QUALIFICATION TEST REPORT

FP-13-51
LOW TAKE-OFF ROTATION SPEED COMMUTER TYPE AIRCRAFT AERODYNAMIC TESTING OF THE CANDIDATE TYPE I FLUID

Arctica DG RTU
lot # 28

Produced at Tatarstan, Russia

for

ARCTON LTD.
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GO 11, Nizhnekamsk
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by

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July 2013

QUALIFICATION

This report presents results of low speed ramp aerodynamic acceptance tests, using Boundary Layer Displacement Thickness (BLDT) values, performed on samples of the candidate Type I fluid **ARCTON LTD. Arctica DG RTU lot # 28,** produced at **Tatarstan, Russia** evaluated concentrated as received according to the latest revisions of the SAE AMS 1424K specification and AS5900B standard [1-3]. The tests were performed between 0°C and -29.3°C within a ± 2°C range, using the flat plate set-up in the Luan Phan refrigerated wind tunnel at the Anti-icing Materials International Laboratory (AMIL) research laboratory. AMIL is independent of fluid manufacturers and was found qualified on September 11, 1997 (reconfirmed September 13th, 2012) by the Performance Review Institute according to PRI document AC 3001, "audit criteria for compliance to SAE AMS1424 and AMS1428".

On the basis of the acceptance criteria, the candidate Type I fluid ARCTON LTD. Arctica DG RTU lot # 28 qualifies according to AMS 1424K specification for use on low take-off rotation speed commuter type aircraft in the following temperature ranges:

- **above -29°C in the case of the Fluid as received.**

Final Fluid Thickness (paragraph 3.5.3.1)

The final fluid thickness, based on an initial thickness of 2000 µm, was measured to be from 127 µm to 457 µm for all dilutions, **therefore below the required 600 µm.**

This fluid is qualified from 2013 July 25, for a four year period.

LIMA AMIL
Approved by / Approuvé par
2013-07-26
Date

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LIST OF SYMBOLS

δ^*_{ave}	average Boundary Layer Displacement Thickness (BLDT) over the test section perimeter at cross-section 3 (Figure 5) evaluated by the equation 2 in Attachment 1 (mm)
δ^*	Boundary Layer Displacement Thickness (BLDT) over the test section perimeter at cross-section 3 (Figure 5) evaluated by the equation 3 in Attachment 1 (mm)
AIR	Aerospave Information Report
AMIL	Anti-icing Materials International Laboratory
AMS	Aerospace Material Specification
AS	Aerospace Standard
FE	Fluid Elimination during the test (%)
FP	Flat Plate elimination test identification number
FPC	Flat Plate Calibration test identification number
FPD	Flat Plate elimination test Dry (without fluid)
FPET	Flat Plate Elimination Test
P	Static Pressure as measured by gauges positioned at points # 1, 2 and 3 in the set-up (Figure 5) (mPa)
Rh	Relative humidity (%)
SAE	Society of Automotive Engineers
t	Thickness of the film fluid on the plate (μm)
T_a	Air Temperature as recorded at the top of the cross-section 2 in the set up (Figure 5) (°C)
T_f	Fluid Temperature as recorded in the fluid film at the bottom of the cross-section 3 (Figure 5) (°C)
UQAC	University of Quebec at Chicoutimi
V	Air Velocity derived from the measurement of the pressure difference P_1 - P_2 using the equation (1) Attachment 1 (m/s)
WC	Water Change (% w/w)

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TEST RESULTS

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Table 1 - Fluid Identification

Company Name	Product	Color	Manuf. Location	Manuf. Date	AMIL Label	Recep. Date
ARCTON LTD.	Arctica DG RTU lot # 28 Fluid as received	Orange	Tatarstan, Russia	April 2013	J162	13-06-10
AMIL	Reference Fluid* lot # 20130703 75/25	Colorless	Saguenay, Quebec (Canada)	13-07-03	M117	13-07-03

Table 2 - Apparent Surface Tension, pH and Refractive Index

DEICING FLUID ARCTON LTD.
Arctica DG RTU, lot # 28

	Apparent Surface Tension (± 0.5)		pH (± 0.1)		Refractive Index (± 0.0002)	
Fluid	T (°C)	dynes/cm	T (°C)	Value	T (°C)	Value
J162	22	36.8	22	9.4	20	1.4121
M117	not measured	not measured	not measured	not measured	20	1.4087

* For the reference fluid formulation, refer to AS5900B paragraph 2.1.4 for the low speed ramp tests.

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Table 3 - Brookfield Viscosity (mPa·s)

DEICING FLUID ARCTON LTD.
Arctica DG RTU, lot # 28

Fluid	Temp (°C)	0.3 RPM			6 RPM			30 RPM		
		Viscosity	Accuracy	Spindle #	Viscosity	Accuracy	Spindle #	Viscosity	Accuracy	Spindle #
J162	20	< 20	200	1	10	10	1	10.6	2	1
	0	40	200	1	29	10	1	29.0	2	1
	-10	60	200	1	56	10	1	56.2	2	1
	-20	120	200	1	124	10	1	124.0	2	1
	-30	300	1000	2	285	50	2	283	10	2

Fluid	Temp (°C)	0.3 RPM			6 RPM			30 RPM		
		Viscosity	Accuracy	Spindle #	Viscosity	Accuracy	Spindle #	Viscosity	Accuracy	Spindle #
M117	20	< 20	200	1	14	10	1	13.8	2	1
	0	40	200	1	48	10	1	48.0	2	1
	-10	100	200	1	97	10	1	97.0	2	1
	-20	300	1000	2	310	50	2	310	10	2
	-30	800	1000	2	785	50	2	784	10	2

For additional viscosity details, see Table 6 .

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Table 4 - Aerodynamic Performance Test Data: Fluid as received

DEICING FLUID ARCTON LTD.
Arctica DG RTU, lot # 28

LOW SPEED RAMP

TEST CODE	T_a °C	T_f °C	Rh %	t_o[1] µm	t_{end}[2] µm	FE[3] %	WC[4] %	V[5] m/s	δ* mm
J162A228	-0.5	-0.3	97.0	2000	127	93.6	2.38*	36.3	5.60
J162A229	-0.8	-0.6	96.3	1933	170	91.2	2.01*	36.3	6.04
J162A230	-0.7	-0.6	96.8	1933	170	91.2	2.51*	35.9	5.82
J162E243	-21.1	-20.3	63.9	1800	279	84.5	0.13	37.0	8.36
J162E244	-21.7	-20.4	62.8	1800	338	81.2	0.13	36.6	7.98
J162E245	-22.0	-20.8	62.6	1800	338	81.2	-0.25	36.5	8.36
J162G252	-31.0	**-29.1**	54.1	1800	424	76.4	-0.13	36.0	**10.27**
J162G251	-31.3	**-29.2**	52.7	1800	424	76.4	-0.25	36.2	**10.22**
J162G250	-31.2	**-29.3**	53.2	1800	457	74.6	-0.38	36.3	**9.97**

*caution : value outside the ±2% range

Acceptance Criteria :

D_{-20} = 10.53 mm

(1) Thickness of the fluid measured at the beginning of the test.
(2) Thickness of the fluid measured at the end of the test.
(3) Fluid Elimination.
(4) Water Change.
(5) Air velocity 30 seconds after the beginning of the test.

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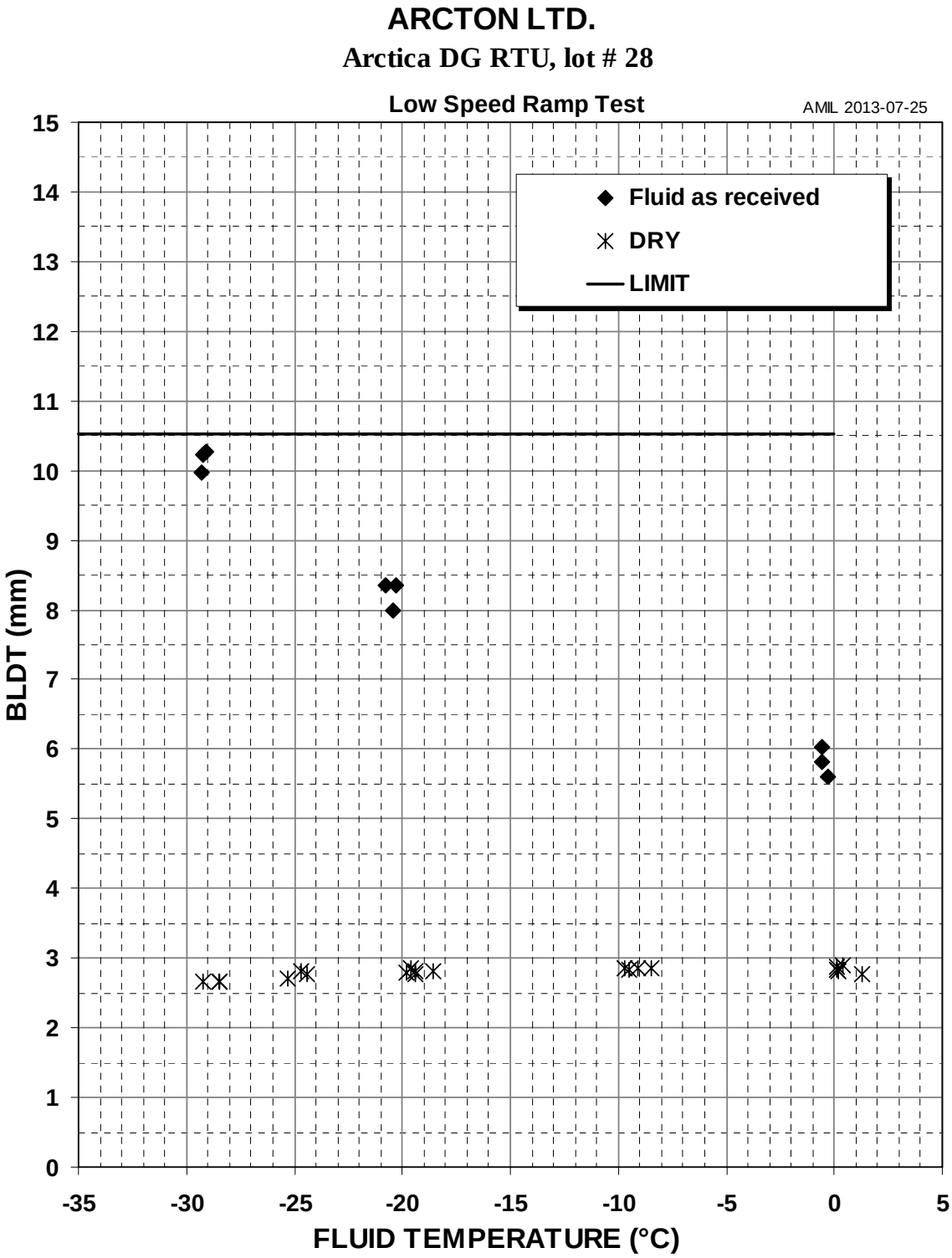

Figure 1 - Aerodynamic Test Results

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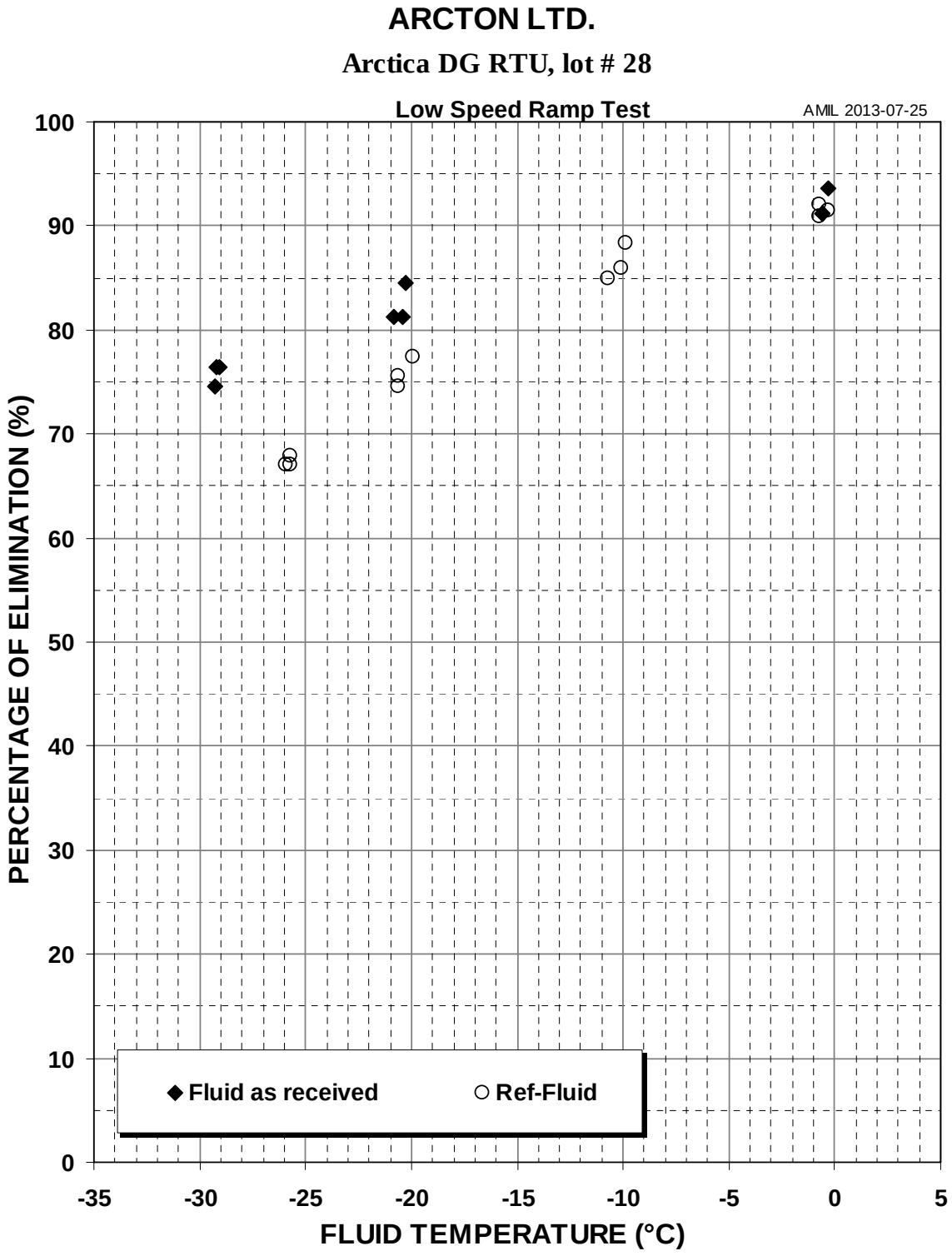

Figure 2 - Fluid Elimination

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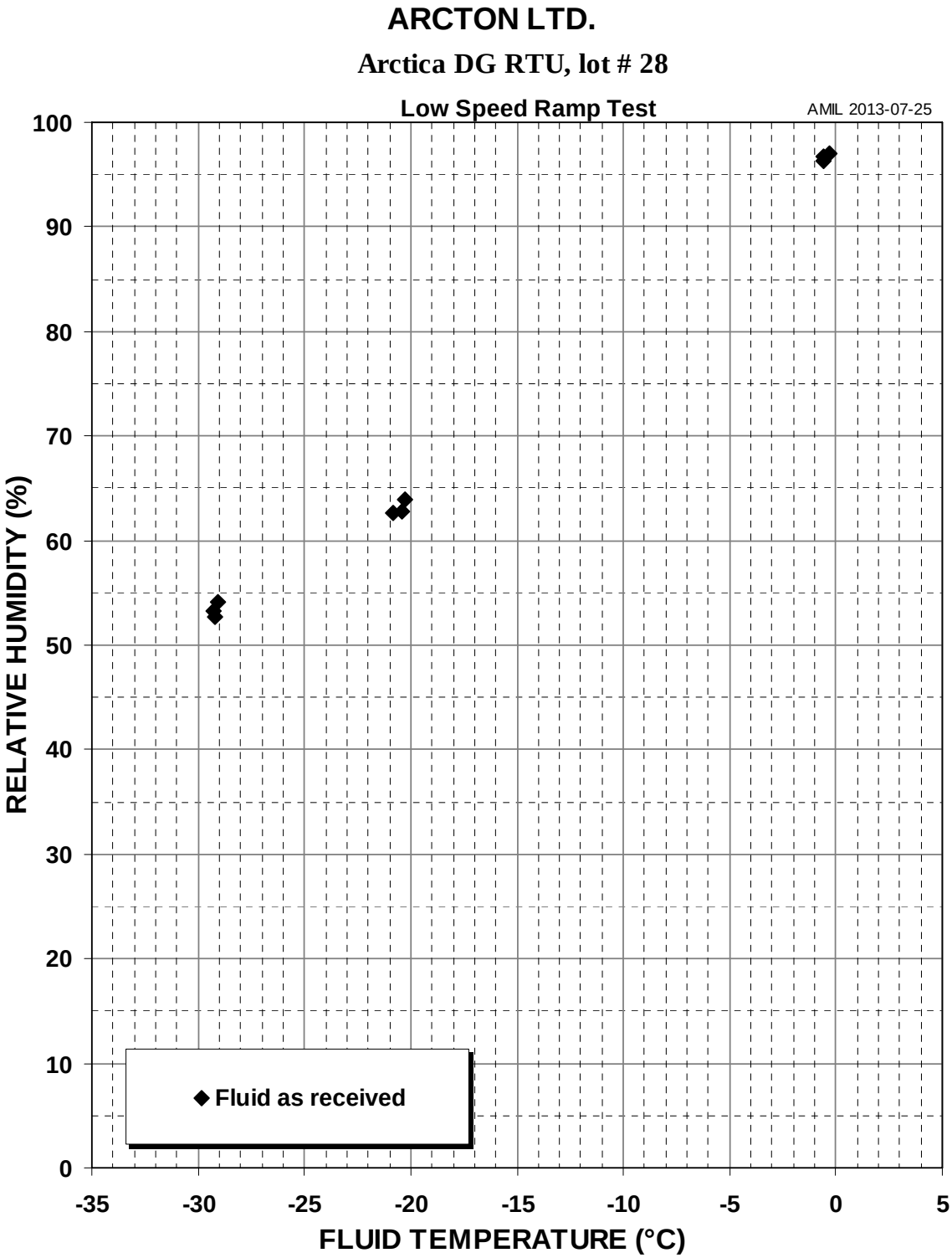

Figure 3 - Relative Humidity

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Table 5 - Refractive Index Data and Water Change: Fluid as received

DEICING FLUID ARCTON LTD.
Arctica DG RTU, lot # 28

TEST CODE	RI Initial	RI Final	ΔRI	WC % W/W	Rh %
J162A228	1.4120	1.4101	-0.0019	2.38*	97.0
J162A229	1.4120	1.4104	-0.0016	2.01*	96.3
J162A230	1.4123	1.4103	-0.0020	2.51*	96.8
J162E243	1.4122	1.4121	-0.0001	0.13	63.9
J162E244	1.4122	1.4121	-0.0001	0.13	62.8
J162E245	1.4120	1.4122	0.0002	-0.25	62.6
J162G252	1.4122	1.4123	0.0001	-0.13	54.1
J162G251	1.4121	1.4123	0.0002	-0.25	52.7
J162G250	1.4120	1.4123	0.0003	-0.38	53.2

*caution : value outside the ±2% range

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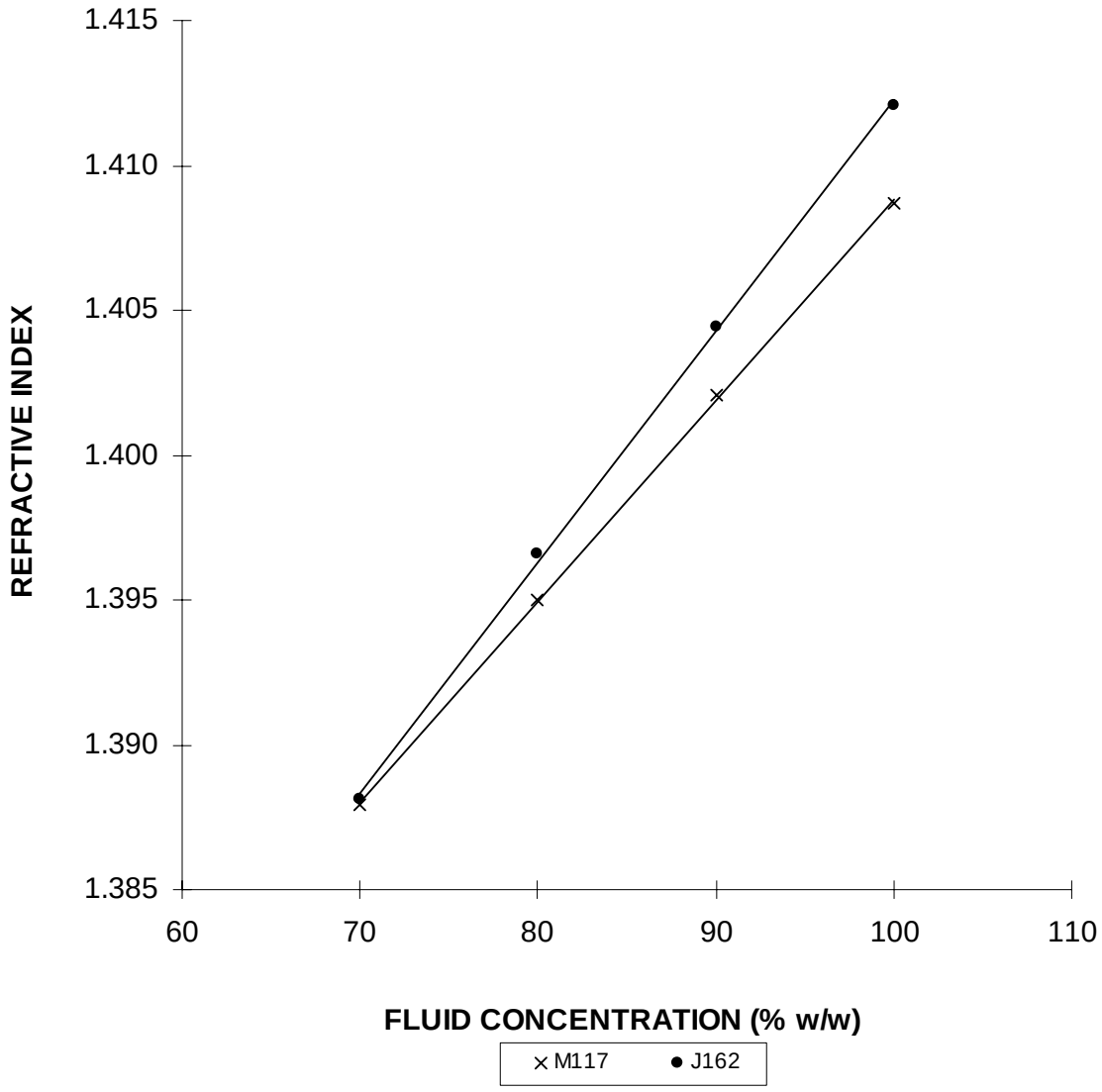

M117: RI = 0.000695 % w/w + 1.339350
J162 : RI = 0.000798 % w/w + 1.332470

BASIS : 100 % w/w corresponds to NEAT fluid

Figure 4 - Refractive Index versus Water Content

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TEST DESCRIPTION

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1. INTRODUCTION

This report details the performance of fluid samples, identified in Table 1, when subjected to the Flat Plate Elimination Test, denoted FPET hereafter. The FPET procedure follows the SAE Aerospace Material Specifications, AMS 1424K [2] and AS5900B [3] for deicing fluid on the low-speed ramp. The tests were carried out in the Luan Phan refrigerated wind tunnel of the "Anti-icing Materials International Laboratory" (AMIL) at the "Université du Québec à Chicoutimi" (UQAC) [4]. UQAC facility is operated independently from fluid manufacturers and meets the requirements of the aerodynamic acceptance testing standards. It was found qualified on September 11, 1997 (reconfirmed September 13th, 2012) by the Performance Review institute according to PRI document AC3001, “audit criteria for compliance to SAE AMS1424 and AMS1428”.

2. TEST DESCRIPTION

2.1 Flat Plate Elimination Test

This test is designed to measure the Boundary Layer Displacement Thickness, BLDT, which is related to lift loss [5]. The flat plate set-up consists of a duct inserted in the test section of AMIL cold wind tunnel. In this tunnel, the airflow and the fluid can be maintained at a constant temperature, between 5°C ± 1°C and –45°C ± 2°C. A set-up sketch is given in Figure 5.

The FPET procedure consists in submitting a 2 mm thick layer of deicing product covering the duct floor to an accelerating air flow of 2.1 m/s², simulating a low take-off rotation speed commuter type aircraft (Figure 6). The BLDT on the flat plate is measured at pressure tap location # 3 (Figure 5), twenty seconds after the beginning of the simulated take-off. A detailed description of this test is presented in AS5900B [3].

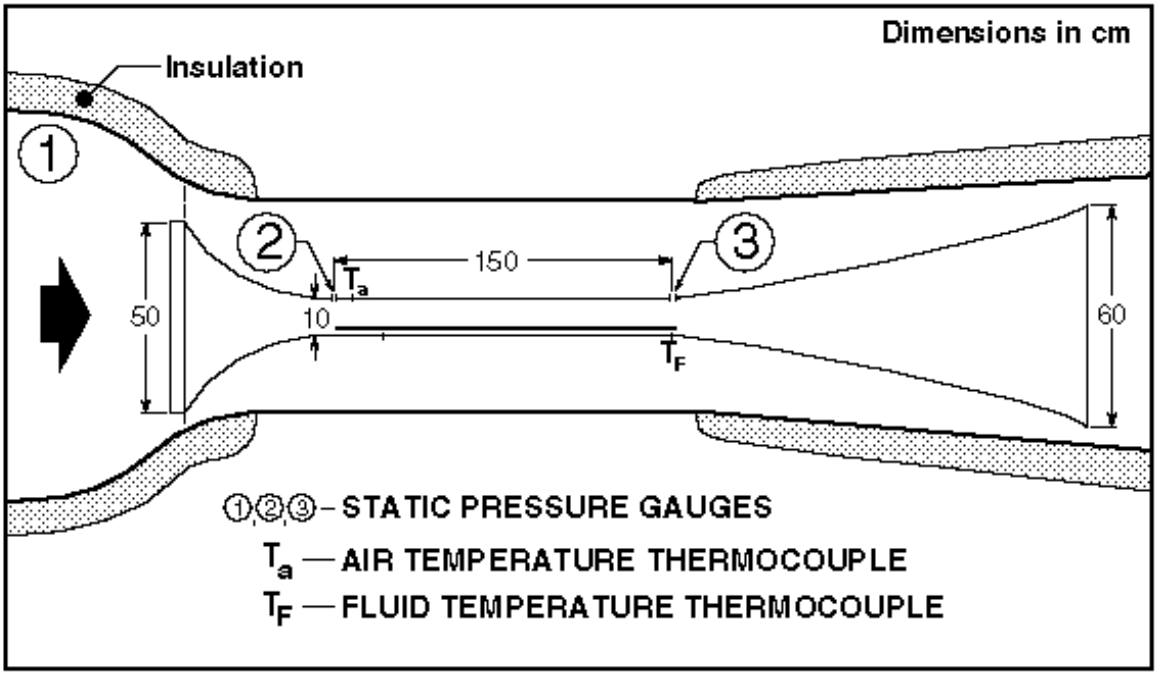

Figure 5 - FPET Set-up

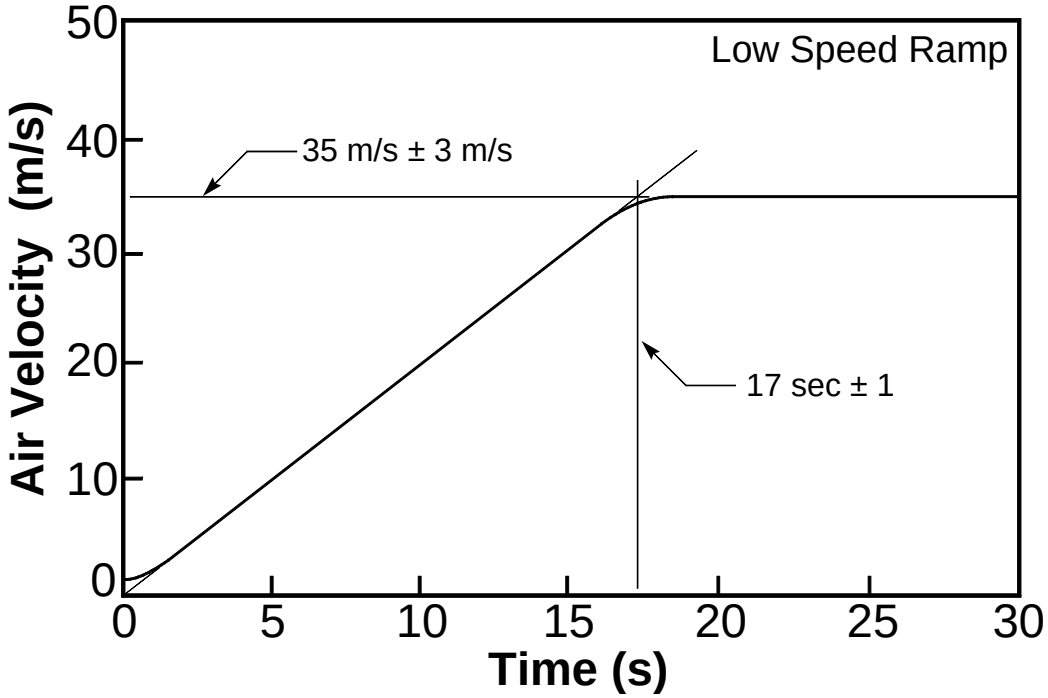

Figure 6 - Take-off Ground Acceleration Simulation

2.2 Measurements

In a FPET, the fluid performance is evaluated from BLDT measurements. The BLDT value used for the fluid evaluation is the average of the BLDT measured between the 19th and the 21st seconds after the beginning of the test. The starting time (t = 0) is evaluated by extrapolating the straight line of the acceleration ramp to the point where V = 0 m/s.

In addition, the following parameters are measured:

1. **apparent surface tension at room temperature (dynes/cm)**

   Apparent Surface Tension measured with a DuNouy precision tensiometer, CSC Scientific Company Inc., model No. 70535, using a 5.992 cm pulling ring.

2. **pH at room temperature**

   pH values measured with a Fisher Accumet pHmeter, Fisher Scientific Company, model 925, using a pHRESH, Flow-On-Demand Epoxy Body Combination pH Electrode, Beckman, model 511110.

3. **refractive index which is used to determine the water change (%)**

   Refractive Index measured with a REICHERT AR7 SERIES Refractometer, Reichert, Inc., model AR70.

4. **viscosity at room and test temperatures (mPa . s)**

5. **fluid film thickness (μm) at the beginning and at the end of the FPET to compute fluid elimination (%)**

Table 6 - Viscosity Measurement Details

Fluid Type	Measurement Device	Spindle #	Container Description	Sample Volume (ml)	Rotation Duration (min)		
					0.3 RPM	6 RPM	30 RPM
I	LV	1	600 ml Beaker	600	5	5	5
		2		600	5	5	5
		3		550	5	5	5
		4		550	5	5	5
II III IV	SSA	31	13 R (P)	10	30	5	5
		34	13 R (P)	10	30	5	5
		16	8 R (P)	4.2	30	5	5
		18	13 R (P)	8	30	5	5

The viscometers are calibrated yearly by the accredited laboratory CAN-AM Instruments, Ltd. The NIST traceable calibration certificate is available upon request.

2.3 Calibration and Acceptance Criteria

The calibration is obtained from dry tests, performed without fluid, and Reference Fluid tests (as described in AS5900B paragraph 2.1.4), for which BLDT results are well documented. The BLDT values obtained from a dry test should be 2.8 mm ± 0.4 mm. For dry and calibration tests, the BLDT values are recorded at four temperatures: 0°C, -10°C, -20°C and -25°C. Reference Fluid BLDT values and dry BLDT values are used to calculate the acceptance criteria required for certification. A candidate fluid is acceptable at a test temperature if none of the independent BLDT measurements is greater than the acceptance criteria. This test temperature is the average of the three lowest temperatures of the acceptable data points.

3. TEST RESULTS

3.1 Test Presentation

The fluid identification is presented in Table 1 and the fluid physical properties in the following tables : Apparent surface tension, pH and refractive index values are given in Table 2 and Brookfield viscosity values in Table 3. FPET results are presented in Table 4. Calibration data from dry tests and tests with the Reference Fluid are reproduced in Table 7 and Table 8 respectively. Finally Table 5 presents

refractive index data and water change calculations. Figure 4 shows the refractive index as a function of water change. Fluid elimination and relative humidity are presented as a function of test temperature in Figure 2 and Figure 3 respectively.

3.2 Calculation of the Calibration and Acceptance Criteria

Calibration tests, as defined in section 2.3, consist of dry tests and tests with the Reference Fluid. The dry test results are presented in Table 7. According to specifications [2], the AMIL system is considered adequately calibrated, since the dry test BLDT value(δ^*) varies within the standard range of 2.8 mm ± 0.4 mm. The Reference Fluid results are presented in Table 8. These results are also in agreement with known values. As mentioned in section 2.3, dry and Reference Fluid BLDT values are used to compute the criteria of acceptance, presented below and in Figure 7. The acceptance envelope is a constant straight line with a BLDT equal to the value D20. The D20 is calculated accordingly to the AS5900B [3] for the low take-off rotation speed ramp:

Calculation of acceptance level at -20°C:

$$D20 = (1.12 \times \delta^*_{ref}) - 0.19\left(\delta^*_{ref} - \delta^*_{dry}\right)_{-20}$$

$$D20 = (1.12 \times 10.74) - 0.19 \times (10.74 - 2.83) = 10.53 \text{ mm}$$

Table 7 - Dry Test Data

TEST CODE	T_a (°C)	T_f (°C)	Rh (%)	V[(1)] (m/s)	δ^*_{dry} (mm)
DRY_A397	-1.6	1.3	86.9	35.4	2.78
DRY_A399	-0.6	0.4	95.6	34.2	2.89
DRY_A401	-0.4	0.2	97.9	35.0	2.82
DRY_A398	-0.5	0.1	93.9	35.2	2.87
DRY_A400	-0.7	0.1	96.0	35.0	2.83
DRY_C402	-11.5	-8.5	82.5	35.4	2.85
DRY_C403	-10.8	-9.1	80.6	35.1	2.86
DRY_C404	-10.6	-9.5	80.9	35.4	2.83
DRY_C405	-11.0	-9.7	79.4	35.4	2.85
DRY_E409	-21.3	-18.6	60.4	35.8	2.81
DRY_E411	-21.8	-19.4	63.0	35.6	2.77
DRY_E412	-21.7	-19.4	65.1	35.7	2.81
DRY_E410	-22.0	-19.6	60.1	35.5	2.85
DRY_E413	-21.8	-19.8	66.0	35.2	2.79
DRY_F406	-25.9	-24.4	66.9	34.2	2.76
DRY_F407	-27.6	-24.7	65.0	35.6	2.82
DRY_F408	-26.2	-25.3	63.4	35.6	2.70
DRY_G420	-31.7	-28.5	57.8	35.6	2.66
DRY_G421	-31.6	-28.5	55.9	35.4	2.67
DRY_G419	-31.4	-29.2	53.2	34.9	2.66

(1) Air velocity 30 seconds after the beginning of the test

Table 8 - Aerodynamic Performance Test Data : Reference Fluid

TEST CODE	T_a °C	T_f °C	Rh %	t_o[1] µm	t_{end}[2] µm	FE[3] %	WC[4] %	V[5] m/s	δ* mm
M117A283	-1.7	-0.3	88.7	1800	152	91.5	1.73	36.1	6.56
M117A284	-1.2	-0.7	91.2	1933	152	92.1	2.73*	35.8	6.76
M117A285	-0.7	-0.7	96.1	1867	170	90.9	2.73*	36.6	6.54
M117C286	-11.3	-9.9	80.9	1800	211	88.3	0.29	36.1	8.22
M117C287	-10.7	-10.1	80.8	1800	254	85.9	1.01	36.0	8.27
M117C288	-10.6	-10.7	79.4	1800	272	84.9	0.58	35.6	8.61
M117E293	-21.6	-19.9	57.0	1800	406	77.4	0.14	34.6	11.20
M117E294	-21.9	-20.6	56.1	1800	439	75.6	-0.29	34.8	11.44
M117E296	-21.5	-20.6	62.2	1800	457	74.6	-0.58	34.4	11.18
M117F290	-27.1	-25.7	61.5	1800	577	67.9	-1.15	34.6	11.59
M117F291	-26.4	-25.7	62.5	1800	592	67.1	-1.58	34.7	11.89
M117F292	-27.4	-25.9	60.0	1800	592	67.1	-1.29	34.6	11.67

*caution : value outside the ±2% range

(1) Thickness of the fluid measured at the beginning of the test.
(2) Thickness of the fluid measured at the end of the test.
(3) Fluid Elimination.
(4) Water Change.
(5) Air velocity 30 seconds after the beginning of the test.

Table 9 - Refractive Index Data and Water Change: Reference Fluid

TEST CODE	RI Initial	RI Final	ΔRI	WC % W/W	Rh %
M117A283	1.4088	1.4076	-0.0012	1.73	88.7
M117A284	1.4092	1.4073	-0.0019	2.73*	91.2
M117A285	1.4092	1.4073	-0.0019	2.73*	96.1
M117C286	1.4087	1.4085	-0.0002	0.29	80.9
M117C287	1.4090	1.4083	-0.0007	1.01	80.8
M117C288	1.4085	1.4081	-0.0004	0.58	79.4
M117E293	1.4090	1.4089	-0.0001	0.14	57.0
M117E284	1.4087	1.4089	0.0002	-0.29	56.1
M117E296	1.4085	1.4089	0.0004	-0.58	62.2
M117F290	1.4082	1.4090	0.0008	-1.15	61.5
M117F291	1.4080	1.4091	0.0011	-1.58	62.5
M117F292	1.4081	1.4090	0.0009	-1.29	60.0

*caution : value outside the ±2% range

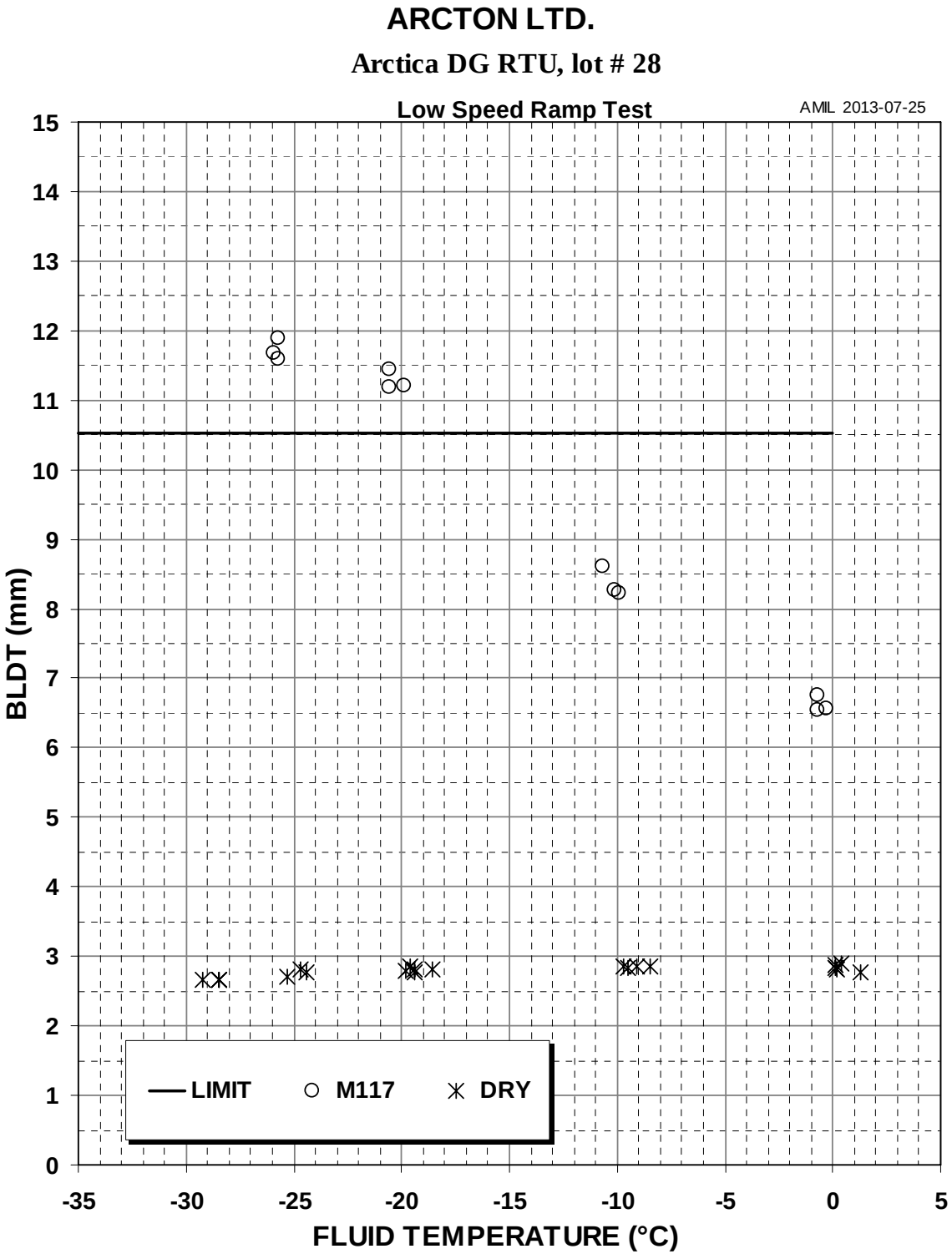

Figure 7 - Acceptance Criteria

3.3 Flat Plate Elimination Tests

BLDT, fluid elimination and water change values are listed in Table 4. In Figure 1, BLDT values are presented in comparison with the acceptance criteria. This figure shows that the candidate fluid **ARCTON LTD. Arctica DG RTU lot # 28** is acceptable with the low speed ramp above -29°C in the case of the Fluid as received.

4. REFERENCES

1. *American Society for Testing and Materials "Standard Specification for Reagent Water", ASTM D 1193-06, 2011.*
2. *SAE International Aerospace Material Specification, "Deicing/Anti-icing Fluid, Aircraft, SAE Type I", AMS 1424, revision K, March 2012.*
3. *SAE International Aerospace Standard, "Standard Test Method for Aerodynamic Acceptance of SAE AMS 1424 and SAE AMS 1428 Aircraft Deicing/Anti-icing Fluids", AS5900, revision B, July 1, 2007.*
4. *Laforte, J.-L., P. Louchez, G. Bouchard, and M. Farzaneh, "A Facility to Evaluate Performance of Aircraft Ground De/Anti-Icing Fluids Subjected to Freezing Rain". Cold Regions Science and Technology, 1990.* ***18****: p. 161-171.*
5. *Laforte, J.-L., P. Louchez, and G. Bouchard, "Experimental Evaluation of Flat Plate Boundary Layer Growth over an Anti-Icing Fluid Film". Canadian Aeronautics and Space Journal, 1993.* ***39****(2): p. 96-104.*

ATTACHMENT 1

Measurement Principle*

The time varying velocity at the inlet of the test section will be derived from the measurement of the pressure difference $P_1 - P_2$, recorded as a function of time during all test runs. For such purpose, the following relation, obtained from application of Bernouilli and continuity equations according to usual wind tunnel practice, will be used:

$$V = \sqrt{\frac{2(P_1 - P_2)}{\rho} \Big/ \left(1 - \left[\frac{S_2}{S_1}\right]^2\right)} \qquad (1)$$

where ρ is the mass per unit volume of the test gas at the test conditions, and S1/S2 is the area ratio of the wind tunnel contraction.

The boundary layer displacement thickness (BLDT) on the bottom flat plate, at the location of the pressure tap P_3 (cross-section 3), will be evaluated from the measurement of the two pressure differences $P_1 - P_2$ and $P_1 - P_3$ recorded as functions of time during all the test runs.

Indeed, an increase in BLDT from inlet to outlet of the test section causes a restriction of the net cross-sectional area, thus producing an increase in the air velocity along the test section, which in turn causes a decrease of static pressure from cross-section 2 to 3.

* This text reproduces Appendix B of DOCUMENT NO D6-55573: "Aerodynamic Acceptance Test for Aircraft Ground Deicing/Anti-icing Fluids". BOEING Commercial Airplane Company.

More precisely, the average BLDT δ^*_{ave} over the test section perimeter, at cross-section 3, will be evaluated using following relation, obtained from application of mass conservation and Bernouilli equations:

$$\delta^*_{ave} = \frac{1}{c}\left[S_3 - S_2 \sqrt{\frac{P_1 - P_2}{(P_1 - P_2) + (P_2 - P_3)}} \right] \qquad (2)$$

where c is the test section perimeter at cross-section 3, and S_2 and S_3 are the areas of cross-sections 2 and 3 respectively.

When no fluid is present on the bottom flat plate, all four test section walls are in the same dry state, and the previous expression (2) yields the value of the BLDT on a dry wall:

$\delta^*_{dry} = \delta^*_{ave}$ (with no fluid)

On the other hand, when the bottom plate of the test section is covered with a layer of de/anti-icing fluid, and the top and sides are not, the BLDT is not constant over the perimeter of the cross-section 3. Indeed, it assumes a value δ^* on the bottom plate and another value on the sides and top wall. Expressing the previously determined δ^*_{ave} as a perimeter-weighted average of δ^*_{dry} and δ^*, the following relation can be obtained:

$$\delta^* = \frac{c}{b}\left[\delta^*_{ave} - \frac{c-b}{c} \delta^*_{dry} \right] \qquad (3)$$

where b is the width of the bottom flat plate. This relation will be used to derive the BLDT over a wet surface, δ*, from the measurement of δ^*_{ave} carried out as explained with fluid on the bottom test section wall, provided an expression for

δ^*_{dry} has been previously determined by a number of "dry" runs, carried out without any fluid in the test section. More precisely, these dry runs, to be made during the setting up and calibration of the facility, will yield the value of δ^*_{dry} and they will be used to determine the constant in the following empirical formula:

$$\delta^*_{dry} = const \times \left[\frac{V}{n}\right]^{-1/5} \qquad (4)$$

where V is the tunnel air velocity at cross-section 2 and n is the cinematic viscosity of the test gas at the test conditions. For data reduction of a test with fluid in the test section, this last expression (4) will be used to evaluate, as function of the instantaneous velocity determined by (1), the value of δ^*_{dry} to be used in expression (3).

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ATTACHMENT 2

TEST DATA SHEETS

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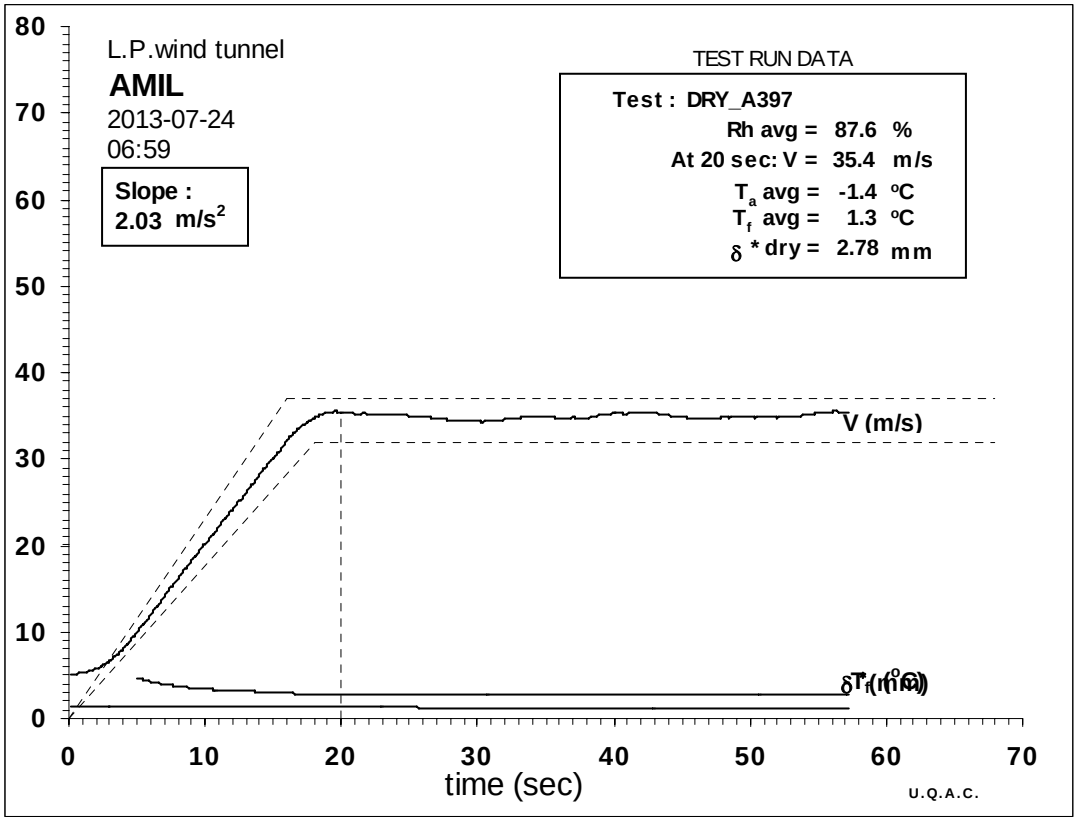
DRY RUNS

DRY_A397



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-1.6	1.3	86.9	3.17	35.1	-0.05	2.64
20	-1.6	1.3	86.8	3.27	35.6	-0.03	2.80
21	-1.6	1.3	86.9	3.23	35.4	-0.01	2.88

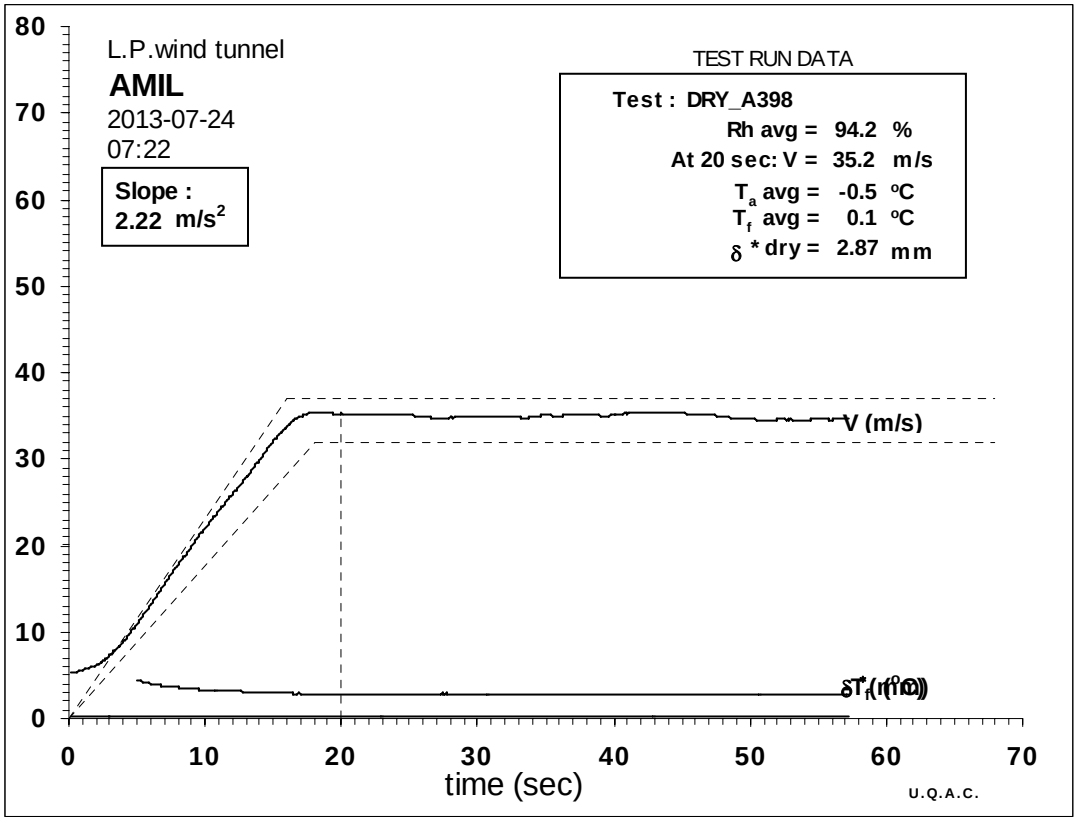
Averages between 19 and 21 seconds:

20	-1.6	**1.3**	86.9	3.23	35.4	-0.03	**2.78**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_A398



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.5	0.1	93.8	3.18	35.2	-0.04	2.74
20	-0.6	0.1	93.9	3.17	35.1	0.00	2.92
21	-0.5	0.1	93.9	3.19	35.3	-0.01	2.89

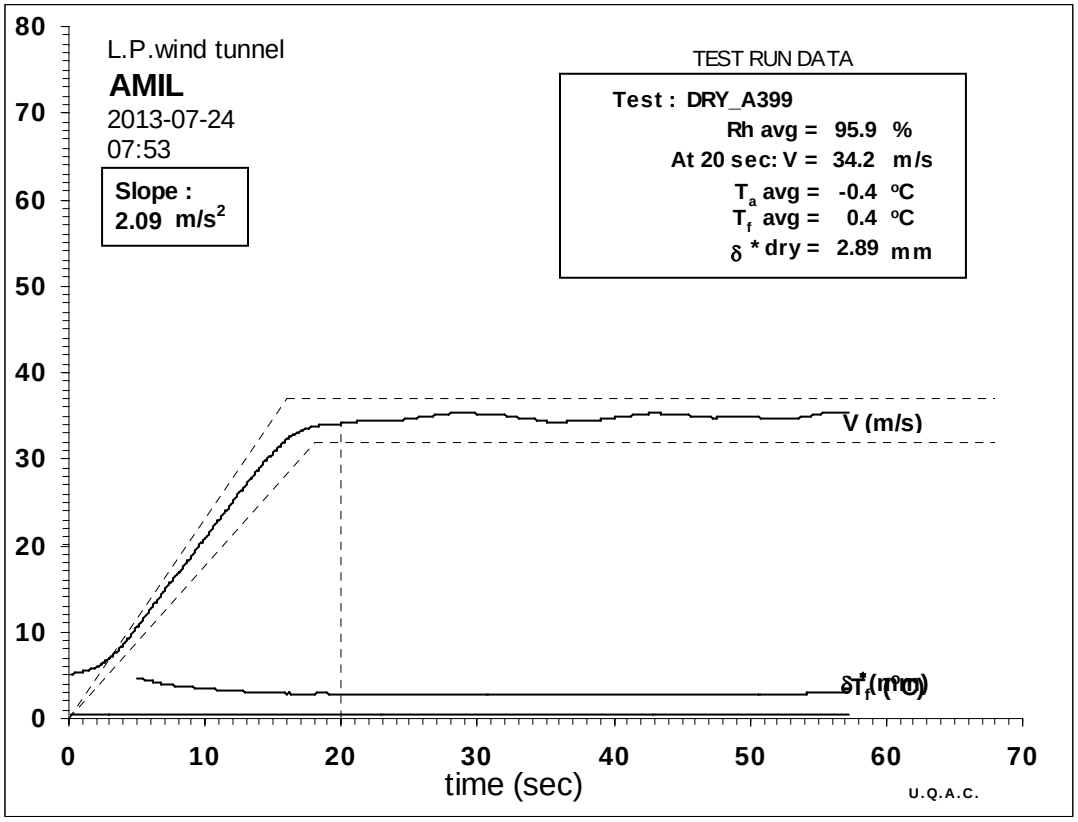
Averages between 19 and 21 seconds:

20	-0.5	**0.1**	93.9	3.18	35.2	-0.01	**2.87**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_A399



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.6	0.4	95.4	2.99	34.1	-0.01	2.89
20	-0.6	0.4	95.7	3.00	34.2	0.00	2.94
21	-0.7	0.4	95.5	3.01	34.2	-0.02	2.81

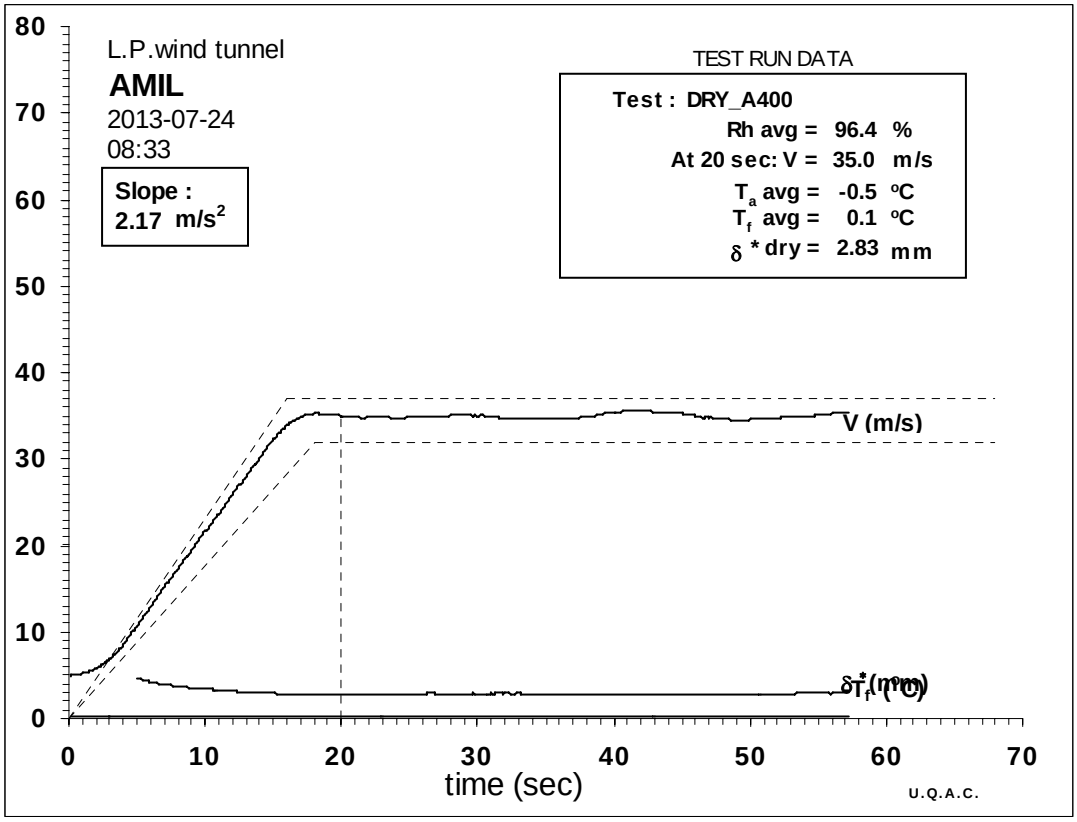
Averages between 19 and 21 seconds:

20	-0.6	**0.4**	95.6	3.00	34.2	-0.01	**2.89**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_A400



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.7	0.1	96.1	3.21	35.4	-0.02	2.84
20	-0.7	0.1	96.0	3.11	34.8	-0.02	2.82
21	-0.7	0.1	96.0	3.14	35.0	-0.02	2.82

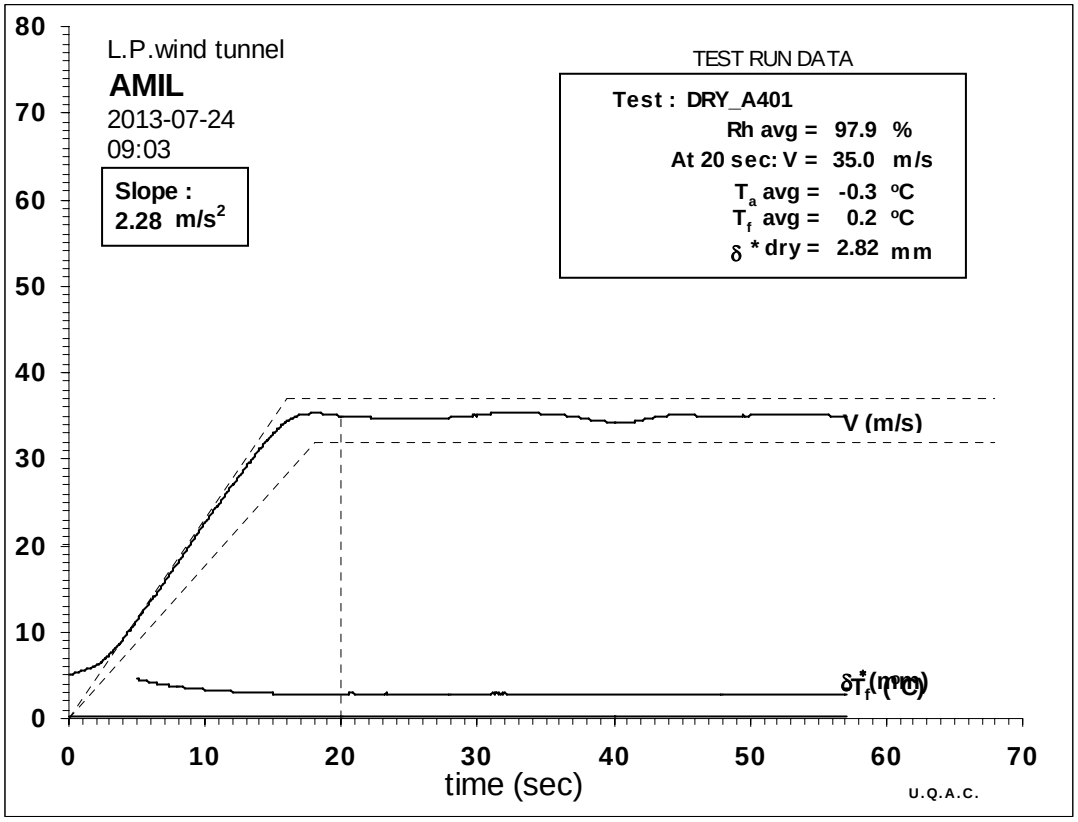
Averages between 19 and 21 seconds:

20	-0.7	**0.1**	96.0	3.14	35.0	-0.02	**2.83**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_A401



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.4	0.2	98.1	3.18	35.2	-0.02	2.85
20	-0.4	0.2	97.7	3.20	35.3	-0.03	2.80
21	-0.4	0.2	98.0	3.03	34.4	-0.02	2.84

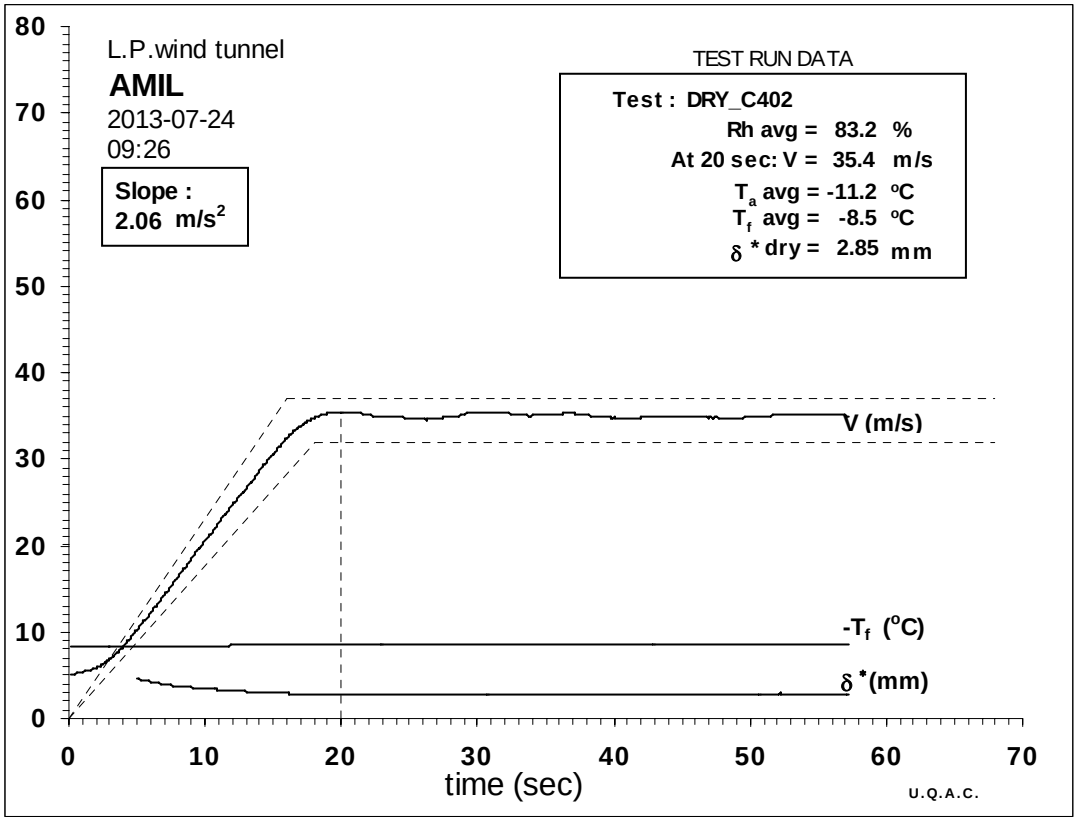
Averages between 19 and 21 seconds:

20	-0.4	**0.2**	97.9	3.15	35.0	-0.02	**2.82**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_C402



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.5	-8.5	82.3	3.32	35.2	0.00	2.97
20	-11.5	-8.5	82.5	3.37	35.5	-0.02	2.84
21	-11.5	-8.5	82.5	3.32	35.2	-0.03	2.75

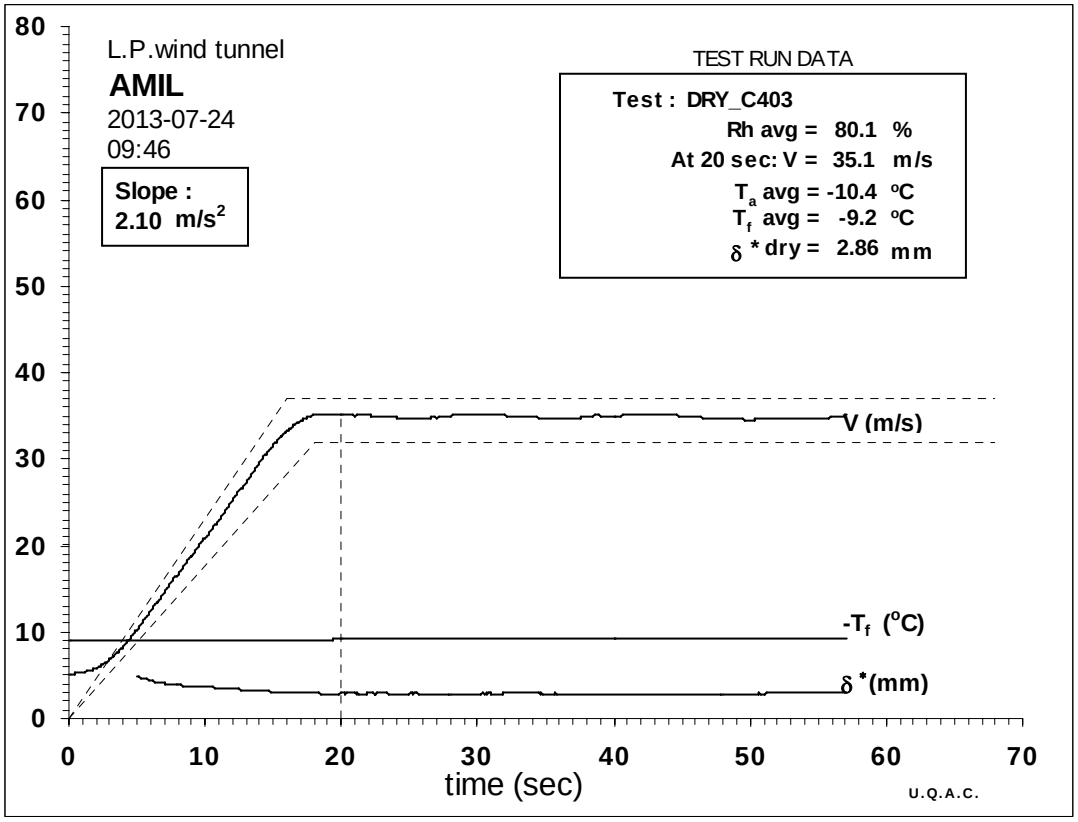
Averages between 19 and 21 seconds:

20	-11.5	**-8.5**	82.5	3.35	35.4	-0.02	**2.85**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_C403



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time	T_a	T_f	Rh	P_1-P_2	V	P_2-P_3	δ^*
Sec	°C	°C	%	"H_2O	m/s	"H_2O	mm
19	-10.8	-9.1	80.7	3.31	35.2	-0.02	2.81
20	-10.8	-9.1	80.6	3.29	35.1	-0.01	2.90
21	-10.9	-9.2	80.5	3.28	35.0	-0.02	2.84

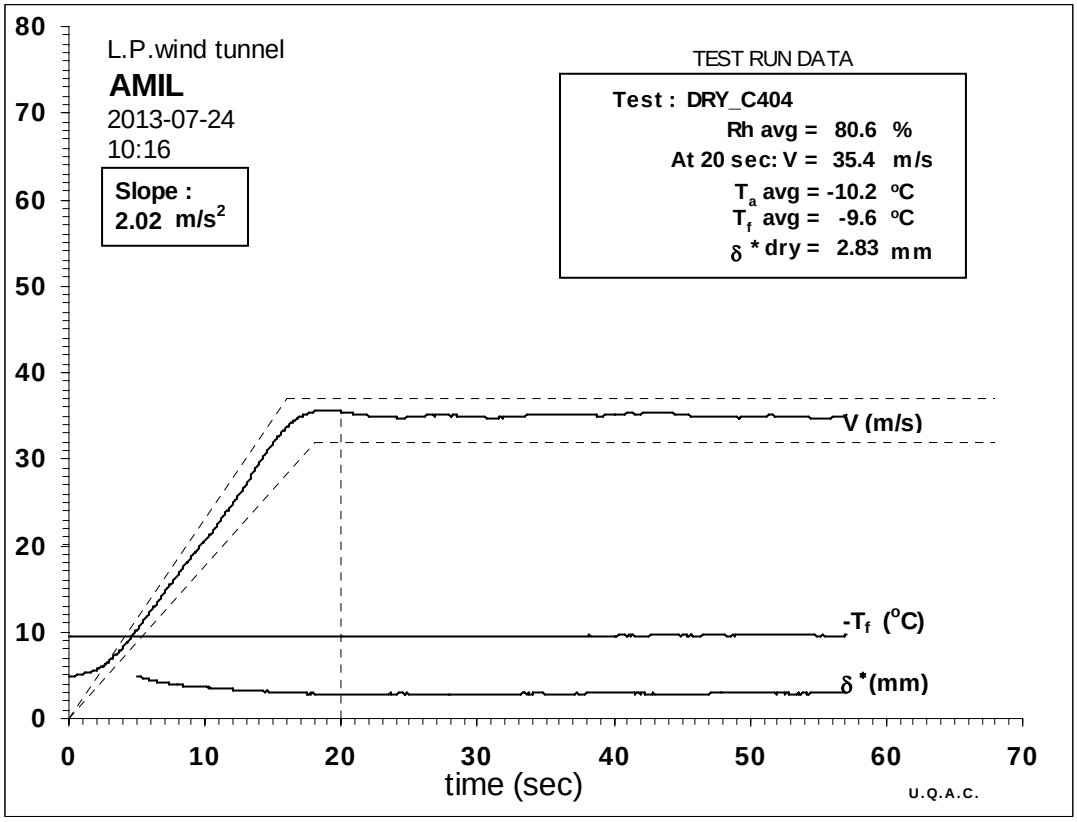
Averages between 19 and 21 seconds:

20	-10.8	**-9.1**	80.6	3.29	35.1	-0.01	**2.86**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_C404



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.6	-9.5	80.8	3.34	35.4	-0.03	2.80
20	-10.6	-9.5	80.9	3.34	35.4	-0.01	2.91
21	-10.6	-9.5	80.9	3.35	35.5	-0.04	2.73

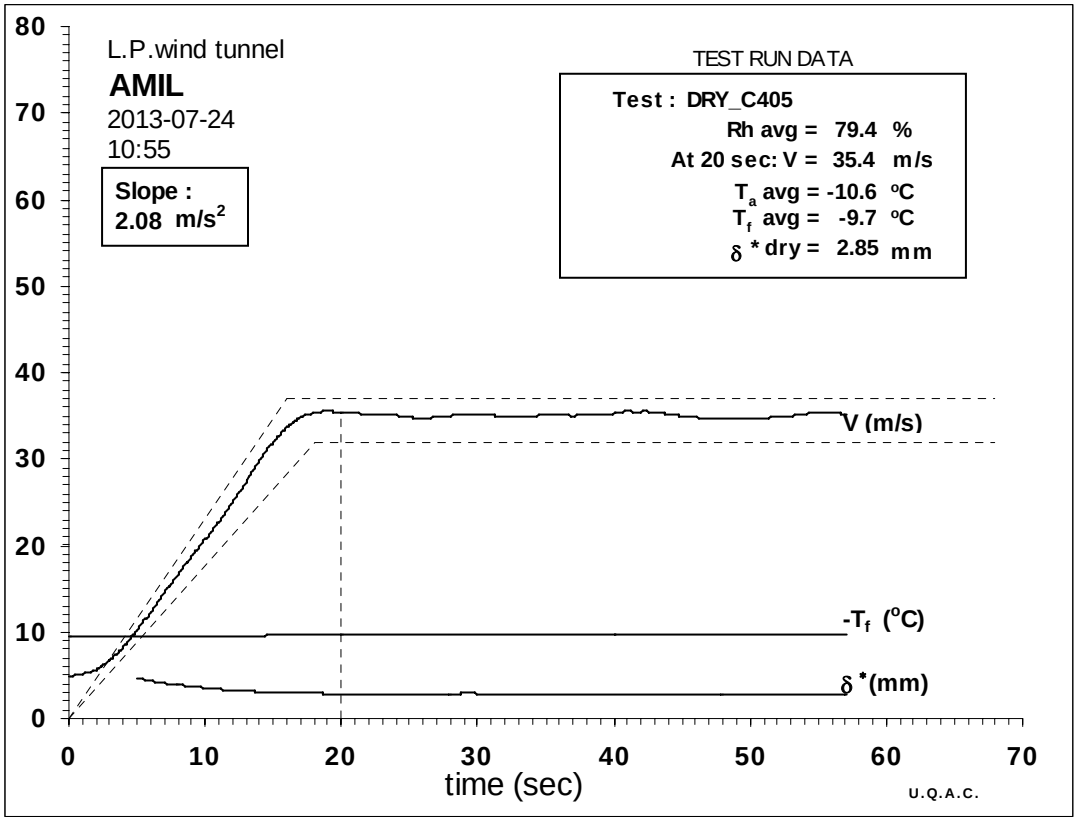
Averages between 19 and 21 seconds:

20	-10.6	**-9.5**	80.9	3.34	35.4	-0.02	**2.83**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_C405



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.0	-9.6	79.7	3.42	35.8	-0.02	2.86
20	-11.0	-9.7	79.3	3.33	35.3	-0.01	2.90
21	-11.0	-9.7	79.2	3.31	35.2	-0.03	2.75

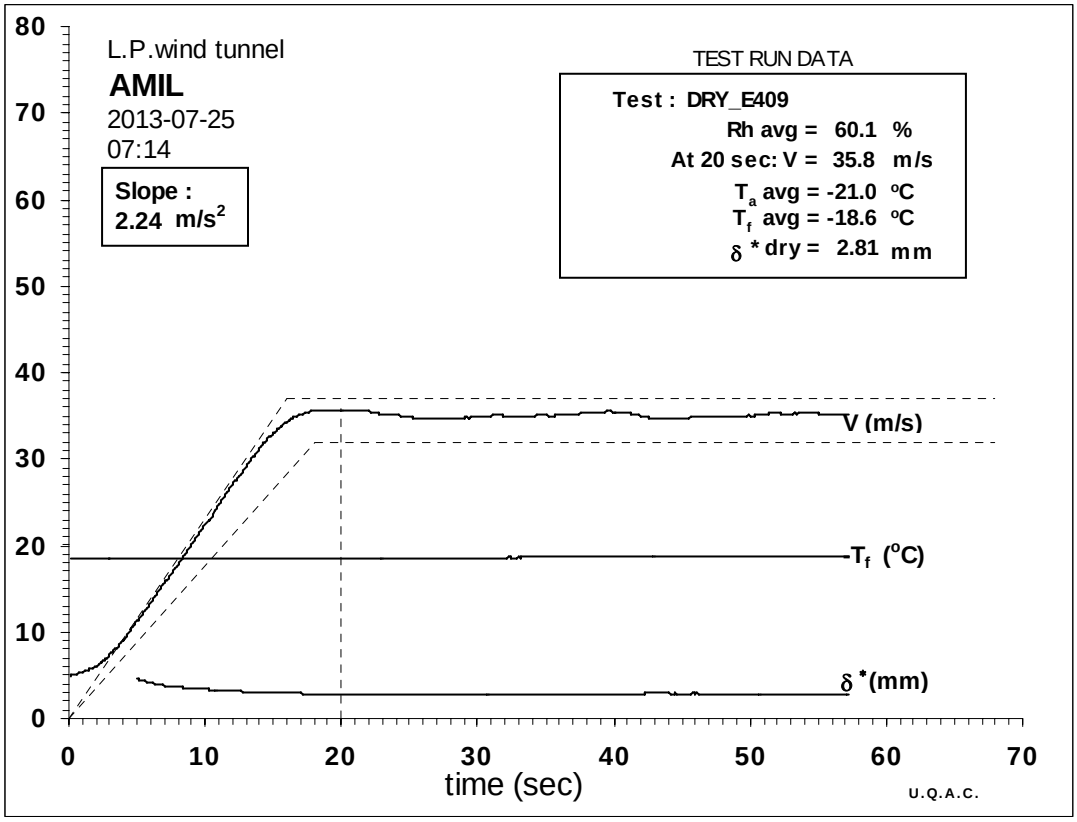
Averages between 19 and 21 seconds:

20	-11.0	**-9.7**	79.4	3.35	35.4	-0.02	**2.85**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_E409



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.3	-18.6	60.4	3.53	35.6	-0.02	2.82
20	-21.3	-18.6	60.3	3.56	35.8	0.00	2.94
21	-21.3	-18.6	60.6	3.59	36.0	-0.07	2.58

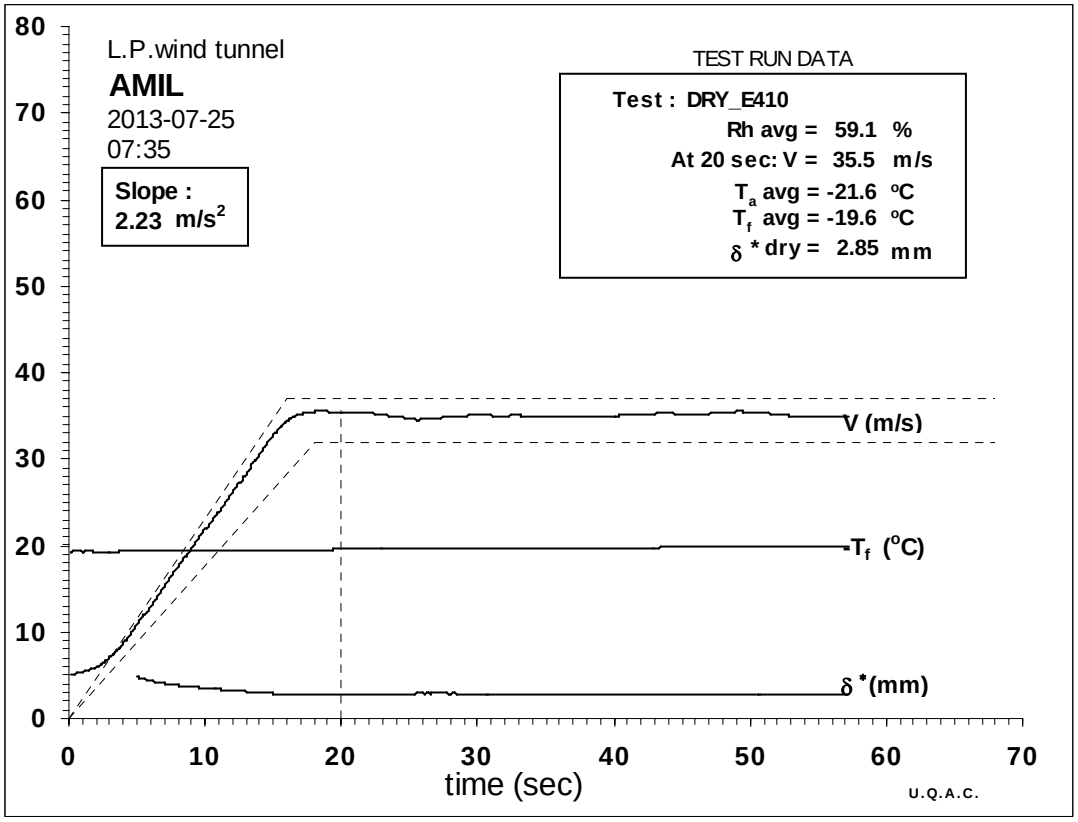
Averages between 19 and 21 seconds:

20	-21.3	**-18.6**	60.4	3.56	35.8	-0.03	**2.81**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_E410



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.9	-19.5	60.1	3.44	35.2	0.00	2.96
20	-22.0	-19.6	60.1	3.53	35.6	-0.02	2.86
21	-22.1	-19.6	60.0	3.51	35.5	-0.04	2.72

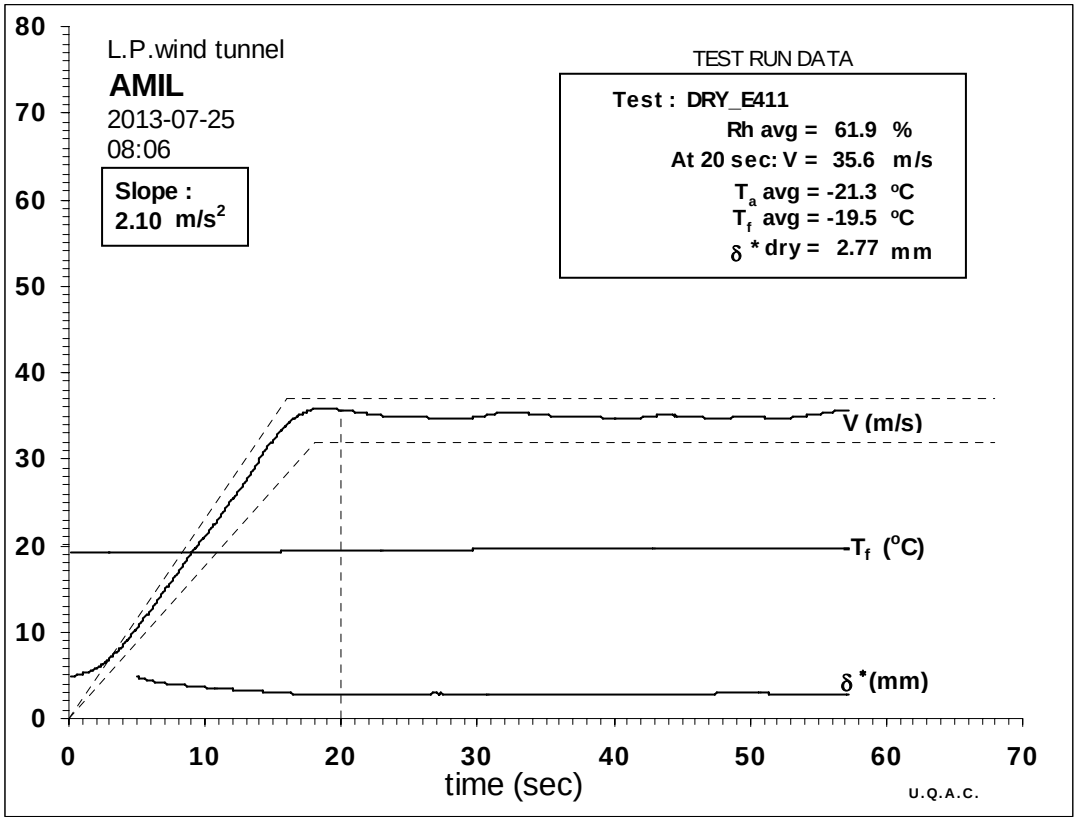
Averages between 19 and 21 seconds:

20	-22.0	**-19.6**	60.1	3.50	35.5	-0.02	**2.85**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_E411



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.8	-19.4	63.6	3.58	35.9	-0.03	2.80
20	-21.9	-19.4	62.9	3.57	35.8	-0.04	2.73
21	-21.9	-19.4	62.7	3.46	35.2	-0.03	2.81

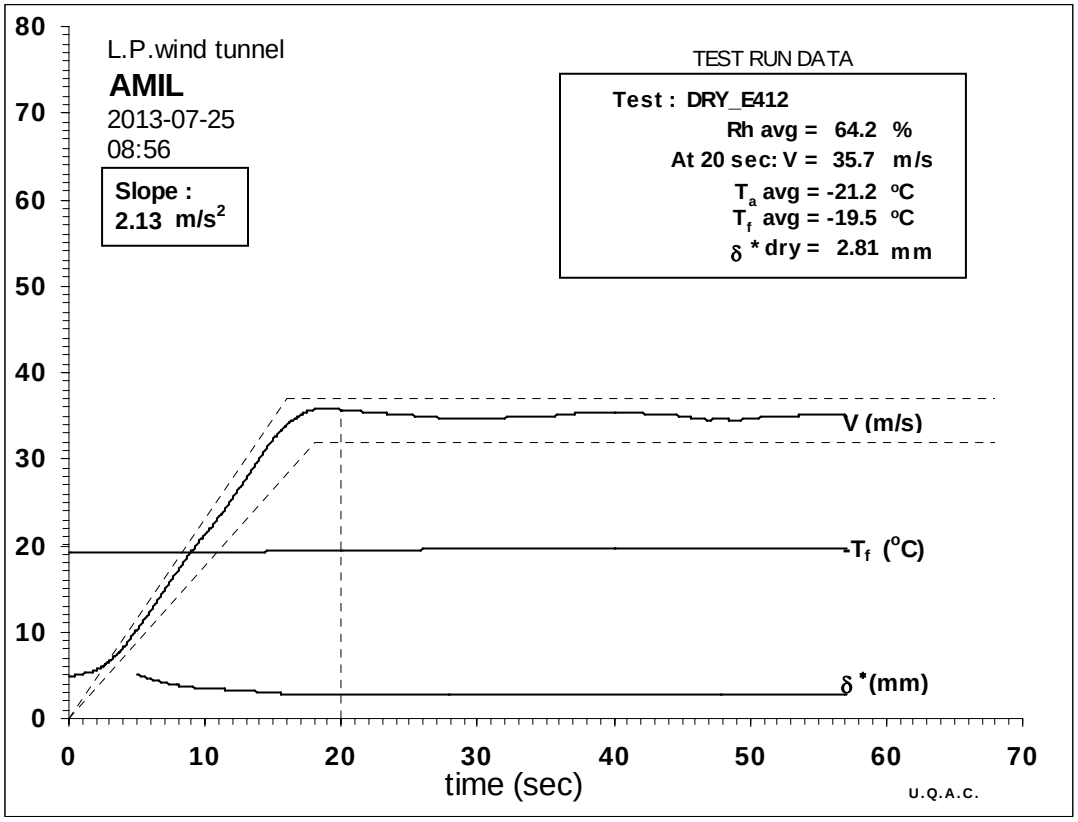
Averages between 19 and 21 seconds:

20	-21.8	**-19.4**	63.0	3.54	35.6	-0.03	**2.77**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_E412



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.6	-19.4	65.3	3.58	35.9	-0.03	2.79
20	-21.7	-19.4	65.2	3.51	35.5	-0.03	2.79
21	-21.8	-19.5	65.0	3.58	35.9	-0.02	2.86

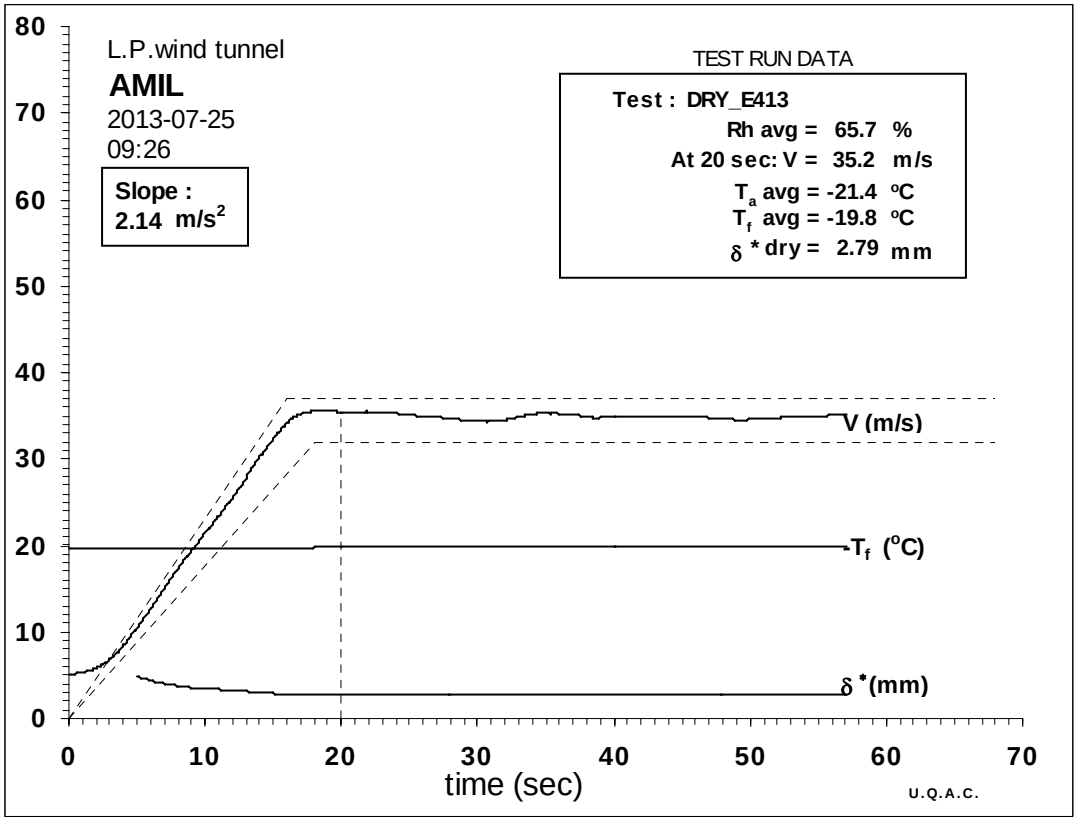
Averages between 19 and 21 seconds:

20	-21.7	**-19.4**	65.1	3.55	35.7	-0.03	**2.81**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_E413



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.7	-19.8	66.2	3.41	35.0	-0.02	2.83
20	-21.8	-19.8	66.0	3.42	35.1	-0.03	2.76
21	-21.8	-19.8	65.9	3.53	35.6	-0.02	2.82

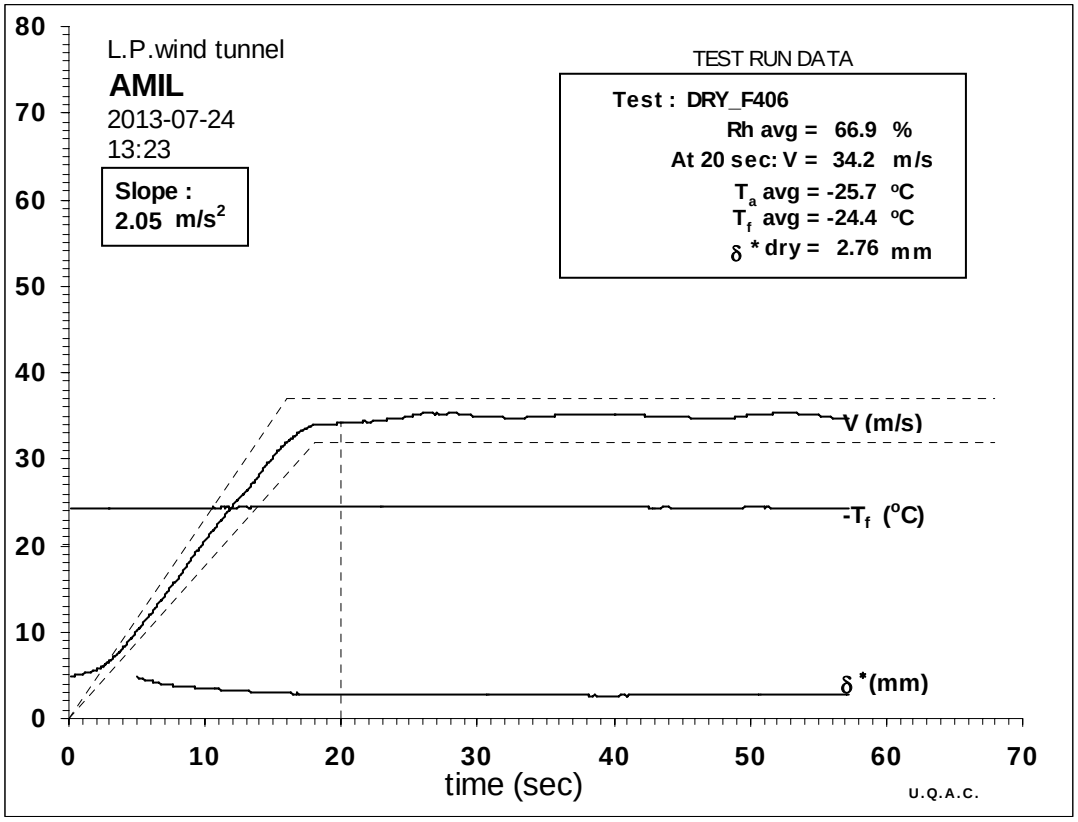
Averages between 19 and 21 seconds:

20	-21.8	**-19.8**	66.0	3.45	35.2	-0.03	**2.79**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_F406



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-25.9	-24.4	67.3	3.25	33.9	0.00	2.92
20	-25.9	-24.4	66.7	3.34	34.4	-0.05	2.67
21	-25.9	-24.4	66.8	3.32	34.3	-0.03	2.79

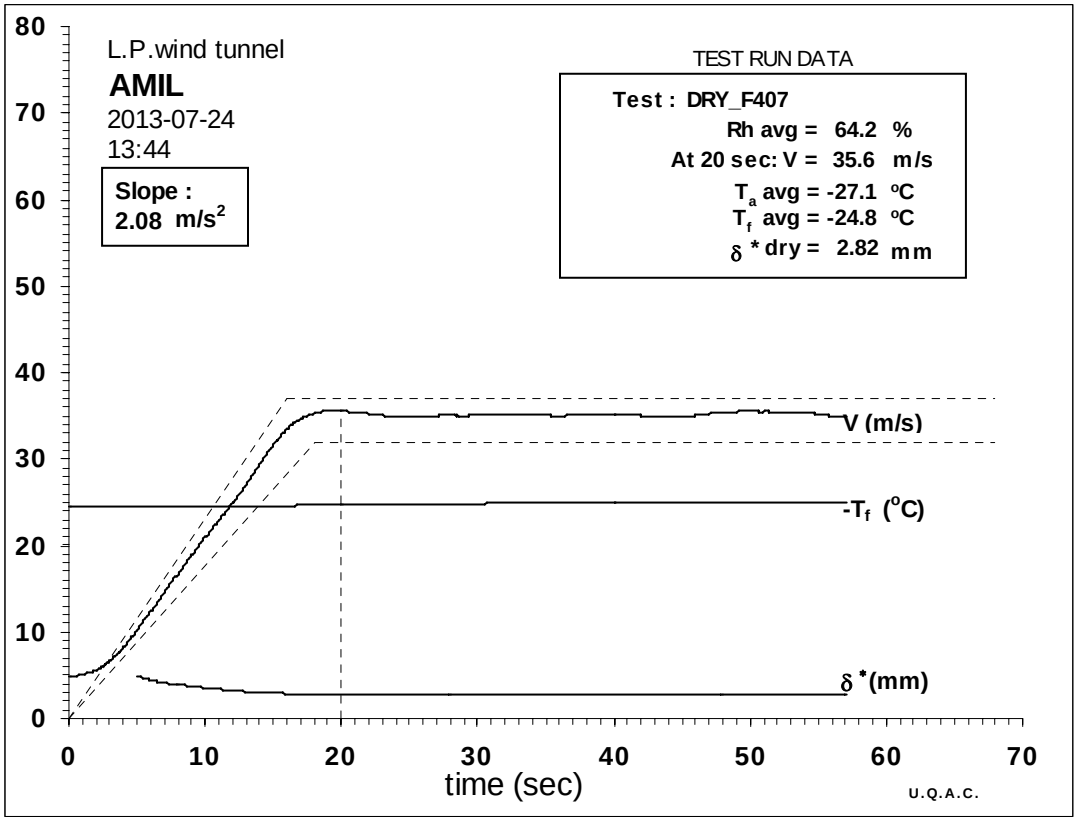
Averages between 19 and 21 seconds:

20	-25.9	**-24.4**	66.9	3.31	34.2	-0.03	**2.76**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_F407



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-27.5	-24.7	65.0	3.59	35.5	-0.01	2.89
20	-27.6	-24.7	65.1	3.63	35.7	-0.03	2.79
21	-27.6	-24.7	64.7	3.61	35.6	-0.02	2.84

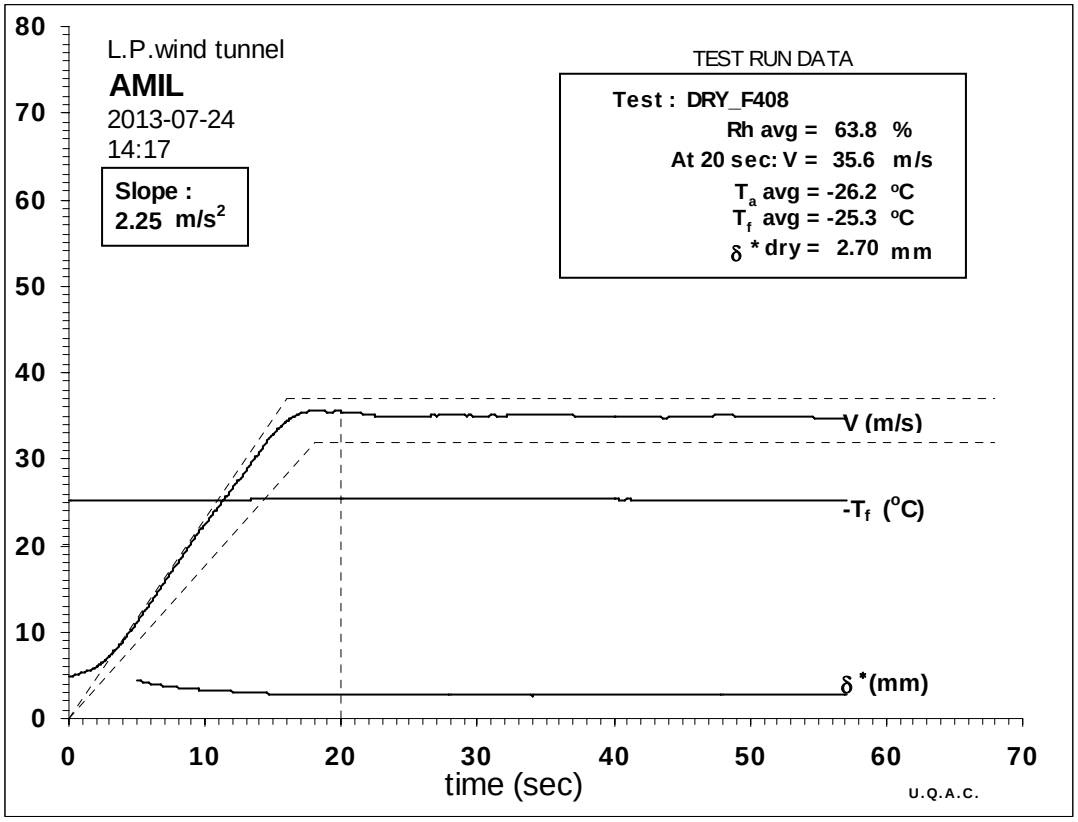
Averages between 19 and 21 seconds:

20	-27.6	**-24.7**	65.0	3.61	35.6	-0.02	**2.82**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_F408



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-26.3	-25.3	63.1	3.53	35.3	-0.02	2.86
20	-26.2	-25.4	63.6	3.62	35.8	-0.05	2.66
21	-26.2	-25.3	63.4	3.58	35.5	-0.06	2.64

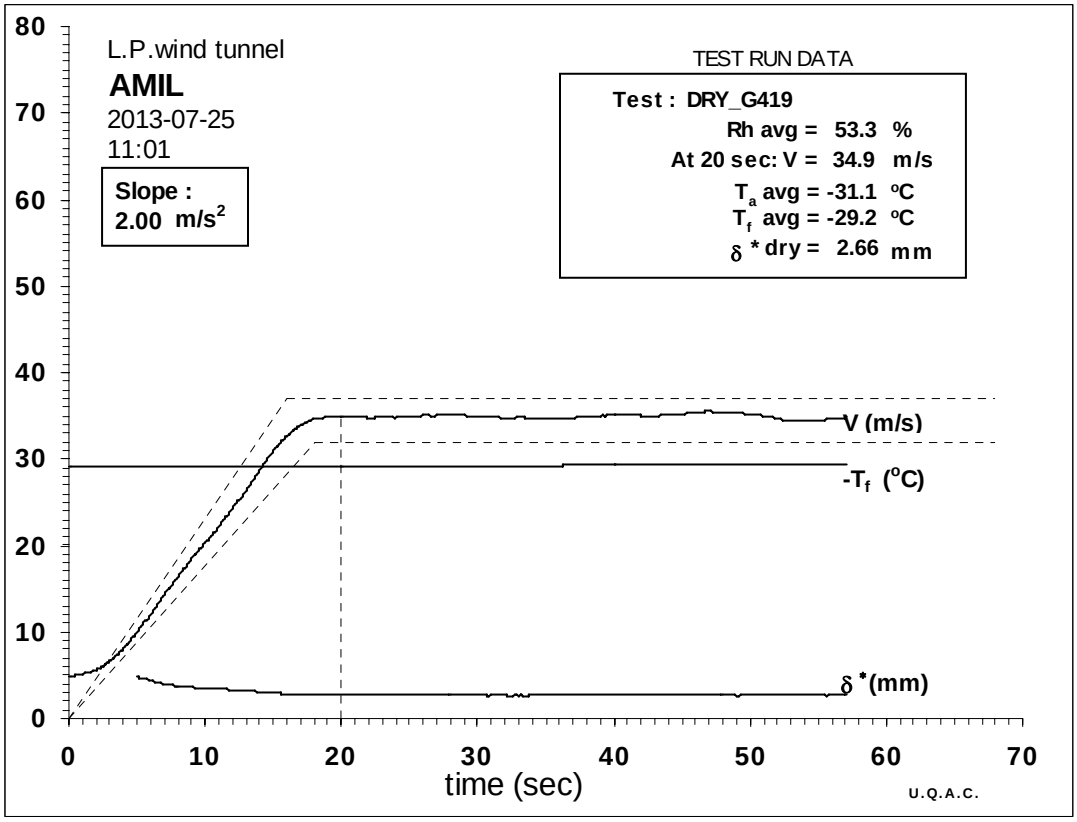
Averages between 19 and 21 seconds:

20	-26.2	**-25.3**	63.4	3.59	35.6	-0.05	**2.70**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_G419



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-31.4	-29.2	53.2	3.50	34.8	-0.04	2.71
20	-31.4	-29.2	53.1	3.57	35.1	-0.06	2.65
21	-31.4	-29.2	53.2	3.50	34.8	-0.06	2.61

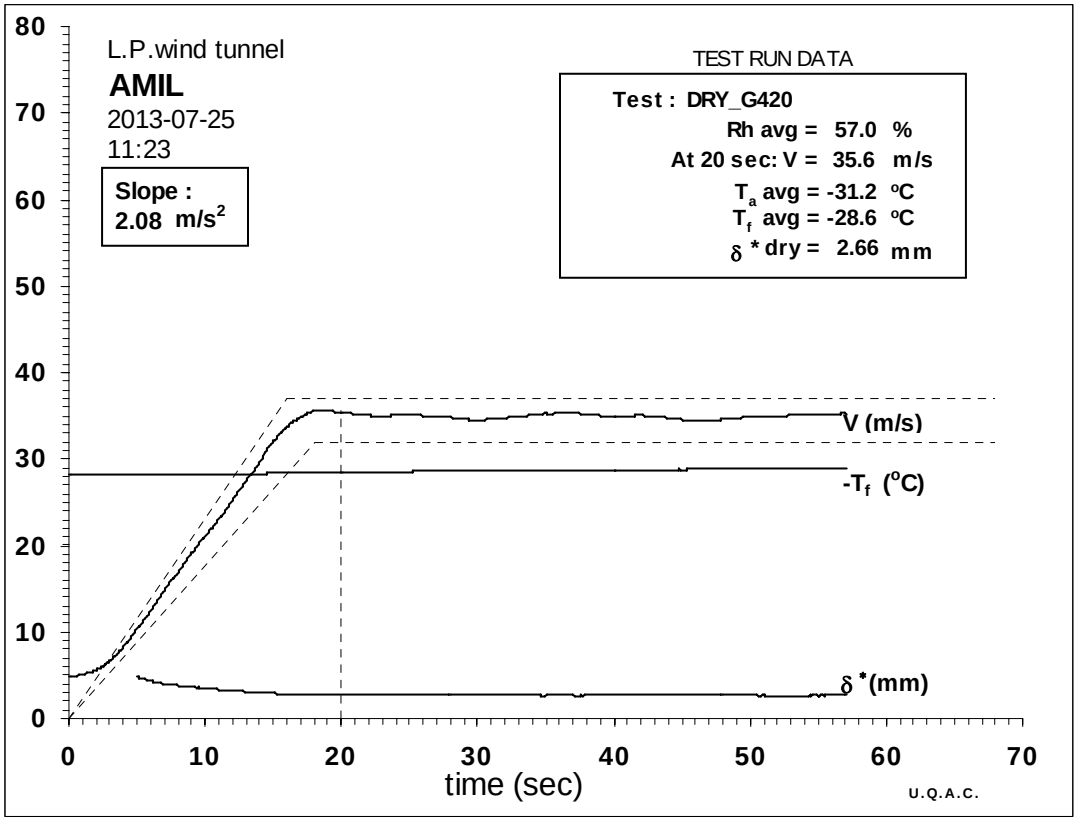
Averages between 19 and 21 seconds:

20	-31.4	**-29.2**	53.2	3.53	34.9	-0.05	**2.66**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_G420



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-31.6	-28.4	57.6	3.72	35.8	-0.01	2.88
20	-31.7	-28.5	57.8	3.72	35.8	-0.06	2.64
21	-31.7	-28.5	57.8	3.56	35.0	-0.08	2.53

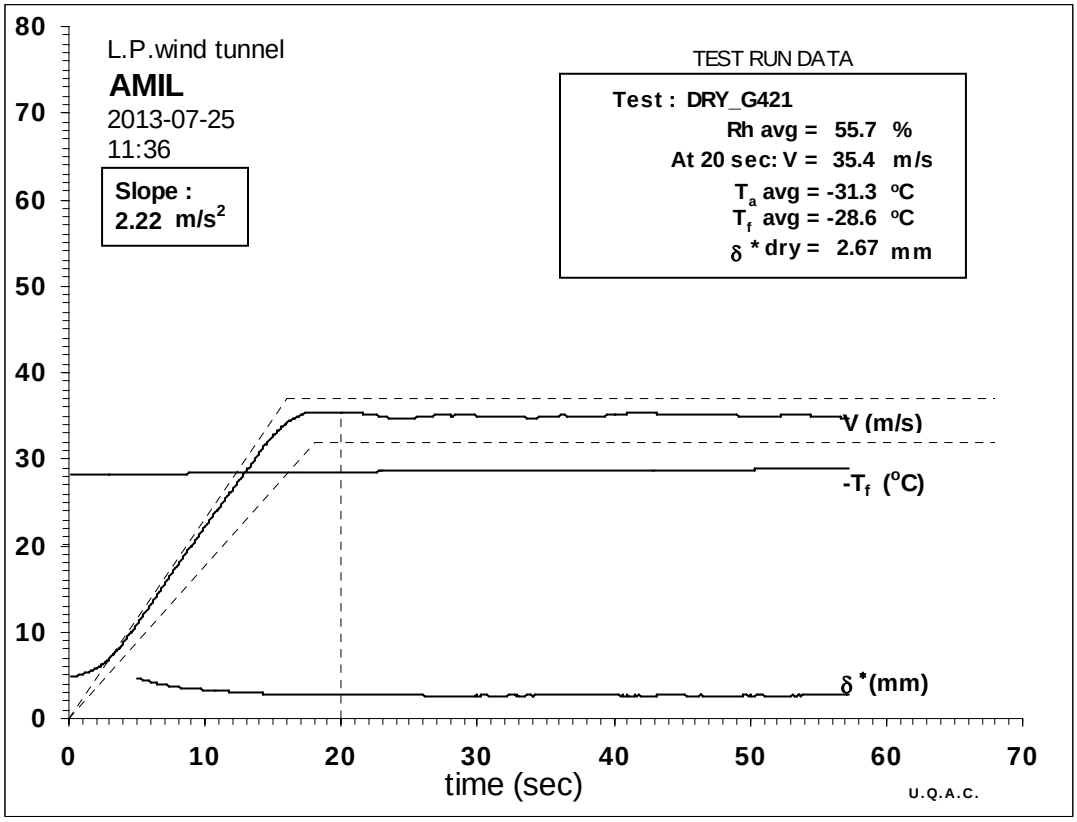
Averages between 19 and 21 seconds:

20	-31.7	**-28.5**	57.8	3.67	35.6	-0.05	**2.66**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

DRY_G421



CRITICAL TIME TEST DATA AVERAGED OVER ONE SECOND

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-31.6	-28.5	56.2	3.60	35.2	-0.03	2.81
20	-31.6	-28.5	55.9	3.61	35.3	-0.05	2.67
21	-31.6	-28.5	55.7	3.69	35.7	-0.08	2.53

Averages between 19 and 21 seconds:

20	-31.6	**-28.5**	55.9	3.63	35.4	-0.05	**2.67**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm

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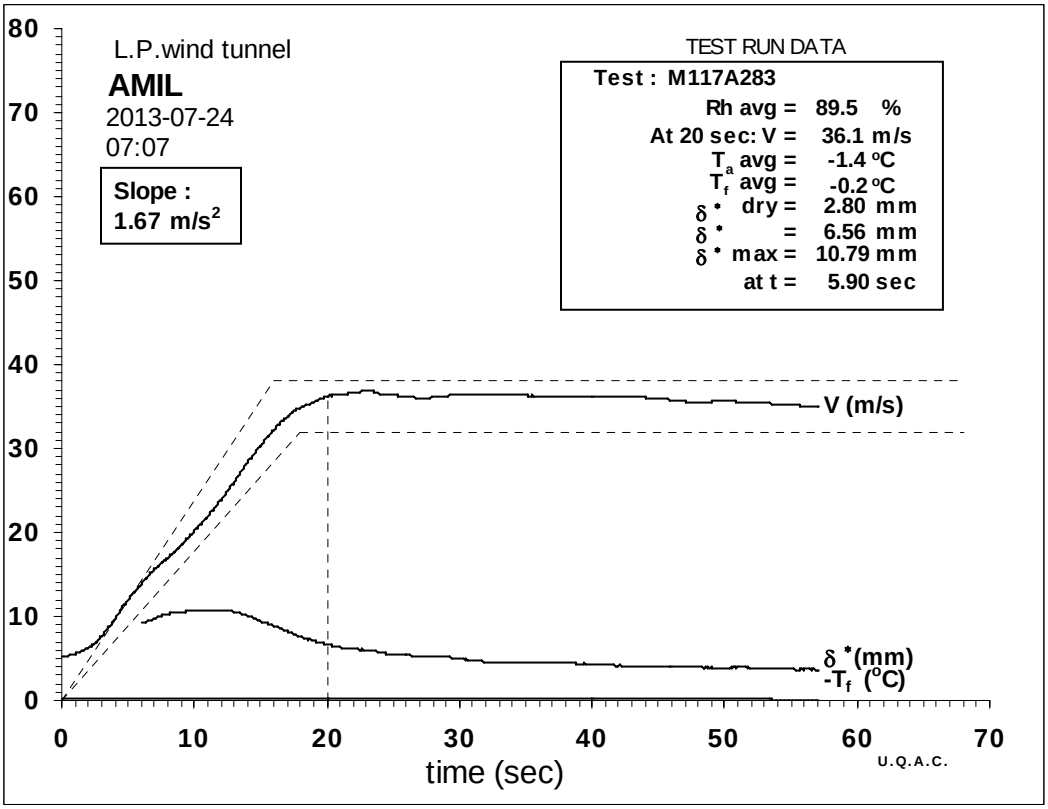
RUNS WITH REFERENCE FLUID M117

M117A283



CRITICAL TIME TEST DATA

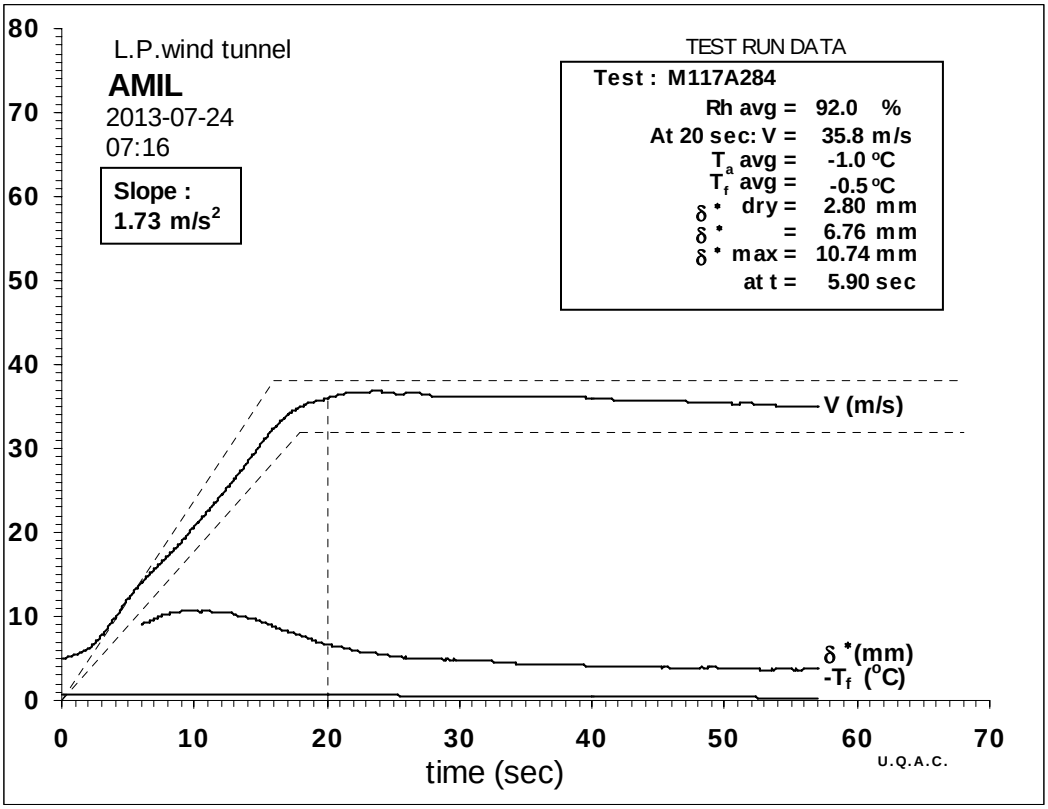
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-1.7	-0.3	88.3	3.37	36.1	0.28	7.21
20	-1.6	-0.3	88.9	3.33	35.9	0.21	6.23
21	-1.7	-0.3	88.5	3.42	36.4	0.24	6.59

Averages :

20	-1.7	**-0.3**	88.7	3.36	36.1	0.23	**6.56**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

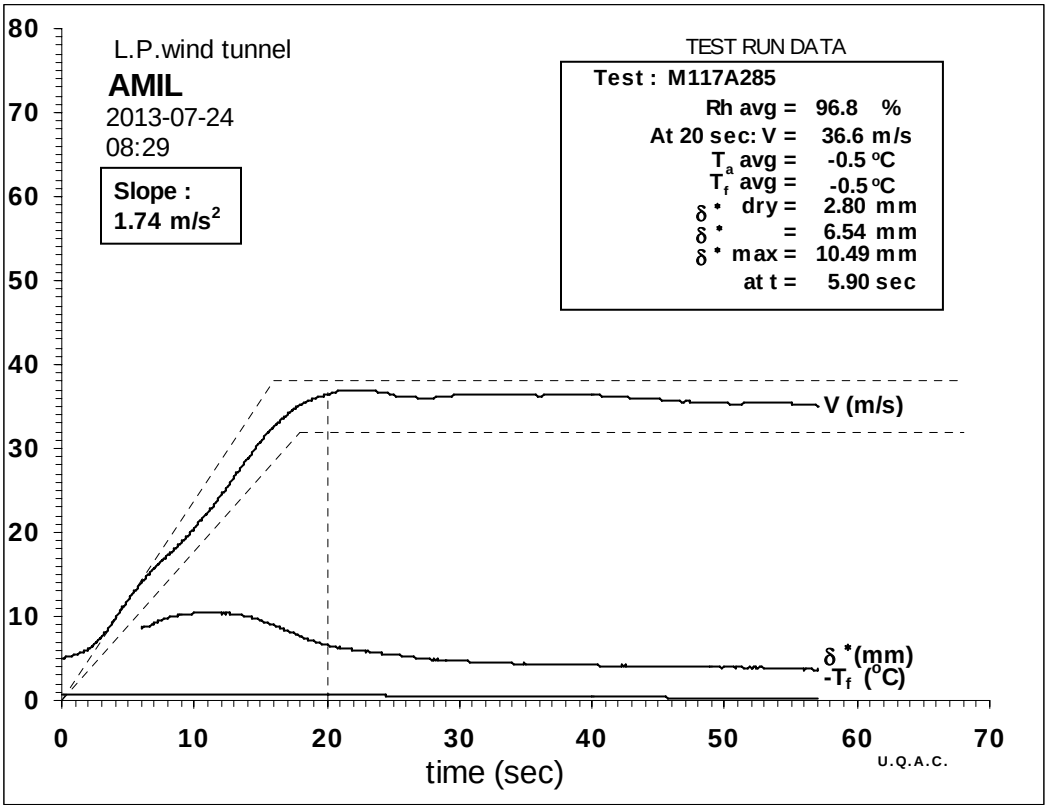
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-1.2	-0.6	90.9	3.16	35.1	0.28	7.47
20	-1.2	-0.7	91.1	3.35	36.1	0.26	6.91
21	-1.2	-0.6	91.5	3.34	36.0	0.19	5.93

Averages :

20	-1.2	**-0.7**	91.2	3.30	35.8	0.24	**6.76**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

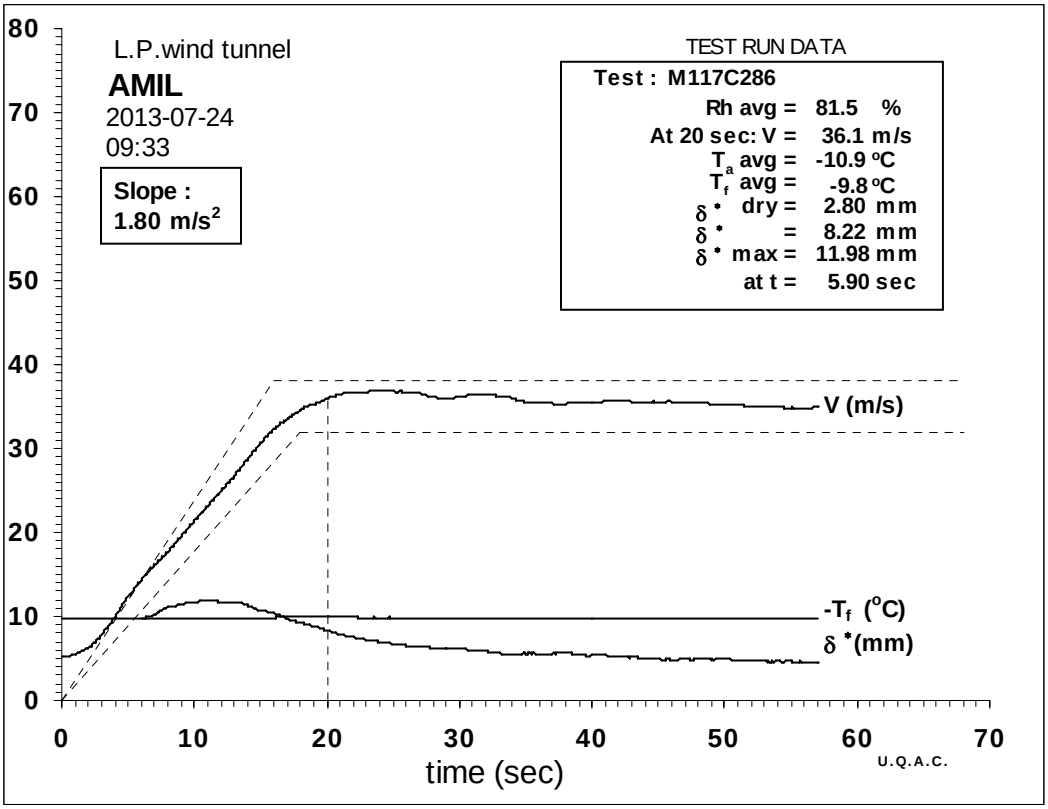
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.6	-0.7	96.2	3.44	36.6	0.25	6.74
20	-0.7	-0.7	96.0	3.43	36.5	0.23	6.48
21	-0.6	-0.6	96.1	3.48	36.8	0.23	6.46

Averages :

20	-0.7	**-0.7**	96.1	3.45	36.6	0.24	**6.54**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

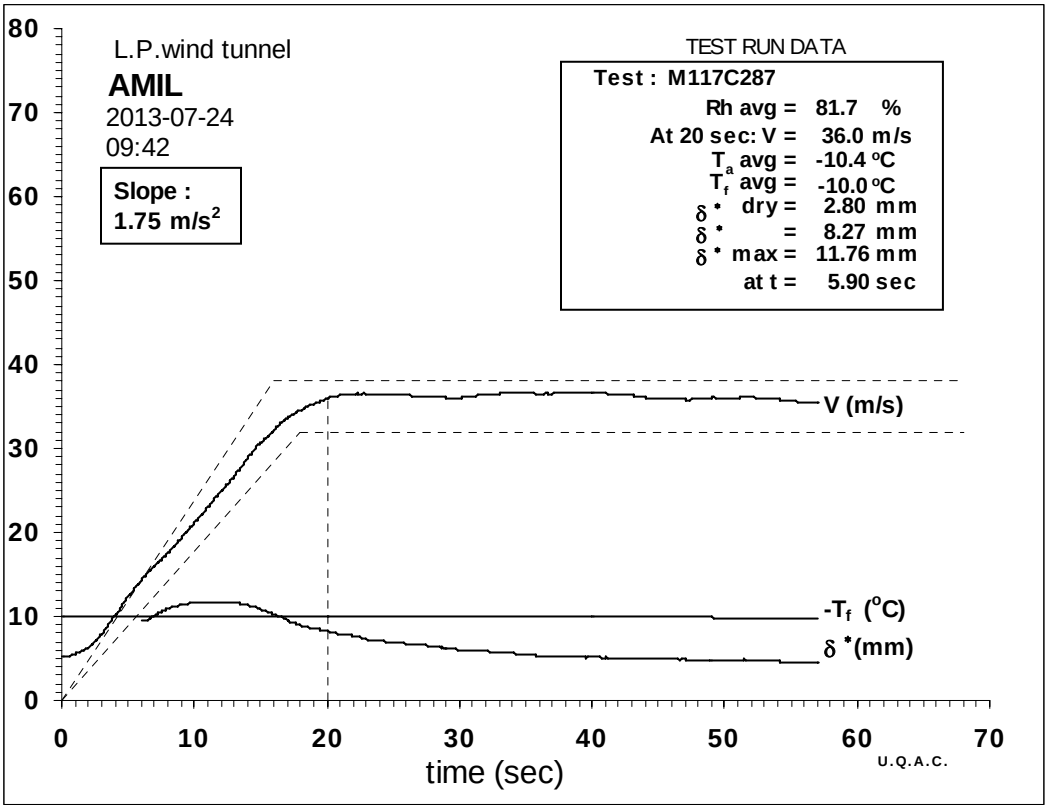
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.3	-9.9	81.2	3.34	35.3	0.39	8.60
20	-11.3	-9.9	80.9	3.56	36.5	0.39	8.34
21	-11.3	-9.9	80.7	3.46	36.0	0.33	7.70

Averages :

20	-11.3	**-9.9**	80.9	3.48	36.1	0.37	**8.22**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

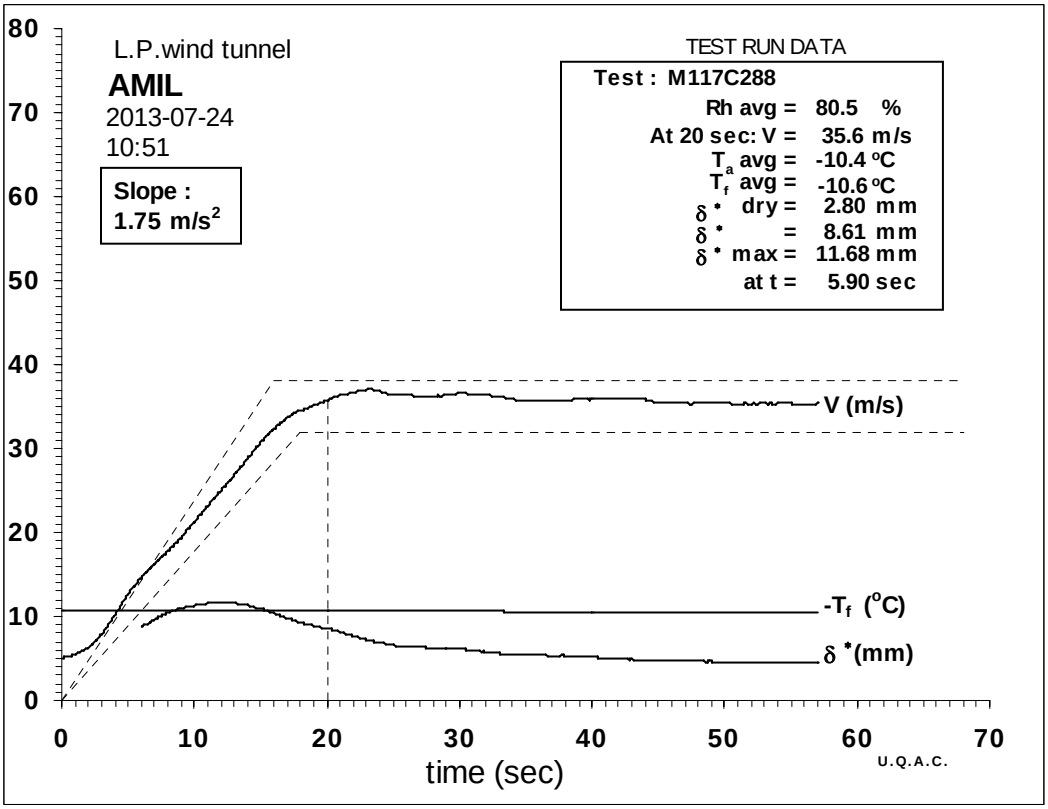
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.7	-10.1	80.7	3.28	35.1	0.33	7.99
20	-10.7	-10.1	81.0	3.47	36.1	0.38	8.36
21	-10.7	-10.1	80.7	3.57	36.6	0.39	8.37

Averages :

20	-10.7	**-10.1**	80.8	3.46	36.0	0.37	**8.27**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

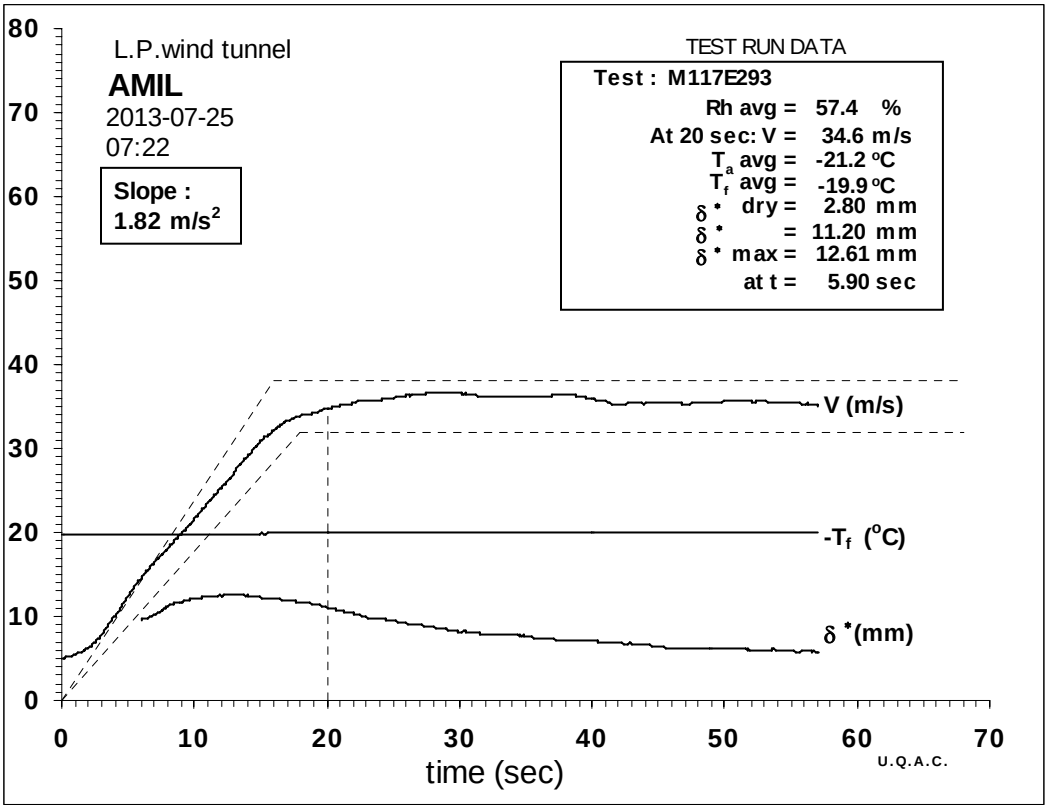
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.7	-10.7	79.5	3.34	35.4	0.39	8.75
20	-10.6	-10.7	79.2	3.31	35.2	0.37	8.53
21	-10.6	-10.7	79.6	3.57	36.6	0.41	8.62

Averages :

20	-10.6	**-10.7**	79.4	3.39	35.6	0.39	**8.61**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

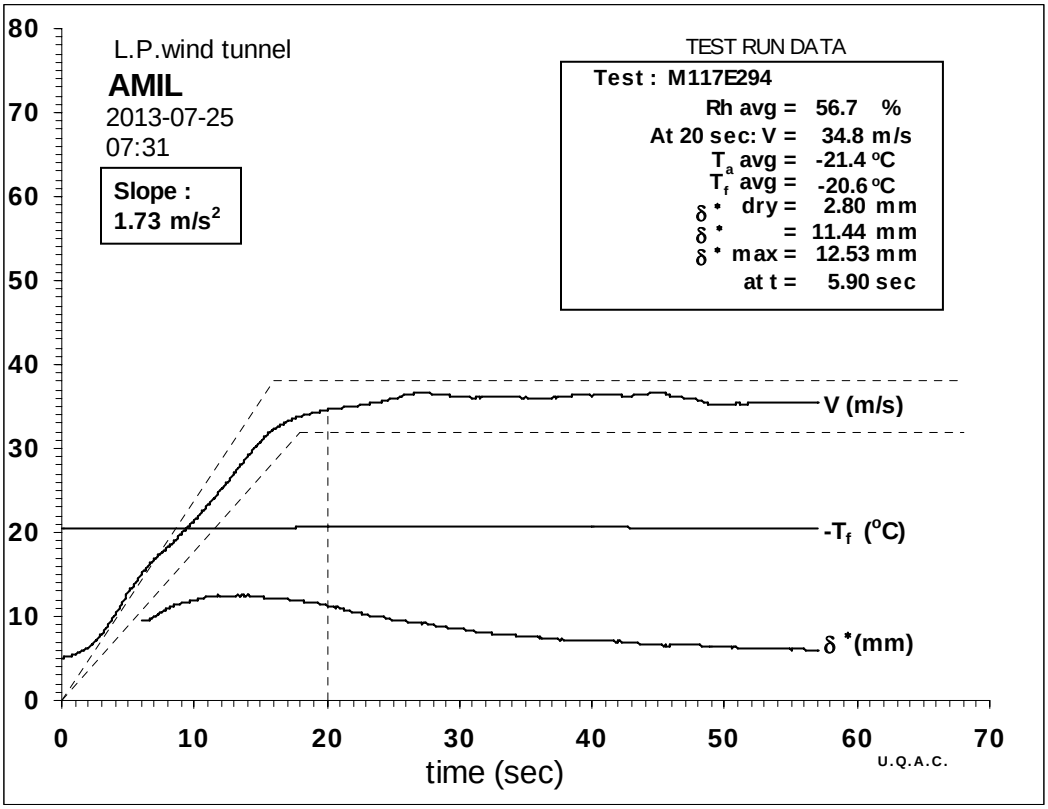
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.6	-19.9	56.9	3.36	34.7	0.61	11.38
20	-21.6	-19.9	57.1	3.25	34.2	0.57	11.06
21	-21.6	-19.9	56.9	3.47	35.3	0.62	11.26

Averages :

20	-21.6	**-19.9**	57.0	3.34	34.6	0.59	**11.20**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

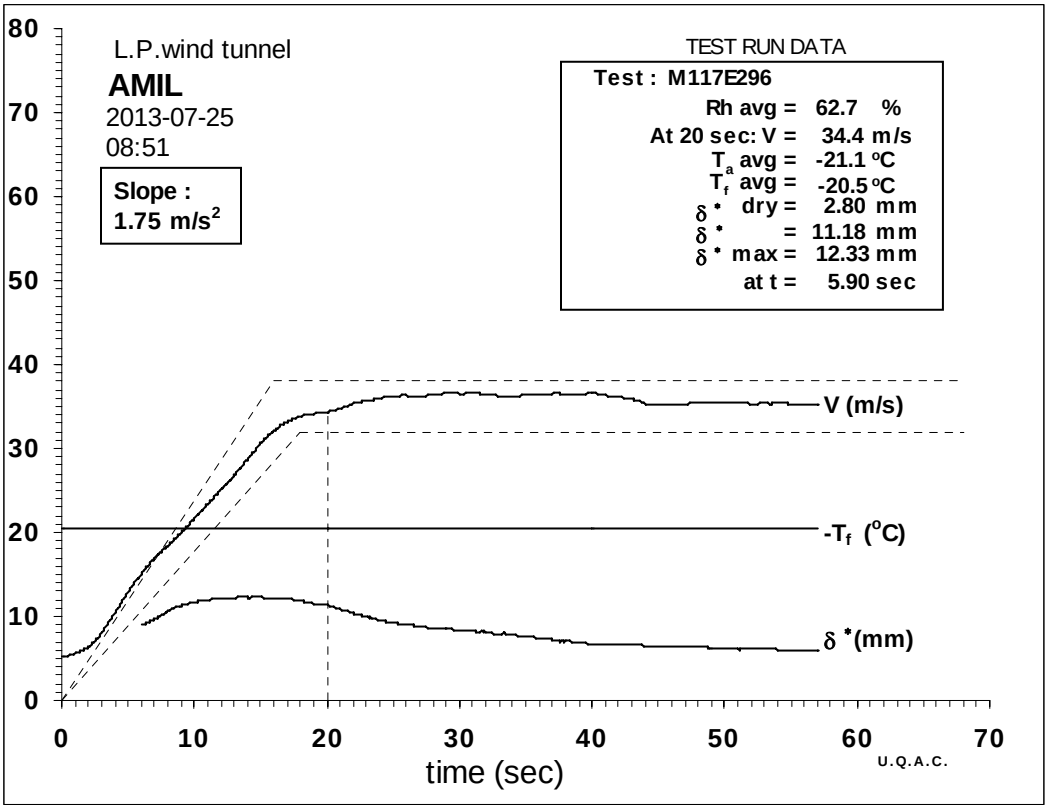
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.9	-20.6	55.9	3.27	34.3	0.63	11.78
20	-21.9	-20.6	56.3	3.36	34.7	0.61	11.40
21	-21.9	-20.6	55.9	3.47	35.3	0.62	11.21

Averages :

20	-21.9	**-20.6**	56.1	3.37	34.8	0.62	**11.44**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

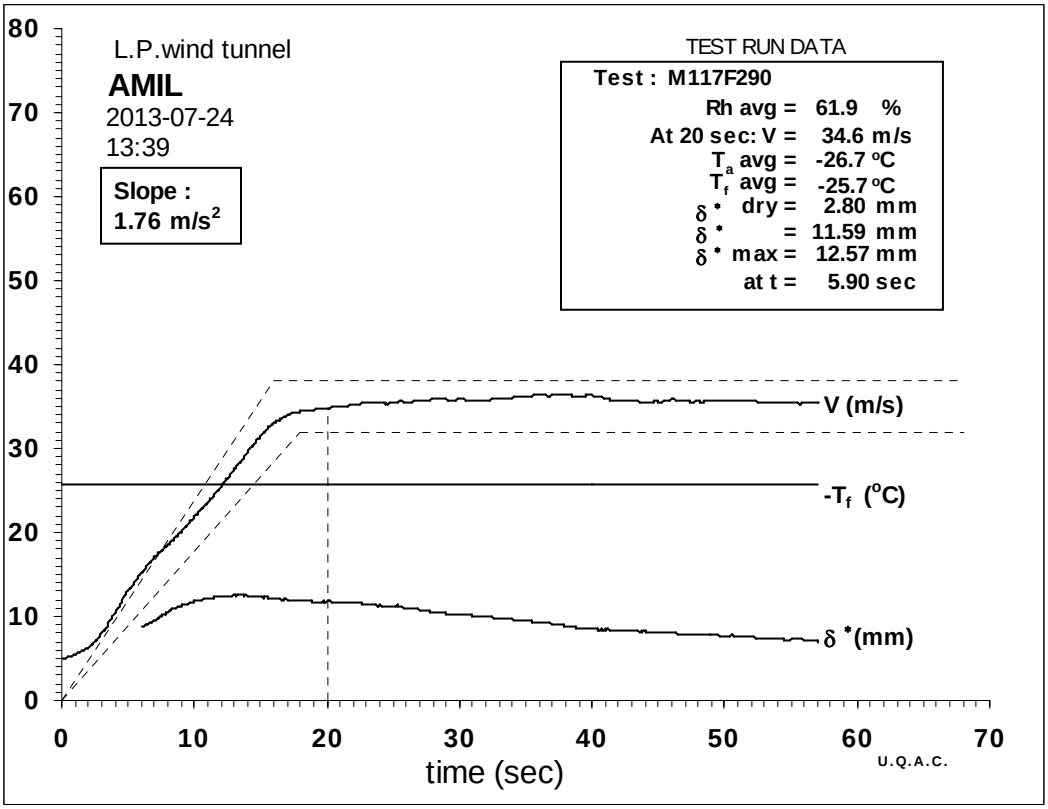
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.5	-20.6	62.0	3.17	33.7	0.61	11.77
20	-21.5	-20.6	62.2	3.28	34.3	0.56	10.98
21	-21.5	-20.6	62.3	3.43	35.1	0.59	11.02

Averages :

20	-21.5	**-20.6**	62.2	3.30	34.4	0.58	**11.18**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

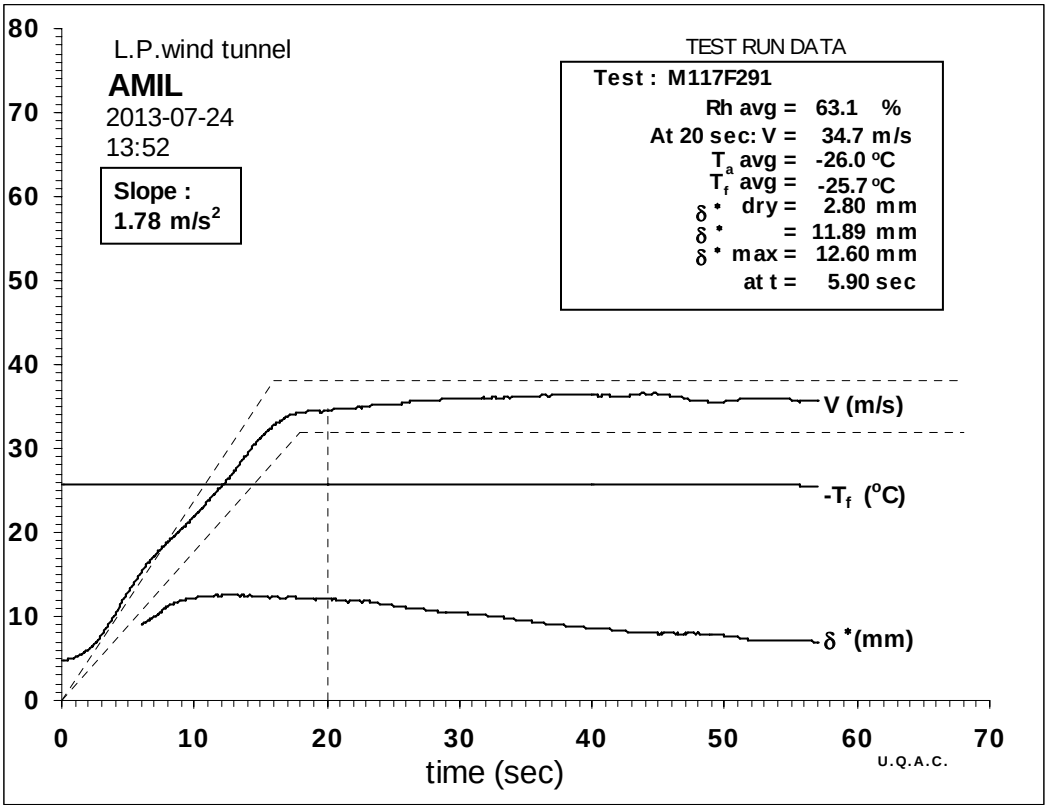
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-27.1	-25.7	61.5	3.43	34.7	0.62	11.34
20	-27.1	-25.7	61.6	3.37	34.4	0.65	11.77
21	-27.1	-25.7	61.5	3.44	34.8	0.64	11.48

Averages :

20	-27.1	**-25.7**	61.5	3.41	34.6	0.64	**11.59**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

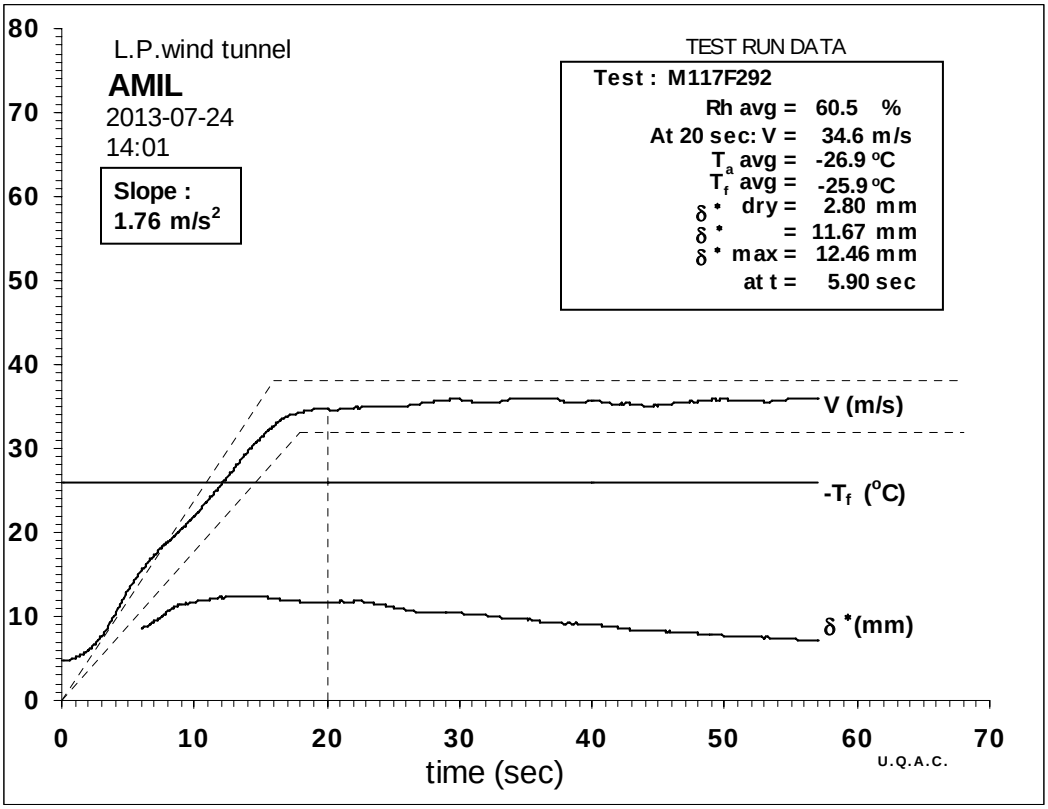
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-26.4	-25.7	62.4	3.36	34.4	0.72	12.63
20	-26.4	-25.7	62.4	3.38	34.5	0.64	11.70
21	-26.4	-25.7	62.7	3.50	35.1	0.66	11.60

Averages :

20	-26.4	**-25.7**	62.5	3.41	34.7	0.67	**11.89**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-27.5	-25.9	60.2	3.27	33.9	0.68	12.40
20	-27.4	-25.9	59.9	3.44	34.7	0.61	11.22
21	-27.4	-25.9	60.1	3.47	34.9	0.67	11.80

Averages :

20	-27.4	**-25.9**	60.0	3.41	34.6	0.64	**11.67**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

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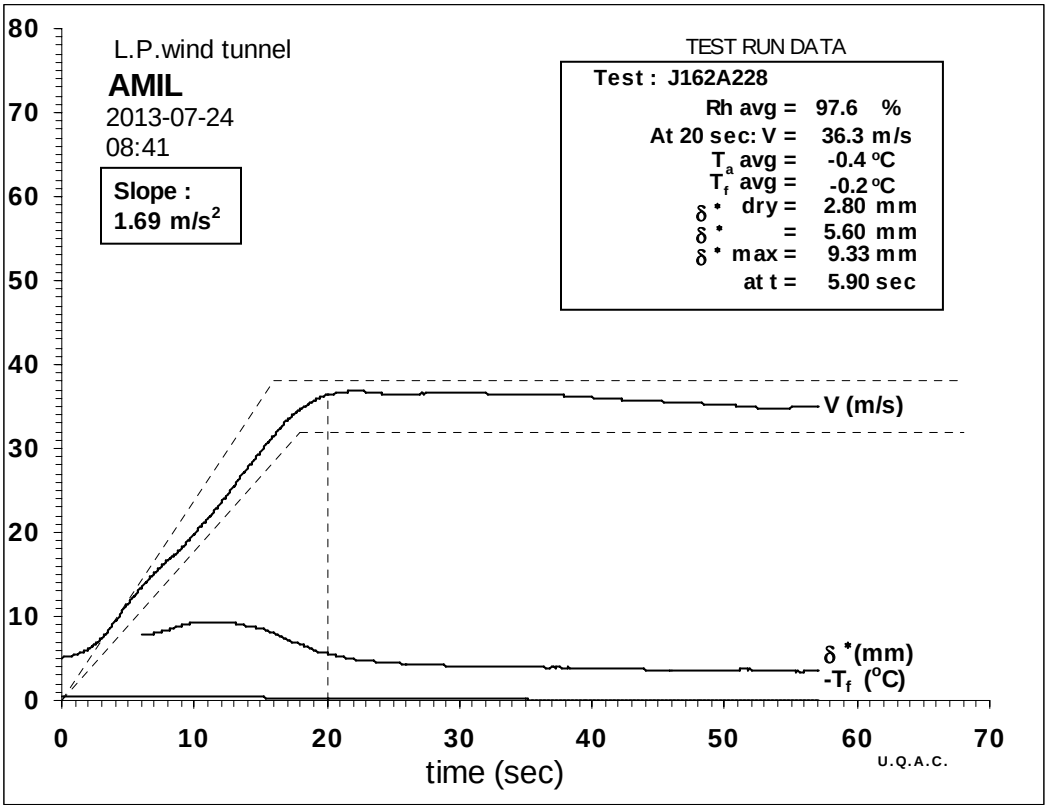
ARCTON LTD. DEICING FLUID

Arctica DG RTU lot # 28,
Fluid as received J-162

J162A228



CRITICAL TIME TEST DATA

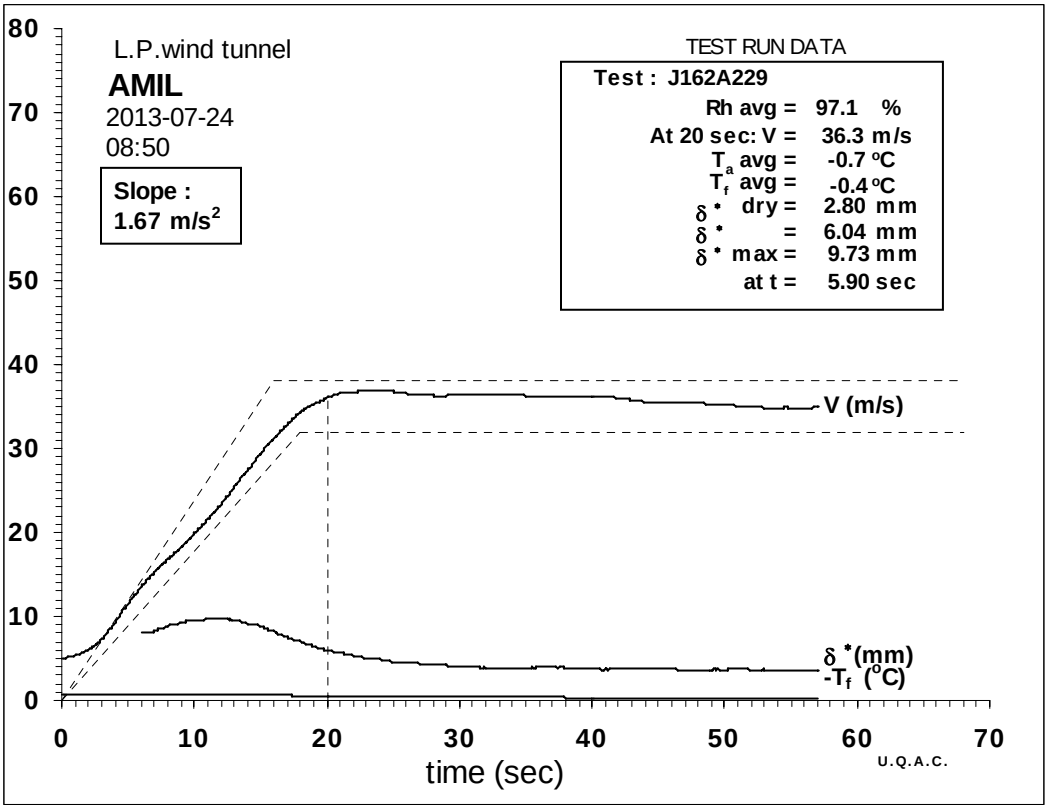
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.5	-0.3	97.0	3.31	35.9	0.20	6.17
20	-0.5	-0.3	97.0	3.38	36.3	0.16	5.59
21	-0.5	-0.3	97.2	3.44	36.6	0.13	5.14

Averages :

20	-0.5	**-0.3**	97.0	3.38	36.3	0.17	**5.60**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.8	-0.6	96.3	3.44	36.6	0.21	6.17
20	-0.8	-0.6	96.3	3.32	36.0	0.19	6.04
21	-0.8	-0.6	96.2	3.41	36.4	0.19	5.93

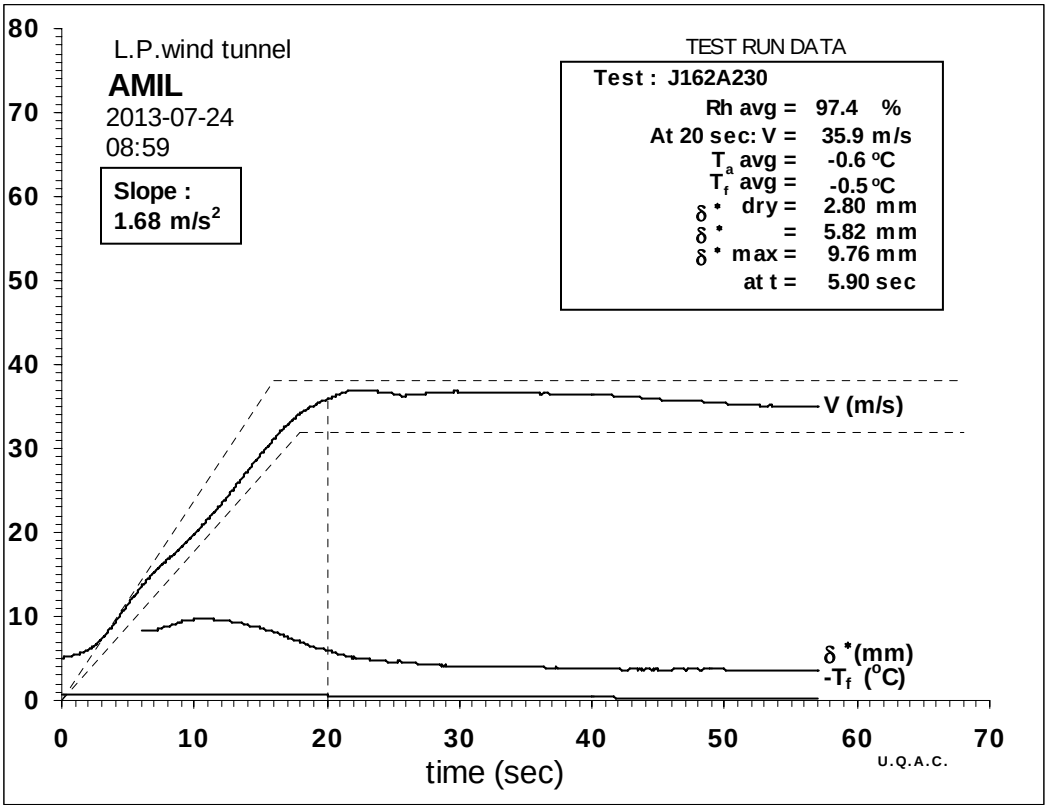
Averages :

20	-0.8	**-0.6**	96.3	3.38	36.3	0.20	**6.04**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

J162A230



CRITICAL TIME TEST DATA

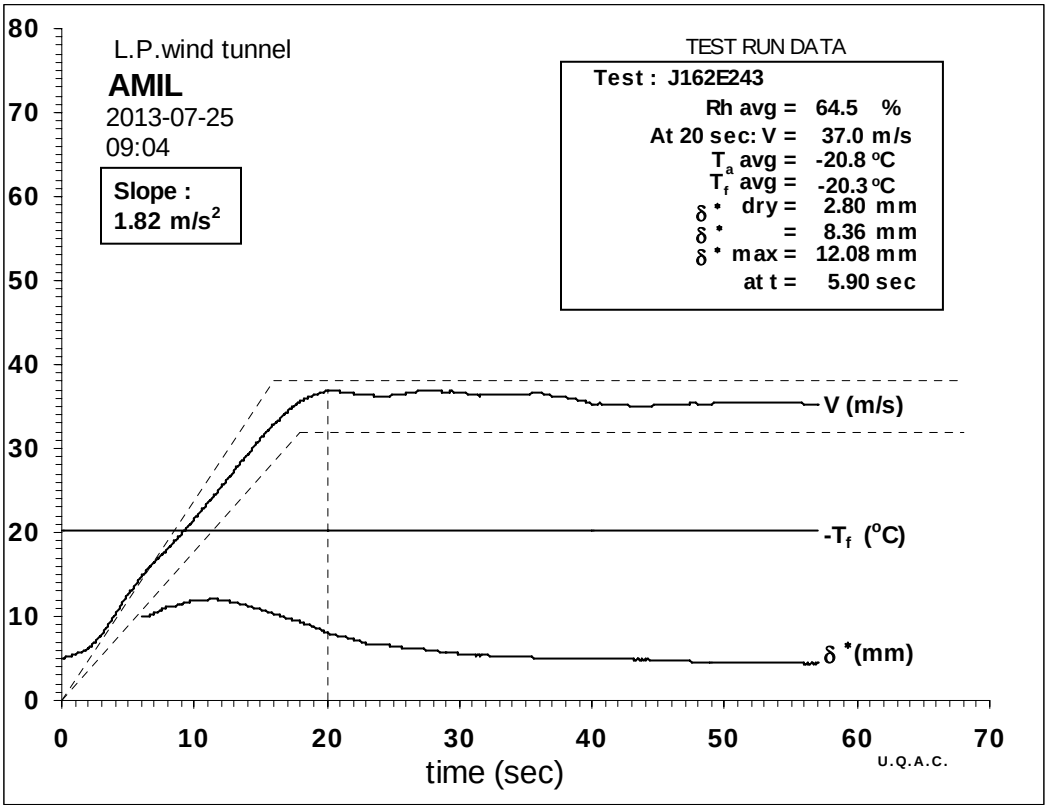
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.7	-0.6	96.8	3.22	35.4	0.19	6.07
20	-0.7	-0.6	96.7	3.35	36.1	0.20	6.06
21	-0.7	-0.6	96.9	3.33	36.0	0.14	5.23

Averages :

20	-0.7	**-0.6**	96.8	3.31	35.9	0.18	**5.82**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.1	-20.3	64.0	3.77	36.8	0.46	8.87
20	-21.1	-20.3	63.9	3.75	36.7	0.40	8.27
21	-21.1	-20.3	63.8	3.95	37.7	0.41	8.10

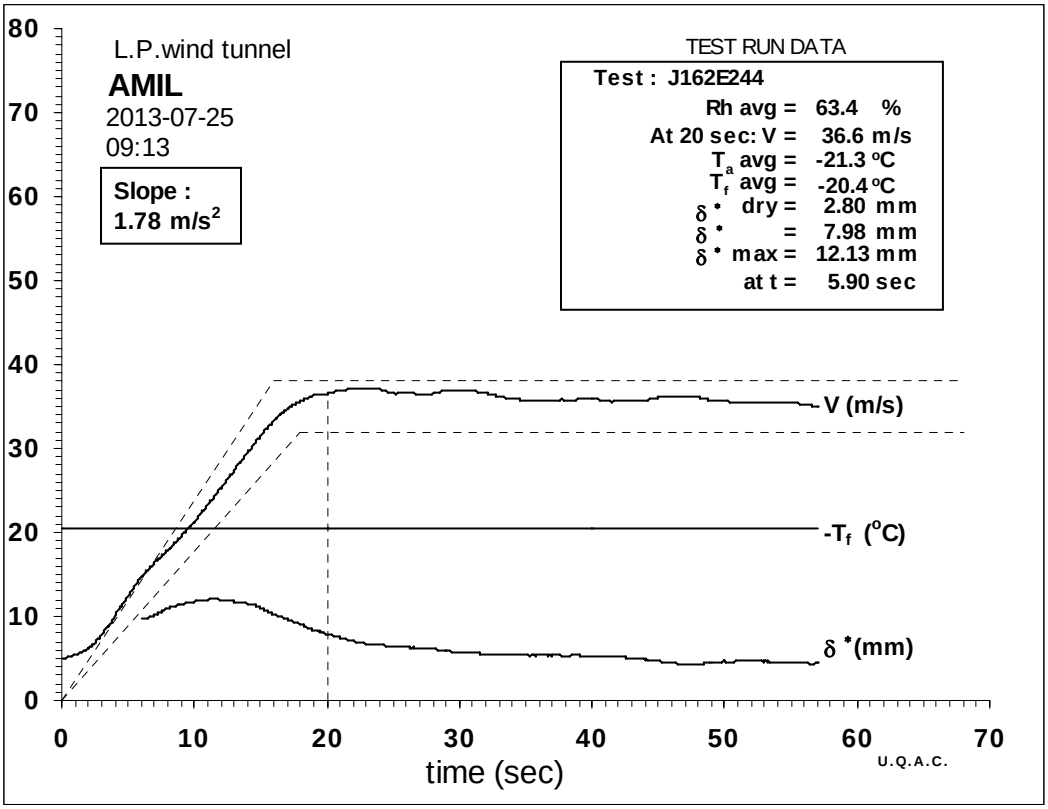
Averages :

20	-21.1	**-20.3**	63.9	3.81	37.0	0.42	**8.36**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

J162E244



CRITICAL TIME TEST DATA

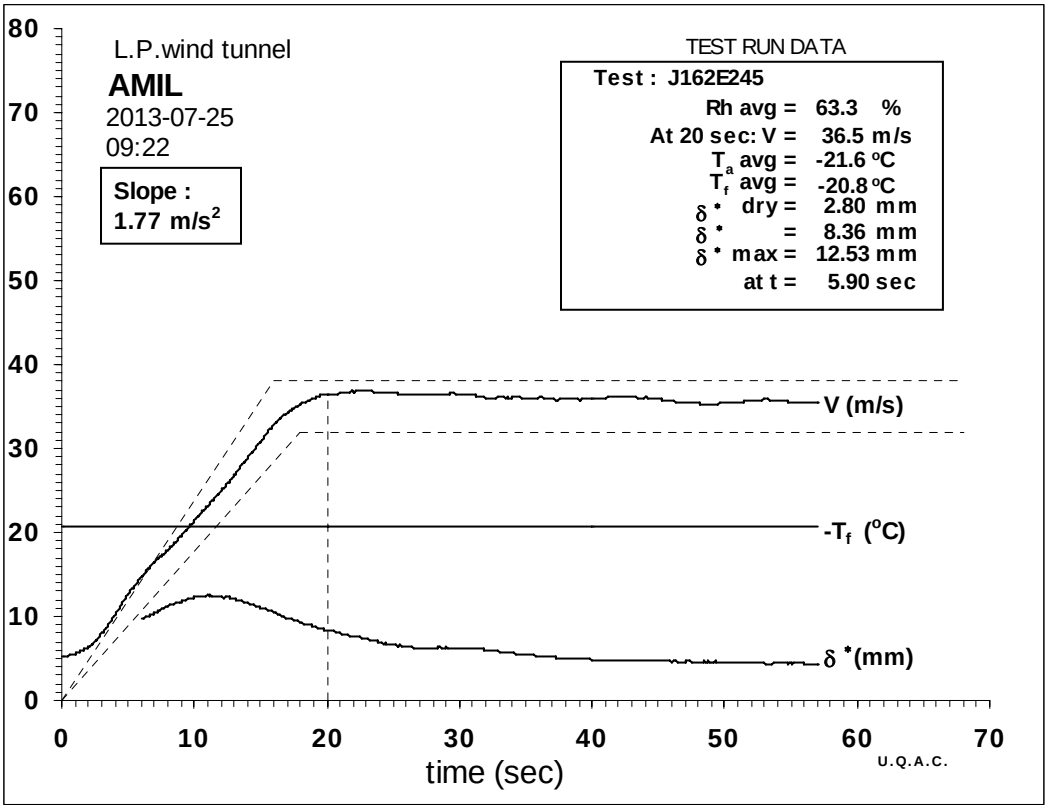
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.7	-20.4	63.1	3.62	36.1	0.39	8.26
20	-21.7	-20.4	62.6	3.69	36.4	0.39	8.13
21	-21.7	-20.5	62.7	3.92	37.5	0.35	7.49

Averages :

20	-21.7	**-20.4**	62.8	3.74	36.6	0.38	**7.98**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-22.1	-20.8	62.6	3.54	35.6	0.43	8.92
20	-22.0	-20.8	62.6	3.74	36.6	0.41	8.31
21	-22.0	-20.8	62.5	3.85	37.2	0.39	7.99

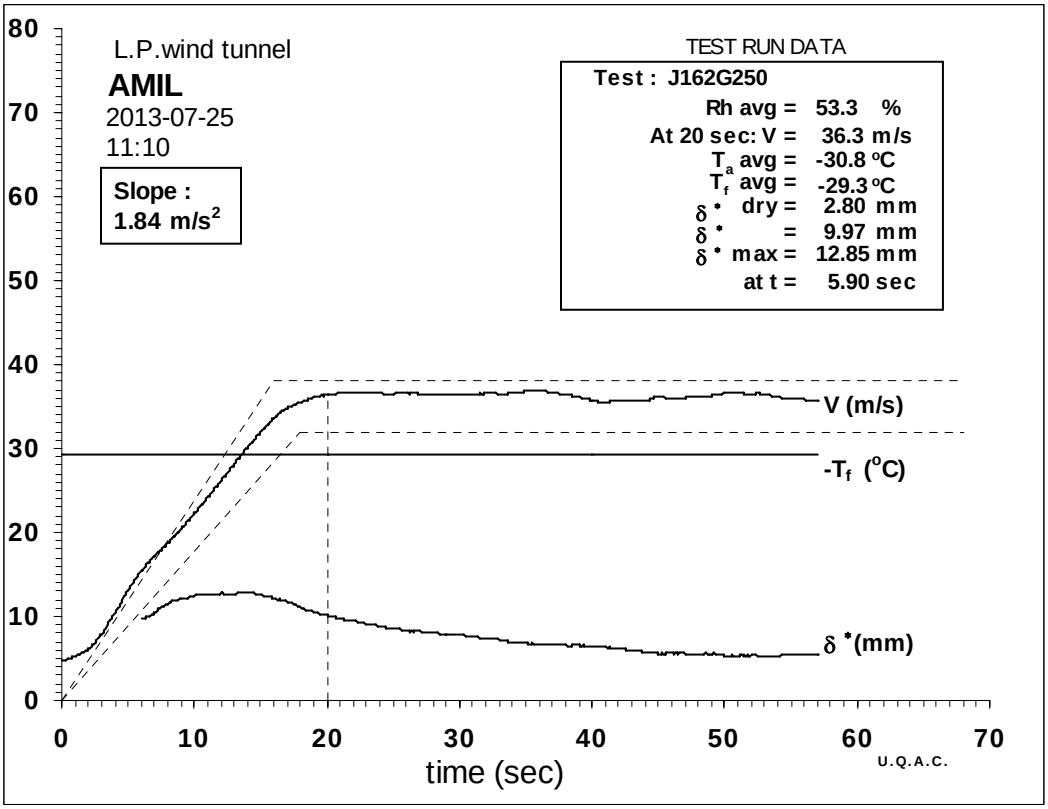
Averages :

20	-22.0	**-20.8**	62.6	3.72	36.5	0.41	**8.36**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

J162G250



CRITICAL TIME TEST DATA

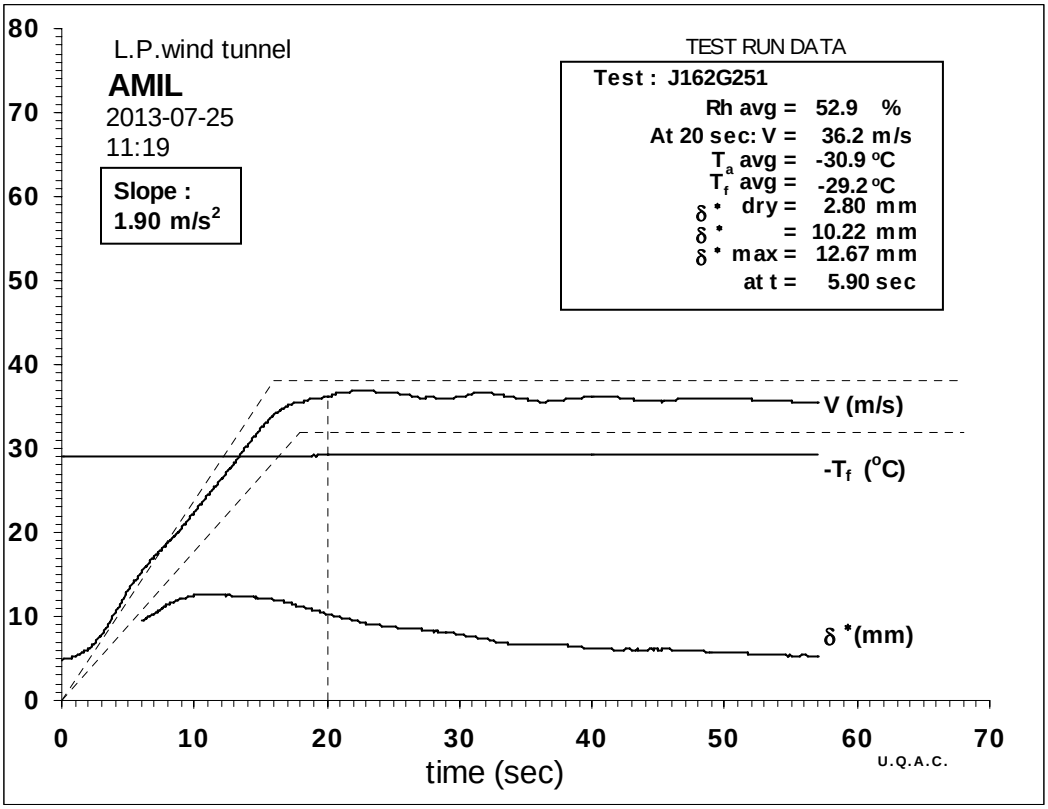
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-31.2	-29.3	53.0	3.64	35.5	0.59	10.57
20	-31.2	-29.3	53.4	3.78	36.1	0.54	9.74
21	-31.2	-29.3	53.1	3.99	37.1	0.58	9.87

Averages :

20	-31.2	**-29.3**	53.2	3.81	36.3	0.56	**9.97**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-31.3	-29.2	52.7	3.63	35.4	0.56	10.20
20	-31.3	-29.2	52.8	3.75	36.0	0.59	10.42
21	-31.3	-29.2	52.5	3.98	37.1	0.58	9.89

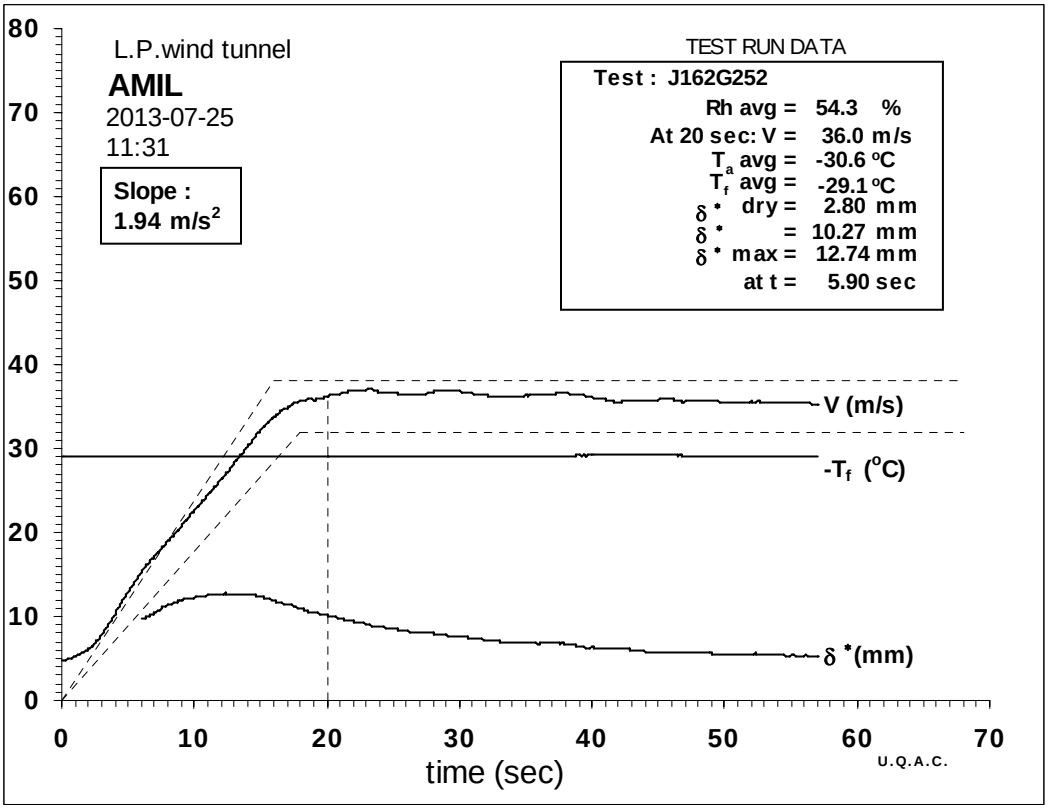
Averages :

20	-31.3	**-29.2**	52.7	3.79	36.2	0.58	**10.22**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

J162G252



CRITICAL TIME TEST DATA

time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-31.0	-29.1	54.0	3.80	36.2	0.70	11.45
20	-31.0	-29.1	54.1	3.78	36.2	0.55	9.91
21	-30.9	-29.1	54.2	3.68	35.7	0.53	9.89

Averages :

20	-31.0	**-29.1**	54.1	3.75	36.0	0.58	**10.27**

Test Duct Dimensions :

S2 = 30845.149 mm² S3 = 33276.211 mm² B3 = 302.374 mm C3 = 825.221 mm²

ACCREDITATION

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In accordance with PRI Program Document AC3001, Audit Criteria for compliance to SAE AMS 1424 and AMS 1428:

Anti-Icing Materials International Laboratory (AMIL)

Universite du Quebec a Chicoutimi
Department des Sciences Appliquees
555, Boulevard de l'Universite
Chicoutimi Quebec, CanadaG7H 2B1

Has had its facilities examined and approved through continuing audit procedures as established by the Commercial Aviation Accreditation conformance to the applicable specification requirements for the Aircraft Ground Deicing/Anti-Icing Aerodynamic acceptance test facilities.

This certificate is granted by authority of the Performance Review Institute for:

Testing of Deicing/Anti-Icing Fluids

Certificate Number: 0001 – C
Expiration Date: 31 October 2017
Issue Date: 13 September 2012

Joseph G. Pinto, Vice President and Chief Operating Officer

Performance Review Institute (PRI) 161 Thorn Hill Road Warrendale, PA 15086-7527