0.3 rpm, Spindle SC4-31/13R, 10 mL fluid, 10 min)

TABLE L-4

TABLE C COMPARED TO GENERIC TYPE IV FLUID HOLDOVER TIME GUIDELINE

OAT °C	OAT °F	Type IV Fluid Concentration Neat-Fluid/Water (% by volume)	*FROST	FREEZING FOG	SNOW ①	***FREEZING DRIZZLE	LIGHT FRZ RAIN	RAIN ON COLD SOAKED WING	OTHER****
			Approximate Holdover Times Anticipated Under Various Weather Conditions (hours:minutes)						
above 0º	above 32º	**100/0**	18:00	1:05-2:15	0:35-1:05	0:40-1:00	0:25-0:40	0:10-0:50	
				1:20-3:20	1:10-2:00	0:55-1:50	0:35-1:00	0:15-1:15	
		75/25	6:00	1:05-1:45	0:20-0:40	0:30-1:00	0:15-0:30	0:05-0:35	
				1:05-1:45	0:30-1:05	0:35-1:10	0:25-0:35	0:10-0:40	
		50/50	4:00	0:15-0:35	0:05-0:20	0:10-0:20	0:05-0:10		
				0:30-0:35	0:05-0:20	0:10-0:20	0:05-0:10		
0 to -3	32 to 27	**100/0**	12:00	1:05-2:15	0:30-0:55	0:40-1:00	0:25-0:40	**CAUTION No holdover time guidelines exist**	
				1:20-3:20	0:50-1:35	0:55-1:50	0:35-1:00		
		75/25	5:00	1:05-1:45	0:20-0:35	0:30-1:00	0:15-0:30		
				1:05-1:45	0:30-0:55	0:35-1:10	0:25-0:35		
		50/50	3:00	0:15-0:35	0:05-0:15	0:10-0:20	0:05-0:10		
				0:15-0:35	0:05-0:15	0:10-0:20	0:05-0:10		
below -3 to -14	below 27 to 7	**100/0**	12:00	0:20-1:20	0:20-0:40	**0:20-0:55	**0:10-0:30		
				0:45-1:35	0:25-0:50	0:20-1:00	0:10-0:30		
		75/25	5:00	0:25-0:50	0:15-0:25	**0:20-0:50	**0:10-0:25		
				0:25-1:00	0:20-0:35	0:20-1:00	0:10-0:30		
below -14 to -25	below 7 to -13	**100/0**	12:00	0:15-0:40	0:15-0:30				
				0:20-0:40	0:20-0:35				
below -25	below -13	**100/0**	SAE TYPE IV fluid may be used below -25ºC (-13ºF) provided the freezing point of the fluid is at least 7ºC (13ºF) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type IV fluid cannot be used.						

GENERIC TYPE IV FLUID	0:15-0:30
Table C	0:15-0:30

Table C represents the following fluids:
CLARIANT SAFEWING MPIV 2001
Viscosity of Neat 100% Fluid Tested 18,000 cP (20°C, 0.3 rpm, Spindle SC4-34/13R, 10 mL fluid, 15 min)
KILFROST ABC-S
Viscosity of Neat 100% Fluid Tested 17,000 cP (20°C, 0.3 rpm, Spindle LV2, 250 mL beaker, 150 mL fluid, 10 min, grd.leg)

OCTAGON MAXFLIGHT
Viscosity of Neat 100% Fluid Tested 5,540 cP (20°C, 0.3 rpm, Spindle LV1, 600 mL beaker, 500 mL fluid, 33 min 20 sec, grd.leg)

Advantages to operators using generic tables:

- Reducing the number of fluid-specific tables reduces the confusion.
- No decision required as to the choice of table to use (fluid-specific or generic).
- If a small aircraft operator typically uses generic tables, the new set increases the window of time available. This is because the new set of tables provides more time for fluids that belong to the high performing category.

Disadvantages to operators using generic tables:

- When using generic tables, an operator is not required to know the fluid that is being sprayed. The only information required is the type of fluid being sprayed, whether it is Type II or Type IV. However, when using the new set of tables, the operator is required to know the fluid being sprayed to identify the table that must be used.

Advantages to operators using fluid-specific tables:

- Reducing the number of tables reduces the probability of error.
- Using the new set of tables introduces added safety (shorter times).
- The major loss experienced in holdover time when choosing generic fluid holdover timetables instead of fluid-specific tables is greatly diminished. For example, the holdover time of Clariant SAFEWING MPIV 2001, neat, in snow below 0° to -3° in the upper limit is 115 minutes. The holdover time stated in the Generic Holdover Time Guidelines for Type IV fluids is 55 minutes. This signifies a loss of 60 minutes. This fluid was categorized in this analysis under the third category of tables, Table C; therefore, the holdover time stated for this condition is 95 minutes, producing a loss of only 20 minutes. In fact, the maximum loss experienced by all 11 fluids under the four values analyzed when using the new set of table is 30 minutes.

Disadvantages to operators using fluid-specific tables:

- There will continue to be some loss in holdover time experienced when choosing to use the new set of tables instead of the fluid-specific tables.

Advantages to the fluid manufacturers:

- The new set of tables may remove the possibility of the regulating bodies imposing minimum performance levels, and will allow for fluids to be categorized in one of three categories. The good performers will be recognized and the bad performers will continue to be allowed to market their products.

Disadvantages to the fluid manufacturers:

- Some fluid manufacturers will lose a strong marketing tool.

Advantages to the regulating bodies:

- The concern over too many fluid specific tables will be removed.
- The concern over the lowering and ever-changing Generic Tables will be removed.
- If aircraft operators welcome the use of the new set of tables instead of the fluid-specific tables, an added safety buffer will be re-introduced.
- SAE may recognize the new tables and accept that they be published in APR 4737.

Disadvantages to the regulating bodies:

- The introduction of a new set of tables will require time, effort and a scientific approach that will be valid and sustainable in the long term.

4. CONCLUSIONS AND RECOMMENDATIONS

It has been proven in this report that there is a need to conduct further investigations into the nature of the fluids in the market, where they stand when compared to one another, and how the generic fluid holdover guidelines are irrelevant to the performance of many of these fluids.

Although the principles that were used to conduct this analysis are based on a basic, somewhat subjective method of visually separating eleven fluids into three groups after simplifying the analysis by choosing only four points to describe each fluid, even though the four points chosen are values that were deemed the most in use, the procedure employed nevertheless provides a good method and simplifies the HOT tables.

It is recommended that a scientific method of analysis be used to conduct this analysis. A statistician using sophisticated software is capable of running models that will encompass all of the fluids' attributes and produce clusters that are numerically closely related.

Once the clusters are identified, the same methodology used to generate the Generic Tables and Table A, Table B, and Table C may be used to generate the tables that adequately represent the fluids in the market. The number of tables generated does not have to be limited to three.